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THE DECLINE OF THE PAMPAS MEADOWLARK: DIFFICULTIES OF APPLYING THE IUCN CRITERIA TO NEOTROPICAL GRASSLAND BIRDS

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Abstract. The current status of the Pampas Meadowlark (*Sturnella defilippii*) was analyzed in terms of the new criteria adopted by the World Conservation Union. Estimated values of the species' Extent of Occurrence and Area of Occupancy were 8,000 square kilometers and 150 square kilometers, respectively. The total population size of the species was estimated to be approximately 7,500 adults. Considering its Extent of Occurrence and population size, this species qualified as Vulnerable by World Conservation Union criteria, but because of its small Area of Occupancy and possible fluctuations in its preferred habitat—natural grasslands—the species should be placed in the Endangered category.

LA DECLINACIÓN DE LA LOICA PAMPEANA: DIFICULTADES PARA LA APLICACIÓN DE LOS CRITERIOS DE LA UICN A LAS AVES NEOTROPICALES DE PASTIZAL

Sinopsis. Se analizó el estatus actual de la Loica Pampeana (*Sturnella defilippii*) en función de los nuevos criterios adoptados por la UICN. Los valores estimados para la Extención de Ocurrencia y el Área de Ocupación son 8.000 km^2 y 150 km^2, respectivamente. El tamaño total de la población fue estimado en 7.500 adultos. Por su Extención de Ocurrencia y tamaño poblacional la especie califica como Vulnerable, pero considerando su pequeña Área de Ocupación y posibles fluctuaciones en el hábitat preferido (pastizales naturales) la especie debe ser ubicada en la categoría En Peligro.

Key Words: Argentina; grasslands; IUCN; pampas; Pampas Meadowlark; *Sturnella defilippii*; World Conservation Union.

Neotropical grasslands in South America are widespread and include a variety of types. For example, high-altitude grasslands can be found in the Andes, Sierras Pampeanas, and Puna plateau. Low-altitude grasslands occur in the Venezuelan llanos, pampas of Argentina, and campos of Uruguay and southern Brazil (Cabrera and Willink 1980). Lowland grasslands such as the Pampas have experienced extensive pressure from agriculture and cattle-farming (Soriano et al. 1991), and concern about the conservation of Argentine grassland birds is growing (Bucher and Nores 1988).

The Pampas Meadowlark (*Sturnella defilippii*) is typical of many bird species living in lowland grasslands. This is a highly dimorphic species, especially during the austral spring and summer when mature males exhibit a red throat and breast contrasting with a dark body. Females are much duller, with a reduced, paler red breast area. Pampas Meadowlarks are gregarious, even during the breeding season, which typically extends from October to December. Males' territories are small and tightly packed in areas of suitable habitat, forming what we call reproductive groups. The nest consists of an open cup built on the ground and concealed under grasses. In January, at the end of the breeding season, individuals congregate in large flocks, hereafter referred to as nonreproductive groups, until the following spring.

Formerly distributed from southern Brazil and Uruguay to central Argentina, the Pampas Meadowlark has declined since the beginning of the twentieth century. In this paper we describe the species' present status. We also discuss the applicability of the new criteria of the World Conservation Union (IUCN) for assigning threat status (Mace and Stuart 1994) to neotropical grassland species in general and to the Pampas Meadowlark in particular.

METHODS

This study is based on field work done in Argentina in November 1992 and 1993 and in January, May, and December 1996 in the southwest of the province of Buenos Aires and adjacent areas of the province of La Pampa.

Field work took place on an 11,800-km route on primary and secondary roads. We looked for Pampas Meadowlarks from a vehicle moving at low speed (< 50 km/hr) and with windows down. Pampas Meadowlarks were easily detected because males have a conspicuous flight display and flight song. We made numerous stops along the route, as many as one every 0.5–1.5 km, in areas where previous information or research suggested the species might be present, as well as at any site judged to be appropriate habitat.

The minimum geographical area (hereafter referred to as Extent of Occurrence, or EO; Mace and Stuart 1994) covered by the Pampas Meadowlark was estimated using a grid of 100 km^2 superimposed on a map (Mercator projection) with the location of reproductive

groups found during field work. We drew a minimum convex polygon, which included the outermost points of distribution of reproductive groups, and counted the number of squares included inside the polygon. The number of squares multiplied by 100 yielded the EO in square kilometers. The Area of Occupancy, or AO (the fraction of the EO effectively occupied by the species; Mace and Stuart 1994), was calculated as the sum of the areas of the sites where the species was found or estimated to be present.

We used additional sources of information to determine the species' original distribution and the timing of its range contraction. These included ornithological collections at the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" in Buenos Aires and at the National Museum of Natural History, Smithsonian Institution, Washington, D.C; the database of the grassland birds of eastern Argentina, Asociación Ornitológica del Plata (R. Fraga, pers. comm.); and a bibliographic survey, including the complete collection of the journal *El Hornero* from 1918 to 1995. The International Council for Bird Preservation (ICBP)/IUCN book *Threatened Birds of the Americas* (Collar et al. 1992) also provided useful information.

In areas where we detected Pampas Meadowlarks during field work, we conducted a point count using a visual scanning method (Lehner 1979, Bibby et al. 1992) and estimated the area used by the reproductive group. The frequency of vocal and flight displays increased with the size of the reproductive group (Gochfeld 1978), so small groups were less detectable, or appeared smaller in size than they were.

To assess the relationship between the visual scanning count and the real size of a reproductive group, at four sites we made exhaustive searches coupled with song recordings and territory mapping. These searches revealed that our scanning method underestimated the size of reproductive groups by about 50%. We therefore applied a correction factor, which consisted of doubling the number of counted birds, to estimate the number of individuals per site.

The procedure for estimating the total Pampas Meadowlark population size was as follows. First we divided the EO into four subareas (Villa Iris, Chasicó, Felipe Solá, and Napostá) based on maps (scale 1: 100,000) from the Instituto Geográfico Militar. Inside each subarea we counted the number of potential sites (NPS) judged to be suitable habitat for Pampas Meadowlarks. We then multiplied the NPS by the proportion of sites occupied by the species and by the mean number of Pampas Meadowlarks per site.

For the study of habitat preferences, we considered three types of habitats differing in species composition and structure: natural grasslands, planted pastures, and croplands. Planted pastures and croplands revert to natural grasslands when abandoned for periods ranging from 5 to $\geq$ 15 yr. It is important to note that natural grasslands are not natural in a strict sense because all of them have been cultivated or grazed at some point (Soriano et al. 1991). We studied plant species composition by collecting herbarium specimens in most areas where Pampas Meadowlarks were detected. This material was identified at the Darwinion Institute in San Isidro City. Natural grasslands were dominated by a variety of *Stipa* and *Piptochaetium* species, among them *S. ambigua, S. trichotoma, S. neesiana, S. clarazi, P. montevidense,* and *P. stipoides.* We also found *Bromus unioloides* and *Hordeum parodii.* The structure of natural grasses had a typical "tussock" physiognomy. Planted pastures and croplands typically included *Avena barbata, A. sativa, Bromus mollis, Lolium multiflorum,* alfalfa (*Medicago sativa*), *Trifolium repens, Vicia angustifolia, V. sativa,* and wheat (*Triticum aestivum*) as dominant species. The main difference between planted pastures and croplands is that planted pastures are not cropped at the end of the annual growing cycle but remain in place for several years.

We used a graduated ruler to assess the height of the vegetation at 25 sample points inside each habitat type. These samples were located along a transect crossing the area and were separated by 10 m. At each sample point we measured the height of the vegetation touching the ruler to the nearest centimeter.

We compared vegetation height between habitat types using the Student t-test. Paired t-tests on vegetation height were performed between preferred sites that were occupied by Pampas Meadowlarks and adjacent unoccupied sites, or when we compared the same sites at different times. All statistical tests were two-tailed.

RESULTS

Range Contraction

The former range of the Pampas Meadowlark included most of the Pampas grasslands from the southern part of Brazil (Rio Grande do Sul, Santa Catarina, and Paraná states), Uruguay (departments of Canelones, Paysandú, Cerro Largo, Flores, San José, Tacuarembó, and Montevideo), and eastern and central Argentina (including the provinces of Entre Ríos, Buenos Aires, Santa Fe, Córdoba, San Luis, and La Pampa; Fig. 1).

Since 1900 the distribution of this species has decreased by 90%. It is now virtually extinct in Brazil, Uruguay, and most of the northern and central Argentine pampas (Fig. 1). Pampas Meadowlarks were very common near the city of Buenos Aires until 1925, but now they are found almost exclusively on the margins of their former distribution, mainly in the southwestern part of the province of Buenos Aires.

Although the range contraction of this species has been rapid and extensive, the pace of the contraction has not been steady; most of the local extinction occurred between 1890 and 1950, coincident with the period of extensive agricultural transformation of natural grasslands (Soriano et al. 1991). Since 1950, Pampas Meadowlarks have been seen regularly in the marginal areas of the southwestern Pampas (Short 1968; Gochfeld 1978, 1979a, b; Tubaro et al. 1994).

Extent of Occurrence and Area of Occupancy

In 1992 and 1993 we found 41 sites occupied by reproductive groups of Pampas Meadow-

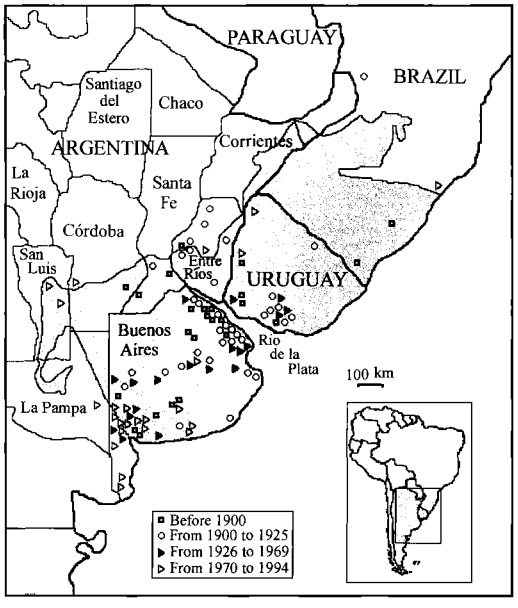

FIGURE 1. Sites where Pampas Meadowlarks were collected or sighted during different time periods. For simplicity, the 59 sites where Pampas Meadowlarks were recorded during field work in 1992–1996 are excluded. The shaded area indicates the extent of the Rio de la Plata Grasslands (Soriano et al. 1991) which include the Argentine pampas and the campos of Uruguay and southern Brazil. The present distribution of the Pampas Meadowlark is restricted to the margins of the original area, mainly in the southwestern part of the province of Buenos Aires.

larks. All of the sites were located in the southwestern part of the province of Buenos Aires and neighboring areas of the province of La Pampa (Fig. 2). Based on these findings, we estimated the EO of the species to be approximately 8,000 km^2. In 1996 we found 18 additional sites supporting reproductive and nonreproductive groups inside the EO. In the same year, however, we found a similar number of sites that had been occupied by the species in previous years unoccupied.

Based on the area used by 41 reproductive groups studied in 1992 and 1993, and assuming a population size of about 7,500 individuals (see "Population Size," below), we estimated the AO of the Pampas Meadowlark to be less than 150 km^2.

Winter Grounds

We saw Pampas Meadowlarks most commonly in the northern part of their range during the nonreproductive season (Fig. 3), supporting Hudson's (1920) idea that this species, or at least some of its members, moves northward during the winter. In May 1996, however, we found six nonreproductive groups containing a total of 516 individuals (range 9–173 individuals/group) in areas used by reproductive groups during the breeding season. This suggests that the Pampas Meadowlark, or at least a part of its population, is resident year-round.

Population Size

In November 1993 we counted a total of 533 individuals (mostly males). In January 1996 we counted a total of 1,645 individuals. The number declined to 414 in November 1996. These differences reflect, at least in part, a change in the social behavior of these meadowlarks because at the end of the breeding season (January) they concentrate in large flocks where females and juveniles are more easily seen. Although an estimate of population size must be considered speculative given the information presently available, we think it is valuable to assist in conservation planning. Based on the estimated number of appropriate sites inside the EO and the number of such sites supporting reproductive groups of the species in the studied area, we extrapolated a population size of approximately 7,500 individuals (Table 1).

We also observed that the proportion of potential sites supporting reproductive groups of Pampas Meadowlark was low—less than 29% in the most suitable subarea. Pampas Meadowlarks were particularly abundant in the Chasicó and Napostá subareas (Table 1).

Habitat Preference

We found 31 of the 41 reproductive groups (76%) on natural grasslands, even though this habitat represented less than 10% of the land in the study area. The remaining 10 groups (24%) occupied planted pastures and cultivated fields. No less than 89% (16/18) and 83% (5/6) of the nonreproductive flocks preferred natural grasslands during January and May 1996, respectively. This contrasted with 11% (2/18) and 17% (1/6) of the groups found over planted pastures in January and May 1996, respectively.

Height of the vegetation appeared to be another important factor for Pampas Meadowlarks. The height of the vegetation in sites supporting reproductive groups was 34.52 ± 5.79 cm ($\bar{X}$ ± SD, range 29–45 cm, N = 11 sites) for natural grasslands and 44.29 ± 17.83 cm (range 25–67 cm, N = 4 sites) for planted pastures. To assess the importance of vegetation height in Pampas Meadowlark settlement, we measured this variable at occupied and adjacent unoccupied sites supporting similar habitat. Occupied sites had higher vegetation than unoccupied areas (32.83

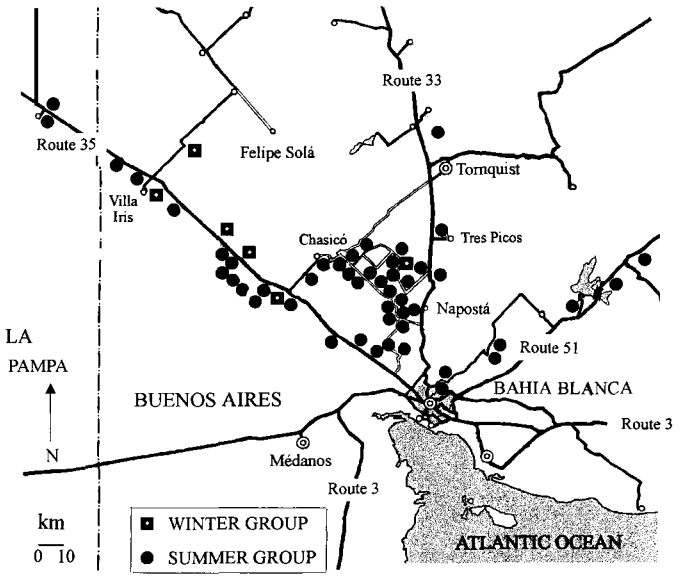

FIGURE 2. Detail of the southwestern portion of the province of Buenos Aires, showing sites where Pampas Meadowlarks were recorded during field work in 1992–1996. Summer groups included reproductive and nonreproductive groups detected between November and January. Winter groups consisted of nonreproductive groups found in May 1996.

± 14.85 cm vs. 9.54 ± 6.15 cm, $t = 6.87$, $df = 10$, $P < 0.001$).

Pampas Meadowlarks can coexist with cattle. About 26% of the natural grasslands supporting reproductive groups also supported cattle, but no planted pasture supported cattle and meadowlarks simultaneously. In the southwestern Pampas we found that grazed natural grasslands had higher vegetation than grazed planted pastures (28.00 ± 9.53 cm vs. 12.60 ± 11.54 cm, $t = 3.19$, $df = 17$, $P < 0.01$).

In 1993 Pampas Meadowlarks disappeared from 3 of the 11 sites where they had occurred in 1992. At all three sites the natural or planted grasslands had been replaced by wheat (*Triticum* spp.) fields. This suggests that habitat alteration is an important cause of local extinction. By December 1996, 18 natural grassland sites that supported Pampas Meadowlarks had been totally or partially converted. An additional six sites with planted pastures had been replaced by agriculture. Thus, 46% of the sites supporting Pampas Meadowlarks had suffered some kind of alteration by the end of our study period. Between 1993 and 1996 we also detected a substantial reduction in the height of the vegetation layer in the remaining sites (34.67 ± 6.20 cm vs. 12.95 ± 7.41 cm, $t = 9.88$, $df = 9$, $P < 0.001$). This was probably the result of extreme drought affecting the region, which reduced vegetation growth and increased the cattle load on natural grasslands. Although the effect of these habitat changes on Pampas Meadowlark populations cannot be assessed presently, we suspect a negative impact because of the species' preference for taller natural grasslands.

DISCUSSION

In the early twentieth century, Pampas Meadowlarks were abundant throughout the Pampas region (Hudson 1920). Hudson considered the name Military Starling appropriate for this species because it referred to the huge numbers and coordinated movements of individuals in nonreproductive groups. The current status of the Pampas Meadowlark is clearly different. We could find it only in the southernmost part of its former distribution. Some recent records seem to confirm that the species is still present in other marginal areas of its former distribution, including southern Brazil (M. Pearman *in* Collar et al. 1992), Uruguay (Pearman 1994; A. Azpiroz and J. Cravino, pers. comm.), and Argentina in the provinces of Entre Ríos (C. Bertonatti and S. Heinonnen, pers. comm.), San Luis and Córdoba (Nellar Romanella 1993), and the southern tip of Buenos Aires (A. Di Giacomo, pers. comm.). Some of these records may reflect wintering migrants, although the migratory behavior of this species has never been clearly demonstrated. In contrast, our finding of six nonreproductive groups wintering in grasslands in the south-

FIGURE 3. Sites where Pampas Meadowlarks were recorded according to time of year. For simplicity, the groups found during field work in 1992–1996 are excluded. The shaded area indicates the extent of the Rio de la Plata Grasslands (Soriano et al. 1991) which include the Argentine pampas and the campos of Uruguay and southern Brazil. Most of the fall and winter records (April–August) are from the northern half of the species' range, suggesting that at least part of the population is, or was, migratory.

western portion of the province of Buenos Aires demonstrates that at least part of the population is resident year-round in the same general area.

Evidence suggests that the primary cause of the Pampas Meadowlark's decline is habitat destruction or degradation. In our study, Pampas Meadowlarks clearly preferred sites with taller grasses. This vegetative structure was found mainly in natural grasslands and to a lesser extent in planted pastures without cattle. Core areas of the Pampas have been rapidly transformed by agriculture since 1890, with a corresponding range contraction of Pampas Meadowlarks. Only marginal areas of low productivity, with reduced rainfall and poor soils, have escaped transformation. The limited availability of water is one of the environmental factors limiting productivity of temperate grassland ecosystems (Sala et al. 1981), and there is a clear trend of decreasing rainfall from north to south and from east to west in the Pampas (Prohaska 1952). Consequently, the southwestern Pampas are not suitable for agriculture, and natural grasslands continue to persist in this area.

A possible explanation for the existence of taller vegetation in natural grasslands than in planted pastures lies in differences of cattle use. Natural grasslands support fewer cattle (< 1 head/ha), so the disruptive effects of cattle-grazing and cattle movement (cover loss, disappearance of large tussocks, changes in species composition, and changes in the vertical distribution of verdant material [Sala et al. 1986]) are not as acute. Planted pastures are more palatable, support greater cattle densities, and are typically grazed until the grass is very low.

The habitat preferred by Pampas Meadowlarks is scarce, and its availability varies annually because of the management decisions of landowners. During the 4 yr of this study, we documented the conversion of 46% of the areas used by this species. At the same time, new areas were regenerating where pastures and croplands had been abandoned. It is important to remember that "natural grasslands" are in fact lands that have been abandoned for periods ranging from 5 to ≥15 yr. In the past, these sites were not always available for the settlement of Pampas Meadowlarks, and some of them will be unavailable in the near future. This dynamic balance between habitat loss and gain may be critical for Pampas Meadowlark survival. Because the habitat preferred by Pampas Meadowlarks is ephemeral, this species may be unable to colonize all available sites. This may explain the low

TABLE 1. ESTIMATED NUMBERS OF PAMPAS MEADOWLARKS, 1992–1993

Subarea	Number of potential sites scanned	Proportion of potential sites with *S. defilippii*	Estimated number of potential sites	Expected number of potential sites with *S. defilippii*	Mean number of individuals per site	Total number of individuals
Villa Iris	210	0.048 (10/210)	1,600	76.8	14.8	1,137
Chasicó	116	0.138 (16/116)	840	115.9	33.0	3,825
Felipe Solá	20	0.050 (1/20)	1,008	50.4	16.0	806
Napostá	28	0.286 (8/28)	180	51.5	33.1	1,705
All subareas	374	0.1305	3,628	294.6	24.2	7,473

proportion of apparently appropriate sites occupied by the species (Table 1). In addition, we think the social behavior of Pampas Meadowlarks may play a role in the local pattern of distribution. We always saw these birds in groups, so it is possible that some males may use suboptimal habitats (e.g., planted pastures and croplands) because they are stimulated by social interactions of displaying males in adjoining natural grasslands.

Other Possible Threats

Although there is a general correlation between the degree of habitat transformation in the Pampas and the range contraction of the Pampas Meadowlark, there are other possible causes of this species' decline. Some of these causes may interact with habitat loss.

The southern Pampas is the only place in the Americas where three *Sturnella* species coexist. Such coexistence increases the possibility that interspecific competition may adversely affect one or more of the species, as has been documented with Pampas Meadowlarks and White-browed Blackbirds (*S. superciliaris*; Gochfeld 1979b). We also recorded interspecific aggression between Pampas Meadowlarks and Long-tailed Meadowlarks (*S. loyca*; see also Gochfeld 1979b). White-browed Blackbirds are particularly abundant in modified agroecosystems, and Long-tailed Meadowlarks are expanding northward because farmers have supplied elevated song perches (fences, poles, and planted rows of trees), which this species requires (Gochfeld 1978). In this circumstance, habitat transformation could have compounded negative effects on Pampas Meadowlark populations, both by reducing the extent of its preferred habitat (natural grasslands) and by favoring increases in competitor species.

Another factor may be illegal capture for the pet trade. Pampas Meadowlarks were sold as cagebirds in Uruguay until 1920 (R. Vaz Ferreira, pers. comm.), and they are still captured illegally in Argentina. In 1985, 12 individuals were exported to the United States, and in 1986 at least 10 individuals were offered on the local market; in 1988 the latter number exceeded 100 individuals (Bertonatti and Tubaro 1993). Although we have no further data on the illegal trade of Pampas Meadowlarks, it seems that commercial exploitation is not extensive at present. Because the estimated population is so small, however, any extractive activity may be significant.

Current Status of the Pampas Meadowlark and Problems of Applying the IUCN Criteria

Recent efforts have been made by the IUCN to standardize criteria used in the evaluation of a species' status (Mace and Lande 1991, Mace and Stuart 1994). The use of such criteria not only helps establish a common priority agenda for conservation efforts but also describes the current status of a species in terms that are relevant for conservation. For example, listing a species as Endangered requires at least one of the following conditions: (1) a population decline greater than 50% in 10 yr or three generations; (2) an EO and AO smaller than 5,000 km^2 and 500 km^2, respectively; (3) a declining population with fewer than 2,500 mature (i.e., capable of reproducing) individuals; (4) a stable population of fewer than 250 mature individuals; or (5) a population viability analysis suggesting a probability of extinction greater than 20% in the next 20 yr.

Collar et al. (1994) considered the Pampas Meadowlark to be Endangered because of its extensive range contraction, which implies an equivalent decline in population. We do not think the available evidence supports this contention, however. The Pampas Meadowlark's geographic range has not changed substantially since 1950, although it declined rapidly in the first half of the twentieth century (Fig. 1).

The Pampas Meadowlark can also be classified as Vulnerable, as its EO is smaller than 20,000 km^2 and its population size is below 10,000 mature individuals. The species should be considered Endangered, however, because of its extremely small AO of about 150 km^2, which is substantially smaller than the threshold of 500 km^2 required by this category. In addition, two of the following three subcriteria are also required for a species to be considered Endangered: (1) a population that is severely fragmented, (2) a continuous decline (observed or inferred) in the EO and AO, and (3) an extreme fluctuation in the EO, AO, or number of locations in which the species is found. We detected important changes in the extent and quality of the Pampas Meadowlark's preferred habitat, natural grasslands, which is affected by agriculture and cattle-grazing. By the end of our study, most of the sites supporting Pampas Meadowlarks on the margins of its EO had been abandoned. For example, between 1993 and 1996 no reproductive groups were found north or east of the city of Tornquist in the province of Buenos Aires (Fig. 2). Thus, we think that subcriteria 1 and 2 are met and that the species should be classified as Endangered.

According to Collar et al. (1994), 6.3% of the world's threatened bird species occur in grasslands; habitat loss and alteration are identified as main threats. Some Critical or Endangered species live in the Pampas, among them Saffron-cowled Blackbird (*Xanthopsar flavus*), Ochre-

breasted Pipit (*Anthus natereri*), Marsh Seedeater (*Sporophila palustris*), and Entre Rios Seedeater (*S. zelichi*). With the exception of the Ochre-breasted Pipit, the main criterion used for the inclusion of these species in the Endangered category was the rapid decline in their population sizes. Although most of the Pampas bird species depending on natural grasslands suffered extensive range contractions, this process probably occurred primarily between 1870 and 1950, when the Pampas were altered by agriculture and increasingly intensive cattle-farming (Soriano et al. 1991). As in the case of the Pampas Meadowlark, there is no clear evidence that the ranges of the above species have contracted further since 1950, which would be required by the IUCN for them to be considered Endangered. Thus, other factors should be considered in assessing their present status.

We have found that the main problems in applying the IUCN criteria to neotropical grassland birds are the scarcity of data about the species' biology, uncertainties about the actual distribution and population numbers, and dearth of historical information (see also Bucher and Nores 1988). This situation makes it very difficult to decide, or even to project on a reasonable basis, the future conservation status of a particular species. In the case of Pampas grassland birds, this situation is aggravated by the fact that they live on the margins of the main agricultural area of the Neotropics. There is still no protection against the rapid conversion of this land, which could happen again if costs of supplies fall and/or crop prices rise.

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