

# The Importance of Corps of Engineers Lands to Migrating and Breeding Birds

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**PURPOSE:** This technical note is a product of the Ecosystem Management and Restoration Research Program (EMRRP) work unit titled “Improved Methods for Ecosystem-Based Habitat Management at Corps Projects.” The objective of the work unit is to provide appropriate technology on managing wildlife species and their habitats using ecosystem-based strategies. The emphasis is on methods that improve natural resources for a variety of animals rather than a single species.

Birding is one of the fastest growing recreational activities in the United States. The economic impacts associated with this recreational activity on local communities have only recently been recognized. This technical note addresses the Corps’ role in bird conservation, the potential economic impacts of birding, and how the Corps might increase public awareness of projects as recreational sites for birding. This technical note also provides information for developing and incorporating bird conservation concerns into management plans for Corps lands.

**BACKGROUND:** The U.S. Army Corps of Engineers manages over 450 man-made lakes and an additional 24,000 miles of inland navigation streams in the continental United States. Reservoir projects include approximately 11.5 million acres of land and water and a total shoreline length that exceeds the coastline of the continental United States. The reservoirs were impounded to provide for flood control, navigation, hydroelectric power production, and other human uses (Figure 1).

The water surface and associated land at these lakes constitute a unique natural resource base. The U.S. Congress recognized the value of natural resources and the recreational use of these resources with the passage of Section 4 of the 1944 Flood Control Act (U.S. Congress 1944), which was the first legislative authority for the agency to plan for and to manage recreation and fish and wildlife resources. This legislation also authorized the Corps to lease and license lands to non-federal public agencies for these activities.



Figure 1. Corps reservoirs are often surrounded by abundant lakeshore riparian, wetland, and upland habitats that are important to a variety of birds and other wildlife species

The importance of fish and wildlife management and outdoor recreation was further emphasized in 1965 with enactment of the Federal Water Project Recreation Act (U.S. Congress 1965), which elevated these mission areas to a level on par with navigation and other traditional congressionally authorized purposes.

Approximately half of all bird species that nest in the United States are classified as neotropical migratory birds (also referred to as neotropical migrants). These species, which include approximately 360 species of songbirds, shorebirds, waterfowl, and birds of prey, move annually between their breeding grounds in North America and wintering areas in Mexico, Central America, South America, and the Caribbean (Figure 2). The other half of bird species are considered either temperate migrants that move between breeding and wintering grounds entirely within North America, or resident species that are nonmigratory. During the 1980's, ecologists began to notice that many species of neotropical migrant birds were undergoing long-term population declines (Hagan and Johnston 1992; Martin and Finch 1995; James, McCulloch, and Wiedenfeld 1996; Sauer et al. 2000). These species included birds that depend on many different types of habitats, including grasslands, wetlands, early successional habitats, and mature forests. As an example, grasslands are recognized as one of the most imperiled ecosystems in the nation (U.S. Department of the Interior 1996). Thirty years of data (1966-1993) from the long-term national Breeding Bird Survey indicated that almost 70 percent of the 29 grassland birds species (e.g., dickcissel (*Spiza americana*), cassin's sparrow (*Aimophila cassinii*), and lark sparrow (*Chondestes grammacus*) had negative population trends.

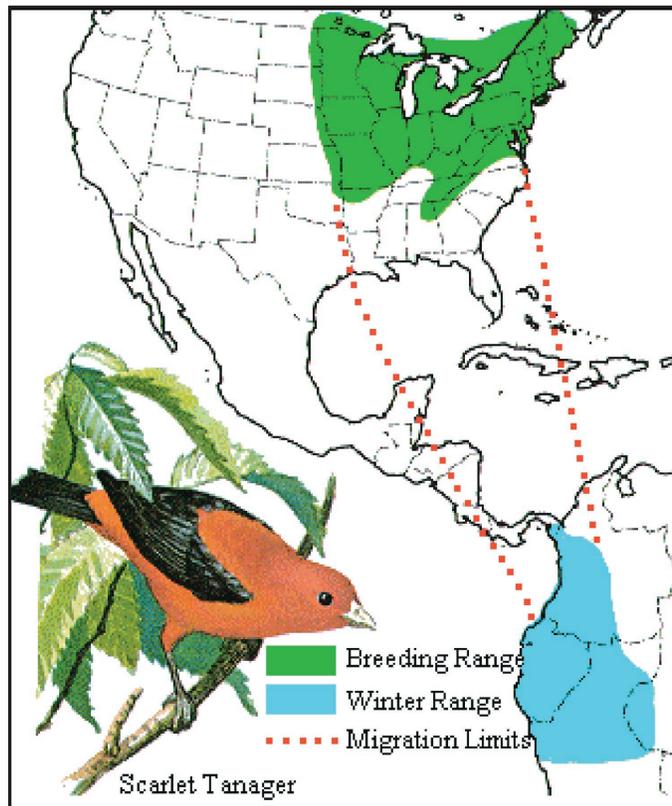


Figure 2. Breeding and wintering ranges of the scarlet tanager (*Piranga olivacea*), a neotropical migrant songbird (figure from Lincoln and Peterson (1979))

**IMPORTANCE OF CORPS LANDS:** Corps projects are relatively small compared to the land area administered by other land management agencies such as the U.S. Forest Service or the Bureau of Land Management. However, the relative size is compensated for by location of the projects. Many reservoir projects are located along the migration routes of neotropical migratory birds, especially in the Mississippi and Ohio River Valleys and the Great Plains (Figure 3). Riparian habitats, which have been identified as high-priority habitats in numerous PIF physiographic regions, are known to be an important landscape feature for many bird species. Corps projects maintain a wealth of riparian areas adjacent to lakes, streams, and rivers. Dams along major rivers have created habitat clusters of islands, open water, and lakeshore riparian habitats

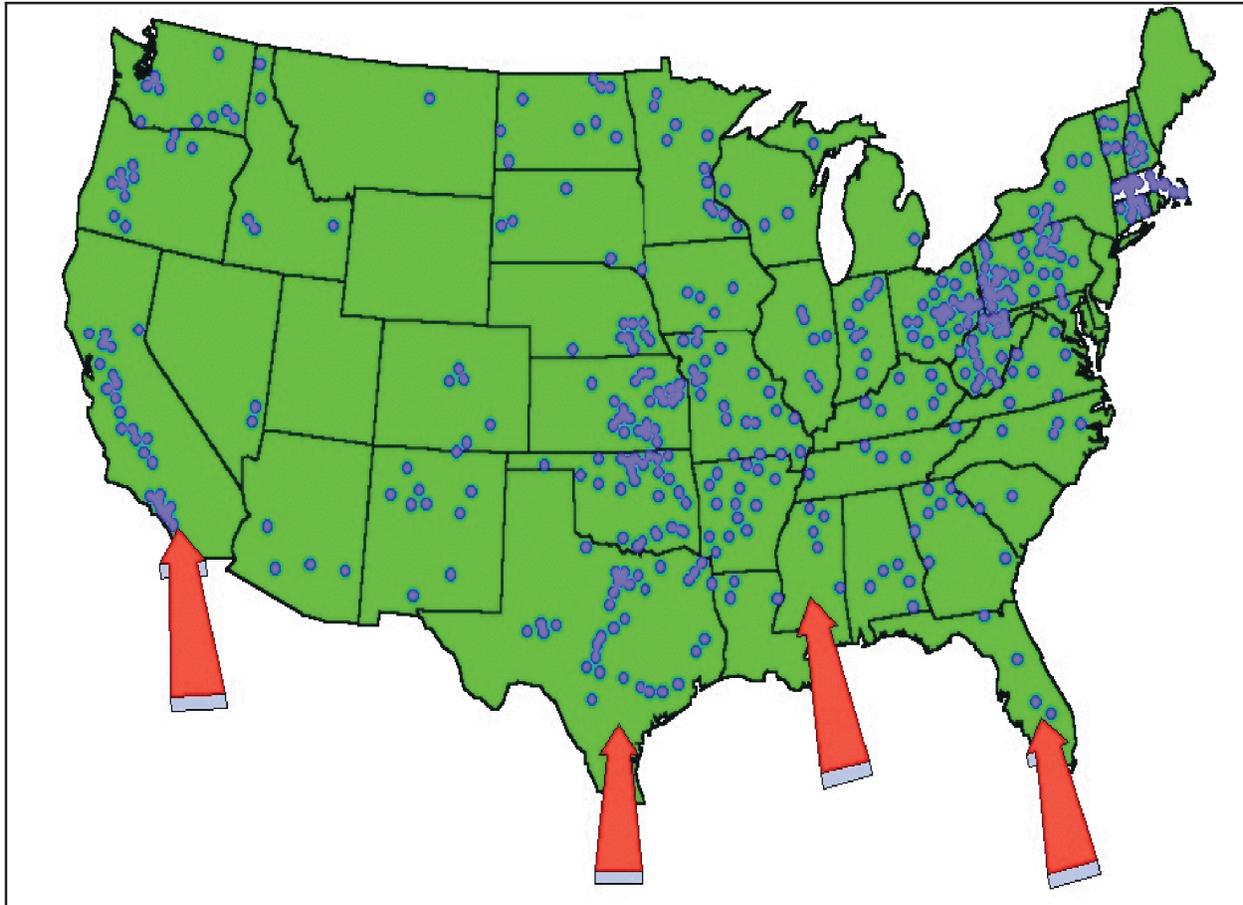


Figure 3. The distribution of Corps of Engineers reservoirs and major migrational pathways of neotropical migrant songbirds. Projects concentrated along the Pacific flyway, in the Great Plains, and through the Mississippi and Ohio River Valleys may provide the most important habitats

that may be very important seasonally to birds. Based on the distribution and position of Corps projects on the landscape, and their proximity to wetland, riparian, and aquatic habitats, Corps lands likely provide important habitats for many breeding bird species, act as important stopover habitat for migrating birds, and provide wintering habitat for birds that reside in North America year-round. Furthermore, many Corps projects protect headwater riparian or wetland ecosystems from human development, conserving critical breeding and migratory stopover habitat (Hamilton and Fischer 2001). Corps lakes are also located near concentrations of people. Eighty percent of Corps lakes are located within fifty miles of a major urban center.

**ECONOMICS OF BIRDING:** Birds are big business. American preferences for wildlife-related recreational experiences have been evolving over the past three decades from consumptive uses such as hunting and fishing to nonconsumptive uses including birding, and wildlife observation and photography (Cordell, Herbert, and Pandolfi 1999). Although consumptive uses of natural resources remain important outdoor recreation activities, there is increased interest in wildlife-related activities that result in minimal disturbance to animals and their habitats but provide intrinsic benefits to visitors. A 1995 National Survey on Recreation and the Environment noted that birdwatching has become one of the fastest growing recreational activities in the United

States, ahead of other popular activities such as hiking, skiing, and golf (Cordell, Herbert, and Pandolfi 1999). In 1991, more than 24.7 million people reported they traveled to watch birds. A more recent study estimated that 65 million people (43 percent of households) provide food for wild birds; as a nation we spend at least \$2.5 billion annually on bird-related products. That number more than doubles to \$5.2 billion when expenses on goods and services associated with recreational birding are included, such as money spent on gas, hotels, and food (Southwick Associates 1995; Baicich, Butcher, and Green 1998).

Many National Wildlife Refuges, with their quality bird habitat, high visibility, and publicity, attract hundreds of thousands of birders each year. Lodging, purchases, and other local expenditures by visiting birders result in substantial economic gains for local communities. For example, the birders traveling to the Rio Grande Valley of Texas to view birds during migration spend in excess of \$90 million annually. More than 100,000 people swarm to Chincoteague National Wildlife Refuge in Virginia during migration, and spend in excess of \$10 million on birding-related goods and services (Kerlinger, Payne, and Eubanks 1997). Other similar examples occur at other locations around the country.

**MAKING CORPS LANDS MORE ATTRACTIVE TO BIRDERS:** Field personnel have verified that Corps lands are highly important to migratory birds. However, the relative importance of most individual Corps projects to birds remains unknown. Improved information on how birds use Corps lands, coupled with a better means of publicity, could dramatically increase use of these lands by recreational birders. As discussed in detail below, the inclusion of Corps lands in “Birding Festivals,” promoting Corps lands along “Birding Trails,” and identifying Corps lands suitable for inclusion in the “Important Bird Areas” program could provide a link between Corps natural resources and the burgeoning interest in birding as a recreational activity. Local communities adjacent to Corps projects that experience an increase in visitation by recreational birders would receive an economic boost.

**Birding Festivals.** One indication of the popularity of birding is the rapid rise in the number of “Birding Festivals” in the United States (Figure 4). Birding festivals are planned events in which a local community publicizes a birding resource such as areas used heavily by migrating birds, or areas with a diverse breeding bird community. Some of the more popular festivals center around spring migration, when millions of birds comprising hundreds of species move North to their breeding grounds. During this time, observers have a high probability of observing a large number of species in a relatively short period of time. In the Rio Grande Valley example mentioned above, several communities in southern Texas have initiated festivals that have provided substantial economic gains for many local businesses.

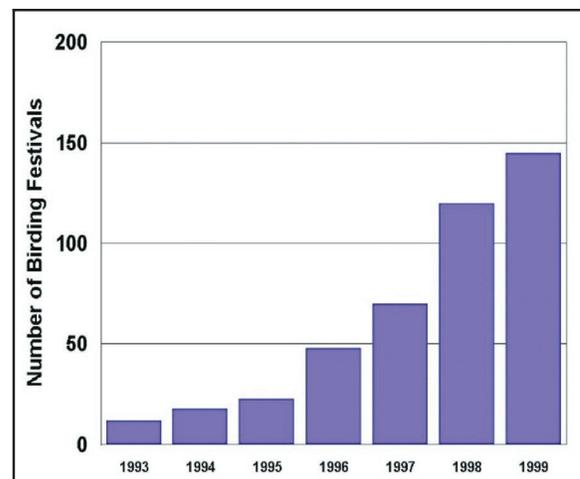


Figure 4. Number of birding festivals in the United States, 1993-1999 (Source: National Fish and Wildlife Foundation and the American Bird Conservancy, Washington, DC)

**Birding Trails.** Another increasingly popular birding resource is the development of birding trails. Birding trails typically involve multiple birding sites accessible along a series of roads and highways. Identifying birding sites along trails increases their exposure to the public, which can boost economic benefits to local communities by increasing tourism. An increase in visitation to some of these sites may also assist in their conservation, as responsible agencies and organizations place higher value on their conservation. The most popular birding trail in the United States is the Great Texas Coastal Birding Trail (GTCBT), which occurs along the entire Texas Gulf coast. More than 450 of the 620 species of birds that breed in or migrate through Texas are found at approximately 300 sites along the 600-mile trail. Maps are available highlighting sites along the trail, and each site is marked with a special sign that identifies its link to the trail system. Some Corps lands, including Lake Sam Rayburn and a woodlot near the Galveston District office, are included along the trail. The State of Texas is also planning a more extensive system of trails, called the Great Texas Wildlife Trail, which will be contiguous with the GTCBT and span most of the remainder of the state. The proposed Heart-of-Texas Wildlife Trail is a section of the Great Texas Wildlife Trail that will include several Corps lakes (e.g., Hords Creek Lake and Lake Georgetown). Jerry Brite, Lake Manager at Canyon Lake, is working with Texas Parks and Wildlife to include land and water associated with Canyon Lake because the site attracts significant numbers of both eastern and western U.S. bird species. Also, two rare and endangered birds, the golden-cheeked warbler (*Dendroica chrysoparia*) and the black-capped vireo (*Vireo atricapillus*), regularly nest in the area during summer.

Other states are also developing birding trails. For example, Virginia is currently planning and developing the Virginia Birding and Wildlife Trail, which likely will be a part of a larger Mid-Atlantic Coastal Birding Trail. The Great Florida Birding Trail has also been initiated but all sites have not yet been identified and designated. There are opportunities for managers at Corps projects to submit nominations (typically accessed through Web sites designed for the trail) to birding trail organizers to incorporate Corps lands that have significant birding opportunities.

**Important Bird Areas.** The Important Bird Areas (IBA) Program is sponsored by the Audubon Society and American Bird Conservancy. An IBA is a site that provides essential habitat for one or more bird species during breeding, winter, or migration seasons. The IBA Program identifies and conserves critical sites for bird conservation in North America. At least six Corps reservoir projects, Jordan Lake, NC; Carters Lake, GA; Blue Marsh Lake, PA; Saylorville Reservoir, IA; and C. J. Brown Reservoir and William H. Harsha Lake, OH, have recently been designated as IBA's. The Rock Island District's Mississippi River Project was recently identified as a Globally Significant IBA; the project is visited by hundreds of thousands of waterfowl during migration, including a significant proportion of the world's population of canvasbacks (*Aythya valisineria*), significant numbers of lesser scaup (*Aythya affinis*), and thousands of other ducks and geese. The site also provides shallow-water habitat for thousands of shorebirds and herons, floodplain forest habitat for significant numbers of breeding and migrating songbirds, and feeding and resting habitat for hawks during fall migration.

Other projects, including C. J. Brown Reservoir in Ohio, are currently under consideration as IBA's. This designation does not have any legal influence on project operations; however, it may provide an impetus for including the needs of migrant and resident bird species in operational management plans. For example, managers at Saylorville Reservoir have worked cooperatively

with the Iowa Department of Natural Resources to develop a strategy to manipulate the reservoir pool, within existing constraints for flood control, water supply, and low-flow augmentation. This change in operation of the flood pool provides seasonal habitats for numerous migratory bird species. In mid-summer, a gradual 6-in. (0.15-m) drawdown is initiated to provide several hundred acres of exposed mud flats and shallow water for migrant shorebirds, and 3,000 to 8,000 white pelicans (*Pelecanus erythrorhynchos*), that stop over at the lake. In early October, the pool level is increased 6 to 12 in. (0.15 to 0.30 m) to flood vegetation that has grown on mudflats from July to late September, which provides abundant food for migrating and wintering waterfowl. In early November, the pool level is increased up to 48 in. (1.2 m), which floods larger expanses of areas vegetated with waterfowl foods such as smartweed (*Polygonum* spp.).<sup>1</sup>

**CONSERVATION ISSUES:** To fully understand all the issues associated with the conservation and management of migratory birds, one must understand the life history of these species and impacts of various types of land uses on their habitats. A holistic approach incorporating information from breeding grounds in North America, wintering grounds in the Neotropics, and at stopover sites between these disjunct seasonal habitats is needed.

The most significant problem facing bird populations in North America is the reduction in the quality and quantity of suitable habitat. Rapid alterations associated with large-scale landscape modifications have dramatically altered habitats and the sustainability of associated wildlife populations. Habitat fragmentation (i.e., the transformation of a landscape into smaller patches that are isolated from each other and from the larger remaining tracts of intact habitat) is the main result of this land conversion. The type of land use that leads to fragmentation is an important consideration when assessing the impacts to bird habitat. Fragmenting landscapes for agricultural production and urban development tends to result in permanent habitat loss that is most damaging to bird populations. In forested landscapes dominated by contiguous forest habitat blocks, timber harvests that remove relatively small percentages of the overall forest may only cause a temporary reduction in habitat for forest-interior species (i.e., those that rely on large blocks of forested habitat). While timber harvests can negatively affect forest-interior species, there are some benefits to species that depend on early-successional forests (Rosenberg et al. 1999). The effects of fragmentation on birds can be manifested in several different ways, including area sensitivity, nest parasitism, and predation. These effects are described below.

**Area Sensitivity.** Fragmentation has a direct impact on a large number of birds, particularly the “area-sensitive” species that require large contiguous blocks of habitat far removed from edges, and whose occurrence or reproductive success is reduced in small habitat patches (Rosenberg et al. 1999). For these species, the size and shape of available habitat are important factors for successful breeding (Whitcomb et al. 1981). Many area-sensitive species will not use habitat blocks less than their required size even if suitable habitat is present (Hagen and Johnston 1992). Those attempting to breed in fragmented habitat patches often experience lower reproductive success in the remaining habitat (Brittingham and Temple 1983, Wilcove 1985, Martin 1988, Robinson et al. 1995).

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<sup>1</sup> Personal communication. 2001. Scott Rolfes, Natural Resources Manager, Saylorville Lake, IA.

**Nest Parasitism.** Fragmented habitats increase the efficiency of brood parasites, particularly the brown-headed cowbird (*Molothrus ater*), which parasitizes nests of other species (Brittingham and Temple 1983, Robinson et al. 1992). Cowbirds do not build their own nests and raise their own young; rather, they lay their eggs in the nests of other birds (i.e., the host species), leaving the incubation and brood-rearing activities to a host. Cowbird chicks tend to hatch before the host hatchlings, and often outcompete the host's nestlings for food and parental care (Jackson and Roby 1992). Therefore, most neotropical migrant species whose nests are parasitized unknowingly raise cowbird chicks at the expense of their own young. Because most neotropical migrant species typically lay only one or two clutches of eggs per year, many of these individuals fail to raise any of their own young successfully (Robinson 1992). Nest parasitism by cowbirds is a significant factor contributing to the decline of many songbirds in North America (Robinson et al. 1995).

**Nest Predation.** Nest predators such as raccoons (*Procyon loter*), crows (*Corvus* spp.), jays (*Cyanocitta* spp.), and domestic cats tend to be much more common in smaller, fragmented habitat blocks (Wilcove 1985, Yahner 1988). They often penetrate these habitats through abundant open travel corridors such as roads, power- and gas-line right of ways, and other openings. Several studies consistently have shown that nest predators have a greater negative effect on the reproductive success of forest birds in fragmented rather than contiguous forested habitats (Wilcove 1985, Small and Hunter 1988).

**Edge Effects.** Creation and maintenance of edge habitats was once a paradigm in wildlife management (Giles 1971). Ecologists have learned that while edge habitats increase diversity by attracting many common species (especially game animals like deer and rabbits, and even some neotropical migrant birds like indigo buntings (*Passerina cyanea*)), forest-interior species tend to disappear from areas that have a high degree of edge habitat. Furthermore, cowbirds prefer to parasitize nests located near edges, and typically will not travel very far into forest blocks in search of host nests. Evidence suggests that detrimental effects of edges can extend from 150 to 300 ft (45 to 90 m) into the forest interior (Rosenberg et al. 1999).

**PARTNERS IN FLIGHT:** In 1990, an organization called Partners in Flight (PIF; [www.partnersinflight.org](http://www.partnersinflight.org)) was initiated in response to growing concerns about declines in the populations of many land bird species. During the 1990s, the PIF focus was on identifying and mapping approximately 60 physiographic regions in the United States based on major distinctions in bird communities and habitats (Figure 5); and developing a *species prioritization process* in which each breeding bird species within each physiographic region was given a "Concern Score" to identify species most in need of conservation attention (Carter et al. 2000). The prioritization process ranks each species based upon seven measures of conservation "vulnerability." Birds exceeding certain thresholds in the prioritization process in each region are considered the "Priority" species and are the focus of conservation attention within the region (Fitzgerald and Pashley 2000). Scores for PIF species in each physiographic region can be downloaded on the Internet at [www.rmbo.org/pif/pifdb.html](http://www.rmbo.org/pif/pifdb.html).

In 2000, PIF moved into the next phase, development of Bird Conservation Plans for each physiographic region. These plans clearly describe species and habitats most in need of conservation, identify the general habitat requirements of priority species, establish objectives for bird

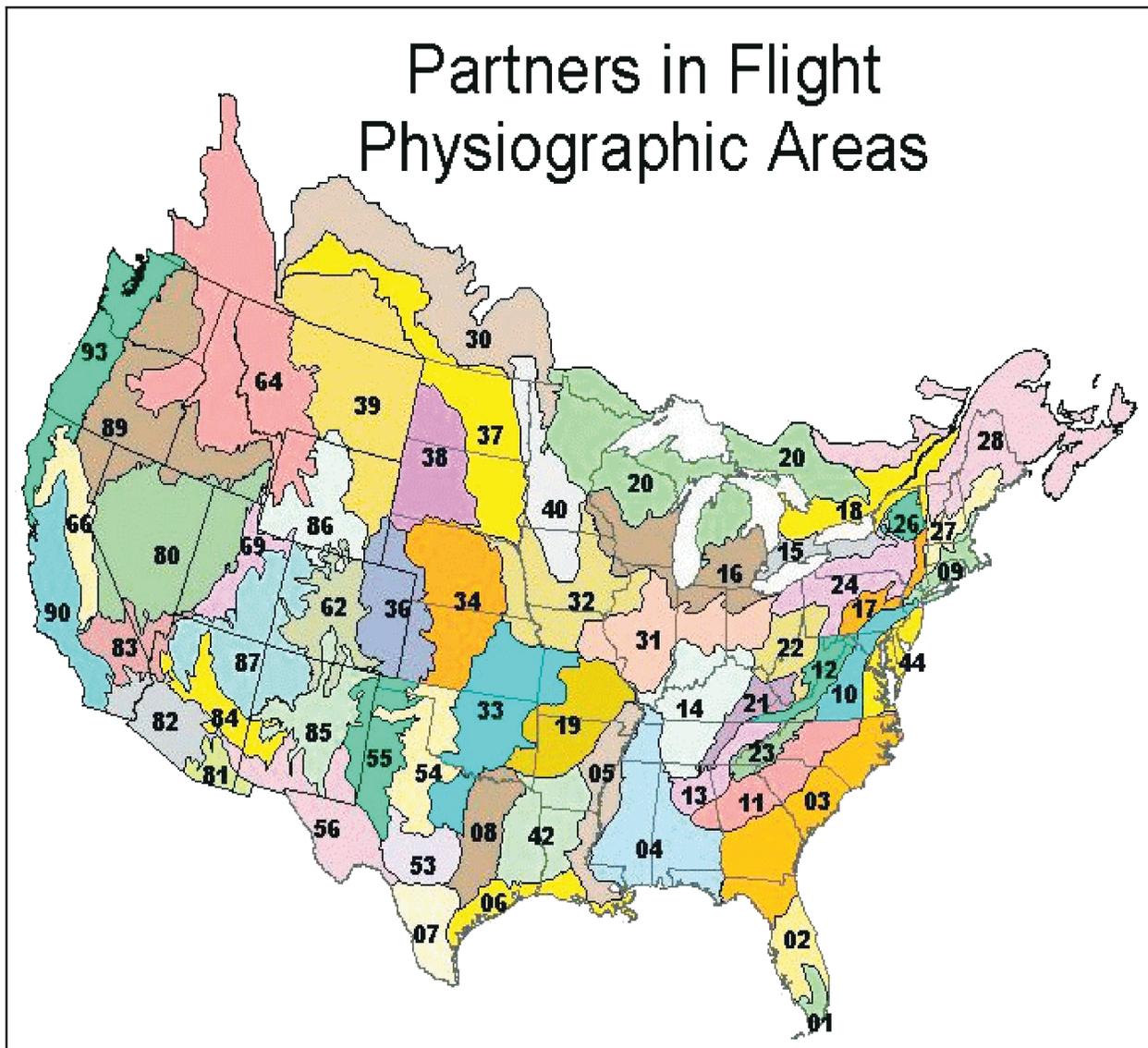


Figure 5. Physiographic regions identified as distinct conservation regions by Partners in Flight

populations and habitats, and discuss habitat management recommendations for habitats that support priority species. Drafts of many of these plans have been completed and can be downloaded at [www.blm.gov/wildlife/pifplans.htm](http://www.blm.gov/wildlife/pifplans.htm).

Some Corps resource managers have been directly involved in PIF and other bird conservation planning efforts. For example, Steven Lee, Resource Manager at Caesar Creek Lake in Ohio, has participated in the Ohio Working Group of PIF since its inception in 1993. The Working Group has representatives from land management agencies in Ohio including the Ohio Department of Natural Resources, U.S. Forest Service, U.S. Fish and Wildlife Service, and the Corps of Engineers. Also represented are local metroparks, academic institutions such as The Ohio State University, and nongovernmental organizations such as the National Audubon Society and the Black Swamp Bird Observatory. Mr. Lee is currently chairman of the Management subcommittee, and has been instrumental in compiling a list of all land management agencies in Ohio

and their research needs. The committee has developed species priority lists for birds in Ohio and made them available to land managers. The committee has also compiled a comprehensive management handbook that includes life histories of target species and management leaflets for particular habitat groups. Peer-reviewed management leaflets were developed for wetlands, grasslands, shrublands, forests, and urban areas. Each leaflet describes habitat goals, management techniques, associated bird species, and suggested further readings. The working group co-hosted the first Ohio Avian Ecology and Conservation Conference during 2001.

**MANAGEMENT ISSUES:** The Corps has an opportunity to make a significant contribution to bird conservation by participating in the PIF initiative. Participation in bird conservation at the individual project level should be an objective. This can be accomplished if land managers at Corps projects obtain the PIF Bird Conservation Plan for their specific region; these plans provide recommendations for improving habitats used by declining priority species. Before using these plans to develop and implement management plans for bird conservation, Corps projects should first conduct an inventory of bird communities and habitats found on the project. This will then allow personnel to identify opportunities for implementing management strategies recommended in the Bird Conservation Plans. Long-term monitoring of bird communities will allow managers to identify response to changes in management and land uses.

The majority of Corps projects occur in the eastern half of the United States and typically have forested lands along shorelines and streambanks. A few projects are bordered by native grassland or desert habitats. Specific habitat management recommendations are far too numerous to cover here in detail, but there are some general habitat management guidelines that can be summarized from Bird Conservation Plans and from other publications (e.g., Herkert et al. 1993, Maryland Partners in Flight 1997, Sample and Mossman 1997, Rosenberg et al. 1999, Fischer 1999, Fischer and Fischenich 2000). These guidelines apply primarily to forested habitats since forests comprise the majority of habitat found adjacent to Corps reservoirs. Recommendations for grassland habitats are also provided.

### **General Forest Management Guidelines**

- ***Uneven-aged forests with a well-developed but broken canopy (i.e., approximately 70 percent canopy closure) provide the best forest habitat for forest-interior birds.***
- ***Avoid fragmentation of large contiguous forest tracts whenever and wherever possible.*** Larger forest blocks support the largest number and diversity of forest-interior birds, as well as provide habitat for the “area-sensitive” forest species. Ideally, blocks of mature forest at least 7,500 acres (3,000 ha) should be the goal, but blocks smaller than this still have conservation value for some breeding and wintering birds, and are especially valuable as stopover habitat for migrating birds.
- ***Develop a long-range forest management plan at as large a scale as possible.*** Identify the successional stage of each timber stand and which stands should be priority for development into large, mature stands having interior forest. Maintain corridor connections between regenerating forest stands to assist movement of birds and other wildlife among stands (Fischer and Fischenich 2000).

- **Reforestation efforts should avoid monocultures, especially nonnative species.** Forests should be monitored for nonnative plant species; a removal or control plan should be devised to avoid problems associated with invasive species.
- **Disturbances such as new construction of roads, campgrounds, and buildings should be along edges and not within the interior of forest blocks.** Activities such as mowing, logging, and use of pesticides in all habitats should be precluded from April through early August, as these are the dates between which most species breed, nest, and fledge young. Limit the number, length, and width of new roads and allow the canopy to close over roads through forested habitats where possible.
- **Avoid the loss of even small forest blocks** (e.g., less than 25 acres [10 ha]), particularly riparian habitats along creeks, streams, rivers, and reservoirs. Also, small blocks of habitat in areas with little forest or in areas of high disturbance should be retained when possible. These habitats may not provide abundant or suitable nesting cover but should at least provide some habitat for migrant birds that “stop over” during migration.
- **Attempt to manage for forested blocks that minimize edge.** Circular and square plots have the least amount of edge and greatest amount of interior forest, whereas linear strips have high edge and little or no interior forest.
- **Maintain a well-developed woody and herbaceous understory.** This not only provides cover from predators, but also a variety of foods and abundant nest sites. Heavy grazing by livestock, and over-browsing by dense deer herds, can significantly reduce understory vegetation, which can negatively impact the ability to meet this objective.
- **Retain at least some snags (i.e., dead or dying trees) on each acre of forest land.** Snags at least 8 in. (20 cm) in diameter are best for providing nesting habitat for cavity-nesting bird species. Dead and dying trees also provide abundant insects used as food in the diets of many birds. In areas with high cowbird densities, snags that protrude above the canopy (within 100 m of the edge) should be considered for removal to deny cowbirds an observation post.
- **Avoid “high-grade” timber removal** (i.e., removing the most valuable and structurally superior trees). This tends to reduce stand habitat quality by reducing tree-species diversity and fitness. If timber is removed, consider leaving those trees that provide high-quality food or cover.
- **Retain riparian buffer strips along streams, rivers, and lakes.** A no-cut buffer of at least 160 ft (50 m) should be provided on each side of the channel where the canopy closes over the water; at least 320 ft (100 m) of buffer strip should be provided along lakeshores, and on either side of streams and rivers where the canopy is open over the waterway.
- **Minimize forest stand isolation.** Isolation of forest patches can be minimized by reforesting gaps between patches either through natural succession or by planting native trees. Reforestation should also be considered for forest openings, peninsulas, and to widen riparian corridors. Before reforesting fields larger than 100 acres (40 ha), determine whether they are already functioning as quality grassland bird nesting habitat. Careful consideration should then be given to whether the site should remain a grassland habitat or be reforested.

## General Grassland Management Guidelines

- ***Avoid fragmentation and further loss of existing grassland areas.*** Identify and conserve existing grassland areas, especially those at least 250 acres (100 ha) or those presently used by grassland species.
- ***Grassland areas less than 50 acres (20 ha) can benefit grassland bird species least sensitive to habitat fragmentation,*** but much larger tracts (e.g., at least 125 acres [50 ha] and preferably more than 250 acres [100 ha] in area) are necessary to benefit grassland bird species with high sensitivity to habitat fragmentation. Small blocks should not be isolated on the landscape, but should be situated as closely together as possible and connected by other suitable grassland habitat (Sample and Mossman 1997).
- ***Design grassland plantings for area-sensitive birds to minimize the amount of linear edge.*** While circular plots are ideal, square plots are preferred to rectangular plots of similar acreage because they provide more “interior” habitat away from edge. Also, avoid establishing restorations with very irregular borders that can dramatically increase the ratio of edge-to-interior habitat.
- ***In areas where existing grasslands are scarce, grassland creation through prairie plantings can be very beneficial.*** Where 50-acre (20-ha) or greater contiguous restorations are not possible, establish several smaller scattered restorations with individual patch sizes at least 15 to 20 acres (6 to 8 ha) (preferably located within a mile of each other). Adjacent grassy habitats such as pastures, hayfields, and grassed waterways should be incorporated into the overall design by using them as connections between grassland patches or as non-woody, open edges.
- ***Locate plantings at least 100 yd (90 m) from forested areas and activity centers considered “hostile environments” to grassland birds*** (e.g., farmsteads, roads, suburban developments, feedlots). The planting should not be bordered by tall fencelines or groves of trees because this woody vegetation attracts nest predators and nest parasites (Johnson and Temple 1990). Open pastures, hayfields, small grains, and even row crops are acceptable adjacent habitats.
- ***When revegetating grassland areas, select a mixture of native warm-season, tall and short grasses,*** for plantings because some characteristic prairie bird species prefer short vegetation height, whereas others prefer intermediate to tall vegetation height at the start of the breeding season. Recommended tall grasses for prairie plantings include big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum* spp.), and switchgrass (*Panicum virgatum*). Recommended short grasses include little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*) and prairie dropseed (*Sporobolus heterolepis*). Monotypic stands typically are not recommended. Also include forbs (native flowering herbaceous plants) in the seed mixture or supplement with nursery grown stock, if possible. Most grassland bird species prefer at least low to moderate forb cover, which provides vital habitat components such as song perches and above-ground nesting substrates for many species.
- ***Prescribed burning and grazing are effective means of managing grassland habitats*** (e.g., controlling encroachment of woody vegetation). Grazing tends to have greater importance in mixed-grass and shortgrass prairies, while fire assumes greater importance in eastern tallgrass prairies.

- ***Prescribed fires should be conducted on suitable grasslands managed for breeding bird habitat in early spring (March to early April) or late fall (October and November).*** Care should be taken to follow local and/or state ordinances on burning. Conduct prescribed burns on areas over 100 acres (40 ha) in size in a rotation of 20 to 30 percent of the area annually since some species of grassland birds prefer recently burned areas whereas others prefer unburned areas (Herkert 1991). This will also provide refugia for displaced wildlife. On small, isolated grassland areas burn compartments may consist of a larger percentage of the total area, but should not exceed more than 50 to 60 percent in any burn season. In areas where several small grasslands are in proximity, selectively burn parcels on a rotational schedule to provide both unburned and recently burned habitats (Ryan 1990). Specific prescriptions for burning should be tailored to location of individual projects (e.g., type of vegetation, bird species present in the area).
- ***Grazing, if properly controlled, can be a versatile technique for managing grassland areas for breeding birds*** (Ryan 1990). Studies in Missouri have shown that light-to-moderate grazing may benefit several grassland bird species. Light grazing resulting in approximately 40 percent or more of vegetation cover at 10 in. (0.25 m) in height, would benefit grassland bird species with intermediate vegetation height and density preferences. Moderate grazing resulting in approximately 20 to 40 percent of vegetation cover at 10 in. in height would benefit grassland species with low vegetation height and density preferences. The most desirable grazing practice would be to keep grazing pressure light and use a rotation system by which only some sections are grazed and other areas are left idle. For example, an area could be divided into thirds, with the three subunits receiving light, moderate, and no grazing regimes on an annual rotational pattern.
- ***Where possible, use existing 'natural' firebreaks (e.g., roads, lakes, streams, and frequently mowed areas) as borders of restoration sites.*** In addition, these edges also may help retard the encroachment of exotic weeds and woody vegetation on to the grassland.
- ***Where existing grassland habitats border forested tracts, allow prescribed fires to burn slowly through the adjacent forest edge (and into the forest) as opposed to installing a firebreak along the forest edge.*** This management technique will assist in reducing edge-related predation by creating a more natural open or 'feathered' edge between the grassland and forest rather than a sharp, contrasting wall of woody vegetation (Johnson and Temple 1990).
- ***Remove and control woody vegetation that exceeds the normal grass height.*** Grassland birds in the midwestern United States nesting in proximity to woody vegetation suffer significantly higher nest predation and nest parasitism rates than birds nesting far from woody vegetation (Johnson and Temple 1990). In most cases, woody vegetation should be kept to a maximum of 5 percent of grassland habitat (Sample and Mossman 1997).
- ***If hiking trails are to be developed, restrict activities to the edges of the area to avoid disturbances to breeding and nesting birds.***
- ***Mowing grassland areas for hay, or weed or woody vegetation control, is another effective management technique for grassland birds.*** However, such mowing must be avoided during the breeding and fledging seasons (typically early May to early August) because several studies have now documented high rates of nestling and fledgling mortality in grassland areas subjected to mid-season cutting (Bollinger, Bollinger, and Gavin 1990; Frawley and Best 1991). Avoid cutting prairie areas very late in the growing season because this adversely affects plant species composition and regrowth, and encourages the

invasion of problem grass species such as Kentucky bluegrass. As with burning and grazing, manage mowed grasslands on a rotational system with some subunits left idle in each year.

**THE FUTURE:** The concern about birds in North America extends far beyond landbirds. Recently, a more comprehensive approach to bird conservation, called the North American Bird Conservation Initiative (NABCI) was launched with a goal of initiating regional, landscape-oriented partnerships that address “all birds and all habitats” in North America. This initiative, which includes significant coordination with both Canada and Mexico, brings together PIF, the North American Waterfowl Management Plan, the United States Shorebird Conservation Plan, and the North American Colonial Waterbird Conservation Plan. This initiative will assist managers in thinking more in terms of the influence of management decisions on all types of birds instead of smaller taxonomic groupings of species.

**SUMMARY:** Collectively and individually, Corps lakes represent unique and important resources that likely play an important role in the health and vigor of bird populations within and beyond the project boundaries. Corps lands may serve as important habitat for many species of birds that migrate through, winter, and breed in the United States. However, little is known about the role the Corps plays or what management prescriptions are needed on Corps lands to improve habitat for these species.

Implementation of Partners in Flight management recommendations designed to head off the declines in many of our bird species can be accomplished only if those individuals, industries, and land-management agencies like the Corps willingly participate in the proper management of lands. The Corps can become a better participant in the bird conservation arena by taking several steps. First, birds and their habitats should be inventoried on individual Corps projects to identify projects that harbor significant numbers of priority species and associated priority habitats. Second, Bird Conservation Plans should be used to identify and improve priority habitats as part of the overall species population goals in each physiographic region. Finally, the Corps should consider increasing participation in birding festivals in local communities, and identifying more lands for inclusion in the Important Bird Areas and birding trail programs. This should provide the public with increased awareness of the value of Corps lands to birds and other natural resources.

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