

## GRASSLAND BIRD CONSERVATION IN NORTHEASTERN NORTH AMERICA

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**Abstract.** As a first step in the development of a conservation plan for grassland birds in the northeastern United States, we prioritized species based on the percent of estimated total breeding population in states and provinces throughout North America. As expected, most species had only a small percent of their total breeding population in the Northeast. We estimated that 82 percent of all Savannah Sparrows (*Passerculus sandwichensis*), 47 percent of Vesper Sparrows (*Pooecetes gramineus*), and 37 percent of Bobolinks (*Dolichonyx oryzivorus*) breed in Canada. An estimated 60 percent of North American Grasshopper Sparrows (*Ammodramus savannarum*) breed in Kansas, Nebraska, North Dakota, and South Dakota. The grassland species we consider to be most at risk, Henslow's Sparrow (*A. henslowii*), has a relatively restricted breeding range with most of the population (more than 50 percent) in Ohio, Michigan, and Wisconsin but with a substantial percent (more than 20 percent) in the Northeast as well. This highlights the responsibility of different regions to the global, long-term persistence of species. A species-level analysis, however, does not consider regional genetic variability that may include taxonomic recognition below the species level. We considered this factor by repeating the above process for each subspecies of eastern grassland bird. We found that 100 percent of Eastern Henslow's Sparrows (*A. h. susurrans*) breed in the northeastern United States. Similarly, the Northeast supports 12 percent of the breeding Eastern Grasshopper Sparrows (*A. s. pratensis*) but only 4 percent of the total breeding population (all subspecies combined). This perspective counters the suggestion that the northeastern United States is unimportant for grassland birds. A regional grassland bird conservation plan should include (1) standardized inventory and monitoring, particularly for Henslow's Sparrow; (2) identification of key nesting sites supporting high diversity and abundance of grassland birds and development of plans for management or acquisition of these sites where appropriate; (3) completion of a preliminary population viability analysis for the least abundant species to assess the relative importance of different sites; and (4) development of guidelines for how private landowners and public land managers can manage grasslands to benefit grassland birds.

## CONSERVACIÓN DE AVES DE PASTIZAL EN EL NORESTE DE AMÉRICA DEL NORTE

**Sinopsis.** Como primer paso en el desarrollo de un plan de conservación para aves de pastizal en el noreste de los Estados Unidos, pusimos en orden de las especies a partir de su porcentaje de la tasa total de la población reproductiva en estados y provincias en toda América del Norte. Como esperamos, la mayoría de las especies tenía sólo un pequeño porcentaje del total de su población reproductiva en el noreste. Estimamos en un 82 por ciento los Gorriones Sabaneros (*Passerculus sandwichensis*), en un 47 por ciento los Gorriones Coliblanco (*Pooecetes gramineus*) y en un 37 por ciento los Tordos Arroceros (*Dolichonyx oryzivorus*) que se reproducen en Canadá. Un número aproximado al 60 por ciento de los Gorriones Chapulines (*Ammodramus savannarum*) de América del Norte se reproducen en Kansas, Nebraska, Dakota del Norte y Dakota del Sur. La especie de pastizal que consideramos con más riesgo, el Gorrión de Henslow (*A. henslowii*), tiene una extensión reproductiva relativamente reducida, con la mayoría de la población (más de un 50 por ciento) en Ohio, Michigan y Wisconsin, pero también con una presencia importante (más de un 20 por ciento) en el noreste. Esto subraya la responsabilidad de varias regiones ante la sobrevivencia mundial de especies a largo plazo. Sin embargo, un análisis a nivel de especie no considera la variación genética regional que puede incluir un reconocimiento taxonómico menor al de especie. Consideramos este elemento al repetir el proceso anterior para cada subespecie de ave de pastizal del este. Descubrimos que 100 por ciento de los Gorriones de Henslow del Este (*A. h. susurrans*) se reproducen en el noreste de los Estados Unidos. De igual manera el noreste mantiene un 12 por ciento de los Gorriones Chapulines del Noreste (*A. s. pratensis*) en reproducción, pero tiene sólo un 4 por ciento de la población reproductiva total (todas las subespecies combinadas). Esta perspectiva contradice la idea sugerida de que el noreste de los Estados Unidos no es importante para las aves de pastizal. Un plan de conservación regional para aves de pastizal debe incluir (1) inventario y medición uniformes, especialmente para los Gorriones de Henslow; (2) identificación de lugares de reproducción que mantienen mucha diversidad y abundancia de aves de pastizal, y desarrollo de planes para la administración o adquisición de estos lugares donde sea apropiado; (3) realización de un análisis preliminar de la viabilidad de la población para las especies menos abundantes, con el fin de determinar la importancia relativa de varios lugares; y (4) desarrollo de sugerencias para dueños particulares y administradores de terrenos públicos en relación al manejo de pastizales para beneficiar a las aves de pastizal.

**Key Words:** bird conservation; conservation priorities; grassland birds; Henslow's Sparrow; northeastern United States; subspecies.

Assessing regional species and habitat priorities is critical to the conservation planning process and is central to the North American songbird management plan under development through the Partners In Flight coalition (Finch and Stangel 1993). Bird species may be prioritized for conservation consideration based on several global and regional criteria (Hunter et al. 1993, Carter et al. in press) or on the proportion of their total breeding population supported in a particular region (Rosenberg and Wells 1995, in press). This latter approach, which provides a global perspective on the relative responsibility of each region to the overall conservation of each species, has been applied to all neotropical migratory landbirds breeding in the northeastern United States (Rosenberg and Wells 1995, in press). That analysis highlighted a potential conflict between long-term planning for species with high proportions of their total breeding population in the region and local concern for species showing significant population declines. Bird species of grasslands and other early-successional habitats are at the center of this dichotomy.

In the northeastern United States, grassland and shrubland birds have been identified as the habitat-community groups showing the most widespread and persistent declines in abundance (Witham and Hunter 1992, Askins 1993). Initially, however, these declines were treated as a matter of little importance because of a perception that there had been little grassland and shrubland habitat in the Northeast prior to European colonization. More recently, careful reviews of the available evidence have shown that open grassland and shrubland habitats composed a significant proportion of the pre-European arrival landscape (Marks 1983, Askins 1993). One of the most compelling pieces of evidence for the existence—and rapid destruction—of such habitats is the evolution of a distinct taxonomic form of the Greater Prairie Chicken (*Tympanuchus cupido*) in the eastern United States: the Heath Hen (*T. c. cupido*), which became extinct on Martha's Vineyard, Massachusetts, in 1932 (AOU 1957).

Concern for the conservation of declining grassland birds has resulted in legal designation of one or more species on virtually every northeastern state's threatened and endangered species list (Vickery 1992). For example, Upland Sandpiper (*Bartramia longicauda*) and Grasshopper Sparrow (*Ammodramus savannarum*) are listed by at least seven states, and Vesper Sparrow (*Poocetes gramineus*) and Henslow's Sparrow (*Ammodramus henslowii*) are listed by at least five states. In addition, Henslow's Sparrow was recently assessed as a potential candidate

for listing by the U.S. Fish and Wildlife Service (USFWS; Pruitt 1996).

In this paper we assess the conservation status of grassland bird species in the northeastern United States from a continental perspective. We first consider the importance of the Northeast to the total breeding population of each species; we then compare population trends in the Northeast with those in other regions of the United States and Canada. Finally, because of the potential distinctiveness of eastern populations of certain grassland birds, we discuss how consideration of subspecies affects our current view of grassland bird conservation in the Northeast.

#### METHODS

We considered the following eight species of eastern grassland birds: Upland Sandpiper, Horned Lark (*Erismophila alpestris*), Savannah Sparrow (*Passerculus sandwichensis*), Grasshopper Sparrow, Henslow's Sparrow, Vesper Sparrow, Bobolink (*Dolichonyx oryzivorus*), and Eastern Meadowlark (*Sturnella magna*). As a measure of potential genetic diversity, we considered the subspecies described in the 1957 American Ornithologists' Union's check-list (AOU 1957), which was the most recent reference that systematically reviewed subspecies in all North American species north of Mexico.

We estimated the proportion of the total population of each species breeding in each U.S. state and Canadian province using the following procedure. First, using ranges described in Peterson 1980 and 1990, we estimated the proportion of each state occupied and then multiplied that proportion by the area of each state. We then multiplied the range area occupied in each state and province by the relative abundance calculated for that area based on USFWS Breeding Bird Survey (BBS) data from 1966 to 1994 (Sauer et al. 1996). These state and province values were then summed to get an index of the total breeding population size. Note that this index represents a species' total breeding range size as well as the species' relative abundance across its breeding range; it is not, however, an accurate estimate of the total number of individuals in the species' breeding population.

For each species we then divided the value for each state or province by the total population size index to get the estimated percent of the total population breeding in each state and province. These percentages were then summed to give an estimate of the percent of the total population breeding in the Northeast (here defined as USFWS Region-5 [Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Maryland, Delaware, Virginia, and West Virginia]), other USFWS regions, and Canada (Table 1). For species with subspecies described in the American Ornithologists' Union's 1957 check-list, we also determined what proportion of the relevant subspecies breed in the Northeast. Finally, to assess geographic patterns in population trends, we compared percent of population in USFWS regions and Canada against the 1966–1994 BBS trend (Sauer et al. 1996).

TABLE 1. PERCENT OF TOTAL BREEDING POPULATION OF EIGHT GRASSLAND BIRD SPECIES IN THE NORTHEASTERN UNITED STATES (USFWS REGION-5), OTHER USFWS REGIONS, AND CANADA

Species	Region					
	NE	SE	MW	GP	SW	CAN
Upland Sandpiper	0.3 <sup>a</sup>	0.0	5.6	85.0	0.0	9.1
Horned Lark	0.1	0.1	6.0	47.5	13.7	19.4
Savannah Sparrow	1.6	0.0	9.1	5.1	0.0	81.7
Grasshopper Sparrow	3.6	2.2	19.8	70.0	4.1	0.2
Henslow's Sparrow	21.3	0.0 <sup>b</sup>	78.6	0.0	0.0 <sup>c</sup>	0.0
Vesper Sparrow	0.6	0.0	15.1	31.7	0.0	46.6
Bobolink	13.7	0.0	32.6	17.0	0.0	36.5
Eastern Meadowlark	5.4	31.9	23.3	3.6	35.1	0.6

Note: NE = Northeast (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia); SE = Southeast (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee); MW = Midwest (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin); GP = Great Plains (Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, Wyoming); SW = Southwest (Arizona, New Mexico, Oklahoma, Texas); CAN = Canada.

<sup>a</sup> Estimate may be low because BBS abundance was not calculated for most northeastern states.

<sup>b</sup> Small, recently discovered population in North Carolina.

<sup>c</sup> Large, recently discovered population in Oklahoma.

## RESULTS AND CONSERVATION IMPLICATIONS

Of the eight species considered at the species level, Henslow's Sparrow had the highest percent of its breeding population in the Northeast, with 21.3%, followed by Bobolink with 13.7% and Eastern Meadowlark with 5.4% (Table 1). None of the other species had more than 5% of their estimated population in the region. Most species had a high percent of their total breeding population in a single region. For example, 85% of Upland Sandpipers and 70% of Grasshopper Sparrows were estimated to breed in the Great Plains region (USFWS Region-6). Similarly, the Midwest (USFWS Region-3) supported an estimated 78.6% of the world's breeding Henslow's Sparrows. Canada had 81.7% of breeding Savannah Sparrows and 46.6% of breeding Vesper Sparrows (Table 1).

When we considered subspecies, the importance of the Northeast to certain grassland birds was highlighted (Table 2). For example, although the Northeast held 1.6% of all breeding Savannah Sparrows, it supported 55% of the

eastern subspecies, *P. s. savanna*. Similarly, the Northeast held 3.6% of breeding Grasshopper Sparrows but 11.5% of the eastern subspecies, *A. s. pratensis*. The most dramatic example was Henslow's Sparrow, for which the Northeast supported 21.3% of the entire breeding population but 100% of the remaining populations of the described eastern subspecies, *A. h. susurrans*.

All eight grassland species under consideration, except Upland Sandpiper, showed a significant negative trend based on continental BBS data (Sauer et al. 1996). Henslow's Sparrow, with the lowest population size index, also had the greatest negative trend (Fig. 1).

If the percent of total breeding population in each region is compared with the trends for those regions, a geographic pattern of the conservation status of each species emerges (Fig. 2). These patterns show where conservation efforts will have the greatest overall influence on each species and help put the conservation status of grassland birds in the Northeast in a larger perspective. We summarize these patterns in the following species accounts.

TABLE 2. PERCENT OF TOTAL BREEDING POPULATION OF NINE GRASSLAND BIRD SPECIES IN THE NORTHEASTERN UNITED STATES, CONSIDERING GEOGRAPHICALLY VARIABLE SUBSPECIES

Species	Eastern subspecies	All subspecies
Heath Hen	100.0 ( <i>T. c. cupido</i> )	?
Upland Sandpiper	no subspecies	0.3
Horned Lark	2.1 ( <i>E. a. praticola</i> )	0.1
Savannah Sparrow	55.2 ( <i>P. s. savanna</i> )	1.6
Grasshopper Sparrow	11.5 ( <i>A. s. pratensis</i> )	3.6
Henslow's Sparrow	100.0 ( <i>A. h. susurrans</i> )	21.3
Vesper Sparrow	3.1 ( <i>P. g. gramineus</i> )	0.6
Bobolink	no subspecies	13.7
Eastern Meadowlark	12.9 ( <i>S. m. magna</i> )	5.4

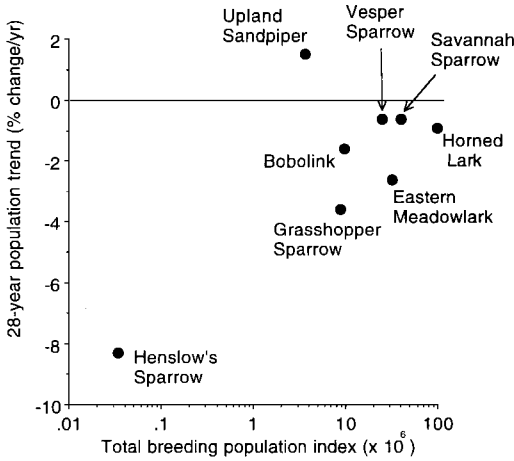


FIGURE 1. Total breeding population index versus 28-year population trend in eight species of northeastern grassland birds.

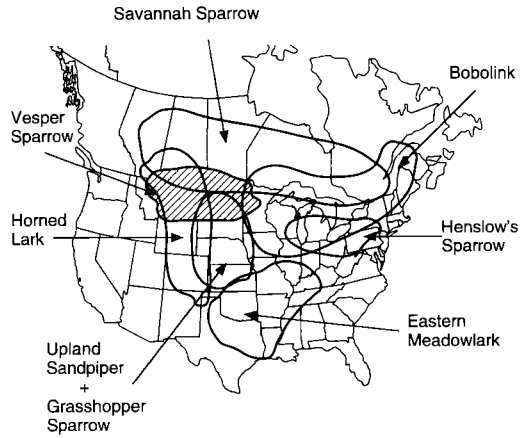


FIGURE 3. Schematic showing general areas of highest abundance for eight species of northeastern grassland birds.

UPLAND SANDPIPER

The largest breeding populations of Upland Sandpipers occur in the Great Plains states of South Dakota (34%), North Dakota (19%), Nebraska (15%), and Kansas (11%; Fig. 3). In the Great Plains, the species shows an increasing population trend, indicating that the overall population is doing well where the species is most abundant (Fig. 2). The northeastern United States supports a small percentage of the total

breeding population of this species, and no subspecies have been described. The long-term population trend for the region appears to be stable, although there is clear evidence for declines in Upland Sandpipers in portions of the Northeast (Andrle and Carroll 1988, Brauning 1992, Foss 1994). Conservation of Upland Sandpipers in the Northeast will have little impact on the global population status, but as this species is an indicator of intact and diverse grassland commu-

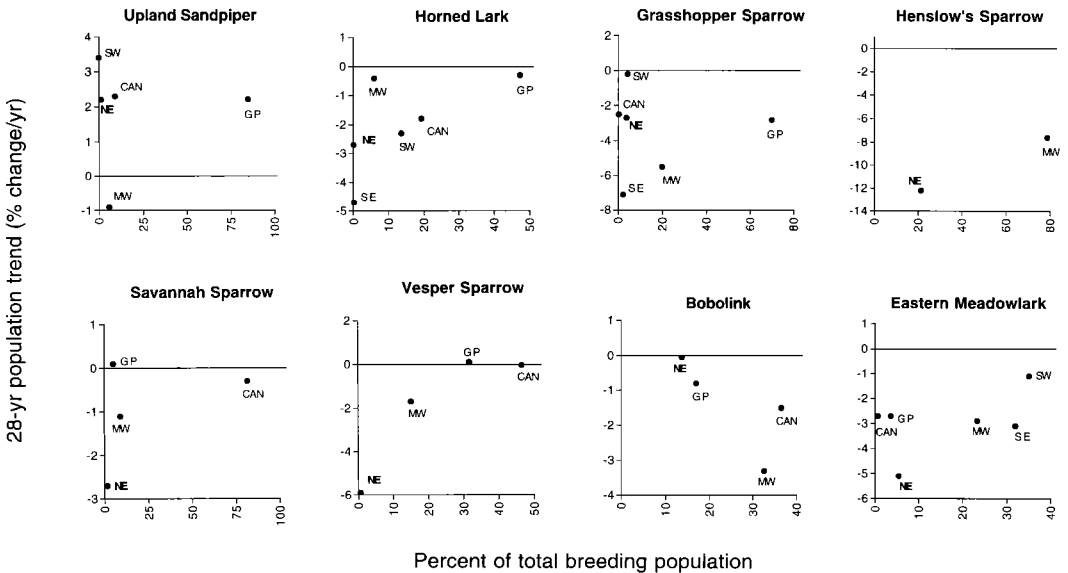


FIGURE 2. Percent of total breeding population for U.S. Fish and Wildlife Service (USFWS) regions and Canada (see Table 1 for abbreviations) versus 28-year population trend for eight species of northeastern grassland birds.

nities, local conservation efforts undoubtedly will continue.

#### HORNED LARK

The largest percentage of the total Horned Lark breeding population occurs in the western Great Plains states and provinces, including Montana (13%), Saskatchewan (12%), Colorado (10%), and North Dakota (7%; Fig. 3). Percentages for this species are probably exaggerated somewhat because far-northern populations in Canada and Alaska are not censused by the BBS and therefore are not included in our analyses. The northeastern United States currently supports less than 1% of the total breeding population of this species and only 2% of the eastern subspecies, *E. a. praticola*. Horned Lark populations are stable in areas where they are most abundant but are decreasing over much of the remainder of the breeding range (Fig. 2). Particularly large declines are seen in northeastern states such as New York (-5.7%) and Pennsylvania (-9.7%) as well as at the southern limit of the eastern breeding range in Kentucky (-9.1%) and Tennessee (-7.9%). By itself the Horned Lark may not be considered a high priority species in the region, as conservation efforts will have minimal impact on the species as a whole. To conserve the rich genetic diversity evident in this highly variable species, however, a continentwide strategy for stabilizing populations is desirable.

#### SAVANNAH SPARROW

The largest proportion of all Savannah Sparrows breed in the Canadian provinces from Alberta to Quebec (Fig. 3). The northeastern United States supports less than 2% of the total breeding population of this species but 55% of the eastern subspecies, *P. s. savanna*. Savannah Sparrows are increasing in the western Canadian provinces but decreasing in the eastern provinces (except Newfoundland), resulting in a stable trend overall in Canada (Fig. 2). Steepest declines are occurring in the Northeast, including most of the range of the eastern subspecies. Because the northeastern United States supports a large percentage of the population of this declining subspecies, its status should be elevated to that of moderate conservation concern in the Northeast. Fortunately, both the global population and local densities of Savannah Sparrows are very high, and the species is more generalized in its habitat selection than are most other grassland species in the region (Wheelwright and Rising 1993).

#### GRASSHOPPER SPARROW

Grasshopper Sparrow breeding populations are largest in the Great Plains states of Kansas (19%), South Dakota (17%), North Dakota (13%), and Nebraska (12%; Fig. 3). The northeastern United States supports only 3.6% of the total breeding population of this species but 11.5% of the eastern subspecies, *A. s. pratensis*. Population declines are evident throughout the range of this species, except in the Southwest (Fig. 2). Declines are particularly steep in some northeastern states, especially New York (-10.2%), New Jersey (-10.2%), and West Virginia (-12.5%), but an increasing population trend in the Piedmont of Virginia (+4.9%) caused the regionwide population decline to be less steep. Because Grasshopper Sparrows are in need of a continentwide conservation strategy, we think efforts to stabilize or enhance local populations in the Northeast are justified.

#### HENSLOW'S SPARROW

Henslow's Sparrow has the smallest total breeding range of any of the species we considered, with virtually the entire global population concentrated in the Midwest and Northeast (Fig. 3). Henslow's Sparrow also shows the steepest declines of any grassland bird, both in the Northeast and throughout its range (Fig. 2). Percentages for these regions may be exaggerated because this species is too rare to be detected on BBS routes in certain states, and these are therefore not included in our trend analysis. For example, fairly large numbers have been found breeding in northeastern Oklahoma since the early 1990s, though the species has only occasionally been registered on BBS routes in that state (Pruitt 1996).

We consider this species to rank first in conservation priority among grassland birds in the Northeast, and efforts to stabilize or enhance regional populations should be made in coordination with an overall strategy to protect this species.

#### VESPER SPARROW

The Vesper Sparrow's breeding distribution overlaps broadly with that of the Horned Lark (Fig. 3), with the largest percentage of the Vesper Sparrow's total breeding population in Alberta (18%), Montana (16%), and Saskatchewan (15%). Populations in these areas, and in the remainder of the species' western range, are stable or increasing (Fig. 2). In contrast, small populations in the northeastern states are declining precipitously. These populations represent 3% of the eastern subspecies, *P. g. gramineus*, which is declining throughout its range. As with Horned Lark and other widespread species, con-

ervation efforts in the Northeast will have little impact on the total breeding population of vesper sparrows; however, concern for the eastern subspecies, if warranted, could elevate this species' conservation status in the region.

#### BOBOLINK

Unlike most of the other species considered here, the Bobolink is fairly evenly distributed over a broad area; no single state or province supports more than about 10% of the total breeding population. The largest numbers occur in a belt from North Dakota and Minnesota east to southern Quebec (Fig. 3). Unlike populations of the other species we considered, Bobolink populations have been stable in most northeastern states (Fig. 2); the largest declines have occurred in the Midwest (especially Indiana [-8.7%] and Illinois [-10.7%]) and in Quebec (-4.1%). The Northeast has a relatively large percent of the total breeding population (13.7%); only Henslow's Sparrow has more of its total breeding population in this region (21.3%). The lack of declining populations and lack of geographic variation evident in this species, however, suggest that the Bobolink is only a moderate conservation priority in the region.

#### EASTERN MEADOWLARK

The largest breeding populations of Eastern Meadowlarks occur in the southern Great Plains states, from Missouri to Texas (Fig. 3). Populations in these states show a weak negative population trend (Fig. 2). Throughout the remainder of the species' range, declines are much steeper, with declines of more than 8% per year in some northeastern states. All states with significant declining trends are in the range of the eastern subspecies, *S. m. magna*. Conservation status of the Eastern Meadowlark in the Northeast is similar to that of the Grasshopper Sparrow, in that although regional efforts will have little impact on the global population, they may be coordinated with a rangewide strategy to conserve the species. Similarly, recognition that the eastern subspecies is particularly vulnerable elevates its conservation priority in the region.

#### DISCUSSION

Our analyses confirm that the northeastern United States does not support a large proportion of the total breeding population of most grassland species. Henslow's Sparrow is the only species for which a substantial proportion of the total breeding population is restricted to the Northeast. Clearly, Henslow's Sparrow is the highest priority grassland species in the region based on this criterion, and any regional conservation plan should focus on stabilizing or en-

hancing populations of this species. Indeed, Henslow's Sparrow ranked first in regional concern, even when compared with all nongrassland birds (Rosenberg and Wells 1995, in press). Therefore, in a regional grassland bird initiative, states such as Pennsylvania and New York, with high proportions of the total breeding population, are most responsible for plans to protect and manage Henslow's Sparrows. Recent status assessments of this species recommended that comprehensive inventory and monitoring programs be undertaken throughout the breeding range, especially since the ability to monitor Henslow's Sparrows through BBS data will become increasingly problematic as the species declines (Smith 1992, Pruitt 1996).

Should other grassland species be given low priority for conservation in the Northeast? Even though conservation actions in this region will have little effect on the long-term continental persistence of these species, several factors argue for continued concern for regional populations. First, most of the declining grassland species are found in habitats that support unique assemblages of plants, invertebrates, and other nonavian vertebrates. For example, northern blazing star (*Liatris scariosa* var. *novae-angliae*) is a rare grassland perennial found only in the northeastern United States; it occurs in habitats that also support grassland birds (Vickery 1996).

Additionally, for several geographically variable species, eastern populations represent described subspecies, and in nearly every case the eastern subspecies are exhibiting the most precipitous declines. Even for widespread species such as Savannah Sparrow and Eastern Meadowlark, significant genetic diversity may be represented in the Northeast and is therefore worthy of protection.

Changes in species-level taxonomy, reflecting modern knowledge of genetic variation, continue to have profound effects on conservation priorities. A recent example is the elevation of Bicknell's Thrush (*Catharus bicknelli*) to full species (Ouellet 1993, AOU 1995), changing its status in the Northeast from a marginal population of the widespread Gray-cheeked Thrush (*C. minimus*) to being among the highest priority landbird species in the region (Rosenberg and Wells 1995, in press). Similarly, the recognition of Salt-marsh Sharp-tailed Sparrow (*Anmodramus caudacutus*) as a separate species (AOU 1995) has made it one of the Northeast's highest priorities in terms of importance of the region to the global population of the species. Importantly, these examples serve to focus attention on the restricted habitats of these "new" species, in these cases stunted mountaintop forests and coastal salt marshes, respectively. Although

modern studies of geographic variation are lacking for most North American bird species (Zink and Remsen 1986), we feel that assessing conservation priorities based on even a dated assessment of morphological distinctiveness (i.e., the 1957 American Ornithologists' Union's check-list) is preferable to ignoring potential regional genetic diversity in northeastern grassland species.

#### BIOGEOGRAPHIC PERSPECTIVE ON GRASSLAND BIRD CONSERVATION

Our analyses have identified areas of North America where the largest breeding populations of each grassland species are concentrated (Fig. 3). Each of these areas has a high responsibility for the overall conservation of a particular species or suite of species, and conservation efforts outside these areas should be coordinated with efforts in the core of each species' range. Interestingly, species that are similar in overall breeding distribution also tend to be similar in their local distribution and habitat affinities in the Northeast. For example, Vesper Sparrows and Horned Larks, which both reach their highest abundance in the western Great Plains, have similar breeding distributions in the northeastern United States based on atlas-block occurrence (Rosenberg and Wells 1995). Both species also tend to occupy dry, sparsely vegetated sites. These distributions are different, however, from those of Bobolinks and Savannah Sparrows, which are also similar to each other in continental and regional breeding distribution as well as in habitat preference. A third example is that of Upland Sandpipers and Grasshopper Sparrows, whose highest abundances are concentrated in the prairie states from North Dakota to Kansas. These two species require larger habitat areas than other species in the Northeast (Vickery et al. 1994), and they tend to share a similar distribution throughout the region.

None of these grassland-species clusters, however, was strongly tied to any geographic portions of the region, such as particular physiographic areas (Rosenberg and Wells 1995). This means there is no clearly defined physiographic region in the Northeast where management plans could be developed for grassland birds as a whole. Instead, what is required is a larger, regionwide initiative that would set different goals for different species in each area.

#### DEVELOPING A CONSERVATION PLAN FOR THE NORTHEAST

The first step in developing a management plan for grassland species in the Northeast is to carry out a comprehensive inventory so we know where the species of interest occur and

how many occur at each site. Fortunately, in New England many of the sites where grassland birds occur have been identified and surveyed (Jones and Vickery 1995), and monitoring efforts are well underway. Inventories are also being undertaken in other northeastern states, including New York and Pennsylvania, through the National Audubon Society Important Bird Areas programs in coordination with the Northeastern Grassland Bird Working Group of Partners In Flight.

Estimates of many other demographic parameters for each population (fecundity, mortality, mean population growth rates, etc.) are also needed to understand the factors affecting abundance trends and to model extinction probabilities (Boyce 1992, Burgman et al. 1993). There are, however, first approximations of these parameters available from other studies (Wells 1995) that allow at least preliminary consideration of the importance of different sites to the extinction risks of grassland species. In Maine, a population viability analysis (PVA) that was carried out for Grasshopper Sparrows yielded useful management recommendations (Wells 1995). Carrying out a preliminary PVA for the New England grassland bird species of concern would help identify those sites of highest importance for the long-term persistence of grassland species in the Northeast. These sites could then be targeted for action, whether it be acquisition, easements, management agreements, or other options.

Another logical step in developing a regional plan for grassland birds would be to identify sites that support multiple grassland species and to see how many of these sites are protected. This is the basic concept of GAP analysis as applied to a limited bird community (Scott and Csuti 1991). For example, consider the number of sites in New England (excluding Vermont) where all of the following species breed: Upland Sandpiper, Vesper Sparrow, and Grasshopper Sparrow. There are perhaps six sites where all three species are known to breed (P. Vickery, pers. comm.). Only one of these is a protected wildlife preserve (Kennebunk Plains Wildlife Management Area, Maine). Four of the other sites are military or municipal airports, and one is a privately owned parcel. The airports could be managed quite easily and effectively for grassland birds with little added expense or modification of airport management plans, as has been shown at Westover Air Force Base in Massachusetts (Melvin 1994, Jones and Vickery 1995). Clearly, however, the long-term persistence of any grassland species in New England will require preservation and management at more than these six sites.

For Henslow's Sparrow, which we have identified as one of the species of most immediate concern in the Northeast, conservation plans are not fully developed. The first priority for developing a plan is to find out where the birds occur and how many are at each site. Therefore, a regional cooperative effort, largely involving New York and Pennsylvania, must be undertaken to identify and survey sites for Henslow's Sparrow. The majority of the most important sites have been identified through the site inventory programs of the National Audubon Society Important Bird Areas programs in New York and Pennsylvania. These sites, and others throughout New England, are being inventoried and monitored using a standardized methodology coordinated through the Northeastern Grassland Bird Working Group of Partners In Flight.

One aspect of the conservation of all species of grassland birds in the Northeast is the importance of military installations and of commercial and municipal airports. Many of the largest concentrations of grassland birds occur at these sites throughout the region. In New England, cooperative management between airport or site managers and wildlife managers has been successful in increasing grassland bird populations (Melvin 1994). The importance of these sites should be assessed for the entire region, and coordination of management efforts among sites (particularly those in the same organizations, i.e., naval bases, air-force bases, etc.) should be encouraged.

Finally, we note that the long-term persistence of grassland bird species in the Northeast is unlikely if these species are restricted to a few isolated, publicly managed sites. Private landowners and public land managers must be provided with guidelines for management practices that are beneficial to grassland birds, and they must be encouraged to implement them.

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