

Missouri Waterbirds and Working Lands

Technical Report January 2007

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Prepared by William E. Jensen

As a product of the “Waterbirds on Working Lands” Audubon-Monsanto partnership, this report summarizes the interface between wetland and waterbird conservation and agriculture in Missouri, with special emphasis on Audubon Missouri’s (AM) Important Bird Areas (IBA) program. The purpose of this partnership is to “Promote sustainable farming practices that will maintain the economical viability of the land while measurably improving environmental health and wildlife habitat value.” Much of the material in this report was expanded from Jensen and Forbes (2006). “Waterbirds” are defined here as those bird species associated with wetlands in Missouri for any portion of their life cycle (e.g., wading birds, shorebirds, waterfowl, etc.). The reader is referred to Appendix A for definitions of agency and programmatic acronyms and Appendices B and C for lists of common and scientific names of birds and plants, respectively, used throughout this document.

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Wetlands in Missouri: Past and present

Native wetland communities have been greatly reduced in Missouri, by approximately 87% since 1800 (Nelson 2005). As a result, many waterbird populations have declined in the state, hence, their prominence in the conservation priority list in Appendix D. Larger rivers, most notably the Missouri and Mississippi, had braided and unrestricted channels and wide floodplains with varying periods of inundation. These floodplains, including the Mississippi Alluvial Basin of the Bootheel, contained flooded forest (swamp), shrub swamp, herbaceous marshland, sandbar, and mudflat habitats (Nigh and Schroeder 2002, Nelson 2005). Seeps and marshes occupied tallgrass prairies. Fen openings were scattered throughout the Ozark Highlands. As wetlands typically occupy deep, productive soils, much wetland in Missouri has been converted to cropland. Additionally, Missouri’s largest rivers (the Mississippi and Missouri) have been channelized and dammed for barge traffic and contained in levees, which greatly reduces seasonal flooding of river bottomland, while perpetually increasing the river levels elsewhere. Swamps were drained and their associated forest cut. Though possibly external to individual wetland sites, local hydrology altered through various land and water uses can disrupt hydrological flows to and from wetlands. This affects the deposition of silt and pollutants that can affect wetland depths and vegetative characteristics (e.g., nitrogen from fertilizer runoff affecting algal blooms), in addition to adding contaminants directly to trophic webs. Additionally, riparian bird habitats also have been subjected to inundation by large reservoirs, especially in the Ozark Highlands (e.g., Swainson’s Warblers nest in riparian giant cane stands). Invasive plants such as purple loosestrife have the potential to overtake and eliminate native marshland vegetation and habitats.

Though much less common and more fragmented than they were historically, wetlands still exist in Missouri. Wetland restoration has variously occurred, in addition to protection of remnant wetland habitats. Water levels within marshes on many refuges and conservation areas are manipulated to provide habitat at appropriate times for breeding and migrating waterbirds. Additionally, much land within these refuges is managed for waterfowl forage through grain plantings in flooded fields (though the prioritization of these habitats vs. all waterbird habitats is a matter of some debate – see below). Though the Missouri River remains a channelized conduit for barge traffic, much floodplain cropland was devastated by the Great Flood of 1993, and as a result was acquired by various conservation agencies to restore more native bottomland habitats. “Wing dikes” restricting river channels have been purposefully

altered by the USACE along some stretches of the Missouri's big rivers (Missouri and Mississippi Rivers) to provide shallow water and sandbar habitats. Some reservoirs are periodically drawn down and their upper reaches provide stopover habitat for migrating shorebirds. Prescribed fire has been used to control woody invasion of open marshes, and diking is sometimes used to maintain marshland in an early successional state.

Waterbird Trends in Missouri

Appropriate long-term surveys of waterbirds during breeding and migration are generally lacking. The North American Breeding Bird Survey (BBS) is currently the most geographically widespread and longest-term breeding bird survey on the continent. However, waterbirds often occupy restricted and isolated habitats in Missouri and are thus under-sampled by the BBS. Of the estimated 31 waterbird species breeding in the state (Table 1; Robbins and Easterla 1992, Jacobs and Wilson 1997), the BBS detected only six species across at least 14 survey routes (necessary for trend analysis; Sauer et al. 2005) in the state from 1966-2004. Results from BBS trend analyses for these species, show population trends to be generally stable or increasing in the state, relative to birds in other habitats (Table 2).

Table 1. List of waterbirds that breed in Missouri.

Common Name	Scientific Name
American Bittern	<i>Botaurus lentiginosus</i>
American Coot	<i>Fulica americana</i>
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>
Belted Kingfisher	<i>Ceryle alcyon</i>
Black-necked Stilt	<i>Himantopus mexicanus</i>
Blue-winged Teal	<i>Anas discors</i>
Cattle Egret	<i>Bubulcus Ibis</i>
Canada Goose	<i>Branta canadensis</i>
Common Moorhen	<i>Gallinula chloropus</i>
American Coot	<i>Fulica americana</i>
Double-crested Cormorant	<i>Phalacrocorax auritus</i>
Great Blue Heron	<i>Ardea herodias</i>
Great Egret	<i>Ardea alba</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>
Least Tern	<i>Sterna antillarum</i>
Killdeer	<i>Charadrius vociferus</i>
King Rail	<i>Rallus elegans</i>
Least Bittern	<i>Ixobrychus exilis</i>
Mallard	<i>Anas platyrhynchos</i>
Marsh Wren	<i>Cistothorus palustris</i>
Northern Pintail	<i>Anas acuta</i>
Pied-billed Grebe	<i>Podilymbus podiceps</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Sora	<i>Porzana carolina</i>
Spotted Sandpiper	<i>Actitis macularia</i>
Trumpeter Swan	<i>Cygnus buccinator</i>
Virginia Rail	<i>Rallus limicola</i>
Wood Duck	<i>Aix sponsa</i>
Yellow-crowned Night-Heron	<i>Nyctanassa violacea</i>
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>
Green Heron	<i>Butorides virescens</i>

Table 2. Estimated trends in abundance estimates of per avian habitat guild, and associated species with statistically-significant trends ($P < 0.1$, as defined by USGS), from the North American Breeding Bird Survey (BBS), pooled across survey routes in Missouri, 1966-2004 (Sauer et al. 2005). Negative and positive values indicate increasing and decreasing trends, respectively. Note that these analyses are only for the number of species detected on at least 14 survey routes.

Habitat Guild	Species associates	Species detected	Mean % change per year	Proportion of species with significant negative trends	Proportion of species with significant positive trends
Wetland Breeding		6	2.71	0.33	0
	Wood Duck		7.13		
	Canada Goose		8.86		
Grassland Breeding		8	-0.26	0.50	0.12
	Horned Lark		-2.25		
	Grasshopper Sparrow		-2.25		
	Dickcissel		-1.87		
	Eastern Meadowlark		-1.60		
	Bobolink		+5.40		
Successional or Scrub Breeding		21	-1.24	0.38	0.05
	Prairie Warbler		-4.47		
	Yellow Warbler		-4.03		
	Bell's Vireo		-3.54		
	Lark Sparrow		-3.04		
	Northern Bobwhite		-2.65		
	Eastern Towhee		-2.56		
	Field Sparrow		-2.54		
	Brown Thrasher		-2.50		
	Song Sparrow		+2.44		
Woodland/Forest Breeding		33	1.18	0.12	0.30
	Black-billed Cuckoo		-3.97		
	Black-capped Chickadee		-1.96		
	Yellow-billed Cuckoo		-1.84		
	Great Crested Flycatcher		-1.39		
	Kentucky Warbler		+1.59		
	Northern Parula		+2.12		
	Warbling Vireo		+2.64		
	White-breasted Nuthatch		+3.21		
	Red-eyed Vireo		+3.64		
	Red-shouldered Hawk		+3.65		
	Scarlet Tanager		+4.35		
	Yellow-throated Warbler		+4.44		
	Barred Owl		+5.73		
	Black-and-white Warbler		+6.48		

Waterbird Habitat Use and Agriculture

Migration, wintering, or breeding habitat for waterbirds may exist in various forms on agricultural lands without specific wetland management. These habitats might include ephemeral or perpetually flooded cropfields (Hands et al. 1991, Twedt et al. 1998, Rivers and Cable 2003), irrigation or drainage ditches, or flooded field buffer habitats. Rice fields are typically flooded and can provide sufficient habitat for wintering waterbirds (Elphick 2000). More “natural” wetland remnants (e.g., emergent marsh, or flooded grassland, shrubland, or woodland) may also exist on farms, with or without active wetland management.

Some studies have examined waterbird habitat use in an agricultural context. At Ted Shanks Conservation Area in northeastern Missouri, Hands et al. (1991) found overall densities of five shorebird species during spring and fall migration to be higher in more natural marsh and moist-soil wetlands than in flooded agricultural fields (corn and soybeans) or field border ditches. Within flooded agricultural fields managed for waterfowl in Arkansas and Mississippi, Twedt et al. (1998) found overall fall-spring shorebird density to be greater on soybean fields than in rice or other moist-soil fields. However, wetlands created from drawing down water levels from the upper reaches of reservoirs had higher densities of shorebirds (particularly Semi-palmated Sandpiper, *Calidris pusilla*) relative to flooded crop fields during fall migration (Twedt et al. 1998).

There are larger, landscape-scale settlement patterns of waterbirds that may be common to all forms of wetlands, whether natural or semi-natural. Many waterbird species use multiple wetlands and wetland types at broad scales within and among breeding, migration, and wintering seasons (Haig et al 1998). Complexes containing multiple wetland units provide habitat alternatives for opportunistic waterbirds amidst fluctuating hydrological conditions typical of mid-continental wetlands (Skagen and Knopf 1994). Shorebird abundance has been found to be positively related to wetland unit size during migration in Kansas (Skagen and Knopf 1994). In the Prairie Pothole region of the Great Plains, Fairbairn and Dinsmore (2001) found wetland bird species richness, and densities of five species, to be correlated to the amount of wetland habitat in landscapes surrounding wetland complexes.

Agricultural Context for Missouri’s Wetlands

According to the 2002 Census of Agriculture for Missouri (USDA, National Agricultural Statistics Service), roughly 30 million acres of Missouri’s land is in farms. Table 3 lists acreages per product and land use across this farmland. The amount and variation of inundated agricultural land functioning as waterbird habitat per most of Missouri’s crops is not known. However, flooded rice fields resemble marshes and can serve as wetland habitat for wintering (Elphick 2000, Manley et al. 2004)—and possibly breeding (Meanly 1953)—waterbirds.

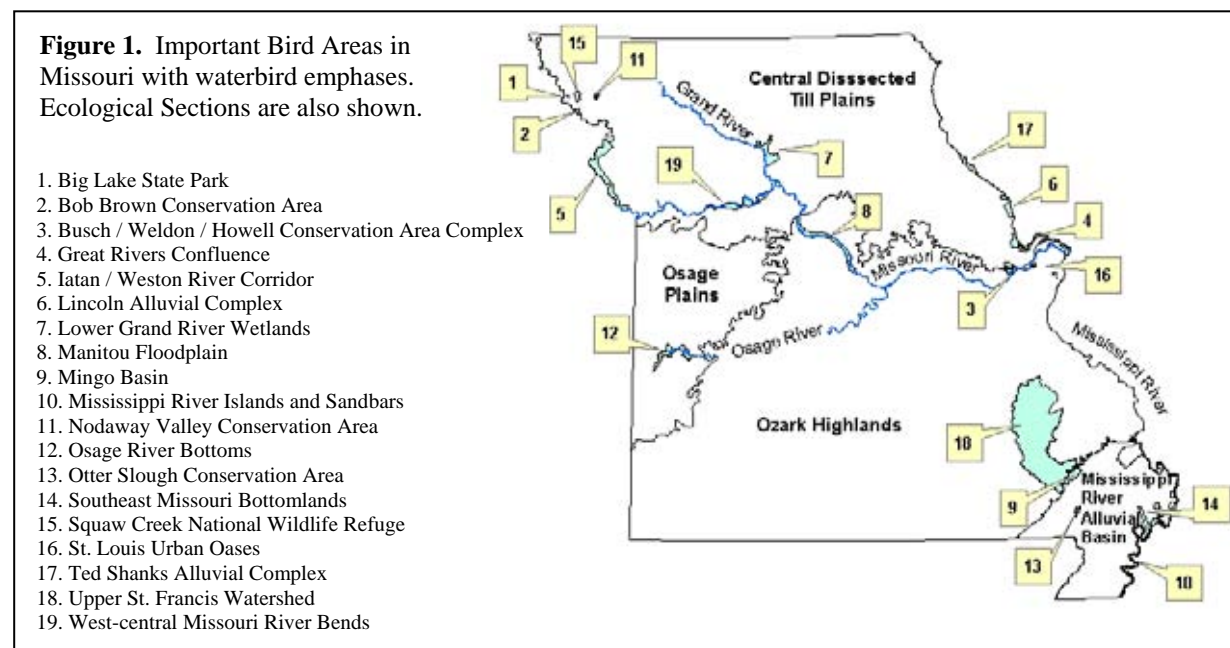
Table 3. Agricultural acreages reported from the 2002 Census of Agriculture in Missouri (USDA, National Agricultural Statistics Service). Acreages of cotton and rice in counties of Missouri’s southeastern “Bootheel” region (Butler, Dunklin, Mississippi, New Madrid, Pemiscot, Scott, and Stoddard Counties) are in parentheses.

Type	Acres
State acreage	44,596,701
Land in farms	29,946,035
Cropland	18,884,920
Soybeans	5,001,858
Hay	4,142,725
Corn	2,748,676
Wheat	811,586
Cotton	395,880 (395,776)
Sorghum	209,000
Rice	167,716 (164,063)
Other crops*	5,407,479
Pastureland	9,033,012
Land enrolled in CRP or WRP**	1,418,874
Other (farmland not in uses above)	609,229

* Other crops with acreages <100,000 total acres.

** CRP (Conservation Reserve Program), WRP (Wetland Reserve Program)

Geographical Patterns of Wetlands and Agriculture.—Most of the wetlands in Missouri’s IBAs with waterbird emphases—and most of the wetlands in the state—are generally classified as “riverine wetlands” (Nelson 2005). Permanent and ephemeral inundation of riverine wetlands occurred naturally *via* over-bank flooding of rivers and streams, groundwater seepage, watershed runoff, and direct precipitation. Natural communities occurring in riverine wetlands include marsh, swamp, and shrub swamp (Nelson 2005). Missouri’s riverine wetlands can be categorized into two somewhat distinct regions of the state based on historical and present wetland communities and differences in agricultural context. These regions are (1) the broad Mississippi River Alluvial Basin, otherwise known as Missouri’s southeastern-peninsular “Bootheel,” and (2) the more serpentine floodplains of major rivers throughout the rest of the state (e.g., Grand, Mississippi, Missouri, and Osage rivers). In both regions emergent marsh and shrub swamps were historically common (Nelson 2005) and drainage ditches and ephemerally flooded crop fields provide some modern waterbird habitat. Differences in remnant and restored wetland natural communities and agricultural characteristics among these regions are discussed here.



The wetlands of Missouri’s Bootheel comprised nearly half of the historical wetlands in the state (Nelson 2005). Marsh and shrub swamps were widespread in the Bootheel, but swamps (mostly cypress-tupelo) were largely restricted to this region of Missouri (Nigh and Schroeder 2002, Nelson 2005). The Bootheel also receives the greatest amount of annual precipitation in the state. Today, only two percent of the Bootheel’s wetlands remain (Nelson 2005). Drainage ditches and diversion channels were constructed around 1900 (Nigh and Schroeder 2002) to drain the Bootheel’s wetlands for agriculture, and the vast majority of standing swamp and bottomland timber was cut. Many diversion channels are still maintained through regular dredging. Agriculture in the Bootheel region differs from much of the rest of the state. The vast majority of the state’s cotton and rice are produced in the Bootheel (Table 3), the latter being of value to waterbirds (Elphick 2000). According to the Missouri 2002 Census of Agriculture, farms in the Bootheel’s counties (counties listed in Table 3 heading) are also significantly larger than farms in other counties where waterbird IBAs occur (Table 4). Beyond what wetland destruction has already occurred, remaining threats to wetland fragments in the Bootheel include sedimentation from erosion of surrounding croplands that reduces wetland depths and vegetative characteristics. Excessive nutrient pollution from fertilizer runoff can also alter wetland vegetative communities. Though not

currently a major problem in Missouri, purple loosestrife poses an invasive species threat to Missouri's wetlands.

Outside of the Bootheel, most of Missouri's historic riverine wetlands occurred in the Central Dissected Till and Osage Plains and northern Ozark Highlands (latter in the Missouri River valley), being comprised of marsh and shrub swamp communities (Nelson 2005). Many of the rivers in this region, especially the Missouri and Mississippi, are contained in levees. This allowed for continuous farming of floodplains and stabilized river channels for barge traffic on the Missouri and Mississippi Rivers. Corn, soybeans, wheat, and other crops are grown in these valleys (Table 3). Remnant or restored wetlands are fragmented. However, much floodplain cropland in the central Missouri River valley was devastated by recent floods (in 1993 and 1995), which led to land acquisitions by various conservation agencies for wetland and bottomland forest restoration. Farm sizes in counties containing these river-valley wetlands are typically smaller than farms in the Bootheel (Table 4). Though average land prices (per acre) between the Bootheel and Missouri's other riverine wetland counties are similar (Table 4), the average price per acre in St. Charles County (\$3,991) (where the Great Rivers Confluence IBA is located) exceeds that of all other waterbird IBA counties (likely due to suburban development market value of the St. Louis metropolitan area). Like the Bootheel, destruction of historical wetlands had likely reached a maximum in the past century, but continuing threats include sedimentation and runoff of pollutants.

Table 4. Difference in average farm sizes among counties in Missouri's Bootheel region (7 counties) vs. other counties where other waterbird IBAs occur (12 counties; excluding counties of the Upper St. Francis Watershed IBA, where reservoir developments provide the only significant wetlands and the IBA is predominantly forested). Source: 2002 Missouri Census of Agricultural.

	Bootheel Counties	Other Waterbird IBA Counties
Average farm size (acres) (Mean of county means)	751.6	303.6
95% confidence interval (acres)	485.5 – 1,017.7	246.9 – 360.3
Range (acres)	368 – 1,149	120 – 519
Average price per acre (Mean of county means)	\$1,813	\$1,888
95% confidence interval (acres)	\$1,683 – \$1,943	\$1,314 – \$2,462
Range (acres)	\$1,499 – \$2,048	\$1,005 – \$3,991

Agriculture at the Important Bird Area Scale.—Aside from the county-level data on crop acreages, farm sizes, etc. from the Missouri Census of Agriculture, such statistics within specific IBAs are not yet available for each waterbird IBA. However, identification of farm and field borders and prospective wetland sites is underway for the Iatan / Weston River Corridor IBA, a waterbird IBA of initial focus to AM (see profile for this IBA below). All waterbird-emphasized IBAs in Missouri are subject to hydrology, sediment flux, and pollutant flux from beyond their borders. Some of the IBAs are at—or near—the scale of individual refuges (e.g., Bob Brown Conservation Area), and may include tracts leased for crop fields. These fields are sometimes flooded for habitat for migratory and wintering waterfowl. Other IBAs include landscapes well beyond refuge borders with considerable acreages of privately owned and managed agricultural lands. Thus, agriculture is a ubiquitous presence in and around waterbird IBAs in Missouri.

Waterbird Conservation Opportunities for Agricultural Producers

The management of working agricultural lands to provide improved wetland habitat for waterbirds may take various forms. As noted above, waterbirds may use existing wetlands on agricultural lands that are not actively managed as waterbird habitat. However, in order to maximize waterbird diversity and numbers, additional management may be required. This may include allowing crop fields to be flooded by prohibiting drainage (e.g., terracing), diverting water among fields, allowing flooded fields to revert to idle vegetation, planting vegetative habitats, etc. Such control can also manipulate wetland size. Once established, prescribed fire may be used to control woody invasion of open marshes, and disking is sometimes used to maintain marshland in an early successional state.

Incentive programs are available for private land stewards to manage for waterbird habitat and other wildlife. These and other programs will be promoted through the Missouri Agricultural Wetland Initiative, which has been created to facilitate wetland and wildlife conservation on agricultural lands through partnerships among farmers, conservation agencies, and non-profit organizations. This initiative was formed to communicate the many wetland conservation programs in which agricultural producers can participate. Brochures detailing six federal and state programs are contained in packets that present subsidized wetland management alternatives available to producers. These programs include:

- Wetlands Reserve Program (USDA)
Incentive program for landowners to restore and protect wetlands in marginal agricultural land. Landowners voluntarily limit use of the land, but retain ownership. Landowners and the NRCS jointly develop wetland restoration and maintenance plans. 100,000 acres of wetland habitat in Missouri have been restored through the Wetland Reserve Program (WRP), mostly in floodplains of major rivers and their tributaries. Missouri ranks among the top ten states in the US for WRP enrollment (NRCS). Many positive responses by a great diversity of wetland birds to WRP have been documented (Rewa 2005).
- Partners for Fish and Wildlife Program (USFWS)
Provides technical and financial assistance to private landowners for restoring fish and wildlife habitats on their lands.
- Continuous Conservation Reserve Program, CP-9 (USDA): Shallow Water Areas for Wildlife
NRCS incentive program for producers to provide water for wildlife with an average depth of 6 – 18 inches for at least 6 months per year. Buffers of perennial vegetation are required.
- Continuous Conservation Reserve Program, CP-23 (USDA): Wetland Restoration
For restoring wetlands that are entirely within a 100-year floodplain where wetland hydrology has been removed / altered by drainage and/or manipulation.
- Continuous Conservation Reserve Program, CP-23 (USDA, MDC, DU): Wetland Restoration Enhancement
Financial Support to “enhance” CP-23 projects for migrating waterfowl through the seasonal flooding of adjoining cropland.
- MDC 800 Wetland Development (MDC)
Program for wetland restoration on sites where surface or ground water quality has been degraded by runoff carrying excessive sediments, nutrients, or pesticides, or where wetland restoration is needed for wildlife habitat improvements. Cropland flooding can reduce nitrogen runoff and soil erosion, and provide shallow water habitats for migrating, wintering, and resident waterbirds.

Audubon Missouri’s Role.—AM has taken several steps toward waterbird conservation on private agricultural lands and public conservation areas. Promoting wetland and waterbird conservation to private agricultural producers figures prominently in AM’s conservation strategies. AM has contributed to the statewide Missouri Agricultural Wetland Initiative (described above), in part with funding from Monsanto, and will promote associated programs (above) for specific IBA implementation projects.

Audubon Missouri’s IBA technical committee also recognized a need for improvement on public lands. Audubon Missouri is a close partner with the Missouri Department of Conservation (MDC), with AM’s Director of Bird Conservation and two of the four IBA technical committee members being MDC

employees. Many MDC conservation area fields are leased for agricultural production (mostly croplands), and are occasionally managed as waterfowl habitat by flooding crop fields during waterfowl wintering and migration (i.e., hunting) seasons. However, many of these areas could provide habitat for a greater diversity of waterbirds throughout the year (including breeding seasons) if managed properly. The AM technical committee will be drafting a letter to address this issue to MDC administration to help emphasize the need for better all-waterbird management on MDC conservation areas. The committee is already networking with local conservation area managers on how all-waterbird conservation might be better achieved.

AM’s focal conservation implementation efforts in Missouri are directed by the state’s IBA program. Of the 47 landscapes in Missouri identified by AM as IBAs, 19 of these contain waterbird species of concern, or provide current and potential wetland habitats for waterbirds (Figure 1). The following are profiles of these IBAs, beginning with the two most significant waterbird IBAs that present the greatest opportunities for improving waterbird conservation in Missouri.

Missouri’s Premiere IBA Opportunities for Waterbird Conservation

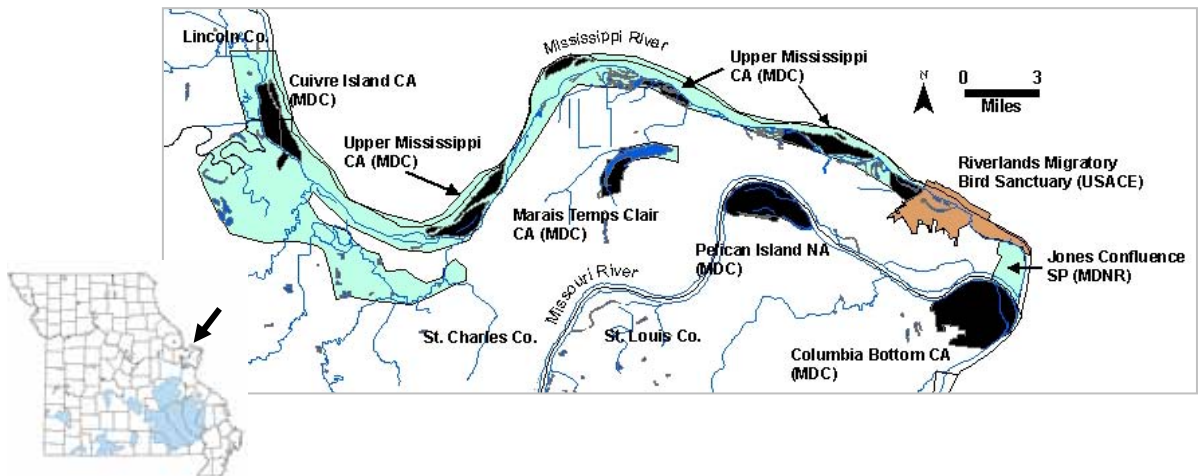
Of Missouri’s waterbird-emphasized IBAs, two IBAs—the Great Rivers Confluence and the Iatan / Weston River Corridor—stand out as having the most developed partnership infrastructure, identified conservation needs, and conservation strategies. These IBAs are large landscapes (53,452 and 99,638 acres, respectively) where pilot conservation implementation projects by AM are underway. Their profiles are as follows:

Great Rivers Confluence

Lincoln, St. Charles, and St. Louis Counties

Location (UTM): x723869, y4315460

53,452 acres (21,640 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round), American Bittern (breeding, migration), King Rail (breeding, migration), Interior Least Tern (breeding, migration)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Waterfowl, shorebirds, migrant landbirds

Site description

The Great Rivers Confluence IBA was historically dominated by extensive lowland wet prairie and marsh, and bottomland forest (Nigh and Schroeder 2002). Today, much of the IBA is cropland, with embedded restored marshes and bottomland forest. The Riverlands Migratory Bird Sanctuary contains a 1,200 acre (486 ha) restored wet prairie / marsh.

Thirty-eight percent of the IBA is publicly-owned conservation land. Landholdings managed by MDC include: Columbia Bottom CA (4,253 acres, 1,722 ha), Cuivre Island CA (1,670 acres, 676 ha), Marais Temps Clair CA (948 acres, 384 ha), Pelican Island CA (2,569 acres, 1,040 ha), and Upper Mississippi CA (4,276 acres, 1,731 ha). Also included in the IBA are Jones Confluence SP (MDNR; 2,761 acres, 1,118 ha), and the Riverlands Migratory Bird Sanctuary (USACE; 3,700 acres, 1,498 ha). Over 20,000 acres of this IBA are held by private duck club owners.

Ornithological significance

The Great Rivers Confluence IBA is an important wetland complex for migrating and breeding waterbirds along the Mississippi migratory flyway. Bald Eagle and King Rail have bred within the IBA. American Bittern are also often observed at the Riverlands Migratory Bird Sanctuary, but have not been confirmed breeding there. Interior Least Terns have attempted nesting at an artificial island at Riverlands Migratory Bird Sanctuary, but have not yet been successful due to flooding. Least Bittern and Willow Flycatcher also nest on Marais Temps Clair CA (Palmer and Palmer 2001). Thousands of waterfowl and shorebirds pass through the IBA during migration each year, along with large numbers of neotropical migratory songbirds, which are found primarily in bottomland forest present along the rivers.

Conservation status

The Great Rivers Confluence IBA is encompassed by MDC's Missouri / Mississippi Confluence COA (MDC 2005). (Conservation Opportunity Areas (COAs), have been identified by MDC as having great potential for "all wildlife" conservation as part of Missouri's Comprehensive Wildlife Conservation Strategy. The reader is referred to the MDC document (MDC 2005; see Literature Cited) for lists of specific conservation issues, challenges, strategies, and partners in these COAs pertaining to other wildlife species.) Habitat restoration on private lands and public appreciation of natural floodplain qualities are vital for conservation success in this COA/IBA (MDC 2005). Extensive marsh, wet prairie, and bottomland forest restoration is underway at Columbia Bottom CA and Edward "Ted" and Pat Jones-Confluence Point SP.

A Premiere IBA for Waterbird Conservation.—The Great Rivers Confluence IBA is a focal IBA for initial project implementation by AM. Avian conservation targets include: American Bittern, Least Bittern, Black Rail, King Rail, Virginia Rail, Marsh Wren, Sora, Kentucky Warbler, Prothonotary Warbler, Red-headed Woodpecker, Rusty Blackbird, Willow Flycatcher, Wood Thrush, and Bald Eagle. AM is making a major investment in the Great Rivers Confluence across many fronts:

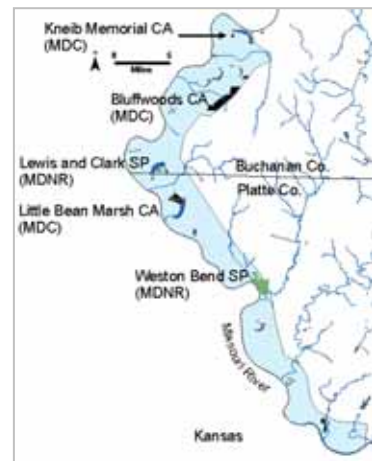
- **Partnerships.** AM has developed a broad conservation partnership of stakeholders in the Confluence region, including St. Louis Audubon Society, MDNR, MDC, Great Rivers Greenway, USACE, USFWS, USNPS, DU, PF, local governmental agencies, major foundations and corporations, philanthropists, and private landowners. AM is participating with the Missouri / Mississippi Confluence Partnership (administered by USFWS) in developing a conservation plan for the Confluence region, which will include conservation strategies for private lands, and environmental education programs for citizens in the Confluence region. As a partner with the Missouri Agricultural Wetlands Initiative (includes USFWS, MDC, USDA/NRCS, and DU), AM will be encouraging all-waterbird management on local duck clubs and other private lands. AM is also contributing restoration of recently acquired public lands, including Jones Confluence SP and Columbia Bottom CA. There is also promise of connecting to other ongoing work in the region, including the work being done through St. Louis Audubon for the Urban Bird

Conservation Treaty and the wetlands conservation and education efforts at Little Creve Coeur Marsh (see St. Louis Urban Oases IBA profile).

- Education.** AM is also greatly expanding environmental educational opportunities in the Confluence region. In collaboration with the MDNR, MDC, Great Rivers Greenway, the USACE, the St. Louis Audubon Society, the McKnight Foundation, and a broad cross-section of community stakeholders, AM is developing the Great Rivers Audubon Center and Riverboat education/tourism project to connect people to the confluence and the broader conservation needs in the region. Programs will inform citizens about the important ecological and cultural resources in the Confluence region and provide direct interaction with these resources. On 28 April 2006, AM orchestrated the “Wings of Spring” Confluence Birding Festival, in which over 1,000 visitors participated in birding tours, educational demonstrations, and wildlife art exhibits. AM has currently raised \$2.4 million, and expects a total of \$5.5 million to be raised for education and habitat restoration programs in the Confluence region. Contributors include MDNR (pledged \$960,000), MDC (pledged \$940,000), Great Rivers Greenway, McKnight Foundation, and several other generous donors.
- Duck Club Relationships.** As much of the western portion of this IBA is held by private duck clubs, these private lands are key to waterbird conservation action in the Confluence region. AM has developed significant, positive relationships with owners and habitat managers of over 5,000 acres in the Confluence region. AM recently (May 2006) led a spring “Big Day” birding event to record bird species on private duck clubs in the Confluence region. This information will be shared with confluence duck club owners and managers to demonstrate the diversity of birds that can be accommodated on their lands, in addition to waterfowl. AM also intends to develop all-waterbird conservation workshops for duck club managers. There is promise of voluntary implementation of all-waterbird habitat management by these clubs, with the guidance of various conservation staff (e.g., MDC private lands staff), but wetland restoration incentive programs presented by the Missouri Agricultural Wetlands Initiative (see above) should also prove useful in facilitating all-waterbird habitat restoration by duck clubs.

Iatan / Weston River Corridor

Buchanan and Platte Counties
 Location (UTM): x333748, y4365083
 99,638 acres (40,339 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round), American Bittern (breeding, migration), King Rail (breeding, migration)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Migrant landbirds

Site description

Historically, the Iatan / Weston River Corridor was bottomland tallgrass prairie, marshland, and forest of the Missouri River floodplain, grading into hilly upland drainages with oak and mixed hardwood woodlands and forests (Nigh and Schroeder 2002). Today, cropland and urban development dominate the bottomland, with some managed marshland areas and bottomland forest. Second-growth forest, cool-season pasture, and cropland currently occur in the upland

areas. Fort Leavenworth, Kansas lies immediately across the Missouri River from Weston Bend SP (see below) and contains the largest tract of bottomland forest along the Missouri River adjacent to the IBA. Four percent of the IBA is publicly-owned conservation land. Three areas managed by MDC occur in the IBA: Bluffwoods CA (2,245 acres, 909 ha), Kneib Memorial CA (35 acres, 14 ha), Little Bean Marsh CA (437 acres, 177 ha). Two State Parks (MDNR) are in the IBA: Lewis and Clark SP (189 acres, 77 ha) and Weston Bend SP (1,133 acres, 459 ha).

Ornithological significance

Current and future wetlands will provide important habitat for migrant and breeding waterbirds. State endangered American Bittern and King Rail have been observed on the IBA during the breeding season, along with Sora, Least Bittern, Marsh Wren, and other marsh-nesting species. The extremely rare Black Rail was also reported at Little Bean Marsh in 2005. Bald Eagles may be found there year-round. The bluff-top forests above the Missouri River Floodplain are renowned among birders for excellent “fallouts” of migrant songbirds during spring migration. Across the Missouri River, breeding Cerulean Warblers occur at Fort Leavenworth, Kansas.

Conservation status

The Iatan / Weston Missouri River Corridor COA outlined by MDC (2005) encompasses the Iatan / Weston River Corridor IBA. Conservation challenges outlined by MDC for this region include habitat restoration, hydrological issues with wetlands associated with the channelized Missouri River, and urbanization.

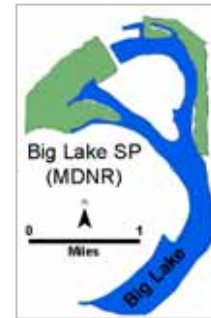
A Premiere IBA for Waterbird Conservation.—The Iatan / Weston River Corridor is a focal IBA for initial project implementation by AM to facilitate conservation of habitats on private lands within the corridor on both the Missouri and Kansas sides of the Missouri River. AM also will encourage management of public lands within the IBA to focus on its conservation targets (Waterbirds: American Bittern, Least Bittern, King Rail, Virginia Rail, Common Moorhen, and Marsh Wren; Bottomland Forest Birds: Red-headed Woodpecker, Prothonotary Warbler, Kentucky Warbler, Cerulean Warbler, and Wood Thrush). In addition to private landowners, partners for these efforts will include the Burroughs and Midland Empire Audubon Societies, MDC, USFWS, Mid-America Regional Council (MARC), NRCS, EPA, and the Kansas Department of Wildlife and Parks. AM is moving forward on conservation planning for the Iatan / Weston River Corridor IBA:

- **GIS Wetland Modeling.** MARC has provided AM funding to develop wetland conservation plans for the IBA. To first identify locations within the IBA where wetland restoration appears most fruitful, AM has contracted the Missouri Resource Assessment Partnership (MoRAP) and MU to perform GIS analyses of topographical and agricultural boundary features in the IBA. This information will be important for directing wetland restoration plans.
- **Stakeholder Meeting.** MDC, via the Doris Duke Foundation, has pledged money for AM to host a meeting of stakeholders associated with the IBA (above) to define conservation and educational opportunities in the project area.
- **Project Director.** An AM site conservationist director position is also being considered for the IBA. The director would perform outreach activities with private landowners to facilitate waterbird conservation on their lands. This would include promoting wetland restoration incentive programs outlined by the Missouri Agricultural Wetland Initiative (see above).

Other IBA Opportunities in Missouri for Waterbird Conservation

Big Lake State Park

Holt County
Location (UTM): x299222, y4439807
393 acres (159 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round), American Bittern (breeding, migration)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Waterfowl, shorebirds

Site description

Historically, Big Lake State Park was a mosaic of wet prairie, marshland, and bottomland forest within the Missouri River floodplain (Nigh and Schroeder 2002). Big Lake SP contains Missouri's largest natural oxbow lake, and is one of only a few remaining natural wetlands in the state. The park contains the largest marsh within Missouri's State Park system. Boundaries of the IBA are superimposed on those of Big Lake SP (MDNR).

Ornithological significance

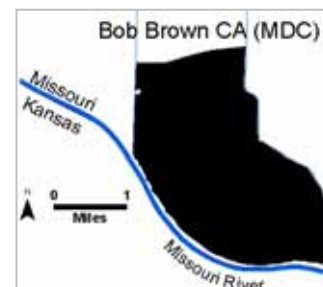
Big Lake SP provides wetland habitat for breeding, migrating, and wintering waterbirds. Large concentrations of waterfowl and shorebirds frequent the IBA during spring and fall migration, moving between this and other large wetlands in the vicinity. Bald Eagles have attempted nesting adjacent to the area, and Least Bittern, Pied-billed Grebe, Marsh Wren, Yellow-headed Blackbird, and other marshbirds regularly breed on the area. American Bitterns also have been observed in the vicinity of the IBA during the breeding season (Jacobs and Wilson 1997), and probably breed within the park during some years.

Conservation status

The MDNR is managing wetland habitats on Big Lake SP, in conjunction with heavy public use. A major land acquisition in 1989 helped preserve the remaining marsh habitat. Boaters and jet-skiers may present a disturbance to nesting eagles and other birds on Big Lake.

Bob Brown Conservation Area

Holt County
Location (UTM): x308475, y4426110
3,361 acres (1,361 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Waterfowl, shorebirds

Site description

The area occupied by Bob Brown Conservation Area was historically mostly bottomland forest, with some scattered wet prairie (Nigh and Schroeder 2002). Today the area is a matrix of marshland, cropland, old-field, grassland, and forest. Boundaries of the IBA are superimposed on those of Bob Brown CA.

Ornithological significance

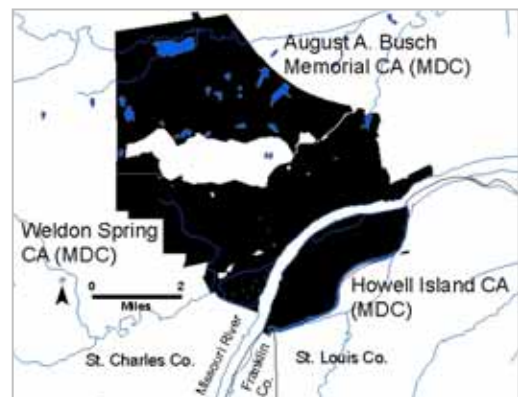
Bob Brown CA provides wetland habitat for breeding, migrating, and wintering waterbirds. Over 18,000 waterfowl (mostly Mallards) were present on the area during MDC's 2005 Midwinter Waterfowl Survey. Some tracts of emergent marsh have been established on the area, and Least Bittern, American Bittern, Yellow-headed Blackbird, Marsh Wren, and other marshbirds are frequently seen in good numbers by local birders. The marshes have not been well explored during breeding season, and thus breeding status of many of these species on the area is not fully known, although the high quality of the habitat there and diversity of species seen indicates that many sensitive species may breed there, possibly even King Rails. Landbirds to be seen include Willow Flycatcher, Bells' Vireo, Loggerhead Shrike, and Sedge Wren.

Conservation status

Wetlands within Bob Brown CA are intensively managed for waterfowl hunting and for marsh habitat, and habitats on the area are relatively secure. Emergent marshes that have been developed on the area in recent years are exceptional.

Busch / Weldon / Howell Conservation Area Complex

St. Charles and St. Louis Counties
Location (UTM): x697086, y4284907
17,317 acres (7,011 ha)



Criteria for establishment

Species of concern (D1): Cerulean Warbler (breeding, migration)

Exceptional concentrations of birds (D4): Waterfowl, shorebirds

Site description

Historically the land occupied by the Busch / Weldon / Howell Conservation Area Complex included upland prairie, savanna, and woodlands, grading to oak and mixed-hardwood forest in the hilly breaks, to bottomland prairie and marshland (Nigh and Schroeder 2002). Today, unlike the surrounding urbanized landscape, the area remains protected by MDC, and contains second-growth upland and bottomland forest, shrubland, marshland, and cropland.

All of the Busch / Weldon / Howell Conservation Area Complex is publicly-owned, MDC land, comprising August A. Busch Memorial CA (7040 acres, 2850 ha), Weldon Springs CA (7563 acres, 3062 ha), and Howell Island CA (2707 acres, 1096 ha).

Ornithological significance

Nesting Cerulean Warblers, and—more commonly—singing males during breeding dates, have been detected along Lost Valley Trail at Weldon Springs CA, and formerly at Busch CA. The river

bottom and artificial lakes provide stopover habitats for migrating waterfowl and shorebirds. Large tracts of upland forest provide breeding habitat for forest interior birds. Shrubland bird habitat also is abundant in upland areas.

Conservation status

Priorities stated by MDC for management on the conservation areas include prairie and savanna restoration on Busch CA and wetland restoration on Weldon Spring CA.

Lincoln Alluvial Complex

Lincoln and Pike Counties
Location (UTM): x695142, y4339737
19,648 acres (7,955 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round), American Bittern (breeding, migration), King Rail (breeding, migration)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Waterfowl, shorebirds, migrant landbirds

Site description

Historically the area encompassing the Lincoln Alluvial Complex was mostly wet prairie and marshland, with some bottomland forest along rivers and islands (Nigh and Schroeder 2002). Though much of the region was plowed to cropland, marshland and bottomland forest still exist, protected on many conservation landholdings. Fifty-six percent of the IBA is publicly-owned conservation land. Included in the IBA are Clarence Cannon NWR (3,750 acres, 1,518 ha), managed by USFWS, and the following MDC areas: B. K. Leach Memorial CA (4,335 acres, 1755 ha), Prairie Slough CA (610 acres, 247 ha), and Upper Mississippi CA (2,327 acres, 942 ha; all the remaining black-colored lands without arrows on the map above).

Ornithological significance

The wetlands in the Lincoln Alluvial Complex provide habitat for many migrant and breeding waterbirds. Nesting records on Clarence Cannon NWR include American and Least Bitterns, Bald Eagles, Common Moorhen, Marsh Wren, and Virginia Rail. Sora also have been observed during breeding season at the NWR. King Rail have been confirmed nesting at the north unit of B. K. Leach Memorial CA and adults have been observed during the breeding season at Prairie Slough CA. Least Bitterns also nest at B. K. Leach Memorial CA (north unit). Large concentrations of migratory waterfowl and shorebirds also utilize the wetland pools and mudflats within this IBA each year. This IBA also is located along a major flyway for neotropical migratory songbirds, which utilize the bottomland forest habitats in the IBA for stopover sites.

Conservation status

On Clarence Cannon NWR, a spillway was constructed along a levee bordering the Mississippi River, which allows periodic flooding of the refuge. Water levels are manipulated among pools on the NWR, and prescribed burns and disking are used to maintain marshland in an early successional state. Despite tree die-offs from the Great Flood of 1993, 450 acres of bottomland forest remain on Clarence Cannon NWR. Recently established emergent marsh units at B. K. Leach Memorial CA also have shown great promise.

Lower Grand River Wetlands

Chariton, Linn, and Livingston Counties
Location (UTM): x478379, y4389377
43,220 acres (17,498 ha)



Criteria for establishment

Species of concern (D1): Bald Eagles (winter, potential breeding),
American Bittern (breeding, migration)
Species in rare habitat type (D3): Wetland birds, grassland birds
Exceptional concentrations of birds (D4): Waterfowl, shorebirds

Site description

The majority of the Lower Grand River Wetlands south of Linn County occupies the Missouri-Grand River Alluvial Plain, which was historically characterized by wet prairie, with some forest and marsh in the bottomland (Nigh and Schroeder 2002). The northern end of the IBA had some upland prairie, savanna, and woodland. Much prairie has been converted to cropland, but many acres persist as wetlands and bottomland forest on the conservation lands mentioned below.

Fifty-one percent of the Lower Grand River Wetlands is publicly-owned conservation land. Swan Lake NWR (10,795 acres, 4,370 ha) is managed by USFWS. Under management of MDC are Fountain Grove CA (7,405 acres, 2,998 ha) and Yellow Creek CA (593 acres, 240 ha). Pershing SP (3,566 acres, 1,444 ha) is managed by MDNR.

Ornithological significance

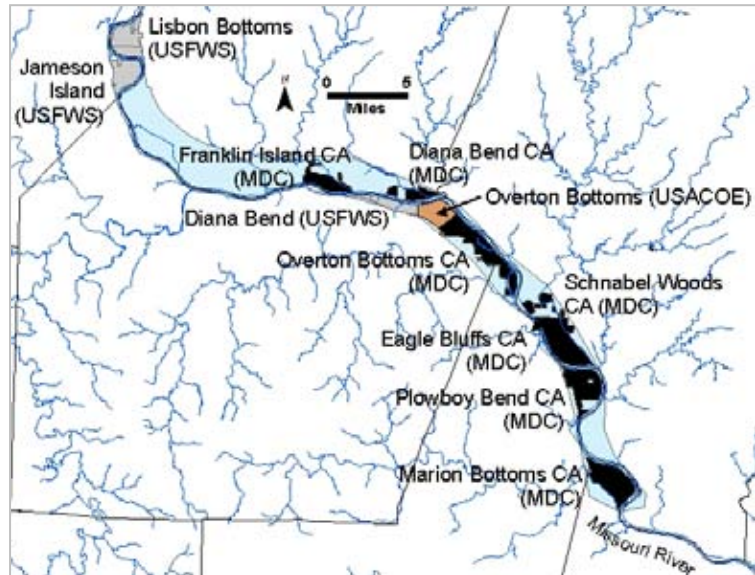
The Lower Grand River Wetlands IBA provides much habitat for waterbirds, for both migration stopover and breeding. The IBA also provides grassland bird habitat and riparian woodlands for arboreal nesting species (including Bald Eagle, Great Blue Heron, Red-headed Woodpecker, Acadian Flycatcher, Prothonotary Warbler, and Wood Thrush). American Bitterns are common during migration and Least Bitterns have been observed to nest in the IBA. Pied-billed Grebes and Red-shouldered Hawks also nest on the Swan Lake NWR (Palmer and Palmer 2001). Other waterbirds observed in the IBA include Common Moorhen, Interior Least Tern (probably dispersing individuals), Marsh Wren, and Sora. During migration and winter, this IBA regularly supports large concentrations of waterfowl, and good numbers and diversity of shorebird species.

Conservation status

Restoration of bottomland forest and wet prairie communities would be aided by controlling soil erosion and resulting silt deposition (MDC 2005), and can be facilitated through multiple conservation programs available through the USDA Farm Bill. MDC (2005) has designated an area encompassing the Lower Grand River Wetlands as the Lower Grand River COA, where conservation partners, including private landowners, can advance needed changes in soil and grassland conservation practices.

Manitou Floodplain

Boone, Cole, Cooper, Howard,
Moniteau, and Saline Counties
Location (UTM): x539039, y4311052
67,898 acres (27,489 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Waterfowl, shorebirds, migrant landbirds

Site description

The Manitou Floodplain is located primarily within the Missouri River floodplain, along with some of the surrounding upland bluffs. Historically, much of this floodplain was covered in bottomland forest, with some marshland and shrub swamps in abandoned river channels (Nigh and Schroeder 2002), with hardwood forest in the upland areas. Most of the floodplain was converted to cropland. However, much of this cropland was destroyed and abandoned by the Great Flood of 1993 and purchased by federal and state agencies for conservation land. In addition to the pre-flood residual habitat, riverfront forests, marshes, shrub swamps, scour pools, and natural sandbars and mudflats are returning to the floodplain. The IBA also contains Schnabel Woods CA, a patch of rare, old-growth mesic loess forest atop the bluffs overlooking Eagle Bluffs CA (Nelson 2005).

Thirty-four percent of the IBA is publicly-owned conservation land. Of these, USFWS manages the following units of the Big Muddy National Fish and Wildlife Refuge: Diana Bend (1,188 acres, 481 ha), Jameson Island (1,871 acres, 757 ha), Lisbon Bottoms (2,013 acres, 815 ha), and Overton Bottoms (1,655 acres, 670 ha; also managed by USACE). The remaining public lands in this IBA are managed by MDC, and include a small portion of D aviddale CA (44 acres, 18 ha), Diana Bend CA (1,060 acres, 429 ha), Eagle Bluffs CA (4,268 acres, 1,728 ha), Franklin Island CA (1,662 acres, 673 ha), Marion Bottoms CA (2,939 acres, 1,190 ha), Overton Bottoms (3,725 acres, 1,508 ha), Plowboy Bend CA (2,675 acres, 1,083 ha), and Schnabel Woods CA (79 acres, 32 ha).

Ornithological significance

The Manitou Floodplain IBA provides abundant wetland habitats for migratory waders, waterfowl, and shorebirds. Approximately 10,000 mixed waterfowl were detected during MDC's 2005 Midwinter Waterfowl survey. Flocks of thousands of shorebirds also use the IBA. Bald Eagles nest there, and there has also been evidence for breeding Common Moorhen. Virginia Rail and Marsh Wren also have been observed in the IBA during their respective breeding seasons. Bottomland forest provides habitat for many forest birds, including Prothonotary Warbler, Pileated Woodpecker, and Wood Thrush, as well as habitat for large numbers of migrating songbirds.

Conservation status

The Manitou Floodplain is included within MDC's Manitou Bluffs COA. Much of the floodplain is being allowed by state and federal agencies to return to "natural" floodplain habitats, despite the continued channelization of the Missouri River. In addition to allowing natural habitat reclamations, water levels are maintained artificially in wetland pools. Suggestions for management and public outreach for the IBA include greater manipulation of shallow water habitats for shorebirds, control of purple loosestrife, and promoting birding trips. A partnership with the Friends of Big Muddy would facilitate future Audubon Missouri IBA plan implementation.

The Manitou Floodplain is a focal IBA for initial project implementation by AM. A Monitoring Avian Productivity and Survivorship (MAPS) station (coordinated internationally by the Institute for Bird Population Studies) will begin in the spring of 2006. This "constant-effort" banding program, conducted throughout songbird breeding seasons, will provide data on breeding season and annual survivorship, productivity, and population trends of songbirds at the Eagle Bluffs CA. Volunteers from the Columbia Audubon Society and local citizens will assist with the banding efforts. AM also will conduct feather pulling on individuals of certain species, in collaboration with researchers at the Center for Tropical Research-UCLA, Neotropical Bird Conservation Genetics Project. The latter activity utilizes a new technology aimed at refining our understanding of migratory ecology of certain bird species. In conjunction with the MAPS station, AM also is developing a multi-faceted partnership to develop an international conservation connection between Missouri and Belize that results in direct on-the-ground conservation action in Belize. Many of Missouri's breeding neotropical migrant bird species also over-winter in Belize, providing incentive to contribute to conservation on these species wintering grounds. A possible first step could be to establish a "sister" Monitoring Over-wintering Survival (MOSI) station in Belize. AM also will seek to define public outreach linkages within Missouri to educate people about where our birds over-winter and to encourage them to become engaged in international conservation. Partners currently include AM, Columbia Audubon, Belize Audubon Society, BirdLife International, MDC, and the USFWS (and possibly the National Wild Turkey Foundation – as the Ocellated Turkey occurs in Belize).

Mingo Basin

Bollinger, Stoddard, and Wayne Counties
Location (UTM): x753616, y4099673
28,080 acres (11,368 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Waterfowl, shorebirds, breeding/migrant landbirds

Site description

The Mingo Basin occupies the alluvial plain between the Castor and St. Francis rivers, being bordered more broadly by the Ozark Escarpment to the west and Crowley's Ridge to the east (Nigh and Schroeder 2002). The relatively flat terrain was historically occupied by forested bottomlands, swamps, and emergent marshes, much of which remain in the IBA protected in federal and state lands.

Most (99%) of the area designated as the Mingo Basin is public land, of which 21,676 acres (8,776 ha) is contained by the Mingo NWR (USFWS) and 6,145 acres (2,488 ha) by Duck Creek CA (MDC).

Ornithological significance

The Mingo Basin is a largely protected remnant of bottomland forest, swamps and marsh that provides tremendous wetland habitat for breeding and migratory waterbirds. Three separate Bald Eagle nest sites have been monitored across both public landholdings in past years. Common Moorhen, Least Bittern, and other marsh species also have been detected on these lands, with evidence of nesting. Purple Gallinule have been observed in the IBA (Robbins and Easterla 1992, Palmer and Palmer 2001), with possible, yet unconfirmed breeding. Large numbers of bottomland forest nesting species occur in the IBA, including Acadian Flycatcher, Prothonotary Warbler, Hooded Warbler, and Barred Owl.

Conservation status

The vast majority of the area is already protected in existing public conservation lands. The IBA's natural hydrology has been altered, but swamp habitat restoration on private lands may improve hydrological conditions, even on neighboring conservation lands (Nigh and Schroeder 2002). Such activities are suggested by MDC (2005) for the Mingo Basin COA that encompasses the IBA, and could be achieved through conservation partnerships.

Mississippi River Sandbars and Islands

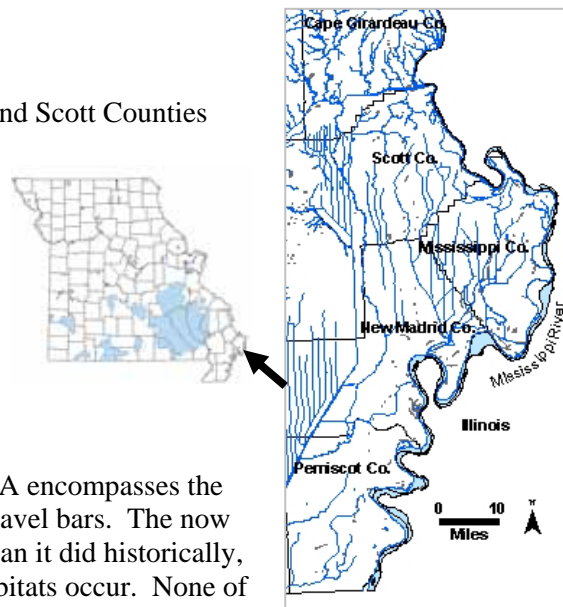
Cape Girardeau, Mississippi, New Madrid, Pemiscot, and Scott Counties
Location (UTM): x840530, y4060965
90,504 acres (36,641 ha)

Criteria for establishment

Species of concern (D1): Interior Least Tern
(breeding, migration), Bald Eagle (year-round)

Site description

The Mississippi River Sandbars and Islands IBA encompasses the Mississippi River and its associated islands of sand / gravel bars. The now heavily channelized Mississippi River meanders less than it did historically, but periodic flooding and inundation of these island habitats occur. None of the IBA is in dedicated conservation land.



Ornithological significance

Several nesting records of Interior Least Tern are from the

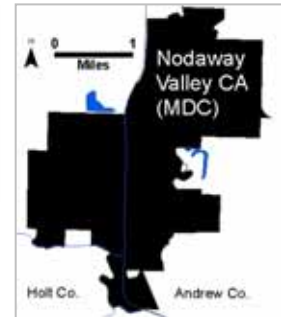
Mississippi River Sandbars and Islands, where some nesting colonies have contained over 300 nests. In 2005, just over 1,000 individuals were counted during annual surveys by the USACE. Colony sizes fluctuate annually. Bald Eagles also nest along wooded islands and riparian forest edges adjacent to the IBA.

Conservation status

These island habitats used by nesting Interior Least Terns are subject to inundation during natural flood events that may be made more severe due to river containment. High numbers of terns have been recorded in recent years, although it is unclear whether this is the result of local production or emigration from coastal populations.

Nodaway Valley Conservation Area

Andrew and Holt Counties
Location (UTM): x325071, y4440290
3,912 acres (1,584 ha)



Criteria for establishment

Species of concern (D1): American Bittern (breeding, migration)
Species in rare habitat type (D3): Wetland birds
Exceptional concentrations of birds (D4): Waterfowl, shorebirds

Site description

Historically, the Nodaway Valley Conservation Area IBA was lowland prairie, marsh, and bottomland forest (Nigh and Schroeder 2002). Today these habitats are still present in smaller patches, although much of the area has been converted to row-crop agriculture. Nodaway Valley CA is managed by MDC (3,912 acres, 1,584 ha).

Ornithological significance

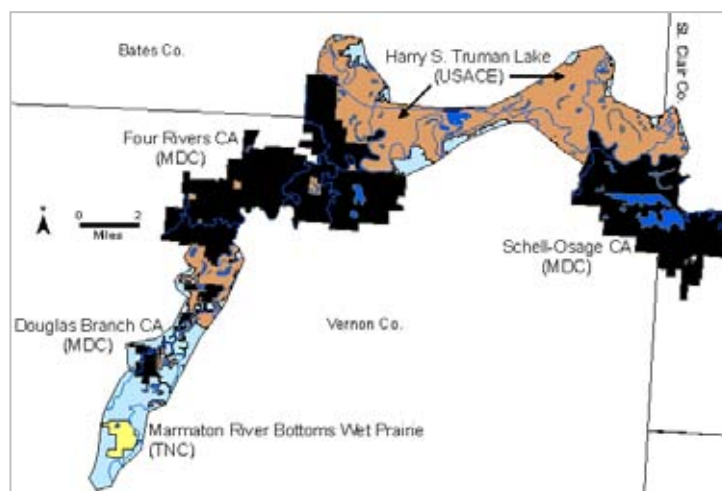
American Bittern, Least Bittern, Pied-billed Grebe, and Common Moorhen have nested on the Nodaway Valley CA, along with other marsh-nesting species. The restored wetlands also provide stopover and breeding habitat for large numbers of migratory waterfowl and shorebirds, as well good numbers of wintering Bald Eagles. Area staff reported that in 2003, 40,000 waterfowl could be seen on the CA at one time. Other species occurring in the IBA include Black-billed Cuckoo, Sedge Wren, and high densities of Bell's Vireo.

Conservation status

MDC purchased Nodaway Valley CA from 1991-1993, and has since restored some wetland habitat, in cooperation with multiple partners, including DU, MPF, and many others. Much habitat restoration has been accomplished through funding from a North American Wetland Conservation Act grant. Approximately 60-70% of the area is managed for waterfowl food production.

Osage River Bottoms

Bates, St. Clair, and Vernon Counties
Location (UTM): x391285, y4210596
46,337 acres (18,760 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round), Cerulean Warbler (breeding, migration)
Species in rare habitat type (D3): Waterbirds
Exceptional concentrations of birds (D4): Waterfowl, shorebirds

Site description

Historically, the Osage River Bottoms IBA was a complex of bottomland prairie, marsh, and forest (Nigh and Schroeder 2002). Today, the IBA is mostly protected marsh and bottomland forest, with little cropland.

Eighty-seven percent of the Osage River Bottoms is publicly-owned conservation land. This includes the following USACE lands managed by MDC as Conservation Areas: Cephas Ford Access (to the Marmaton River; 101 acres, 41 ha), Douglas Branch CA (521 acres, 211 ha), Four Rivers CA (13,741 acres, 5,563 ha), and Schell-Osage CA (8,596 acres, 3,480 ha). The IBA also includes TNC's Marmaton River Bottoms Wet Prairie (566 acres, 229 ha). USACE manages the remaining public land, comprising 16,643 acres (6738 ha) surrounding Harry S. Truman Lake.

Ornithological significance

The Osage River Bottoms IBA presents abundant wetland habitat for migrating and breeding waterbirds. Bald Eagles nest on the IBA—and the surrounding vicinity (Jacobs and Wilson 1997)—in the highest densities in the state. There is evidence for breeding Cerulean Warblers in the vicinity of the IBA (Jacobs and Wilson 1997). Nesting Mississippi Kites and Red-shouldered Hawks have been found on Four Rivers CA, and Scissor-tailed Flycatcher and Prothonotary Warbler on Schell-Osage CA (Palmer and Palmer 2001). Thousands of waterfowl pass through the IBA each year (over 30,000 individuals were recorded at both Schell Osage and Four Rivers CA during 2005 during MDC's Midwinter Waterfowl Survey), along with good numbers and diversity of shorebirds.

Conservation status

The Osage River Bottoms IBA is included in MDC's Marmaton / Wah' Kon-Tah COA (MDC 2005), where MDC describes conservation challenges on private land of habitat destruction and fragmentation, fire suppression, altered hydrology, invasive plants, and landowner participation in conservation efforts.

Otter Slough Conservation Area

Stoddard County

Location (UTM): x757890, y4066633

5,462 acres (2,211 ha)

Criteria for establishment

Species of concern (D1): Bald Eagle (year-round)

Species in rare habitat (D3): Wetland birds

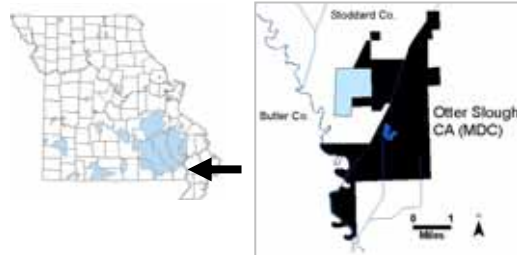
Exceptional concentrations of birds (D4): Waterfowl, shorebirds

Site description

Within the Mississippi River Alluvial Basin, the Otter Slough Conservation Area represents a remnant of historical bottomland forest, marsh, and swamp. Nearly all of these habitats outside this IBA have been converted to cropland. The 20-acre area of Otter Slough NA (MDC) contains a high quality tupelo swamp. This is a rare example of the once far more common tupelo swamps in the Mississippi River Alluvial basin. Most (88%) percent of the Otter Slough Conservation Area is in publicly owned conservation land (Otter Slough CA and NA 4,809; 1,947 ha) managed by MDC.

Ornithological significance

Bald Eagles have nested on Otter Slough Conservation



Area. Over 100,000 Snow Geese were detected during the 2005 MDC Midwinter Waterfowl Survey, in addition to approximately 7,100 Greater White-fronted Geese and over 46,000 dabbling ducks. Otter Slough Conservation Area provides tremendous wetland habitats for breeding and migratory waterbirds. Prothonotary Warblers may be observed during the breeding season, in addition to transient southern species, like Anhinga (Palmer and Palmer 2001).

Conservation status

Otter Slough Conservation Area is a remnant complex of swamp, forest, and marsh embedded in the vast cropland matrix that characterizes the Mississippi Alluvial Basin. Thus, it has obvious value as a wetland refuge for migrating and breeding waterbirds in the region. Swamp reforestation could be considered for deforested portions of Otter Slough CA. MDC manages flooded cropland for duck forage. Wetland habitat restoration could be promoted in the smaller private landholding in the IBA.

Southeast Missouri Bottomlands

Mississippi and New Madrid Counties
 Location (UTM): x822301, y4059591
 34,723 acres (14,058 ha)



Criteria for establishment

- Species of concern* (D1): Bald Eagle (year-round), Swainson’s Warbler (breeding, migration)
- Species in rare habitat type* (D3): Wetland birds
- Exceptional concentrations of birds* (D4): Waterfowl, shorebirds, migrant and breeding landbirds

Site description

The Southeast Missouri Bottomlands IBA historically was dominated by bottomland forest / swamp, with some prairie and marsh lands (Nigh and Schroeder 2002). Today, few tracts of bottomland forest persist amidst the cropland of the surrounding landscape. Much of the area was drained for cropland (see diversion ditches on map above).

Thirty-four percent of the IBA is publicly-owned conservation land, including Big Oak Tree SP (MDNR; 1,029 acres, 417 ha), and three MDC landholdings: Donaldson Point CA (5,743 acres, 2,325 ha), Seven Island CA (1,425 acres, 577 ha), and Ten Mile Pond CA (3,757 acres, 1,521 ha).

Ornithological significance

The IBA presents some of the last remaining stands of bottomland and swamp forests in the Mississippi Alluvial Basin, which provide habitat for migrant and breeding birds. Bald Eagles have nested at two locations (simultaneous nest attempts) near Donaldson Point CA, and observed at Big Oak Tree SP during the breeding season. Interior Least Terns have been sighted on Ten Mile Pond CA, but not observed nesting there. Singing male Swainson’s Warblers have been observed at Donaldson Point CA in recent years, and had been found nesting at Big Oak Tree SP, but haven’t **been seen there since** 1976 (Palmer and Palmer 2001). Hooded and Prothonotary Warblers also occur at Big Oak Tree SP during their breeding seasons (Palmer and Palmer 2001).

Conservation status

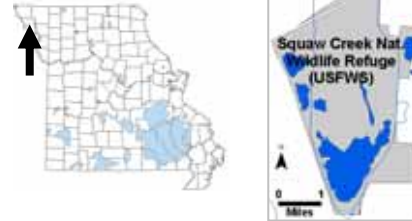
The Southeast Missouri Bottomlands IBA overlaps MDC's (2005) River Bends COA. Conservation challenges identified by MDC for this area include needs to increase bottomland forest, impediments to natural flooding, and developing partnerships with operators of private forest lands. The Wetland Reserve Program needs promotion to local landowners.

Squaw Creek National Wildlife Refuge

Holt County

Location (UTM): x307923, y4440033

7,044 acres (2,852 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round), American Bittern (breeding, migration), King Rail (breeding, migration)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Waterfowl, shorebirds

Site description

Historically, the Squaw Creek National Wildlife Refuge was a mosaic of bottomland wet prairie and marshland in the Missouri River floodplain (Nigh and Schroeder 2002), with some prairie habitat on steep, loess hills. Today, the refuge is mostly managed wetland and grassland habitats, with some loess hill prairies, forest and cropland. All of the IBA is within the Squaw Creek NWR (USFWS).

Ornithological significance

Squaw Creek NWR provides excellent wetland habitat for birds breeding, migrating (especially shorebirds), and wintering in wetlands. Bald Eagle, Common Moorhen, Least Bittern, Marsh Wren, and American Bittern also occur during their respective breeding seasons. The area is renowned for enormous flocks of migrating Snow Geese in spring and fall, sometimes numbering in the hundreds of thousands. King Rail also occur on the refuge during their breeding season, and Short-eared Owls are often encountered during winter (Palmer and Palmer 2001).

Conservation status

Water levels in the refuge's wetland pools are manipulated to provide habitat for a variety of waterbirds for the various phases of their migration and breeding activities, and the area contains large expanses of high-quality emergent marsh. Grassland habitats are managed with prescribed burning. An ongoing partnership with the Friends of Squaw Creek, which includes many Audubon chapter members, could facilitate future Audubon Missouri IBA plan implementation.

St. Louis Urban Oases

St. Louis City / County

Location (UTM): x727588, y4281217

3,509 acres (1,421 ha)



Criteria for establishment

Species of concern (D1): American Bittern (breeding, migration)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Migrant landbirds

Site description

As the name of the St. Louis Urban Oases IBA suggests, habitat for many species is limited within the heavily urbanized St. Louis metropolitan area. What was a mosaic of prairie, savanna, woodland, and forest (Nigh and Schroeder 2002) has long since gone through transitions of farmland to urban development, with little natural habitat remaining. What remains is planted or second growth forest, some of which has matured well into hardwood forest with large diameter trees and a natural forest understory (e.g., John F. Kennedy Memorial Forest in Forest Park, where some oaks may be pre-settlement relicts), and “old-growth” urban parkland (Tower Grove Park). Oxbow lakes formed from the Missouri River remain in and near Creve Coeur Park, providing wetland habitats of open water and cattail and shrub marshland.

All of the landholdings that encompass this IBA are publicly-owned. Creve Coeur Park (1,917 acres, 776 ha) is maintained by the St. Louis County Parks Department, while Forest Park (1,307 acres, 529 ha) and Tower Grove Park (291 acres, 118 ha) are managed by St. Louis Parks and Recreation. Within Forest Park is the 80-acre John F. Kennedy Memorial Forest, which is managed in cooperation with MDC.

Ornithological significance

The wetlands at Creve Coeur Lake Memorial Park provide habitat for many migrating waders, waterfowl, and shorebirds. There is evidence of breeding American Bittern at Creve Coeur Lake, and Least Bittern, Pied-billed Grebe, and Common Moorhen all have been observed there during their respective breeding seasons. King, Virginia, and Black Rails have been observed there as well (Palmer and Palmer 2001). This park, and the more urban-isolated forests of the two city parks, also provide stopover habitat for many passerine migrant species in spring and fall (Korotev 1999), in addition to some breeding habitat for many birds excluded from the surrounding urban landscape (e.g., hawks and owls). Tower Grove Park is a renowned location for St. Louis birders during spring migration (Palmer and Palmer 2001), due to the amazing numbers and diversity of migrating songbirds that stopover on the site, especially warblers.

Conservation status

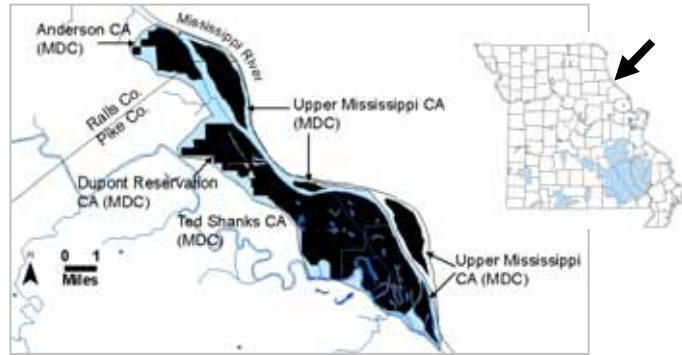
Wetland protection and water level manipulation are being done in and around Creve Coeur Lake and the nearby Little Creve Coeur Lake. The St. Louis Audubon Society and the Webster Groves Nature Study Society have coordinated with the St. Louis County Parks Department in developing a master plan for management of Creve Coeur Park. A goal of the Forest Park Master Plan is wildlife habitat improvement. These improvements include removal of invasive honeysuckle from the understory of Kennedy Forest and planting of native savanna vegetation. Plantings of trees are still being done in Tower Grove Park.

Ted Shanks Alluvial Complex

Pike and Ralls Counties

Location (UTM): x659029, y4378108

15,096 acres (6,112 ha)



Criteria for establishment

Species of concern (D1): Bald Eagle (year-round), American Bittern (breeding, migration), King Rail (breeding, migration)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Waterfowl, shorebirds, migrant landbirds

Site description

Historically, the uplands around Anderson CA (at the north end of the IBA) were oak and mixed-hardwood woodland and forest (Nigh and Schroeder 2002), much of which remains in timber today. The rest of the Ted Shanks Alluvial Complex was bottomland mixed-hardwood and riverfront forest, with scattered prairies and marshes (Nigh and Schroeder 2002). Today, the conservation areas occupying this alluvial plain contain bottomland timber, grassland, marsh, and cropland.

Seventy percent of the IBA is publicly owned conservation land, comprised of MDC managed lands. These include Anderson CA (1,067 acres, 432 ha), Dupont Reservation CA (1,270 acres, 514 ha), Ted Shanks CA (6,718 acres, 2,720 ha), and the Upper Mississippi CA (1,573 acres, 637 ha).

Ornithological significance

The area provides abundant migratory stopover and breeding habitat for water and forest birds. Breeding Pied-billed Grebes, King Rails, and Bald Eagles (at least two pairs nesting simultaneously) have been observed on the Ted Shanks Alluvial Complex, and Least Bittern and Common Moorhen have been observed during their breeding seasons. There also is evidence of nesting for American Bittern and Bobolinks on Ted Shanks CA (Palmer and Palmer 2001).

Conservation status

MDC has plans for restoring bottomland forest and wetland on Ted Shanks CA. Much of these habitats were inundated when lock and dam construction raised river levels, a problem that was exacerbated during the floods of 1993 and 1995. Reed canary grass continues to pose a problem for land managers in the area, and much effort is spent towards its control.

Upper St. Francis Watershed

Bollinger, Butler, Iron, Madison, St. Francois,
Washington, and Wayne Counties
Location (UTM): x718000, y4129632
777,674 acres (314,848 ha)



1. St. Joe SP (MDNR)
2. Bismark CA (MDC)
3. Buford Mtn. CA (MDC)
4. Cedar Mtn. CA (MDC)
5. Buck Mtn. CA (MDC)
6. Taum Sauk Mtn. SP (MDNR)
7. Ketcherside Mtn. CA (MDC)
8. Millstream Gardens CA (MDC)
9. Mark Twain Nat. Forest, Fredericktown District (USFS)
10. St. Francis River
11. Riverside CA (MDC)
12. Graves Mtn. CA (MDC)
13. Sam A. Baker SP (MDNR)
14. Coldwater CA (MDC)
15. Wappapello Reservoir CA (MDC)
16. Flatwoods CA (MDC)
17. Mark Twain Nat. Forest, Poplar Bluff District (USFS)
18. Wappapello Reservoir (USACE)
19. Yokum School CA (MDC)
20. University Forest CA (MDC)
21. Lake Wappapello SP (MDNR)
22. Wappapello Training Site (MONG)

Criteria for establishment

Species of concern (D1): American Bittern (breeding, migration), Bald Eagle (year-round), Cerulean Warbler (breeding, migration), Swainson's Warbler (breeding, migration), Bachman's Sparrow (breeding, migration)

Exceptional concentrations of birds (D4): Waterfowl, shorebirds, migrant and breeding landbirds

Site description

Historically, the Upper St. Francis Watershed supported mixed oak-pine forest and woodland, with some glade openings (Nigh and Schroeder 2002). Large landscapes of forest and woodland—although much being second-growth—are still present today, although the shortleaf pine and glade components are diminished.

Thirty-five percent of the IBA is publicly-owned conservation land. This includes:

- Bismark CA (MDC); 116 acres, 47 ha
- Knob Lick Towersite (MDC); 79 acres, 32 ha
- Buford Mtn. CA (MDC); 694 acres, 281 ha
- Cedar Mtn. (MDC); 119 acres, 48 ha
- Buck Mtn. CA (MDC); 205 acres, 83 ha
- Ketcherside Mtn. CA (MDC); 3,537 acres, 1,432 ha
- Millstream Gardens CA (MDC); 677 acres, 274 ha
- Riverside CA (MDC); 173 acres, 70 ha
- Graves Mtn. CA (MDC); 3,174 acres, 1,285 ha
- Coldwater CA (MDC); 4,574 acres, 1,852 ha
- Wappapello Reservoir CA (MDC); 2,018 acres, 817 ha
- Flatwoods CA (MDC); 944 acres, 382 ha
- Yokum School CA (MDC); 161 acres, 65 ha
- University Forest CA (MDC); 7,180 acres, 2,907 ha
- St. Joe SP (partly) (MDNR); 2,428 acres, 983 ha
- Taum Sauk Mountain SP (partly) (MDNR); 250 acres, 101 ha
- Sam A. Baker SP (MDNR); 5,324 acres, 2,155 ha
- Lake Wappapello SP (MDNR); 1,854 acres, 751 ha
- Wappapello Training Site (MONG); 2,200 acres, 891 ha
- Wappapello Reservoir (USACE); 45,000 acres, 8,219 ha
- Mark Twain National Forest, Fredericktown District (partly) (USFS); 65,385 acres, 26,472 ha

Mark Twain National Forest, Poplar Bluff District (partly) (USFS); 126,178 acres, 51,084 ha

Ornithological significance

Two Bald Eagle pairs have nesting along Wappapello Reservoir in recent years. American Bitterns have been observed during safe breeding dates in marshy bottomland at Sam A. Baker SP. Swainson's Warblers have been observed at Sam A. Baker SP and along the St. Francis River north of Wappapello Reservoir (USACE and MDC managed lands). Cerulean Warblers have been heard on Wappapello Reservoir USACE land and Taum Sauk Mountain SP. Several Bachman's Sparrows were seen recently in power line cuts and old fields in the northwestern and central portions of the IBA, respectively. Many shorebirds use the exposed mudflats when Wappapello Reservoir is drawn down during early spring. Species of neotropical migratory songbirds use both the forest interior (e.g., Ovenbird and Wood Thrush) and early successional habitats (e.g., Blue-winged and Prairie Warblers) present within this IBA. Pine Warbler may also be seen in association with pines in lands around Lake Wappapello (Palmer and Palmer 2001). The Upper St. Francis Watershed is included in the extensive contiguous forest of the Ozark Highlands, which provides suitable nesting habitat for forest-interior songbirds (Robinson et al 1995), possibly facilitating source populations (Donovan et al. 1995b).

Conservation status

The Upper St. Francis Watershed overlaps MDC's (2005) St. Francois Knobs COA, where the agency has identified conservation challenges of maintaining igneous glade and woodland communities with prescribed fire, though the importance to the IBA criteria species of these communities is minimal. Pine woodland restoration at St. Joe SP and other potential sites may provide future habitat for pine woodland birds. Large blocks of forest interior habitat occurred in the area and should be retained for forest interior birds.

West-central Missouri River Bends

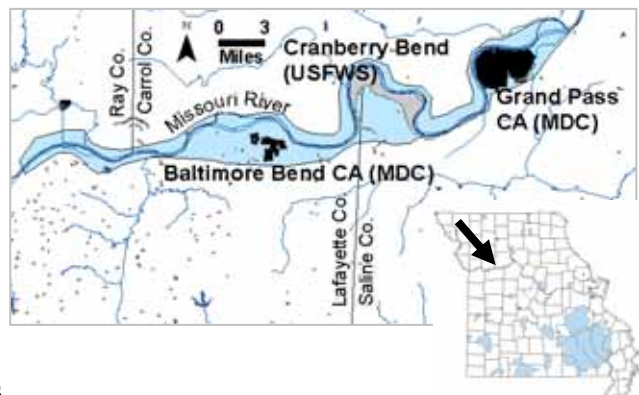
Carroll, Lafayette, Ray, and Saline Counties
Location (UTM): x455921, y4341255
59,640 acres (24,146 ha)

Criteria for establishment

Species of concern (D1): Bald Eagle (year-round), American Bittern (breeding, migration), King Rail (breeding, migration)

Species in rare habitat type (D3): Wetland birds

Exceptional concentrations of birds (D4): Migrant landbirds



Site description

Historically, the floodplain along the Missouri River (that comprises the majority of the IBA) in the West-central Missouri River Bends was extensive wet prairie and marshland (Nigh and Schroeder 2002). Aside from marshland protected at the refuge and conservation areas, the IBA today is mostly cropland, protected by levees. Some wetlands in the floodplain were re-created by the Great Flood of 1993. The upland hills on the south side of the IBA were historically timbered in oak and mixed-hardwood woodland and forest, which remain today as second-growth fragments among cool season pasture and scattered cropland.

Eleven percent of the IBA is publicly-owned conservation land, comprised of: the Cranberry Bend Unit of the USFWS's Big Muddy NWR (467 acres, 189 ha), and MDC's Baltimore Bend CA

(1,149 acres, 465 ha) and Grand Pass CA (5,120 acres, 2,073 ha). Of the three, Baltimore Bend CA is upland forest, where the other two have bottomland wetlands. Baltimore Bend CA is predominantly upland forest, whereas Cranberry Bend and Grand Pass CA are mostly managed wetlands.

Ornithological significance

Many wetland habitats occur in the West-central Missouri River Bends for a great diversity of migrant and breeding waterbirds. Massive concentrations of waterfowl utilize this IBA during migration and winter, with over 170,000 individuals seen at Grand Pass CA alone during the 2005 MDC Midwinter Waterfowl Survey. Bald Eagles and Yellow-headed Blackbirds have nested in the IBA, and King Rail were observed with young during 1993 flood. American Bittern, Least Bittern, Sora, and Marsh Wren have been observed in the IBA within their respective breeding seasons. Sandhill Cranes have even attempted nesting at Grand Pass CA, where staff reported observing a chick in 2003.

Conservation status

Despite the remnant and newly created wetlands from the 1993 flood, the Missouri River remains channelized and the flood plain heavily agricultural. Private landowners could cooperate with state and federal agencies in wetland restoration or protection through various incentive programs (e.g., WRP). Increasing public awareness of wildlife values of the area is a priority listed in MDC's Wakenda Bottoms COA (MDC 2005) that encompasses the West-central Missouri River Bends IBA.

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Appendices

Appendix A. Agency, organization, and program acronyms defined. (From Jensen and Forbes 2006.)

AM	Audubon Missouri
BCR	Bird Conservation Region (NABCI)
CA	Conservation Area (MDC)
COA	Conservation Opportunity Area (MDC)
CRP	Conservation Reserve Program (USDA)
DU	Ducks Unlimited
GC	Grassland Coalition
EPA	Environmental Protection Agency
IBA	Important Bird Area
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MONG	Missouri National Guard
MPF	Missouri Prairie Foundation
MU	University of Missouri—Columbia
NA	Natural Area (MDC)
NABCI	North American Bird Conservation Initiative
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge (USFWS)
NWTF	National Wild Turkey Federation
PF	Pheasants Forever
QU	Quail Unlimited
SF	State Forest (MDC)
SLCPD	St. Louis County Parks Department
SP	State Park (MDNR)
TNC	The Nature Conservancy
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDD	United States Department of Defense
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USNPS	United States National Parks Service
WA	Wildlife Area (MDC)
WRP	Wetland Reserve Program (USDA)

Appendix B. List of common and scientific bird species names used throughout this report. (From Jensen and Forbes 2006.)

Acadian Flycatcher	<i>Empidonax vireescens</i>
American Bittern	<i>Botaurus lentiginosus</i>
American Redstart	<i>Setophaga ruticilla</i>

American Swallow-tailed Kite	<i>Elanoides forficatus</i>
Bachman's Sparrow	<i>Aimophila aestivalis</i>
Bachman's Warbler	<i>Vermivora bachmanii</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Barred Owl	<i>Strix varia</i>
Bell's Vireo	<i>Vireo bellii</i>
Black-and-white Warbler	<i>Mniotilta varia</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Black-capped Chickadee	<i>Poecile atricapillus</i>
Black Rail	<i>Laterallus jamaicensis</i>
Black-throated Green Warbler	<i>Dendroica virens</i>
Blue-winged Teal	<i>Anas discors</i>
Blue-winged Warbler	<i>Vermivora pinus</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Brown-headed Nuthatch	<i>Sitta pusilla</i>
Brown Thrasher	<i>Toxostoma rufum</i>
Cape May Warbler	<i>Dendroica tigrina</i>
Cerulean Warbler	<i>Dendroica cerulea</i>
Chipping Sparrow	<i>Spizella passerina</i>
Common Moorhen	<i>Gallinula chloropus</i>
Dickcissel	<i>Spiza americana</i>
Eastern Meadowlark	<i>Sturnella magna</i>
Eastern Towhee	<i>Pipilo erythrophthalmus</i>
Eastern Wood-Pewee	<i>Contopus virens</i>
Field Sparrow	<i>Spizella pusilla</i>
Grasshopper Sparrow	<i>Ammodramus savannarum</i>
Great Blue Heron	<i>Ardea herodias</i>
Great-crested Flycatcher	<i>Myiarchus crinitus</i>
Greater Prairie-Chicken	<i>Tympanuchus cupido</i>
Henslow's Sparrow	<i>Ammodramus henslowii</i>
Hooded Warbler	<i>Wilsonia citrina</i>
Horned Lark	<i>Eremophila alpestris</i>
Indigo Bunting	<i>Passerina cyanea</i>
Interior Least Tern	<i>Sterna antillarum athalassos</i>
Ivory-billed Woodpecker	<i>Campephilus principalis</i>
Kentucky Warbler	<i>Oporornis formosus</i>
King Rail	<i>Rallus elegans</i>
Lark Sparrow	<i>Chondestes grammacus</i>
Least Bittern	<i>Ixobrychus exilis</i>
Le Conte's Sparrow	<i>Ammodramus leconteii</i>
Loggerhead Shrike	<i>Lanius ludovicianus</i>
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>
Louisiana Waterthrush	<i>Seiurus motacilla</i>
Marsh Wren	<i>Cistothorus palustris</i>
Mississippi Kite	<i>Ictinia mississippiensis</i>
Northern Bobwhite	<i>Colinus virginianus</i>
Northern Harrier	<i>Circus cyaneus</i>
Northern Parula	<i>Parula americana</i>
Ovenbird	<i>Seiurus aurocapilla</i>
Painted Bunting	<i>Passerina ciris</i>
Passenger Pigeon	<i>Ectopistes migratorius</i>
Pied-billed Grebe	<i>Podilymbus podiceps</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>
Pine Warbler	<i>Dendroica pinus</i>
Prothonotary Warbler	<i>Protonotaria citrea</i>
Purple Gallinule	<i>Porphyrio martinica</i>
Red-cockaded Woodpecker	<i>Picoides borealis</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>
Ruffed Grouse	<i>Bonasa umbellus</i>

Scarlet Tanager	<i>Piranga olivacea</i>
Scissor-tailed Flycatcher	<i>Tyrannus forficatus</i>
Sedge Wren	<i>Cistothorus platensis</i>
Short-eared Owl	<i>Asio flammeus</i>
Snow Goose	<i>Chen caerulescens</i>
Song Sparrow	<i>Melospiza melodia</i>
Sora	<i>Porzana carolina</i>
Sprague's Pipit	<i>Anthus spragueii</i>
Summer Tanager	<i>Piranga rubra</i>
Swainson's Warbler	<i>Limnothlypis swainsonii</i>
Upland Sandpiper	<i>Bartramia longicauda</i>
Virginia Rail	<i>Rallus limicola</i>
Warbling Vireo	<i>Vireo gilvus</i>
White-breasted Nuthatch	<i>Sitta carolinensis</i>
White-eyed Vireo	<i>Vireo griseus</i>
Willow Flycatcher	<i>Empidonax traillii</i>
Wood Thrush	<i>Hylocichla mustelina</i>
Worm-eating Warbler	<i>Helmitheros vermivora</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
Yellow-breasted Chat	<i>Icteria virens</i>
Yellow-crowned Night-Heron	<i>Nyctanassa violacea</i>
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>
Yellow Rail	<i>Coturnicops noveboracensis</i>
Yellow-throated Vireo	<i>Vireo flavifrons</i>
Yellow-throated Warbler	<i>Dendroica dominica</i>
Yellow Warbler	<i>Dendroica petechia</i>

Appendix C. List of common and scientific plant species names used throughout this report. (From Jensen and Forbes 2006.)

Bald cypress	<i>Taxodium distichum</i>
Bush honeysuckle	<i>Lonicera</i> spp.
Cottonwood	<i>Populus deltoides</i>
Eastern red cedar	<i>Juniperus virginiana</i>
Giant cane	<i>Arundinaria gigantea</i>
Oak	<i>Quercus</i> spp.
Post oak	<i>Quercus stellata</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Sericea lespedeza	<i>Lespedeza cuneata</i>
Shortleaf pine	<i>Pinus echinata</i>
Swamp Tupelo	<i>Nyssa aquatica</i>
Tall fescue	<i>Festuca arundinacea</i>
Willow	<i>Salix</i> spp.

Appendix D. Bird species of conservation priority in Missouri. The following were derived from the Audubon (Au) Watch List (R=Red, high concern; Y=Yellow, moderate concern), lists of state and federal species of conservation concern (T=Threatened, E=Endangered), and the Partners in Flight watch list. Under "Threats," "LDF" refers to habitat Loss, Degredation, and Fragmentation. MDC ranks of relative endangerment are denoted by S1 – S5 (S1 being most imperiled). Those species chosen as highest priority, whose occurrence in an IBA designates the IBA as containing "Species of concern," are printed in **bold type**. (From Jensen and Forbes 2006.)

Species	Status	Threats
American Bittern	State E	Habitat LDF (wetlands)
Bachman's Sparrow	Watch (PIF, AuR), State E	Habitat LDF (pine woodland, glades)
Bald Eagle	State E, Federal T	Habitat LDF, shooting, pesticides
Bell's Vireo	Watch (PIF, AuR)	Habitat LDF (prairies/shrublands)
Black Rail	Watch (AuR)	Habitat LDF (wetlands), lack of info.
Blue-winged Warbler	Watch (PIF, AuY)	Habitat LDF (shrublands, woodlands)
Brown-headed Nuthatch	Extirpated, Watch (PIF, AuY)	Habitat LDF (pine woodland)
Cerulean Warbler	Watch (PIF, AuR)	Habitat LDF (bottomland forest)
Common Moorhen	S2	Habitat LDF (wetlands)
Dickcissel	Watch (PIF, AuY)	Habitat LDF (prairies)

Greater Prairie-Chicken	State E, Watch (PIF, AuR)	Habitat LDF (prairies)
Henslow's Sparrow	Watch (PIF, AuR)	Habitat LDF (prairies)
Interior Least Tern	Fed E, State E	Habitat LDF (islands on Mississippi River, flood regime)
Kentucky Warbler	Watch (PIF, AuY)	Habitat LDF (woodland/forest)
King Rail	State E	Habitat LDF (wetlands)
Least Bittern	S3	Habitat LDF (wetlands)
Loggerhead Shrike	S2	Habitat LDF (prairies, shrublands)
Marsh Wren	S3	Habitat LDF (wetlands)
Northern Harrier	State E	Habitat LDF (prairies)
Painted Bunting	Watch (PIF, AuY)	Habitat LDF (shrublands, esp. wintering), captured for cage birds
Prairie Warbler	Watch (PIF, AuY)	Habitat LDF (shrublands, esp. wintering), mangroves
Prothonotary Warbler	Watch (PIF, AuY)	Habitat LDF (bottomland forest, esp. wintering) mangroves
Red-cockaded Woodpecker	Extirpated, Fed E, Watch (PIF, AuR)	Habitat LDF (pine woodland)
Red-headed Woodpecker	Watch (PIF, AuY)	Habitat LDF (Savanna/woodland, forest)
Rusty Blackbird	Watch (PIF, AuY)	Habitat LDF (Bottomland forests, wetlands)
Short-eared Owl	Watch (PIF, AuY)	Habitat LDF (Prairies)
Sora	S3	Habitat LDF (Wetlands)
Swainson's Hawk	Watchlist (PIF, AuY)	Habitat LDF (prairies, open shrublands), pesticide use on wintering ground
Swainson's Warbler	Watchlist (PIF, AuR), State E	Habitat LDF (bottomland forest)
Trumpeter Swan	Watchlist (AuY)	Habitat LDF (wetlands), lead poisoning
Virginia Rail	S2	Habitat LDF (wetlands)
Willow Flycatcher	Watchlist (PIF, AuY)	Habitat LDF (riparian areas with willows)
Wood Thrush	Watchlist (PIF, AuY)	Habitat LDF (upland forest)
Worm-eating Warbler	Watchlist (PIF, AuY)	Habitat LDF (upland forest)
Yellow Rail	Watchlist (AuY)	Habitat LDF (wetlands)

Appendix E. National Audubon Society Important Bird Area criteria and codes (from Jensen and Forbes 2006).

	Audubon IBA Criteria
Global Criteria	<p>A1-Global: Global Species of Conservation Concern</p> <p>A2-Global: Assemblage of Restricted-range species</p> <p>A3-Global: Assemblage of Biome-restricted species</p> <p>A4i-Global: >1% biogeographic waterbird population (N.A.population) simultaneously; 5% over a season</p> <p>A4ii-Global: >1% global seabirds or terrestrial species simultaneously; 5% over a season</p> <p>A4iii-Global: > 20,000 waterbirds/>10,000 seabirds</p> <p>A4iv-Global: > 5% N.A. population of migratory waterbirds; >5% global population of migratory seabirds or terrestrial during a season</p>
Continental Conservation Concern	<p>B1-North America: Continental Species of Conservation Concern</p> <p>B2-North America: Not applicable at regional level</p> <p>B3-North America: Assemblage of Bird Conservation Region-restricted Species</p> <p>B4i-North America: > 1% flyway/subspecies waterbird population simultaneously; 5% over a season</p> <p>B4ii-North America: > 1% biogeographic population of seabirds or terrestrial species simultaneously; 5% over a season</p> <p>B4iv-North America: >5% flyway/subspecies population migratory waterbirds; >5% N.A. population migratory seabirds or terrestrial species during a season</p>
State Conservation Concern	<p>D1-US State: State Species of Conservation Concern</p> <p>D3-US State: Species in rare/unique habitat</p> <p>D4i-US State: > 1% State population</p> <p>D4ii-US State: waterfowl (State defined)</p> <p>D4iii-US State: wading birds (State defined)</p> <p>D4iv-US State: seabirds/other colonial waterbirds (State defined)</p>

D4v-US State: shorebirds (State defined)
D4vi-US State: raptors/season (State defined)
D4vii- US State: outstanding land bird stopover
D5-US State: Research site



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