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CONSERVATION OF GRASSLAND BIRDS IN THE WESTERN HEMISPHERE

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> "The sweeping vista of the world's natural grasslands—be they steppes, savannas, rangelands, punas or prairies—occupy nearly seven billion hectares; over half of the earth's land surface. Add to that figure the vast area converted to . . . habitats of low intensity agriculture and grasslands become second only to the oceans in terms of direct dominance of the planet's ecosystems. They govern, directly, the livelihoods of hundreds of millions of people."
>
> —C. Imboden (1988:vii).

Research on and interest in grassland birds have increased considerably in the past 20 yr. There are several reasons for this heightened interest. Foremost, it is clear that populations of many grassland birds have declined sharply throughout the Western Hemisphere (e.g., Bucher and Nores 1988, Cavalcanti 1988, Fjeldså 1988, McNicholl 1988, Knopf 1994, Peterjohn and Sauer 1999). In North America, populations of at least 13 species of grassland birds declined significantly between 1966 and 1995 (Peterjohn and Sauer 1999). And as a group, North American grassland birds have experienced "steeper, more consistent, and more geographically widespread declines than any other behavioral or ecological guild," largely because of habitat loss and degradation (Knopf 1994:251). Similar declines are also occurring in South America, where species such as Pampas Meadowlark (*Sturnella defilippii*; Tubaro and Gabelli 1999), Saffron-cowled Blackbird (*Agelaius flavus*; Fraga et al. 1998), and *Sporophila* seedeaters (Silva 1999) have declined in the past 20 yr. Indeed, Collar et al. (1992:35) describe the "near-total destruction of open grasslands in south-east Brazil . . . and in the vast central planalto . . . as one of the great ecological catastrophes in South America."

Another reason for the increased research interest in grassland birds is changing agricultural practices. For example, the U.S. Department of Agriculture's Conservation Reserve Program (CRP), which has taken more than 14 million ha of cropland out of production under 10-yr contracts, has made it possible to examine regional, and even continental, effects of changing landscapes on grassland birds (e.g., Lauber 1991, Reynolds et al. 1994, Herkert 1998). Additionally, the CRP has provided excellent opportunities to study bird colonization, habitat use, and nesting success in different regions and under different ecological conditions. Finally, grassland birds are also fascinating from ecological and evolutionary perspectives. Distinctive or unusual adaptations, such as large body size and cursorial habits, have evolved in grassland birds. And the ability to readily observe many behaviors makes these species ideal for research (e.g., Wheelwright and Mauck 1998).

GRASSLAND HABITATS IN THE WESTERN HEMISPHERE

Grassland ecosystems occur in a variety of forms and are affected by geology, geography, moisture, soil type, elevation, climate, and disturbance regime (Kantrud 1981, Vickery et al. in press). In this volume, we define a grassland habitat as any extensive area that is dominated by more than 50% grass (Poaceae) or sedge (Cyperaceae) cover and that generally has few scattered shrubs (< 4 m high) and trees. We have generally excluded habitats that are dominated by more than 50% shrub cover, such as chaparral.

In addition to such obvious grassland habitats as tallgrass and shortgrass prairies, pampas, and Patagonian grassland, we include sedge-dominated tundra, alpine ridges and barrens, puna, and paramo. We also include the longleaf pine (*Pinus palustris*) ecosystems of the southeastern United States and the pine (*Pinus* spp.) forests and savannas of Mexico because it is clear that several species of birds, among them Bachman's Sparrow (*Aimophila aestivalis*), Striped Sparrow (*Oriturus superciliosus*), and Sierra Madre Sparrow (*Xenospiza baileyi*), have adapted to the graminoid ground cover beneath these forests. Although these ecosystems are generally viewed as forests, the above species appear to occupy them as a form of grassland, not forest, habitat. Bachman's Sparrow, for example, continues to occupy clear-cut glades after forest removal (Dunning 1993). In North America, we also include as grassland wet-mesic upland habitats where the soil is often saturated but not inundated for long periods; we do not include freshwater, brackish, and saltwater wetlands where

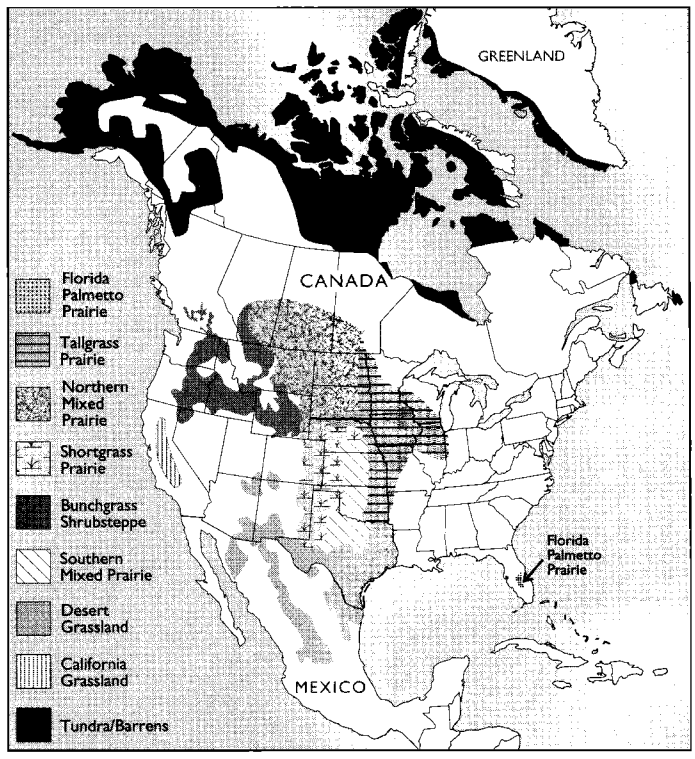

FIGURE 1. Distribution of major grassland ecosystems in North America and Mexico prior to European settlement. Alpine zones above tree line have not been depicted. This map was adapted and modified from two primary sources, Risser et al. 1981 and Environment Canada 1998.

standing water is present for long periods, however.

Native grasslands in the Western Hemisphere extend from high-arctic sedge meadows in the tundra of North America to pampas and Patagonian grasslands in southern South America (Figs. 1 and 2). In North America, a mosaic of tundra/barrens habitats forms the northernmost grassland component. In the temperate region, the most extensive grasslands historically included the shortgrass prairie and southern mixed prairie of the western Great Plains and the tallgrass prairie and northern mixed prairie of the midwestern United States and Canada (Knopf 1988; Fig. 1). Although they were less extensive, bunchgrass shrubsteppe (including palouse prairie) and California grasslands in the west, desert grasslands in the southern United States and Mexico, and palmetto (*Serenoa repens*) dry prairie in Florida were historically all major grassland types in North America (Fig. 1).

In South America, major native grassland ecosystems include high-altitude paramo and puna grasslands (listed as Andean grasslands; Fig. 2) and mid-elevation monte grasslands (Fig. 2). Low-elevation grasslands include Patagonian grasslands in southern Argentina and Chile and pampas in eastern Argentina, Uruguay, and southernmost Brazil. Brushier savanna grasslands include chaco, cerrado (particularly "campo limpo" and "campo sujo" in central Brazil), Beni savannas, Amazonian savannas, Guianan savannas, and espinal. Native South American grasslands also include such mesic ecosystems as the llanos of Venezuela and Colombia and the Pantanal of southwestern Brazil, where seasonal flooding for several months each year is followed by pronounced dry seasons when most surface water disappears (Soriano 1991, Dinerstein et al. 1995, Stotz et al. 1996; Fig. 2).

DEFINING GRASSLAND BIRDS

> "The difficulty . . . in defining grassland species . . . results from the fact that grassland itself is not easy to define precisely. How small may a prairie be before it is a mere opening? Where does grassland stop and very open woodland begin? . . . How much sage is required before grassland becomes some form of desert scrub?"
>
> —R. M. Mengel (1970:283)

Few would argue that species such as Lesser Rhea (*Rhea pennata*), Sprague's Pipit (*Anthus*

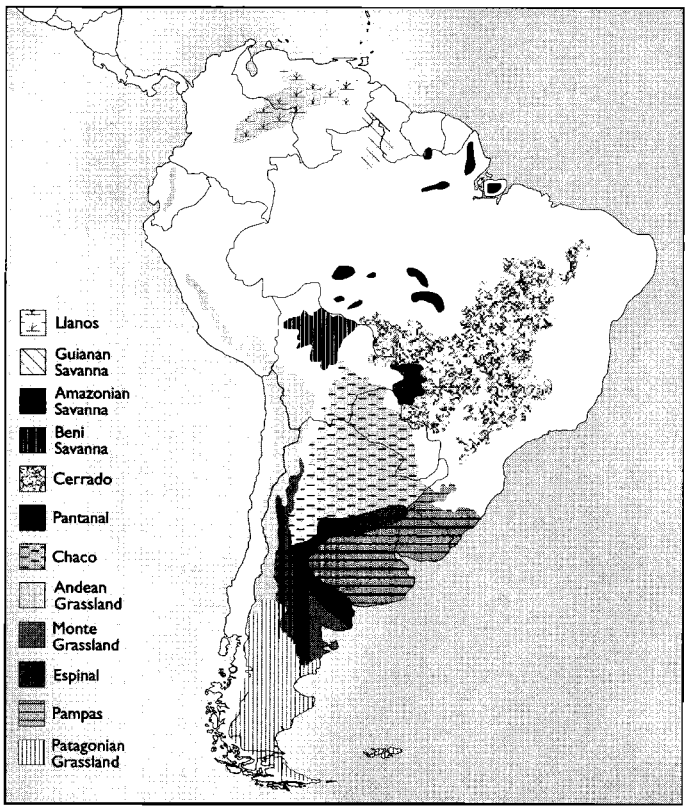

FIGURE 2. Distribution of major grassland ecosystems in South America prior to European settlement. Puna and paramo grasslands have been classified as Andean grasslands. This map was adapted and modified from two primary sources, Cabrera and Willink 1980 and Dinerstein et al. 1995.

spragueii), McCown's Longspur (*Calcarius mccownii*), and Wedge-tailed Grass-Finch (*Emberizoides herbicola*) are completely adapted to grassland habitats and should be considered grassland specialists. Classification seems obvious in these cases, as all of these species use grassland habitat for all their life-history needs. But for many other species, determining which ones should be considered grassland birds quickly becomes complicated and invariably somewhat subjective. Are Western Kingbirds (*Tyrannus verticalis*), Red-winged Blackbirds (*Agelaius phoeniceus*), and Blue-black Grassquits (*Volatinia jacarina*), for instance, also grassland birds? What about jaegers (*Stercorarius* spp.)? Although each of the three jaeger species spends 9 mo a year on the open ocean, all require open tundra for nesting. And nest success in Pomarine Jaegers (*S. pomarinus*), as in Snowy Owls (*Nyctea scandiaca*), depends strongly on collared lemming (*Dicrostonyx torquatus*) populations (Pitelka et al. 1955).

Mengel (1970) recognized the difficulties inherent in trying to define grassland birds. He realized that grasslands extend along a moisture gradient—from arid prairies to wet meadows and marshes—and that defining the limits of this gradient in relation to the birds that occupy these habitats can be, and is, somewhat arbitrary. In addition, he noted that grassland ecosystems frequently intergrade with forested and other habitat types, making it difficult to define the limits of some grassland types. In the Cerrado of central Brazil, for example, "campo limpo," or open grasslands, are interspersed with "campo sujo," or grasslands with scattered trees and shrubs; and campo sujo may blend into "cerradão," which is even more densely forested (Eiten 1972). In the United States, tallgrass prairie intergrades into oak (*Quercus*) savannas in the Midwest, and in the Southeast the dry palmetto prairies of central Florida merge into longleaf pine savannas, called "flatwoods." Consequently, it is often difficult to delineate where grassland ends and forest begins. Furthermore, different species of birds may respond differently to the same ecotone. In Florida, Grasshopper Sparrows (*Ammodramus savannarum floridan-*

us) breed only on treeless palmetto prairies and do not occupy savanna flatwoods. Bachman's Sparrows, however, breed commonly in both habitats. From the perspective of these two sympatric grassland sparrows, the definition of grassland habitat is quite different.

This process is further complicated by the fact that some grassland species use different habitats in different parts of their ranges. Savannah Sparrows (*Passerculus sandwichensis*) are known to use an extraordinary array of open habitats throughout their extensive range (Wheelwright and Rising 1993). In eastern Texas, Bachman's Sparrows typically breed in open pine forests, but in central Florida they commonly breed on treeless palmetto prairies (Dunning 1993, Shriver et al. 1999). Although there are similarities in these habitats, notably the predominant graminoid ground cover, the differences are also obvious and striking.

Finally, the fact that so many grassland habitats have been severely altered by modern agricultural practices further complicates efforts to define grassland birds. Many grassland species in the Western Hemisphere are presently occupying artificial habitats that did not exist 200–300 yr ago. For example, Northern Harriers (*Circus cyaneus*), Short-eared Owls (*Asio flammeus*), Henslow's Sparrows (*Ammodramus henslowii*), and many other grassland birds now breed on reclaimed surface coal mines in western Pennsylvania, West Virginia, Ohio, and Indiana. These newly created "prairies" did not exist 100 yr ago, but they appear to be providing important refugia for threatened species in these regions (D. Brauning, pers. comm.). Conversely, some steppe or forest birds are invading open habitats because as early settlers cleared the land for agriculture, they provided the perches and refuges these species require (Gochfeld 1979, McNicholl 1988). Thus, it is necessary to have some understanding of habitat preferences prior to European settlement to determine whether present-day habitat use reflects long-term evolutionary patterns.

Given the complexities in defining grassland habitats, how does one define the birds that use this variety of habitats? Are there common threads that help define grassland birds? And are these similarities consistent spatially and across taxa?

In midwestern North America, Mengel (1970) recognized two groups of grassland birds based on distribution and habitat selection. He relied on limited geographic range and endemism to determine "primary" grassland birds, which were restricted to the central Great Plains. He identified as "secondary" grassland birds those species that had "strong affinities with the grasslands, although [were] not restricted to them" (Mengel 1970:283). This geographic emphasis created ecological inconsistencies. Wilson's Phalarope (*Phalaropus tricolor*) and Franklin's Gull (*Larus pipixcan*), for instance, were considered "primary" grassland species, but the ecological connections to grassland habitat for either species are limited. Wilson's Phalarope, for example, generally breeds along the edges of prairie potholes and open marshes but makes little use of the surrounding grassland habitat.

We prefer an ecological basis for defining grassland birds. We thus define a grassland bird as any species that has become adapted to and reliant on some variety of grassland habitat for part or all of its life cycle, be it breeding (either nesting or feeding), migration, or wintering. Grassland birds often, but not necessarily, nest on the ground. Thus, we consider Swainson's Hawk (*Buteo swainsoni*), Mountain Plover (*Charadrius montanus*), and Long-billed Curlew (*Numenius americanus*) to be grassland birds, despite the fact that Swainson's Hawks nest in trees and that curlews often use a variety of intertidal habitats in the nonbreeding seasons. Along the moisture gradient, we include as grassland birds four species of South American geese (*Chloephaga* spp.), Sedge Wren (*Cistothorus platensis*), Henslow's Sparrow, and Le Conte's Sparrow (*Ammodramus leconteii*), but we exclude birds that normally breed over or adjacent to standing water, among them Swamp Sparrow (*Melospiza georgiana*), Nelson's Sharp-tailed Sparrow (*Ammodramus nelsoni*), Seaside Sparrow (*A. maritima*), some waterfowl (Anatidae), and most rails (Rallidae) and herons (Ardeidae; but see Sample and Mossman 1997 for a different perspective). Along the shrub gradient, we consider Rufous-winged Sparrow (*Aimophila carpalis*) and Lark Sparrow (*Chondestes grammacus*) to be grassland birds but not Brewer's Sparrow (*Spizella breweri*). We exclude species that occur commonly in grassland habitats but do not use the graminoid components of these habitats; examples include Pinyon Jay (*Gymnorhinus cyanocephalus*), which feeds almost exclusively on shrub seeds, and aerial insectivores such as swifts (Apodidae) and swallows (Hirundinidae), which only feed over grasslands.

Finally, we include species that occupy wetland, shrub, and forest edges adjacent to grassland habitats only when they make regular use of the grassland habitat away from edge (> 100 m). For example, we consider the American Bittern (*Botaurus lentiginosus*), which nests in prairie fragments and fields, and the various puddle ducks that nest in upland fields far from wetlands to be grassland birds.

Obligate and Facultative Grassland Birds

Within our ecological definition of grassland birds, two groups can be reasonably separated. Obligate grassland specialists are species that are exclusively adapted to and entirely dependent on grassland habitats and make little or no use of other habitat types. Examples include Lesser Rhea, Baird's Sparrow (*Ammodramus bairdii*), and Pampas Meadowlark (Tables 1 and 3). Obligate grassland birds would almost certainly become extinct without the appropriate grassland habitat.

Facultative grassland specialists use grasslands as part of a wider array of habitats. In general, these species are not entirely dependent on grasslands but use them commonly and regularly. If the appropriate types of grassland habitat were destroyed, populations of some facultative grassland birds would diminish but probably would not completely disappear. Examples of facultative grassland birds include Barn Owl (*Tyto alba*), Loggerhead Shrike (*Lanius ludovicianus*), Clay-colored Sparrow (*Spizella pallida*), and Blue-black Grassquit (Tables 2 and 4).

The number of obligate species found in grasslands is not especially great compared with other habitats. In North America, Mexico, and the Caribbean, for example, there are 59 species of obligate grassland species from 35 genera (Table 1) compared with more than 180 species of obligate forest-dwelling species. With 124 species from 59 genera (Table 3), South America supports many more obligate grassland species than do North America, Mexico, and the Caribbean. Not surprisingly, facultative grassland species are more numerous than obligates; there are 97 species of facultative grassland birds in North America, Mexico, and the Caribbean (Table 2) and 164 in South America (Table 4).

DISTRIBUTION OF GRASSLAND BIRDS

Obligate grassland specialists have a wide geographic distribution. They occur from north of the Arctic Circle to the southern tip of Argentina and Chile and as far offshore as the Islas Malvinas (Falkland Islands) and, 1770 km east of Tierra del Fuego, South Georgia Island (Tables 1 and 3). As a genus, pipits (*Anthus* spp.) have the widest breeding range of any Western Hemisphere passerines, extending from arctic Canada (American Pipit [*A. rubescens*]) to South Georgia Island (South Georgia Pipit [*A. antarcticus*]).

Only three obligate grassland species are widely distributed across the Americas, however. The Short-eared Owl breeds discontinuously from the arctic regions of Canada and Alaska to Tierra del Fuego; the Burrowing Owl (*Athene cunicularia*) breeds from southern Canada and Florida to the southern pampas of Argentina; and the Sedge Wren, currently classified as a single, widely distributed species, occurs from eastern North America to southern South America (AOU 1998). Only seven obligate grassland species in North America breed in both arctic/alpine and temperate regions (Table 1).

Although there are differences between arctic/alpine breeders in North America (e.g., ptarmigan [*Lagopus* spp.], jaegers, and buntings [*Plectrophenax* spp.]) and temperate or steppe breeders (e.g., prairie-chickens [*Tympanuchus* spp.], sparrows [*Aimophila* spp.], and meadowlarks [*Sturnella* spp.]), the similarities between grassland birds of these regions are pronounced. Many genera are shared between the arctic/alpine and temperate regions, despite the fact that the breeding ranges of most species are restricted to either the arctic/alpine or temperate region (Table 1). For example, McCown's Longspurs and Chestnut-collared Longspurs (*Calcarius ornatus*), both of which occur in shortgrass and mixed prairies, are replaced by Smith's Longspurs (*C. pictus*) and Lapland Longspurs (*C. lapponicus*) farther north. The same allopatric relationships are found among hawks (*Buteo* spp.), falcons (*Falco* spp.), plovers (*Charadrius* spp.), curlews (*Numenius* spp.), godwits (*Limosa* spp.), shrikes (*Lanius* spp.), and pipits.

In South America, taxonomic affinities between high-altitude and lowland temperate birds occur in hawks (*Buteo* spp.), caracaras (*Phalcoboenus* spp.), seedsnipes (*Attagis* and *Thinocorus* spp.), doves (*Metriopelia* and *Zenaida* spp.), tyrant flycatchers (Tyrannidae), and seedeaters (Emberizinae). It should be noted that the geographic scope of research in this volume is limited to birds that breed in the temperate regions of North, Central, and South America.

In North America, the geographic separation between arctic/alpine and temperate breeders largely disappears in the nonbreeding season. Although a few species such as ptarmigan are largely resident, many arctic/alpine species migrate medium to long distances and can be found wintering with temperate grassland breeding birds. A few arctic breeders, such as American Golden-Plovers (*Pluvialis dominicus*) and Eskimo Curlews (*Numenius borealis*), join more temperate breeders such as Upland Sandpipers (*Bartramia longicauda*) and Bobolinks (*Dolichonyx oryzivorus*) to winter on the pampas in Argentina and southern Brazil.

LOSS OF GRASSLAND HABITAT

Since the early 1800s, most grassland ecosystems in North America have been profoundly

altered by agricultural activities, and many are now among the continent's most endangered ecosystems (Table 5; Noss et al. 1995). In most areas, habitat loss has exceeded 80% (Samson and Knopf 1994, Noss et al. 1995), and where soil and topography are well suited for crops, less than 0.1% of native prairie remains (Samson and Knopf 1994). Since 1850, for example, the decline of tallgrass prairie (estimated to be 88–99%) exceeds that reported for any other major ecosystem in North America (Samson and Knopf 1994, Noss et al. 1995). Similarly, in Florida only 19% of the original palmetto dry prairie remains, with most of this habitat having been converted to citrus groves and improved cattle pastures since about 1950 (Shriver and Vickery 1999).

Native temperate grasslands in the Western Hemisphere have experienced major, sometimes profound, losses from agriculture, range management, and urban development. Some grassland species, however, notably Picazuro Pigeon (*Columba picazuro*), Spot-winged Pigeon (*C. maculosa*), Eared Dove (*Zenaida auriculata*), Grasshopper Sparrow, Dickcissel (*Spiza americana*), Bobolink, and meadowlarks have adapted successfully to these modified landscapes (Graber and Graber 1963, Bucher and Nores 1988, Rodenhouse et al. 1995, O'Connor et al. 1999). In the midwestern United States, agricultural lands have provided adequate breeding habitat for many species, but in the past 50 yr conversion of pastures and hayfields into rowcrops (e.g., corn [*Zea mays*] and soybeans [*Glycine max*]) and shortened cutting rotations of hay have made much of this habitat unsuitable and have become major threats to grassland bird populations (Herkert 1991, 1997; Warner 1994; Herkert et al. 1996).

In Canada, approximately 25% of native grasses remain, but losses continue; 570,000 ha, or approximately 6% of what remained, were lost between 1991 and 1996 (Statistics Canada 1997). Southeastern Alberta and southwestern Saskatchewan contain much of the remaining native prairie, and several grassland bird species, among them Baird's Sparrow and Sprague's Pipit, are abundant there (Price et al. 1995). Grazing pressure has generally increased on remaining native grasslands (Gayton 1991).

In South America, modernization and mechanical changes in agricultural practices have had similarly adverse effects on breeding birds (Bucher and Nores 1988, Cavalcanti 1999b, Tubaro and Gabelli 1999). Horses and cattle were introduced to the Pampas in 1535, and by 1750 feral populations were so common that they supported a growing industry of exporting hides. The effects of grazing and burning to improve pastures and to deter aboriginal Indians transformed the Pampas and were commented on by Darwin (1876). The most profound changes, however, occurred after 1890 with the expansion of agriculture in South America. During the first quarter of the twentieth century, the negative effect of agriculture on grassland species such as the Strange-tailed Tyrant (*Alectrurus risora*) became evident (Wilson 1926). Since 1970, increased use of agrochemicals and technology has contributed to the intensive use of grasslands. In the northern Pampas, silviculture is also reducing grassland area.

In Brazil, more than 50% of the Cerrado has been converted for human uses since 1950 (Silva 1995), and today the region is seen as a promising area for "carbon bank" mitigation (planting trees to absorb and convert carbon dioxide) against deforestation in Amazonia (Cavalcanti 1999a). The trend in the Cerrado is an ever-growing rate of destruction of natural habitats. Recent estimates indicate that approximately 75% of this biome can be converted to pastures and agriculture fields to produce about 100 million ton of crops and meat annually (Macedo 1994). An analysis of satellite images from 1987 to 1993 covering the entire Cerrado region showed that 67% of the land surface (excluding non-Cerrado habitats) was in a disturbed or highly disturbed condition as a result of human activity (Mantovani and Pereira 1998).

In the Pampas, less than 5% of the land was used for agriculture in 1890, but in high, mesic areas that figure is now greater than 50%. In the more arid and lowland areas of the Pampas, tillage agriculture represents less than 10% of the land use, but cattle grazing over seeded or natural pastures is widespread (Leon et al. 1984).

It is clear that similar rates of habitat loss have taken place elsewhere in Central and South America, from northern Mexico (Manzano-Fischer et al. 1999) to Argentina (Collar et al. 1992, Dinerstein et al. 1995, Tubaro and Gabelli 1999). It is distressing that conversion of native grasslands for agricultural purposes in South America has been "so utterly neglected as an international conservation issue" (Collar et al. 1992:35). In Brazil, remnants of native grassland are now largely restricted to national parks (Collar et al. 1992). In Argentina, there is no national park protecting a representative sample of pampas (Burkart and Valle Ruiz 1994). Moreover, a recent attempt to create a national park in the Pampas failed because the landowner plowed and destroyed the grassland on his hacienda when he realized the government was considering appropriating the area (P. Tubaro, pers. comm.). The most acutely imperiled grasslands in Central and South America are the Cerrado,

TABLE 1. OBLIGATE GRASSLAND BIRDS OF NORTH AMERICA, MEXICO, AND THE CARIBBEAN

Family		Breeding distribution			
		Arctic/ alpine	Temperate	Sub- tropical/ Mexico	Caribbean
Hawks	Accipitridae				
Northern Harrier	*Circus cyaneus*	√	√		
Swainson's Hawk	*Buteo swainsoni*		√	√	
Ferruginous Hawk	*Buteo regalis*		√		
Rough-legged Hawk	*Buteo lagopus*	√	√		
Falcons	Falconidae				
Aplomado Falcon	*Falco femoralis*			√	
Partridge, grouse, Old World quail	Phasianidae				
Rock Ptarmigan	*Lagopus mutus*	√			
White-tailed Ptarmigan	*Lagopus leucurus*	√			
Sharp-tailed Grouse	*Tympanuchus phasianellus*		√		
Greater Prairie-Chicken	*Tympanuchus cupido*		√		
Lesser Prairie-Chicken	*Tympanuchus pallidicinctus*		√		
New World quail	Odontophoridae				
Montezuma Quail	*Cyrtonyx montezumae*			√	
Ocellated Quail	*Cyrtonyx ocellatus*			√	
Stone curlews	Burhinidae				
Double-striped Thick-knee	*Burhinus bistriatus*			√	
Plovers, lapwings	Charadriidae				
American Golden-Plover	*Pluvialis dominica*	√			
Pacific Golden-Plover	*Pluvialis fulva*	√			
Mountain Plover	*Charadrius montanus*		√		
Shorebirds	Scolopacidae				
Upland Sandpiper	*Bartramia longicauda*	√	√		
Eskimo Curlew*	*Numenius borealis*	√			
Bristle-thighed Curlew	*Numenius tahitiensis*	√			
Long-billed Curlew	*Numenius americanus*		√		
Marbled Godwit	*Limosa fedoa*		√		
Baird's Sandpiper	*Calidris bairdii*	√			
Buff-breasted Sandpiper	*Tryngites subruficollis*	√			
Gulls, jaegers	Laridae				
Pomarine Jaeger	*Stercorarius pomarinus*	√			
Parasitic Jaeger	*Stercorarius parasiticus*	√			
Long-tailed Jaeger	*Stercorarius longicaudus*	√			
Owls	Strigidae				
Snowy Owl	*Nyctea scandiaca*	√			
Burrowing Owl	*Athene cunicularia*		√	√	√
Long-eared Owl	*Asio otus*		√	√	
Short-eared Owl	*Asio flammeus*	√	√		√
Larks	Alaudidae				
Horned Lark	*Eremophila alpestris*	√	√	√	
Wrens	Troglodytidae				
Sedge Wren	*Cistothorus platensis*		√	√	
Pipits	Motacillidae				
American Pipit	*Anthus rubescens*	√	√		
Sprague's Pipit	*Anthus spragueii*		√		
Emberizids	Emberizidae				
Ruddy-breasted Seedeater	*Sporophila minuta*			√	
Saffron Finch	*Sicalis flaveola*				√
Grassland Yellow-Finch	*Sicalis luteola*			√	√

TABLE 1. CONTINUED

Family		Breeding distribution			
		Arctic/ alpine	Temperate	Sub- tropical/ Mexico	Caribbean
Cassin's Sparrow	*Aimophila cassinii*			√	
Bachman's Sparrow	*Aimophila aestivalis*		√		
Botteri's Sparrow	*Aimophila botterii*			√	
Striped Sparrow**	*Oriturus superciliosus*			√	
Vesper Sparrow	*Pooecetes gramineus*		√		
Lark Bunting	*Calamospiza melanocorys*		√		
Savannah Sparrow	*Passerculus sandwichensis*	√	√	√	
Grasshopper Sparrow	*Ammodramus savannarum*		√	√	√
Baird's Sparrow	*Ammodramus bairdii*		√		
Henslow's Sparrow	*Ammodramus henslowii*		√		
Le Conte's Sparrow	*Ammodramus leconteii*		√		
Sierra Madre Sparrow**	*Xenospiza baileyi*			√	
McCown's Longspur	*Calcarius mccownii*		√		
Lapland Longspur	*Calcarius lapponicus*	√			
Smith's Longspur	*Calcarius pictus*	√			
Chestnut-collared Longspur	*Calcarius ornatus*		√		
Snow Bunting	*Plectrophenax nivalis*	√			
McKay's Bunting	*Plectrophenax hyperboreus*	√			
Cardinals and allies	Cardinalidae				
Dickcissel	*Spiza americana*		√		
Meadowlarks, blackbirds	Icteridae				
Bobolink	*Dolichonyx oryzivorus*		√		
Eastern Meadowlark	*Sturnella magna*		√	√	√
Western Meadowlark	*Sturnella neglecta*		√	√	

Note: This list was derived from numerous sources, including Bond 1971; Johnsgard 1981; Hayman et al. 1986; Raffaele 1989; Howell and Webb 1995; AOU 1998; and J. L. Dunn, pers. comm.
* Possibly extinct.
** Autecology poorly known.

chaco savannas, Pampas, and Beni savannas (Bolivia), and more regionally, the savannas near Veracruz and Tehuantepec, Mexico (Dinerstein et al. 1995).

Although habitat loss is frequently viewed primarily as conversion to cropland or other uses, it also includes more subtle forms of degradation, among them unnatural grazing regimes, planting of exotic grasses, and succession to shrublands (Vickery et al. in press). In Patagonia, overgrazing by sheep has degraded tallgrass habitats (Fjeldså 1988), and in the western pampas of Argentina it is contributing to the spread of chañar trees (*Geoffroea decorticans*; Anderson 1977). In North America, shortgrass prairie is adapted to intensive grazing by native herbivores, but contemporary cattle management emphasizes rotations that maintain moderate ground cover, which is less suitable for some rare species such as Mountain Plover (Knopf and Rupert 1999).

THE IMPETUS FOR GRASSLAND BIRD AND HABITAT CONSERVATION

Habitat loss and degradation have been the two most important factors influencing the decline of grassland birds in North and South America (Collar et al. 1992, Knopf 1994, Herkert et al. 1996, Stotz et al. 1996, Vickery et al. in press). In South America, excessive hunting and illegal trapping have also contributed to some grassland bird declines (Bucher and Nores 1988, Collar et al. 1992, Fraga et al. 1998).

In North America, most grassland bird populations have been declining for half a century (Askins 1993, Peterjohn and Sauer 1999). Populations of at least 13 grassland species declined significantly between 1966 and 1996, whereas populations of only 3 species are known to have increased during that period (Peterjohn and Sauer 1999). There is additional concern because these declines have prevailed across much of the continent. It is unlikely that there is a single underlying cause of these declines; instead, multiple causes are probably responsible. It is clear, however, that these declines are not local, isolated phenomena (Peterjohn and Sauer 1999).

Similar declines have taken place throughout South America, especially in lowland grasslands (Bucher and Nores 1988, Fjeldså 1988, Caval-

TABLE 2. FACULTATIVE GRASSLAND BIRDS OF NORTH AMERICA, MEXICO, AND THE CARIBBEAN

Family		Breeding distribution			
		Arctic/ alpine	Temperate	Sub-tropical/ Mexico	Caribbean
Herons	Ardeidae				
American Bittern	*Botaurus lentiginosus*		√		
Cattle Egret	*Bubulcus ibis*		√	√	√
Storks	Ciconiidae				
Jabiru	*Jabiru mycteria*			√	
New World vultures	Cathartidae				
Turkey Vulture	*Cathartes aura*		√	√	√
Lesser Yellow-headed Vulture	*Cathartes burrovianus*			√	
Waterfowl	Anatidae				
Greater White-fronted Goose	*Anser albifrons*	√			
Emperor Goose	*Chen canagica*	√			
Snow Goose	*Chen caerulescens*	√			
Ross's Goose	*Chen rossii*	√			
Canada Goose	*Branta canadensis*	√	√		
Brant	*Branta bernicla*	√			
Gadwall	*Anas strepera*		√		
American Wigeon	*Anas americana*		√		
Mallard	*Anas platyrhynchos*		√		
Blue-winged Teal	*Anas discors*		√		
Northern Shoveler	*Anas clypeata*		√		
Northern Pintail	*Anas acuta*		√		
Green-winged Teal	*Anas crecca*	√	√		
Falcons	Falconidae				
Crested Caracara	*Carcara plancus*			√	√
American Kestrel	*Falco sparverius*		√	√	√
Merlin	*Falco columbarius*	√	√		
Gyrfalcon	*Falco rusticolus*	√			
Peregrine Falcon	*Falco peregrinus*	√	√	√	
Prairie Falcon	*Falco mexicanus*		√	√	
Partridge, grouse, Old World quail	Phasianidae				
Gray Partridge*	*Perdix perdix*		√		
Ring-necked Pheasant*	*Phasianus colchicus*		√		
Willow Ptarmigan	*Lagopus lagopus*	√	√		
New World quail	Odontophoridae				
Scaled Quail	*Callipepla squamata*			√	
Elegant Quail	*Callipepla douglasii*			√	
Northern Bobwhite	*Colinus virginianus*		√	√	√*
Black-throated Bobwhite	*Colinus nigrogularis*			√	
Crested Bobwhite	*Colinus cristatus*			√	
Rails	Rallidae				
Yellow Rail	*Coturnicops noveboracensis*		√		
Cranes	Gruidae				
Sandhill Crane	*Grus canadensis*	√	√		√
Whooping Crane	*Grus americana*		√		
Plovers, lapwings	Charadriidae				
Black-bellied Plover	*Pluvialis squatarola*	√			
Killdeer	*Charadrius vociferus*		√		√
Shorebirds	Scolopacidae				
Lesser Yellowlegs	*Tringa flavipes*		√		
Willet	*Catoptrophorus semipalmatus*		√		
Whimbrel	*Numenius phaeopus*	√			

TABLE 2. CONTINUED

Family		Breeding distribution			
		Arctic/ alpine	Temperate	Sub- tropical/ Mexico	Caribbean
Hudsonian Godwit	*Limosa haemastica*	√			
Surfbird	*Aphriza virgata*	√			
Red Knot	*Calidris canutus*	√			
Sanderling	*Calidris alba*	√			
Semipalmated Sandpiper	*Calidris pusilla*	√			
Western Sandpiper	*Calidris mauri*	√			
Least Sandpiper	*Calidris minutilla*	√	√		
White-rumped Sandpiper	*Calidris fuscicollis*	√			
Pectoral Sandpiper	*Calidris melanotos*	√			
Purple Sandpiper	*Calidris maritima*	√			
Rock Sandpiper	*Calidris ptilocnemis*	√			
Dunlin	*Calidris alpina*	√			
Short-billed Dowitcher	*Limnodromus griseus*	√			
Long-billed Dowitcher	*Limnodromus scolopaceus*	√			
Common Snipe	*Gallinago gallinago*	√	√		√
Wilson's Phalarope	*Phalaropus tricolor*		√		
Gulls	Laridae				
Franklin's Gull	*Larus pipixcan*		√		
Doves	Columbidae				
Mourning Dove	*Zenaida macroura*		√		√
Common Ground-Dove	*Columbina passerina*			√	√
Barn Owls	Tytonidae				
Barn Owl	*Tyto alba*		√	√	√
Owls	Strigidae				
Striped Owl	*Pseudoscops clamator*			√	
Goatsuckers	Caprimulgidae				
Lesser Nighthawk	*Chordeiles acutipennis*			√	
Common Nighthawk	*Chordeiles minor*		√	√	
Common Poorwill	*Phalaenoptilus nuttallii*		√	√	
Tyrant flycatchers	Tyrannidae				
Say's Phoebe	*Sayornis saya*	√	√	√	
Ash-throated Flycatcher	*Myiarchus cinerascens*		√	√	
Cassin's Kingbird	*Tyrannus vociferans*		√	√	
Western Kingbird	*Tyrannus verticalis*		√	√	
Eastern Kingbird	*Tyrannus tyrannus*		√		
Scissor-tailed Flycatcher	*Tyrannus forficatus*		√	√	
Fork-tailed Flycatcher	*Tyrannus savana*			√	
Shrikes	Laniidae				
Loggerhead Shrike	*Lanius ludovicianus*		√	√	
Northern Shrike	*Lanius excubitor*	√	√		
Crows, jays	Corvidae				
Chihuahuan Raven	*Corvus cryptoleucus*		√	√	
Thrushes	Turdidae				
Eastern Bluebird	*Sialia sialis*		√	√	
Western Bluebird	*Sialia mexicana*		√	√	
Mountain Bluebird	*Sialia currucoides*		√		
Thrashers	Mimidae				
Bendire's Thrasher	*Toxostoma bendirei*			√	
Wood-Warblers	Parulidae				
Common Yellowthroat	*Geothlypis trichas*		√	√	

TABLE 2. CONTINUED

Family		Breeding distribution			
		Arctic/ alpine	Temperate	Sub- tropical/ Mexico	Caribbean
Emberizids	Emberizidae				
Blue-black Grassquit	*Volatinia jacarina*			√	√
Yellow-bellied Seedeater	*Sporophila nigricollis*				√
Yellow-faced Grassquit	*Tiaris olivacea*			√	√
Canyon Towhee	*Pipilo fuscus*		√	√	
Rufous-winged Sparrow	*Aimophila carpalis*		√	√	
Rufous-crowned Sparrow	*Aimophila ruficeps*		√	√	
Oaxaca Sparrow**	*Aimophila notosticta*			√	
Clay-colored Sparrow	*Spizella pallida*		√		
Worthen's Sparrow**	*Spizella wortheni*			√	
Lark Sparrow	*Chondestes grammacus*		√	√	
Meadowlarks, blackbirds	Icteridae				
Red-winged Blackbird	*Agelaius phoeniceus*		√	√	√
Brewer's Blackbird	*Euphagus cyanocephalus*		√		
Shiny Cowbird	*Molothrus bonariensis*				√
Bronzed Cowbird	*Molothrus aeneus*		√	√	
Brown-headed Cowbird	*Molothrus ater*		√	√	
Finches	Fringillidae				
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	√			
Black Rosy-Finch	*Leucosticte atrata*	√			
Brown-capped Rosy-Finch	*Leucosticte australis*	√			

Note: This list was derived from numerous sources, including Bond 1971; Johnsgard 1981; Hayman et al. 1986; Raffaele 1989; Howell and Webb 1995; AOU 1998; and J. L. Dunn, pers. comm.

* Introduced.

** Autoecology poorly known.

canti 1999a, Tubaro and Gabelli 1999). According to Wege and Long (1995), 12% of the Neotropic's threatened bird species live in grasslands and savannas. At least 34% of the grassland bird species rank as high conservation priorities, and 80% of the campos grassland birds are at risk (Stotz et al. 1996).

CONSERVATION STRATEGIES

People involved in grassland bird conservation efforts need to recognize the historical dynamics under which these unique habitats evolved. Where feasible, management should incorporate the ecological processes that have generated and maintained these distinctive ecosystems. The timing, intensity, and seasonality of grazing, fire, and other disturbances on grassland conservation areas should mimic natural processes as closely as possible. This is important for many of the plants and animals that occur in these unique habitats. In North America, for example, intensive grazing by native herbivores such as prairie dogs (*Cynomys* spp.), bison (*Bison bison*), and pronghorn (*Antilocapra americana*) was one of the major ecological forces that shaped and maintained shortgrass prairies (Vickery et al. in press). Fires, ignited both naturally and by Native Americans, were primarily responsible for maintaining tallgrass prairies in the Midwest and native grasslands in the Northeast. In Florida, lightning was the primary disturbance that helped maintain prairie habitat. Prescribed fires have generally been conducted in winter, however, whereas natural fires burn primarily in summer—and research has demonstrated that at least two species of grassland birds, Florida Grasshopper and Bachman's sparrows, generally prolong their breeding activities after summer burns (Shriver et al. 1996). In central Brazil, Parker and Willis (1997) reported that several grassland birds shift their habitats every few years in response to local fires: tallgrass species (e.g., Sharp-tailed Grass-Tyrant [*Culcivora caudacuta*] and Bearded Tachuri [*Polystictus pectoralis*]) move to older grasslands, whereas birds that prefer sparser cover (e.g., Coal-crested Finch [*Charitospiza eucosma*] and Campo Miner [*Geobates poecilopterus*]) shift to newly burned sites. Large or connected areas are needed to provide both types of habitats; small reserves protected from fire turn to scrub, whereas annually burned ranches support few species (Parker and Willis 1997).

It is especially important that small individual sites (< 500 ha) not be managed for the greatest diversity of grassland bird species. Management

TABLE 3. PRELIMINARY LIST OF OBLIGATE GRASSLAND BIRDS OF SOUTH AMERICA

	Family
Rheas	Rheidae
Lesser Rhea	*Rhea pennata*
Tinamous	Tinamidae
Red-winged Tinamou	*Rhynchotus rufescens*
Huayco Tinamou	*Rhynchotos maculicollis*
Darwin's Nothura	*Nothura darwinii*
Spotted Nothura	*Nothura maculosa*
Lesser Nothura	*Nothura minor*
Dwarf Tinamou	*Taoniscus nanus*
Waterfowl	Anatidae
Andean Goose	*Chloephaga melanoptera*
Ruddy-headed Goose	*Chloephaga rubidiceps*
Hawks	Accipitridae
Swainson's Hawk	*Buteo swainsoni*
Falcons	Falconidae
Carunculated Caracara	*Phalcoboenus carunculatus*
Mountain Caracara	*Phalcoboenus megalopterus*
White-throated Caracara	*Phalcoboenus albogularis*
Striated Caracara	*Phalcoboenus australis*
Aplomado Falcon	*Falco femoralis*
Stone curlews	Burhinidae
Double-striped Thick-knee	*Burhinus bistriatus*
Plovers, lapwings	Charadriidae
Southern Lapwing	*Vanellus chilensis*
Andean Lapwing	*Vanellus resplendens*
Rufous-chested Plover	*Charadrius modestus*
Tawny-throated Dotterel	*Eudromias ruficollis*
Diademed Sandpiper-Plover	*Phegornis mitchellii*
Seedsnipes	Thinocoridae
Rufous-bellied Seedsnipe	*Attagis gayi*
White-bellied Seedsnipe	*Attagis malouinus*
Grey-breasted Seedsnipe	*Thinocorus orbignyianus*
Shorebirds	Scolopacidae
Upland Sandpiper	*Bartramia longicauda*
Eskimo Curlew	*Numenius borealis*
Buff-breasted Sandpiper	*Tryngites subruficollis*
South American Snipe	*Gallinago paraguaiae*
Puna Snipe	*Gallinago andina*
Giant Snipe	*Gallinago undulata*
Andean Snipe	*Gallinago jamesoni*
Doves	Columbidae
Blue-eyed Ground-Dove	*Columbina cyanopis*
Black-winged Ground-Dove	*Metriopelia melanoptera*
Golden-spotted Ground-Dove	*Metriopelia aymara*
Owls	Strigidae
Burrowing Owl	*Athene cunicularia*
Short-eared Owl	*Asio flammeus*
Goatsuckers	Caprimulgidae
Least Nighthawk	*Chordeiles pusillus*
Lesser Nighthawk	*Chordeiles acutipennis*
Band-winged Nightjar	*Caprimulgus longirostris*
White-tailed Nightjar	*Caprimulgus cayennensis*
White-winged Nightjar	*Caprimulgus candicans*
Spot-tailed Nightjar	*Caprimulgus maculicaudus*

TABLE 3. CONTINUED

	Family
Hummingbirds	Trochilidae
White-tailed Goldenthroat	*Polytmus guainumbi*
Tepui Goldenthroat	*Polytmus milleri*
Ecuadorian Hillstar	*Oreotrochilus chimborazo*
Andean Hillstar	*Oreotrochilus estella*
White-sided Hillstar	*Oreotrochilus leucopleurus*
Black-breasted Hillstar	*Oreotrochilus melanogaster*
Olivaceous Thornbill	*Chalcostigma olivaceum*
Blue-mantled Thornbill	*Chalcostigma stanleyi*
Bronze-tailed Thornbill	*Chalcostigma heteropogon*
Rainbow-bearded Thornbill	*Chalcostigma herrani*
Bearded Helmetcrest	*Oxypogon guerinii*
Hooded Visorbearer	*Augastes lumachellus*
Hyacinth Visorbearer	*Augastes scutatus*
Horned Sungem	*Heliactin cornuta*
Ovenbirds	Furnariidae
Campo Miner	*Geobates poecilopterus*
Common Miner	*Geositta cunicularia*
Puna Miner	*Geositta punensis*
Dark-winged Miner	*Geositta saxicolina*
Creamy-rumped Miner	*Geositta isabellina*
Short-billed Miner	*Geositta antarctica*
Rufous-banded Miner	*Geositta rufipennis*
Slender-billed Miner	*Geositta tenuirostris*
Cipo Canastero	*Asthenes luizae*
Austral Canastero	*Asthenes anthoides*
Junin Canastero	*Asthenes virgata*
Scribble-tailed Canastero	*Asthenes maculicauda*
Straight-billed Reedhaunter	*Limnornis rectirostris*
Tapaculos	Rhinocryptidae
Varzea Tapaculo	*Scytalopus iraiensis*
Tyrant flycatchers	Tyrannidae
Sharp-tailed Grass-Tyrant	*Culicivora caudacuta*
Bearded Tachuri	*Polystictus pectoralis*
Cock-tailed Tyrant	*Alectrurus tricolor*
Fork-tailed Flycatcher	*Tyrannus savana*
Larks	Alaudidae
Horned Lark	*Eremophila alpestris*
Wrens	Troglodytidae
Sedge Wren	*Cistothorus platensis*
Merida Wren	*Cistothorus meridae*
Pipits	Motacillidae
Correndera Pipit	*Anthus correndera*
South Georgia Pipit	*Anthus antarcticus*
Short-billed Pipit	*Anthus furcatus*
Hellmayr's Pipit	*Anthus hellmayri*
Paramo Pipit	*Anthus bogotensis*
Yellowish Pipit	*Anthus lutescens*
Chaco Pipit	*Anthus chacoensis*
Ochre-breasted Pipit	*Anthus nattereri*
Emberizids	Emberizidae
Grasshopper Sparrow	*Ammodramus savannarum*
Grassland Sparrow	*Ammodramus humeralis*
Black-masked Finch	*Coryphaspiza melanotis*
Plumbeous Sierra-Finch	*Phrygilus unicolor*
Red-backed Sierra-Finch	*Phrygilus dorsalis*
White-throated Sierra-Finch	*Phrygilus erythronotos*

TABLE 3. CONTINUED

Family	
Canary-winged Finch	*Melanodera melanodera*
White-winged Diuca-Finch	*Diuca speculifera*
Short-tailed Finch	*Idiospar brachyurus*
Puna Yellow-Finch	*Sicalis lutea*
Bright-rumped Yellow-Finch	*Sicalis uropygialis*
Greater Yellow-Finch	*Sicalis auriventris*
Patagonian Yellow-Finch	*Sicalis lebruni*
Grassland Yellow-Finch	*Sicalis luteola*
Wedge-tailed Grass-Finch	*Emberizoides herbicola*
Duida Grass-Finch	*Emberizoides duidae*
Lesser Grass-Finch	*Emberizoides ypiranganus*
Great Pampa-Finch	*Embernagra platensis*
Plumbeous Seedeater	*Sporophila plumbea*
Capped Seedeater	*Sporophila bouvreuil*
Ruddy-breasted Seedeater	*Sporophila minuta*
Tawny-bellied Seedeater	*Sporophila hypoxantha*
Dark-throated Seedeater	*Sporophila ruficollis*
Marsh Seedeater	*Sporophila palustris*
Rufous-rumped Seedeater	*Sporophila hypochroma*
Chestnut Seedeater	*Sporophila cinnamonea*
Narosky's Seedeater	*Sporophila zelichi*
Black-bellied Seedeater	*Sporophila melanogaster*
Blue Finch	*Porphyrospiza caerulescens*
Cardinals and allies	Cardinalidae
Dickcissel	*Spiza americana*
Meadowlarks, blackbirds	Icteridae
Bobolink	*Dolichonyx oryzivorus*
Saffron-cowled Blackbird	*Agelaius flavus*
White-browed Blackbird	*Sturnella superciliaris*
Peruvian Meadowlark	*Sturnella bellicosa*
Red-breasted Blackbird	*Sturnella militaris*
Pampas Meadowlark	*Sturnella defilippii*
Long-tailed Meadowlark	*Sturnella loyca*
Eastern Meadowlark	*Sturnella magna*
Yellow-rumped Marshbird	*Pseudoleistes guirahuro*

Note: This list was derived primarily from the following sources: Hayman et al. 1986; Ridgely and Tudor 1989; Stotz et al. 1996; and R. S. Ridgely, pers. comm.

for enhanced alpha diversity is neither necessary nor practical and is likely to be counterproductive to regional conservation goals (Vickery et al. in press). It is important to recognize that certain sites are usually best suited to management for a particular subset of grassland birds. Sedge meadows, for example, are better suited to management for Sedge Wrens and Le Conte's Sparrows than to a full range of grassland species (Herkert et al. 1993, Sample and Mossman 1997, Vickery et al. in press).

REGIONAL CONSERVATION PLANNING

To be effective, grassland habitat conservation planning and action must be conducted within a large regional context. Although conservation action and management usually take place on a local scale at specific sites, cooperative management on a landscape or regional level makes it possible to address the complete range of habitat needs required by different species, including rare and endangered species, and to minimize the risks of stochastic catastrophic events. In Florida, extensive research on and management of the endangered Florida Grasshopper Sparrow have been site specific but have not yet incorporated landscape planning or conservation action. Despite intensive site management, populations of this endemic sparrow are declining, in part because of the absence of a broader geographic framework (Shriver and Vickery 1999).

Regional grassland habitat and bird management plans are developing in many parts of North America and are becoming established in parts of South America. These broad initiatives provide the best opportunities for grassland bird and ecosystem conservation.

Partners in Flight, an international effort to

TABLE 4. PRELIMARY LIST OF FACULTATIVE GRASSLAND BIRDS OF SOUTH AMERICA

Family	
Rheas	Rheidae
Greater Rhea	*Rhea americana*
Tinamous	Tinamidae
Small-billed Tinamou	*Crypturellus parvirostris*
Ornate Tinamou	*Nothoprocta ornata*
Andean Tinamou	*Nothoprocta pentlandii*
Curve-billed Tinamou	*Nothoprocta curvirostris*
Elegant Crested-Tinamou	*Eudromia elegans*
Quebracho Crested-Tinamou	*Eudromia formosa*
Puna Tinamou	*Tinamotis pentlandii*
Patagonian Tinamou	*Tinamotis ingoufi*
Herons	Ardeidae
Whistling Heron	*Syrigma sibilatrix*
Cattle Egret	*Bubulcus ibis*
Ibis	Threskiornithidae
Plumbeous Ibis	*Theristicus caerulescens*
Buff-necked Ibis	*Theristicus caudatus*
Black-faced Ibis	*Theristicus melanopis*
Storks	Ciconiidae
Wood Stork	*Mycteria americana*
Maguari Stork	*Ciconia maguari*
Jabiru	*Jabiru mycteria*
New World vultures	Cathartidae
Black Vulture	*Coragyps atratus*
Turkey Vulture	*Cathartes aura*
Lesser Yellow-headed Vulture	*Cathartes burrovianus*
Andean Condor	*Vultur gryphus*
Waterfowl	Anatidae
Upland Goose	*Chloephaga picta*
Ashy-headed Goose	*Chloephaga poliocephala*
Hawks	Accipitridae
Pearl Kite	*Gampsonyx swainsonii*
White-tailed Kite	*Elanus leucurus*
Long-winged Harrier	*Circus buffoni*
Northern Harrier	*Circus cyaneus*
Cinereus Harrier	*Circus cinereus*
Savanna Hawk	*Buteogallus meriodionalis*
Harris's Hawk	*Parabuteo unicinctus*
Black-chested Buzzard-Eagle	*Geranoaetus melanoleucus*
Crowned Eagle	*Harpyhaliaetus coronatus*
White-tailed Hawk	*Buteo albicaudatus*
Variable Hawk	*Buteo polyosoma*
Falcons	Falconidae
Crested Caracara	*Caracara plancus*
Yellow-headed Caracara	*Milvago chimachima*
Chimango Caracara	*Milvago chimango*
Spot-winged Falconet	*Spiziapteryx circumcinctus*
Seriemas	Cariamidae
Red-legged Seriema	*Cariama cristata*
Black-legged Seriema	*Chunga burmeisteri*
Stone curlews	Burhinidae
Peruvian Thick-knee	*Burhinus supercilaris*
Seedsnipes	Thinocoridae
Least Seedsnipe	*Thinocorus rumicivorus*

TABLE 4. CONTINUED

Family	
Shorebirds	Scolopacidae
Hudsonian Godwit	*Limosa haemastica*
Baird's Sandpiper	*Calidris bairdii*
Fuegian Snipe	*Gallinago stricklandii*
Doves	Columbidae
Picazuro Pigeon	*Columba picazuro*
Spot-winged Pigeon	*Columba maculosa*
Eared Dove	*Zenaida auriculata*
Common Ground-Dove	*Columbina passerina*
Plain-breasted Ground-Dove	*Columbina minuta*
Ruddy Ground-Dove	*Columbina talpacoti*
Buckley's Ground-Dove	*Columbina buckleyi*
Picui Ground-Dove	*Columbina picui*
Bare-faced Ground-Dove	*Metriopelia ciciliae*
Moreno's Ground-Dove	*Metriopelia morenoi*
Long-tailed Ground-Dove	*Uropelia campestris*
Scaly Dove	*Scardafella squammata*
Parrots	Psittacidae
Burrowing Parakeet	*Cyanoliseus patagonus*
Monk Parakeet	*Myiopsitta monachus*
Green-rumped Parrotlet	*Forpus passerinus*
Cuckoos	Cuculidae
Striped Cuckoo	*Tapera naevia*
Smooth-billed Ani	*Crotophaga ani*
Groove-billed Ani	*Crotophaga sulcirostris*
Barn Owls	Tytonidae
Barn Owl	*Tyto alba*
Owls	Strigidae
Striped Owl	*Rhinoptynx clamator*
Goatsuckers	Caprimulgidae
Nacunda Nighthawk	*Podager nacunda*
Scrub Nightjar	*Caprimulgus anthonyi*
Scissor-tailed Nightjar	*Hydropsalis brasiliana*
Hummingbirds	Trochilidae
Fiery-throated Hummingbird	*Panterpe insignis*
Green-tailed Goldenthroat	*Polytmus theresiae*
Woodpeckers	Picidae
Andean Flicker	*Colaptes rupicola*
Campo Flicker	*Colaptes campestris*
Ovenbirds	Furnariidae
Straight-billed Earthcreeper	*Upucerthia ruficauda*
Rock Earthcreeper	*Upucerthia andaecola*
Scale-throated Earthcreeper	*Upucerthia dumetaria*
Bar-winged Cinclodes	*Cinclodes fuscus*
Long-tailed Cinclodes	*Cinclodes pabsti*
Dark-bellied Cinclodes	*Cinclodes patagonicus*
White-winged Cinclodes	*Cinclodes atacamensis*
Rufous Hornero	*Furnarius rufus*
Pale-breasted Spinetail	*Synallaxis albescens*
Lesser Canastero	*Asthenes pyrrholeuca*
Cordilleran Canastero	*Asthenes modesta*
Streak-throated Canastero	*Asthenes humilis*
Streak-backed Canastero	*Asthenes wyatti*
Puna Canastero	*Asthenes sclateri*
Many-striped Canastero	*Asthenes flammulata*
Hudson's Canastero	*Asthenes hudsoni*
Firewood-gatherer	*Anumbius annumbi*

TABLE 4. CONTINUED

Family	
Tapaculos	Rhinocryptidae
Collared Crescent-chest	*Melanopareia torquata*
Tyrant flycatchers	Tyrannidae
Plain-crested Elaenia	*Elaenia cristata*
Rufous-crowned Elaenia	*Elaenia ruficeps*
Lesser Elaenia	*Elaenia chiriquensis*
Grey-backed Tachuri	*Polystictus superciliaris*
Rufous-sided Pygmy-Tyrant	*Euscarthmus rufomarginatus*
Grey Monjita	*Xolmis cinerea*
Black-crowned Monjita	*Xolmis coronata*
White-rumped Monjita	*Xolmis velata*
White Monjita	*Xolmis irupero*
Rusty-backed Monjita	*Xolmis rubetra*
Black-and-white Monjita	*Heteroxolmis dominicana*
Chocolate-vented Tyrant	*Neoxolmis rufiventris*
Black-billed Shrike-Tyrant	*Agriornis montana*
White-tailed Shrike-Tyrant	*Agriornis andicola*
Great Shrike-Tyrant	*Agriornis livida*
Grey-bellied Shrike-Tyrant	*Agriornis microptera*
Lesser Shrike-Tyrant	*Agriornis murina*
Spot-billed Ground-Tyrant	*Muscisaxicola maculirostris*
Dark-faced Ground-Tyrant	*Muscisaxicola macloviana*
Cinnamon-bellied Ground-Tyrant	*Muscisaxicola capistrata*
Rufous-naped Ground-Tyrant	*Muscisaxicola rufivertex*
Puna Ground-Tyrant	*Muscisaxicola juninensis*
White-browed Ground-Tyrant	*Muscisaxicola albilora*
Plain-capped Ground-Tyrant	*Muscisaxicola alpina*
Cinereous Ground-Tyrant	*Muscisaxicola cinerea*
White-fronted Ground-Tyrant	*Muscisaxicola albifrons*
Ochre-naped Ground-Tyrant	*Muscisaxicola flavinucha*
Black-fronted Ground-Tyrant	*Muscisaxicola frontalis*
Austral Negrito	*Lessonia rufa*
Spectacled Tyrant	*Hymenops perspicillatus*
Strange-tailed Tyrant	*Alectrurus risora*
Streamer-tailed Tyrant	*Gubernetes yetapa*
Cattle Tyrant	*Machetornis rixosus*
Crows, jays	Corvidae
White-necked Raven	*Corvus cryptoleucus*
Emberizids	Emberizidae
Rufous-collared Sparrow	*Zonotrichia capensis*
Yellow-browed Sparrow	*Ammodramus aurifrons*
Coal-crested Finch	*Charitospiza eucosma*
Many-colored Chaco-Finch	*Saltatricula multicolor*
Ash-breasted Sierra-Finch	*Phrygilus plebejus*
Carbonated Sierra-Finch	*Phrygilus carbonarius*
Yellow-bridled Finch	*Melanodera xanthogramma*
Long-tailed Reed-Finch	*Donacospiza albifrons*
Black-and-rufous Warbling-Finch	*Poospiza nigrorufa*
Stripe-tailed Yellow-Finch	*Sicalis citrina*
Pale-throated Serra-Finch	*Embernagra longicauda*
Blue-black Grassquit	*Volatinia jacarina*
Grey Seedeater	*Sporophila intermedia*
Variable Seedeater	*Sporophila corvina*
Caqueta Seedeater	*Sporophila murallae*
Wing-barred Seedeater	*Sporophila americana*
Rusty-collared Seedeater	*Sporophila collaris*
Lesson's Seedeater	*Sporophila bouvronides*
Lined Seedeater	*Sporophila lineola*
Black-and-white Seedeater	*Sporophila luctuosa*

TABLE 4. CONTINUED

Family	
Yellow-bellied Seedeater	*Sporophila nigricollis*
Double-collared Seedeater	*Sporophila caerulescens*
White-bellied Seedeater	*Sporophila leucoptera*
Chestnut-bellied Seedeater	*Sporophila castaneiventris*
Chestnut-throated Seedeater	*Sporophila telasco*
Large-billed Seed-Finch	*Oryzoborus crassirostris*
Great-billed Seed-Finch	*Oryzoborus maximiliana*
Lesser Seed-Finch	*Oryzoborus angolensis*
Band-tailed Seedeater	*Catamenia analis*
Plain-colored Seedeater	*Catamenia inornata*
Yellow-faced Grassquit	*Tiaris olivacea*
Black-faced Grassquit	*Tiaris bicolor*
Meadowlarks, blackbirds	Icteridae
Red-winged Blackbird	*Agelaius phoeniceus*
Yellow-hooded Blackbird	*Agelaius icterocephalus*
Brown-and-yellow Marshbird	*Pseudoleistes virescens*
Chopi Blackbird	*Gnorimopsar chopi*
Bay-winged Cowbird	*Molothrus badius*
Screaming Cowbird	*Molothrus rufoaxillaris*
Shiny Cowbird	*Molothrus bonariensis*
Bronzed Cowbird	*Molothrus aeneus*

Note: This list was derived primarily from the following sources: Hayman et al. 1986; Ridgely and Tudor 1989; Stotz et al. 1996; and R. S. Ridgely, pers. comm.

protect and enhance North American bird populations, is organized at state, regional, national, and international levels and provides an excellent, flexible structure for facilitating regional conservation efforts (Finch and Stangel 1992). For example, a Northeast Grassland Bird Working Group functions within the rubric of the Northeast Working Group. As a specialist group, the Northeast Grassland Bird Working Group facilitates communication, inventory, and planning across a 13-state region from Maine to Virginia. In 1997 this group was involved in a seven-state inventory of grassland birds, emphasizing regionally rare species such as Upland Sandpiper and Henslow's Sparrow (Shriver et al. 1997). Because Partners in Flight has been instrumental

TABLE 5. ESTIMATED HABITAT LOSS TO GRASSLAND ECOSYSTEMS IN THE UNITED STATES SINCE EUROPEAN SETTLEMENT

Ecosystem	Estimated loss (%)	Reference
Critically endangered ecosystems (> 98% habitat loss)[a]		
Tallgrass prairie east of Missouri River	> 99	Noss et al. 1995
Sedge meadows, Wisconsin	> 99	Reuter 1986
Black belt prairie, Alabama and Mississippi	> 99	Noss et al. 1995
Sandplain grassland, Long Island, NY	99.9	Niering 1992
Native prairie, Willamette Valley, OR	99.5	Ingersoll and Wilson 1991
Palouse prairie, Montana, Idaho, Oregon, and Washington	99.9	Noss et al. 1995
California grasslands, all types	99	Kreissman 1991
Ungrazed sagebrush steppe, Intermountain West	> 99	West 1995
Endangered ecosystems (80–98% habitat loss)		
Tallgrass prairie, all types combined	90	Madson 1990
Grassland shrubsteppe, Washington and Oregon	> 90	Noss et al. 1995
Shortgrass prairie, Montana	80–90	Chadde 1992
Shortgrass prairie, North Dakota	90	Madson 1989
Coastal heathland, s. New England and Long Island, NY	> 90	Noss et al. 1995
Sandplain grassland, New England	> 90	Noss et al. 1995
Palmetto dry prairie, Florida	81	Shriver and Vickery 1999

[a] Classification of critically endangered and endangered ecosystems adapted from Noss et al. 1995.

in bringing together multiple agencies, more than 30 collaborators and dozens of volunteers contributed to the grassland inventory, which censused nearly 1,100 sites (Shriver et al. 1997). More importantly, organizations and agencies in each of these states have become invested in the results of this regional effort. In New York, major breeding habitat for grassland birds has been included in the state's registry of important bird areas and has also received legislative protection (Wells 1998).

In the midwestern United States, a multistate plan for grassland bird conservation has developed a broad outline of the region's conservation priorities (Herkert et al. 1996). Within the region, more detailed state plans have been developed. In Wisconsin, for example, Sample and Mossman (1997) have produced a plan that describes goals and organizing principles of grassland bird management, including a detailed discussion of overall management philosophy; they also identify management priorities for both grassland birds and their habitats within this broad geographic area. The plan supplies detailed habitat management guidelines and management recommendations based on individual species' responses to specific management practices and identifies specific landscapes, sites, and properties worthy of special management attention. This type of specific targeting of conservation activities will undoubtedly result in on-the-ground management that is likely to benefit grassland birds in the target area.

In Canada, conservation of prairie grassland habitat and birds has been gaining momentum through the actions of many organizations since 1990. The scope of these partnerships and interactions has grown, culminating in the formation of provincial implementation groups for the Prairie Conservation Action Plan (PCAP) and the formation of provincial (Manitoba) and regional Partners in Flight-Canada groups. PIF-Canada sets general priorities based on trends and geographic responsibility (based on proportion of range) as set forth by Dunn 1997.

In most cases, Canadian prairie fragments in national and provincial parks, federal government bird sanctuaries, national wildlife areas (NWAs), military bases, Prairie Farm Rehabilitation Administration (PFRA) holdings, and federal and provincial crown grazing lands are secure. Examples of large blocks include Grasslands National Park, Saskatchewan (90,000 ha); Last Mountain Lake NWA, Saskatchewan (15,000 ha); and Canadian Forces Base Suffield, Alberta (270,000 ha). Large holdings include PFRA pastures (75 million ha) and Saskatchewan crown grazing lands (2.9 million ha).

Because there is presently no federal endangered species legislation in Canada, complementary provincial and federal legislation to designate species is being developed, with an emphasis on rewarding stewardship rather than punishing offenders. Efforts have centered around changing adverse government policy and working with agriculture to find "Best Management Practices" for conserving remaining native prairie and other grassland habitats. For example, the recent abolition of grain-shipping subsidies based on the number of hectares under cultivation has removed one incentive to plow native prairie.

Most farmland in Canada is privately owned, and conservation funding is limited. Identifying options that make it worthwhile for landowners to maintain native prairie or use bird-friendly cropping methods has thus proven to be the most effective and economical approach to conserving grassland habitats. Among such options are subsidy-based programs such as Agriculture Canada's Permanent Cover Program (PCP). Instituted in 1989, the PCP has converted 450,000 ha in poor soil classes to grass cover for 10 or more years. The payment to landowners covers some of the cost of seeding, and the landowner may use the land for haying or grazing so long as it is not broken. A recent study showed that many grassland obligates use PCP sites (McMaster and Davis 1998).

In Brazil, high-priority areas for biodiversity conservation in the Cerrado were identified in a 1998 workshop in which more than 200 scientists participated. The workshop was part of the Brazilian government's biome-level biodiversity program to establish biodiversity priorities in the country. Important criteria for designating sites included species richness, number of endemic species, presence of rare and/or endangered species, and sites of unique communities or key areas for migratory species. Eighty-seven priority areas were identified, 20 of which were recommended for reserve status because of their importance for birds (Silva 1998a). Priorities for conservation action for each of these areas were then determined by cross-referencing biodiversity data with data on human encroachment and land-cover changes (Cavalcanti 1999b).

In addition to creating new reserves in the Cerrado, new strategies must be adopted as soon as possible to minimize the impact of human activities on the biota of this region (Silva 1998b). The most pressing need is to provide the agricultural technology to help landowners increase productivity of lands already under cultivation. It is hoped that this will reduce the pressure on lands covered by natural vegetation. Macedo (1994) has suggested that by increasing productivity on lands already used for agricul-

ture in the Cerrado region, it would be possible to produce 100 millions tons of food annually, or enough to feed 250 million people. The second strategy is to establish legal mechanisms that would preclude the destruction of the biological resources of the Cerrado; as an example, new agriculture projects in areas covered by natural vegetation could be banned until their impacts on fauna and flora were rigorously assessed.

Hemispheric Conservation Planning

Since most grassland birds migrate between breeding and wintering areas, it is necessary to understand the habitat requirements and conservation needs in both these areas. In South America, some grassland species breeding in Tierra del Fuego and Patagonia winter in the southern Pampas. This is the case for Upland Goose (*Chloephaga picta*), Ashy-headed Goose (*C. poliocephala*), and the endangered continental race of Ruddy-headed Goose (*C. rubidiceps*). Other grassland species, such as seedeaters and some tyrant flycatchers, breed in the Pampas but winter in northern Argentina, Paraguay, and Brazil (Ridgely and Tudor 1989, Chesser 1994).

Although some species of North American grassland birds are long-distance neotropical migrants, most species migrate relatively short distances and winter primarily in the southern United States and northern Mexico. This provides conservation opportunities for species wintering in North America and Mexico but also underscores the need for coordinated research and conservation efforts across international borders (Hagan and Johnston 1992, Wilson and Sader 1993, Vickery et al. in press).

The habitat requirements of many species wintering in Central and South America are poorly understood. Recently there have been encouraging research and educational efforts in grassland habitats in Mexico (e.g., Colorado Bird Observatory 1996, Manzano-Fischer et al. 1999) and other parts of Central and South America. For example, the Canadian Wildlife Service's newly developed Latin American Program is working to train local avian biologists and build local capacity to study and protect migratory and resident birds (Hyslop 1996). The U.S. Fish and Wildlife Service is undertaking similar collaborative efforts. Additionally, private nonprofit conservation organizations such as The Nature Conservancy and BirdLife International have also developed international bird conservation programs. There are few efforts, however, directed exclusively toward grassland bird and habitat protection. Widespread efforts by farmers in Venezuela to reduce Dickcissel crop damage (Basili and Temple 1999) and the use of pesticides in Argentina that has killed many Swainson's Hawks (Krapovickas and de Perez 1997) clearly demonstrate the need for expanded international grassland bird research and conservation.

Changing agricultural practices in Argentina have profoundly reduced the amount of native grassland in that country, and the loss is seriously affecting populations of endemic grassland birds such as the Pampas Meadowlark (Tubaro and Gabelli 1999). This habitat change is likely to affect populations of nearctic breeders as well and may be particularly significant for long-distance migrants such as Swainson's Hawk, Eskimo Curlew, Upland Sandpiper, Buff-breasted Sandpiper (*Tryngites subruficollis*), and Bobolink, all of which winter in Argentina (Olrog 1984). Similar agricultural changes elsewhere in Central and South America will undoubtedly have consequences for both neotropical and nearctic grassland breeders.

The Western Hemisphere Shorebird Reserve Network (WHSRN), an international conservation network focused specifically on shorebirds (Bildstein et al. 1991), may provide an excellent model for international grassland bird conservation efforts. WHSRN has successfully collaborated with more than 120 other agencies, including the North American Waterfowl Management Plan and Partners in Flight, on international wetland and shorebird conservation issues and has helped protect more than 3.6 million ha of habitat in 7 countries (J. Corven, pers. comm.). For example, joint efforts by the Suriname Forest Service, Canadian Wildlife Service, and WHSRN have helped protect critical wintering habitat for Semipalmated Sandpipers (*Calidris pusilla*) in Suriname (J. Corven, pers. comm.).

Recognizing the rapid decline of many South American grassland birds, especially *Sporophila* seedeaters, Silva (1999) has suggested a system of reserves across South America that would protect a large majority of grassland endemics. Such planning, critical for the protection of endemic neotropical species, could be coupled with efforts to protect nearctic migrants such as Swainson's Hawks and Dickcissels, and thus to develop a comprehensive system for grassland bird protection throughout the Western Hemisphere. Although international efforts, initiated largely by the American Bird Conservancy, in Argentina in 1995 stopped or minimized incidental Swainson's Hawk mortality that resulted from insecticide use on agricultural fields, the absence of an established international network meant that emergency measures were required (Anonymous 1996, Krapovickas and de Perez 1997). It is hoped that an established international grassland bird network would anticipate

such a major crisis and thus minimize the need for such emergency actions. We hope that publication of this volume will facilitate such a network.

Seeking Common Ground

The effective management of grassland landscapes will require the involvement of a diverse group of natural resource professionals, including range managers, game and nongame biologists, soil conservationists, agronomists, farmers, and ranchers (Vickery et al. in press). In many areas, grassland management has historically emphasized soil conservation. To increase the likelihood of successfully conserving grassland habitat, it will be important to combine the goals of avian habitat conservation with those of soil conservation and agriculture. Because the ecological and habitat requirements of many endangered grassland species in South America are poorly understood, it will be most difficult to achieve these disparate goals in South America. Although habitat loss is the main cause of grassland bird declines in South America (Bucher and Nores 1988, Cavalcanti 1988), more subtle factors such as competitive interactions, nest parasitism, social facilitation, and failure to colonize new patches are probably also involved. These factors are probably stronger when populations are small and fragmented.

The North American Waterfowl Management Plan (NAWMP), through Ducks Unlimited Canada's Prairie Care program, has established grazing systems on about 132,000 ha in the grassland portion of Canada's three prairie provinces (Alberta, Manitoba, and Saskatchewan). Provincial agricultural extension services helped producers revamp grazing systems on many additional hectares. Because these systems make grazing more economically viable, they keep the land under grass cover. Initial studies show that a greater variety of bird species, including many grassland obligates, use these sites than use continuous-grazing (i.e., season-long) sites (Dale and McKeating 1996) and that avian productivity is about the same as it was before the grazing systems were instituted (Prescott et al. 1998). The initial demonstration farms and agreements with cattle ranchers required a substantial input, but as the economic benefits became clear and neighboring cattle ranchers saw the results, the conservation management was voluntarily adopted on many more farms and ranches. NAWMP has proven to be a good partner in grassland bird conservation. The Canadian Wildlife Service initiated nongame evaluations of NAWMP in 1989 and was joined in this by provincial partners in 1993 (Dale and McKeating 1996).

GRASSLAND RESTORATION

Because loss of native grassland habitat has been so extensive and has occurred over such a broad region, habitat restoration has become increasingly important for many regions and may be critical for the persistence of some rare and endangered species. For example, a recent landscape analysis in Florida demonstrated that only 19% of the original prairie remains and that the configuration of remaining prairie is insufficient to maintain and enhance populations of the U.S. federally endangered Florida Grasshopper Sparrow (Shriver and Vickery 1999). The best option for the long-term viability of this rare taxon appears to be major habitat restoration (Shriver and Vickery 1999). Although similar landscape analyses have not been undertaken in South America, the sharp decline in Pampas Meadowlark populations in Argentina (Tubaro and Gabelli 1999) and the rapid destruction of grassland habitat in the Cerrado of central Brazil (Cavalcanti 1999a) both suggest that some form of habitat restoration may be critical for the long-term survival of endemic grassland birds in South America. At least in the Pampas, habitat restoration should be possible to achieve in a relatively short time if land is left undisturbed (Leon and Oesterheld 1982, Leon et al. 1984).

In North America, several grassland species have adapted to agricultural fields (Graber and Graber 1963, Knopf 1994) or to other artificial habitats such as airports and reclaimed surface mines (Melvin 1994, Jones and Vickery 1997). Because few native prairie or grassland remnants remain in most of midwestern and northeastern North America, effective grassland bird conservation will require the protection and enhancement of artificial grassland habitats. Reclaimed surface mines in West Virginia, Pennsylvania, Ohio, and Indiana provide important habitat for Henslow's Sparrow and other grassland birds, and airfields in northeastern North America support some of the largest New England populations of several regionally threatened species, notably Upland Sandpiper and Grasshopper Sparrow (Jones and Vickery 1997). Protection and enhancement of these non-native habitats that serve as refugia for many grassland birds will be critical. Where feasible, however, efforts to restore native habitats should be a long-term objective.

FUTURE RESEARCH

From a hemispheric perspective, the most pressing needs are additional research and related conservation in Central and South America, where loss of habitat and population declines are becoming more acute. The number of endemic

species and families in the Neotropics, and the fact that this area provides habitat for wintering nearctic breeders, makes this the highest hemispheric priority for conservation research and action. As in North America, a better understanding of the ecological effects of fire and grazing on South American obligate grassland birds and their habitats should be a high priority (Collar et al. 1992).

Grassland bird conservation programs in the United States and elsewhere in the Western Hemisphere need to address both breeding and wintering ecology (Vickery et al. in press). Although the wintering ecology of most grassland birds is poorly known, there continues to be little research on the wintering habitat requirements of many grassland bird species, as the paucity of papers on wintering ecology in this book clearly demonstrates (3, versus 23 for the breeding season). It is unclear whether habitat loss and degradation on the wintering grounds are primarily responsible for the population declines reported for many species. Winter survivorship may be critically important in the long-term declines of some grassland species (Herkert and Knopf 1998, Vickery et al. in press).

Additionally, although there has been substantial research on some arctic-nesting birds, notably waterfowl (e.g., Snow Goose [*Chen caerulescens*]; Ganter et al. 1996) and shorebirds (Charadriidae and Scolopacidae; e.g., Whitfield and Brade 1991), there has been little research on other grassland species, especially passerines, that breed at high latitudes or altitudes. In particular, there is essentially no research on the winter ecology of these species on temperate grasslands, although initial efforts are underway (E. Dunn, pers. comm.). Winter habitat use, population dynamics, and survivorship of species such as Smith's Longspur and the rosy-finches (*Leucosticte* spp.) are largely unknown and merit careful study.

Unlike in North America, most species of grassland birds in Central and South America are still poorly known, and information regarding their ranges, habitat preferences, and migratory movements are based on relatively few observations and limited museum specimens. For instance, Silva (1995) found that approximately 70% of the Cerrado region has never been adequately sampled for birds. Well-sampled localities are usually natural areas near major cities or national parks with easy access. This probably reflects the situation for most of the major grassland regions in Latin America. The taxonomy for several Central and South American grassland species should be re-evaluated, as they likely comprise two or more distinct phylogenetic species, each one indicating a region where conservation actions need to be taken. Unfortunately, funds for basic ornithological inventory and taxonomic studies in Central and South America are scarce and, when available, are directed at studies on forests rather than grasslands or other open habitats. Any international conservation project directed at Latin American grasslands must include support for both long-term studies on threatened bird populations and basic biological inventory and taxonomic studies.

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