

# Arkansas Waterbirds on Working Lands Initiative

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Dan Scheiman, Ph.D.  
Bird Conservation Director  
Audubon Arkansas  
201 East Markham St.  
Suite 450  
Little Rock, AR 72201



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## Executive Summary

The goal of Audubon's Waterbirds on Working Lands initiative is to identify and promote practical, agricultural practices that will maintain the economic viability of farms while measurably improving waterbird habitat value on private lands. Many waterbird species are experiencing population declines and are of conservation concern at the state, continental, or global level. Shorebirds and marshbirds are of particular concern due in part to loss of suitable habitat. Historically, approximately 28% of Arkansas was covered by wetlands. Today, only 1.5 million ha of natural wetlands remain. Concurrently, the area of row crops (e.g. rice and soybean) and aquaculture ponds has increased by over 5.2 million ha. Fortunately, these 'working lands' can provide waterbird foraging, breeding, and resting habitat year round.

Rice is the row crop with the greatest actual and potential benefit for waterbirds in Arkansas. Thousands of hectares are intentionally flooded for wintering waterfowl. Wading birds and other waterbirds also use flooded fields. Shorebirds forage on flooded and drained fields. Marshbirds and certain landbirds use rice and rice stubble for nesting and foraging. Waterbirds can benefit rice farmers by increasing straw decomposition, consuming invertebrate and plant pests, and providing additional income through hunting and ecotourism. However, production practices that increase farm efficiency such as rapidly maturing rice varieties and pesticide use threaten waterbird populations. Fortunately, best management practices such as conventional harvesting, gradual water drawdowns, and staggering water depths among levees can improve the quality of rice fields for birds.

Waterbird use of aquaculture ponds often results in conflict with producers. Wading birds, cormorants, and pelicans are predators of farmed fish. However, research suggests that these species also help by selectively weeding out sick fish. Still, a combination of non-lethal harassment and lethal control is used to reduce loss. Improved conflict management is needed to reduce the take of both fish and birds.

An effective waterbird-working land management strategy should include education and outreach to gain public support. Producer support also may require economic support. A variety of financial incentive programs are available to encourage installation of best management practices on and adjacent to working lands. In fact, many programs are so popular their implementation is limited by funding rather than number of applications. Audubon Arkansas also plays a role in waterbird conservation through programs such as the Fourche Creek Watershed Initiative, Sustainable Ecotourism Initiative, and Important Bird Areas Program.

## Introduction

Federal and state lands are often charged with protecting vulnerable bird species. However, privately owned lands dominate the landscape and thus are crucial to conservation as well. In Arkansas, approximately 90% of the land area is privately owned, with about 40% of the state in farmland (National Agricultural Statistics Service [NASS] 2005). In addition, thousands of hectares are dedicated to aquaculture (NASS 2000). Therefore, these privately owned 'working lands' have an important role to play in bird conservation throughout the state. Improved agricultural production technologies and federal farm programs are in place to enhance soil, water, air, and habitat quality on working lands. One way to measure the success of these practices is to assess the health of bird populations. Birds are sensitive to changes in

environmental quality such as pollution and habitat loss (Poole 2005). Thus, birds serve as indicators of environmental health.

Waterbirds in particular have been affected by the conversion of native habitat to agriculture and from agricultural practices that affect adjacent habitat (Kushlan et al. 2002). A few species are of high conservation concern because of declining wetland habitat quantity and quality. Yet many waterbirds have adapted to and occupy working lands. Some species, such as waterfowl on rice fields, are encouraged (Bird et al. 2000); others, such as wading birds on aquaculture ponds, are discouraged (Glahn and King 2004). In any case, solutions must be found that allow for both agricultural productivity and healthy populations of waterbirds within an agricultural landscape.

The goal of Audubon's Waterbirds on Working Lands initiative is to identify and promote practical, agricultural practices that will maintain the economic viability of farms while measurably improving environmental health and wildlife habitat value on private lands. As a first step, this report summarizes the status of waterbird populations in Arkansas, the interaction of waterbirds with working lands, and best management practices for waterbirds on working lands.

### Arkansas waterbird species and their conservation status

The Waterbirds on Working Lands Technical Committee developed a list of 303 species considered 'waterbirds' according to various taxonomic and ecological classifications. This list was reduced to 102 species by removing those that do not occur in Arkansas, or, with the exception of Piping Plover (see Table 1 for scientific names), and Black Rail, occur only very rarely (i.e. five or fewer records in a ten year period; James and Neal 1986, Arkansas Audubon Society 2005, ARBIRD-L 2006; Table 1). This list includes species that breed in, winter in, or migrate through the state. Eighty-eight species are globally secure, and yet 33 species are vulnerable, imperiled, or critically imperiled in Arkansas (NatureServe 2006; Table 1). Two are federally endangered, and two are federally threatened. Nine are yellow Audubon WatchList species, meaning they are declining and of national conservation concern; three are red WatchList species, meaning they are rapidly declining and of global conservation concern (National Audubon Society 2002). Twenty-seven species are considered Arkansas Birds of Conservation Interest (ABCI) by Audubon Arkansas; these species are a focus of Arkansas's Important Bird Areas (IBA) program. Nineteen species are considered to be of moderate conservation concern by either the American Waterbird Conservation Plan (Kushlan et al. 2002) or the U.S. Shorebird Conservation Plan (USSCP 2004); five species are of high concern and two are imperiled (Table 1). Not all of Arkansas's waterbirds are considered in these two plans. The North American Bird Conservation Initiative classifies waterbirds into six taxonomic and ecological groups: waterfowl, other waterbirds, waders, shorebirds, marshbirds, and landbirds.

### **Waterfowl**

Arkansas's waterfowl includes 23 species of ducks, geese, and swans (Table 1). Five species (Canada Goose, Wood Duck, Mallard, Mottled Duck, and Hooded Merganser) breed in the state; the remainder are found during migration and winter. All 23 species are globally secure (NatureServe 2006). Three species are vulnerable in Arkansas, and one species is imperiled in Arkansas during the breeding season (Table 1). Mottled and American Black Ducks

are yellow WatchList species (National Audubon Society 2002). Mottled Duck and Hooded Merganser are on the ABCI list.

### **Other Waterbirds**

Thirteen species are classified as other waterbirds, including gulls, terns, and grebes (Table 1). Four species (Pied-billed Grebe, Double-crested Cormorant, Anhinga, and Least Tern) breed in the state; the remainder migrate or winter. American White Pelican is globally vulnerable (NatureServe 2006). The Interior Least Tern and Pied-billed Grebe are imperiled breeding species in Arkansas, and the Anhinga is a critically imperiled state breeder. In addition, the latter three are ABCI species, and Interior Least Tern is federally endangered. Seven species are of moderate conservation concern according to the North American Waterbird Conservation Plan (Kushlan et al. 2002, Waterbird Conservation For The Americas 2006; Table 1). Pied-billed Grebe, Horned Grebe and Interior Least Tern are of high conservation concern.

### **Wading birds**

The 12 species of long-legged waders, such as herons and egrets, are at least apparently globally secure (NatureServe 2006; Table 1). All but the Wood Stork breed in the state. The Wood Stork is a federally endangered species that disperses into Arkansas after breeding elsewhere in the Southeast and Mexico, though it does not overwinter in the state. Nine species are vulnerable or imperiled during the breeding or nonbreeding season in the state; the White Ibis is a critically imperiled breeder. Three are of moderate conservation concern, and five are of high concern (Kushlan et al. 2002; Table 1). Six are ABCI species.

### **Shorebirds**

The majority of the 25 shorebird species only migrate through Arkansas (Table 1). Only the Killdeer, Black-necked Stilt, and American Woodcock breed or overwinter. The Piping Plover is globally vulnerable, federally threatened, a red WatchList species (National Audubon Society 2002), an ABCI species, and listed as imperiled in the U.S. Shorebird Conservation Plan (USSCP 2004; Table 1). Likewise, Buff-breasted Sandpiper is a red WatchList species, an ABCI species, and imperiled. Four other species are yellow WatchList, and two others are ABCI species. Ten species are of moderate conservation concern (USSCP 2004; Table 1).

### **Marshbirds**

The ten marshbird species, including rails and bitterns, are at least apparently globally secure (NatureServe 2006; Table 1). Six species are imperiled or critically imperiled during the breeding or nonbreeding season in Arkansas. Seven are ABCI species. The Yellow Rail is a yellow WatchList species, and Black Rail is a red species (National Audubon Society 2002; Table 1). With the exception of American Coot, these species are of moderate to high conservation concern, and uncommon or rare and localized during the seasons in which they occur in the state.

### **Landbirds**

The 17 landbird species, most of which are fairly common to common raptors or passerines, are at least apparently globally secure (NatureServe 2006; Table 1). The Bald Eagle is imperiled during the breeding season in Arkansas and is federally threatened. The Osprey and Sedge Wren are critically imperiled state breeders. These three species as well as the Marsh

Wren, Prothonotary Warbler, and Rusty Blackbird are ABCI species. The latter two are yellow WatchList species (National Audubon Society 2002; Table 1).

### Waterbird population trends

Quantifying long-term population trends for many waterbirds is difficult, especially at the state level, because many species are poorly covered by the Breeding Bird Survey (BBS; 1966-2005; Sauer et al. 2005) and Christmas Bird Count (CBC; 1964-2003; National Audubon Society 2004). State-level trends suffer from small sample size; there are only 19 CBC circles and approximately 30 active BBS routes in Arkansas. Restricted-range and low-density species also suffer from small sample size at the state and national levels. Targeted, standardized survey techniques have been developed recently (e.g. shorebirds: Howe et al. 2000, colonial waterbirds: Steinkamp et al. 2003, marshbirds: Conway 2004), but have yet to be implemented widely. Partners In Flight (PIF) developed a method for scoring population trend based on a combination of BBS, CBC, local, and species-specific datasets, as well as expert opinion (Carter et al. 2000, Panjabi 2001). This scoring system has been adopted by other bird conservation plans. Table 2 presents population trend scores at either the continental, regional, or state level, depending upon availability, from several sources (Brown et al. 2000, Kushlan et al. 2002, PIF 2002, National Audubon Society 2004, North American Waterfowl Management Plan 2004a, Sauer et al. 2005).

### **Waterfowl**

According to the BBS, breeding populations of Mallard and Wood Duck may be increasing in the state (Table 2). With the exception of Mottled Duck, all of the focal waterfowl species winter in the state. According to the CBC, 16 species are either stable or increasing (Table 2). Six species (Tundra Swan, American Wigeon, American Black Duck, Northern Pintail, Canvasback, and Redhead) show declines, a trend generally reflected in continental CBC data (Table 2). According to Arkansas midwinter waterfowl surveys, state duck populations have been highly variable from year to year, but trending downward overall during the period 1955-2005 (Arkansas Game and Fish Commission [AGFC] 2005). Almost half as many ducks were counted in 2005 (565,302) as were counted in 1955 (1,051,200). On average, the count total decreased by 9,000 individuals per year. Arkansas Mallard counts have trended downward during the period 1989-2005, with 1.2 million in 1989 and 350,000 in 2005 (AGFC 2005). Despite decreasing numbers, eastern Arkansas contains the largest wintering population of Mallards in the country, and this species is the most numerous duck in the state (James and Neal 1986). On a continental scale, 20 of the 23 focal species have been increasing, while three (American Black Duck, Lesser Scaup, and Northern Pintail) have significantly declined (North American Waterfowl Management Plan 2004a; Table 2). Across geographic scales, Northern Pintail populations have decreased consistently (Table 2).

### **Other Waterbirds**

Breeding Pied-billed Grebe populations may be declining. Breeding Bird Survey trends were uncertain due to small sample size for Least Tern, while Double-crested Cormorants and Anhingas were not recorded (Sauer et al 2005). The Pied-billed Grebe and Double-crested Cormorant breed locally in relatively small numbers, but are found throughout the state in larger numbers in winter. The Double-crested Cormorant has shown consistent population increases across geographic scales and seasons (Table 2). Least Terns nest in the state along the



Mississippi, Arkansas and Red Rivers (Lott 2006). Targeted surveys reveal increases along the Lower Mississippi and Arkansas Rivers, though immigration from Gulf Coast populations may contribute to this increase (Thompson 1997, Kirsch and Sidle 1999, Urbanic 2003, Lott 2006). Seven species overwinter in the state, and of those only Horned Grebe has shown possible declines according to the CBC (Table 2). In fact, this species has shown consistent declines across geographic scales. The Black Tern has declined across the U.S. and Southeast.

### **Wading birds**

The three permanent residents, Great Blue Heron, Great Egret, and Cattle Egret, are increasing in the state according to both the BSS and CBC (Table 2). Green Heron and Yellow-crowned Night-Heron appear to be declining in the state. State-level trends are uncertain for Snowy Egret and Little Blue Heron, though the former is thought to be significantly increasing and the latter decreasing at broader geographic scales (Table 2).

### **Shorebirds**

In Arkansas, Killdeer and Black-necked Stilt populations may be on the rise during the breeding season, although winter Killdeer populations may be declining (Table 2). Wintering populations of Wilson's Snipe and American Woodcock also may be declining in the state (Table 2). Targeted woodcock surveys in other parts of its range indicate a long-term decline of <2% during 1968-2006, but no significant population trend during 1996-2006 (Kelly and Rau 2006). According to the CBC, wintering populations of Greater and Lesser Yellowlegs, and Spotted and Least Sandpipers appear to be increasing (Table 2). Throughout the Mississippi Alluvial Valley (MAV), 13 focal species are thought to be declining, while trends are uncertain for 12 others (Kushlan et al. 2002; Table 2); only the Long-billed Dowitcher is estimated to be increasing. This pattern is reflected in estimates of continent-wide population trends (Brown et al. 2000).

### **Marshbirds**

Little is known about the distribution and abundance of the more secretive members of this group (Conway 2004). American Bittern, Virginia Rail, and Sora may be declining in the state, while American Coot appears to be increasing (Table 2). Least Bitterns and King Rails nest in the state but BBS data are insufficient to determine trends. The King Rail may be declining throughout the MAV, Southeast, and continent. In addition, American Bittern and Black Rail are thought to be declining within the MAV and Southeast. Little is known about Yellow Rail population trends.

### **Landbirds**

State-level BBS or CBC data are available for all focal landbird species except two (Bank Swallow and Northern Waterthrush; Table 2). At least 10 species appear to be increasing in the state. The Belted Kingfisher and Common Yellowthroat appear to be increasing during the non-breeding season but decreasing during the breeding season. Red-winged Blackbird populations show the opposite pattern. Wintering populations of Le Conte's and Swamp Sparrows and Rusty Blackbird are declining in the state. The Rusty Blackbird decline is notable for its long-term, range-wide decline of over 90% during the last several decades (Greenberg and Droege 1999). According to the mid-winter Bald Eagle survey, this species increased 0.3% per year in Arkansas and 1.5% per year in the Southeast during 1986-2000 (Steenhof et al. 2004).

## **Population Trend Patterns**

Of the 25 species with state-level BBS data, 14 show a positive trend. These are species that have adapted to human-modified landscapes, such as the Great Blue Heron, and those that use artificial nest structures such as the Purple Martin; even the Black-necked Stilt may be responding to the availability of human-made nesting and foraging sites such as rice fields and impoundments (Robinson et al. 1999). The five species showing a negative trend tend to be associated with riparian forests. This suggests the need to establish more riparian forest buffers and restore bottomland hardwood forest (see Management section). Five of the six species with uncertain trends or lacking sufficient data are imperiled or critically imperiled state breeders. No obvious pattern emerges when grouping species by CBC trend. Trends at the state level are generally reflected continentally. Across geographic scales and seasons, a greater percentage of waterfowl, waterbird, wader, and landbird species are estimated to be stable or increasing rather than decreasing. In contrast, more shorebird and marshbird species are showing some level of decline or lack sufficient data to determine a trend. This pattern may be linked to the loss and limited distribution of mudflat and marsh habitat across the continent (see Management section below). The difficulty of surveying these two groups as compared to other groups also may be a factor.

## **Priority species**

Given the conservation and population status of shorebirds and marshbirds, these groups should be a priority for Arkansas's Waterbirds on Working Lands Initiative. Priority species within these groups are: Buff-breasted Sandpiper, American Bittern, Least Bittern, Yellow Rail, Black Rail, and King Rail. Priority species from other groups are: Mottled Duck, American Black Duck, Hooded Merganser (breeding season), Pied-billed Grebe (breeding season), Least Tern, Snowy Egret, Little Blue Heron, Sedge Wren, and Marsh Wren. Priority species are not only of high conservation concern and declining in the state, but also have significant potential to benefit from conservation actions on Arkansas's working lands. Many other waterbirds will benefit from management conducted on behalf of priority species and vice versa.

## Arkansas land use/cover

### **Historical change**

At the time of European settlement, approximately 3.9 million ha (28%) of Arkansas were covered by wetlands (Dahl 1990). Mudflats, sandbars, oxbows, and sloughs provided the majority of waterbird habitat (Elliot and McKnight 2000). Today, only 1.5 million ha (10% of the state) remain (Hefner et al. 1994). Historic hydrology has been altered by the construction of dams, levees, and reservoirs (Elliot and McKnight 2000). Natural wetlands have been replaced by other cover types, primarily agricultural and urban development (Hefner et al. 1994). Fortunately, flooded agricultural fields provide open water habitat. Thus, expansion of agriculture into the once-forested regions of the state may have offset some of the wetland losses in other regions (Twedt et al. 1998, Elliot and McKnight 2000). However, the end result has been a net loss of wetland area in the state, region, and nation (Dahl 1990).

We defined working lands as those lands used for the production of row crop, as well as aquaculture ponds. Counties with at least 10% of the land area in row crop are a focus for this project. This includes 30 counties in Arkansas (Fig. 1), most in the eastern portion of the state,

and contained within either Bird Conservation Region (BCR) 26 (Mississippi Alluvial Valley, MAV), or BCR 25 (West Gulf Coastal Plain/Ouachitas, WGCP). Before settlement, these regions were largely forested; waterbird habitat was restricted primarily to major rivers and floodplains (Elliot and McKnight 2000). Today, agricultural lands represent a large source of potential habitat. The area of cropland in Arkansas has increased from 319,978 ha in 1850 to 5,589,818 ha in 2005 (Waisanen and Bliss 2002, NASS 2005).

### **Row crops**

Soybean comprises the largest percentage of total row crop area (range = 42-71%, 1972-2003) in the focal counties (NASS 2005). Rice is the second-most abundant row crop in terms of area (range = 7-24%, 1972-2003), and increased in acreage over the last several decades (average = 4%/year; Table 3). Cotton, winter wheat, corn, and sorghum comprise the remainder of major row crops in Arkansas (Table 2). Corn showed the largest average annual increase (10%/year) in acreage during 1972-2003 (Table 3).

Arkansas is the top rice producer in the country (Shipp 2002). Depending on environmental conditions, rice may be planted any time between the beginning of March and mid-June (Table 4). Fields may be flooded either several days before or immediately after planting, depending on the seeding method used (water or dry seeding, respectively). Once a field is flooded it is not drained until harvest sometime between mid-July and late September. Rice may be harvested by cutting close to the base of the plant or by stripping the head. After harvest, some farmers flood the field again and maintain a flooded condition throughout the winter to attract waterfowl (Elphick and Oring 2003). To combat pests, such as red rice, one of the other major row crops may be planted in a rice field every fourth year (Shipp 2002). Herbicides may be applied during seedbed preparation and after seeding. Insecticides may be applied throughout the growing season (Table 4).

Soybean, corn, cotton, and sorghum are generally planted in the spring and early summer (third week of March to second week of June) and harvested in the late summer or fall (third week of August to fourth week of November; Table 4). Winter wheat, on the other hand, is planted between the first week of October and the second week of November, and harvested between the fourth week of May and the fourth week of June.

### **Aquaculture**

In 1998, over 22,000 hectares of open water were provided by more than 200 aquaculture farms in Arkansas (NASS 2000). Arkansas is one of the top four catfish producers in the country. In 2005, Arkansas catfish ponds provided 10,100 ha of open water (NASS 2006), close to the 10-year average of 12,706 ha, though acreage has declined over the past three years due to low farm prices (Arkansas Statistical Office 2005). Eight counties in the focal region are major catfish producers: Ashley, Chicot, Desha, Greene, Lincoln, Lonoke, Poinsett, and Prairie (NASS 2005). Acreages devoted to production of sportfish, baitfish and crayfish are difficult to quantify because of fluctuations in acreage for large businesses and lack of documentation for smaller ventures (Dr. J. Sadler, Arkansas Cooperative Extension Service, *pers. comm.*). Werner et al. (2005) reported 12,100 ha of baitfish farms mostly of golden shiners, fathead minnows, and goldfish in 1995. Approximately 48% and 16% of these were in Lonoke and Prairie counties, respectively.

## Waterbird use of working lands

Over 260 bird species have been associated with agricultural wetlands in the MAV and WGCP regions (Huner et al. 2002). Working lands in Arkansas can provide waterbird foraging, breeding, and resting habitat year round.

### **Rice**

Rice is the row crop with the greatest actual and potential benefit for waterbirds in Arkansas. Water levels on rice fields are actively managed in a way that is often compatible with waterbird needs (Remsen et al. 1991; Twedt et al. 1998; Elphick and Oring 1998, 2003; Elphick 2000; Huner et al. 2002). The importance of rice as waterbird habitat is greater than availability suggests. For example, shorebird density may have been greater on soybean fields, but shorebirds were encountered more frequently on rice fields in portions of the MAV (Twedt et al. 1998).

Waterfowl. – Waterfowl are the primary target of rice field water management outside of the growing season. Some farmers flood their fields in late fall to coincide with the arrival of wintering birds (Table 4). Some of these farmers lease their land to hunters. Approximately 131,000-151,000 ha (25%) of Arkansas's rice fields are flooded throughout the winter for waterfowl (Dr. C. E. Wilson Jr., Rice Research and Extension Center, *pers. comm.*). All 23 focal species have been reported on flooded rice fields throughout the country (James and Neal 1986, Remsen et al. 1991, Day and Colwell 1998, Elphick and Oring 2003, Poole 2005, ARBIRD-L 2006). They eat waste grain, weed seeds such as red rice, green vegetation, and aquatic invertebrates (Wright 1959, Manley et al. 2004). In addition, tens of thousands to millions of Snow, Greater White-fronted, and Canada Geese occupy dry rice stubble throughout Arkansas's MAV where they feed on waste grain. Waterfowl also use rice fields for resting and as a refuge from hunting (Rave and Cordes 1993). The Mottled Duck uses rice fields in Louisiana for nesting (Zwank et al. 1989) as well as for feeding and resting (Durham and Afton 2003). This species occurs in small numbers on artificial and restored wetlands in eastern and southwestern Arkansas (ARBIRD-L 2006). They prefer dense stands of emergent vegetation (Moorman and Gray 1994). One pair nested along an irrigation reservoir on private property in Desha County in 2005 (R. Baxter, Arkansas State University, *pers. comm.*). They may use Arkansas rice fields in late summer after breeding when vegetation structure is favorable.

Other Waterbirds. – Rice fields are too shallow for most of these species, many of which feed by diving. Seven focal species have been associated with flooded rice fields across the U.S.: Pied-billed Grebe, Eared Grebe, American White Pelican, Double-crested Cormorant, Ring-billed Gull, Forster's Tern, and Black Tern (James and Neal 1986, Remsen et al. 1991, Day and Colwell 1998, Elphick and Oring 2003, Poole 2005). These species probably use rice fields and adjacent deeper water habitats such as ditches for foraging and resting during winter and migration. They likely feed on insects, crayfish, and aquatic vertebrates such as fish and frogs found on rice fields and adjacent habitats, but this has not been studied.

Wading birds. – All but three species (Green Heron, Tricolored Heron, and Yellow-crowned Night-Heron) have been documented on flooded and dry rice fields (James and Neal 1986,

Remsen et al. 1991, Elphick and Oring 2003, Poole 2005). They forage for both vertebrate and invertebrate prey (Huner et al. 2002). Foraging birds may trample plants, and although damage has not been quantified it is probably insignificant (Huner et al. 2002). There is no direct information for wading bird use of rice fields in Arkansas other than presence.

Shorebirds. – With the exception of American Woodcock, it is highly likely that every species forages on flooded rice fields and adjacent mudflats in Arkansas during migration (James and Neal 1986, Arkansas Audubon Society 2004, Poole 2005). Peak daily counts are in the hundreds to thousands for some species in particular locations (Graves 1972, James and Neal 1986). Rice stubble and water drawdowns attract and concentrate the aquatic invertebrate prey that shorebirds require for refueling during their long migrations. Black-necked Stilts nest within growing rice (Arkansas Audubon Society 2004).

Marshbirds. – Rice harvest coincides with fall marshbird migration. Yellow, Black, King, and Virginia Rails, Sora, and Least Bitterns have been flushed by combines during September and October (James and Neal 1986, Arkansas Audubon Society 2004, ARBIRD-L 2006). Over 200 Soras have been flushed from a single field in Crittenden County in October with over 400 individuals of three species observed that day (ARBIRD-L 2006). Displaced birds will move to adjacent unharvested rice fields, low wet spots in rice fields, or borrow ditches bordering fields (Meanley 1956). King Rails and occasionally Soras overwinter in small numbers in rice stubble and adjacent ditches (Meanley and Neff 1953, Meanley 1956, James and Neal 1986). Like waterfowl, American Coots overwinter on flooded rice fields and eat germinating seeds (Huner et al. 2002, Poole 2005). Least Bittern, King Rail, Common Moorhen and Purple Gallinule nest in Louisiana rice fields (Hohman et al. 1994). Of these four species, King Rail is the only one that has been studied in detail in Arkansas (Meanley 1953, 1956; Poole et al. 2005). King Rails are resident in the state but abundance increases with the arrival of migrants during February-March and October-November (James and Neal 1986). Pairs form in March and nesting occurs during April-September (Meanley 1953). However, nests are not built in flooded rice fields until June-August and may represent second nesting attempts following failure of nests in cattails, sedges, and rushes in adjacent roadside ditches and canals (Meanley 1953). Birds may choose rice fields later in the summer because ditches become dry and rank with vegetation while rice attains the preferred height and density. Nests in rice fields are built entirely of rice or rice and associated weeds, and are elevated less than 30 cm above the water (Poole et al. 2005). King Rails and other marshbirds eat crayfish, fish, aquatic insects, waste rice, and weed seeds (Meanley 1956, Poole 2005, Poole et al. 2005).

Landbirds. – Few of Arkansas's focal landbird species benefit directly from rice. Bald Eagles may benefit from the abundance of waterfowl (Elphick 1998). Le Conte's Sparrows may winter in rice stubble (James and Neal 1986). Sedge Wrens breeding in the rice-growing regions of Arkansas may delay nesting until rice has obtained a suitable height in August (Meanley 1952). Wrens prefer earlier maturing rice varieties, especially where weeds provide dense cover and nesting material. The Red-winged Blackbird derives the greatest benefit from rice cultivation. During the breeding season, rice fields and adjacent ditches provide nesting and foraging habitat (Pierce 1970, Yasukawa and Searcy 1995). Blackbirds are considered a pest because they can cause localized (within 56 km of a roost) but substantial damage (up to 100% crop loss) to sown seeds and to ripening plants from the milk stage until harvest (Cummings and Avery 2003).

During the nonbreeding season, the influx of migrants swells flock size to hundreds of thousands or millions, and birds eat waste grain (James and Neal 1986). Rusty Blackbirds form a small component of these large winter blackbird flocks (James and Neal 1986).

### **Other row crops**

The abundance of winter-flooded soybean fields containing relatively short, sparse vegetation means this crop type can provide substantial waterbird habitat (Twedt et al. 1998). In fact, waterbird and shorebird densities have been found to be greater on soybean fields than on rice or moist-soil fields in the MAV (Twedt et al. 1998, Twedt and Nelms 1999). However, soybean fields may host relatively low invertebrate biomass compared to rice and moist-soil fields, and soybean fields often lack water control structures (Elliot and McKnight 2000). Fields of harvested soybean, corn, cotton, winter wheat, sorghum, and other small grains provide ample waste grain for Snow, Greater White-fronted, and Canada Geese, Mallard, Northern Pintail, and other wintering waterfowl (Wright 1959, Poole 2005). In fact, the increase in agricultural production in the U.S. may be responsible for the increase in survival and population size of Lesser Snow Geese (Abraham et al. 2005). Migrating American Golden-Plovers forage and rest on open agricultural fields. In Indiana, birds actively selected untilled soybean stubble over tilled soybean residue, tilled corn residue, and untilled corn stubble, presumably because of a greater concentration of earthworms on untilled soybean stubble (Braile 1999). The American Woodcock uses open areas with short vegetation for nocturnal courtship displays. This may include harvested and untilled soybean fields (Keppie and Whiting 1994) and harvested cotton fields (*pers. obs.*). Buff-breasted Sandpipers also will use recently harvested cotton during migration (Lanctot and Laredo 1994). Cattle Egrets are upland foragers and might use a variety of harvested and fallow fields (Telfair 1994). Red-winged Blackbirds nest in winter wheat, and their winter diet includes corn, sorghum, and wheat seeds (Yasukawa and Searcy 1995). Local breeders do some damage to standing corn and sorghum and seeding wheat (Pierce 1970). Mallards also may nest in winter wheat (Drilling et al. 2002). In contrast, row crops other than rice have little value for rails (Eddleman et al. 1988) and probably other waterbirds. Flooded cotton fields offer limited food resources for waterfowl (Twedt and Nelms 1999).

### **Aquaculture**

Aquaculture ponds also provide open water habitat and food resources (Smith et al. 1991, Layher 1993, Elliot and McKnight 2000). All 102 of the focal species have been observed at aquaculture facilities in Arkansas, either on or adjacent to ponds (James and Neal 1986; Smith et al. 1991; Layher 1993; Arkansas Audubon Society 2004; ARBIRD-L 2006; A. Radomski, Agriculture Research Service, *pers. comm.*). Most research has focused on species thought to cause significant economic loss through predation. Bird use of aquaculture facilities varies by species cultured and geographic location (Dorr and Taylor 2003).

Waterfowl. – Although presumably all focal species may use aquaculture ponds for resting and feeding, diving ducks are most often studied because of their piscivorous diet (Stickley 1990, Layher 1993, Wooten and Werner 2004, Werner et al. 2005). Layher (1993) collected foraging waterbirds at two state sportfish hatcheries, and analyzed stomach contents. He found that most Lesser Scaup consumed snails and aquatic vegetation, while two birds also consumed mosquitofish. Eight Bufflehead digestive tracts did not contain fish. Similarly, Wooten and Werner (2004) found that cyprinids comprised only 10% of Lesser Scaup diet by mass (average

= 2.3 g of fish/bird) while chironomids (35%), seeds (20%), and snails (16%) comprised the bulk of the diet. Stickley (1990) lists Hooded Merganser as a potential predator but this has not been studied. Canada Geese and Blue-winged Teal have nested in the grass surrounding ponds at Charlie Craig State Fish Hatchery (an IBA; White 1995, ARBIRD-L 2006, *pers. obs.*).

Other Waterbirds. – The Double-crested Cormorant is considered the primary predator of farm-raised catfish (Glahn and King 2004). The increase in catfish farms across the South may be contributing to the species' substantial population increase over the last several decades (Glahn and King 2004). Abundance in Arkansas is highest between November and April. Over 50,000 birds were counted across several Arkansas roost sites in February 2000 (Glahn and King 2004). Birds travel up to 19 km from night roosts to forage on catfish, thus farms close to roosts have higher depredation rates (Dorr et al. 2004). However, shifting roost sites makes depredation widespread. Estimated catfish consumption and cost of lost fish varies depending on estimation methods and assumptions, but could be as high as 9 catfish/bird/day, with 70% fish of stocker size (10-20 cm); a flock of 30 cormorants feeding for 100 days could consume 6,800 kg of fish valued at \$10,500 on a single commercial farm, resulting in a cost of \$25 million across a region (Glahn et al. 2000). Bivings (1991) studied cormorant diets at various Arkansas catfish, baitfish, and ornamental fish facilities. He found that birds opportunistically shifted their diet by season to take advantage of the most readily available species. During April-May birds ate primarily channel catfish (73%) and golden shiners (22%) with some fathead minnows (2%). During October-December they shifted to primarily gizzard shad (44%) and golden shiners (25%), with some channel catfish (15%), grass carp (15%) and koi (4%). Decreasing water temperatures may have made shad more vulnerable to predation in the fall. Although birds ate few grass carp and koi, these ornamental fish have a high market value so loss of even a few individuals can mean a significant economic loss. At Joe Hogan State Fish Hatchery, Arkansas, Layher (1993) observed an average daily count of 552 cormorants in March declining to 28 in April. Channel catfish averaging 13 cm in length comprised 84.5% of the diet (the remainder were blue catfish and grass carp). He estimated that cormorants ate 985,622 channel catfish worth \$88,705 during the two-month period.

The American White Pelican is present primarily during November-May. The shallow water and high stocking density of catfish ponds make them ideal foraging habitat, although pelicans spend more time resting on nearby flooded agricultural fields than foraging on ponds (Glahn and King 2004). Pelicans forage in the upper 1.25 m of the water column and feed more often at night (Werner 2004). Their diet can consist of 99.6% catfish by weight, with a mean fish size of 26 cm (max = 63 cm; Glahn and King 2004). Pelicans are not widespread and only a small percentage of producers have reported pelican problems. However, pelicans often travel in large flocks of >300 birds (average = 250, max = 2,000) when flying to, foraging on, and departing from catfish ponds (Glahn and King 2004). An average-sized flock is estimated to consume \$2,900 of fish from one day of foraging (Glahn and King 2004). Thus, economic costs are small at a regional scale but highly significant at the scale of a farm.

Additional waterbird species may be only a minor nuisance. Stickley (1990) lists Pied-billed Grebe, gulls, and terns as minor predators, taking mostly small, sick, or dead fish. Layher (1993) found that Ring-billed Gulls ate only a small amount of fish, while grebes ate only crayfish from gamefish ponds. However, where crayfish are the primary crop, cormorants, pelicans, gulls, and terns may be a problem (Huner et al. 2002). Pied-billed Grebes have nested

at Joe Hogan State Fish Hatchery (White 1995) and a private minnow farm (Arkansas Audubon Society 2004).

Wading birds. – The Great Blue Heron and Great Egret are the primary wading bird predators at catfish facilities (Dorr and Taylor 2003). Heron numbers peak in mid-winter with the addition of migrants, whereas egret numbers are highest during the breeding season (Glahn et al. 1999). During the breeding season, depredation pressure may be greater on farms closer to rookeries (Gibbs 1991). Estimates for Great Blue Herons range up to 44% live catfish in the diet of an average length of 15 cm at a cost of \$11,400/year (Glahn and King 2004). Great Egrets, on the other hand, have lower energy requirements and are estimated to consume 8% live catfish averaging 10 cm in length at a cost of \$3,700/year (Glahn and King 2004). However, the costs do not account for the fact that many of the live fish eaten would have died anyway from disease (Glahn et al. 1999). Great Blue Herons and Great Egrets primarily forage on diseased catfish or species of wild fish that have invaded ponds (Glahn et al. 2002). Healthy catfish are consumed when they come to the surface to feed, but <1% of the total healthy stock is consumed. Therefore the economic effect of these two wading birds at catfish ponds may be negligible. Likewise, Little Blue Herons, Snowy Egrets, Tricolored Herons, Green Herons, Yellow-crowned Night-Herons, Black-crowned Night-Herons, and Wood Storks have been observed on catfish farms but there is little evidence to suggest they cause significant economic loss (Stickley 1990, Layher 1993, Dorr and Taylor 2003). Cattle Egrets are commonly found at aquaculture farms but do not eat fish (Glahn and King 2004). However, their presence may attract other waders (Stickley 1990).

Little Blue Herons and Snowy Egrets, along with Great Blue Herons and Great Egrets, are significant predators on baitfish farms (Hoy et al. 1989, Hoy 1994, Dorr and Taylor 2003). Mixed flocks of 100-500 birds during July-September, with peaks during September-October of 3,000 birds have been documented (Hoy et al. 1989, Dorr and Taylor 2003). Baitfish comprised 75% of wading bird diet in one study, with golden shiner comprising the largest percentage among baitfish species (62-83% depending on the bird species; Hoy 1994). A conservative cost estimate for 100 birds foraging for 3 months is \$11,160, but a loss of \$20,000 in 2 weeks could occur if 2,000 birds were foraging during fall migration (Hoy et al. 1989). These estimates are not adjusted for inflation or actual harvestable biomass. Great Blue Herons are a major concern for ornamental fish farms where high-priced goldfish, grass carp, and koi are consumed (Hoy 1994). In contrast, Great Blue Herons were found to be only a minor (2.4%) source of mortality of rainbow trout stocked in a stretch of river that is popular with anglers (Hodgens et al. 2004). The White Ibis and Yellow-crowned Night-Heron are considered threats to crayfish production (Martin and Hamilton 1985, Stickley 1990). Crayfish becomes a major component of the diet during the flooded period when other prey items in the pond (e.g. fish, tadpoles, insects) become less available and young crayfish become more available (Martin and Hamilton 1985). However, Martin and Hamilton (1985) estimated that only 9% of all crayfish consumed were of harvestable size (7.6 cm) so <2% of the total commercial harvest was eaten. Wading birds and other focal species eat seeds and insects in ponds and thus compete for food with crayfish, but this has not been quantified (Huner et al. 2002). Birds also may be a nuisance by destroying the vegetated substrate of crayfish ponds and dislodging and stealing bait from traps (Huner et al. 2002).



Shorebirds. – Availability of foraging habitat depends on timing of drawdowns during late summer and fall (Elliot and McKnight 2000). An estimated 531,000 shorebirds used aquaculture ponds during fall migration in the MAV in 1995 and 1996 (Elliot and McKnight 2000). A snapshot survey conducted in late August 1999, a drought year, found that 29% of birds were counted at aquaculture ponds (Elliot and McKnight 2000). Charlie Craig State Fish Hatchery in northwestern Arkansas regularly hosts up to 25 species on 23 ha of ponds (Smith et al. 1991). Species with daily high counts of over 100 individuals include Killdeer, and Pectoral, Least, White-rumped, and Stilt Sandpipers. Black-necked Stilts have nested on levees of several fish farms; one nest was on the edge of a stand of pigweed (Arkansas Audubon Society 2004).

Marshbirds. – Least Bitterns, Purple Gallinules, and Common Moorhens have nested in the marshy edges of aquaculture ponds (Meanley and Neff 1953, James and Neal 1986). The other marshbird species, except Yellow Rail, have been observed at fish ponds and adjacent ditches around the state during spring and fall migration (White 1995, Arkansas Audubon Society 2004). However, nesting and foraging on ponds was probably more common in the past when producers allowed cattails, reeds, and other marsh vegetation to grow along the edge of ponds (James and Neal 1986).

Landbirds. – Few studies have been conducted on aquaculture pond use. Stickley (1990) lists Belted Kingfisher as a common predator on small fish, and Osprey as an uncommon predator on market-sized fish. Layher (1993) observed occasional foraging by a small number of Belted Kingfishers during January-March. Stomach contents from 6 specimens did not yield identifiable material. Bald Eagles are limited to foraging near the surface; benthic species such as catfish become prey only when dead and floating (Buehler 2000), or perhaps when feeding. Sedge Wrens sing in the fall from cattail-lined ditches adjacent to fish ponds (James and Neal 1986). Swallows and martins forage for insects above ponds, while other focal species have been observed along ditches and uplands surrounding ponds (ARBIRD-L 2006, *pers. obs.*).

### Benefits of waterbirds for working lands

#### **Rice**

Some rice farmers intentionally flood fields during the winter to provide habitat for waterfowl, and earn income by renting the land to waterfowl hunters (Elphick and Oring 2003). Waterfowl also benefit farmers by enhancing straw decomposition. Bird et al. (2000) observed waterfowl shredding straw while searching for invertebrates and grain. Waterfowl foraging increased straw decomposition by a factor of three in untilled fields as compared to unforaged fields. If waterfowl abundance is high enough the need for fall tillage may be reduced, saving time and money (Bird et al. 2000).

Both money and water can be saved if portions of fields are flooded shallowly (<15 cm) to provide habitat for shorebirds in addition to waterfowl (Elphick and Oring 1998). Reducing average water depth will allow farmers to flood more land with the same amount of water without affecting straw decomposition (Elphick and Oring 2003). Additional monetary benefits could be realized by leasing blinds to duck hunters. Leasing hunting blinds can generate \$60-75 per hunter per season (Hite et al. 2003). Winter flooding also conserves soil and soil nutrients, increases the quality of runoff water, retards winter weed growth, and contributes to rice straw decomposition (Manley et al. 2004). This leads to economic and environmental benefits.

Farmers could save \$11.06/ha (\$27.32/ac) assuming winter flooding eliminates the need for fall disking and spring aerial application of herbicides (Hite et al. 2003). Flooding allows sediment and nutrients to settle, thus reducing loading in runoff by 10-46% in continuous rice or rice-soybean rotation compared to continuous soybean or cotton (Hite et al. 2003). Improved water quality and habitat quantity through rice farming and flooding should lead to an increase in wildlife abundance and diversity and thus an increase in wildlife-related recreation (e.g. hunting and bird watching). Wildlife recreation can add money to local economies that provide quality experiences. In 2001, anglers spent \$446 million, hunters spent \$517 million, and wildlife watchers spent \$244 million on their activities in Arkansas (U.S. Fish and Wildlife Service [USFWS] 2003).

Waterfowl and other waterbirds may reduce the need for pesticides by eating invertebrates and weed seeds. For example, ducks proved effective at removing red rice seeds from flooded rice fields in Arkansas (Smith and Sullivan 1980). Similarly, Red-winged Blackbirds are known to eat red rice, as well as weed seeds and insect pests (James and Neal 1986). The Cattle Egret diet includes agricultural pests such as grasshoppers, though some agriculturally beneficial organisms are taken too (Telfair 1994). King Rails consume crayfish that bore holes in rice levees, and eat weed seeds such as rice cutgrass and smartweed (Meanley 1956).

### **Other row crops**

Data gap. Birds probably consume pest species.

### **Aquaculture**

Wading birds such as the Great Blue Heron and Great Egret select sick commercial fish as well as wild fish that invade ponds (Glahn and King 2004). Therefore, waders help to reduce the spread of disease and reduce populations of 'trash' fish that compete with commercial species for resources. Large numbers of waders can serve as indicators to farmers that there is a problem with a pond (Stickley 1990). Bald Eagles also could reduce the spread of disease by removing dead fish from the surface (Buehler 2000). In crayfish ponds, stunting and a lack of forage are caused by overstocking. Wading birds prefer crayfish that are below marketable size (Martin and Hamilton 1985). Allowing waders to forage is one way to remove excess crayfish.

Aquaculturists can realize the economic benefits of wildlife-related recreation. For example, several public and private fish farms in Arkansas are popular bird watching locations (ARBIRD-L 2006). Bird watchers may be willing to pay a nominal fee for access to a facility that is known to hold a diversity of birds. Alternatively, frequent visitation by ecotourists and agritourists could help scare some birds away from ponds (Wires et al. 2001).

### **Threats to waterbirds posed by working lands**

The greatest threats facing waterbirds nationwide are habitat loss and degradation through agricultural development, urban encroachment, exotic plant introduction, hydrologic alterations, and pollution (Poole 2005). Shorebirds in particular are threatened by a lack of mudflats during migration as a result of hydrological alteration. Marshbirds have lost wetlands with emergent vegetation. Specific agricultural practices that pose threats to waterbirds occupying working lands are described below.

## **Row crops**

Rice production practices. – Changes in rice farming practices that increase farm production efficiency can reduce nest success (Poole 2005). Laser leveled fields reduce the hummock and swale topography favored by rails (Poole et al. 2005). Shorter rice varieties decrease nesting cover. Rapidly maturing varieties allow for earlier harvest that coincides with the nesting season, which destroys nests and disturbs birds (Eddleman et al. 1988). Rapidly maturing rice varieties allow Sedge Wrens to nest earlier, and nests will survive a combine that leaves 30-45 cm high stubble, but nests can be crushed by combine wheels (Meanley 1952). Farm machinery may destroy nests within other crop types as well. Conventional tillage on all crop types buries waste grain, making it less accessible to foraging birds.

Pesticides. – Pesticides and other contaminants from agricultural, urban, and industrial practices pose an actual or potential threat to all waterbird species (Eddleman et al. 1988, Mañosa et al. 2001, Poole 2005). Persistent environmental contaminants such as organochlorine pesticides (e.g. DDE, heptachlor epoxide), certain insecticides (e.g. dieldrin, endrin, chlordane), PCBs, and heavy metals (e.g. mercury, lead, selenium, cadmium) have been known to cause reproductive impairment in a variety of bird species (Schmitt and Bunck 1994). Birds bioaccumulate contaminants present in their prey (Mañosa et al. 2001). Fortunately, many of these chemicals are either banned or highly regulated in the U.S. so concentrations in the environment and wildlife have declined (Schmitt and Bunck 1994, Poole 2005). However, measurable levels can be found in bird tissues years after cessation of use (White et al. 1983; Paveglio et al. 1992, 1997; Mañosa et al. 2001). Persistent pesticides have been replaced by more short-lived, fast-acting chemicals such as organophosphates and carbamates that are targeted at specific pest species (Glaser 1994). Over 100 insecticides, herbicides, fungicides, and nematocides are used on <1% to 92% of the acreage of rice, soybean, and cotton fields in Arkansas (Integrated Pest Management Center 2003, 2004a, 2004b). The tradeoff is that these chemicals are highly toxic during the limited period of exposure, and direct bird mortality has been reported (Flickinger et al. 1986, Glaser 1994). If used appropriately and at recommended doses, however, the risk of exposure is limited (Mañosa et al. 2001). Besides mortality and reproductive impairment, pesticides can negatively affect birds by reducing the food supply. Pesticides decrease the biomass of phytoplankton and zooplankton, prevent tadpole metamorphosis, and decrease the vegetation that supports weeds and invertebrates (Mañosa et al. 2001). Pesticide-reduced populations of burrowing crayfish may have contributed to the decline of King Rails from the rice fields of the Arkansas Grand Prairie region (Eddleman et al. 1988). Herbicides reduce weed species within rice fields that marshbirds and Sedge Wrens require for nesting substrate and cover (Meanley 1952, Poole et al. 2005).

Harassment. – The Red-winged Blackbird is considered the primary pest on row crops. Farmers may control depredating flocks without a federal permit using cultural practices, scare devices, chemical repellents, and restricted use of toxicants (Shipp 2002). DRC-1339 is an effective poison that impairs liver and kidney functions (Cummings and Avery 2003). Blackbirds are baited to poison-laced rice. However, non-target species may ingest lethal or sublethal doses as well (Cummings and Avery 2003).

## **Aquaculture**

Lethal control. – Waders and other waterbirds are harassed as predators at aquaculture facilities. In 2003, 79% of Arkansas aquaculturists that responded to a survey reported wildlife-related losses, mostly due to birds, and spent an average of \$14,300 per operation to prevent loss (NASS 2004); these values were higher than those of any other single state in the Southeast. Where non-lethal harassment techniques (see Management section below) alone are not effective, reinforcement with limited lethal control has been suggested (Glahn and King 2004). Concern over fish depredation has led USFWS to issue permits to take piscivorous birds when non-lethal techniques alone have proven ineffective. Most of the American White Pelicans taken in the Southeast during 2000-2002 were from Arkansas (550-750 birds); this represents approximately 0.5% of the global population taken in just three years (Hunter and Patrick 2003). In Arkansas, authorized and reported take of Great Blue Heron, Great Egret, Snowy Egret, and Little Blue Heron has been over 5% of the estimated state breeding population of each species (Hunter and Patrick 2003). Reported take for Great Blue Heron and Great Egret has increased since 1990. Reported take for Snowy Egret and Little Blue Heron, species of high conservation concern (Kushlan et al. 2002), has decreased or been irregular since 1990. Authorized and reported take in Arkansas is higher than any other southeastern state (Hunter and Patrick 2003). The reason for this difference in conflict level among states is unknown. Yet there should be an attempt to understand the situation, especially given recent research that suggests that economic loss from some species may be negligible (Layher 1993, Glahn et al. 1999, Glahn et al. 2002, Wooten and Werner 2004). Reported take should continue to be monitored and its effect on population size evaluated.

An unlimited number of Double-crested Cormorants within the vicinity of an aquaculture facility may be taken without a permit under a Depredation Order (50 CFR Part 21) issued by USFWS for the Southeast Region (Appendix II in Hunter et al. 2005). In addition, a breeding colony that was re-established on Millwood Lake (an IBA) in 1999 was destroyed in 2004 in an effort to reduce statewide population size, effects on sportfish, and damage to cypress trees (M. Hoy, Arkansas Wildlife Services, *pers. comm.*). Ninety-five nests were destroyed along with 6 eggs, 80 chicks, and 113 adults and subadults. Despite rangewide control efforts, populations continue to increase due to a variety of factors, some of which influence birds beyond the Southeast (Glahn and King 2004).

Clean farming. – Marshbirds have lost nesting and foraging habitat because of widespread clearing of marsh vegetation around fish ponds. This may have contributed to the decline of marshbird populations in the state (James and Neal 1986).

## Management of working lands for waterbirds

### **Rice**

Practices at each stage of rice farming can affect waterbird presence, abundance, or reproduction. Fields that were flooded during the winter should be drawn down beginning late February to provide habitat for late wintering waterfowl, early migrating shorebirds, and early migrating wading birds (Helmers 1992). Drawdowns should be gradual or partial to continually expose new habitat throughout migration and to concentrate invertebrate prey (Rundle and Fredrickson 1981, Eddleman et al. 1988, Hands et al. 1991). Although seeding method (wet vs. dry) may not influence nest density, nest density of some species may be higher where stem

density is high (Hohman et al. 1994). Later-maturing rice varieties allow more time for rice-nesting birds to finish nesting before harvest (Eddleman et al. 1988). Areas of natural vegetation in close proximity to rice fields, or unharvested sections in field corners or edges provide escape cover from combines (Eddleman et al. 1988). Although a second rice crop within a season is often not profitable to harvest, ratoon rice provides seeds and cover for birds (Manley et al. 2004). A conventional harvester generally results in higher waterbird diversity and abundance than a strip harvester because a conventional harvester leaves shorter stubble and more waste grain (Day and Colwell 1998). Following harvest, several methods to enhance residual straw decomposition may benefit birds including flooding, burning, rolling, chopping, and plowing (Helmert 1992, Day and Colwell 1998, Elphick and Oring 1998, Twedt et al. 1998). However, results have varied by study and species, and more study is needed. Winter flooding generally is beneficial for waterbirds. Different species prefer different water depth ranges (Elphick and Oring 1998). A water depth range of 10-20 cm across a field may favor the greatest number of species (Elphick and Oring 1998, 2003). Staggering water depths among levees within a field or among adjacent fields also will provide habitat for a variety of species (Hands et al. 1991, Helmert 1992, Elliot and McKnight 2000).

### **Other row crops**

Practicing no-till after harvest maintains waste grain availability (Keppie and Whiting 1994, Braile 1999). Where possible, flood fields in late summer/early fall to encourage aquatic invertebrates and provide habitat when conditions are typically dry (Elliot and McKnight 2000). Flooding will be easiest where crops are grown in rotation with rice. Water should be held as long as possible before preparing the field for other crop types (Helmert 1992). Fields that will remain fallow during the growing season should not be drawn down until late May to provide habitat for late migrating shorebirds (Elliot and McKnight 2000).

### **Aquaculture**

Wading birds and other waterbirds. – Conflict management is of primary concern for these species. Management techniques should be cost effective and have lasting effects with minimal lethal control. However, no one technique is completely successful at minimizing predation. The combination of frightening techniques (e.g. propane exploders, pyrotechnics, live ammunition, effigies, distress calls), harassment patrols (surveillance of ponds and chasing birds), and limited lethal control for reinforcement is recommended (Littauer et al. 1997, Barras and Godwin 2005). Vigilance is required at night where pelicans are a nuisance (Werner 2004). Harassment should be intensified at times when fish are most vulnerable to predation, e.g. when they surface to feed (Glahn and King 2004). Near-farm management is recommended too. For Double-crested Cormorants, night roost harassment coordinated simultaneously over a region is effective at dispersing birds (Glahn et al. 2000) as long as some unharassed roosts far from aquaculture facilities are left as refugia (Dorr et al. 2004). Early detection and dispersal of heron rookeries also will minimize later conflict (Telfair 1994). Draining agricultural fields adjacent to ponds will remove resting areas for American White Pelicans (Glahn and King 2004). Preserving and restoring extensive natural wetlands will provide alternative locations for wading and waterbirds to feed (Glahn and King 2004). For example, French et al. (2004) found that cormorants feeding on Lake Chicot (a natural oxbow lake and an IBA) consumed more forage fish and rough fish (e.g. gizzard shad and yellow bass) than sportfish (e.g. channel catfish and sunfish spp.).

Alterations to commercial fish production practices may reduce predation. Suggested practices include: 1) delay stocking fingerlings until after the peak season of a particular waterbird species (e.g. after mid-April for cormorants), 2) increase stocking rates, 3) use buffer prey in the same or separate ponds, 4) dye the water to reduce visibility, 5) maintain water depth >1 m to limit available feeding area, 6) vary feeding schedules to reduce bird habituation, 7) temporarily use sinking feed instead of floating feed to reduce vulnerability, 8) keep the most vulnerable or valuable fish in ponds closest to centers of human activity, 9) for crayfish, flood and drain ponds rapidly to reduce the time of vulnerability, and 10) provide vegetative cover along edges to protect adults while they burrow (Martin and Hamilton 1985, Cezilly 1992, Dorr and Taylor 2003, Glahn and King 2004). Each method has pros and cons that should be evaluated before instituting. New pond construction should consider: 1) smaller ponds that are easier to protect, 2) designing facilities to make use of deterrent devices more economically feasible, 3) planting trees around ponds to interfere with flight, and 4) locating facilities away from major flyways and concentrations of other facilities where bird densities are high (Wires et al. 2001).

Shorebirds. – Ponds are periodically drawn down for maintenance and disease prevention. Shallow water and mudflat habitat can be provided during spring and fall migration by leaving water control structures closed after draining to hold rainwater in idle basins (Elliot and McKnight 2000).

Marshbirds. – Habitat can be provided by allowing marsh vegetation to grow along edges or corners of ponds. This will provide cover for fish and crayfish as well.

### **Education and Outreach**

Education and outreach should be part of an effective management strategy. A supportive public will work with managers to monitor and protect birds, minimize disturbances, and support legislation (Kushlan et al. 2002). Strong public support also could help minimize the negative public perception of certain agricultural and aquacultural pests. Media campaigns that focus on popular waterbirds such as egrets could garner support. To increase opportunities to provide waterbird habitat on working lands will require expanding partnerships among agricultural and wildlife agencies, and improving relations with private landowners (Johnson-Shultz 2000). Workshops that describe the methods and programs available for providing waterbird habitat are one way to disseminate information and establish partnerships. The first round of workshops should target professionals who work with landowners such as state private lands biologists. Landowners trust their knowledge and experience. To strengthen relations with private landowners, the next round of workshops should target them. Even if landowners that are already amenable to wildlife conservation are the only ones to attend, the success of their projects could encourage others to participate.

### **Incentive Programs**

Several federal, state, and private agencies offer financial incentive programs that encourage installation of best management practices on and adjacent to working lands:

Farm Service Agency (FSA)

Conservation Reserve Program (CRP)

- Conservation Reserve Enhancement Program (CREP)
- Continuous Conservation Reserve Program (CCRP)
- Natural Resources Conservation Service (NRCS)
  - Conservation Security Program (CSP)
  - Environmental Quality Incentive Program (EQIP)
  - Resource Conservation and Development Program (RC&D)
  - Watershed Protection and Flood Prevention Program
  - Wetland Reserve Program (WRP)
  - Wildlife Habitat Incentive Program (WHIP)
- U.S. Fish and Wildlife Service
  - Challenge Cost Share
  - Landowner Incentive Program (LIP)
  - North American Wetland Conservation Act Grants (NAWCA)
  - Partners for Fish and Wildlife
  - Private Stewardship Grant Program
- Ducks Unlimited (DU)
  - Arkansas Partners Program
  - Arkansas's Rice Industry Caring for the Environment (RICE) Project
  - Land Protection Program
- Arkansas Farm Bureau Federation (AFBF)
  - Carbon Credit Aggregation Program

Conservation Reserve Program. – This FSA program encourages farmers to plant long-term conservation covers to improve soil, water and wildlife resources. It offers annual rental payments, incentive payments for certain covers, and cost-share assistance to establish approved cover on established cropland. Cost-share is up to 50% of the participant's costs in establishing approved conservation covers. The duration of contracts is 10-15 years.

<http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp>

In Arkansas, there are 4,769 active contracts enrolling 88,084 ha, including 16,344 ha of wetland restoration (CP23). Cost-share averages \$20.45/ha. Awareness of the program is widespread because it has existed since 1985. Sign-up periods are announced through newsletter, newspaper, radio, and TV ads, as well as through multiple county meetings. The main communication issue revolves around recommended habitat cover types. When the program began it focused solely on soil and water conservation. Many acres were planted in fescue and loblolly pine. In recent years biologists have been promoting cover types that provide better wildlife habitat such as native warm season grasses and longleaf pine (C. Parr, FSA, *pers. comm.*).

<http://www.fsa.usda.gov/ar/Programs/Conservation/Conservation.htm>

Conservation Reserve Enhancement Program. – A refinement of FSA's CRP that addresses multiple resource issues across multiple farms within specific landscapes. Like CRP, CREP contracts require a 10- to 15-year commitment to keep lands out of agricultural production. A federal annual rental rate, including maintenance incentive payment, is offered, plus cost-share of up to 50% to install the practice. Further, the program generally offers a sign-up incentive for participants to install specific practices. Landowners can enroll in both CRP and CREP.

<http://www.fsa.usda.gov/dafp/cepd/crep.htm>

Arkansas's CREP was established in 2001 to target the Bayou Meto watershed within portions of Lonoke, Prairie, Arkansas, Jefferson, and Pulaski Counties. Over \$10 million were allocated to reduce sediment loading by as much as 10,000 tons per year, and establish 320 km of riparian forest buffers to protect and restore water quality and wildlife habitat. Interest in this program was so high that additional money had to be allocated. Currently, 222 contracts totaling 2,606 ha of riparian buffers (CP22) have been established (C. Parr, FSA, *pers. comm.*).  
[http://www.fsa.usda.gov/dafp/cepd/state\\_updates.htm#arkansas](http://www.fsa.usda.gov/dafp/cepd/state_updates.htm#arkansas)

A Bayou DeView CREP is expected to be approved by the end of June 2006. More than 2,529 ha have been targeted for bottomland hardwood reforestation (CP31) in a 4,046 ha area along the corridor where the Ivory-billed Woodpecker (*Campephilus principalis*) was sighted in 2004. The Nature Conservancy (TNC) will buy permanent easements as match. It is expected that there will be more applications than can be funded, so more money will have to be allocated (D. Zollner, TNC, *pers. comm.*).

Continuous Conservation Reserve Program. – This addition to FSA's CRP allows producers to enroll on a continuous basis, rather than through the general CRP sign-up process. High-priority practices eligible under this program that may benefit waterbirds include: shallow-water areas for wildlife (CP9), herbaceous filter strips (CP21), riparian forest buffers (CP22), wetland restoration (CP23), wetland buffers (CP30), and bottomland hardwoods (CP31). Plantings are generally small in area, often <5.0 ha, and concentrated along waterways on highly erodible lands. Contracts are 10-15 years and provide up to 50% cost-share.  
<http://www.fsa.usda.gov/pas/publications/facts/html/crpcont06.htm>

Of the 88,084 ha enrolled in CRP in Arkansas 24,491 ha were enrolled through the continuous sign-up process (C. Parr, FSA, *pers. comm.*).

Conservation Security Program. – A NRCS program that supports ongoing stewardship of private agricultural lands by providing payments for maintaining and enhancing natural resources. It identifies and rewards those farmers and ranchers who are meeting the highest standards of conservation and environmental management on their operations. Farmers within selected watersheds submit a self-assessment of their conservation practices. Applicants are placed in one of three tiers. Depending on the tier, contracts are for 5-10 years. Each state develops a list of conservation practices for which producers can receive payments. The state then sets a per-acre payment or a fixed payment amount per activity. These payments are made each year for the life of the contract. Wildlife practices help meet Tier III eligibility requirements. Farmers who are not in a selected watershed in a given year can begin the assessment process and enroll in other conservation programs that will help them meet higher eligibility requirements when their watershed is selected.  
<http://www.nrcs.usda.gov/Programs/csp/>

In Arkansas, the 2005 CSP focused on five watersheds, and paid \$13,267,581 for 591 contracts, two of which were Tier III. The 2006 CSP is focused on two watersheds: the Lower Arkansas Watershed located in Arkansas, Desha, Jefferson, Lincoln, Lonoke and Pulaski counties in the southeast, and the Poteau Watershed located in Polk, Scott and Sebastian counties in the west. <http://www.ar.nrcs.usda.gov/programs/csp.html>

Environmental Quality Incentive Program. – A NRCS program that supports reduction of non-point source pollution, reduction of emissions, reduction in soil erosion and sedimentation, and



promotion of at-risk species habitat conservation on working lands. Benefits to wildlife are not necessarily a direct focus of this program, but wildlife benefit from soil and water conservation practices. The ranking process used to prioritize contracts and allocation of funds occurs at the state or county level to improve program efficiency at the local level. Contracts have a minimum term that ends one year after the implementation of the last scheduled practices and a maximum term of ten years. Up to 75% cost-share (90% in special cases) is given for structural conservation practices. Participants also may receive incentive payments for land management conservation practices important to improving and maintaining the health of natural resources in the area. A \$450,000 cap is established for each contract.

<http://www.nrcs.usda.gov/programs/eqip/>

EQIP is a successful program in Arkansas. Past levels of participation that exceeded available funds is one measure of success. In 2003, only 21% of applicants were funded; applications requesting federal cost-share funds totaling more than \$76 million were submitted by 4,606 landowners, and yet only \$11 million was allocated among 570 contracts. In addition, there has been an increase in inquiries and invitations to discuss EQIP at producer meetings statewide. Many district conservationists report large numbers of applications even when no formal announcement that funds are available has been made yet. These activities indicate the need for continued program support to address significant resource concerns. The 2006 sign-up has \$18,000 allocated among 1,020 contracts (J. Caudle, NRCS, *pers. comm.*).

<http://www.ar.nrcs.usda.gov/programs/eqip.html>

Resource Conservation and Development Program. – The purpose of this NRCS-administered program is to encourage and improve the capability of volunteer local elected and civic leaders in designated RC&D areas to plan and carry out “quality of life” projects for resource conservation and community development. RC&D Councils obtain the assistance of local, state, and federal agencies, private organizations, and foundations to carry out their projects. Project categories include natural resource improvement, community improvement, forestry, education, economic development, water quantity and quality, recreation and tourism, marketing and merchandising, fish and wildlife habitat enhancement, and waste management and utilization.

<http://www.nrcs.usda.gov/programs/rcd/>

An example of a project to benefit waterbirds in Arkansas is the Point Remove Wetlands Reclamation and Irrigation Project in Pope and Conway counties. This was a 13,000-ha water conservation and wildlife management project that restored wetland habitat and provided irrigation water for approximately 4,500 ha. It was a cooperative effort with the improvement district, Arkansas River Valley RC&D Council, AGFC, DU, Arkansas Soil and Water Conservation Commission, NRCS, and local people.

<http://www.ar.nrcs.usda.gov/programs/rcd.html>

Watershed Protection and Flood Prevention Program. – NRCS implements the Watershed Protection and Flood Prevention Act through three watershed programs: surveys and planning, protection and flood prevention operations, and rehabilitation. Program components include conservation practices, sediment control, fish and wildlife enhancement, and wetlands and wetland function creation and restoration. Landowners in watershed projects receive technical and sometimes financial assistance in applying conservation practices.

<http://www.nrcs.usda.gov/programs/watershed/index.html>

In Arkansas, funding is used primarily for flood control. Landowners bring local flooding problems to the attention of their county NRCS office. NRCS then assists with development of a watershed plan. Program dollars most often pay for dam construction. Two-hundred and five dams have been built. Other projects such as grazing control also have been funded. There are more applications than can be funded, yet Arkansas's allocation is at a lower level than in the past. Some reservoirs are stocked with fish, and Bald Eagles have been observed at these sites (T. Stevenson, NRCS, *pers. comm.*).

**Wetland Reserve Program.** – This NRCS program provides technical and financial assistance to eligible landowners to address wetland, wildlife habitat, soil, water, and related natural resource concerns on private lands in an environmentally beneficial and cost-effective manner. Landowners have the option of retiring marginal lands from agriculture through permanent easements, 30-year easements, or restoration cost-share agreements. The program is offered on a continuous sign-up basis. It pays 100% of wetland restoration costs under a permanent easement, and 75% under a 30-year easement. <http://www.nrcs.usda.gov/programs/wrp/>

In Arkansas, the focus is narrowed to restoring bottomland hardwood forests and improvement of water quality in the MAV through reforestation and hydrology restoration. However, up to 30% of the area may be converted to open moist soil units, shallow water, or deep water. Arkansas is ranked number two in the nation for enrolled WRP acreage. Approximately 60,700 ha of restoration have been completed with another 20,200 ha in progress. Most of the more than 200 contracts are perpetual easements. Around \$12.5 million dollars have been allocated for 2006, though the number may drop slightly next year. Funds cover only a quarter of the requests (J. Caudle, NRCS, *pers. comm.*).  
<http://www.ar.nrcs.usda.gov/programs/wrp.html>

**Wildlife Habitat Incentive Program.** – This is the only NRCS program that specifically focuses on creation of fish and wildlife habitat. Applications for a wildlife habitat plan may be filed at any time. NRCS provides up to 75% cost-share assistance to landowners under contracts that are 5-15 years in duration; even greater cost-share may be provided for 15-year agreements. Partnership with other conservation agencies is a key aspect that has contributed to the program's success; partners have contributed millions of dollars in cost-share and in-kind services (Haufler 2005). <http://www.nrcs.usda.gov/programs/whip/>

In Arkansas, NRCS and AGFC biologists work with applicants to conduct a habitat evaluation of the proposed area, prioritize habitat needs, and install appropriate management practices. Three general and four special funding categories, respectively, are available: riparian, wetlands, uplands, cave ecosystems, elk habitat, Northern Bobwhite (*Colinus virginianus*) habitat, and Ivory-billed Woodpecker habitat. Among the general categories, emphasis is placed on upland habitats because funding is limited (\$436,000 with a cap of \$10,000/project), and other NRCS programs focus on wetlands. Cost-share is either 50% or 75%, depending on the practice. Those practices that are most beneficial to the species of concern are generally cost-shared at the higher rate. Periodic management practices such as mowing and burning are typically funded (J. Caudle, NRCS, *pers. comm.*).  
<http://www.ar.nrcs.usda.gov/programs/whip.html>

Challenge Cost Share. – A USFWS grant to encourage partnerships with non-federal governments, private individuals and organizations, educational institutions, philanthropic and charitable groups, and businesses. Projects focus on restoration of natural resources, the establishment or expansion of wildlife habitats, or wildlife-oriented recreational and education programs. Cost-share is 50%, with a range of \$300-\$25,000 per project.

[http://www.federalgrantswire.com/challenge\\_cost\\_share.html](http://www.federalgrantswire.com/challenge_cost_share.html)

In Arkansas, Challenge Cost Share dollars pay for a significant portion of DU's Arkansas Partners Program (see below). Funding also goes to refuge managers to enhance habitat on refuges and on private lands surrounding refuges (T. Edwards, USFWS, *pers. comm.*).

Landowner Incentive Program. – A USFWS program designed to assist states by providing grants to establish or supplement landowner incentive programs that protect and restore habitats on private lands, to benefit Federally listed, proposed or candidate species or other species determined to be at-risk, and provide technical and financial assistance to private landowners for habitat protection and restoration. Only state agencies with primary responsibility for fish and wildlife may submit proposals. Other agencies, organizations or individuals may partner with or serve as a subgrantee of that fish and wildlife agency. The Tier II portion of the program is for implementation of state programs that provide technical and financial assistance to private landowners. A minimum of 25% non-Federal match, including in-kind contributions, is required. <http://federalasst.fws.gov/lip/lip.html>

In Arkansas, AGFC has used Tier II funds to renovate 24 km of private stream bank along the South Fork Spring River. AGFC also has contracted with TNC to reintroduce fire to up to 5,440 ha through the development of private landowner fire teams. These teams conduct prescribed burns but also train landowners to independently use fire to improve habitat for at-risk species. This is a competitive but nascent program; funds have been allocated to establish administrative support for LIP within AGFC. However, progress has been slowed by budget constraints (R. Gasaway, USFWS, *pers. comm.*).

North American Wetland Conservation Act Grant. – This Federal act provides matching grants to organizations and individuals who have developed partnerships to carry out wetland conservation projects for the long-term benefit of wetland-associated migratory birds and other wildlife. There is a Standard and a Small Grants Program. Cost-share is 50%.

<http://www.fws.gov/birdhabitat/Grants/NAWCA/index.shtm>

Since 1998, \$27,358,355 have been allocated to permanently acquire, restore, or enhance 14,147 ha of wetland in Arkansas. An additional \$15,132,531 has gone to joint wetland conservation projects among Arkansas, Louisiana, Mississippi, Tennessee, and Kentucky totaling 52,669 ha along the Mississippi River.

<http://www.fws.gov/birdhabitat/Grants/NAWCA/BiReport.shtm>

Partners for Fish and Wildlife. – The purpose of this USFWS program is to restore and enhance wetlands and adjacent upland habitats on private land through the establishment of wildlife management agreements or partnerships with private organizations, corporations, and individual landowners. Priority areas include converted wetlands, wet areas in fields, degraded wetlands, and uplands suitable for native prairie. USFWS provides technical assistance and up to 50% cost-share under a 10-year contract.

<http://ecos.fws.gov/partners/viewContent.do?viewPage=home> and <http://www.fws.gov/southeast/partners/>

In Arkansas, activities include restoration and enhancement of bottomland hardwood forest, wetlands, and riparian areas. Over 150 projects have been carried out on over 6,270 ha in cooperation with AGFC, TNC, DU and others. Three-hundred thousand dollars have been secured for additional projects in fiscal year 2006-2007. The next step is to find focus areas for the program and determine where USFWS priorities and projects overlap with those of other agencies for more efficient partnerships (M. Tobin, USFWS, *pers. comm.*).

<http://www.fws.gov/partners/pdfs/AR-needs.pdf>

Private Stewardship Grant Program. – USFWS provides grants and other assistance on a competitive basis to individuals and groups engaged in local, private, and voluntary conservation efforts that benefit federally listed, proposed, or candidate species, or other at-risk species. A 10% match of cash or in-kind contributions is required. The program is available to private landowners and their partners.

[http://www.fws.gov/endangered/grants/private\\_stewardship/index.html](http://www.fws.gov/endangered/grants/private_stewardship/index.html)

In 2006, \$168,748 was awarded to TNC for four projects to restore riparian, grassland, and cave ecosystems in Arkansas. In addition, TNC, Audubon Arkansas, and the Mississippi River Trust are sharing \$800,000 for projects to benefit the Ivory-billed Woodpecker on over 800 ha of potential habitat. <http://www.fws.gov/southeast/news/2006/r06-015.html>

Arkansas Partners Program. – A cooperative effort among DU, USFWS, AGFC, and NRCS. The objective of the program is to manage land for ducks and other waterbirds. The program offers water control structures and technical assistance to private landowners interested in restoring wetlands and managing existing wetlands, idle areas, and agricultural fields after harvest as shallow wetland habitat. The 15-year contract requires: 1) duck hunting be limited to half-days only, 2) crop fields be rolled, not disked or burned, and managed to hold water, 3) structures be closed and fields kept flooded through February, and 4) cooperators maintain water control structures for the life of the agreement. Since 1993, DU and its partners have provided water control structures to over 800 farmers and restored and enhanced over 62,700 ha of waterfowl habitat in Arkansas, especially in the Cache River basin. Approximately 80% of this acreage is agriculture, with the remainder consisting of green tree reservoirs and moist soil units. Emphasis will now be placed on the latter two habitat types. This is a popular program limited only by funding (B. Noble, DU, *pers. comm.*).

<http://www.ducks.org/Arkansas/ArkansasConservation/1287/ArkansasPartnersProject.html>

Arkansas's Rice Industry Caring for the Environment Project. – The goal of this DU project is to demonstrate and promote environmental, agricultural, and wildlife benefits of winter rice field management, including minimum tillage and ponding of winter rainfall, to the rice industry, conservation community, and general public. Objectives are: 1) annually provide more than 60,700 ha of winter managed rice fields, 2) demonstrate the environmental stewardship practiced by Arkansas's rice growers and their industry, and encourage additional farmers to participate, and 3) promote the environmental, agricultural, and wildlife benefits of winter rice field management to the agriculture industry, conservation community, and general public. This program is near completion (B. Noble, DU, *pers. comm.*).

<http://www.ducks.org/Conservation/Habitat/1603/ArkansasRiceProject.html>

Land Protection Program. – Under this program DU places a conservation easement on an individual's land. Efforts are targeted to regions that are important for waterfowl such as the MAV. The owner keeps the right to use the property for economic gain or recreation and the right to sell or deed the property to another. A donation of a conservation easement also may reduce estate, income and property taxes. An easement may be granted for a term of years or in perpetuity. However, for a landowner to take full advantage of the possible tax benefits of a donated easement, it must be given in perpetuity. Approximately 96,300 ha have been placed in easements in the country, 85% of which are in the Southeast.

<http://www.ducks.org/Conservation/LandProtection/1489/LandProtectionHome.html>

In Arkansas, 19 perpetual easements totaling 8,500 ha been established with 4-6,000 additional ha in progress. All easements are donated while an endowment pays for DU personnel time and annual monitoring. Thus, this is a cost neutral program with long-term environmental benefits. DU is using a Geographic Information System (GIS) model to find focal areas that are prone to flooding, that provide connectivity to public lands, or that form large blocks of habitat. They will actively seek easements in these focal areas. An obstacle to sign-up is that some properties are not financially set up to garner tax benefits (J. Emfinger, DU, *pers. comm.*).

Carbon Sequestration Program. – DU's program assists landowners in taking advantage of the emerging carbon market by assembling carbon offset credits associated with forest or grassland restoration work and selling the credits to investors. This provides income to landowners while increasing waterfowl habitat. Private corporations such as power companies pay for restoration and make easement payments to the landowner.

<http://www.ducks.org/Conservation/EcoAssets/1306/CarbonSequestration.html>

In Arkansas, only one 200-ha perpetual easement has been established. Other proposals are in progress. The focus is on bottomland hardwood reforestation. This program is limited by the absence of federal mandatory caps in carbon emissions and federal guidelines on trading carbon credits. Investors are hesitant to invest money. Once caps and guidelines are established DU expects this program to grow (J. Emfinger, DU, *pers. comm.*).

Carbon Credit Aggregation Program. – The Farm Bureau Federation manages and administers carbon credit pools and sells carbon credits on the Chicago Climate Exchange on behalf of farmers. To be eligible for an exchange soil offset certification the farmer must practice continuous conservation tillage (i.e. no-till, strip-till, or ridge-till), or establish permanent grass cover. The advantage is that farmers can earn extra income while continuing to grow crops in a manner that benefits waterbirds. <http://www.iowafarmbureau.com/special/carbon/default.aspx>

The AFBF is currently working to establish this program in the state. They will use Iowa Farm Bureau Federation, which already has a contract with the Chicago Climate Exchange, as their credit aggregator (E. Teague, AFBF, *pers. comm.*).

Evaluation. – The above conservation programs appear to be effective in terms of farmers reached and acreage affected. A simple summation of the numbers given above shows that at least 7,751 projects have been established to install conservation practices on at least 286,647 ha in Arkansas. Although Arkansas is 29<sup>th</sup> among the 50 states in total land area, it is among the top ten in receiving U.S. Department of Agriculture Farm Bill dollars (K. Trice, NRCS, *pers.*

*comm.*). According to agency personnel, awareness of programs is spread by word-of-mouth more than by workshops or brochures. Demonstration projects and the success of neighbors are also responsible for encouraging enrollment. A survey of CRP participants found that 82% felt that FSA assistance was appropriate for providing wildlife habitat (Haufler 2005). However, some farmers wanted even more on-the-ground technical assistance, and more information on conservation options that extend to their entire agricultural operations instead of only the enrolled acres. Thus, while outreach can be improved, it does not appear to be a limiting factor as many programs report more applications than can be funded.

To make the most efficient use of limited funding, programs should place more emphasis on threatened, endangered, and at-risk species (R. Haynes, USFWS, *pers. comm.*). Among Arkansas waterbirds, shorebirds and marshbirds have the highest percentage of declining species (Table 2). Incentive programs also can make more efficient use of funds by taking a landscape-scale perspective. By placing priority on farms that are close to existing waterbird habitat, or by working to enroll neighboring farms within a particular landscape or watershed, a complex of closely spaced habitat patches will be created that together can provide habitat for a higher diversity of species than any single patch (Haig et al. 1998). For example, if just 10% of the rice, soybean, and moist-soil fields of the Arkansas Grand Prairie region were flooded through CRP and WRP, 60,000 ha of waterbird habitat would be created (Twedt and Nelms 1999). Work at the landscape scale will require stronger partnerships and coordination among conservation organizations. For example, Audubon could work with granting agencies, public land managers, and private landowners to enroll private land adjacent to waterbird IBAs.

Farm Bill Title IX: Energy, may become an important companion for Title II: Conservation as interest in bioenergy and carbon sequestration programs grow (D. Walker, USFWS, *pers. comm.*). Waterbird habitat can be provided on both set-aside and working lands through DU and Farm Bureau Federation carbon sequestration programs, respectively. However, the future growth of these programs is dependent upon broader political issues. Political advocacy may be required.

The response of wildlife to conservation programs either has been demonstrated or is generally believed to be positive (Haufler 2005). To benefit waterbirds, cost-share programs for row crops should pay for practices that increase crop residue, invertebrate abundance, and native vegetation. For example, rice field conservation contracts should pay to install water control structures, leave sections unharvested, ratoon, and provide areas of natural vegetation at field corners and in ditches (Manley et al. 2004). Contracts aimed at providing waterfowl habitat should require that drawdowns provide shallow water and mudflat habitat for shorebirds as well. Aquaculturists also should be given financial incentives for late summer drawdowns that provide shorebird habitat (Elliot and McKnight 2000), and to provide native vegetation along the margins or corners of ponds. However, few conservation programs exist for aquaculture. Of the programs reviewed above, only the Resource Conservation and Development program includes language that specifically provides for funding of the “construction or rehabilitation of aquaculture” (NRCS 2004). Perhaps this funding can be applied to provide waterbird habitat around ponds. Alternatively, ponds could be reconstructed to make it easier to install non-lethal bird exclusion devices. Eco-labeling of products that come from certified bird-friendly facilities is another type of economic incentive that could be explored (Bailly and Willmann 2001).

## Data gaps and monitoring strategies

Accurate state-level population data are lacking for most species, especially for species of high conservation concern. Statistically valid, standardized, targeted survey techniques (e.g. Howe et al. 2000, Steinkamp et al. 2003, Conway 2004) need to be implemented widely. Existing state monitoring efforts may require modification or supplementation. The CBC and BBS do not cover most focal waterbird species. Midwinter waterfowl surveys (AGFC 2005) sample most dabbling ducks and geese well, but the Mottled Duck, Wood Duck, diving ducks, and swans are poorly covered or not covered at all (North American Waterfowl Management Plan 2004b). Arkansas Natural Heritage Commission inventories Tricolored Heron, White Ibis, Osprey, Bald Eagle, King Rail, Purple Gallinule, Common Moorhen, Least Tern, Bank Swallow, and Sedge Wren, as well as wading bird nest colonies. However, data are collected opportunistically as location information, not abundance. The U.S. Army Corp of Engineers (USACE) conducts annual Least Tern breeding colony surveys, but more effort is needed on the Arkansas and Red Rivers (Lott 2006). The Corps also monitors wintering and breeding Bald Eagles along the Arkansas River. The U.S. Forest Service (USFS) and AGFC also monitor Bald Eagle nests on state lands. AGFC and the Arkansas Cooperative Fish and Wildlife Research Unit have recently begun marshbird surveys throughout eastern Arkansas on public and private land (Budd and Kremetz 2005) using a standardized protocol (Conway 2004). Various agencies and universities are conducting other short-term surveys of particular species or groups of species on particular public or private lands managed for wildlife in Arkansas. To understand the distribution and abundance of waterbirds on working lands will require survey efforts be focused on private lands during seasons of peak abundance. Roadside surveys may be sufficient for waterfowl, shorebirds, and certain wading birds, other waterbirds, and landbirds occupying row crop. Access to private land may be required for marshbirds, some landbirds, and for birds on aquaculture ponds.

Data on the distribution and abundance of actual and potential habitat is needed for bird survey design, and to step-down continental and regional bird population goals to the state and local levels. A GIS database will aid analyses. Data layers should include row crop type, aquaculture ponds, and water management capabilities (Lower Mississippi Valley Joint Venture Migratory Bird Science Team 2002). Research is needed on food availability and the importance of working lands as a food source in comparison to natural habitats (Kushlan et al. 2002). Concentrations of pesticides and other toxicants in the environment and their lethal and sublethal effects on waterbirds also require research and monitoring (Poole 2005).

More study is needed to determine what effect, if any, lethal control of pest species has on waterbird populations, what effect, if any, waterbirds have on aquaculture production, and to find ecological, economic, and sociopolitical solutions to the conflict. Research should include accurate identification of bird species, numbers of birds using ponds, food habits of depredating birds, compensatory growth and mortality of fish, alternative control methods, and cost-benefit analyses of these methods (Dorr and Taylor 2003). More research is needed on whether wading birds are vectors of fish diseases and parasites (Dorr and Taylor 2003, Glahn and King 2004).

## Audubon Arkansas's role in waterbird conservation

Audubon Arkansas is working on several projects that benefit waterbirds through water quality improvement, habitat restoration, and outreach.

### **Fourche Creek Watershed Initiative**

Through a collaborative network of partners we are engaged in urban environmental stream restoration in the Fourche Creek Watershed of central Arkansas. Fourche Creek is the major drainage for Little Rock and flows into the Arkansas River. The Fourche Creek Watershed Initiative aims to improve water quality, wetland functions, educational opportunities, and community awareness. The Watershed is vitally important not only because of its ability to filter central Arkansas's water, but because of its potential to increase the quality of life for central Arkansas residents. Several waterbird species use Fourche Creek including breeding Wood Ducks and Prothonotary Warblers. This project includes water quality monitoring, stream bank stabilization, reforestation, environmental education, and partnerships with the City of Little Rock, other environmental organizations, and school groups. More information is available at [www.fourchecreek.org](http://www.fourchecreek.org).

### **Wetland Reserve Program**

In January 2005, Audubon Arkansas coordinated the reforestation of approximately 720 ha of agricultural lands near Woodson, Arkansas, for NRCS under the Wetland Reserve Program. Cypress, tupelo, cottonwood, a variety of oaks, and other woody wetland species were planted. Audubon coordinated and contracted with F&G Forestry Service, Professional Forestry Services, International Paper, and the Arkansas Forestry Commission to assist in completing this reforestation project.

### **Ivory-billed Woodpecker Private Stewardship Grant**

In February 2006 Audubon Arkansas received \$247,781 from USFWS to restore 344 ha of bottomland hardwood forest for the Ivory-billed Woodpecker. We are currently working with two private landowners in Monroe county whose property is adjacent to the area known as the Big Woods. The main restoration technique is reforestation with cypress, tupelo, and water tolerant oaks. Bottomland forest is important habitat for waterfowl, landbirds, and some waders.

### **Sustainable Ecotourism Initiative**

Audubon Arkansas, in partnership with the National Fish and Wildlife Foundation and with funding from Entergy, is providing assistance to communities around the Big Woods in developing ecotourism in Arkansas's Delta, an area that has been economically depressed for decades. Rediscovery of the Ivory-billed Woodpecker has stimulated interest in bird-related tourism in the area. The project will offer a series of ecotourism presentations through Phillips Community College that feature regionally recognized experts and panel sessions with agencies and organizations already offering ecotourism services and resources. The project also will provide a comprehensive website for ecotourism in the area, birding seminars and other training in nature-based ventures for local guides, as well as a printed resource guide for the region. The project will culminate with a comprehensive, day-long seminar for private landowners interested in developing an ecotourism business. Audubon will publish a project report to serve as a model for other communities addressing ecotourism in conjunction with a species in recovery or approaching endangered status. This project can serve as a venue for disseminating waterbird habitat conservation on working lands.



### **Grand Prairie Habitat Restoration (proposed)**

Audubon Arkansas recently submitted a \$100,000 proposal to the Wildlife Conservation Society and Arkansas Game and Fish Commission for a project titled the “Grand Prairie Working Lands Initiative.” The goals and objectives of this project are intentionally aligned with the Waterbirds initiative. The Grand Prairie of Eastern Arkansas formerly comprised about 400,000 acres of grassland and wetland. In the past it supported marshbirds, wading birds and some of the largest concentrations of wintering waterfowl in the Mississippi flyway. Today it is one of the premiere rice-producing areas of the U.S. Only 400 acres of native prairie remains. By 2009 Audubon Arkansas proposes to restore a small (2-5 ac) grassland-wetland prairie patch for a demonstration site and seed for a larger-scale restoration. In 5-10 years we will restore a 2,000-acre block to native prairie. This patch will act as a core around which we will continue to work with surrounding landowners to restore smaller parcels of land to historic conditions, and assist producers in implementing BMPs on their agricultural fields that benefit both birds and crop production. Tasks include (1) identifying a core restoration area based on geomorphology, soil composition, proximity to existing protected areas, and the willingness of landowners to participate; (2) identifying the ecological needs of indicator species (e.g. King Rail and Mottled Duck) and how these needs can be met on the landscape; (3) working with private lands biologists to prescribe appropriate cost-share programs; (4) carrying out on-the-ground restoration; and (5) implementing a public outreach strategy for BMPs on working lands. Audubon Arkansas has Memorandums of Agreement with Arkansas Natural Heritage Commission and the U.S. Army Corps of Engineers to accomplish this project.

### **Important Bird Areas Program**

The goal of the IBA program is to recognize sites that consistently harbor a significant abundance of birds, especially birds of conservation concern or birds that are vulnerable because they congregate in large numbers (e.g. wintering waterfowl, colonial waterbirds). These sites serve as focal areas for Audubon bird conservation projects such as population monitoring, habitat restoration, and environmental education. All 24 of Arkansas’s recognized IBAs have been entered into National Audubon’s IBA database. Fifteen provide important waterbird habitat (Appendix II). Nine of these waterbird IBAs are located in the focal counties, eight of which are in the MAV. Least Tern has been documented at seven sites, either during the breeding season or during migration. Piping Plover has occurred at two sites during migration. Other priority waterbird species can be found in small numbers at various sites. Thousands of waterfowl, shorebirds, gulls, and wading birds use these sites for breeding, wintering, or stopover habitat. All but one site (Magness Lake) contain public land that is managed for wildlife or recreation. Yet all sites are embedded in a landscape that is dominated by urban, agricultural, and forestry land uses. Polluted runoff from, and irrigation water diverted to surrounding lands are threats at several sites. Because these IBAs provide large patches of wildlife habitat and high concentrations of birds, they should be priority areas for management, restoration, and conservation (Hunter et al. 2005). Management of surrounding agricultural lands for waterbirds should lessen the negative effects they have on nearby IBAs, and provide additional waterbird habitat across the landscape. Population data, habitat characteristics, land use, and threats for each site are available at <http://iba.audubon.org/iba/stateIndex.do?state=US-AR> and in the National IBA database. Elliot and McKnight (2000) list important shorebird areas in Arkansas. Sites that are not recognized IBAs are Ed Gordon/Point Remove Wildlife Management Area (WMA) and the Oakwood unit of Overflow National Wildlife Refuge (NWR). They also list the

Red River Valley as an area with potential for high shorebird use. Unfortunately, water levels at Oakwood are no longer managed for shorebirds due to logistical constraints (L. Lewis, USFWS, *pers. comm.*). However, this site clearly has the potential to be important for waterbirds. These sites should be monitored and evaluated for their potential to provide waterbird habitat and potential to be recognized as IBAs.

Wapanocca National Wildlife Refuge is one IBA that has been negatively affected by surrounding land uses. Wapanocca Lake and its surrounding bottomlands, which support significant concentrations of waterfowl and wading birds, are fed by rainwater and by Big Creek. When studies in the 1980s and early 1990s found that agricultural ditches connected to Big Creek were carrying high levels of DDT and toxaphene into the creek, the refuge was forced to close off the flow of water into Wapanocca Lake. In recent years rainfall has been insufficient to maintain the lake's historical level. The shallow water has negatively affected sport fishing, though birds still flock to the lake. New studies are needed to test for agricultural chemicals. If concentrations are below threshold levels the Army Corps of Engineers could build weirs to restore the flow from Big Creek.

In January, the Important Bird Areas Technical Committee will begin developing conservation projects for birds of conservation concern and their habitats within each IBA. Conservation projects will be fairly narrow in scope, achievable over a relatively short time horizon (i.e. months to a few years), and amenable to volunteer participation. Ways in which Audubon Arkansas will promote bird conservation include:

- monitoring to fill in data gaps in the distribution and abundance of birds at a particular site or to quantify bird response to habitat change;
- engaging citizens in bird conservation by providing monitoring or educational opportunities at IBAs;
- working with law makers and civic leaders to enact policy beneficial for birds;
- advising on development of management plans by landowners to ensure that birds and their habitats are considered;
- and conducting on-the-ground habitat restoration.

After identifying projects for each site, the Bird Conservation Director and IBA Technical Committee will outline the action steps needed to accomplish those projects, and sequentially accomplish each action step for each site. After a project is completed, a new project will be developed and the process reiterated, thus moving conservation forward at the site.

### **Potential State Partners**

Agencies in Arkansas that may be able to assist Audubon Arkansas in accomplishing the goals of the Waterbirds on Working Lands initiative include:

Agriculture Research Service  
Arkansas Association of Conservation Districts  
Arkansas Cooperative Fish and Wildlife Research Unit  
Arkansas Corn and Grain Sorghum Board  
Arkansas Department of Parks and Tourism  
Arkansas Department of Pollution Control and Ecology  
Arkansas Farm Bureau Federation  
Arkansas Rice Research and Promotion Board  
Arkansas Soil and Water Conservation Commission

Arkansas Soybean Promotion Board  
Arkansas Forestry Association  
Arkansas Forestry Commission  
Arkansas Game and Fish Commission  
Arkansas Game and Fish Foundation  
Arkansas Natural Heritage Commission  
Arkansas Water Resources Center  
Arkansas Wheat Promotion Board  
Arkansas Wildlife Federation  
Ducks Unlimited  
Farm Service Agency  
Harry K. Dupree Stuttgart National Aquaculture Research Center  
Monsanto Corporation  
Multi-Agency Wetland Planning Team  
National Fish and Wildlife Foundation  
Natural Resources Conservation Service  
Resource Conservation and Development Districts  
The Nature Conservancy, Arkansas Field Office  
University of Arkansas-Cooperative Extension Service  
USA Rice Federation  
U.S. Army Corps of Engineers  
U.S. Fish and Wildlife Foundation  
U.S. Fish and Wildlife Service

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Table 1. Status of 102 Arkansas waterbird species grouped by North American Bird Conservation Initiative classification. For Global (G) and State (S) rank definitions see Appendix I. For Federal status, E = endangered and T = threatened. ABCI = Arkansas Bird of Conservation Interest. NAWCP = North American Waterbird Conservation Plan (Kushlan et al. 2002, Waterbird Conservation For The Americas 2006). USCCP = U.S. Shorebird Conservation Plan (2004).

Species	Residence	Relative		Status						
		Abundance <sup>a</sup>	G Rank	S Rank	Federal	WatchList	ABCI	NAWCP	USSCP	
<u>Waterfowl</u>										
Greater White-fronted Goose	<i>Anser albifrons</i>	Migrant	Fc	G5	S4N					
Snow Goose	<i>Chen caerulescens</i>	Winter	C	G5	S5N					
Canada Goose	<i>Branta canadensis</i>	Permanent	C	G5	S5					
Tundra Swan	<i>Cygnus columbianus</i>	Winter	Vr	G5	SNA					
Wood Duck	<i>Aix sponsa</i>	Permanent	C	G5	S4B,S4N					
Gadwall	<i>Anas strepera</i>	Winter	C	G5	S4N					
American Wigeon	<i>Anas americana</i>	Winter	C	G5	S4N					
American Black Duck	<i>Anas rubripes</i>	Winter	U	G5	S3N		Yellow			
Mallard	<i>Anas platyrhynchos</i>	Permanent	C-U	G5	S5N,SNRB					
Mottled Duck	<i>Anas fulvigula</i>	Breeding	R	G4	n/a <sup>b</sup>		Yellow	X		
Blue-winged Teal	<i>Anas discors</i>	Migrant	C	G5	SNA					
Northern Shoveler	<i>Anas clypeata</i>	Winter	C	G5	S4N					
Northern Pintail	<i>Anas acuta</i>	Winter	C	G5	S5N					
Green-winged Teal	<i>Anas crecca</i>	Winter	C	G5	S4N					
Canvasback	<i>Aythya valisineria</i>	Winter	Fc	G5	S4N					
Redhead	<i>Aythya americana</i>	Winter	U	G5	S3N					
Ring-necked Duck	<i>Aythya collaris</i>	Winter	C	G5	S4N					
Greater Scaup	<i>Aythya marila</i>	Migrant	U	G5	SNA					
Lesser Scaup	<i>Aythya affinis</i>	Winter	U	G5	S4N					
Bufflehead	<i>Bucephala albeola</i>	Winter	Fc	G5	S4N					
Common Goldeneye	<i>Bucephala clangula</i>	Winter	U	G5	S4N					
Hooded Merganser	<i>Lophodytes cucullatus</i>	Permanent	Fc	G5	S2B,S5N			X		
Ruddy Duck	<i>Oxyura jamaicensis</i>	Winter	R	G5	S3B,S4N					
<u>Waterbird</u>										
Common Loon	<i>Gavia immer</i>	Winter	Fc	G5	S3N					Moderate
Pied-billed Grebe	<i>Podilymbus podiceps</i>	Permanent	C-U	G5	S2B,S4N			X		High
Horned Grebe	<i>Podiceps auritus</i>	Migrant	Fc	G5	S4N					High
Eared Grebe	<i>Podiceps nigricollis</i>	Migrant	Fc	G5	S3N					Moderate

Species		Residence	Relative		Status					
			Abundance <sup>a</sup>	G Rank	S Rank	Federal	WatchList	ABCI	NAWCP	USSCP
<u>Waterbird</u>										
American White Pelican	<i>Pelecanus erythrorhynchos</i>	Winter	Fc	G3	SNA					Moderate
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Permanent	C-U	G5	SPB,S4N					No Risk
Anhinga	<i>Anhinga anhinga</i>	Breeding	U	G5	S1B			X		Moderate
Bonaparte's Gull	<i>Larus philadelphia</i>	Winter	Fc	G5	S4N					Moderate
Ring-billed Gull	<i>Larus delawarensis</i>	Winter	C	G5	S4N					No Risk
Caspian Tern	<i>Sterna caspia</i>	Migrant	U-FC	G5	SNA					Low
Forster's Tern	<i>Sterna forsteri</i>	Winter	U	G5	SNA					Moderate
Interior Least Tern	<i>Sterna antillarum athalassos</i>	Breeding	U	G4T2Q	S2B	E		X		High
Black Tern	<i>Chidonias niger</i>	Migrant	C	G4	SNA					Moderate
<u>Wading bird</u>										
Great Blue Heron	<i>Ardea herodias</i>	Permanent	C	G5	S3B,S4N					No Risk
Great Egret	<i>Ardea alba</i>	Breeding	C	G5	S2S3B					No Risk
Snowy Egret	<i>Egretta thula</i>	Breeding	Fc	G5	S2B					High
Little Blue Heron	<i>Egretta caerulea</i>	Breeding	C	G5	S2B					High
Tricolored Heron	<i>Egretta tricolor</i>	Breeding	R	G5	S3B,S3N			X		High
Cattle Egret	<i>Bubulcus ibis</i>	Permanent	R-C	G5	S4N,S5B					No Risk
Green Heron	<i>Butorides striatus</i>	Breeding	C	G5	S3B					Low
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	Permanent	U	G5	S2B,S3N			X		Moderate
Yellow-crowned Night-Heron	<i>Nyctanassa violacea</i>	Breeding	U	G5	S3B			X		Moderate
White Ibis	<i>Eudocimus albus</i>	Breeding	C	G5	S1B			X		Moderate
Wood Stork	<i>Mycteria americana</i>	Migrant	U	G4	SNA	E		X		High
<u>Shorebird</u>										
Black-bellied Plover	<i>Pluvialis squatarola</i>	Migrant	U	G5	SNA					Moderate
American Golden-Plover	<i>Pluvialis dominica</i>	Migrant	C-U	G5	SNA		Yellow			Low
Semipalmated Plover	<i>Charadrius semipalmatus</i>	Migrant	C	G5	SNA					Low
Piping Plover	<i>Charadrius melodus</i>	Migrant	R	G3	SNA	T	Red	X		Imperiled
Killdeer	<i>Charadrius vociferus</i>	Permanent	C	G5	S4					Moderate
Black-necked Stilt	<i>Himantopus mexicanus</i>	Breeding	Fc	G5	SNRN			X		Moderate
American Avocet	<i>Recurvirostra americana</i>	Migrant	R-U	G5	SNA					Moderate
Greater Yellowlegs	<i>Tringa melanoleuca</i>	Migrant	Fc	G5	SNA					Moderate
Lesser Yellowlegs	<i>Tringa flavipes</i>	Migrant	C	G5	SNA					Moderate
Solitary Sandpiper	<i>Tringa solitaria</i>	Migrant	Fc	G5	SNA					Low
Spotted Sandpiper	<i>Actitis macularia</i>	Winter	Vr	G5	SNA					Low

Species		Residence	Relative		Status					
			Abundance <sup>a</sup>	G Rank	S Rank	Federal	WatchList	ABCI	NAWCP	USSCP
<u>Shorebird</u>										
Ruddy Turnstone	<i>Arenaria interpres</i>	Migrant	R	G5	SNA					Low
Semipalmated Sandpiper	<i>Calidris pusilla</i>	Migrant	C	G5	SNA					Low
Western Sandpiper	<i>Calidris mauri</i>	Migrant	U-FC	G5	SNA					Low
Least Sandpiper	<i>Calidris minutilla</i>	Migrant	C	G5	S4N					Moderate
White-rumped Sandpiper	<i>Calidris fuscicollis</i>	Migrant	Fc-Vr	G5	SNA					Low
Baird's Sandpiper	<i>Calidris bairdii</i>	Migrant	U-FC	G5	SNA					Low
Pectoral Sandpiper	<i>Calidris melanotos</i>	Migrant	C	G5	SNA					Low
Dunlin	<i>Calidris alpina</i>	Migrant	Fc	G5	SNA					Moderate
Stilt Sandpiper	<i>Calidris himantopus</i>	Migrant	U-Fc	G5	SNA					Moderate
Buff-breasted Sandpiper	<i>Tryngites subruficollis</i>	Migrant	R-Fc	G4	SNA		Red	X		Imperiled
Short-billed Dowitcher	<i>Limnodromus griseus</i>	Migrant	U	G5	SNA		Yellow			Low
Long-billed Dowitcher	<i>Limnodramus scolopaceus</i>	Migrant	Fc	G5	SNA					low
Wilson's Snipe	<i>Gallinago delicata</i>	Winter	C	G5	S5					Moderate
American Woodcock	<i>Scolopax minor</i>	Permanent	U	G5	S2B,S4N		Yellow	X		Low
Wilson's Phalarope	<i>Phalaropus tricolor</i>	Migrant	Fc	G5	SNA		Yellow			Low
<u>Marshbird</u>										
American Bittern	<i>Botaurus lentiginosus</i>	Permanent	Vr-U	G4	SPB,S2N			X		High
Least Bittern	<i>Ixobrychus exilis</i>	Breeding	R	G5	S2B,S2N			X		High
Yellow Rail	<i>Coturnicops noveboracensis</i>	Migrant	R	G4	SNA		Yellow	X		High
Black Rail	<i>Laterallus jamaicensis</i>	Migrant	Vr	G4	SU		Red	X		High
King Rail	<i>Rallus elegans</i>	Permanent	Vr-R	G4	S1B,S3N			X		High
Virginia Rail	<i>Rallus limicola</i>	Migrant	U	G5	S2N					Moderate
Sora	<i>Porzana carolina</i>	Migrant	U	G5	S4N					High
Purple Gallinule	<i>Porphyrio martinica</i>	Breeding	R	G5	S1B			X		High
Common Moorhen	<i>Gallinula chloropus</i>	Breeding	U	G5	S1B,S2N			X		Moderate
American Coot	<i>Fulica americana</i>	Permanent	C-U	G5	S3B,S4N					Low
<u>Landbird</u>										
Osprey	<i>Pandion haliaetus</i>	Permanent	R	G5	S1B,S4N			X		
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Permanent	Fc-U	G4	S2B,S4N	T		X		
Belted Kingfisher	<i>Ceryle alcyon</i>	Permanent	C	G5	S3					
Eastern Phoebe	<i>Sayornis phoebe</i>	Permanent	Fc-C	G5	S4					
Fish Crow	<i>Corvus ossifragus</i>	Permanent	C	G5	S4					
Purple Martin	<i>Progne subis</i>	Breeding	C	G5	S4B,S4N					

Species		Residence	Relative		Status					
			Abundance <sup>a</sup>	G Rank	S Rank	Federal	WatchList	ABCI	NAWCP	USSCP
<u>Landbird</u>										
Tree Swallow	<i>Tachycineta bicolor</i>	Breeding	Fc	G5	S4B,S5N					
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	Breeding	C	G5	S4B,S4N					
Bank Swallow	<i>Riparia riparia</i>	Migrant	Fc	G5	S2B,S3N					
Sedge Wren	<i>Cistothorus platensis</i>	Permanent	U-Vr	G5	S1B,S4N				X	
Marsh Wren	<i>Cistothorus palustris</i>	Winter	U	G5	S4N				X	
Prothonotary Warbler	<i>Protonotaria citrea</i>	Breeding	Fc	G5	S4B		Yellow		X	
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Migrant	Fc	G5	SNA					
Louisiana Waterthrush	<i>Seiurus motacilla</i>	Breeding	Fc	G5	S4B					
Common Yellowthroat	<i>Geothlypis trichas</i>	Permanent	R-C	G5	S3N,S4B					
Le Conte's Sparrow	<i>Ammodramus leconteii</i>	Winter	U	G4	S3S4N					
Swamp Sparrow	<i>Melospiza georgiana</i>	Winter	C	G5	S4N					
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Permanent	C	G5	S5B,S5N					
Rusty Blackbird	<i>Euphagus carolinus</i>	Winter	Fc	G4	S5N		Yellow		X	

<sup>a</sup> – Relative abundance values are: Vr = very rare, R = rare, U = uncommon, Fc = fairly common, C = common (Arkansas Audubon Society 2005). Where abundance varies by season, values are given as spring-fall for migrants, and winter-breeding for permanent residents.

<sup>b</sup> – State rank not available for Arkansas.



Table 2. Population trends for 102 Arkansas waterbirds. Headings are source of the estimate, species group (if specific), geographic extent, season (if specific), and period of assessment. Trends are I = definite increase, i = possible increase or stable, u = trend uncertain or no data, d = possible decrease, D = definite decrease. NAWMP (2004b) trends were given and interpreted as increasing (= I), no trend (= i), and decreasing (= D).

Common Name	CBC, Arkansas, 1911-2004 <sup>a</sup>	CBC, Continental, 1900-2004 <sup>a</sup>	BBS, Arkansas, 1967-2005 <sup>b</sup>	BBS, Continental, 1966-2005 <sup>b</sup>	NAWCP Southeast, 1970-2002 <sup>c</sup>	NAWCP, MAV, 1970-2002 <sup>c</sup>	NAWCP, Continental, 1970-2005 <sup>d</sup>	NAWMP, Waterfowl, Continental, 1970-2003 <sup>e</sup>	USSCP, Shorebirds, Continental, ?-2004 <sup>f</sup>	PIF, MAV, Breeding, 1975-2005 <sup>g</sup>	PIF, Continental, 1975-2005 <sup>g</sup>
Greater White-fronted Goose	I	I						i			I
Snow Goose	I	I						i			d
Canada Goose	I	I	u	I				i		u	i
Tundra Swan	d	d						I			
Wood Duck	i	I	i	I				I		i	u
Gadwall	I	I		I				I			I
American Wigeon	d	d		u				i			d
American Black Duck	d	i		d				D			d
Mallard	i	I	i	I				i		I	D
Mottled Duck		i		D				i			I
Blue-winged Teal	i	I		d				i		u	u
Northern Shoveler	I	i		I				I			I
Northern Pintail	d	D		D				D			D
Green-winged Teal	i	d		i				I			i
Canvasback	d	D		d				i			d
Redhead	d	d		i				i			
Ring-necked Duck	I	I		I				I			i
Greater Scaup	I	d						i			D
Lesser Scaup	I	d		d				D			D
Bufflehead	I	I		i				I			u
Common Goldeneye	i	d		i				i			i
Hooded Merganser	I	I		u				I		u	I
Ruddy Duck	i	i		i				I			u
Common Loon	i	d		u	I	I	u				u
Pied-billed Grebe	I	I	d	i	d	d	d			u	I
Horned Grebe	d	d		D	D	D	d				D
Eared Grebe	i	D		I	I	I	d				d
American White Pelican	I	I		I	i	i	u				I
Double-crested Cormorant	I	I		I	I	I	I			I	I
Anhinga		I		i	i	u	u			u	I

Common Name	CBC, Arkansas, 1911-2004 <sup>a</sup>	CBC, Continental, 1900-2004 <sup>a</sup>	BBS, Arkansas, 1967-2005 <sup>b</sup>	BBS, Continental, 1966-2005 <sup>b</sup>	NAWCP Southeast, 1970-2002 <sup>c</sup>	NAWCP, MAV, 1970-2002 <sup>c</sup>	NAWCP, Continental, 1970-2005 <sup>d</sup>	NAWMP, Waterfowl, Continental, 1970-2003 <sup>e</sup>	USSCP, Shorebirds, Continental, ?-2004 <sup>f</sup>	PIF, MAV, Breeding, 1975-2005 <sup>g</sup>	PIF, Continental, 1975-2005 <sup>g</sup>
American Bittern	d	D		D	d	d	d			u	D
Least Bittern		i		u	d	u	d			u	u
Great Blue Heron	I	I	I	I	I	I	I			I	I
Great Egret	I	I	I	I	i	i	I			i	I
Snowy Egret		I	u	I	I	I	d			I	I
Little Blue Heron		d	u	D	D	d	d			d	u
Tricolored Heron		i		i	i	u	d				u
Cattle Egret	i	d	I	i	i	i	I			I	I
Green Heron		i	d	D	d	i	I			I	I
Black-crowned Night-Heron		I		I	D	i	d			u	I
Yellow-crowned Night-Heron		i	d	d	u	u	u			i	u
White Ibis		I		I	i	i	u			u	d
Wood Stork		I		d	D	d	d				
Osprey	I	I		I						u	I
Bald Eagle	i	I		I						u	u
Yellow Rail		i			u	u	d				u
Black Rail		i			d	d	D				d
King Rail		d	u	D	D	D	D			u	u
Virginia Rail	d	I		u	I	I	u				I
Sora	d	i		d	i	i	d				u
Purple Gallinule		i		u	d	u	d				u
Common Moorhen		I		i	I	u	u			u	I
American Coot	i	d		d	D	u				u	d
Black-bellied Plover		i					D		D		D
American Golden-Plover		D					d		d		
Semipalmated Plover		i					u		u		
Piping Plover		D					D		D		D
Killdeer	d	d	i	D		D			D	i	D
Black-necked Stilt		I	i	i		u			u		u
American Avocet		I		i		u			u		
Greater Yellowlegs	I	I		u		u			u		u
Lesser Yellowlegs	I	i		D		u			D		u
Solitary Sandpiper		i		u		u			u		u
Spotted Sandpiper	i	i		D		u			u		u
Ruddy Turnstone		i				d			d		
Semipalmated Sandpiper		D				D			D		

Common Name	CBC, Arkansas, 1911-2004 <sup>a</sup>	CBC, Continental, 1900-2004 <sup>a</sup>	BBS, Arkansas, 1967-2005 <sup>b</sup>	BBS, Continental, 1966-2005 <sup>b</sup>	NAWCP Southeast, 1970-2002 <sup>c</sup>	NAWCP, MAV, 1970-2002 <sup>c</sup>	NAWCP, Continental, 1970-2005 <sup>d</sup>	NAWMP, Waterfowl, Continental, 1970-2003 <sup>e</sup>	USSCP, Shorebirds, Continental, ?-2004 <sup>f</sup>	PIF, MAV, Breeding, 1975-2005 <sup>g</sup>	PIF, Continental, 1975-2005 <sup>g</sup>
Western Sandpiper		d				u			D		u
Least Sandpiper	i	i				D			D		D
White-rumped Sandpiper		d				u			u		
Baird's Sandpiper		D				u			u		
Pectoral Sandpiper		d				u			u		
Dunlin		d				D			D		D
Stilt Sandpiper		I				u			u		
Buff-breasted Sandpiper						d			d		
Short-billed Dowitcher		i				D			D		D
Long-billed Dowitcher		i				i			i		i
Wilson's Snipe	d	D	d			D			D		D
American Woodcock	d	D	u			D			D		D
Wilson's Phalarope		i	i			d			D		
Bonaparte's Gull		i			u	u					I
Ring-billed Gull	I	i	i		I	I	I				I
Caspian Tern		d	I		u	I	I				u
Forster's Tern		I	i		u	i	d				I
Interior Least Tern		d	u	d	i	i	d			u	
Black Tern		D	d		d	d	u				
Belted Kingfisher	I	I	D	D						u	I
Eastern Phoebe	I	I	I	I						u	i
Fish Crow	i	i	I	d						i	I
Purple Martin		i	i	u						I	
Tree Swallow		d	i	u						u	
Northern Rough-winged Swallow		i	I	d						u	
Bank Swallow		d		d						u	
Sedge Wren	I	i	I	I						u	i
Marsh Wren	i	i		I						u	I
Prothonotary Warbler		d	D	D						D	
Northern Waterthrush		D		d							
Louisiana Waterthrush		i	i	u						u	
Common Yellowthroat	I	d	D	D						D	i
Le Conte's Sparrow	d	d		d							i
Swamp Sparrow	d	D		I							u
Red-winged Blackbird	d	d	I	D						I	D
Rusty Blackbird	D	D		D							D

- <sup>a</sup> – National Audubon Society 2004.
- <sup>b</sup> – Sauer et al. 2005.
- <sup>c</sup> – Kushlan et al. 2002.
- <sup>d</sup> – Waterbird Conservation For The Americas 2006.
- <sup>e</sup> – North American Waterfowl Management Plan 2004b.
- <sup>f</sup> – U.S. Shorebird Conservation Plan 2004.
- <sup>g</sup> – Partners In Flight 2005.

Table 3. Area, in thousands of hectares, of row crops in 30 counties in Arkansas (see Fig. 1) that contain at least 10% row crop cover. Annual change is the average annual change in crop acreage over the period 1972 to 2003, given as a percent. 1972 to 2003 is the period for which data are available for all crop types (NASS 2005).

	Corn	Cotton	Rice	Sorghum	Soybean	Winter Wheat	Total
Area (1000 ha)							
1972	6	565	177	54	1564	113	2479
2003	131	379	581	79	1139	217	2526
Annual change (%)	10	-1	4	1	-1	2	<1

Table 4. Arkansas row crop calendar. Calendar is approximate and varies each year depending on climatic conditions. Darker bars for rice flooding indicate optional flooding after harvest, typically for waterfowl.

Month	J				F				M				A				M				J				J				A				S				O				N				D							
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
<b>RICE</b>																																																				
Seedbed preparation																																																				
Planting																																																				
Flooding																																																				
Fertilizing																																																				
Pesticide application																																																				
Harvest																																																				
<b>SOYBEAN</b>																																																				
Planting																																																				
Harvest																																																				
Pesticide application																																																				
<b>CORN</b>																																																				
Planting																																																				
Harvest																																																				
Pesticide application																																																				
<b>COTTON</b>																																																				
Planting																																																				
Harvest																																																				
Pesticide application																																																				
<b>SORGHUM</b>																																																				
Planting																																																				
Harvest																																																				
Pesticide application																																																				
<b>WINTER WHEAT</b>																																																				
Planting																																																				
Harvest																																																				
Pesticide application																																																				



Figure 1. Arkansas counties with at least 10% land cover in row crops are shaded. These 30 counties are focal counties for the Waterbirds on Working Lands initiative.

## Appendix I

### Global (G) and State (S) ranks used by NatureServe (2006).

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- G/S1 Critically imperiled globally/in the state
- G/S2 Imperiled globally/in the state
- G/S3 Vulnerable globally/in the state
- G/S4 Apparently secure globally/in the state
- G/S5 Secure globally/in the state
- SA Accidental in the state
- SNA Not applicable. A conservation status is not applicable because the species is not a suitable target for conservation activities
- G/SU Unrankable. Currently unrankable due to lack of information or due to substantially conflicting information about status or trends
- SX Apparently extirpated from the state
- T- T subranks are given to global ranks when a subspecies, variety, or race is considered at the state level. The subrank is made up of a "T" plus a number or letter (1, 2, 3, 4, 5, A, U, X) with the same ranking rules as a full species

#### General Ranking Notes

- Q A "Q" in the global rank indicates the element's taxonomic classification as a species is a matter of conjecture among scientists
  - ? A question mark is used temporarily when there is some indecision regarding the rank assignment or when an element has not been ranked
  - B Breeding status
  - N Non-breeding status
  - NR Not ranked. Conservation status not yet assessed
-



## Appendix II

There are 15 recognized Important Bird Areas in Arkansas that contain waterbird species of concern or provide current and potential wetland habitat for waterbirds. Not all of these sites are in the 30 focal counties (Fig. 1). See Appendix III for acronyms. The waterbird IBAs are:

Bald Knob National Wildlife Refuge	Lake Chicot
Bell Slough Wildlife Management Area	Lake Dardanelle
Big Lake	Magness Lake
Cache-Lower White Rivers	Millwood Lake
Camp Robinson Wildlife Demonstration Area	Overflow National Wildlife Refuge
Charlie Craig State Fish Hatchery	Shugart/Felsenthal Red-cockaded
Choctaw Island Wildlife Management Area	Woodpecker
Holla Bend National Wildlife Refuge	Wapanocca National Wildlife Refuge

Below are detailed profiles of these IBAs. Each profile includes the following:

### IBA name

**Counties** occupied by the IBA.

**Location** of the IBA centroid given in UTM (Universal Transverse Mercator) easting (e) and northing (n).

**Area** of the IBA (acres and hectares).

### **Map**

Illustrates IBA location, boundaries, and conservation network therein. Conservation lands are labeled on all maps, and lands for each agency are colored consistently across all maps.

### **IBA criteria** for establishment

A list of species meeting two IBA criteria:

*Species of concern* (occurrence of waterbird Arkansas Birds of Conservation Interest; Table 1)

*Exceptional concentrations of birds* (provides habitat for species that are vulnerable because they congregate in large numbers)

### **Site description**

A description of historical and current habitats generally located in the IBA from the IBA nomination form. Also listed are the landholdings of dedicated conservation lands (public and private) and their respective sizes.

### **Ornithological significance**

This section provides specific information on species locations, other species of conservation concern found to occur in the IBA, general descriptions of avian communities there, and any other information of site-specific relevance to avian populations in the IBA.

## Conservation status

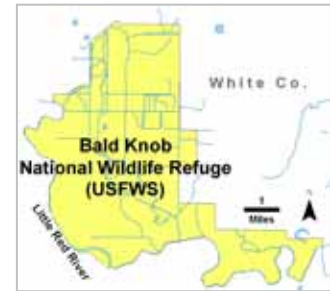
This section lists known or potential threats and proposed or occurring conservation actions in the IBA relevant to birds.

### Bald Knob National Wildlife Refuge

White County

Location: e 630087, n 3904812

14,810 acres (5,993 ha)



## Criteria for establishment

*Species of concern:* Pied-billed Grebe, Anhinga, American Bittern, Least Bittern, Tricolored Heron, Black-crowned Night-Heron, Yellow-crowned Night-Heron, White Ibis, Wood Stork, Mottled Duck Hooded Merganser, Osprey, Bald Eagle, Yellow Rail, King Rail, Piping Plover, Black-necked Stilt, Buff-breasted Sandpiper, American Woodcock, Least Tern, Willow Flycatcher, Bank Swallow, Sedge Wren, Marsh Wren, Yellow Warbler, Prothonotary Warbler, Rusty Blackbird

*Exceptional concentrations of birds:* waterfowl, shorebirds, wading birds

## Site description

Bald Knob NWR is managed by USFWS. It encompasses 14,810 acres of cropland, bottomland hardwoods, cypress/tupelo brakes, and other natural wetlands along the Little Red River.

## Ornithological significance

Much of the MAV has been cleared of bottomland hardwood forest and cypress-tupelo swamp. Bald Knob NWR provides an island of habitat for wetland birds in a sea of agriculture. The size and quality of the wet habitat makes the area ideal for nesting species such as Pied-billed Grebe, Yellow-crowned Night-Heron, Black-necked Stilt, Grasshopper Sparrow, and Cerulean, Swainson's, and Prothonotary Warblers. Managers manipulate water levels to provide stopover habitat for migrating shorebirds including Piping Plover, Buff-breasted Sandpiper, and Least Tern. In fact, the refuge has recorded 50 of the 63 species on the Arkansas Birds of Conservation Interest list: 26 as known or suspected breeders, 20 as migrants, and 4 as winter residents.

## Conservation status

This site provides secure, healthy habitat for birds. Conditions are only improving as refuge staff work to restore the hydrology of the area by building weirs and installing water-control structures to simulate natural winter flooding. In addition, staff have restored approximately 5,000 acres of wetlands by planting native bottomland hardwoods. Plans include planting additional hardwoods on marginal cropland and building additional water-control structures on the south end of the refuge.

## Bell Slough Wildlife Management Area

Faulkner County

Location: e 552977, n 3866293

2040 acres (826 ha)



### **Criteria for establishment**

*Species of concern:* American Bittern, Yellow-crowned Night-Heron, Hooded Merganser, Bald Eagle, American Woodcock, Sedge Wren, Marsh Wren, Prothonotary Warbler

*Exceptional concentrations of birds:* waterfowl

### **Site description**

Bell Slough WMA is primarily upland hardwood forest. Twenty-five percent of the area was cropland that has been converted to a seasonal, grassy wetland (moist soil unit). The area is used for hunting and fishing. AGFC owns the land.

### **Ornithological significance**

The bottomland hardwood forests and open wetland habitat of Bell Slough WMA provide feeding habitat for wading birds such as American Bittern, Yellow-crowned Night-Heron, Hooded Merganser, American Woodcock, and Sedge Wren. In winter, the moist soil unit is used by Gadwall, Northern Shoveler, Ring-necked Duck, Lesser Scaup, Bufflehead, Common Goldeneye, Ruddy Duck, Wood Duck, and Hooded Merganser. Breeding birds include Northern Bobwhite, Yellow-throated Vireo, Yellow-throated Warbler, Northern Parula, Kentucky Warbler, and Painted Bunting. Bewick's Wren are rare in winter and fall.

### **Conservation status**

This site is managed for waterfowl and wading birds through water releases from Lake Conway. However, water manipulation is complicated by lake front property owners and the need to reduce downstream flooding. Because the site is located between Little Rock and Conway there is pressure to develop Lake Conway's shoreline. This could affect bird use of the site.

## Big Lake

Mississippi County

Location: e 761997, n 3979160

23,320 acres (9,438 ha)



### **Criteria for establishment**

*Species of concern:* Black-crowned Night-Heron, Yellow-crowned Night-Heron, Bald Eagle, King Rail, Prothonotary Warbler

*Exceptional concentrations of birds:* waterfowl

### **Site description**

Big Lake includes the 11,000-acre Big Lake National Wildlife Refuge, managed by USFWS, and the adjacent 12,320-acre Big Lake Wildlife Management Area, managed by AGFC. Big Lake is the largest Mississippi River drainage area in northeast Arkansas, and supports an extensive bottomland-hardwood forest habitat, lowland oak forest, as well as both permanent and ephemeral lakes and ponds. The area is an island of natural habitat in an agricultural and urban landscape.

### **Ornithological significance**

USFWS airboat surveys of Big Lake NWR have counted over 10,000 wintering waterfowl; over 80% are Mallards. Big Lake IBA also provides stopover habitat for birds migrating along the Mississippi flyway, as well as breeding habitat for many species of conservation concern. Notable species include: Yellow-crowned and Black-crowned Night-Herons, Northern Bobwhite, King Rail, Red-headed Woodpecker, Acadian Flycatcher, Wood Thrush, Loggerhead Shrike, American Redstart, Prothonotary Warbler, and Baltimore Oriole. Breeding bird surveys are required to determine the density and reproductive success of these species.

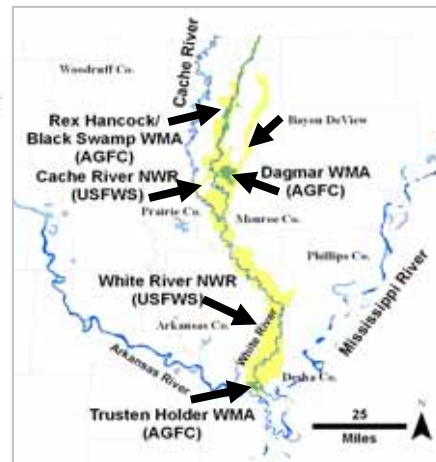
### **Conservation status**

Big Lake NWR is managed primarily for wildlife conservation. USFWS staff have attempted to maintain or improve habitat for both game and non-game bird species as well as other wildlife; no hunting is allowed on the refuge although the lakes are open for fishing most of the year. Big Lake WMA is maintained primarily for hunting. The WMA is managed using a variety of practices, including selective logging. The hydrology of the Big Lake area changes seasonally due to the drainage practices of the Corps of Engineers. From a landscape perspective, Big Lake NWR and WMA are important in alleviating and controlling the flood levels of the agricultural lands just north of the area in Missouri. This has resulted in unnatural hydrological conditions. Generally, flooding in the bottomland areas is excessively deep and occurs later in the spring/summer than under historical flood patterns.

The most serious threats to avian habitat at this site are siltation and agricultural run-off from the farmlands to the north. USACE controls the drainage channels, thus the staff of the NWR and WMA are unable to alter water management practices. Excessive flooding in late spring has eliminated much of the natural understory vegetation, including cane. It is likely that this site may have once supported substantial populations of Bachman's and Swainson's Warblers before habitat conversion. At this time, the Swainson's Warbler is probably not present or is rare, but surveys are needed to confirm the status of this and other passerine species. Habitat conversion at Big Lake would be enhanced by reducing the amount of flood water entering the area. However, the importance of this area as a run-off easement for the surrounding farmlands makes reduction of water input difficult. Communication and collaboration with USACE and local farmers is needed.

## Cache-Lower White Rivers

Arkansas, Desha, Monroe, Phillips,  
Prairie, and Woodruff Counties  
Location: e 299222, n 4439807  
201,000 acres (81,342 ha)



### **Criteria for establishment**

*Species of concern:* Pied-billed Grebe, Anhinga, Black-crowned Night-Heron, Yellow-crowned Night-Heron, Wood Stork, Hooded Merganser, Bald Eagle, American Woodcock, Prothonotary Warbler

*Exceptional concentrations of birds:* waterfowl, wading birds, raptors

### **Site description**

This region was designated as a "Wetland of International Importance" under the Convention on Wetlands of International Importance, especially for its waterfowl habitat. This IBA includes two NWRs (Cache River [55,000 ac] and White River [160,000]) managed by USFWS, and three wildlife management areas (Rex Hancock/Black Swamp [6394 ac], Dagmar [7976], and Trusten Holder [4406 ac]) managed by AGFC. It extends from the vicinity of Des Arc to the confluence of the White, Arkansas, and Mississippi Rivers. Historically most of the site was covered by bottomland hardwood forest, and it still contains the largest continuous expanse of bottomland hardwoods remaining in the Lower Mississippi River Valley. Depending on the frequency, duration, and timing of flooding, tree species include bald cypress, tupelo, various oaks, sugarberry, honey locust, pecan, and water hickory. Many of the cleared areas are currently being reforested. Permanent water, in the form of rivers, oxbow lakes, sloughs, swamps, and beaver ponds, covers approximately five percent of the area.

### **Ornithological significance**

The first confirmed sighting of an Ivory-billed Woodpecker in the US since 1944 occurred on the Cache River NWR in April 2004. This IBA will likely support the return of the Swallow-tailed Kite to Arkansas; since 2002, a pair has nested annually in White River NWR, the first attempts in over 100 years. This is the most important wintering area for Mallards in North America, with an average of 306,000 individuals. Thousands of southbound Mississippi Kites, and hundreds of Red-tailed, Red-shouldered, and Broad-winged Hawks migrate through the region per day. Up to 100 Bald Eagles winter here. Hundreds of post-breeding Wood Storks visit every year. A variety of migratory songbirds breed here, including: Acadian Flycatcher (1000s), Wood Thrush (100s), Prothonotary Warbler (1000s), Hooded Warbler (100s), Swainson's Warbler (100s), and Cerulean Warbler (1-5).

### **Conservation status**

Hydrologic change is the major threat to the area. The navigation channel on the White River is being studied for enlargement to nine feet deep. Several agricultural irrigation projects are under consideration that would remove water from the White River, including the Grand Prairie Irrigation Project. Changes in water release patterns from Bull Shoals and Norfolk Lakes are constantly under consideration. These projects could degrade habitat quality by altering

flooding frequency and duration. Cowbirds parasitize a large proportion of monitored Swainson's Warbler nests. TNC worked with the city of Clarendon to develop a management plan that recognizes the value of natural resources to the economic vitality and cultural identity of the community. As part of this plan, they began an annual Big Woods Birding Festival in 2001. The Big Woods Conservation Partnership, which includes Audubon Arkansas, is addressing habitat conservation in general, and Ivory-billed Woodpecker conservation in particular.

Camp Robinson Wildlife Demonstration Area

Faulkner County  
 Location: e 559923, n 3869739  
 4,029 acres (1,630 ha)



**Criteria for establishment**

*Species of concern:* Hooded Merganser, Osprey, Bald Eagle, Least Tern, Sedge Wren, Marsh Wren, Yellow Warbler, Prothonotary Warbler

**Site description**

Camp Robinson Wildlife Demonstration Area, owned by AGFC, is 4,029 ac of primarily oak savannah and prairie in Faulkner County. Prominent features include parts of Lake Conway and a 60 ac nursery pond.

**Ornithological significance**

This site regularly supports significant densities of a variety of birds of state conservation interest throughout the year. Frequent burning and mowing maintains habitat for breeding Bachman's Sparrow and Bell's Vireo. Ospreys and Bald Eagles nest on Lake Conway, while Hooded Mergansers, Wood Ducks, and Prothonotary Warblers nest at the Nursery Pond. Least Tern, Virginia Rail, Sora, Sedge Wren, Marsh Wren, American Redstart, and Yellow, Chestnut-sided, and Black-throated Green Warblers are common spring and fall migrants. A variety of sparrows winter here, including: Field, Fox, White-crowned, White-throated, Song, Chipping, Vesper, Savannah, Swamp, Lincoln's, and even Le Conte's.

**Conservation status**

Although wildlife management occurs there, it is not necessarily targeted at birds of conservation interest. Collaboration with AGFC to develop plans for species such as Bachman's Sparrow is desirable. Because the site is located between Little Rock and Conway there is pressure to develop Lake Conway's shoreline. This could affect bird use of the site.

Charlie Craig State Fish Hatchery

Benton County  
 Location: e 384070, n 4023474  
 185 acres (75 ha)



## Criteria for establishment

*Species of concern:* Piping Plover, Least Tern, Sedge Wren, Marsh Wren

## Site description

Charlie Craig State Fish Hatchery consists of a series of shallow fish ponds surrounded by pasture and suburban development. It is relatively treeless, and except for a low hill to the west, the terrain is flat. It is run by AGFC for rearing sportfish.

## Ornithological significance

This site's artificial impoundments provide waterbird habitat in the predominantly forested and increasingly urban landscape of northwestern Arkansas where little wetland habitat exists otherwise. Thirty-seven of the state's 41 shorebird species have been recorded there, including migrating Piping Plovers and Least Terns. Twenty-three of the state's 37 waterfowl species occur there as well. Wading birds also take advantage of the open water habitat and food supply. Furthermore, many rare, out-of-range species such as Eared Grebe, Snowy Plover, Cinnamon Teal, Prairie Falcon, Say's Phoebe, and Yellow-headed Blackbird have been documented. Therefore it is no surprise that this may be the most popular birding spot in the region.

## Conservation status

Waterbirds are not harassed at this site. However, urban development and hydrologic changes are potential threats. Encroaching suburbia will not affect fish raising activities, but the close proximity of residential housing could adversely affect bird movements. Urbanization also is straining the water supply. There may not be sufficient water in the future to keep the ponds flooded, leading to closure of the site and loss of waterbird habitat. If this happens, efforts should be made to keep the land from being developed and maintain wildlife habitat.

## Choctaw Island Wildlife Management Area

Desha County

Location: e 669249, n 3718891

8,300 acres (3107 ha)

## Criteria for establishment

*Species of concern:* Least Tern, Prothonotary Warbler

*Exceptional concentrations of birds:* shorebirds

## Site description

Choctaw Island Wildlife Management Area, managed by AGFC, is not a true island, but is bounded to the west by the Mississippi River levee and connected to the mainland by a narrow isthmus. Choctaw Bar Island is a true island in the Mississippi River that makes up approximately 2,000 ac of the total 8,300-ac WMA. The habitat is mostly bottomland hardwood forest, but also includes significant components of lowland pine-hardwood forest, riverine forest, glades, and sandbars. The land was purchased in late 2001 from a private timber company, so the area has had a history of timber harvest and management. However, approximately 70% of



the area is mature bottomland hardwood or pine-hardwood mixed forest. Deer have been the primary management focus of refuge staff, but staff also wish to promote the area to birders.

### **Ornithological significance**

Choctaw Island WMA provides stopover habitat for birds migrating along the Mississippi Flyway such as shorebirds and neotropical migrant songbirds. The riverine dune habitat on the eastern edge of Choctaw Island, and surrounding Choctaw Bar Island, appear ideal for migrating shorebirds. The area also hosts several breeding species of state conservation interest including Acadian Flycatcher, Wood Thrush, Prothonotary Warbler, Cerulean Warbler, Painted Bunting, and Baltimore Oriole. This is the first Arkansas IBA to support breeding Least Terns. Least Terns have been documented nesting on or near Choctaw Bar Island in 1981, 1992-1994, and 1997-2000, and nesting on or near Choctaw Bend in 1988, 1992, 1997, 1999, and 2000. In 2000, 48 adult terns nested on Choctaw Bar Island, and 79 nested on Choctaw Bend.

### **Conservation status**

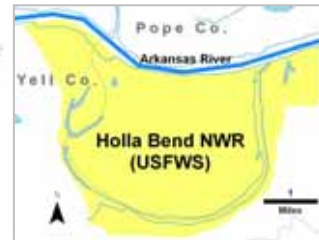
Under direction of AGFC, Choctaw Island WMA is managed for wildlife and is not under serious or potential threat at this time. A small percentage (~8%) of the area consists of hardwood plantations that were established for timber harvest. These areas may require management to reestablish native flora and fauna. Feral hogs destroy native vegetation.

### **Holla Bend National Wildlife Refuge**

Pope and Yell Counties

Location: e 494495, n 3888306

7,050 acres (2,853 ha)



### **Criteria for establishment**

*Species of concern:* Hood Merganser, Osprey, Bald Eagle, American Woodcock, Sedge Wren, Marsh Wren, Yellow Warbler, Prothonotary Warbler, Rusty Blackbird

*Exceptional concentrations of birds:* waterfowl, raptors, gulls

### **Site description**

Holla Bend NWR lies along the Arkansas River and is bounded by an old oxbow that was created when the USACE cut a channel through a bend in the river to promote navigation and flood control. The refuge provides recreational opportunities for hunters and birders alike. The site is mostly lowland hardwood forest and oxbow lake. The remainder is agricultural for wildlife, shrub-scrub, riverine forest and canebrake.

### **Ornithological significance**

Holla Bend NWR provides wintering habitat for a variety of raptors: Bald and Golden Eagles, Northern Harrier, Sharp-shinned and Cooper's Hawks, American Kestrel, Merlin, Peregrine Falcon, and up to 6 species of owls including Short-eared. Waterfowl numbers vary depending on water levels, but the refuge routinely hosts 15+ species during the winter. Numbers vary by species with Mallard being the most common. The 2000 Christmas Bird Count had recorded 19,588 Mallards alone. Thousands of gulls from nearby Lake Dardanelle feed in



recently plowed or cut crop fields. The bottomland hardwood forests attract another winter visitor, the Rusty Blackbird. Notable migrant or breeding songbirds include: Acadian Flycatcher, Baltimore Oriole, Painted Bunting, American Redstart, and Yellow, Chestnut-sided, Black-throated Green, Prairie, Cerulean, Prothonotary, Kentucky, Worm-eating, Swainson's and Hooded Warblers.

### Conservation status

Cowbird parasitism is a known threat in Holla Bend. Minor threats include development, predators, disturbance to birds and habitat, hydrologic changes and off road vehicle use. Potential threats include invasive or non-native plants and introduced animals.

### Lake Chicot

Chicot County

Location: e 660226, n 3688434  
5,505 acres (2,227 ha)



### Criteria for establishment

*Species of concern:* Pied-billed Grebe, Anhinga, American Bittern, Tricolored Heron, Black-crowned Night-Heron, White Ibis, Wood Stork, Bald Eagle, Black-necked Stilt, Prothonotary Warbler

*Exceptional concentrations of birds:* waterfowl, shorebirds, gulls

### Site description

Lake Chicot is the largest natural oxbow lake in North America (20 miles long, 5,300 ac), formed approximately 500 years ago when the course of the Mississippi River changed. Lake Chicot State Park consists of 205 acres of park-like woodland on the eastern edge of the lake. The park is maintained for public recreational use. On the northwest side is a periodically flooded bald cypress and tupelo forest. This area is about 500 acres, and is owned by the 87th Avenue Farm Ltd. Partnership. The flooded area is open to public use for fishing and boating.

### Ornithological significance

Lake Chicot supports breeding Black-necked Stilts, Bald Eagles, Red-headed Woodpeckers, Wood Thrush, Prothonotary Warblers, and Baltimore Orioles. Wintering waterbirds include: Pied-billed Grebe, Green-winged Teal, Mallard, Northern Shoveler, Gadwall, Greater White-fronted Goose, Lesser Scaup, Ruddy Duck, and Hooded Merganser. Ten years of Christmas Bird Count data indicate that this is an important site for Bonaparte's (average = 178 birds) and Ring-billed Gulls (average = 850). American Bittern, Painted Bunting, and Henslow's Sparrow have been observed during migration. Anhingas have been recorded during several months throughout the year.

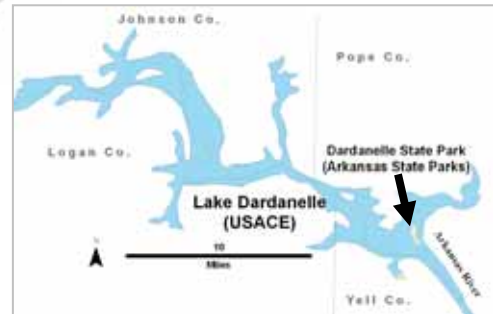
### Conservation status

The main threat to birds in this area is disturbance from recreation, primarily boating and fishing. The flooded cypress area is under relatively heavy pressure by fisherman; a great deal of garbage is dumped in that area, and boaters may disturb nesting birds. On the north side of the

lake, private home development and conversion of woodlands to agriculture may potentially threaten available habitat.

### Lake Dardanelle

Johnson, Logan, Pope, and Yell County  
Location: e 462953, n 3911299  
34,540 acres (13,977 ha)



### **Criteria for establishment**

*Species of concern:* Hooded Merganser, Bald Eagle, Black-crowned Night-Heron, Yellow-crowned Night-Heron, Least Tern, Yellow Warbler, Rusty Blackbird

*Exceptional concentrations of birds:* waterfowl, wading birds, shorebirds, gulls, raptors

### **Site description**

Lake Dardanelle was formed by a dam on the Arkansas River. It is managed as a navigable waterway by the USACE. Much of the area is interspersed by river channels of the Arkansas & Piney Rivers and the Illinois Bayou. Shoreline, island, and upland habitats vary from pine to hardwood forest. The presence of dabbling ducks attracts local duck hunters. Birdwatchers from across the state travel to the lake during fall and winter to see the ducks and gulls. The 240-ac Lake Dardanelle State Park, managed by Arkansas State Parks, offers various recreational opportunities.

### **Ornithological significance**

Interior Least Terns use the sand bars of Dardanelle during migration. There are no known nest sites at this time, though the species nested historically and habitat currently exists. A resident population of Brown-headed Nuthatches may support a range expansion to the north into Ozark National Forest. Yellow and Cerulean Warblers are uncommon breeders in backwater areas of the lakeshore. Rusty Blackbird is another uncommon species that winters in flooded portions of the backwaters. Hundreds of American White Pelicans winter there every year. Wintering waterfowl numbers shift daily with hundreds to thousands of dabbling ducks and diving ducks such as scaup. Gulls also winter in abundance with tens to thousands of Ring-billed, Bonaparte's, Herring, Laughing, and Franklin's Gulls seen daily. Rare gulls such as Black-headed, Sabine's and California have been found there as well. Warm water output from the Nuclear One power plant raises the nearby water temperature by 0.5-2 degrees, thus providing open water during even the coldest parts of winter.

### **Conservation status**

Barge and boat traffic can disturb bird populations to some degree. Zebra mussels may attract diving ducks, but at the same time might pose a risk of heavy metal poisoning. Sandbar creation and management may enhance the lake's appeal to nesting Least Terns.

## Magness Lake

Cleburne County

Location: e 596824, n 3928009

60 acres (24 ha)



### **Criteria for establishment**

*Species of concern:* Trumpeter Swan

### **Site description**

Magness Lake IBA is 60 acres (of a 700-ac property) owned by an absentee family and managed by a neighboring landowner. Magness Lake is a remnant oxbow (15 ac) with a manmade dike, and adjacent pastures and bottomland hardwoods. Specifically, it includes a lake, mature planted pine, buttonbush swamp, and fescue and Bermuda grass pasture. The land is privately owned but the public is welcomed to observe the swans and other waterbirds.

### **Ornithological significance**

Magness Lake supports the largest and oldest wintering population of Trumpeter Swans in the Southeast. Ninety-eight birds were counted in 2005 and the number grows every year. The manager feeds the swans to attract them and ensure they survive the winter. Pastureland adjacent to the pond provides forage as well. A Great Blue Heron rookery occurs on the other side of the pasture. Other waterfowl winter on the lake.

### **Conservation status**

Grass carp are competing with the Trumpeter Swans for aquatic vegetation. Supplemental feeding, which may have helped attract the swans initially, should be considered in a controlled supervised effort, with a long-term goal of working with the landowner to grow crops on the land surrounding the lake which will provide natural foods for the swans. AGFC has developed a management plan. The proposed plan included removal of grass carp, reestablishment of aquatic plants preferred by swans, and farming of the hayfield to provide the agricultural crop foods utilized by the swans. Excessive public visitation directly disturbs the birds; they will not approach the shore if too many people are present.

## Millwood Lake

Hempstead, Howard, Little

River, and Sevier Counties

Location: e 408796, n 3734457

33,682 acres (13,630 ha)



### **Criteria for establishment**

*Species of concern:* Anhinga, American Bittern, Least Bittern, Tricolored Heron, Black-crowned Night-Heron, Yellow-crowned Night-Heron, White Ibis,

Wood Stork, Hooded Merganser, Osprey, Bald Eagle, Purple Gallinule, Common Moorhen, Least Tern, Buff-breasted Sandpiper, Sedge Wren, Marsh Wren, Yellow Warbler, Prothonotary Warbler, Rusty Blackbird

*Exceptional concentrations of birds:* waterfowl, wading birds, gulls, raptors,

### Site description

Millwood Lake is a reservoir created by the USACE. The shoreline is interspersed with standing dead timber, live cypress, and marsh-emergent vegetation. Surrounding the reservoir are hardwood, coniferous, and mixed forests. Primarily, Millwood Lake serves as a flood-control reservoir but, secondarily, it provides a water supply for local industry, nearby municipalities, and supports many recreational interests that include bird-watching, butterfly-watching, camping, boating, fishing, hunting, and nature photography. Millwood State Park is 835 acres and managed by Arkansas State Parks. It offers various recreational opportunities.

### Ornithological significance

Of the 400 birds on Arkansas's state list, 321 have been found at Millwood Lake. A wide variety of species of state conservation interest breed here including: Hooded Merganser, Mississippi Kite, Bald Eagle, Osprey Red-headed Woodpecker, Brown-headed Nuthatch, Prothonotary Warbler, Painted Bunting and Baltimore Oriole. The lake is especially well known for its wading birds: Anhinga, Tricolored Heron, Black-crowned Night-Heron, Yellow-crowned Night-Heron, White Ibis, Wood Stork, Purple Gallinule, and Common Moorhen. Thousands of American White Pelicans, Franklin's Gulls, and Tree Swallows forage here during migration. A number of rarities and state records have been recorded here such as all three jaegers, Black-headed, Little, and Sabine's Gulls, Black-legged Kittiwake, Couch's Kingbird, and Cave Swallow.

### Conservation status

There are potential threats to the area from invasive or non-native plants, cowbird parasitism, and habitat conversion/development. There are minor threats from boats and nest predators. USACE is proposing to raise the lake level to flood standing dead vegetation in the water. If this occurs it also will flood marshbird habitat.

### Overflow National Wildlife Refuge

Ashley County

Location: e 624316, n 3658907

13,000 acres (5,260 ha)



### Criteria for establishment

*Species of concern:* Mottled Duck, Black-necked Stilt,

Prothonotary Warbler

*Exceptional concentrations of birds:* waterfowl, shorebirds

### Site description

Overflow National Wildlife Refuge protects high quality floodplain hardwood habitat in the Mississippi Alluvial Valley. The refuge forest is crossed by Overflow Creek and several

other secondary tributaries and is basically roadless. Access is by foot or seasonally open all-terrain vehicle trails.

### Ornithological significance

This site regularly supports significant densities several birds of state conservation concern: Prothonotary Warbler, Wood Thrush, Mottled Duck, Mississippi Kite, Loggerhead Shrike, and Black-necked Stilt. Several thousand acres of impoundment units are managed specifically for waterfowl and shorebirds. The average 10 year winter population of ducks is about 75,000. Common species are Mallard, American Widgeon, Gadwall, Ring-necked Duck, Wood Duck, and Lesser Scaup. Shorebird populations routinely exceed 5,000, with 10,000 birds at peak use periods during mid-late summer. Common species are Pectoral Sandpiper, Killdeer, Black-necked Stilt, Least Sandpiper, and Spotted Sandpiper. The refuge also provides high quality floodplain habitat for many species of neotropical migrants, including interior forest dwelling land birds.

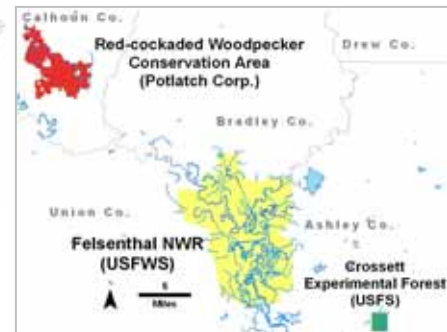
### Conservation status

Changes to water levels through water diversions, and introduced animals are potential threats.

### Shugart/Felsenthal Red-cockaded Woodpecker

Ashley, Bradley, Calhoun, Drew, and Union Counties

Location: e 578634, n 3671930  
1,296,000 acres (524,473 ha)



### Criteria for establishment

*Species of concern:* Black-crowned Night-Heron, Yellow-crowned Night-Heron, Wood Stork, Prothonotary Warbler  
*Exceptional concentrations of birds:* waterfowl, wading birds

### Site description

The Shugart/Felsenthal Red-cockaded Woodpecker IBA site is Arkansas' largest IBA at over one million acres of loblolly and shortleaf pine forest in various stages of growth. Approximately 85% of this land is privately owned, mostly by Plum Creek and Potlatch timber corporations, while the remaining private in-holdings belong to smaller timber companies, farmers, and homeowners. Casey Jones WMA (60,000 ac; not mapped) is leased to AGFC for public hunting access, but is owned and managed by Plum Creek. Felsenthal NWR (65,000 ac, owned by USFWS) is primarily bottomland hardwood forest, but contains 9,400 ac of loblolly pine. The USFS's Crossett Experimental Forest is 1,600 ac of pine forest, including some old-growth and mature stands. Due to the size of the proposed area, several towns lie within its boundaries, including Crossett and Hampton, AR.

### Ornithological significance

Shugart/Felsenthal protects 120 Red-cockaded Woodpecker family clusters, with 2-4 individuals per cluster. Plum Creek and Potlatch have consolidated their clusters into

Conservation Areas. Plum Creek's (not mapped) conservation area is in LA. Felsenthal NWR maintains breeding populations of Bachman's Sparrow, Red-headed Woodpeckers, and Prothonotary Warblers. The 10-year average winter waterfowl population at Felsenthal is 75,000 ducks. Common species are: Mallard, Gadwall, Ring-necked Duck, Lesser Scaup, Wood Duck, and American Wigeon. Several locations on Felsenthal support significant numbers of nesting pairs of wading birds including: Great Blue Heron (150+ nesting pairs), Green Heron (50+), Snowy Egret (30+), Cattle Egret (30), Great Egret (100+), Black-crowned Night-Heron (20), Yellow-crowned Night-Heron (20+), and Little Blue Heron (15+).

**Conservation status**

Plum Creek and Potlatch timber company Habitat Conservation Plans translocated Red-cockaded Woodpeckers from areas that were designated for logging to habitat conservation areas. While consolidation connects populations that would otherwise be isolated in forest fragments, the overall area of suitable habitat for this species has been reduced. Coordination of management for woodpeckers by independent landowners is greatly needed. As part of their forest certification, Potlatch has expressed interest in also monitoring Bachman's Sparrow and Brown-headed Nuthatch.

Wapanocca National Wildlife Refuge

Crittenden County

Location: e 752768, n 3915155

5,484 acres (2,219 ha)



**Criteria for establishment**

*Species of concern:* Black-crowned Night-Heron, Yellow-crowned Night-Heron, Hooded

Merganser, Bald Eagle, American Woodcock, Least Tern, Prothonotary Warbler

*Exceptional concentrations of birds:* waterfowl, wading birds, shorebirds,

**Site description**

Wapanocca National Wildlife Refuge is a wildlife oasis in an agricultural desert. A diversity of habitat exists, comprised of open shallow lake, bottomland forest, cypress/willow swamp, and slowly reforesting old fields, all linked by miles of nature drives, foot and canoe trails. Fishing is allowed, and small game and archery deer hunting are allowed in season, but waterfowl are preserved.

**Ornithological significance**

Waterfowl wintering at Wapanocca NWR tend to roost on the lake by day and feed in the surrounding rice fields at night. During hard freezes, when Wapanocca has the only open water, numbers skyrocket; hundreds of thousands, probably over a million ducks and geese swimming shoulder to shoulder keep long leads open in the center of the lake. As many as a million Snow Geese can be present, and since Snow Geese flocks contain as much as 0.1 percent Ross' Geese, 1,000 Ross' Geese may be present. The Snow Goose flocks draw in tens of thousands of White-fronted Geese as well. A heronry principally of Great Blue Herons and Great Egrets, but probably including Anhingas and Black-crowned and Yellow-crowned Night-Herons, exists in a nearly inaccessible area of cypress swamp. Censuses of the heronry, when it was formerly

located in a more accessible area, counted upwards of 500 nests. In dry years when mud is exposed at the south end of the lake, good numbers of shorebirds come in migration, with large numbers of Stilt Sandpipers. The refuge also is excellent in migration for warblers and terns. Twenty-eight species of warbler were recorded here on a “Big Day” in 1992. Flocks of well over 100 Least Terns are commonly seen on the lake in the fall, with abundant Black and Forster's Terns as well.

### **Conservation status**

This site's lake and bottomlands are fed by rainwater and ground water. A combination of drier and hotter weather and, especially, the decreasing ground water due to irrigation of the surrounding agricultural land is a critical problem. Damage has already occurred. Surrounding lands were drained and deforested. Big Creek, which was once a fishery source for restocking the lake, was degraded through channelization and lost its fishery value. Additionally, Big Creek was the major fresh water source for the lake. In 2001-2002 the shallow lake almost dried out completely, and though it has since recovered, the danger was clearly demonstrated.

### Appendix III

List of acronyms used in this report.

ABCI	Arkansas Birds of Conservation Interest
AFBF	Arkansas Farm Bureau Federation
AGFC	Arkansas Game and Fish Commission
BBS	Breeding Bird Survey
BCR	Bird Conservation Region
CBC	Christmas Bird Count
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
DU	Ducks Unlimited
EQIP	Environmental Quality Incentive Program
FSA	Farm Service Agency
GIS	Geographic Information System
IBA	Important Bird Area
LIP	Landowner Incentive Program
MAV	Mississippi Alluvial Valley
NASS	National Agricultural Statistics Service
NAWCP	North American Waterbird Conservation Plan
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge
PIF	Partners In Flight
RC&D	Resource Conservation & Development
TNC	The Nature Conservancy
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USSCP	U.S. Shorebird Conservation Plan
WMA	Wildlife Management Area
WRP	Wetland Reserve Program







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