

ON GRASSLAND BIRD CONSERVATION IN THE NORTHEAST

Author: Norment, Christopher

Source: The Auk, 119(1) : 271-279

Published By: American Ornithological Society

URL: [https://doi.org/10.1642/0004-8038\(2002\)119\[0271:OGBCIT\]2.0.CO;2](https://doi.org/10.1642/0004-8038(2002)119[0271:OGBCIT]2.0.CO;2)

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.



The Auk 119(1):271–279, 2002

On Grassland Bird Conservation in the Northeast

CHRISTOPHER NORMENT¹

Department of Biological Sciences, SUNY College at Brockport, Brockport, New York 14420-2971, USA

Populations of many grassland birds in North America have declined significantly during the last 30 years (Knopf 1994, Peterjohn and Sauer 1999). Although population trends of many groups of breeding birds vary across geographic regions (James et al. 1992, Herkert 1995, Sauer et al. 1997), the declining trend for grassland birds is consistent across much of North America, including the Northeast (Bollinger and Gavin 1992, Askins 1993, Peterjohn and Sauer 1999). Declining trends and relatively low population levels for many grassland birds in the Northeast (Shriver et al. 1997), defined here as New York and the six New England states, has led to concern for the status of many species. By the early 1990s, birds of grassland and open habitats were the species most frequently listed as endangered, threatened, or of special concern by states in the Northeast, with 12 species classified by three or more states (Vickery 1992). Reasons for grassland bird decline in the Northeast include farmland abandonment with subsequent succession to woodland habitat, decline of hayfield area, and increased haycropping during the nesting season (Andrle and Carroll 1988, Bollinger et al. 1990, Askins 1997, Vickery and Dunwiddie 1997). Because many grassland bird species are area-sensitive, those species are particularly vulnerable to habitat loss and fragmentation (Herkert 1994, Vickery et al. 1994). In New England and New York, grassland area has declined by 60% since the 1930s (Vickery et al. 1994).

Concern for grassland birds in the Northeast has stimulated research, educational initiatives, conservation-oriented management, and habitat acquisition by federal, state, and nongovernmental organizations (Vickery et al. 1994, Jones and Vickery 1997, National Resources Conservation Service 1997, Shriver et al. 1997, Vickery and Dunwiddie 1997, Casey 1998). However worthwhile those activities may be, they have occurred without a comprehensive regional plan for managing grassland birds. Such a regional plan, preferably as part of a general plan for all native birds in the region, is crucial for several reasons. First, the plan would provide a rationale for conserving grassland birds in the Northeast in the context of current and historical land-use patterns.

Second, the plan could establish a regional framework for coordinating research and conservation and implementing management and monitoring activities. The plan might be formulated by the U.S. Department of the Interior Fish and Wildlife Service (USFWS), the federal agency most involved in management of nongame birds in the region, in concert with state agencies and nongovernmental organizations, and the Bird Conservation Plans developed by Partners in Flight for physiographic regions of North America (Carter et al. 2000, Rosenberg 2000). To date, bird conservation plans have been developed for all eight physiographic regions within the Northeast and adjacent parts of Canada and the United States (Partners in Flight 2001).

The Recent History of Grasslands and Grassland Birds in the Northeast.—A strong rationale for conserving grassland birds in the Northeast is necessary because their regional decline is probably a recent phenomenon, caused mainly by a post-1900 decrease in non-forested habitat (Fig. 1; Whitney 1994, Foster 1995, Pimm and Askins 1995). Prior to European settlement, there were scattered large grasslands in the region, such as the 24,000 ha Hempsted Plains on Long Island, the coastal plains surrounding Narragansett Bay, Rhode Island, and the “blueberry barrens” along the Maine coast (Askins 1997, 2000; Winne 1997). However, land survey records and palynological data suggest that in pre-Columbian times, most of northeastern North America was forested (Russell 1981, Burden et al. 1986, McAndrews 1988, Patterson and Sassaman 1988, Marks and Gardescu 1992, Foster 1995, Dieffenbacher-Krall 1997). Native Americans created open areas through agricultural practices and fire use (Burden et al. 1986, McAndrews 1988, Askins 1997), particularly in south and central coastal New England (Patterson and Sassaman 1988). However, Foster’s (1995) analysis of 400 years of land-use history in New England concludes “... there is little evidence that aboriginal activity exerted an impact on the broad-scale pattern of vegetation as would have occurred for example through extensive slash-and-burn agriculture.”

Askins (1997, 2000) and Wells and Rosenberg (1999) also cite endemic avian taxa such as the Heath Hen (*Tympanuchus cupido cupido*), the eastern subspecies of Henslow’s Sparrow (*Ammodramus henslowii* su-

¹ E-mail: cnorment@brockport.edu

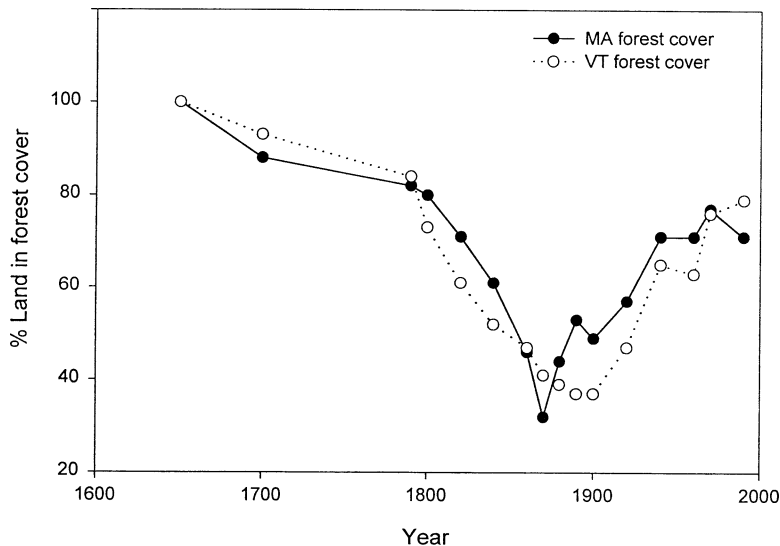


FIG. 1. Forest cover in Massachusetts (MA) and Vermont (VT), 1650–1990. Data from Foster (1995) and Harvard Forest data archives.

surrans), and the “Ipswich” subspecies of Savannah Sparrow (*Passerculus sandwichensis princeps*) as evidence that extensive grasslands existed in the region prior to European colonization, or before Native Americans started clearing land. Although there may be some validity to that argument, inferences concerning extensive grasslands in the region based on these subspecies are only as strong as the data on habitat selection and systematics. Heath Hens were common in scrub oak habitats, oak parklands, and shrubby habitats, as well as fire-created prairie and blueberry barrens (Schroeder and Robb 1993, Askins 1997); thus, long-term persistence and differentiation of populations in the Northeast may not have required extensive grasslands. Parkes (1952) questioned the subspecific status of specimens referred to as *A. h. susurrans*, and Henslow’s Sparrows may vary clinally along an east–west gradient (Smith 1998). If this scenario is correct, it would be difficult to use *A. h. susurrans* to support existence of extensive pre-Columbian grasslands. Finally, although the Ipswich Sparrow is restricted to the Northeast, it breeds only on Sable Island, off the coast of Nova Scotia (Wheelwright and Rising 1993).

Whatever the taxonomic status of eastern Henslow’s Sparrow populations, and Heath Hen habitat preferences, some grassland species expanded their range into eastern North America during the late 1800s and early 1900s due to forest clearing in the Midwest and Northeast (Hurley and Franks 1976, Askins 1997). Horned Larks (*Eremophila alpestris*) spread eastward from Illinois and Wisconsin beginning in the 1870s, and reached New England by 1891 (Hurley and Franks 1976). Other grassland species

that expanded their range eastward include the Western Meadowlark (*Sturnella neglecta*; Lanyon 1956) and Lark Sparrow (*Chondestes grammacus*; Brooks 1938). The Henslow’s Sparrow, listed as threatened or endangered by five Northeast states, and whose status was recently assessed by the USFWS (Pruitt 1996), also expanded its range within the last 100 years. In New York, the species was rare in the early 1900s, and populations apparently increased in the 1920s through 1940s (Hyde 1939, Pruitt 1996). The species may not have occurred in Pennsylvania prior to 1900. In Massachusetts, maximum Henslow’s Sparrow abundance coincided with the period of farm abandonment (Pruitt 1996), and the species first appeared in Ontario, Canada in the 1890s (Knapton 1984). Hyde (1939) hypothesized that Henslow’s Sparrows colonized vacant habitats from population centers in the Midwest and East Coast salt-marsh habitats. Other grassland birds currently common in the Northeast, including Upland Sandpiper (*Bartramia longicauda*), Grasshopper Sparrow (*Ammodramus savaannarum*), Savannah Sparrow, Eastern Meadowlark (*Sturnella magna*), and Bobolink (*Dolichonyx oryzivorus*), probably were present in the region prior to large-scale forest clearing (Askins 1997). Even so, it is unlikely that pre-Columbian grassland bird populations in the Northeast would have been very high relative to populations at any time since 1900, given the preponderance of forest habitat in the region prior to European settlement.

Lack of extensive pre-Columbian grasslands in the Northeast should not necessarily be used to argue against promoting regional grassland bird populations, given their continental decline and rates of

habitat loss in the Midwest. In the Midwest, habitat loss due to urban development, agriculture, and range management practices exceeds 80%, with rates >99% for tallgrass prairie east of the Missouri River and >80% for shortgrass prairie in Montana and North Dakota (Samson and Knopf 1994, Vickery et al. 1999). Although anthropogenic habitats in the Midwest such as pastures and hayfields provide breeding habitat for grassland birds, conversion of those areas into rowcrops and shortened cutting rotations for hay have rendered much of that region unsuitable for grassland birds (Vickery et al. 1999). Thus, northeastern grasslands may provide important habitat for species such as the Bobolink and Henslow's Sparrow, which are declining across much of their historic ranges (Herkert 1997, Wells and Rosenberg 1999).

On the Need for a Temporally Explicit Management Plan for Grassland Birds.—My analysis of prehistoric and historic vegetation and avian distribution patterns is not meant to suggest that concern for grassland birds in the Northeast is misplaced. Rather, I am emphasizing the need for a temporally explicit management plan for grassland birds in the Northeast. By “temporally explicit” I mean that any viable management plan for grassland must incorporate the principle that landscapes and the populations they support are dynamic on geological and historical time scales (Litwin and Smith 1992, Foster 1995, Christensen 1997, Crow and Gustafson 1997). Given that landscapes are dynamic, a critical issue becomes one of identifying where a target ecosystem, community, or population lies along the temporal continuum, and incorporating a historical perspective into questions related to conservation priorities and the allocation of precious resources. Thus, the seemingly straightforward suggestion that restoration activities should target “the original ecosystem” (Bradshaw 1987) ignores the issue of a temporal reference point for defining “original ecosystem.”

Ecologists have long recognized the need to incorporate spatial scale into planning ecological restorations. Issues of temporal scaling (i.e. history) have received less attention until recently, although they should be incorporated into our thinking about bird population changes and management (Freemark et al. 1995, Knopf 1996, Christensen 1997, Crow and Gustafson 1997). For example, early-successional forest species such as the Chestnut-sided Warbler (*Dendroica pensylvanica*) and American Redstart (*Setophaga ruticilla*) probably were rare prior to European colonization of New Hampshire, and increased as early successional habitats increased during the late 1800s and early 1900s; more recent population declines have followed forest maturation which began in the mid-1900s (Litvaitis 1993, Hunt 1998). At a local scale, forest succession and changing land-use practices dramatically affected composition of a Neotropical migrant bird community in an undis-

turbed central New York forest fragment (Litwin and Smith 1992).

Given the dynamic nature of northeastern landscapes, what should be the temporal target for grassland bird conservation in the region? Perhaps the target should be 1600 A.D., prior to the arrival of European colonists. There is a widespread view that North American ecosystems should be managed within their “range of natural variability,” which refers to ecosystem variability in structure, composition, and dynamics prior to the influence of Europeans; thus, precolonial landscapes represent a conservation “ideal” (Kaufmann et al. 1994, Swanson et al. 1994). For example, the goal for habitat restoration at Walnut Creek National Wildlife Refuge, Iowa is a return “to the natural condition that existed prior to Euro-American settlement” (Drobney 1994), while the Minnesota Valley National Wildlife Refuge Landscape Plan identifies the time at which “the system was least affected by human [European] disturbance (Schroeder et al. 1998)” as the reference point for establishing management objectives. In the Northeast, one USFWS biologist suggested that the regional ideal might be a landscape with scattered, small openings like those created by native peoples—even though “. . . there is no conclusive paleoecological record of Indian modification of the New England forest landscape (Foster 1995),” and aboriginal land use patterns were dynamic in space and time (Patterson and Sassaman 1988, Doolittle 1992, Graber 1995). Given the relationship between habitat loss and grassland bird abundance (Herkert et al. 1996, Vickery et al. 1999) and the assumption that the amount of grassland habitat in the Northeast is inversely (if only roughly) proportional to regional forest cover, grassland bird abundance at the regional level must have been very low in pre-Colonial times, and current grassland bird abundance in the region is most likely higher than in the 1600s.

Another target for grassland bird management might be 1875–1900, when the amount of cleared land in New England reached its historical maximum (Foster 1995), species such as Henslow's Sparrow were expanding their range, and regional grassland bird populations probably were much higher than between 1966 and 2000. Yet another target might be 1966, when the USFWS began the Breeding Bird Survey; at this point, we would be able to incorporate data on grassland bird populations into management plans. For example, Breeding Bird Survey data for Savannah Sparrows and Eastern Meadowlarks, which are widely distributed in the Northeast (Sauer et al. 1997; Fig. 2), show consistent region-wide declines between 1966 and 1996. Similar trends for other species are the basis for current concern for grassland birds in the region.

The question now becomes, How should this analysis influence thinking about management objectives for grassland birds? Very different conclusions fol-

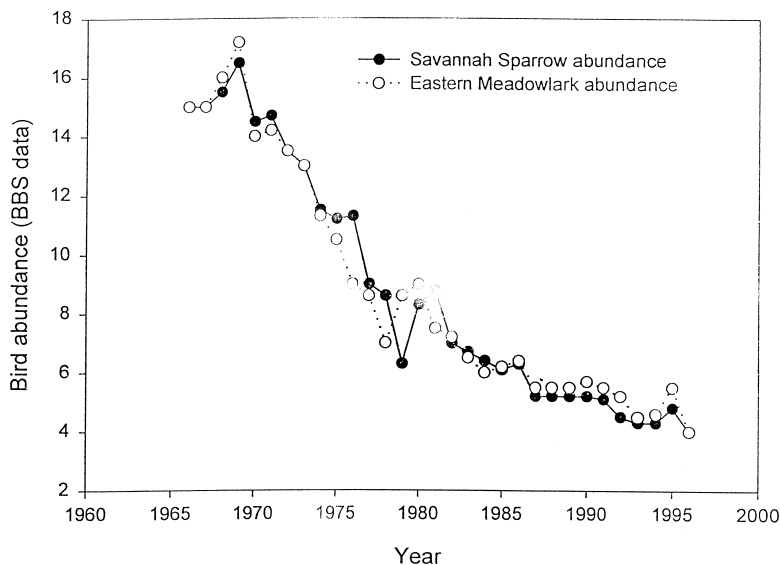


FIG. 2. Savannah Sparrow and Eastern Meadowlark abundance from Breeding Bird Survey (BBS) data for U.S. Department of the Interior Fish and Wildlife Service Region 5; data from Sauer et al. 1997.

low from selecting 1600, 1875, or 1966 as a regional target date. If we accept the ideal of targeting pre-Columbian landscapes as our restoration goal and chose 1600, evidence suggests that grassland habitats and birds are undoubtedly much more common in 2000 than in 1600 (Whitney 1994, Foster 1995, Pimm and Askins 1995), whereas birds dependent on mature deciduous forest habitat are less common. That could lead to the conclusion that we should de-emphasize grassland bird conservation in the Northeast and focus on late-successional forest species. If we choose 1875–1900 as our target, then we probably have fewer grassland birds and we should emphasize those species at the expense of forest-dependent species. A focus on 1966, with a perspective incorporating Breeding Bird Survey data, would also imply that we should be most concerned about grassland birds, due to their recent region-wide decline. That focus would be quite different than during the 1970s and 1980s, when reported declines in forest-dependent species received much attention (Whitcomb 1977, Robbins 1979, Askins and Philbrick 1987)—even though Breeding Bird Survey data suggest that many forest-interior species, such as the Ovenbird (*Seiurus aurocapillus*), are now increasing in the region (Sauer et al. 1997).

But we cannot think only about landscapes and populations at a scale restricted to the Northeast. A case in point is the Bobolink, which is declining at rates approaching 10% per year in Illinois and Indiana (Herkert 1997, Wells and Rosenberg 1999). In the Northeast, Bobolinks are most abundant in the St. Lawrence River Valley (Shriver et al. 1997); on the basis of Breeding Bird Survey data, Rosenberg (2000)

estimated that the St. Lawrence Plain may support up to 17% of the world's population of Bobolinks. Even though the St. Lawrence River Plain was dominated by deciduous hardwood forests in pre-Columbian times (Despons 1996), cultivation during the last 200 years has created a vast agricultural grassland in which climate and poor drainage have enhanced the value of the region to grassland birds such as the Bobolink and Henslow's Sparrow (Rosenberg 2000). In this case, a rational argument could be made for a management target date set in the late twentieth century, with an emphasis on enhancing grassland habitat. That approach is being undertaken by the USFWS in its St. Lawrence Wetlands and Grassland Management District, where the Partners in Wildlife program restores old field habitats to grasslands, which are maintained in an early successional stage by private landowners.

Thinking Outside of the Box.—Is there a way out of the dilemma imposed by the dynamic nature of landscapes, in which we can create a rational, regional management plan for grassland birds? There is, as long as we recognize that management decisions are based on values, and first identify the reasons why the conservation of grassland birds is important in the Northeast. Rosenberg and Wells (1995) and Wells and Rosenberg (1999) argue that grassland birds should be a conservation priority in the Northeast because the global or national abundances of several species are tied to the region, and it is important to maximize regional biodiversity of native bird species. Once a rationale has been developed, conservation priorities can be established, as the Partners in Flight and the Rocky Mountain Bird Observatory

are doing for North American breeding birds, and those priorities incorporated into management plans. Management plans applying concepts of spatial and temporal scales could then be produced, as with the Partners in Flight Landbird Conservation Plans. For example, the St. Lawrence Plain plan (Physiographic Area 18; Rosenberg 2000), which emphasizes grassland bird conservation, explicitly acknowledges the issue of temporal dynamics: "This issue [early vs. late-successional habitats and species—historical baselines] which permeates bird-conservation planning throughout the Northeast, must be resolved before priority species and habitats are determined" (Rosenberg 2000).

However, as the bird conservation plans assume, management plans should be developed not only for one species or group of species, such as grassland birds, but for all species in some more inclusive group, such as terrestrial birds. Management activities targeted for one group of organisms, such as grassland birds, may affect all taxa in the area—both groups that will increase under the proposed management regime, and those that will decrease (Hendricks 1997). For example, increasing grassland habitat in the Northeast could lead to an increase in forest fragmentation at the landscape scale, which in turn could negatively affect breeding success of forest species through increased nest predation and Brown-headed Cowbird (*Molothrus ater*) brood parasitism (Brittingham and Temple 1983, Wilcove 1985, Hahn and Hatfield 1995, Trine 1998, Porneluzi and Faaborg 1999). An exception to that fragmentation effect might occur in landscapes with a high proportion of "nonfunctional" habitat, such as agricultural lands supporting few native birds; in such situations, it might be possible to increase grassland bird habitat by managing agricultural habitat without decreasing forest habitat and fragmentation (P. Vickery pers. comm.).

Accepting grassland bird conservation as a regional priority in the Northeast and managing most effectively for that species group would mean violating several important principles accepted by many conservation biologists. The first of those is the pre-Columbian landscape ideal, which in the Northeast would mean de-emphasizing grassland bird conservation. Instead, we would need to promote anthropogenic grassland habitat where little or none existed prior to European settlement. Whereas returning to the type of landscape that existed in the Northeast in 1900 would be neither desirable nor possible, we might want to consider the habitat composition that would have existed at around 1966 to be the ideal towards which we should strive. A second principle that we might need to violate to promote grassland bird populations is related to ecosystem management. Although ecosystem management has been defined in different ways (Clark 1999), most definitions incorporate the idea that ecosystems are dy-

namic, and must be managed as such (e.g. Gumbine 1994, Christensen 1997). To quote Christensen (1997), "management determined to 'freeze' ecosystems in a particular state has generally proven to be futile and unsustainable." However, promoting grassland habitat in the Northeast means that extant habitat must be maintained in an early successional state, primarily through a combination of mowing, herbicide treatment, and prescribed burning. Most Northeast undisturbed grassland habitats will quickly revert to old-fields dominated by shrubs and late-season perennial herbs, and then to forest (Root 1995, Dunwiddie et al. 1997, Mitchell 2000); reclaiming those sites requires much time, effort, money, and equipment (Dickerson et al. 1998, Mitchell 2000). Thus, if our selected target date for northeastern birds is 1966, we will have to fight the dynamic nature of landscapes to retard forest succession in the region to attain our management goals.

A third conservation principle that may need to be ignored is that of promoting native rather than introduced species (Gumbine 1994). Most naturally occurring grasslands in the Northeast, which were limited primarily to maritime areas and sand plains, were structurally and floristically similar to mid-western prairies, and were dominated by warm-season grasses (Niering and Dreyer 1989, Mehrhoff 1997, Dunwiddie et al. 1997). Conversely, most extant grasslands in the Northeast are anthropogenic habitats (pastures and hayfields) dominated by introduced cool-season grasses (Vickery and Dunwiddie 1997). Recent grassland restorations in the Northeast have focused on establishing warm-season grasses such as big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), and little bluestem (*Schizachyrium scoparium*) (Dickerson et al. 1998). However, restored vegetation in northeastern fields dominated by warm-season grasses is generally tall and dense, and often does not provide good structure for most grassland birds; for example, dense stands of switchgrass support almost no grassland birds in western New York (Norment et al. 1999). Conversely, abundance of most northeastern grassland birds is high in cool-season grasslands with relatively low, sparse cover and dominated by introduced species such as timothy (*Phleum pratense*) and orchard grass (*Dactylis glomerata*) (Bollinger 1995, Vickery and Dunwiddie 1997, Norment et al. 1999). Although some cool-season grasses native to the Northeast are available commercially, cultivars of native cool-season species generally have not been developed for use in the region (Dickerson et al. 1998). Thus managers desiring to promote grassland bird populations in the Northeast might want to encourage the growth of nonnative cool-season grasses, perhaps in mixtures with native warm-season grasses of lower stature (Sample and Mossman 1997).

I previously mentioned the possibility of using Partners in Flight Bird Conservation Plans as the basis for a management plan for grassland birds in the Northeast. Among the eight bird conservation plans developed for physiographic regions in the Northeast, five (St. Lawrence Plain, Lower Great Lakes Plain, Southern New England, Northern Ridge and Valley, and Allegheny Plateau) list grassland birds as conservation priorities, and target a total of 988,000 ha of grassland in the United States and Canada for protection (Partners in Flight 2001). However, these plans (as well as other grassland bird conservation efforts in the region) do not fully consider the recent vegetation history, nature of the Northeast, the difficulty of maintaining grasslands in the region, or the costs involved in doing so. For example, although some of the targeted 988,000 ha of habitat can be maintained as agricultural grasslands, as in the St. Lawrence Plain (Rosenberg 2000), recent changes in agricultural practices have rendered many areas in the Midwest as unsuitable for grassland birds (Vickery et al. 1999) and could have similar effects in the Northeast. Thus, maintenance or creation of grasslands in agricultural areas, as well as in protected areas such as National Wildlife Refuges, may involve substantial costs for agencies and nongovernmental organizations with limited budgets. At Iroquois National Wildlife Refuge in western New York, it costs about \$675 per hectare to establish a cool-season grassland in old-field habitat, or about \$13,500 for a 20 ha field, with ongoing maintenance costs of about \$1,000 annually (S. Kahl pers. comm.). Although those costs may seem reasonable at the local level, budgetary and personnel considerations may impose severe limitations on establishment and maintenance of northeastern grasslands. These constraints, along with issues related to habitat fragmentation, may necessitate the use of a "triage" approach to grassland habitat management in the Northeast, with only the "best" grasslands targeted for management.

In conclusion, declining trends and relatively low population levels for many grassland birds across much of North America, particularly in the Midwest, along with increasing rates of habitat loss, support the argument that grassland bird conservation should be a regional priority in the Northeast. However, grassland bird conservation in the Northeast presents a dilemma because populations of most species were probably low at the regional level prior to the arrival of Europeans, whose activities have dramatically altered the landscape during the last 400 years. If grassland birds are to be a regional conservation priority, we may have to violate several widely accepted tenets of conservation biology, and promote anthropogenic habitats that are dominated by introduced species and protected against ecological succession. Additionally, promoting grassland bird populations in the Northeast through habitat creation and maintenance may mean diverting pre-

cious resources from other regionally important conservation efforts in the Northeast (F. Knopf pers. comm.), including conserving species that historically may have been more abundant than grassland birds in the region. For these reasons, issues and management activities related to grassland bird conservation in the Northeast must be approached with particular wisdom and care.

Acknowledgments.—The U.S. Department of the Interior Fish and Wildlife Service, New York State Department of Environmental Conservation, and State University of New York at Brockport funded my research on grassland birds. P. Harris, P. Hendricks, D. Johnson, F. Knopf, P. Vickery, and M. Winter commented on drafts of the manuscript.

LITERATURE CITED

- ANDRLE, R. F., AND J. R. CARROLL. 1988. The Atlas of Breeding Birds in New York State. Cornell University Press, Ithaca, New York.
- ASKINS, R. A. 1993. Population trends in grassland, shrubland, and forest birds in eastern North America. *Current Ornithology* 11:1–34.
- ASKINS, R. A. 1997. History of grasslands in the northeastern United States: Implications for bird conservation. Pages 119–136 in *Grasslands of Northeastern North America* (P. D. Vickery and P. W. Dunwiddie, Eds.). Massachusetts Audubon Society, Lincoln, Massachusetts.
- ASKINS, R. A. 2000. Restoring North America's Birds: Lessons from Landscape Ecology. Yale University Press, New Haven, Connecticut.
- ASKINS, R. A., AND M. J. PHILBRICK. 1987. Effect of changes in regional forest abundance on the decline and recovery of a forest bird community. *Wilson Bulletin* 99:7–21.
- BOLLINGER, E. K. 1995. Successional changes and habitat selection in hayfield communities. *Auk* 112:720–730.
- BOLLINGER, E. K., P. B. BOLLINGER, AND T. A. GAVIN. 1990. Effects of haycropping on eastern populations of the Bobolink. *Wildlife Society Bulletin* 18:142–150.
- BOLLINGER, E. K., AND T. A. GAVIN. 1992. Eastern Bobolink populations: Ecology and conservation in an agricultural landscape. Pages 497–506 in *Ecology and Conservation of Neotropical Migrant Landbirds* (J. M. Hagan III and D. W. Johnston, Eds.). Smithsonian Institution Press, Washington, D.C.
- BRADSHAW, A. D. 1987. The reclamation of derelict land and the ecology of ecosystems. Pages 53–74 in *Restoration Ecology* (W. R. Jordan III, M. E. Gilpin, and J. D. Aber, Eds.). Cambridge University Press, New York.
- BRITTINGHAM, M. C., AND S. A. TEMPLE. 1983. Have cowbirds caused forest songbirds to decline? *BioScience* 33:31–35.

- BROOKS, M. 1938. The Eastern Lark Sparrow in the upper Ohio Valley. *Cardinal* 4:181–200.
- BURDEN, E. T., J. H. MCANDREWS, AND G. NORRIS. 1986. Palynology of Indian and European forest clearances and farming in lake sediment cores from Awenda Provincial Park, Ontario. *Canadian Journal of Earth Science* 23:43–54.
- CARTER, M. L., W. C. HUNTER, D. N. PAHLEY, AND K. V. ROSENBERG. 2000. Setting conservation priorities for landbirds in the United States: The Partners in Flight approach. *Auk* 117:541–548.
- CASEY, J. 1998. Wildlife inventory/monitoring procedure: Grassland birds. U.S. Department of the Interior, Fish and Wildlife Service Region 5, Hadley, Massachusetts.
- CHRISTENSEN, N. L. 1997. Managing for heterogeneity and complexity in complex landscapes. Pages 167–186 in *The Ecological Basis of Conservation* (S. T. A. Pickett, R. S. Ostfeld, M. Shachak, and G. E. Likens, Eds.). Chapman and Hall, New York.
- CLARK, J. R. 1999. The ecosystem approach from a practical point of view. *Conservation Biology* 13: 679–681.
- CROW, T. R., AND E. J. GUSTAFSON. 1997. Ecosystem management: Managing natural resources in space and time. Pages 215–228 in *Creating a Forestry for the 21st Century* (K. A. Kohm and J. F. Franklin, Eds.). Island Press, Washington, D.C.
- DESPOIS, M. 1996. Biogeography of Québec. Pages 18–70 in *Breeding Birds of Québec* (J. Gauthier and Y. Aubry, Eds.). Association Québécoise des Groupes d'Ornithologues, Province of Quebec Society for the Protection of Birds, and Canadian Wildlife Service of Environment Canada, Montreal.
- DICKERSON, J. D., B. WARK, D. BURGDORF, R. MAHER, T. BUSH, B. POOLE, AND C. MILLER. 1998. Vegetating with native grasses in northeastern North America: A manual. U.S. Department of Agriculture, National Resources Conservation Service, Plant Materials Program, and Ducks Unlimited Canada, Syracuse, New York.
- DIFFENBACHER-KRALL. 1997. Paleoecology and historical ecology of an extensive bluejoint reed-grass grassland in coastal eastern Maine. Pages 53–67 in *Grasslands of Northeastern North America* (P. D. Vickery and P. W. Dunwiddie, Eds.). Massachusetts Audubon Society, Lincoln, Massachusetts.
- DOOLITTLE, W. E. 1992. Agriculture in North America on the eve of contact: A reassessment. *Annals of the Association of American Geographers* 82: 386–401.
- DROBNEY, P. M. 1994. Iowa prairie rebirth. *Restoration and Management Notes* 12:16–22.
- DUNWIDDIE, P. W., W. A. PATTERSON III, J. L. RUDNICKY, AND R. E. ZAREMBA. 1997. Vegetation management in coastal grasslands on Nantucket Island, Massachusetts: Effects of burning and mowing from 1982 to 1993. Pages 85–98 in *Grasslands of Northeastern North America* (P. D. Vickery and P. W. Dunwiddie, Eds.). Massachusetts Audubon Society, Lincoln, Massachusetts.
- FOSTER, D. 1995. Land-use history and 400 years of vegetation change in New England. Pages 253–319 in *Global Land Use Change: A Perspective from the Columbian Encounter* (B. L. Turner II, A. G. Sal, F. G. Bernáldez, and F. di Castri, Eds.). Consejo Superior de Investigaciones Científicas, Madrid, Spain.
- FREEMARK, K. E., J. B. DUNNING, S. J. HEIL, AND J. R. PROBST. 1995. A landscape ecology perspective for research, conservation and management. Pages 381–427 in *Ecology and Management of Neotropical Migrant Birds* (T. E. Martin and D. M. Finch, Eds.). Oxford University Press, New York.
- GRABER, D. M. 1995. Resolute biocentrism: The dilemma of wilderness in national parks. Pages 123–135 in *Reinventing Nature? Response to Postmodern Deconstruction* (M. E. Soule and G. Lease, Eds.). Island Press, Washington, D.C.
- GUMBINE, R. E. 1994. What is ecosystem management? *Conservation Biology* 8:27–38.
- HAHN, D. C., AND J. S. HATFIELD. 1995. Parasitism at the landscape scale: Cowbirds prefer forests. *Conservation Biology* 9:1415–1424.
- HENDRICKS, P. 1997. Critics of policy change. *Conservation Biology* 11:305.
- HERKERT, J. R. 1994. The effects of habitat fragmentation on midwestern grassland bird communities. *Ecological Applications* 4:461–471.
- HERKERT, J. R. 1995. An analysis of midwestern breeding bird population trends: 1966–1993. *American Midland Naturalist* 134:41–50.
- HERKERT, J. R. 1997. Bobolink *Dolichonyx oryzivorus* population decline in agricultural landscapes in the midwestern USA. *Biological Conservation* 80:107–112.
- HERKERT, J. R., D. W. SAMPLE, AND R. E. WARNER. 1996. Management of midwestern grassland landscapes for the conservation of migratory birds. Pages 89–116 in *Managing Midwest Landscapes for the Conservation of Neotropical Migratory Birds* (F. R. Thompson III, Ed.). U.S. Department of Agriculture, Forest Service General Technical Report NC-187.
- HUNT, P. D. 1998. Evidence from a landscape population model of the importance of early successional habitat to the American Redstart. *Conservation Biology* 12:1377–1389.
- HURLEY, R. J., AND E. C. FRANKS. 1976. Changes in the breeding ranges of two grassland birds. *Auk* 93:108–115.
- HYDE, S. A. 1939. The life history of Henslow's Sparrow (*Passerherbulus henslowii*). *Miscellaneous*

- publication 41, Museum of Zoology, University of Michigan, Ann Arbor.
- JAMES, F. C., D. A. WIEDENFIELD, AND C. E. McCULLOCH. 1992. Trends in breeding populations of warblers: Declines in the southern highlands and increases in the lowlands. Pages 43–56 in *Ecology and Conservation of Neotropical Migrant Landbirds* (J. M. Hagan III and D. W. Johnston, Eds.). Smithsonian Institution Press, Washington, D.C.
- JONES, A., AND P. VICKERY. 1997. *Conserving Grassland Birds: Managing Agricultural Lands Including Hayfields, Crop Fields, and Pastures for Grassland Birds*. Massachusetts Audubon Society, Lincoln, Massachusetts.
- KAUFMANN, M. R., R. T. GRAHAM, D. A. BOYCE, JR., W. H. MOIR, L. PERRY, R. T. REYNOLDS, R. L. BASSETT, P. MEHLER, C. B. EDMISTER, W. M. BLOCK, AND P. S. CORN. 1994. An ecological basis for ecosystem management. U.S. Department of Agriculture, Forest Service General Technical Report RM-246.
- KNAPTON, R. W. 1984. The Henslow's Sparrow in Ontario: A historical perspective. *Ontario Birds* 2: 70–74.
- KNOFF, F. L. 1994. Avian assemblages on altered grasslands. *Studies in Avian Biology* 15:247–257.
- KNOFF, F. L. 1996. Prairie legacies—birds. Pages 135–147 in *Prairie Conservation: Preserving North America's Most Endangered Ecosystem* (F. B. Samson and F. L. Knopf, Eds.). Island Press, Washington, D.C.
- LANYON, W. E. 1956. Ecological aspects of the sympatric distribution of meadowlarks in the north-central United States. *Ecology* 37:98–108.
- LITWIN, T. S., AND C. R. SMITH. 1992. Factors influencing the decline of Neotropical migrants in a northeastern forest fragment: Isolation, fragmentation, or mosaic effects? Pages 483–496 in *Ecology and Conservation of Neotropical Migrant Landbirds* (J. M. Hagan III and D. W. Johnston, Eds.). Smithsonian Institution Press, Washington, D.C.
- LITVAITIS, J. A. 1993. Response of early successional vertebrates to historic changes in land use. *Conservation Biology* 7:866–873.
- MARKS, P. L., AND S. GARDESCU. 1992. Vegetation of the central Finger Lakes region of New York in the 1790s. *New York State Museum Bulletin* no. 484, Albany.
- MCANDREWS, J. H. 1988. Human disturbance of North American forests and grasslands: The fossil pollen record. Pages 673–697 in *Vegetation History* (B. Huntley and T. Webb III, Eds.). Kluwer Academic Publishers, New York.
- MEHRHOFF, L. J. 1997. Thoughts on the biogeography of grassland plants in New England. Pages 15–23 in *Grasslands of Northeastern North America* (P. D. Vickery and P. W. Dunwiddie, Eds.). Massachusetts Audubon Society, Lincoln, Massachusetts.
- MITCHELL, L. R. 2000. Use of prescribed fire for management of old fields in the Northeast. M.S. thesis, Cornell University, Ithaca, New York.
- NATIONAL RESOURCES CONSERVATION SERVICE. 1997. New York State plan for the Wildlife Habitat Incentives Program (WHIP). Rochester, New York.
- NIERING, W. A. AND G. D. DREYER. 1989. Effects of prescribed burning on *Andropogon scoparius* in postglacial grasslands in Connecticut. *American Midland Naturalist* 122:88–102.
- NORMENT, C. J., C. D. ARDIZZONE, AND K. HARTMAN. 1999. Habitat relations and breeding biology of grassland birds in western New York. *Studies in Avian Biology* 19:112–121.
- PARKES, K. C. 1952. The birds of New York and their taxonomy. Ph.D. dissertation, Cornell University, Ithaca, New York.
- PARTNERS IN FLIGHT. 2001. Partners in Flight Bird Conservation Plans. [Online.] Available at <http://www.PartnersinFlight.org/pifbcps.htm>.
- PATTERSON, W. A. III, AND K. E. SASSMAN. 1988. Indian fires in the prehistory of New England. Pages 107–135 in *Holocene Human Ecology in Northeastern North America* (G. P. Nicholas, Ed.). Plenum Publishing, New York.
- PETERJOHN, B. G., AND J. R. SAUER. 1999. Population status of North American grassland birds from the North American Breeding Bird Survey, 1966–1996. *Studies in Avian Biology* 19:27–44.
- PIMM, S. L., AND R. A. ASKINS. 1995. Forest bird losses predict extinctions in eastern North America. *Proceedings National Academy of Sciences USA* 92:9343–9347.
- PORNELUZI, P. A., AND J. FAABORG. 1999. Season-long fecundity, survival, and viability of Ovenbirds in fragmented and unfragmented landscapes. *Conservation Biology* 13:1151–1161.
- PRUITT, L. 1996. Henslow's Sparrow status assessment. U.S. Department of the Interior, Fish and Wildlife Service, Fort Snelling, Minnesota.
- ROBBINS, C. S. 1979. Effect of forest fragmentation on bird populations. Pages 198–212 in *Proceedings of the Workshop on Management of Northcentral and Northeastern Forests for Nongame Birds* (R. M. DeGraff and K. E. Evans, Eds.). U.S. Department of Agriculture, Forest Service General Technical Report NC-51.
- ROOT, R. B. 1995. Herbivore pressure on goldenrods (*Solidago altissima*): Its variation and cumulative effects. *Ecology* 77:1074–1087.
- ROSENBERG, K. V. 2000. Partners in Flight Landbird Conservation Plan, Physiographic Area 18: Saint Lawrence Plain. Draft Version 1.0. [Online.] Cornell Laboratory of Ornithology, Ithaca, New York. Available at <http://www.blm.gov/wildlife/pl18sum.htm>.

- ROSENBERG, K. V., AND J. V. WELLS. 1995. Importance of geographic areas to Neotropical migratory birds in the Northeast. Report to U.S. Department of the Interior, Fish and Wildlife Service Region 5, Hadley, Massachusetts.
- RUSSELL, E. W. B. 1981. Vegetation of northern New Jersey before European settlement. *American Midland Naturalist* 105:1–12.
- SAMPLE, D. W., AND M. J. MOSSMAN. 1997. Managing habitat for grassland birds: A guide for Wisconsin. Wisconsin Department of Natural Resources Publication no. SS-925-97, Madison, Wisconsin.
- SAMSON, F., AND F. KNOFF. 1994. Prairie conservation in North America. *BioScience* 44:418–421.
- SAUER, J. R., J. E. HINES, G. GOUGH, I. THOMAS, AND B. J. PETERJOHN. 1997. The North American Breeding Bird Survey, version 96.1. [Online.] Pautuxent Wildlife Research Center, Laurel, Maryland. Available at <http://www.mbr.nbs.gov/bbs/bbs.html>.
- SCHROEDER, M. A., AND L. A. ROBB. 1993. Greater Prairie Chicken (*Tympanuchus cupido*). In *The Birds of North America*, no. 36 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, D.C.
- SCHROEDER, R. L., W. J. KING, AND J. E. CORNELLY. 1998. Selecting habitat management strategies on refuges. Information and Technology Report USGS/BRD/ITR-1998–003. U.S. Geological Survey, Reston, Virginia.
- SHRIVER, W. G., A. L. JONES, AND P. D. VICKERY. 1997. Northeast Grassland Bird Survey. Massachusetts Audubon Society, Lincoln, Massachusetts.
- SMITH, C. R. 1998. Henslow's Sparrow (*Ammodramus henslowii*). Pages 514–516 in *Bull's Birds of New York State* (E. Levine, Ed.). Comstock Publishing, Ithaca, New York.
- SWANSON, F. J., J. A. JONES, D. O. WALLIN, AND J. H. CISSEL. 1994. Natural variability: Implications for ecosystem management. Pages 80–94 in *Ecosystem Management: Principles and Applications*, vol. II (M. E. Jensen and P. S. Bouregon, Eds.). U.S. Department of Agriculture, Forest Service General Technical Report PNW-GTR-318.
- TRINE, C. L. 1998. Wood Thrush population sinks and implications for the scale of regional conservation strategies. *Conservation Biology* 12: 576–585.
- VICKERY, P. D. 1992. A regional analysis of endangered, threatened, and special-concern birds in the Northeastern United States. *Transactions of the Northeast Section of the Wildlife Society* 48: 1–10.
- VICKERY, P. D., AND P. A. DUNDWIDDIE, Eds. 1997. *Grasslands of Northeastern North America*. Massachusetts Audubon Society, Lincoln, Massachusetts.
- VICKERY, P., M. L. HUNTER, JR., AND S. M. MELVIN. 1994. Effects of habitat area on the distribution of grassland birds in Maine. *Conservation Biology* 8:1087–1097.
- VICKERY, P. D., P. L. TUBARO, J. M. CARDOSA DA SILVA, B. G. PETERJOHN, J. R. HERKERT, AND R. B. CAVALCANTI. 1999. Conservation of grassland birds in the Western Hemisphere. *Studies in Avian Biology* 19:2–26.
- WELLS, J. V., AND K. V. ROSENBERG. 1999. Grassland bird conservation in eastern North America. *Studies in Avian Biology* 19:72–80.
- WHEELWRIGHT, N. T., AND J. D. RISING. 1993. Savannah Sparrow (*Passerculus sandwichensis*). In *The Birds of North America*, no. 45 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, D.C.
- WHITCOMB, R. F. 1977. Island biogeography and "habitat islands" of eastern forest. *American Birds* 31:3–5.
- WHITNEY, G. G. 1994. *From Coastal Wilderness to Fruited Plain*. Cambridge University Press, New York.
- WILCOVE, D. S. 1985. Nest predation in forest tracts and the decline of migratory songbirds. *Ecology* 66:1211–1214.
- WINNE, J. C. 1997. History of vegetation and fire on the Pineo Ridge pine grassland barrens of Washington County, Maine. Pages 25–52 in *Grasslands of Northeastern North America* (P. D. Vickery and P. W. Dunwiddie, Eds.). Massachusetts Audubon Society, Lincoln, Massachusetts.

Received 19 January 2001, accepted 1 August 2001.

Associate Editor: A. Powell