A Plan for Conserving Grassland Birds in New York: Final Report to the New York State Department of Environmental Conservation under contract #C005137

Michael Morgan and Michael Burger
Audubon New York

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Audubon New York
159 Sapsucker Woods Rd.
Ithaca, NY 14850

(607) 254-2487 or mmorgan@audubon.org

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Many partnering agencies are contributing to the coordinated grassland bird conservation effort in New York, and are listed as partners in this plan. The following individuals have either contributed to the development of various components of the plan, or supported its development through review of draft materials or participation in discussions, and this support is greatly appreciated. Thanks to Jeff Bolsinger, Chris Dobony, Peter Gibbs, Mitch Hartley, Paul Hess, Sheila Hess, Tom Jasikoff, Heidi Kennedy, Chris Lajewski, Mike Murphy, Paul Novak, Dave Odell, Ray Perry, Tim Post, Marcelo del Puerto, Chris Reidy, Ron Rohrbaugh, Ken Rosenberg, Paul Salon, Carl Schwartz, Shanna Shaw, Gerry Smith, Bryan Swift, Mike Townsend, and Maiken Winter, among others. Our apologies to anyone that we've failed to mention.

Executive Summary

- Grassland birds have been declining faster than any other habitat-species suite in the northeastern United States. The primary cause of these declines is abandonment of agricultural lands, causing habitat loss due to reversion to later successional stages or due to sprawl development. Remaining potential habitat is also being lost or severely degraded by intensification of agricultural practices, e.g., conversion to row crops or early and frequent mowing of hayfields.
- Audubon New York is coordinating efforts of several conservation partners to achieve maximum results with the limited resources available. This version of a conservation plan describes these efforts, and provides the information needed to further align efforts. This plan also identifies upcoming planning and research priorities that are needed to fully implement a conservation plan. As these planning and information needs are met, the relevant information will need to be incorporated into future versions of this plan.
- The key strategy for coordinating conservation efforts is the delineation and employment of "focus areas," which are regions of the state that support key, residual populations of grassland birds. Because grassland birds are sensitive to landscape-level factors (such as availability of suitable habitat within the surrounding landscape) and funding for conservation activities is limited, the best opportunity for achieving success is to concentrate efforts within focus areas. Current lack of suitable landcover classification datasets prevents the incorporation of habitat availability into the delineation process, but efforts are underway to address this need.
- Habitat managers often struggle with balancing the conservation priorities highlighted by various initiatives. Although grassland bird conservation is widely accepted as a top priority, managers occasionally fail to fully assess their capacity to provide the needed habitat characteristics of the targeted species before executing plantings or management projects. This plan provides the "recipe" for creating management plans for projects located within the focus areas, based upon a review of the grassland bird species most likely to be able to respond to the project, along with the ability to provide the various characteristics which define a suitable habitat patch for those species.
- Although proper management of grassland habitat currently on public lands or targeted for acquisition within the focus areas is one important component of this effort, the vast

majority of remaining habitat is privately owned. Therefore, private lands incentive and educational programs will be a major component of the conservation effort. Protection of existing habitat for threatened and endangered species through enforcement of regulations pertaining to the taking of habitat in a critical component of the conservation effort for these species.

- To complement existing, but under-funded incentive programs, the New York State Department of Environmental Conservation is collaborating with Audubon New York to deliver funding from a US Fish and Wildlife Service Landowner Incentive Program grant to willing landowners throughout the focus areas. This new program is important in that selection and scoring factors have been identified that will ensure funding is delivered to protect high quality habitats that are most likely to provide significant habitat to grassland birds. Furthermore, this program requires careful monitoring of grassland bird use of the properties enrolled.
- Land trusts are a key partner in conservation activities, either by facilitating the transfer of lands into public ownership, or by permanent acquisition and protection of critical habitats. However, their activities have traditionally focused on forested lands, wetlands, or open space in general, while avoiding grasslands with a few exceptions. The invaluable role that land trusts could play in grasslands conservation efforts warrants further exploration, including an assessment of existing properties that contain grasslands, as well as developing relationships with and providing technical assistance to active land trusts operating within the grassland focus areas.
- The monitoring scheme being developed for the Landowner Incentive Program will be the basis for regional monitoring throughout the Northeast, and will facilitate meaningful assessment of grassland bird responses at several levels, including site-level response to management, along with regional response to conservation programs.
- Further research is needed on:

  1. Methods and data for modeling distributions and abundance of grassland landcover across the landscape.

  2. Impacts of management on productivity of grassland birds, to amplify existing information on grassland bird abundances associated with management.

3. Potential benefits of native grass species as grassland habitat in contrast with demonstrated benefit of non-native cool season grasses.

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1 - Introduction

Stabilizing the declines of populations of grassland birds has been identified as a conservation priority by virtually all of the bird conservation initiatives, groups, and agencies in the northeastern US, as well as across the continent (Vickery and Herkert 2001, Brennan and Kuvlesky 2005), due to concern over how precipitous their population declines have been across portions of their ranges (for the list of species of concern and their population trends, see Table 1). In New York, grassland bird population declines are linked strongly to the loss of agricultural grasslands, primarily hayfields and pastures (see Figure 1, below). Norment (2002) describes in some detail the reasons for, and summarizes some of the arguments against, grassland bird conservation in the Northeast.

Table 1. Grassland bird population trends at three scales from 1966 to 2005 (from Sauer et al. 2005).

Species	New York		USFWS Region 5		Survey-wide	
	trend (%/year)	population remaining (%)	trend (%/year)	population remaining (%)	trend (%/year)	population remaining (%)
Northern Harrier[1]	-3.4	25.9	1.1	153.2	**-1.7**	**51.2**
Upland Sandpiper[1]	-6.9	6.2	-0.7	76.0	0.5	121.5
Short-eared Owl[1]	--	--	--	--	**-4.6**	**15.9**
Sedge Wren[1]	-11.5	0.9	0.5	121.5	**1.8**	**200.5**
Henslow's Sparrow	-13.8	0.3	-12.6	0.5	**-7.9**	**4.0**
Grasshopper Sparrow[1]	**-9.4**	**2.1**	**-5.2**	**12.5**	**-3.8**	**22.1**
Bobolink[1]	-0.5	82.2	-0.3	88.9	**-1.8**	**49.2**
Loggerhead Shrike[1]	--	--	**-11.4**	**0.9**	**-3.7**	**23.0**
Horned Lark[2]	**-4.7**	**15.3**	**-2.1**	**43.7**	**-2.1**	**43.7**
Vesper Sparrow[2]	**-7.9**	**4.0**	**-5.4**	**11.5**	**-1.0**	**67.6**
Eastern Meadowlark[2]	**-4.9**	**14.1**	**-4.3**	**18.0**	**-2.9**	**31.7**
Savannah Sparrow[2]	**-2.6**	**35.8**	**-2.3**	**40.4**	**-0.9**	**70.3**

[1]Highest priority or [2]High priority for conservation

Note: Background colors correspond with "regional credibility measures" for the data as provided by the authors. **Blue** indicates no deficiencies, **Yellow** (yellow) indicates a deficiency, and **Red** indicates an important deficiency.

Bold indicates significant trends (P<0.05).

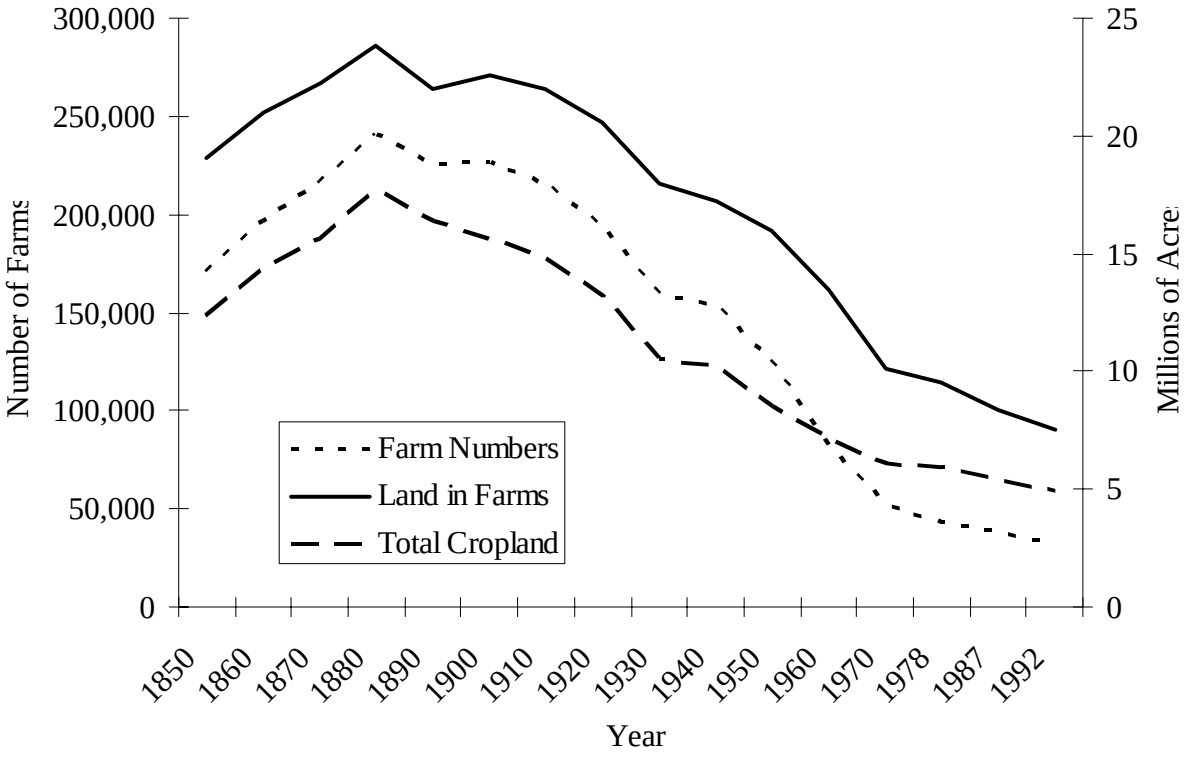


Figure 1. Trends in land use and ownership for agricultural land in New York (from Stanton and Bills 1996).

Audubon New York, with support from the New York State Department of Environmental Conservation (NYSDEC), is coordinating a comprehensive grassland bird conservation effort in New York State. A significant portion of this initial effort will culminate with the drafting and implementation of this grassland bird conservation plan. A New York grassland bird partnership group has been formed to help determine the approach and strategies for this effort (Table 2).

Table 2. Members of the New York grassland bird conservation partnership (in alphabetical order).

Audubon New York (ANY)
Colorado State University at Ft. Drum (CSU)
Cornell Lab of Ornithology (CLO)
Ducks Unlimited (DU)
Finger Lakes Land Trust (FLLT)
Fort Drum-US Department of Defense (Ft. Drum)
Gerry Smith-Independent consultant
New York Natural Heritage Program (NYNHP)
New York State Parks, Recreation and Historical Preservation (NYSOPRHP)
New York State Department of Environmental Conservation (NYSDEC)*
State University of New York at Brockport (SUNY Brockport)
The Nature Conservancy (TNC)
Thousand Islands Land Trust (TILT)
US Department of Agriculture-Natural Resource Conservation Service (USDA-NRCS)
US Fish and Wildlife Service (USFWS)

*The NYSDEC provided financial and intellectual support for the development of this plan.

The primary objective for this effort is to stabilize or reverse the declining trends of New York's grassland birds—Northern Harrier (*Circus cyaneus*), Upland Sandpiper (*Bartramia longicauda*), Short-eared Owl (*Asio flammeus*), Sedge Wren (*Cistothorus platensis*), Henslow's Sparrow (*Ammodramus henslowii*), Grasshopper Sparrow (*Ammodramus savannarum*), Bobolink (*Dolichonyx oryzivorus*), Loggerhead Shrike (*Lanius ludovicianus*), Horned Lark (*Eremophila alpestris*), Vesper Sparrow (*Pooecetes gramineus*), Eastern Meadowlark (*Sturnella magna*), and Savannah Sparrow (*Passerculus sandwichensis*), (for population trends for these species, see Table 1).

Because the vast majority of grasslands in New York are privately owned hayfields and pastures, it would be impossibly expensive to protect all of them through conservation programs that focus on acquisition and management of public lands. Furthermore, the NY grassland group

determined that spreading existing grassland conservation resources over too broad an area was unlikely to result in landscapes sufficient to support viable grassland bird populations. Therefore, regions of the state where grassland birds are most likely to persist, i.e. focus areas, have been identified and will be targeted for surveys and monitoring and serve to focus conservation resources—particularly incentive programs that encourage proper management of private lands, although proper management of publicly-owned lands in these areas is also important to this effort.

This plan describes the identification of these focus areas, techniques for habitat management, steps for creating site-specific habitat management plans, and summaries of the habitat requirements for the targeted species. In addition, this plan will identify strategies (and methods for evaluating their success) for implementing this plan.

1.1 - New York's Grassland Birds

While a variety of wildlife and plants depend on grassland habitats, the targeted species in this effort (listed in Table 1) are the most specific in their habitat preferences and needs, and are the species most commonly designated as "grassland birds" in New York. While the natural habitats most commonly considered to be grasslands are the tall and short-grass prairies of the Midwest, some of the common landcover types in New York that provide habitat for these grassland birds include hayfields, pastures, fallow fields, and other agricultural lands, as well as recently abandoned agricultural lands, landfills, airports, and a variety of other land uses that maintain the land cover in very early successional stages.

New York's grassland birds are not all the same priority for conservation. Some have experienced steeper declines than others, or have a smaller population size and/or distribution across the state or region. For the purpose of this plan, species included in the highest priority tier are those of greatest conservation need (as indicated by the priority rankings given to these species by a variety of conservation initiatives and regulatory rankings; see Appendix A). The highest priority tier includes ("alpha codes" in parentheses for abbreviation in certain tables and figures): Northern Harrier (NOHA), Upland Sandpiper (UPSA), Short-eared Owl (SEOW), Sedge Wren (SEWR), Henslow's Sparrow (HESP), Grasshopper Sparrow (GRSP), Bobolink (BOBO), and Loggerhead Shrike (LOSH). Species included in the high priority tier are those that have been given relatively lower priority by the conservation initiatives, but whose

populations are also declining and are in need of conservation. The high priority tier includes: Horned Lark (HOLA), Vesper Sparrow (VESP), Eastern Meadowlark (EAME), and Savannah Sparrow (SAVS).

While these birds rely on grasslands in New York as breeding habitat (in general), two of these species (Northern Harrier and Short-eared Owl) and several other raptor species also rely on New York's grasslands for wintering habitat. For this reason, a third target group of birds are those species that rely on grassland habitats while they over-winter (or are year-round residents) in New York. For a list of the target species with their categorization by a variety of prioritization schemes and regulatory lists (that supported the ranking of theses species into tiers), see Appendix A.

1.2 - Overview of Plan Objective, Strategies, and Implementation

The primary objectives of the efforts outlined in this plan are to halt or even reverse the declining trends for populations of grassland birds in New York, and to sustain viable populations of them into the future. To accomplish those objectives, this plan outlines several strategies and provides information that will be helpful as the NY grassland bird conservation partners move forward on implementation. Those strategies/steps that are central to this plan for grassland bird conservation include: 1) identification of grassland bird focus areas where land use and habitat availability are such that continued support of grassland birds is more likely than in other parts of the state; 2) identification of target species of grassland birds within each focus area that habitat management in the areas will seek to support; 3) coordination and concentration of grassland bird conservation efforts on both public and private lands within the focus areas to achieve landscape characteristics that support grassland birds; 4) implementation of various management and restoration projects for target species within the focus areas; 5) monitoring to evaluate response of grassland birds on project sites and changes of grassland bird relative abundance within focus areas; and 6) revision of this plan upon consideration of monitoring results and evaluation of resources and scale of implementation required to achieve the objectives.

The strategies and supporting information are covered in more detail in the remainder of this plan. Some of the components are in their final forms, while others are more dynamic and are expected to be modified after results of initial implementation and monitoring are completed.

2 - Grassland Focus Areas

New York contains diverse habitats (and associated species assemblages) including the three general categories of grasslands, wetlands, and forests. There are many regions of New York where few or no grasslands exist. In these areas grassland conservation would be imprudent, and may be detrimental to other populations of significant conservation concern by fragmenting critical habitat. However, there are many other regions of New York where grassland conservation would be much more practical, and where important populations of grassland birds currently breed. In several of these areas, grassland habitats cannot only coexist with other habitat types, but are ideal neighbors in a balanced landscape. For example, wetland associated grasslands are ideal nesting habitat for several waterfowl species. In addition, creating landscapes that contain relatively large amounts of grassland habitat would support conservation efforts by increasing grassland bird species richness throughout these regions (Hamer et al. 2006).

To focus this conservation effort on regions of the state that have the highest likelihood for sustaining grassland bird populations on a long-term basis, we identified regions where we assumed conservation efforts would be most effective and that would help identify priorities for the comprehensive conservation planning that is occurring statewide. While certain regions of New York are easily eliminated as potential grassland bird conservation areas, such as the forests of the Adirondack Mountains and the Tug Hill Plateau, the remaining area still contains vast regions that either currently do not support large populations of grassland birds, or are otherwise lacking as potential grassland conservation areas. There are many additional conservation priorities beyond grassland birds and their habitat, and many regions of New York contain important landscapes dominated by early successional/shrubland and forest habitats. The development of these grassland focus areas facilitates land-use planning and simplifies decision making for managers and landowners that are considering which conservation priorities to address through their habitat management.

Although one objective for creating these focus areas is to establish large expanses of suitable grassland habitat at a landscape level, this plan does not advocate capricious clearing of forests within the focus areas. In general, the landcover within the focus areas is less forested than other regions of the state, but even within the focus areas, conservation should be directed at

sites most suitable as grassland bird habitat, e.g., those containing large, open expanses of grasslands, agricultural lands, or other open space. At the site level, consideration given to any particular land unit and its associated management objectives should include the values that any forest land cover within the focus areas may provide to other conservation priorities.

2.1 - A Review of Available Landcover Data

The 1992 National Land Cover Dataset and the New York Gap Analysis (1998) provide landcover classifications based upon satellite imagery collected in 1992 by the Landsat Thematic Mapper satellite. Both of these classifications categorized grassland-type land covers with relatively poor accuracy. The 1992 NLCD provides the user with a 42% accuracy rate for land cover class 81-Pasture/Hay (Stehman et al. 2003), and the NY GAP provides an accuracy rate of 48 % (Laba et al. 2003). Furthermore, because of the dynamic nature of grassland habitats, many changes may have taken place since 1992 due to crop rotation, natural succession, and development. As a result, neither of these datasets was found to be of much use in attempting to identify grassland focus areas.

Audubon New York attempted to combine the two classification datasets in an effort to improve their accuracies by evaluating discrepancies in their classifications. By limiting the predicted grassland habitat to only those areas that were classified as grasslands by both datasets, a marginal improvement in accuracy was realized (as evaluated by additional ground-truthing conducted by Audubon New York in 2004). However, the error rates (>50% for many categories associated with grassland and agricultural cover types) were still too great to rely on this hybrid classification scheme for identifying grassland focus areas.

Note (added in Feb. 2008): In 1999, a second generation of the Multi-Resolution Land Characteristics Consortium was formed to analyze Landsat 7 imagery to create an updated landcover dataset. This NLCD 2001 is nearly complete; however, data for New York was only recently made available. A preliminary assessment of Landsat 7 accuracy in the St. Lawrence Valley indicated some usefulness when predicting existing and potential grassland landcover, and further assessment across New York would be beneficial. To see this dataset using Ducks Unlimited's online mapping application, visit:
http://glaro.ducks.org/website/HEN/Template/viewer.htm?StLawrence

A general assessment of all possible cover classes from the NLCD 2001 that may include habitat suitable for grassland birds was conducted with regard to the Focus Areas identified below, and the results are presented in section 2.6.

2.2 - Use of Bird Distribution Data to Identify Focus Areas

To define the focus areas for this effort, Audubon New York examined available data to identify areas containing core populations of grassland birds. The New York portion of the North American Breeding Bird Survey (BBS; Sauer et al. 2005) includes more than one hundred roadside transects through all possible habitat types, but provides only a limited amount of information regarding grassland bird distributions. While the BBS is capable of determining population trends and general distributions at broad, regional levels for most species, it lacks the resolution needed to identify important grassland bird populations at a smaller scale. In addition, certain grassland bird species experience very low detection rates for this type of roadside survey, and the BBS lacks sufficient power to determine significant population trends in New York for these species.

New York recently completed its second Breeding Bird Atlas (BBA; NYSDEC 2006), which attempted to document all bird species that breed in the state. This project involved hundreds of volunteer observers who classify breeding efforts for all possible species in 5 km by 5 km "blocks" across the entire state. While the BBA was useful for identifying grassland bird focus areas, there are two concerns to be aware of when using the data. First, since data were collected on a volunteer basis, effort level and observer ability likely varied considerably from block to block, so the absence of records for a species from a block should not be considered as definitive that the species was not present. Second, the BBA does not provide estimates of population sizes, breeding densities, or even relative abundances.

Despite these drawbacks, the effort is sufficiently complete and adequate for identification of large regions within the state that support grassland birds. Therefore, focus areas were delineated using BBA data from 2000-2004. The general approach was to include in a focus area all blocks with high richness of breeding grassland birds, as well as contiguous blocks also supporting grassland species. These focus area boundaries were smoothed in an inclusive manner, such that some areas of low grassland bird richness were included in the focus areas.

This process has resulted in the identification of 8 focus areas that support New York's grassland breeding birds (see Figure 2).

Following the completion of the atlasing effort in 2005, and review of the Focus Area maps and final BBA data by the New York grassland bird conservation partnership, three areas were identified that would have been included in the Focus Area boundaries during the previous delineation process (following the criteria of contiguity of adjacent blocks with high species richness). These areas include a portion of the lake plain west of Rochester (an extension of the northeastern border of Focus Area 1), a smaller extension of the southeastern border of Focus Area 4, and islands in eastern Lake Ontario and the St. Lawrence River overlooked when the initial shapefiles were created. These areas are highlighted in blue in Figure 2.

Finally, the BBA blocks with which the Focus Areas were delineated are arranged so that every portion of New York is included in a standardized block. As a result, the blocks overlapping the borders of the state extend past the geographic boundary by varying distances (by several kilometers in many cases). Therefore, a simple modification to the Focus Area boundaries was to clip areas extending past the official boundaries of New York.

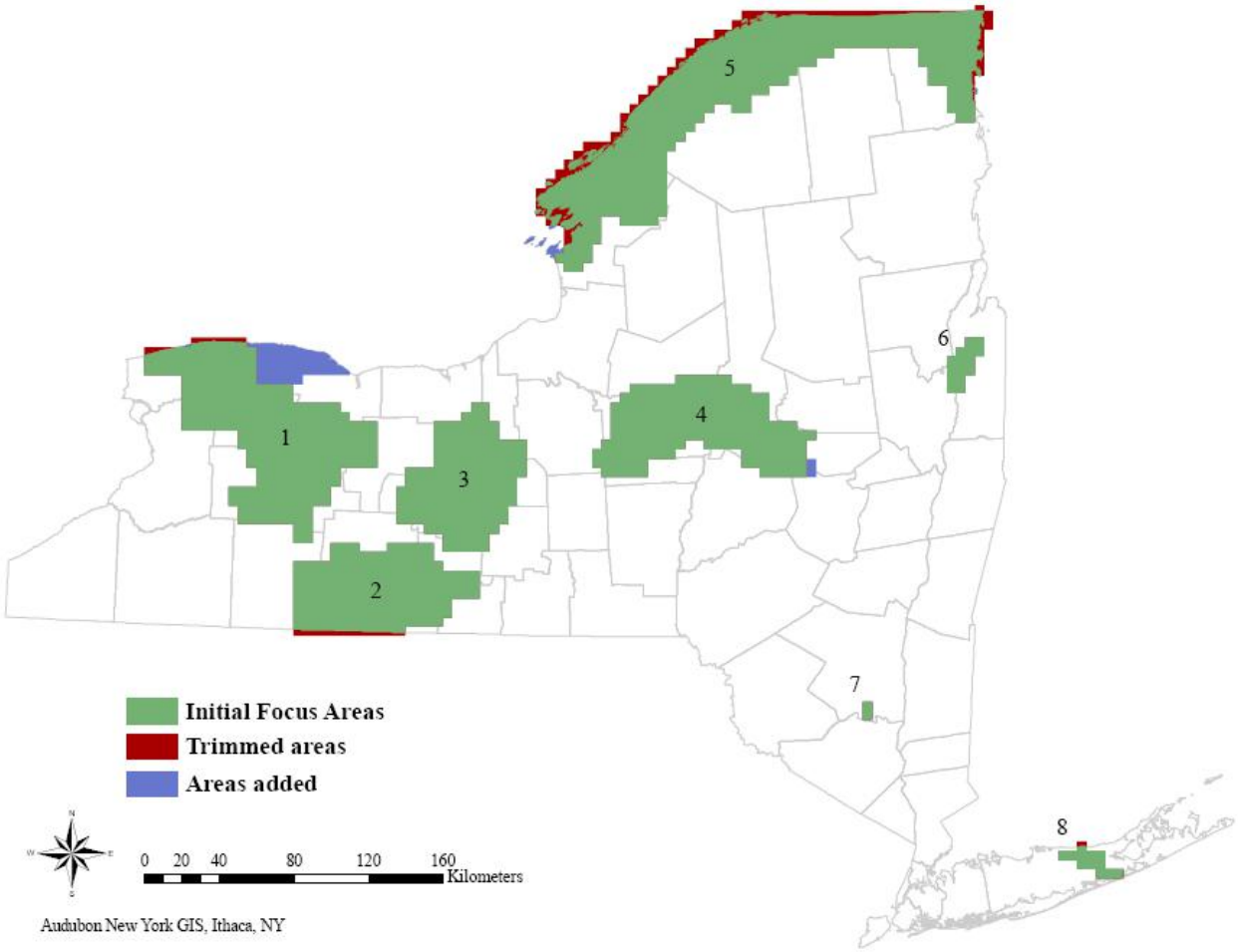


Figure 2. Grassland focus areas identified using data from the 2000 Breeding Bird Atlas.

The target for the Focus Areas was to "capture" or include at least 50% of the BBA blocks where each of the grassland species was found to be breeding across the state. The Focus Areas were able to reach that target for all but the most ubiquitous species, while including only 21.78% of the total number of BBA blocks, or 2,797,445.5 ha (22.31 % of the area of New York State). The Focus Areas capture an average of 62.69% of the blocks in which all the grassland birds were reported and an average of 72.06% of the blocks for all but the most ubiquitous species (Bobolink, Savannah Sparrow, and Eastern Meadowlark). To see the capture rates of the Focus Areas for each species using the complete 2000-2005 BBA dataset, see Table 3, below (see Appendix B for maps of the distribution of blocks in NY in which each species was documented).

Although the BBA does not provide estimates of abundance or densities, one of the criteria for inclusion in a Focus Area was contiguity with adjacent blocks containing grassland birds, and recent analysis by Zuckerberg et al. (2006) indicates that such blocks contain significantly higher abundances of the target species than isolated blocks. Therefore, the actual capture rates of all individual grassland birds as proportions of population size are likely considerably higher than capture rates for simply the BBA blocks themselves.

The Focus Areas provide wintering habitat for many species, and information on current and historical wintering sites for Short-eared Owls was provided by Kathy Schneider (2004, 2006; for a map of historic and current Short-eared Owl wintering areas, see Appendix D). Ten of 14 currently known wintering sites are included within the Focus Areas.

Table 3. Grassland Focus Area capture rates of Breeding Bird Atlas Blocks that recorded possible breeding attempts by grassland birds from 2000-2005, where "Total # Blocks" is the total number of blocks in which a species was found across the state and "Targeted # Blocks" is the number of these blocks contained within the focus areas.

Species	Total # Blocks	Targeted # Blocks	% Captured
Northern Harrier	917	502	54.74%
Upland Sandpiper	165	116	70.30%
Short-eared Owl	24	19	79.17%
Sedge Wren	69	52	75.36%
Henslow's Sparrow	70	57	81.43%
Grasshopper Sparrow	477	285	59.75%
Bobolink	3178	1031	32.44%
Loggerhead Shrike	4	4	100.00%
Horned Lark	698	443	63.47%
Vesper Sparrow	564	363	64.36%
Eastern Meadowlark	2635	968	36.74%
Savannah Sparrow	3070	1060	34.53%
		Average for all	62.69%
		Average without EAME, BOBO, and SAVS	72.06%

While the focus areas are officially identified as Focus Areas 1 through 8, common names for the geographic regions of New York in which they are found are listed below:

Focus Area 1 is found in Western New York

Focus Area 2 is found in the Southern Tier

Focus Area 3 is found in the Finger Lakes Region

Focus Area 4 includes portions of both the Central Leatherstocking region and the Mohawk River Valley

Focus Area 5 is found in the St. Lawrence River Valley

Focus Area 6 includes the Ft. Edward Grasslands IBA

Focus Area 7 includes the Shawangunk Grasslands

Focus Area 8 is found in central Long Island and includes portions of the Long Island Pine Barrens

2.3 - 2005 Grassland Breeding Bird Focus Area Survey

Audubon New York conducted surveys throughout the 8 focus areas during the 2005 breeding season (~15 May to 15 July) to collect distribution and abundance data to be used in combination with the BBA data when identifying targets for each focus area. Surveys were conducted using 5-minute point counts (both double and single-observer), and were randomly distributed across the focus areas. Survey effort was allocated according to the relative size of the focus area. Surveys were conducted at both roadside and in-field locations (when landowner permission was granted), in a variety of grassland habitats.

A total of 487 different habitat patches were surveyed (see Figure 3). Although vegetation and habitat data were collected during this survey, of particular interest was determining the species composition within each focus area to guide conservation activities. In addition, the data were assessed to determine the value of various methods for collecting data in support of the planning and development of a monitoring system for grassland birds, which will be discussed in more detail in that section.

Because a portion of the data was collected using double observer point counts (333 of 487 locations), detection abilities of the various observers were calculated and used to adjust the relative abundance estimates (see Table 4 for detection rates by the four observers). Because Northern Harrier, Vesper Sparrow, Upland Sandpiper, and Sedge Wren were rarely encountered,

the overall detection rates for each observer were used when calculating abundances for those species. Please see Table 5 for the average relative abundances of each species within each focus area; for maps depicting the corrected relative abundances for each species, please see Appendix C.

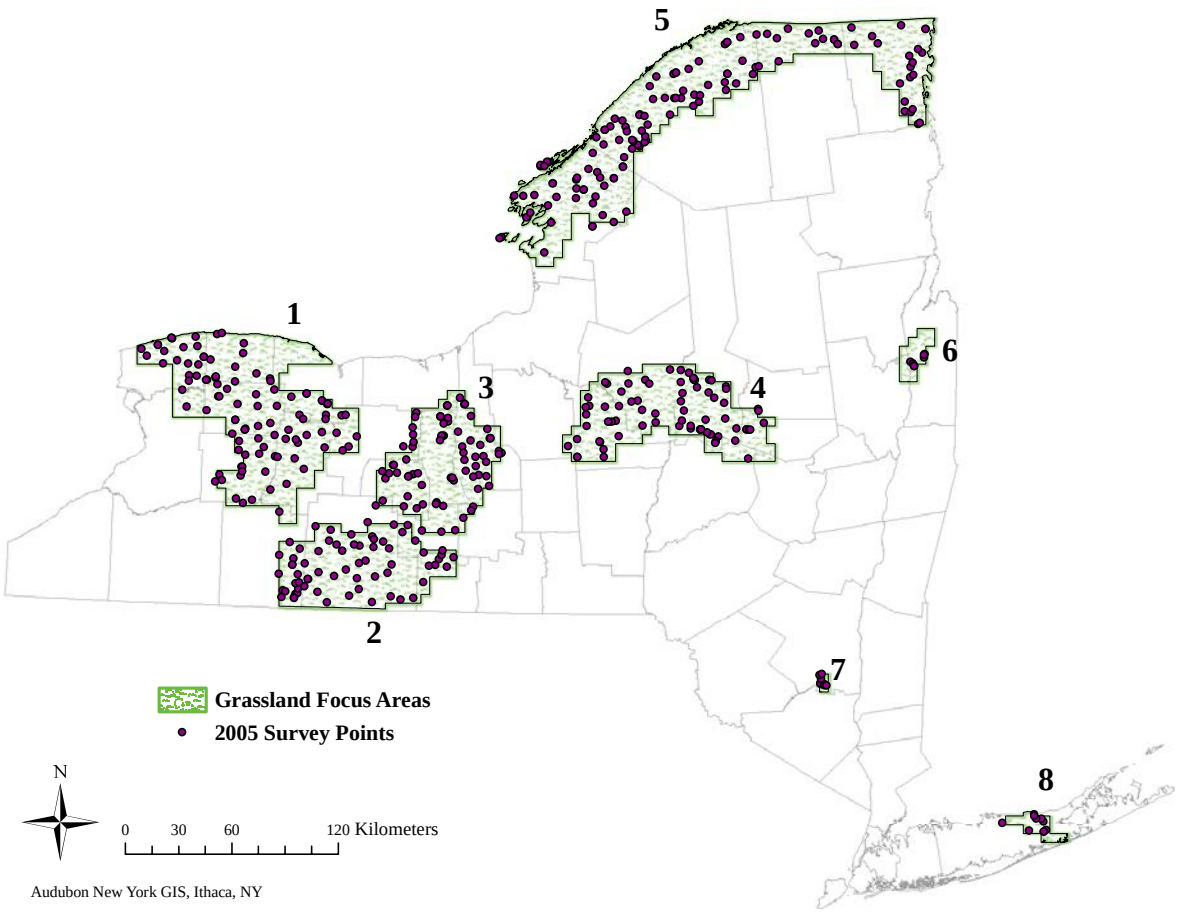


Figure 3. Locations surveyed during the 2005 grassland breeding bird focus area survey.

No Henslow's Sparrows, Short-eared Owls, or Loggerhead Shrikes were detected at any of the point count locations, and several other species had relatively low representation in the survey, as was expected based on the population trends for those species and the low numbers of BBA blocks in which those species were documented. Below is a table (Table 5) indicating the number of points sampled and the adjusted relative abundances for the detected species in each focus area as determined from 2005 survey data.

Table 4. Detection rates for each observer for each species during the 2005 focus area surveys (alpha codes listed here).

Observer	Category	BOBO	SAVS	EAME	GRSP	HOLA	NOHA	VESP	UPSA	SEWR	Total
ED	Observed	233	173	79	15	12	0	1	1	1	515
	Missed	38	26	10	4	4	1	1	2	0	86
	% Observed	**0.860**	**0.869**	**0.888**	**0.789**	**0.750**	**0.000**	**0.500**	**0.333**	**1.000**	**0.857**
GL	Observed	160	153	72	16	16	1	3	3	1	425
	Missed	41	16	9	4	4	1	1	2	0	78
	% Observed	**0.796**	**0.905**	**0.889**	**0.800**	**0.800**	**0.500**	**0.750**	**0.600**	**1.000**	**0.845**
JM	Observed	194	195	46	9	20	1	3	1	2	471
	Missed	29	22	7	1	5	0	2	3	0	69
	% Observed	**0.870**	**0.899**	**0.868**	**0.900**	**0.800**	**1.000**	**0.600**	**0.250**	**1.000**	**0.872**
MM	Observed	293	208	56	9	31	1	8	7	2	615
	Missed	45	20	12	0	8	1	0	0	0	86
	% Observed	**0.867**	**0.912**	**0.824**	**1.000**	**0.795**	**0.500**	**1.000**	**1.000**	**1.000**	**0.877**

Table 5. Number of points sampled and the corrected relative abundances for each species after adjusting for observer detection ability in each focus area.

Focus Area	Number points	Relative Abundances								
		BOBO	SAVS	EAME	GRSP	HOLA	NOHA	VESP	UPSA	SEWR
1	105	1.176	1.434	0.220	0.053	0.172	0.000	0.044	0.044	0.000
2	68	2.146	1.522	0.735	0.143	0.000	0.051	0.000	0.000	0.000
3	76	0.968	1.500	0.211	0.080	0.417	0.000	0.046	0.030	0.000
4	81	1.971	1.075	0.200	0.016	0.000	0.029	0.000	0.014	0.000
5	130	2.151	1.095	0.704	0.064	0.000	0.026	0.000	0.018	0.054
6	8	2.740	0.548	0.607	0.000	0.000	0.285	0.142	0.000	0.000
7	9	6.939	0.511	0.915	0.000	0.000	0.000	0.000	0.127	0.000
8	10	0.000	0.000	0.000	0.477	0.000	0.000	0.000	0.000	0.000
Total	487	1.779	1.246	0.431	0.073	0.102	0.024	0.019	0.024	0.014

The results of the 2005 Grassland Breeding Bird Focus Area Survey were assessed to determine if they supported any further prioritization within the Focus Area boundaries. The initial step in this assessment was to interpolate relative abundances across each focus area for each species using the ArcGIS Geospatial Analyst kriging function (Oliver and Webster 1990). This technique allows the graphical display of estimated relative abundances for each species across the Focus Areas as a surface based upon known values from the nearby sample sites. Values upon the surface are displayed using specified colors, and the values estimated using these surfaces ranged between the high and low counts provided for each species from the 2005 survey data.

Once kriging was concluded, the results for each species were reclassified into 4 standardized classes or tiers (using geometric intervals). Zero relative abundance was scored a zero and the other groups were ranked low (given a score of 1), medium (given a score of 2), and high (given a score of 5). This allowed the results to be compiled and standardized among all the species, providing a comprehensive review of the relative importance to all grassland bird populations of all the areas included within the Focus Areas. In addition, due to the disparity in relative abundances of the various grassland bird species, the least common species were given twice as much weight in the final calculations. The final compilation of the ranked surfaces is displayed in the following figure (figure 4), which aggregates both species diversity and high relative abundances. The surfaces calculated for each species using the kriging technique, as well as surfaces that depict only high relative abundances and only diversity are provided in Appendix E.

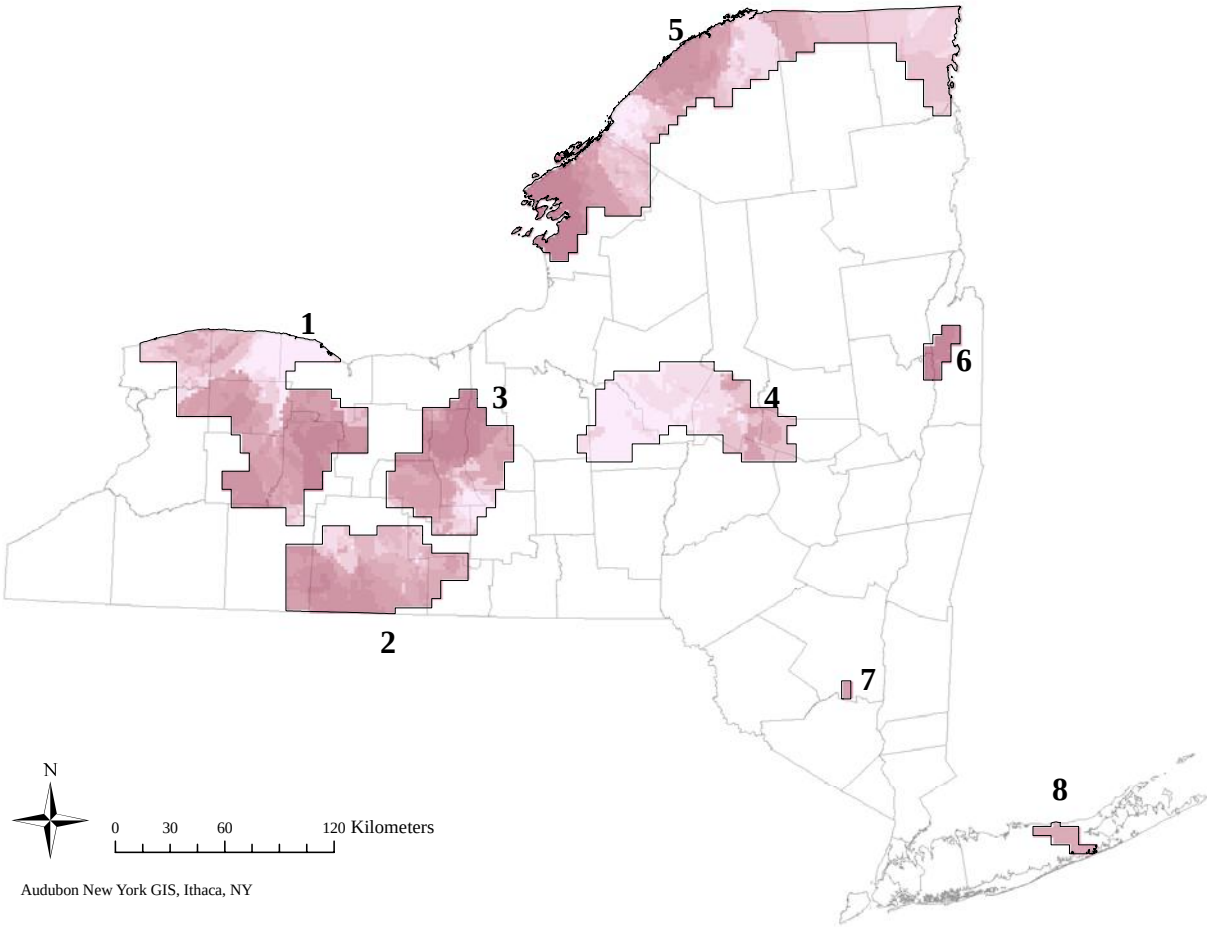


Figure 4. Surfaces displaying the combined scores of the reclassification of the kriging interpolation of 2005 point count survey data. Darker shading indicates more important areas, i.e. areas that generally support higher relative abundances, higher richness, and rarer species than areas with lighter shading.

The value of this analysis applies to those conservation efforts with the capacity to direct especially focused efforts at distinct regions of the state at scales finer than those provided by the focus areas. Other efforts with limited resources may also desire to target important areas with exceptional diversity or abundances of grassland birds. The following map (Figure 5) indicates the highest priority regions of the state that scored in the upper quartile of this combined index of abundance and diversity for breeding grassland birds. Locations important for wintering raptors, especially the Short-eared Owl, should also be considered as highest priority when directing

conservation towards highest priority areas (for a map of historic and current Short-eared Owl wintering areas, see Appendix D).

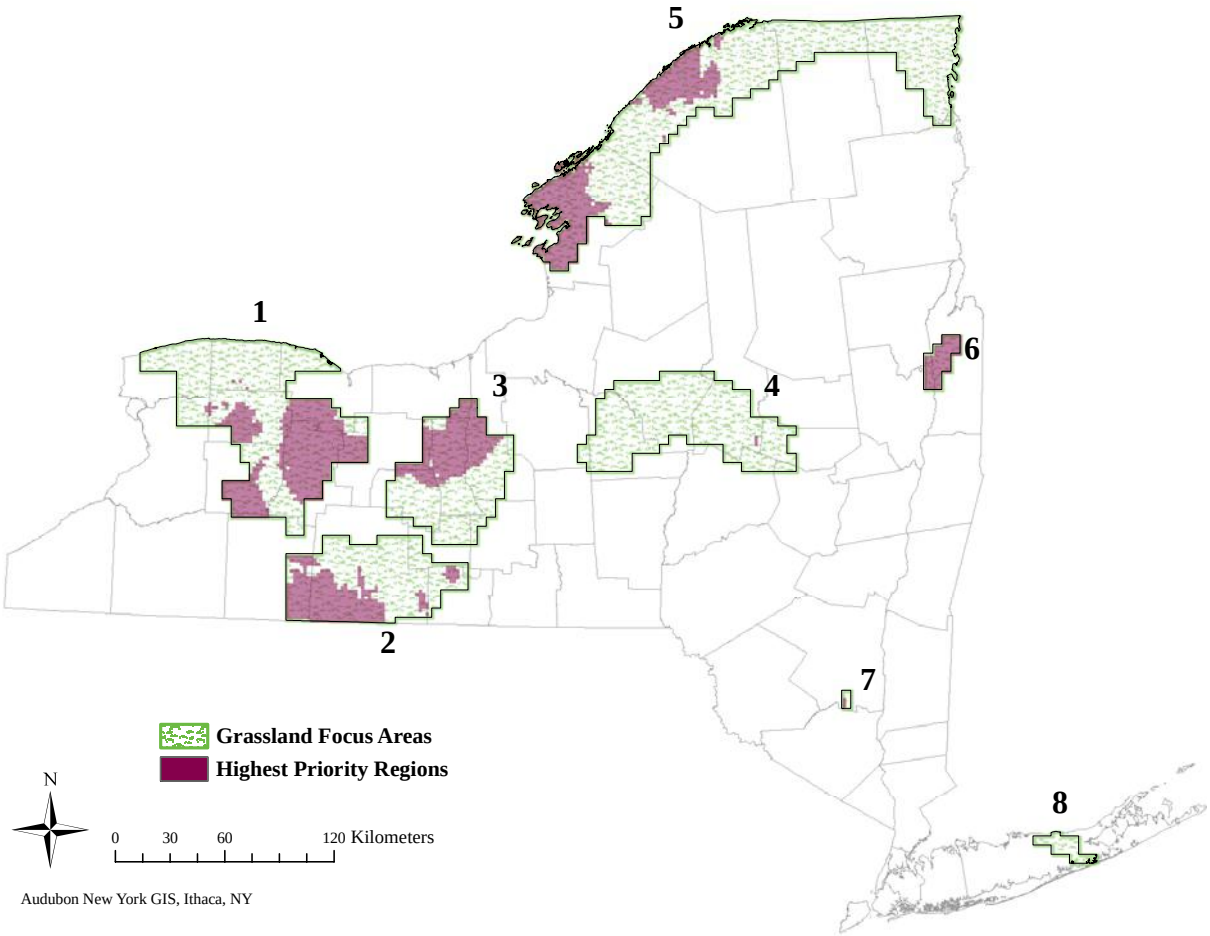


Figure 5. Highest priority regions within the Focus Areas that scored in the highest of four geometric intervals of the combined diversity and abundance index.

2.4 - 2006 Pittman–Robertson funded Targeted Surveys for Uncommon Grassland Birds

In 2006, the NYSDEC obtained Pittman-Robertson funding through to employ technicians to conduct targeted surveys for grassland bird species poorly represented (or not represented at all) in the 2005 survey. The primary species targeted were Short-eared Owl, Upland Sandpiper, Henslow's Sparrow, Grasshopper Sparrow, and Sedge Wren; however, all grassland birds detected during the survey effort were recorded. The target population contained all records for which the NYSDEC had received "notable species forms" during the 2000 BBA effort. These

forms documented specific locations where rare species or “species of management concern” were observed in the state. Birding listservs, the Natural Heritage Database, and other sources were also reviewed for additional locations.

A particular goal of the 2006 survey was to determine locations that continue to support remnant populations of the least common grassland birds, as these populations are sufficiently small and isolated that they were rarely encountered through the fairly coarse scale of the 2005 survey effort. Unfortunately, data collected by one of the observers were not suitable for further analysis, because the geographic locations recorded for the surveys are suspect and do not allow detailed geo-referencing of the data. However, this observer’s observations of Short-eared Owls, Henslow’s Sparrows, Sedge Wrens, along with numbers of the more common grassland birds, indicate the value of the St. Lawrence River Valley and Ft. Edward Grassland Focus Areas in general (areas this observer surveyed and for which the coordinates were invalid). Observations of the target species (with valid coordinates) by other participants in this survey effort (see Figure 6) will be useful for targeting highest priority areas for conservation efforts in other focus areas.

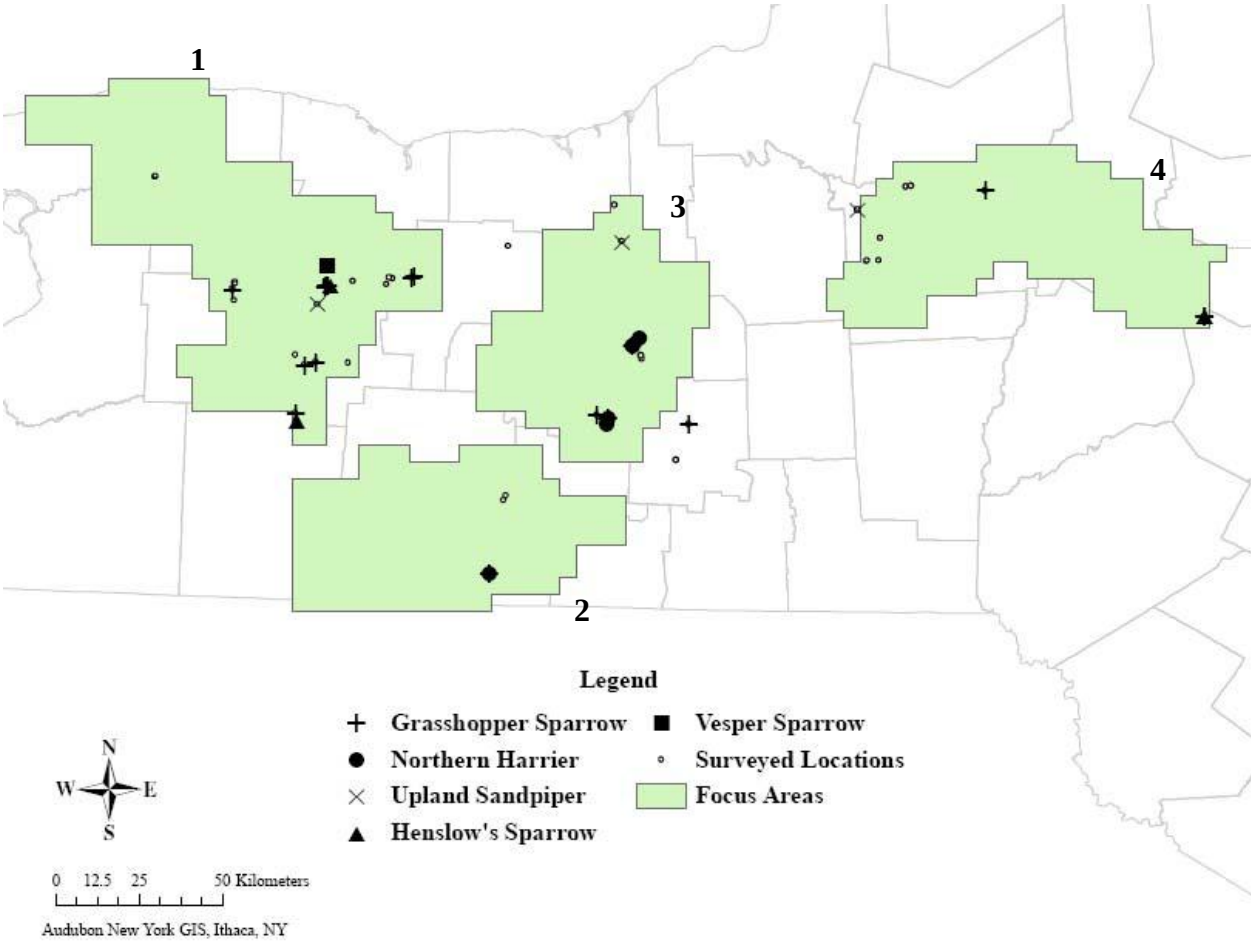


Figure 6. Locations surveyed during the NYSDEC 2006 Uncommon Grassland Bird Survey, along with symbols indicating the species identified at certain locations.

2.5 - Principal Species within each Focus Area

As the information in following sections will show, grassland birds vary in their preferences for the various habitat characteristics that distinguish different grasslands. To determine which focus areas are relatively more important for supporting each of the grassland bird species, the relative abundances for each species as determined by previous survey efforts should be considered (see Table 5). This information can be used as a preliminary review by managers and landowners to ensure that they provide the proper habitat characteristics needed by the important species in that area, although a thorough review must also include BBA data for the block in which the project is found, along with on-site monitoring and surveys.

As populations of Henslow's Sparrows and Short-eared Owls were not assessed effectively by the survey effort, additional information on the distributions of those species was solicited from researchers with pertinent data. Sarah Lazazzero provided a report given to the Biodiversity Research Institute about the results of her research on grassland birds (and particularly Henslow's Sparrows) in the St. Lawrence Valley (primarily in Jefferson County; Lazazzero and Norment 2006).

Kathy Schneider provided information on Short-eared Owl wintering areas in New York collected from reports to birding listservs and surveys of important roosts (Schneider 2004, 2006; for a map of historic and current Short-eared Owl wintering areas, see Appendix D). Ten of 14 currently known wintering areas are captured by the Focus Areas, including important sites such as the Washington County grasslands and several areas in Jefferson County. Eight of all 34 current and historic sites are included within the Focus Areas.

Loggerhead Shrike is now likely extirpated from New York as a breeder, and therefore distribution data for that species were not collected. However, an occasional pair may attempt to breed in the St. Lawrence Valley in areas rarely visited by birders or other observers (Paul Novak, pers. comm.).

The following table (Table 6) lists important species for each focus area based upon this information and the abundances calculated from 2005 survey data (Table 5). This list may be subject to revision based upon follow monitoring and surveys.

Table 6. Principal species within each focus area (from 2005 survey data, Lazazzero and Norment 2006, and Schneider 2006).

Focus Area	Targeted Species
1	Upland Sandpiper, Vesper Sparrow, Horned Lark, Savannah Sparrow, Short-eared Owl*
2	Northern Harrier, Grasshopper Sparrow, Eastern Meadowlark, Savannah Sparrow
3	Vesper Sparrow, Grasshopper Sparrow, Horned Lark, Savannah Sparrow, Short-eared Owl*
4	Northern Harrier, Upland Sandpiper, Short-eared Owl*
5	Henslow's Sparrow, Upland Sandpiper, Sedge Wren, Eastern Meadowlark, Bobolink, Short-eared Owl*
6	Northern Harrier, Vesper Sparrow, Bobolink, Short-eared Owl*
7	Upland Sandpiper, Eastern Meadowlark, Bobolink, Short-eared Owl*
8	Grasshopper Sparrow, Short-eared Owl*
	*Wintering only

2.6 - Predicting Grassland Bird Habitat using Landcover Data

As described above, in section 2.1, newer landcover data are available from the Multi-Resolution Land Characteristics Consortium as part of the National Land Cover Database (NLCD) 2001. Although a full accuracy assessment is underway, it is unlikely that data collected 6 or more years ago will be sufficiently recent to address the issues of crop rotation, succession, and development that plague efforts to predict grassland habitat in New York. However, the general group of "potential grassland habitat," which includes the NLCD 2001 land cover classes most likely to include suitable grassland bird habitat (listed below) may be useful when classifying certain habitat characteristics such as landscape level habitat fragmentation, or as a sampling frame for regional monitoring efforts.

36% of the area considered to be potential grassland bird habitat is captured by the Focus Areas (see Table 7), which in turn capture 22.3% of the geographic area of New York. Land characterized as class 71-Grassland/Herbaceous, in particular, is well represented within the Focus Areas, as 46% of the area included in that class is captured by the Focus Areas. The distribution of area of these classes within and outside of the Grassland Focus Areas supports the conclusion that the Focus Areas contain areas of New York characterized by relatively large amounts of open space, such as agricultural lands and other potential grassland bird habitat.

The land cover classes of interest that may contain potential grassland bird habitat are:

21. Developed, Open Space - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes

31. Barren Land (Rock/Sand/Clay) - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.

52. Shrub/Scrub - Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.

71. Grassland/Herbaceous - Areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

81. Pasture/Hay - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.

82. Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.

95. Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Table 7. Area in each NLCD 2001 Land Cover Class that includes potential grassland bird habitat in New York and in the Grassland Focus Areas.

	New York	Focus Areas	
Land Cover Class	Area (ha)	Area captured (ha)	% captured
21 - Developed, Open Space	613,736	122,608	20.0%
31 - Barren Land	23,495	3,639	15.5%
52 - Shrub/Scrub	383,466	124,319	32.4%
71 - Grassland/Herbaceous	124,525	53,719	43.1%
81 - Pasture/Hay	1,745,252	635,852	36.4%
82 - Cultivated Crops	1,071,545	492,919	46.0%
95 - Emergent Herbaceous Wetlands	78,442	21,013	26.8%
All Potential Grassland Habitat	4,040,461	1,454,068	36.0%

3 - Habitat Management and Considerations

Before deciding to implement grassland habitat projects, managers (defined as anyone considering implementing grassland habitat management, including private landowners) should consider the efficacy of the potential project and ensure that the parcel being considered can contribute to the conservation of grassland birds, while considering other conservation priorities. To facilitate this decision-making process, the flowchart in Figure 7 provides an example of the process for considering the viability of new grassland habitat projects when early successional habitat management is another option (adapted from the NY Wildlife Habitat Incentives Program planning process). It should be noted, however, that the presence of grassland birds actively using any existing habitat patch anywhere within New York supports the decision to continue maintenance of that habitat patch. If the general decision is made to move forward with a new project that will contribute to grassland conservation efforts, the following sections provide the

information needed to target appropriate species and habitat characteristics when developing a site management plan.

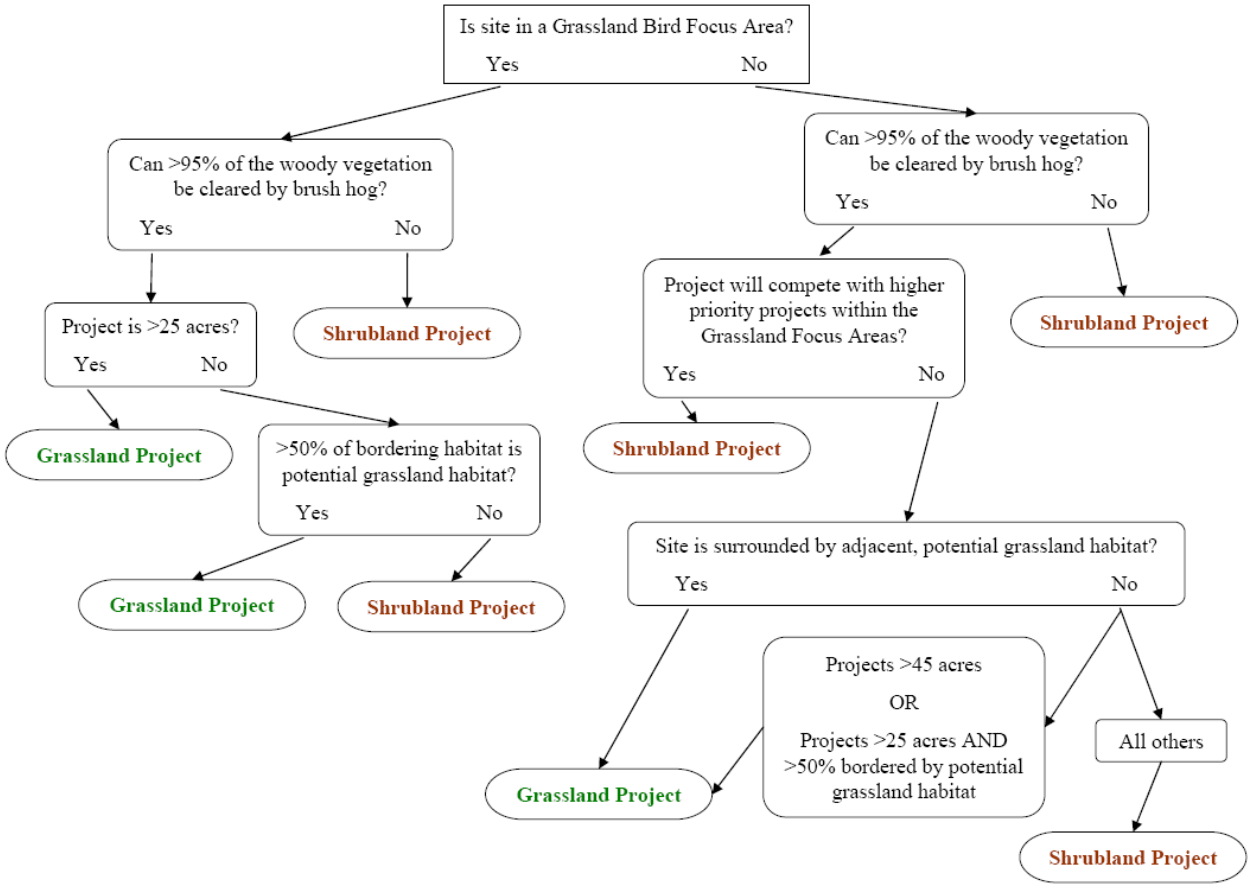


Figure 7. Example process for deciding between grassland and shrubland/early successional habitat projects (adapted from the NY Wildlife Habitat Incentives Program planning process).

3.1 - Tailoring Management to the Targeted Breeding Species

Table 6 lists suggested important species for each focus area, and these species can be used as initial targets for the management and implementation of conservation strategies within each focus area. Because the grassland bird communities vary among the focus areas, using this approach can help to avoid unproductive efforts to provide habitat for a species not breeding in the general area, although these data should not supplant information provided by surveys and monitoring at the project site or from the local area.

When developing management strategies, it is tempting to simply implement the management that requires the simplest (or cheapest) techniques and readily-available equipment. This often results in a basic mowing rotation of 2 to 4 years to prevent encroachment by woody vegetation or invasive plants. Alternatively, management may be based primarily on maintaining the substantial investment made to plant and establish native grass species.

However, the following is proposed as the optimal formulation for creating management plans for sites or complexes within the Focus Areas:

Step 1. Assess local grassland bird community and identify reasonable targets.

Those involved in habitat restoration and management often operate under the assumption "if you build it, they will come", which does not necessarily hold true for grassland species (Ahlering and Faaborg 2006). Site-specific factors are only a portion of the overall probability that a particular patch will be used by the targeted species. Of particular importance are landscape level characteristics (e.g. prevalence of the preferred habitat in the vicinity of the patch, Winter et al. 2006, Renfrew and Ribic 2008; and the amount of development, Lazazzero and Norment 2006), and perhaps most important is the role of conspecific attraction (Ahlering and Faaborg 2006). These considerations strongly support the concept of grassland "focus areas" delineated around the key populations of the grassland bird species, and bring into question the judiciousness of grassland conservation projects outside these focus areas.

Therefore, it is important to review all available data on presence of grasslands birds within the focus areas at two scales. First, review the species present in the local area, and whose offspring may be most likely to colonize the site. Second, monitoring of the project site itself will indicate which species currently use the site (and targeted management may increase their productivity and thus benefit the local population).

Recommended sources for these data are (in order of resolution, from coarse to fine):

1. The important species for each focus area listed in this plan in Table 6.
2. Data from the most recent NY Breeding Bird Atlas for the Atlas block in which the project site is found. It can also be useful to review adjacent blocks as a very rough indication of the relative abundance of the species in that area (Zuckerberg et al. 2006), and in case observer effort in that particular block was lacking.
   -Data and maps available at: http://www.dec.ny.gov/animals/7312.html.

3. Monitoring done at the project site (or local complex) and in the vicinity. This is probably the most important source for tailoring management guidance for existing grasslands, while the coarser datasets may be slightly more appropriate for new plantings. Monitoring is an important part of the management process, and feeds back into several stages of the conservation planning process. For details on coordination of grassland bird monitoring, see that section (or click here).

These data should be used to select the highest priority species targets from the list of grassland birds, and those priority species are then used in the next steps to evaluate habitat characteristics.

Step 2. Determine if project site meets the minimum habitat size requirements for the targeted species.

While the area-sensitivity of grassland breeding birds is well-known, often the majority of the consideration regarding a patch's quality is given to vegetation characteristics within the patch. However, the importance of the size and landscape components cannot be emphasized enough.

It is easy to define size as the total area bounded by a contrasting habitat type; however, grassland birds likely perceive size as a function of their requirements (e.g. able to view a long distance in all directions). This is supported by habitat models which indicate that the Perimeter-to-Area ratio of habitat patches accounts for more of the variation in grassland bird abundance and species richness than Area alone (Lazazzero and Norment 2006). This relationship between Perimeter-to-Area and bird response is inverse, with abundance and species richness increasing with a decrease in the Perimeter-to-Area ratio. Therefore, optimal habitat patches will be both large and of a shape that minimizes the perimeter (e.g. circular or square rather than elongated).

However, thresholds for calculating probability of occurrences using this ratio have yet to be rigorously assessed, so Perimeter-to-Area should be considered along with the delineated size of the habitat patch. Thresholds of 50% probability of occurrence (Robbins et al. 1989) for the grassland birds within a range of patch sizes have been well documented, and have been summarized for each species and included in a following section describing the habitat needs of grassland birds in New York.

In addition to patch size and shape, the surrounding landscape should be considered. As mentioned above, the amount of potential habitat in the vicinity of the patch (along with the inverse, or amount of trees and other woody cover) also contributes to the likelihood that the patch will be occupied by the targeted species (Winter et al. 2006), and also affects productivity of the targeted species (Gates and Gysel 1978). The distances at which this effect has been demonstrated commonly range from 200 m to 1200 m (Ribic and Sample 2001, Fletcher and Koford 2002, Winter et al. 2006), although it may extend farther (Renfrew and Ribic 2008).

If more than one priority species is selected (likely for most sites), and if the project site is sufficiently large, it may be recommended that the site be managed as subdivisions to provide multiple habitat conditions (Winter et al 2006). Once again, it is important to ensure that the "sub-patches" are of a sufficient size and shape to reflect the needs of the priority species.

However, for some species (notably Savannah Sparrow and Vesper Sparrow, and others to a lesser extent) the size of the actual habitat patch matters less than the size of the overall "open area". For example, during Audubon New York's 2005 survey, the observers occasionally noted grassland birds using extremely small habitat patches (occasionally as small as 5 meters in diameter, or 1 meter wide strips at field transitions) surrounded by agricultural fields that were likely providing little additional useful habitat but extended the "apparent" size of the habitat patch. Quantifying this benefit requires additional study, although it may simply be an extreme effect demonstrating the importance of the amount of potential (or open) habitat in the surrounding landscape, as described above.

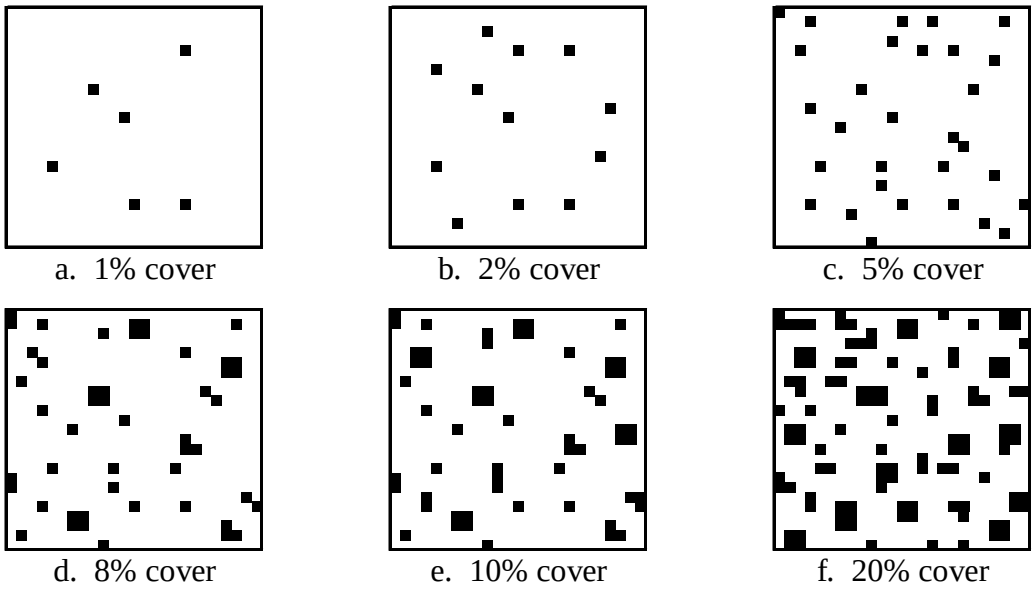
Step 3. Identify habitat characteristics preferred by the targeted species.

While the portion of the spectrum of early-successional habitat that is commonly described as "grasslands" has many characteristics in common, a considerable amount of variation exists in the preferences of grassland bird species for specific habitat attributes. In addition to the importance of size as a habitat characteristics (described above), several other habitat attributes, discussed below, come into play. The specific requirements for each species have been summarized in the following table (Table 8) using the best available and most geographically relevant sources.

Shrub Tolerance

Grasslands are at the very beginning of the natural tendency of habitats in the Northeast to “succeed” to shrubland and then forest. As a result, management often includes control of the woody shrubs that attempt to colonize grasslands. The thresholds of shrub cover at which most grassland birds cease to find grasslands to be suitable are at relatively small percentages (less than 5% cover; Wheelwright and Rising 1993, Martin and Gavin 1995, Winter et al. 2006).

However, quantifying the amount of woody vegetation within a grassland while in the field is very challenging due to issues associated with observer inconsistency and the different growth forms of various species of shrubs and saplings. Estimating percent cover is one possible alternative, but frequent review of a set of illustrations of percent cover (Figure 8) is very important to “calibrate” estimates both among different observers and even to maintain some level of consistency by a single observer.



Figures 8a-f. Illustration of various percent cover categories.

Another alternative for quantifying the distribution of woody vegetation is to measure the distance from the sampling point to the nearest woody stem (>0.5 m tall), or the number of stems within a relatively small, specified distance from the sampling point. Some variation may exist according the random location of sampling points within a field, particularly when the percent cover is low, so data should be collected from a number of points. Data

collected using these techniques would need to be adjusted to allow comparisons to be made to the indicated thresholds of tolerance for grassland birds in Table 8.

Forb Component

The distribution of forbs (broad-leaved herbaceous vegetation) is another site-specific characteristic that influences a habitat patch's suitability for various species. Some particular groups or species of forbs may even have a stronger influence than others, so percent cover of forbs could be expanded to a broader estimate of various cover of: live goldenrod, live legume, standing dead vegetation (include both grass and forb), and total cover (or the inverse—percent bare soil). These are typically estimated using a sampling frame (of pvc or other material) placed in pre-selected random locations, and multiple points are sampled to calculate within-patch variation. As with estimating percent cover of woody vegetation, frequent calibration by reviewing illustrations is helpful.

The percent cover of grass should be the inverse of the percent cover of all forbs combined with other estimated cover categories (such as bare soil and standing dead vegetation), and may be useful to include on data sheets as an error checking mechanism (if the sums do not add to 1, then they were estimated incorrectly).

Litter Depth

Litter (used interchangeably with "thatch") results from either lodging of residual dead vegetation from the previous growing seasons, or from the layer of detritus formed when mowing. Some species prefer more litter as they build nests directly into or covered by the layer (e.g. Savannah Sparrow and Eastern Meadowlark), while other prefer little to no litter (e.g. Grasshopper Sparrow, Horned Lark, and Vesper Sparrow).

Litter depth alone (measured with a meter stick by carefully inserting it through the layer until the soil is reached, and without compressing the layer) may be a useful measure of habitat quality for grassland birds, although multiple measurements are necessary to account for the considerable variability for this measurement that exists in a relatively small area.

Vegetation Height and Vegetation Density

Vegetation height varies dramatically according to phenology, particularly after graminoid inflorescences develop. Vegetation height is linked to nesting success, but migratory grassland birds return and begin establishing territories while most vegetation is

still dormant, so their site selection may be based on characteristics other than vegetation height. Vegetation height does explain some variation in grassland bird distributions, but a measure (or an index) that combines measurements of both height and density is most useful (Robel et al. 1970).

A "Robel" pole is a fast and simple approach to assess vegetation height and density. However, care must be used in its application to ensure that the individual/s applying the technique do not excessively trample the vegetation and alter the measurements as the observer circles the sampling point to collect measurement from four directions 90 degrees apart. For more information on this technique, review the article by Robel et al. (1970).

Perches

While territorial grassland birds sing and display both in flight and while stationary, some species have been reported to prefer sites with suitable perches (e.g. Eastern Meadowlark and Upland Sandpiper; Lanyon 1995, Houston and Bowen 2001). It is particularly difficult to reasonably quantify the availability of perches within a site. Reports of this characteristic may be attributable to the fact that the cryptic coloration of grassland birds makes observing the species on the ground fairly difficult and observers are most likely to detect the species when perched. Nevertheless, it may be an important characteristic and is easily modified (through the addition of fence posts or maintenance of limited amounts of woody vegetation), and thus the need for available perches is included as a category in Table 8.

Data for each species' habitat preferences are included in the following table (Table 8) and are averaged from various sources; however, as habitat preferences vary by individuals within a species according to geographic region (e.g. Northeast vs. Midwest US; Sample and Mossman 1997), some sources were weighted according to geographic representation. Data collected in New York (when available) is probably more specific to habitat management in New York than data collected in other parts of the Northeast region, and Northeast regional data (when available) are probably somewhat more relevant than data collected throughout the ranges of the grassland breeding birds. Therefore, when characteristics reported from multiple studies and from multiple locations varied widely, studies from the Midwest were excluded from the averaged results.

Table 8. Breeding habitat characteristics preferred by the grassland bird species.

Species[1]	Northern Harrier	Upland Sandpiper	Short-eared Owl	Sedge Wren
Recommended Field Size (ha)	30+	30+	Large (exact sizes not available)	10 – 20
Shrub Tolerance (% cover)	Medium to high (1-5%)	Low (1%)	None indicated	Medium to high (3-8%)
Forb Component (% cover)	Low (10%)	Low (10 - 15%)	Medium (20%)	Very Low (0 - 10%)
Litter Depth (cm)	No preference indicated	Low (1)	No preference indicated	Medium (1-4)
Vegetation Height (cm)	Tall (60+)	Mixed (<15 & 40+)	Medium (40 - 60)	Tall (80+)
Vegetation Density	High	Low	High	High
Perches Important		Yes	Possible	
Notes	Nest success may be higher in wetter sites. Variable in vegetation preferences.	Requires low, sparse vegetation for loafing, feeding, and brood-rearing. Maintenance of perches beneficial.	Shares sites with Northern Harrier, but avoids wetter areas.	Prefer wetter areas with tall, dense vegetation--often reed canarygrass, switchgrass, or sedges.

Descriptions: Recommended Field Size - based on estimates of 50% probability of occurrence for each species, commonly accepted as the standard for minimum size targets.
Maximum Shrub Tolerance - estimates of the maximum percentage of total cover of a habitat patch that each species will tolerate as covered by woody vegetation.
Preferred Forb Component - estimates of the percentage of total cover of a habitat patch that each species prefers as covered by herbaceous vegetation (non-grass).

Preferred Litter Depth - estimates of the preferred litter depth (thatch) tolerated by each species. Continued in next section...

Species[1]	Henslow's Sparrow	Grasshopper Sparrow	Bobolink	Loggerhead Shrike*
Recommended Field Size (ha)	60+	50 - 100+	10	
Shrub Tolerance (% cover)	High (3 - 4%?)	Medium (1-3%)	Low (<1%)	High (10%+)
Forb Component (% cover)	High (25%+)	Medium	High (50%+)	No preference indicated
Litter Depth (cm)	High (6+)	Low (<1)	Medium (3 - 4)	Low
Vegetation Height (cm)	Tall (60)	Medium (30)	Medium (30 - 40)	Low to medium (15 - 40)
Vegetation Density	High	Low	Medium to Low	Low
Perches Important				Yes
Notes	Requires undisturbed fields (often >10 years), with some standing dead vegetation.	Prefers little or no litter and >20% bare soil (evenly distributed, not patchy).	Still fairly ubiquitous across New York, and may be found in habitat patches that are less than ideal.	Prefer short, patchy grassy fields (pastures), clumps of woody vegetation for nesting and perches.

Descriptions (continued): Preferred Vegetation Height/Density - Estimates of the vegetation height and approximate density preferred by each species (generally early in breeding season when establishing territories).

Perches - "Yes" when literature suggests that suitable perches may be an important habitat selection factor for that species.

[1]Data pooled from various sources but weighted according to geographic representation: New York>Northeastern US>Rangewide.

Species[1]	Horned Lark	Vesper Sparrow	Eastern Meadowlark	Savannah Sparrow
Recommended Field Size (ha)	1 - 10	10	15	5 – 10
Shrub Tolerance (% cover)	None (0%)	Low (<1%)	Medium (2-3%)	Medium (2 - 3%)
Forb Component (% cover)	High**	High**	High (20 - 30%)	< 40%
Litter Depth (cm)	0	Low (<1)	Medium (2 - 6)	4 (+)
Vegetation Height (cm)	Very Short (0 - 10)	Short (< 20)	Medium (20 - 40)	Medium (30 - 40)
Vegetation Density	Minimal	Low	High	Medium
Perches Important		Yes	Yes	
Notes	Prefer barren (or patchy) areas with exposed soil. Early disturbances on portion of habitat beneficial (before 15 March).	Prefer areas with exposed soil and little litter, such as newly planted grass or seed crops.	Accepts wide variety of habitat conditions.	May be found in small habitat patches, particularly when surrounded by open land.

*Likely extirpated. **When overall vegetation density is low.

Sources: Audubon New York grassland bird survey 2005; Bent 1929, 1932, 1938, 1942, 1948, 1950, 1958; Birds of North America Online (Beason 1995; Herkert et al. 2001, 2002; Houston 2001; Jones and Cornely 2002; Lanyon 1995; MacWhirter and Bildstein 1996; Martin and Gavin 1995; Temple 2002; Vickery 1996; Wheelwright and Rising 1993; Wiggins et al. 2006; and Yosef 1996); Lazazzero and Norment 2006; Mitchell et al. 2000; and unpublished data provided by Michael Morgan.

Step 4. Determine capacity to implement management and conduct monitoring.

Following the identification of desirable habitat characteristics, and the techniques needed to make any changes (described in the following sections), a manager should assess the ability to provide these characteristics. This includes an assessment of the current conditions of the habitat under the manager's control, along with the ability to effect the desired changes.

There are some site-specific factors that may influence the applicability of the various management techniques. These include: soil type, hydrology, and the length of the growing season (and their influence on vegetation within the site and the necessary frequency of management), proximity of housing or other development that may influence the ability to use prescribed fire, availability of personnel and equipment, and availability of farmers willing to provide either livestock for grazing or a market for hay and straw.

Should the manager find that the necessary capacity is lacking, or find through monitoring that no individuals of the targeted species are utilizing the habitat (despite rigorous monitoring indicating that the recommended habitat conditions for the targeted priority species are being maintained), it may be necessary to revisit the species prioritization process. Additional research is needed on the amount of time necessary for the grassland bird species to encounter and "colonize" previously unoccupied sites in order to more fully inform such decisions to make a management change. In addition, prior to revising management plans should the managers be dissatisfied with the apparent lack of success of their habitat project, consideration should be given to the benefit "their" patch provides to the overall character of the landscape, and its effect on the suitability of neighboring patches.

For an additional approach to improving the desirability of a newly converted habitat patch, Ahlering and Faaborg (2006) suggest considering the use of playbacks of recorded calls to simulate occupancy of a patch and encourage conspecifics to take up residency.

3.2 - Management Options

Grasslands are one of the most ephemeral habitat conditions in the process of ecological succession in the Northeast. Quite rapidly, grasslands revert to shrublands and other early successional habitats. This process is expedited by the prevalence of invasive shrubs such as honeysuckle (*Lonicera spp.*), buckthorn (*Rhamnus cathartica*), and multiflora rose (*Rosa multflora*), among others. Invasive plants such as mugwort (common wormwood, *Artemisia*

vulgaris) and swallowwort (*Cynanchum spp.*) can also alter natural successional processes, and can rapidly out-compete desirable grassland vegetation. Some native vegetation, such as goldenrod (*Solidago sp.*) and asters (various members of the Asteraceae family) can also rapidly alter the forb component and dominate a grassland, thereby reducing its suitability as habitat for grassland birds.

To prevent degradation of grassland habitat due to succession or invasion by undesirable vegetation, a regular pattern of disturbance (i.e. management) is needed. While mowing or grazing of agricultural lands during the breeding season causes many grassland bird breeding attempts to fail (Perlut et al. 2006), this frequent disturbance also maintains vegetation in a condition attractive to grassland birds, causing those fields to function as ecological traps (Schlaepfer et al. 2002; Shochat et al. 2005). Potential management options and the tradeoffs between management and impacts to breeding bird communities are discussed in some detail in the following sections.

The three general methods for maintaining grassland vegetation are mowing, grazing, and burning. Considerable variation exists in how each method can be applied, and the methods can also be applied inappropriately, thereby degrading habitat quality. The basic premise for each management technique is that they disturb (or remove) standing vegetation; however, their effect on ground litter (or thatch) and other habitat characteristics can vary depending on their application. Despite the potential variation in their application, some research indicates that grassland vegetation response (primarily controlling dominant invasive grasses and subordinate native vegetation) does not vary significantly among these different methods (MacDougall and Turkington 2007). However, site-specific factors such as soil moisture or the different growing periods of warm-season or cool-season grasses may lend themselves well to a particular method.

Grassland habitats vary across several characteristics (for more information, see the section which describes the habitat characteristics preferred by grassland birds) and result from a variety of land uses (for example hayfields, pastures, conservation grasslands, landfills, airports, parks, and more). Different applications of the methods for maintaining grasslands can yield different habitat characteristics and are described in more detail in the following sections.

Timing of management actions requires a delicate balance between selecting the optimal time to initiate the disturbance to select for the desired vegetation characteristics and avoiding potential impacts to the local population of grassland birds within the managed habitat patch.

Occasionally, if habitat conditions are severely degraded, it may become necessary to temporarily forgo attempting to provide undisturbed breeding sites in favor of bringing the conditions back to those more suitable as breeding habitat, under the assumption that the long-term benefits of the management actions outweigh the temporary loss of habitat. In addition, suitable monitoring of birds present in the habitat patch will indicate to managers whether or not any priority species are present that will be impacted by management during the breeding season. If habitat conditions are degraded to the point that the habitat patch is no longer being used by individuals of the target species, then aggressive management actions will have no impact on the local population.

The timing of the various stages in the breeding cycle of New York's grassland birds is presented in Table 9 and Figure 9. The earliest date that grassland breeding birds return (for non-overwintering species) during spring migration is around 15 March. However, management may occur somewhat later as territorial boundaries and locations remain extremely dynamic well into April. The general rule-of-thumb date for ceasing management activities in the spring is suggested as 23 April (based on dates for initiation of nesting reported in Table 9).

Mowing and harvesting of hay within grasslands has commonly been permitted following 15 July, and allows several grassland bird species sufficient opportunity to breed successfully. However, given the relatively high failure rate of nests and the need to renest later in the breeding season, along with the protracted breeding season of some grassland birds, a more suitable date is suggested as 15 August. As mentioned above, although is it tempting to simply postpone mowing as late as conditions permit, regular mowing is needed as soon as possible after the breeding season to maintain suitable vegetation conditions, by retarding the competition by forbs and shrubs. Should regular mowing after 15 August not be sufficiently early to control undesirable vegetation, a temporary shift to earlier dates may be warranted. However, spot mowing or treatment is preferable to complete mowing of a habitat patch during the breeding season (i.e. prior to 15 August).

Table 9. Approximate timing of stages in the breeding cycle of grassland breeding birds in New York.

	Dates (1 May = 0)						
Species[1]	Arrival	Nesting	Hatching	Fledging	Flighted	End of Cycle	Double-brooded*
Northern Harrier	-45**	-7	37	63	77	105	No
Upland Sandpiper	-5	10	44	44-45	74	94	No
Short-eared Owl	N/A**	-15	17	32	53	96	Possible
Sedge Wren	10	25+	48	61	Unk (+14?)	111+	Yes
Henslow's Sparrow	8	15	37	46	Unk (+14?)	109	Yes
Grasshopper Sparrow	0	10	29	38	Unk (+14?)	91	Yes
Bobolink	2	14	35	46	51 (+)	89	Occasionally
Loggerhead Shrike[2]	*-30*	*-13*	*15*	*33*	*47*	*62*	*Yes*
Horned Lark	N/A**	-15 (+)	7	17	35	105	Yes
Vesper Sparrow	-23	0	21	31	51	90	Yes
Eastern Meadowlark	-45**	7	31	43	51	80	Yes
Savannah Sparrow	-30**	5	34	43	63	96	Yes

* All species may re-nest if disturbed sufficiently early in the cycle.

** May overwinter (Savannah Sparrow and Eastern Meadowlark in limited numbers).

Descriptions: Arrivals = Pooled early arrival date. Nesting = Pooled early initiation of nesting (site selection and construction). Hatching = Pooled early hatching date. Fledging = pooled early departure from nest. Flighted = Pooled early date when young capable of sustained flight (generally >1 min. or >200 m). End of Cycle = Latest date at which young may become flighted.

[1] Unless otherwise noted, dates pooled from: Birds of North America Online (Beason 1995; Herkert et al. 2001, 2002; Houston 2001; Jones and Cornely 2002; Lanyon 1995; MacWhirter and Bildstein 1996; Martin and Gavin 1995; Temple 2002; Vickery 1996; Wheelwright and Rising 1993; Wiggins et al. 2006; and Yosef 1996); Cayuga Bird Club's "Spring Arrival Dates", compiled by Matthew Medler (2004); Bent 1929, 1932, 1938, 1942, 1948, 1950, 1958; eBird.org; and unpublished nest data collected by Michael Morgan.

[2] Likely extirpated as a breeder. Data provided from Paul Novak's thesis *Breeding ecology and status of the Loggerhead Shrike in New York state* (1989).

Figure 9. Approximate timing of stages in the breeding cycle for grassland breeding birds in New York (adapted from the information provided in Table 9). Dashed line indicates the suggested window for avoiding management activities.

3.2.1 - Mowing

Mowing is likely the primary method by which grasslands are maintained in New York. Included in this category are haying (with removal of the cut vegetation) and "brush-hogging" or similar techniques that leave behind chopped vegetation. Mowing grassland habitat can be done in early spring or fall without concern of impacting nesting grassland birds (see Table 9 for breeding season dates). Spring mowing is intended to set back the development and growth of forbs (Mitchell et al. 2000) under the general premise that their growth buds, or meristematic tissue is concentrated in the tips of the plant, while the meristematic tissue of grasses is found closer to the ground (Fynn et al. 2004). Therefore mowing should be done with the mower deck set high above the ground. Shortly following the spring mowing, grass should begin growing rapidly (particularly cool season grass which grows most rapidly during the spring), and will have a slight competitive advantage over forbs, which should be reallocating growth resources due to the loss of their meristematic tissue.

Fall mowing should be done after the breeding season has concluded for grassland birds (see Table 9 and Figure 9), but as early as possible if the objective is to maintain grasses as the dominant component of the vegetation. Grasses spread primarily via extensions of the rhizomes or tillers (Emoto and Ikeda 2005), while most forbs spread by seeds. Mowing prior the time at which seed of forbs become viable will help facilitate the dominance of grasses over forbs. However, mowing later in the fall can facilitate the spread of fully developed seeds, should a higher forb component be desired (Fynn et al. 2004).

While mowing during the breeding season holds considerable potential to negatively impact grassland birds during their breeding cycle, doing so is occasionally necessary to maintain control over the spread of invasive species (particularly if the undesirable plants spread by seeds and mature early in the growing season). The impacts of mowing on breeding birds can be minimized by limiting mowing to the patches where the invasive species are present (spot mowing), or conducting surveys to determine whether or not any grassland species are in fact attempting to breed in a given patch or field. If grassland birds are avoiding a field that has been degraded by invasive species, intensive management can be conducted all season long with little or no impact to the targeted species.

Simply mowing or "brush-hogging" (as opposed to haying) has one drawback, in that the cut vegetation is left to accumulate on the ground in the form of "thatch" (ground litter;

Rudnicky et al. 1997). Grassland species vary in their preferences regarding thatch, and several prefer little or none (see Table 8 – Grassland Bird Habitat Preferences). When species preferring little or no thatch are the targets for management, or when thatch has accumulated to the point of hindering the growth of desirable vegetation, haying may be recommended. Another alternative may be to use one of the two other general methods—grazing or burning.

The frequency of mowing that should be prescribed varies according to soil types, moisture, and presence of invasive species or dominant vegetation that rapidly shifts habitat conditions to later successional stages. As a very general rule, maintenance mowing needs to be done only every two or three years (although Henslow's Sparrows may require a longer undisturbed period), as annual mowing may increase the depth of the thatch layer, reduce the amount of erect or partially erect vegetation (and perches), and therefore reduce the habitat's attractiveness.

3.2.2 - Grazing

Grazing performs many of the same functions as mowing, with the added benefits of little or no accumulation of thatch, along with replacement of many nutrients in a form that may enhance the soil (i.e. manure and urine). In addition, the patchy nature of the vegetation removal by livestock can benefit species that prefer a mix of vegetation heights and densities (including Horned Larks and Upland Sandpipers; see Table 8-Habitat Preferences of New York's Grassland Birds).

However, the quality of the habitat may be limited if grazing is done at too high a stocking rate (i.e. the number of animals grazed per acre), even if done in a rotational grazing scheme if it involves very high densities of animals that reduce vegetation characteristics (Adler et al. 2001) below the thresholds required by grassland birds. Often, high-density rotational grazing functions as repeated disturbances throughout the breeding season, and the rotations are scheduled to maximize use of peak vegetation growing rates, with periods between grazing too short to allow successful breeding attempts by grassland birds. Grazing at high densities can result in excessive trampling of the vegetation/soil (including trampling/ingestion of nests, eggs, and nestlings), as well as removal of nesting cover, leading to increased predation and exposure of nests (Ammon and Stacey 1997, Rohrbaugh et al. 1999). In addition, livestock (cows, sheep,

horses, etc.) can be selective, leading to the spread of undesirable plant species (such as invasive shrubs, thistle, etc.) that must be controlled by regular clipping (mowing) of the pastures.

Grazing may be conducted within the project site during the breeding season and still provide opportunity for successful breeding, given that the minimum habitat requirements of the grassland birds are met (Jones and Vickery 1997). These requirements can be met by maintaining a low stocking rate and ensuring that only a small portion of the pasture (the areas being actively grazed at any given time) is impacted to the detriment of the habitat. Low density, continuous grazing may be preferable, and the impacts to the vegetation are diffuse across the season; however, if a rotational grazing scheme is employed, careful monitoring of pasture conditions will indicate the necessary timing to rotate livestock to the next pasture (Mitchell et al. 2000). Clipping of pastures to control invasives and woody vegetation should follow the guidelines listed for management by mowing.

Grazing outside of the breeding season may function very similarly to mowing and haying, in that the disturbance reduces the amount of vegetation biomass of standing vegetation and prevents the accumulation of thatch.

3.2.3 - Burning

While burning is occasionally considered to be the most ideal or “natural” method of maintaining a grassland, it is gradually becoming less practical for widespread application. Costs associated with personnel and training, equipment, and the trouble of coordinating all the resources and planning that must occur before a burn can be conducted combine to make burning unviable for many public land managers. Private landowners may or may not have the same problems; however, encouraging untrained, private landowners to conduct burning as management may have potential to become a public relations liability, should the burn injure someone or escape beyond the intended patch.

In general, burning is conducted in early spring, to accomplish many of the same objectives described in the section on mowing. In particular, spring burning immediately prior to the rapid growth season of many warm season grasses is commonly employed, as it can greatly facilitate their establishment. Timing burning to occur in early spring often has the added benefit that potential fuels in adjacent habitats (e.g., dormant vegetation or compressed ground litter that take

longer to dry out than residual warm season grasses) may hold high moisture contents, which helps to limit the spread of out-of-control fires.

Refer to section *3.2.5.1 - Warm-season versus cool-season grasses* for a brief description of a project to assess using summer burns to improve habitat conditions for grassland birds in a warm-season grassland.

3.2.4 - Comparison of management techniques

For a simplified comparison of the effects of mowing, grazing, and burning on the habitat characteristics preferred by grassland breeding birds, please see the following table (Table 10).

Table 10. Effects of management techniques on selected grassland bird habitat characteristics.

	Mowing			Grazing		Prescribed Fire		
	Spring[1]	**Summer**	**Fall**	**Rotational**	**Continuous**	**Spring**	**Summer**	**Fall**
Field Size	Can increase	Can increase	Can increase	No effect	No effect	No effect	No effect	No effect
Shrubs (% cover)	Decrease	Slight decrease to slight increase	Decrease to slight increase	Slight increase to slight decrease	Increase	Decrease to no change (varies with species)	Slight decrease to no change	No effect
Forbs (% cover)	Decrease	Decrease	Decrease (early fall mowing) to increase (late fall mowing)	Slight increase to increase (especially weeds)	No change to slight increase	Decrease	Slight increase (in warm season grasses) or decrease (aggressive late-flowering forbs)	Decrease to no change
Litter Depth	Increase (if not hayed)	Increase (if not hayed)	Increase (if not hayed)	Decrease	Decrease	Decrease	Slight decrease to no change	Decrease
Vegetation Height	Decrease	No change	Slight increase to no change	Decrease	Slight decrease	Increase (temporary decrease)	No change	Increase
Vegetation Density	Increase (if hayed)	Increase (if hayed)	Increase (if not hayed)	Decrease	Slight decrease	Increase	No change to slight decrease	Increase
Perches	Removes	Removes	Removes	Maintains	Maintains	May remove	May remove	May remove

Sources: Higgins et al. 1989, Frawley and Best 1991, Mitchell et al. 2000, Lueders et al. 2006, Zuckerberg and Vickery 2006.

[1]In general, spring should be interpreted as prior to the grassland bird breeding season (1 May to 15 August), summer as during the breeding season, and fall as after the breeding season.

3.2.5 - Planting or "Restoring" Grassland Vegetation

In some instances, it may be desirable to convert a field or other piece of property into a new grassland habitat. While habitat conversion is not recommended for certain forests, wetlands, or other priority habitats, occasionally farmland is taken out of production, or patchy habitat may be consolidated into a single cover type. In addition, parks, municipal lands, or other greenspace may be suitable for establishing grassland bird habitat. In these instances, it may be beneficial to plant grasses and preferred forbs, rather than relying on "natural" succession and running the risk of invasion by exotic plant species.

Planting land previously used as tillable agricultural land is often the simplest, as conditions have been maintained to facilitate planting of crops (e.g. access, relatively smooth surfaces, and active weed management). Otherwise, aggressive removal of existing vegetation is necessary, and can include various combinations of tree and shrub removal, application of herbicide, and intensive disking of the soil prior to preparing to plant. "No-till grass seed-drills" are becoming more readily available as they are acquired by conservation partners, and, if conditions allow, may ease the process of site preparation. Planting can occur in both spring and fall, although effort needed to prepare the site and specific seed varieties (and the method by which they are prepared for planting) may necessitate one or the other. The seed supplier can provide information on the preferred timing for planting for the specific seed mix selected.

For more detailed information on the mechanics of planting and establishing grass, a useful source is *Vegetation with Native Grasses in Northeastern North America* by Dickerson and Wark (1998).

3.2.5.1 - Warm-season versus cool-season grasses

Most remaining grasslands in the Northeast consist of non-native cool-season grass species established by European colonists as forage and hay for livestock (Vickery and Dunwiddie 1997, Giuliano and Daves 2002). However, in keeping with commonly accepted principles of conservation, many "restored" grasslands are planted with native warm-season grass species (George et al. 1979). The distinction between the two is that cool-season grasses achieve maximum growth rates during early spring and late fall (during relatively cooler periods), and warm-season grasses achieve their peak growth rate during the summer (or during the warm-season). In addition, warm-season grasses generally grow more robustly and achieve much

higher heights and densities than cool-season grasses. There are limited numbers of native cool-season species available, and they are only recently being evaluated for their value as grassland bird habitat (Paul Salon, pers. comm.).

The motivation for planting warm-season grasslands originally came from three factors. First, from a general conservation biology perspective, they are desirable as native vegetation in contrast to the common, non-native cool-season species mentioned above (Jones and Vickery 1997). They also are fairly resistant to flattening (lodging) by snowpack over the winter and provide dense nesting cover for upland game birds and waterfowl in the spring until new growth begins (George et al. 1979). Finally, they also lend themselves well to management by burning (prescribed fire), since new growth primarily occurs after conditions have warmed and dried in the spring (Rorhbaugh 1999). This allows weeds and forbs to expend resources in germination and new growth early in the spring that are then unavailable following a well-timed burn as the undesirable vegetation attempts to compete with the warm-season grasses which shortly begin to rapidly grow.

Unfortunately for our application in New York, the growth habitats of warm-season grasses (especially varieties of switchgrass, *Panicum spp.*) tends to create very tall, dense stands of grass, which receive limited use by grassland birds (Norment et al. 1999, McCoy et al. 2001). This especially holds true when a very high ratio of grass to forbs is achieved following intensive management. The disparity between the habitat quality of native warm-season and non-native cool-season grasses is large enough that Lazazzero and Norment (2006) strongly advocate the use of the non-native cool-season grasses when managing grassland bird habitat in New York.

Iroquois National Wildlife Refuge conducted a prescribed fire in a portion of a warm-season grassland during the summer of 2007 (Paul Hess, pers. comm.). The purpose of this burn is counter to the traditional approach, in that the objective is to impede the growth of the warm-season grasses in an established stand, increase the vegetation diversity, lower the overall height and density, and improve conditions for grassland breeding birds. The results of this experiment will be followed closely in the event that it may prove useful for improving the grassland bird habitat value of existing warm-season grasslands.

3.2.5.2 - Seed mixes.

The USDA Natural Resource Conservation Service's Plant Materials Program in New York has been maintaining a list (Technical Guide NY-36: Plant Materials – Seeding Mixes for Wildlife) of recommended seed mixes for planting grassland vegetation (source for the list included below). The list includes four categories: non-native cool-season grasses and forbs, native warm-season grasses, native warm-season and cool-season grasses (mixed), and native cool-season grasses. In addition, a list is included of native forbs that can be added to the mixes to increase species diversity (and thus structural diversity), although colonization by forbs from the surrounding habitats often reduces the need to purchase large quantities of the relatively expensive forb seed.

This list will periodically be refined as some mixes are still relatively experimental and as they are planted and evaluated, so it is best to access the most current list in PDF format at http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=NY. The list can be located by clicking on any county within the displayed map, and then following the menu tree to: Section I→Reference lists→Technical Notes and References by Discipline/Plant Materials→TN36-Wildlife Seeding Rates. Alternatively, the lists can also be found by searching for "TN36" in the provided search box.

For more information about these mixes, contact the NY Plant Materials Specialist Paul Salon at (315) 477-6535 or Paul.Salon@ny.usda.gov.

3.3 - Management for Targeted Wintering Species

It is easy to focus on the breeding requirement of migratory birds, without considering the needs of overwintering species. Many of the targeted grassland bird species rely on New York's grassland habitats for breeding or as early staging areas for migration, but several species also rely on grassland habitats in New York during winter. Short-eared Owls overwinter in many locations throughout New York, and are often found with high numbers of Northern Harriers and many other raptors including Rough-legged Hawks, American Kestrels, Red-tailed Hawks, and even an occasional Snowy Owl (see Appendix D for Short-eared Owl wintering locations). Better management of these areas is needed to better meet the needs of this species, and other grassland species such as northern harrier. A critical component for Short-eared Owl habitat is that relatively large patches of standing grass cover be maintained into winter. Short-eared Owls have not been documented as breeding in New York since the first few years of the

2000-2005 Breeding Bird Atlas, and so the greatest contribution New York can provide for this species is to protect and maintain the critical habitat needed to sustain this wintering population.

Eastern Meadowlarks and Savannah Sparrows may remain throughout the year, or leave only for a brief period of time during the coldest winter months. Horned Larks commonly overwinter in large numbers in crop fields throughout New York, particularly in fields windswept free of snow and in areas where manure or waste grain is spread. Although spreading manure on top of packed snow is commonly discouraged by various Soil and Water Conservation Districts due to water quality concerns during snowmelt, this practice provides important foraging areas for Horned Larks (Beason 1995).

Since most habitat management activities will occur shortly after the breeding season for the grassland birds, and before most wintering individuals appear, it is challenging to predict which habitat patches will be utilized. Habitat management activities commonly occur as staggered occurrences from year to year; however, consideration of the needs of wintering grassland birds and particularly raptors should be considered. Some of the resources available to determine if a site may be important for wintering grassland birds include the map of Short-eared Owl wintering locations mentioned above, as well as the myriad of observations collected and reported by the bird watching community. These reports can be obtained from the various listservs used to report bird observations, and especially through eBird (www.ebird.org).

The practice of dividing habitat patches into sections and managing a portion of each field in each year, or rotating management activities across a complex of habitat patches can provide the undisturbed habitat needed as roosting and foraging areas for wintering raptors. Short-eared Owls in New York particularly rely on voles (*Microtus spp.*, Clark 1975), and rely on open expanses of grassland habitat for their aerial foraging. Short-eared Owls also commonly roost on the ground in low, dense, herbaceous vegetation, although they will tree roost if snowpack is particularly thick (Clark 1975, Beason 1995).

While no specific minimum ratio of undisturbed to disturbed habitat is provided in the pertinent literature, various creative techniques can be explored to ensure that some habitat remains, such as maintaining wide grassy buffers along streams and field borders. In addition, if the management objective for mowing a field is to control woody vegetation, spot mowing of shrubs allows relatively large amounts of undisturbed herbaceous vegetation to persist through the winter.

4 - Implementation of Plan

4.1 - Conservation Objective and Targets (Habitat and Population)

There have been several strategies identified for achieving success in the conservation of grassland birds in New York. The two discussed in detail in the previous sections of this plan include the focus area concept and efforts to provide guidance on how to provide optimal habitat conditions for the targeted grassland birds. In addition, establishing a partnership of the various entities concerned with conservation of grassland birds in New York could also be considered a strategy, and has already been a valuable part of the achievements to date. Prior to discussing additional strategies, it is important to establish the goals and objectives that this partnership is trying to reach by the implementation of this plan.

One important part of objective setting when attempting to conserve populations of concern is to asses the current condition of the population (e.g. population size and trend). We are able to track population trends for the grassland bird species at various scales, but estimating population sizes requires the ability to accurately estimate the amount of potential habitat available to the species combined with estimates of population density. As was discussed in the section "The use of landcover to identify focus areas", current landcover classification datasets lack the accuracy needed to quantify the amount of potential habitat. While we now likely possess sufficient data to reasonably model the abundance of grassland birds associated with various grassland habitat types, the inability to model habitat distribution across the landscape is an important handicap, and warrants further study.

Were we able to map grassland habitats accurately across the state, population conservation targets could be established, following the form of "X hectares of habitat A would support Y individuals of a particular species in focus area 4, and if established, would double the population of that species in the focus area." Nevertheless, as our concern for these species is founded upon their rapidly declining trends, we can establish the general objective of "improving the availability of suitable habitat to stabilize the rapidly declining trends of the grassland bird populations in the focus areas in which individuals of those species are found."

4.2 – Strategies

In addition to the focus area concept and partnership efforts, there are several additional strategies being implemented by partners in the NY grasslands conservation group. These strategies are best categorized into one of three sections—Incentives and Easements (generally on private lands), Purchases, and Education. Each of these is discussed in more detail in the following sections. However, the value of coordinating efforts within the Focus Areas cannot be overstated, as this cooperation provides the best opportunity for developing the habitat complexes most beneficial to grassland birds. In particular, leveraging several programs to complement each other can often take a habitat conservation project past the size limitations that can handicap their usefulness. For example, the following figure illustrates how potential enrollment in the Landowner Incentive Program can complement other conservation programs to manage large expanses of habitat. Also, although landowners may not be able to enroll their entire parcels into incentive programs, their newfound knowledge of grassland bird habitat management may affect operations on the remainder of the parcel, assuming that the program representatives fully communicate the objectives and need for grassland bird conservation.

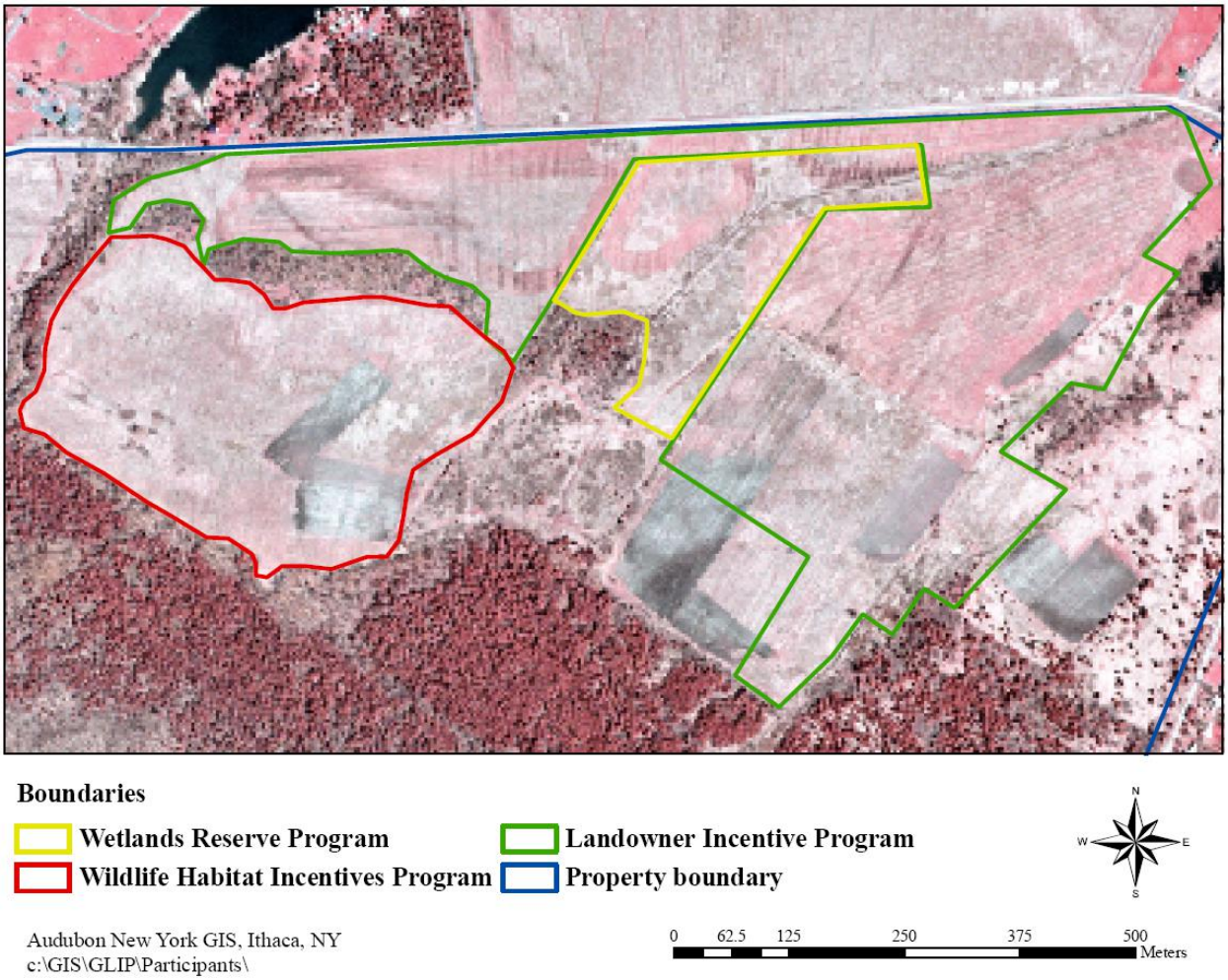


Figure 10. Over 100 acres of grassland habitat complex protected and managed through complementary conservation programs.

4.2.1 – Incentives and Easements (Private Lands)

Grassland bird populations peaked in Northeast the latter portion of the 19th century (as was described in the Introduction) as a result of the widespread clearing of forests for agricultural land. While the amount of hayfield and pastures available as grassland habitat has drastically decreased since that historic peak, the majority of habitat currently available continues to be private lands that are or have recently been agricultural lands. While farmland abandonment and reversion to forest has been the leading cause of the decreases, other threats are becoming more prevalent. These include intensification of haying (early and frequent mowing of hay), development of rural land associated with sprawl growth, and conversion of hayfields and

pastures into tillable land (crop land). This last category is of particular concern as the demand (or perception of a demand) for corn and other biomass for the production of ethanol has dramatically raised the value of agricultural land. This has led to widespread conversion of land that was previously too unproductive to allow profitable production of rowcrops (and was often left as hayfields).

Therefore, the most efficient approach to providing high quality grassland habitat will be to work closely with private landowners, rather than focusing all efforts on acquisition and management of public property. The various voluntary programs available to landowners in New York are listed below (and are summarized in Table 9).

Landowner Incentive Program: Grasslands Protection and Management (GLIP)
Coordinating Agency: NYS Department of Environmental Conservation
Contact: Marcelo del Puerto (mjdelpue@gw.dec.state.ny.us)
Website: http://www.dec.ny.gov/animals/32722.html
Total Enrollment: ~22 participants in 2008, contract review and signing is underway.
Average Annual enrollment: $600,000 is available for this initial offering, and will fund approximately 2,100 acres (~$55/acre). Additional funding has not yet been determined.

The newest incentive program is the NYS Department of Environmental Conservation's Landowner Incentive Program for Grassland Management and Protection. New York received funding for this program through a $600,000 Tier 2 grant from the US Fish and Wildlife Service. There is a 25% landowner match requirement for the funds, which will fund the protection and management of approximately 2,100 acres of habitat for a period of 5 years at $55/acre/year ($60/acre/year near metropolitan areas). Applicants were required to be within or bordering the focus areas to be considered eligible, although focus area 8 (Long Island) was not included in the program as the program coordinator (with input from Audubon New York) decided that land values and the lack of suitable habitat on private lands negated any benefit LIP could provide to the area. Over 200 applications were received (Figure 6 shows the distribution of applicants), and were ranked and evaluated following a rigorous process to ensure that the highest quality habitat patches were selected for the program (to see the evaluation criteria, visit

http://www.dec.ny.gov/pubs/32751.html). Final preparation of contracts with the selected participants is underway.

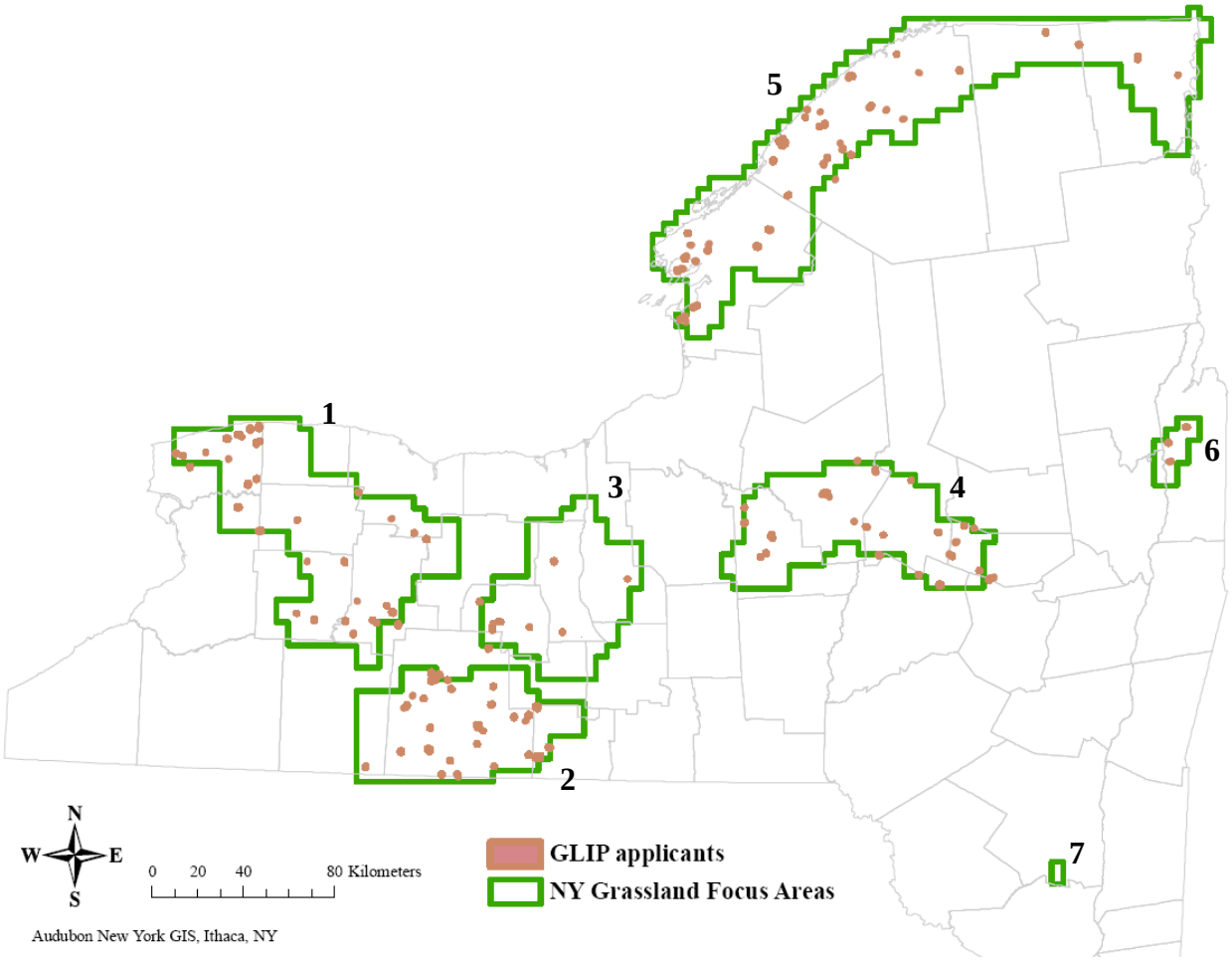


Figure 11. Locations of applicants to the Landowner Incentive Program for Grassland Protection and Management in 2006-2007.

Conservation Reserve Program (CRP)

Coordinating Agency: USDA Farm Service Agency/Natural Resource Conservation Service

Contact: Virginia Green, Supervisory Program Specialist (Virginia.Green@ny.usda.gov)

Website: http://www.ny.nrcs.usda.gov/programs/index.html#crp

Total Enrollment: 59,756 acres

Average Annual Enrollment: 2,500 acres

The Conservation Reserve Program offers incentives and cost-sharing opportunities for a variety of actions targeting the conservation of soil, water, wildlife, and other natural resources. The Conservation Reserve Program in general controls the largest budget of any of the listed conservation programs; however, only some of its various components may be applicable to the conservation of grassland birds. Of particular interest are the practices CP-1, CP-2, and CP-10, which involve the planting and maintenance of grasslands. The Conservation Reserve Program incorporates incentive payments for enrollment that vary according to the duration of the agreement (easement), along with cost-share payments for management and restoration activities.

This program is an important component of the Farm Security and Rural Investment Act of 2002 (or 2002 Farm Bill), and the last General Signup was in Fiscal Year (FY) 2006. The next General Signup is expected in FY 2009 at the earliest, subject to funding through a revised Farm Bill.

Most recently, New York submitted an application to the State Acres For wildlife Enhancement component of the Conservation Reserve Program (SAFE-CRP) to guide the allocation of 4,950 acres of funding towards habitat patches most valuable as grassland bird habitat. This allocation will be modeled after the ranking criteria developed by the NYSDEC LIP and in consultation with Audubon New York and the NYSDEC (and other partners).

Partners for Fish and Wildlife Program

Coordinating Agency: US Fish and Wildlife Service

Contact: Carl Schwartz (carl_schwartz@fws.gov)

Website: http://ecos.fws.gov/partners/viewContent.do?viewPage=home

Total Enrollment: 675 participants (~7,500 acres)

Average Annual Enrollment: Between 500 and 1,000 acres

The Partners for Fish and Wildlife Program provides financial (cost-sharing) and technical assistance to landowners for management and conservation targeting a variety of habitats. Some of the priority projects the Program participates in are wetland restoration, grassland restoration, in-stream restoration, stream bank stabilization and restoration, and restoration of riparian and floodplain areas (see Fig. 11 for a map of project site locations).

The National priority ranking factors for the Partners Program are used to assign funding priority status to proposed projects that meet these conditions:

-Improve habitat for Federal Trust Species, including migratory birds; threatened and endangered species; inter-jurisdictional fish; marine mammals; and, other declining species.

-Complement activities on National Wildlife Refuge System lands, or contribute to the resolution of problems on refuges that are caused by off-refuge practices.

-Address species and habitat priorities that have been identified through Service planning teams (with our partners), or in collaboration with state fish and wildlife agencies.

-Reduce habitat fragmentation or serve as buffers for other important Federal or state conservation lands.

-Result in self-sustaining systems that are not dependent on artificial structures.

If other considerations are generally equal, then priority is directed to those projects that link private lands to important Federal lands (such as Refuges), have cooperative agreements of longer duration, multiple partners, cost sharing, and the greatest cost effectiveness.

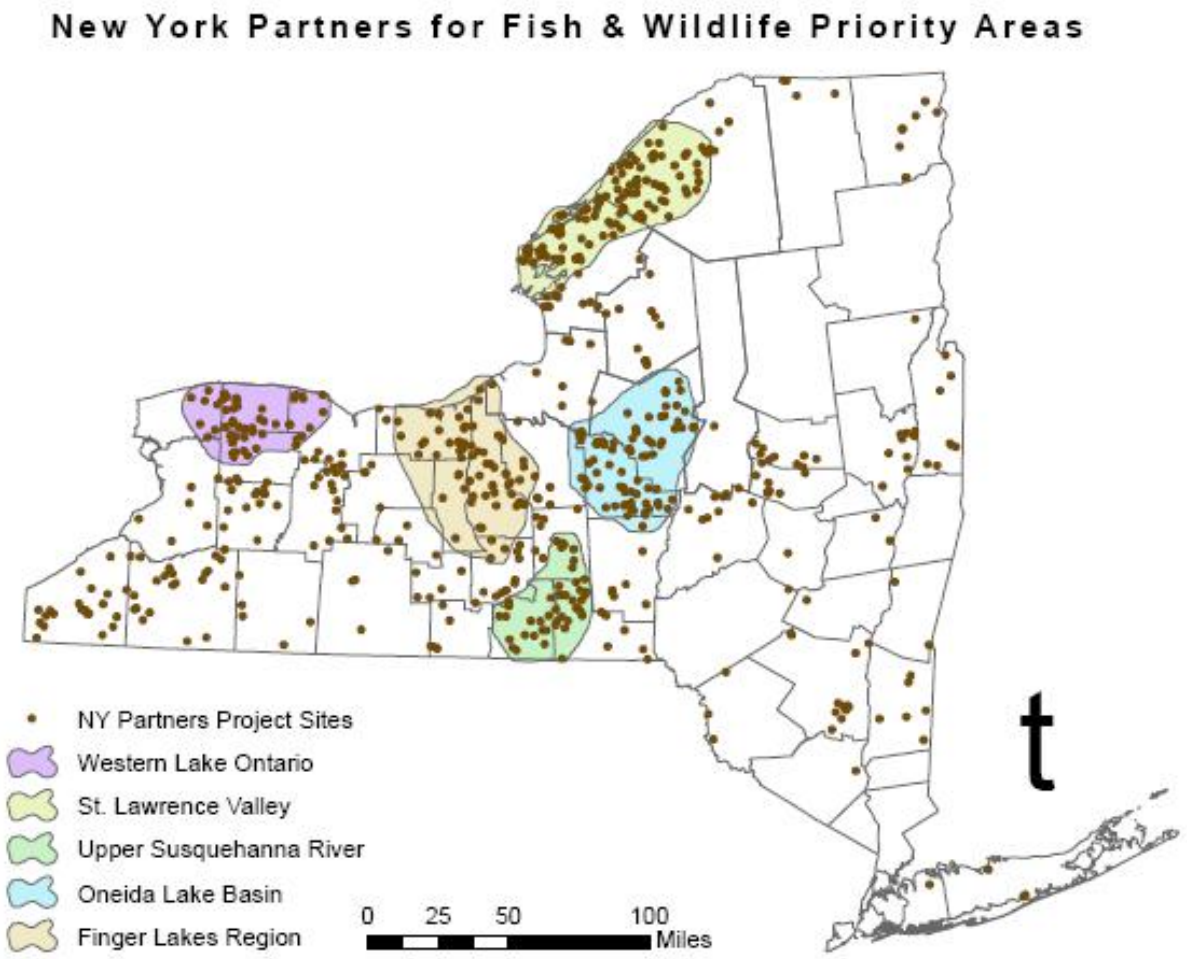


Figure 12. Project site locations for the NY Partners for Fish and Wildlife Program.

Wildlife Habitat Incentives Program (WHIP)

Coordinating Agency: USDA Natural Resource Conservation Service

Contact: Mike Townsend (michael.townsend@ny.usda.gov)

Website: http://www.ny.nrcs.usda.gov/programs/#whip

Total Enrollment: 559 contracts (16,500 acres, average cost of $175/acre)

Average Annual Enrollment: 1,830 (~1,000 for 2007)

The Wildlife and Habitat Incentives Program pays landowners as a cost share for seeding and/or management activities that are undertaken for grassland bird management. There is no rental payment or incentive as in CRP.

Table 11. Private lands incentive and cost-sharing conservation programs.

Program Name	Approximate Annual Enrollment (acres)	Total Acres Enrolled	Landowner Commitment	Payment Type
Conservation Reserve Program (CRP) [1]	2,500	59,756	10-15 years	Incentive and Cost-share
Landowner Incentive Program: Grassland Protection and Management[2]	N/A	~2,100*	5 years	Incentive
Partners for Fish and Wildlife Program[3]	500-1,000	7,500	10+ years	Cost-share
Wildlife Habitat Incentives Program (WHIP)[1]	1,830	16,500	5-10 years	Cost-share

*Contracting with selected recipients is underway. Further funding for this program has not been confirmed.

[1] USDA Farm Service Agency/Natural Resource Conservation Service

[2] NYS Department of Environmental Conservation

[3] US Fish and Wildlife Service

4.2.2 – Purchases (Public Lands)

While the primary strategy for reversing declining trends in populations of grassland breeding birds will be private lands conservation programs, proper management of public land remains an important component of the overall conservation effort. This management in particular likely has significant impacts on the suitability of landscape-level selection factors for grassland birds in the general vicinity of the public lands. For example, what is probably the largest remaining population of Henslow's Sparrows in New York is clustered around the Perch River Wildlife Management Area in the St. Lawrence River Valley (Focus Area 5). Although the rural, agricultural nature of the local community and soils that hinder vegetative succession are key factors in the maintenance of the population, the public grasslands managed by the NYSDEC undoubtedly play an important role in maintaining a suitable landscape.

The proportion of the total area in each Focus Area that is publicly owned averages 5.8%, and varies from less than 1% in Focus Area 6, to more than 28% in Focus Area 8 (see Table 12 and Figure 13). In addition, the percentage of potential habitat identified using the 2001 NLCD (discussed in section 2.6) that occurs on public land is 6%. This indicates that the proportion of grassland habitat on public lands reflects its distribution in the landscape, and that past public land acquisition and management efforts may not have placed any particular emphasis on grassland habitats.

One notable exception to this pattern is based on preliminary surveys, which found that practically all remaining grassland habitat in Focus Area 8 is currently in public ownership due to aggressive development on private lands, and indicates that proper management of these public lands will be critical for sustaining that region's populations of grassland birds. In particular, the largest habitat patch remaining occurs on the former Naval Weapons Industrial Reserve Plant (also know as the Grumman plant or Calverton airport), now officially referred to as the Enterprise Park at Calverton (EPCAL). Unfortunately, the site has been proposed for development, but is also receiving much attention as various partners have been advocating for continued protection and management of its habitats.

Additionally, the NYSDEC is exploring a comprehensive plan to work with various municipalities in Washington County to develop a habitat protection initiative involving acquisition and purchase of easements on several thousand acres of critical habitat in the Ft. Edward Grassland IBA portion of Focus Area 6.

For maps of each Focus Area that identify all public lands and their locations within the Focus Areas, please view Appendix F.

Table 12. Proportion of focus areas in public ownership (from NYS Accident Location Information System-Public Land Boundaries 2006).

	Focus Areas								
Land Ownership Category	1	2	3	4	5	6	7	8	Overall
Federal Recreational	4,393	15	8,635	7	0	0	0	0	13,049
Federal Non-recreational	10	256	4,302	417	38,282	0	257	2,432	45,955
State Recreational	16,994	20,458	5,531	7,367	40,743	0	0	4,508	95,493
State Non-Recreational	95	0	174	517	1,469	0	213	34	2,502
State Campgrounds	41	0	96	10	257	0	0	19	422
County Recreational	2,729	0	0	1,741	118	0	0	1,371	5,362
Municipal Recreational	573	0	48	658	84	54	0	195	1,611
Totals (ha)	24,834	20,728	18,786	10,717	80,952	54	470	8,559	164,395
% of Focus Area	4.0	5.3	5.3	2.5	8.2	0.1	9.4	28.5	5.8

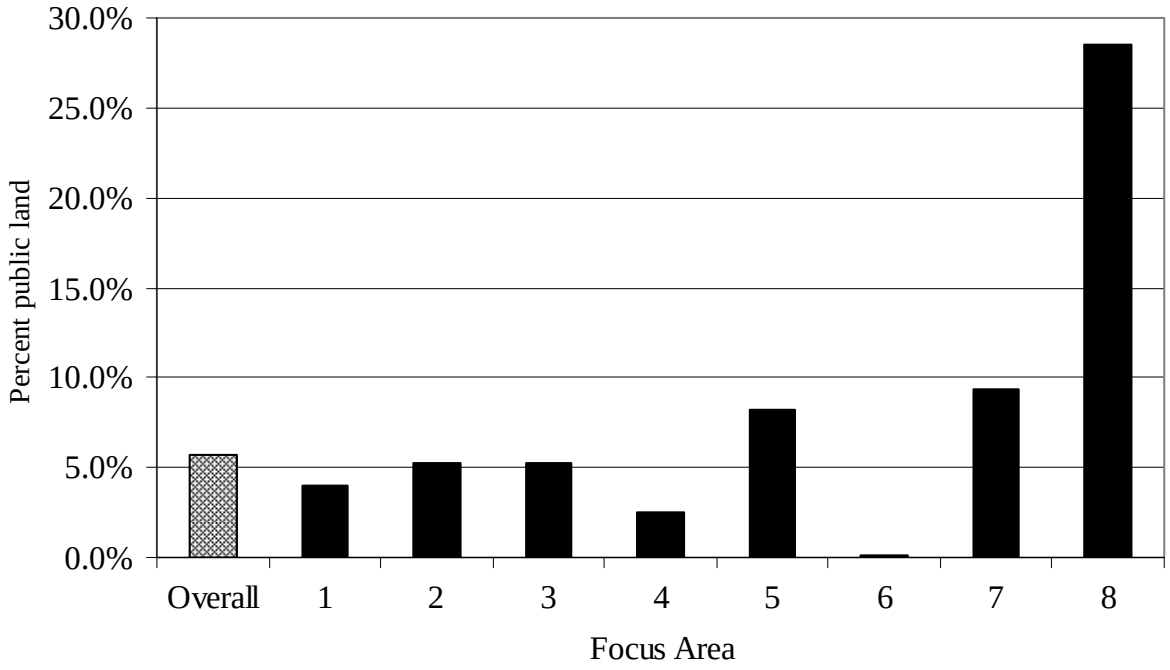


Figure 13. Chart comparing proportions of each Focus Area that are publicly owned (from NYS Accident Location Information System-Public Land Boundaries 2006).

4.2.3 - Land Trusts

Land trusts (or not for profit organizations that acquire land in both fee title and easements) are not reflected in the categories described above, as they operate independently and many focus on easements (the proportion of which varies among land trusts), and are therefore a blend of public and private land conservation efforts. There area approximately 70 land trusts that operate on a local level in New York, 3 that operate statewide, and 9 that operate nationally (with varying levels of involvement in New York). For a list of New York's land trusts that are members of the Land Trust Alliance, please see Appendix F (from the Land Trust Alliance website at http://www.lta.org/index.shtml). Specific land trusts that participate in the partnership effort to conserve grassland habitat in New York include The Nature Conservancy and the Thousand Islands Land Trust.

Comprehensive data on land trust stewardship activities regarding grasslands in New York are not readily available, but this warrants further assessment, as land trusts hold potential for enrolling considerable amounts of habitat in the grassland conservation effort. Some land trust

stewardship activities are supported through the private lands conservation programs listed above.

4.2.4 - Education

Management of grassland habitat requires commitment and resources beyond those available to most private landowners. However, a minor subset of landowners in New York does maintain land voluntarily for wildlife habitat. Those landowners often are eager to implement management actions when given proper guidance, and they should not be ignored as partners in this effort.

In addition, many agricultural landowners appreciate the ability of their land to provide wildlife habitat, and are able to voluntarily implement certain conservation activities when they do not interfere with the productivity of their operations. For example, knowledge of the timing of the breeding cycle and the need for undisturbed grasslands as nesting habitat for grassland birds can encourage farmers to maintain refuge "islands" of unmowed grass in hayfields, and to delay haying of poorer quality grass (which can be used as bedding material or forage for livestock that do not have the rigorous dietary requirements of dairy cattle).

In addition to this plan, some of the resources available that should be provided to interested landowners include educations materials developed by MassAudubon and Cornell Cooperative Extension. Links to these resources can be found in the "Additional Resources" section of this document.

In addition, Audubon New York is exploring opportunities for relationships with various farmland preservation efforts in New York, many of which are very interested in learning about the habitat value of carefully managed farmland, as wildlife habitat values can be used to further their farmland preservation agenda.

4.2.5 - Public Policy

While protection of threatened and endangered grassland bird species is provided by both the USFWS under the Migratory Bird Treaty Act and the NYSDEC under the Environmental Conservation Law, protection of habitats for these species has been less than adequate to prevent impacts to their populations. Further development and implementation of public policy pertaining to the protection of habitat for threatened and endangered species would alleviate

some portion of the threats associated with the loss or degradation of existing habitat. However, this process will require full participation by a wide variety of stakeholders, and must be carefully considered.

4.3 - Assessment / Monitoring

Unfortunately, no existing monitoring program provides the information required for assessing population trends and responses to management actions within the grassland focus areas of New York, but this need has been identified as a priority by multiple planning efforts, including by the partnership supporting the development of this plan, and the NY State Wildlife Grants planning process. The Breeding Bird Survey (BBS) lacks the power needed to effectively meet these needs at anything less than a regional scale, because of its extremely coarse resolution; potential bias associated with roadside point counts; its "all habitat" approach, which limits the amount of possible grassland habitat that is surveyed; and the increasingly rare nature of Northeastern grassland birds that further limits the ability of the BBS to detect meaningful population trends.

Indeed, it is challenging to develop a protocol for monitoring grassland birds that fills all the data collection needs to meet multiple objectives. When the objective of a protocol is to monitor population changes at a regional level, it may not be sufficiently precise to allow a habitat manager to determine if their actions are having a desirable effect on the local grassland bird community.

Government agencies and conservation organizations in the Northeastern states are in the process of developing a unified bird monitoring framework that will facilitate monitoring grassland birds at various scales and for various purposes across the Northeast (along with other bird groups and habitat/species suites) through the Northeast Coordinated Bird Monitoring Partnership. Audubon New York has been selected to lead the grassland component of this effort, which will ensure that the program used to monitor grassland birds in New York will be fully aligned and coordinated with the regional program, and will facilitate comparisons and interpretation of New York trends in a broader context. This coordinated bird monitoring effort is coordinated by Dan Lambert (American Bird Conservancy) and materials supporting this effort can be found at www.nebirdmonitor.org. Efforts to expand and develop this regional grassland bird monitoring program will be supported by the broader NE CBM effort; however,

the foundation for this program and assessments of various survey techniques was developed through the creation of this plan, and is reported below.

While conducting the 2005 grassland breeding bird focus area survey (described in section 2.3), additional data were evaluated to assess various techniques used to estimate grassland bird abundance. This effort is described in more detail in the following section.

4.3.1 – Assessment of data collection techniques.

During the 2005 focus area surveys, Audubon New York employed four methods of collecting grassland bird abundance data:

a. Single observer roadside point counts (SORS)
b. Single observer infield point counts (SOIF)
c. Double observer roadside point counts (DORS)
d. Double observer infield point counts (DOIF).

The use of these four techniques allowed comparisons to be made between single and double observer point counts, as well as in-field and roadside point counts. Since the value of double observer point counts was discussed in some detail in section 2.3, it will not be discussed here. The differences in relative abundances estimated using roadside and in-field point counts was simply compared using a 2-tailed T test, and significant differences were only found for two species (see Table 13).

Table 13. Differences in average relative abundances estimated using roadside (RS) versus in-field (INF) point counts during the 2005 grassland breeding bird focus area survey conducted by Audubon New York (significant differences in bold).

Species	Treatment	N	Mean	SE Mean	Difference	T-Value	P-Value	95% CI
BOBO	INF	182	2.16	0.38	0.601206	1.48	0.14	(-0.197662,
	RS	341	1.56	0.14				1.400075)
SAVS	INF	182	1.31	0.13	0.086985	0.57	0.571	(-0.214785,
	RS	341	1.22	0.084				0.388754)
EAME	INF	182	0.311	0.06	**-0.15308**	**-2.03**	**0.043**	(-0.301147,
	RS	341	0.464	0.046				-0.005017)
GRSP	INF	182	0.094	0.029	0.027554	0.74	0.459	(-0.045557,
	RS	341	0.066	0.023				0.100665)
HOLA	INF	182	0.21	0.058	**0.161421**	**2.67**	**0.008**	(0.042458,
	RS	341	0.048	0.017				0.280384)
NOHA	INF	182	0.011	0.0077	-0.01834	-1.31	0.19	(-0.045807,
	RS	341	0.029	0.012				0.009134)
VESP	INF	182	0.022	0.011	0.010248	0.79	0.433	(-0.015407,
	RS	341	0.012	0.0072				0.035902)
UPSA	INF	182	0.027	0.012	0.01281	0.85	0.393	(-0.016661,
	RS	341	0.015	0.0088				0.042281)
SEWR	INF	182	0.022	0.013	0.016113	1.15	0.252	(-0.011525,
	RS	341	0.0059	0.0041				0.043751)

Based upon these preliminary results, a protocol for estimating grassland bird populations should rely on using the double observer technique to collect at least a portion of the data. This allows for assessment of (and correction for) observer accuracy in the final estimates.

In addition, due to few significant differences in relative abundance of grassland birds between roadside and infield point count locations (and contradicting “directions” of the two statistically significant differences), a survey protocol that includes roadside surveys likely would describe reasonably accurately the true relative abundance and distribution of New York’s

grassland bird populations. In New York in particular, the vast majority of grassland habitat patches are adjacent to roads, and a survey based on roadside point counts would likely be able to sample most patches. In addition, by incorporating both roadside and infield point counts into the study plan, observers will be able to visit more points than if they were to conduct only in-field point counts, as roadside points are more easily located and require less travel time to reach and return from.

However, because many land managers should be conducting in-field point counts (to assess vegetation characteristics and for rigorous site-level monitoring), it will likely be possible to combine the two techniques. An ideal monitoring scheme will be able to assess both local bird response and regional population changes to most effectively utilize the available observers. The monitoring scheme currently envisioned will likely make use of in-field point counts conducted by managers in a "fixed" set of habitat patches, along with roadside point counts conducted at randomly selected patched that are classified as "potential" grassland bird habitat.

4.3.2 Tiers or "strata" of interest for evaluation/monitoring efforts.

A robust sampling design will allow comparisons at multiple levels including comparing grassland bird response as a result of habitat management to population changes throughout the region (both site-specific and programmatically), modeling the availability of suitable habitat across the regions (of concern due to inability to precisely model habitat using landcover datasets), and assessing vegetation response to management actions. The hierarchy of specific population inferences that are of interest are below, for the primary objective of indicating the effectiveness of coordinated conservation efforts at conserving the remaining populations of grassland birds:

1. Regional population trend for the Northeast (defined as USFWS Region 5, to align with BBS and other coordinated efforts).
2. State Level Trends (states within USFWS Region 5).
3. Trends for populations within Focus Areas.
4. Trends for specific conservation programs (or lack thereof) including private lands programs (LIP, CRP, WHIP, PFW, etc.) and public land efforts (refuges and wildlife management areas) contrasted with trends for populations occurring on private, intensive

agricultural lands such as active hayfields and pastures not enrolled in conservation programs.

5 - Preliminary Research Needs

The following list describes research needs that will assist the development of future planning for the conservation of grassland birds.

1. Improved methods and data for modeling distributions and abundance of grassland landcover across the landscape.
2. Improved knowledge of impacts of management on productivity (production of viable young) of grassland birds, to amplify existing information on grassland bird abundances associated with management.
3. Further research into potential benefits of native grass species as grassland habitat in contrast with demonstrated benefit of non-native cool season grasses.

6 - Next Steps

1. Finalize a comprehensive monitoring framework for grassland birds.
2. Collection of data on activities of Land Trusts to preserve/manage grassland habitat.

7 - Additional Information and Related Planning Efforts

For additional perspectives on grassland bird conservation, please see the following selected sources of information:

1. Ochterski, J. 2005. Cornell Cooperative Extension's guidelines for landowners on conserving grassland habitat. (http://scnyat.cce.cornell.edu/grassland/)
2. Herkert, James R., Robert E Szafoni, Vernon M. Kleen, and John E. Schwegman. 1993. Habitat establishment, enhancement and management for forest and grassland birds in Illinois. Division of Natural Heritage, Illinois Department of Conservation, Natural Heritage Technical Publication #1, Springfield, Illinois. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/birds/manbook/index.htm (Version 16JUL97).

a. Summarized version: http://www.bcnbirds.org/greenpapers_files/GPgrassland.html

3. Johnson, Douglas H., Lawrence D. Igl, and Jill A. Dechant Shaffer (Series Coordinators). 2004. Effects of management practices on grassland birds. Northern Prairie Wildlife Research Center, Jamestown, ND. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/literatr/grasbird/index.htm (Version 12AUG2004).
4. MassAudubon (http://www.massaudubon.org/Birds_&_Beyond/grassland/index.php)
5. New Jersey Audubon (http://www.njaudubon.org/Conservation/Stewardship.html)
6. Sample, D. W. and Mossman, M. J. 1997. Managing habitat for grassland birds: a guide for Wisconsin. Bureau of Integrated Science Series. Wisconsin Department of Natural Resources, Monona, Wisconsin. 154 pages. http://www.npwrc.usgs.gov/resource/birds/wiscbird/index.htm

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Appendices

Appendix A - Grassland Bird Species targeted by the NY Grassland Bird Conservation Plan.

Species	Partners in Flight Ranking (Carter et al. 2000)	NE Concern[1]	NY SGCN[2]	NY E,T,SC[3]	**Tier**
Northern Harrier	High Regional Priority/High Regional Threats	Yes	Yes	T	**1**
Upland Sandpiper	High Continental Concern/High Regional Responsibility, High Regional Threats	Yes	Yes	T	**1**
Short-eared Owl	High Continental Concern/Low Regional Responsibility, High Regional Threats	Yes	Yes	E	**1**
Sedge Wren	High Regional Priority/High Regional Threats	Yes	Yes	T	**1**
Henslow's Sparrow	High Continental Concern/High Regional Priority; High Regional Priority/High Regional Concern, High Regional Threats	Yes	Yes	T	**1**
Grasshopper Sparrow	High Regional Priority/High Regional Threats	-	Yes	SC	**1**
Bobolink	High Regional Priority/High Regional Concern, High Regional Responsibility	-	Yes	-	**1**
Loggerhead Shrike	High Regional Priority/High Regional Threats	Yes	Yes	E	**1**
Horned Lark	-	-	Yes	SC	**2**
Vesper Sparrow	-	-	Yes	SC	**2**
Eastern Meadowlark	High Regional Priority/High Regional Concern	-	-	-	**2**
Savannah Sparrow*s*	-	-	-	-	**2**
Wintering Raptors*	N/A	N/A	N/A	N/A	**3**

[1] Wildlife species of regional conservation concern by Northeast Endangered Species and Wildlife Diversity Technical Committee (2001).

[2] State Wildlife Grants "Species of Greatest Conservation Need" in NY (March 2003).

[3] Species listed as Endangered, Threatened, or Special Concern in NY (New York State 1979).

* Including Northern Harrier, Short-eared Owl, Snowy Owl (*Bubo scandiacus*), Rough-legged Hawk (*Buteo lagopus*), Red-tailed Hawk (*Buteo jamaicensis*), American Kestrel (*Falco sparverius)*, and Northern Shrike (*Lanius excubitor*).

Appendix B - Maps of Breeding Bird Atlas blocks with grassland birds documented as possible, probable, or confirmed breeders (data collected from 2000-2005).

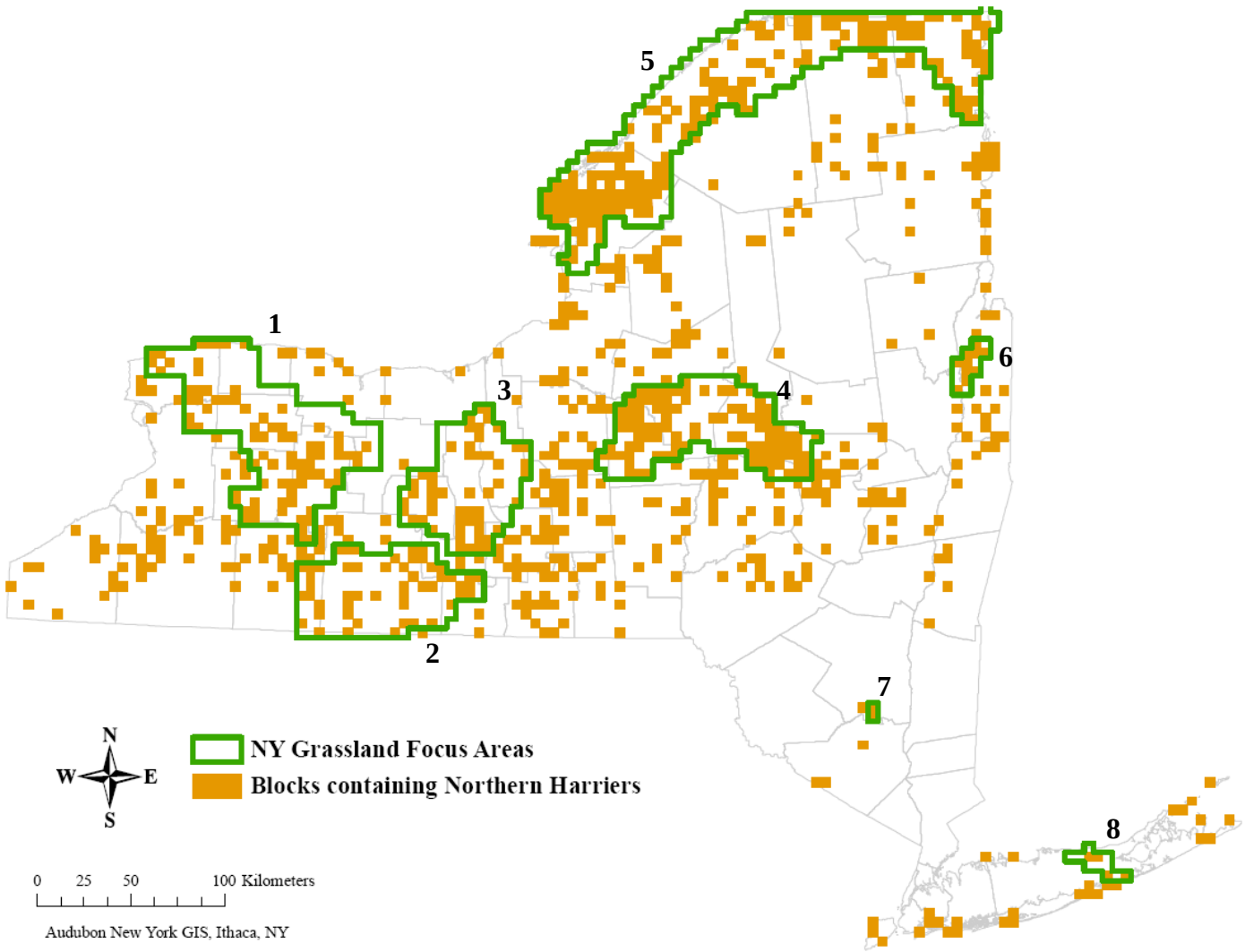

Figure 14. Breeding Bird Atlas blocks in which Northern Harriers were recorded as possible, probable, or confirmed breeders (2000-2005).

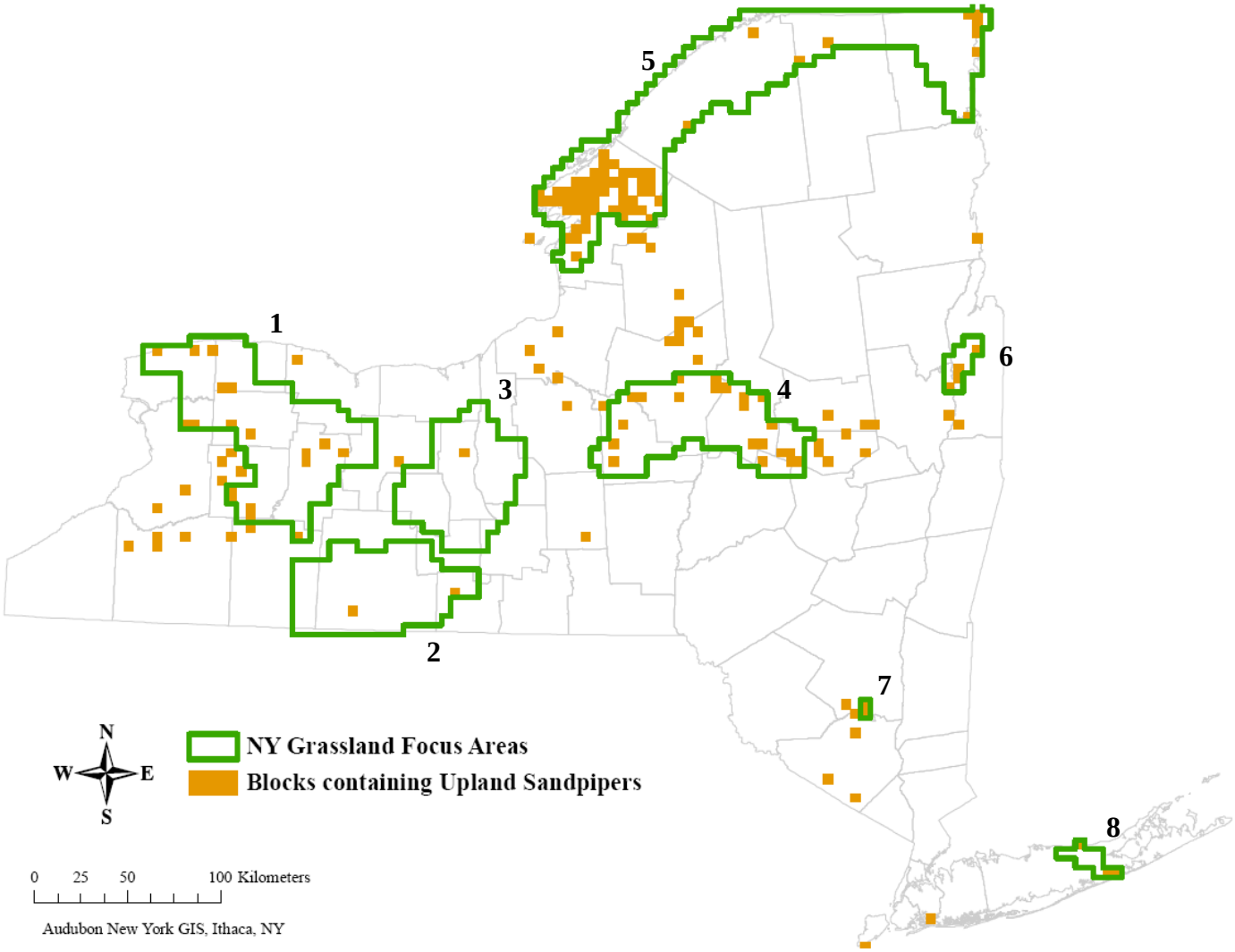

Figure 15. Breeding Bird Atlas blocks in which Upland Sandpipers were recorded as possible, probable, or confirmed breeders (2000-2005).

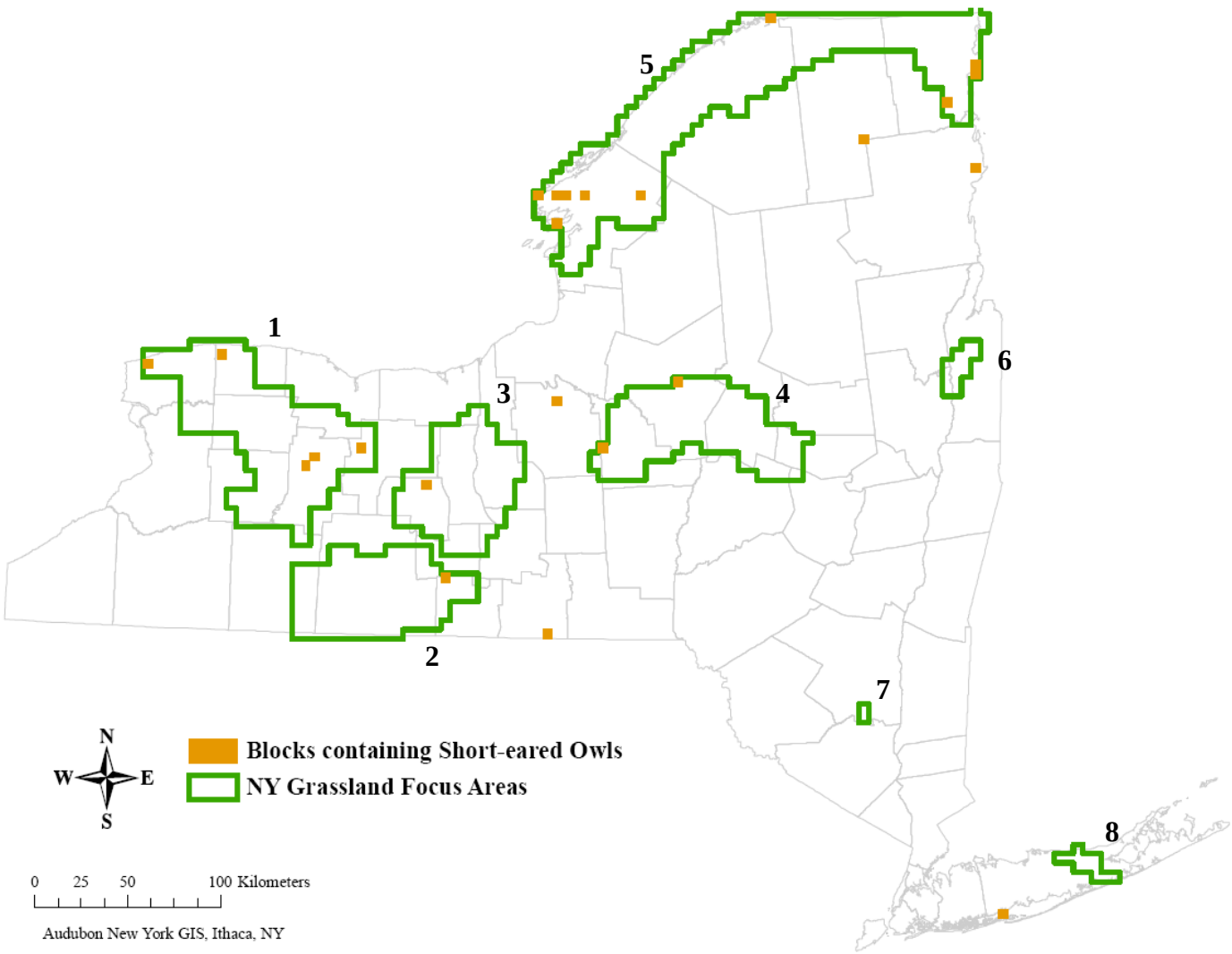

Figure 16. Breeding Bird Atlas blocks in which Short-eared Owls were recorded as possible, probable, or confirmed breeders (2000-2005).

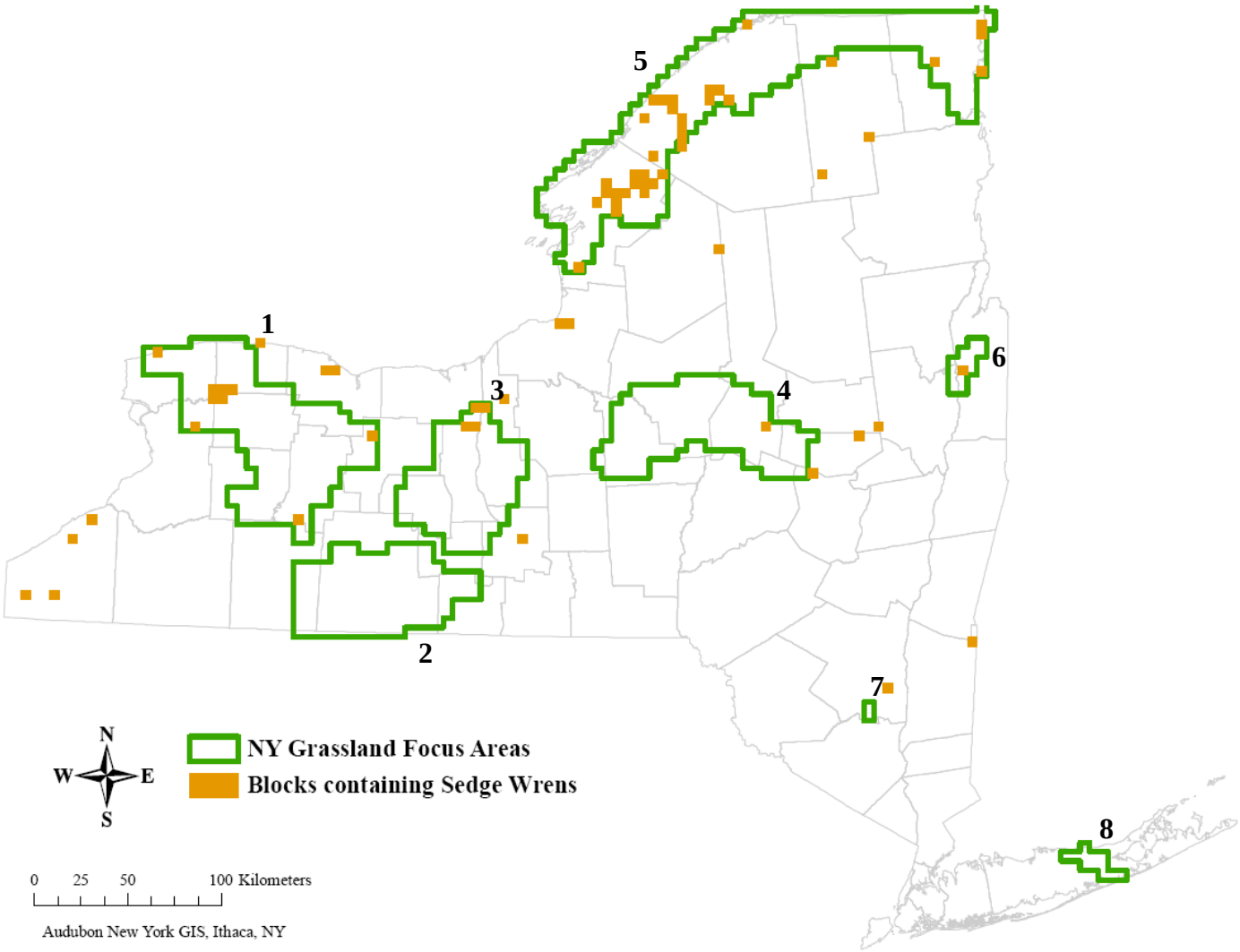

Figure 17. Breeding Bird Atlas blocks in which Sedge Wrens were recorded as possible, probable, or confirmed breeders (2000-2005).

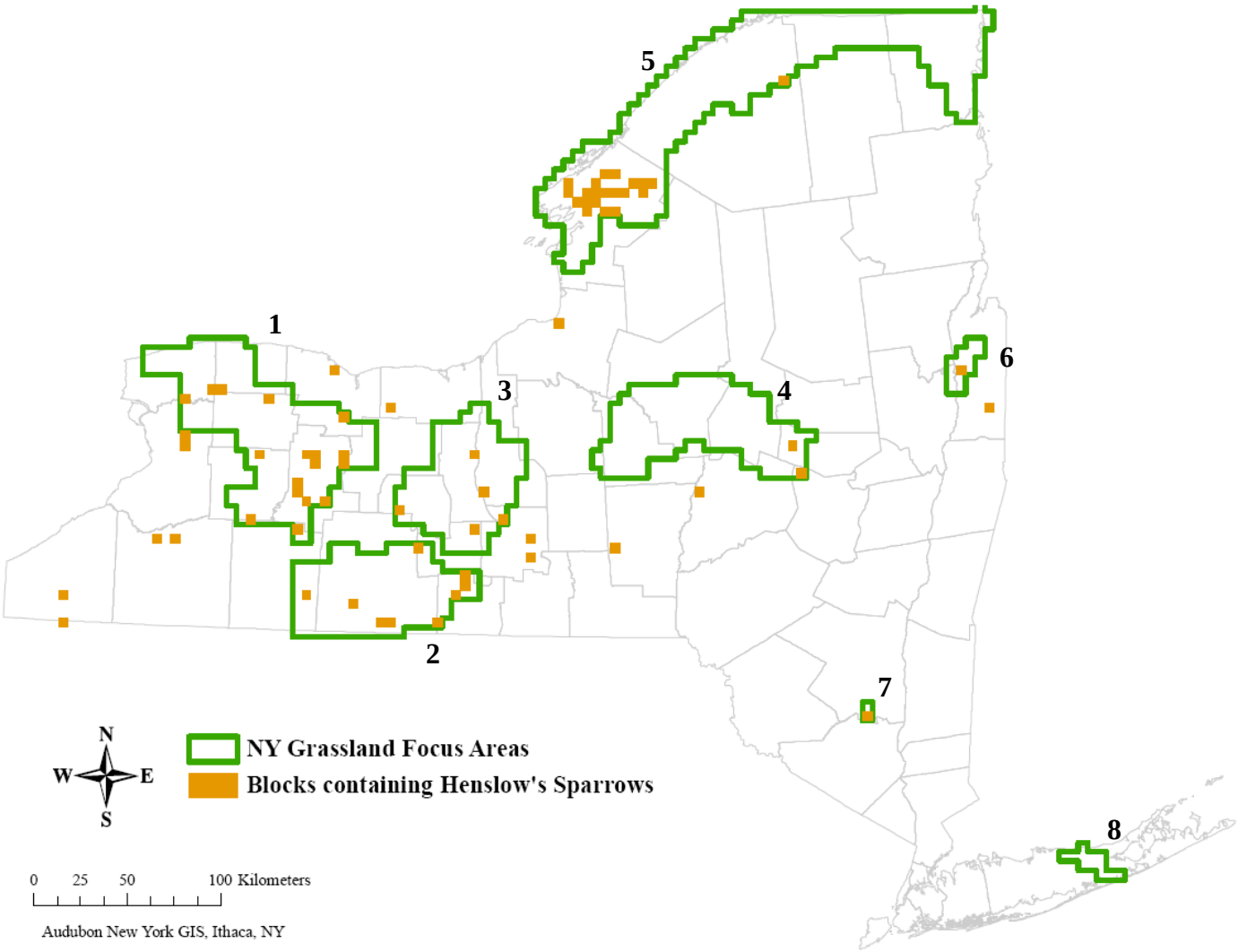

Figure 18. Breeding Bird Atlas blocks in which Henslow's Sparrows were recorded as possible, probable, or confirmed breeders (2000-2005).

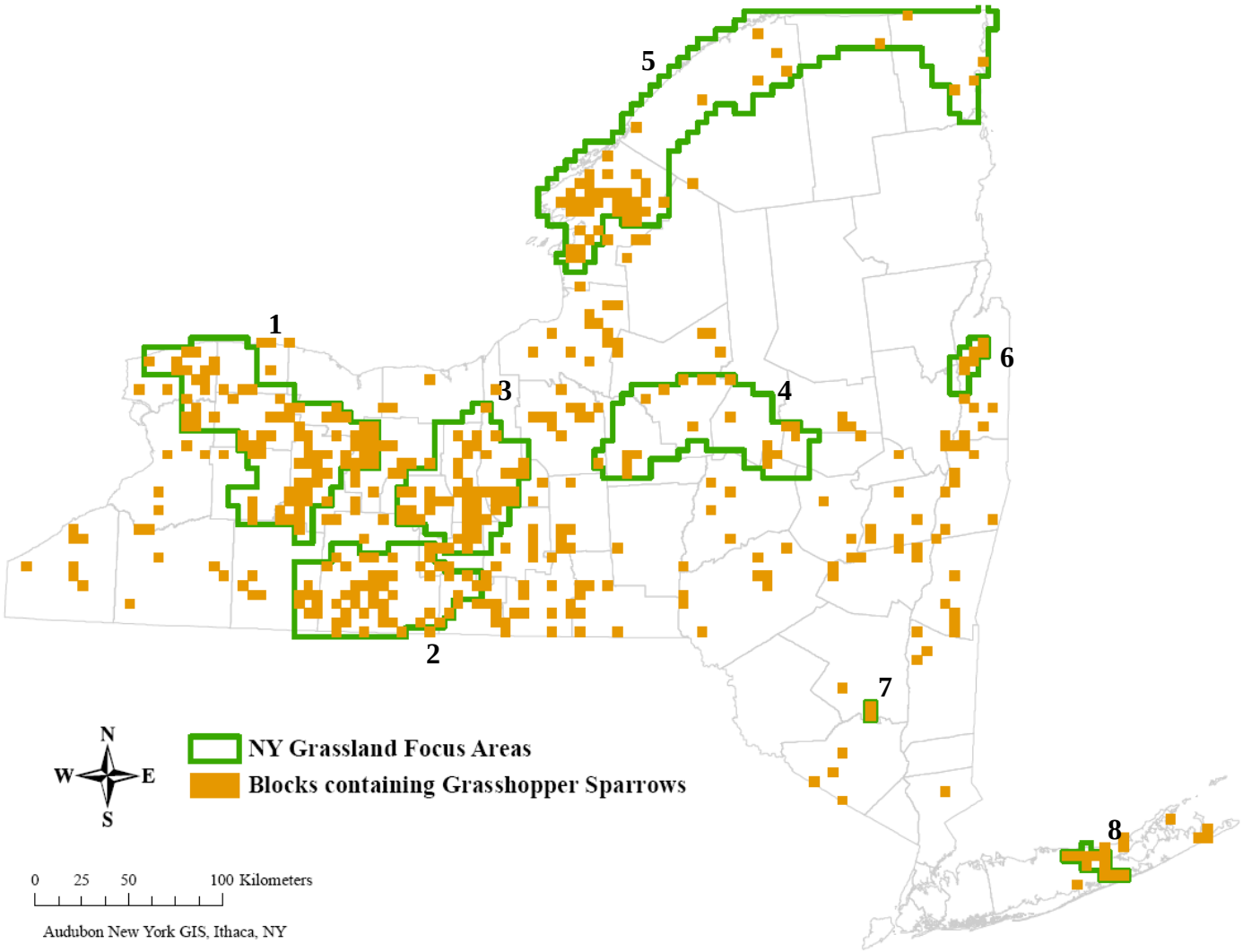

Figure 19. Breeding Bird Atlas blocks in which Grasshopper Sparrows were recorded as possible, probable, or confirmed breeders (2000-2005).

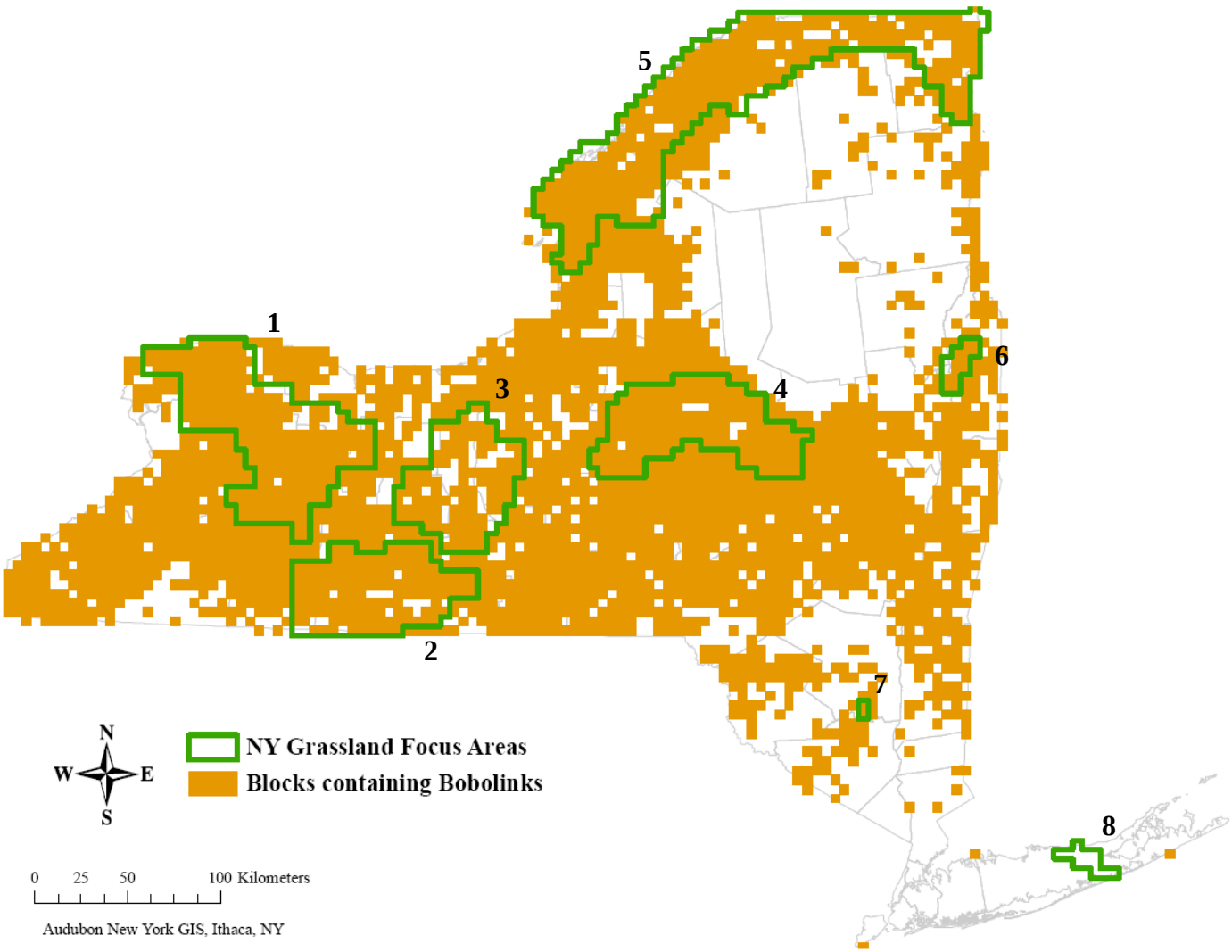

Figure 20. Breeding Bird Atlas blocks in which Bobolinks were recorded as possible, probable, or confirmed breeders (2000-2005).

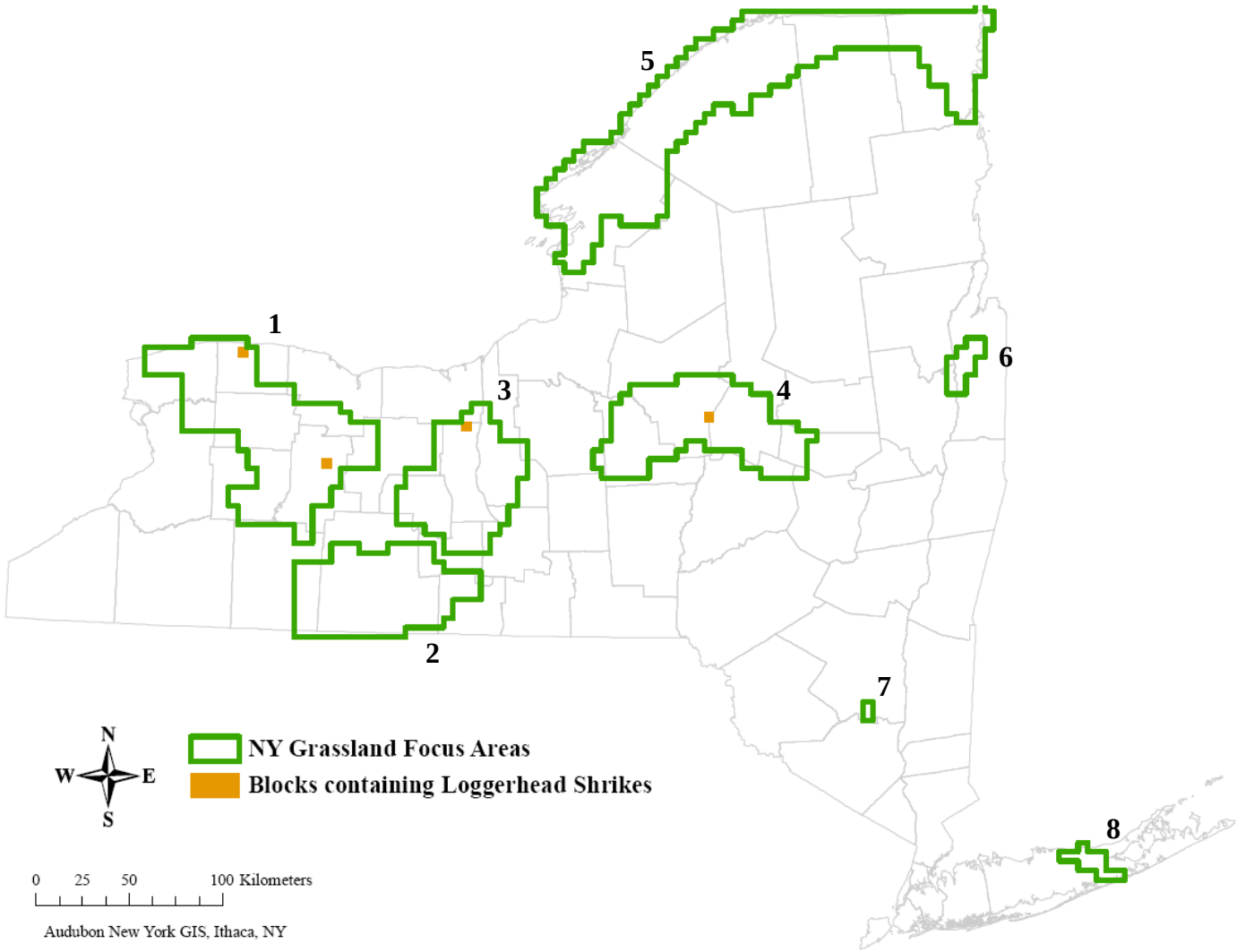

Figure 21. Breeding Bird Atlas blocks in which Loggerhead Shrikes were recorded as possible, probable, or confirmed breeders (2000-2005).

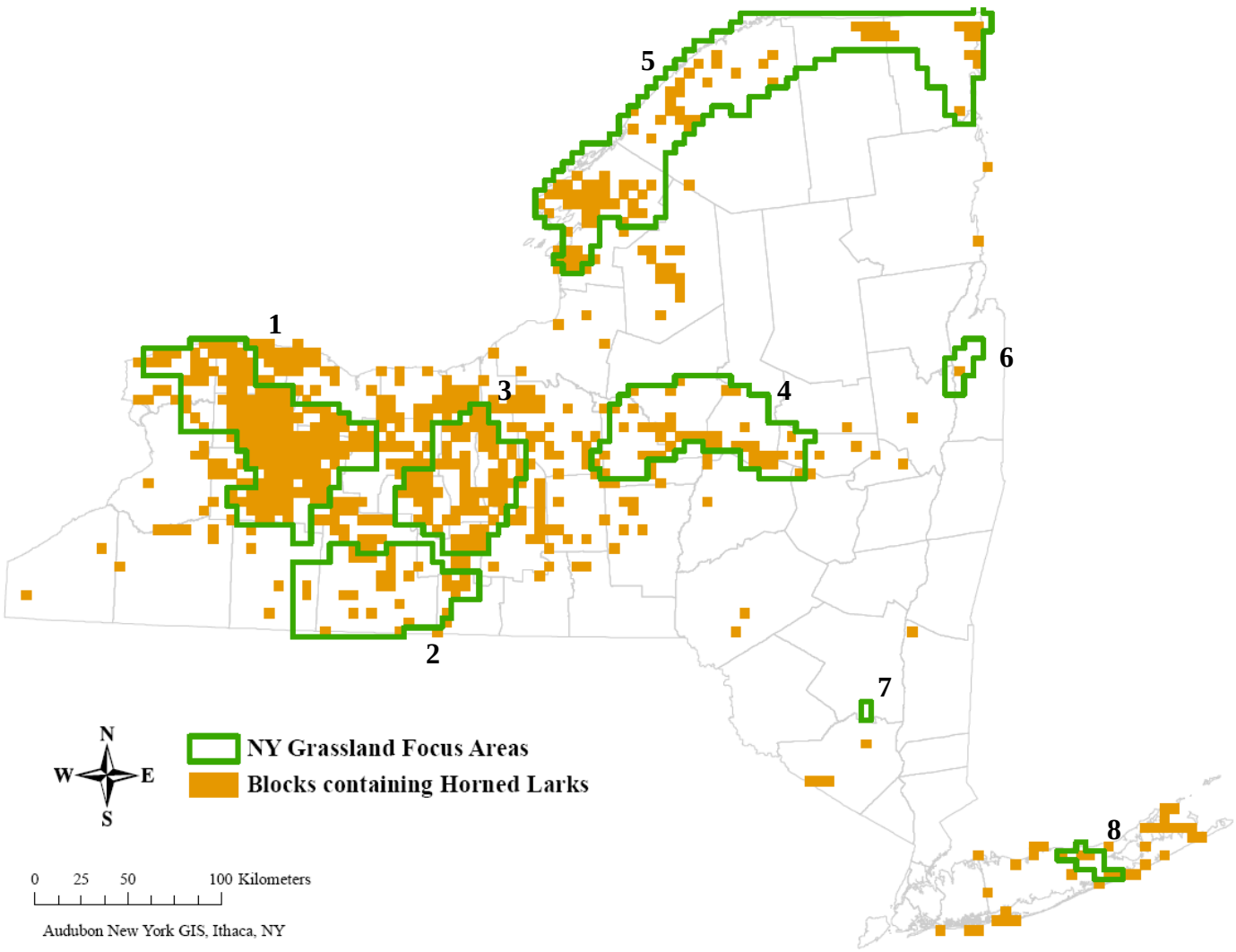

Figure 22. Breeding Bird Atlas blocks in which Horned Larks were recorded as possible, probable, or confirmed breeders (2000-2005).

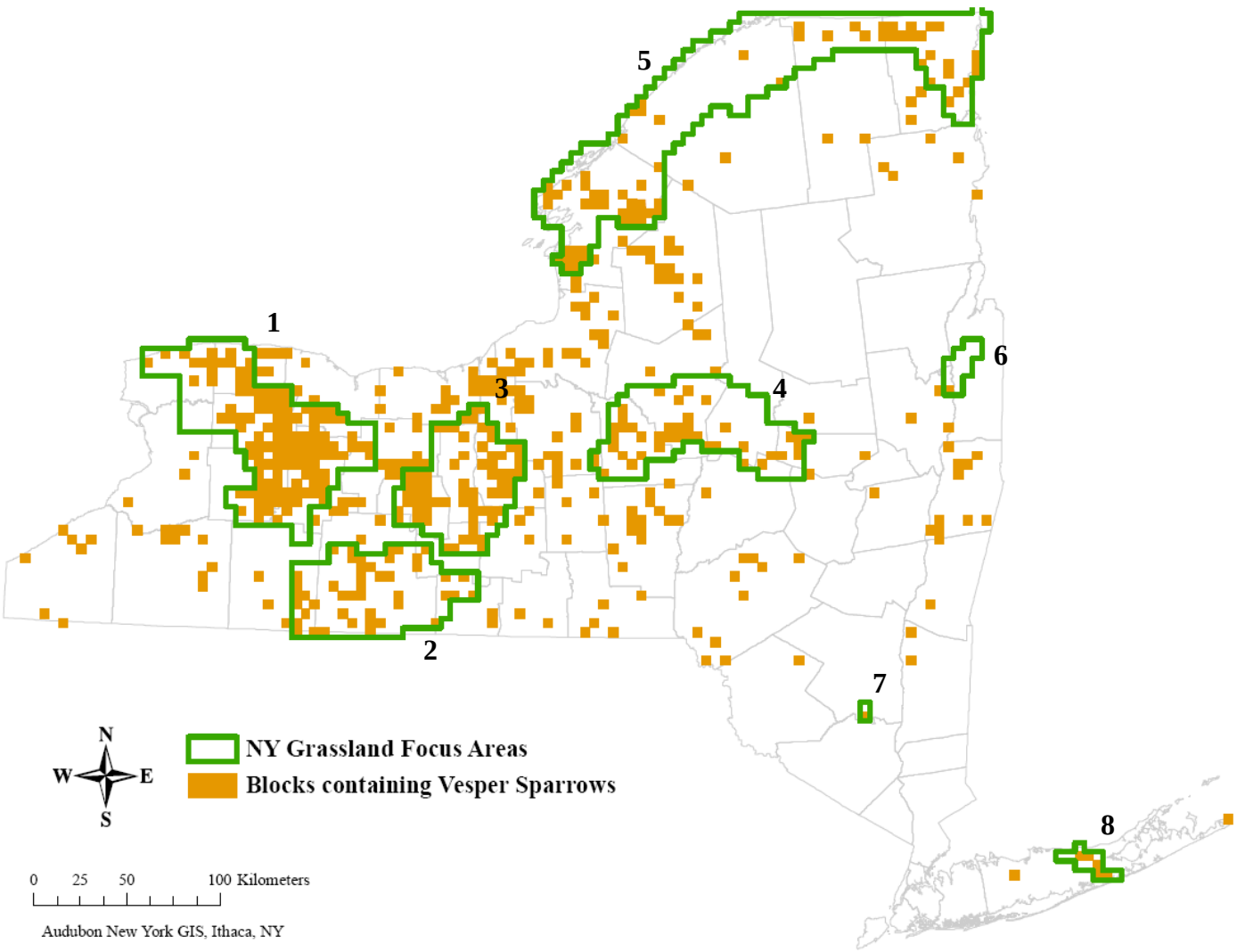

Figure 23. Breeding Bird Atlas blocks in which Vesper Sparrows were recorded as possible, probable, or confirmed breeders (2000-2005).

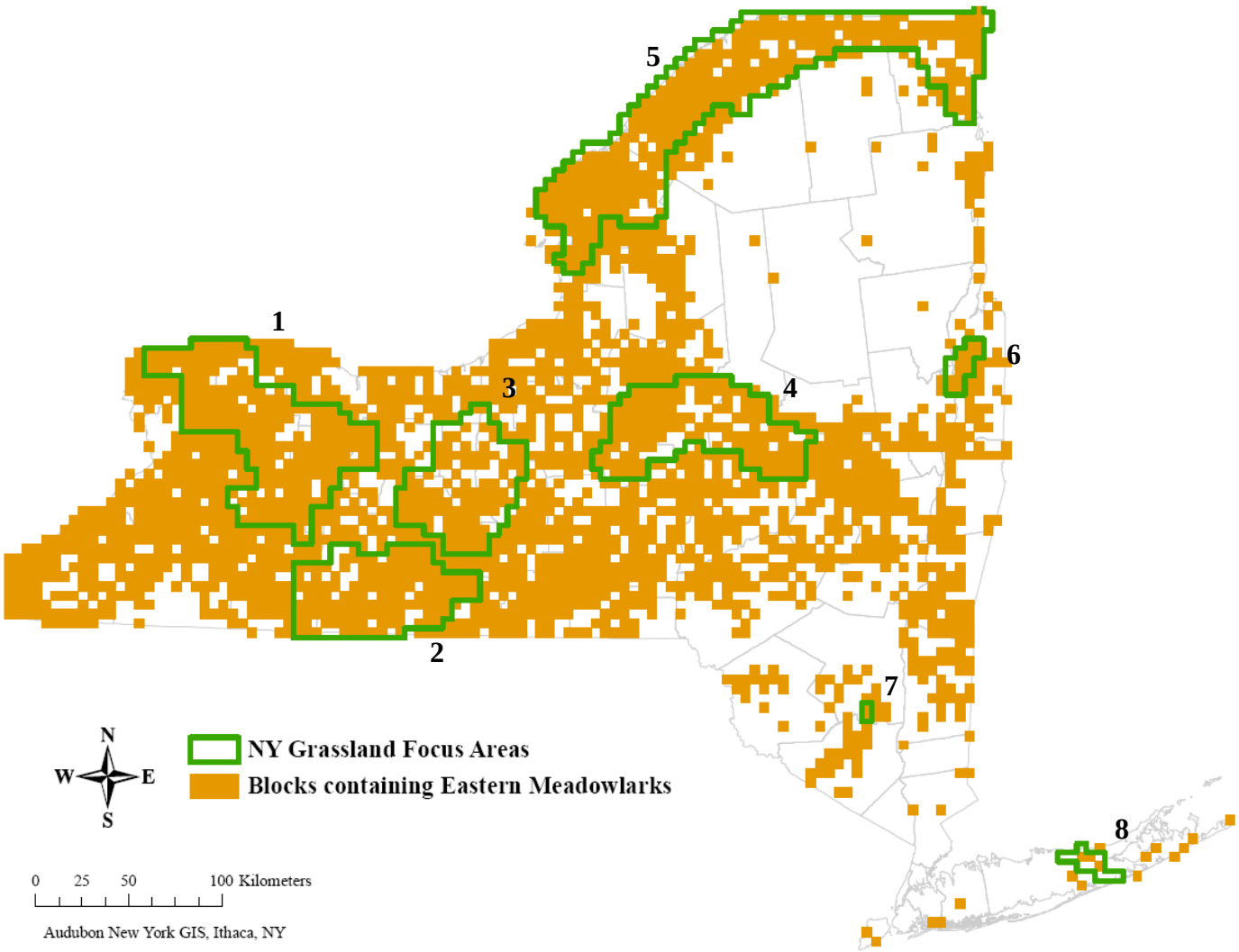

Figure 24. Breeding Bird Atlas blocks in which Eastern Meadowlarks were recorded as possible, probable, or confirmed breeders (2000-2005).

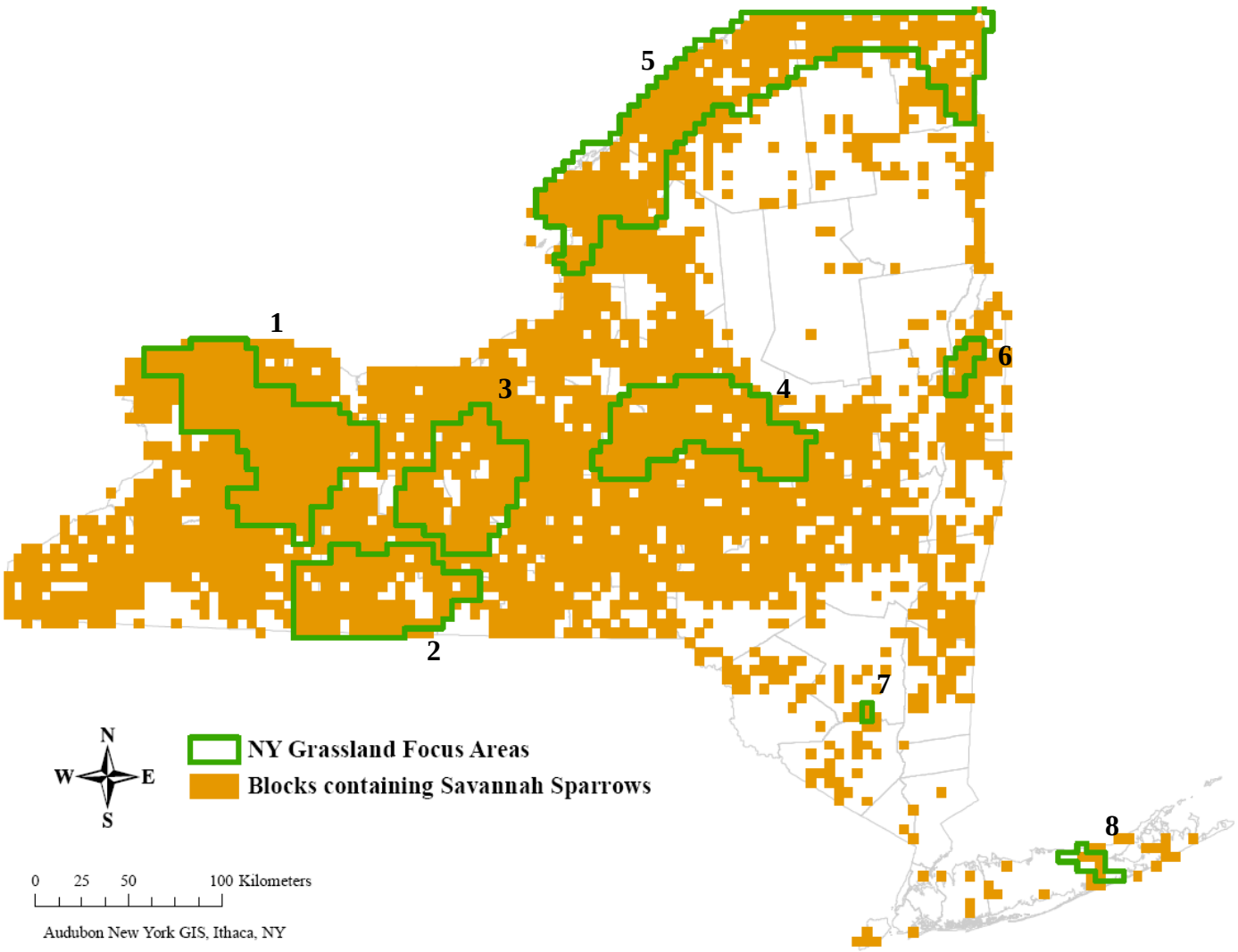

Figure 25. Breeding Bird Atlas blocks in which Savannah Sparrows were recorded as possible, probable, or confirmed breeders (2000-2005).

Appendix C – Maps of the Corrected Relative Abundances observed for each species during the 2005 Grassland Breeding Bird Focus Area Survey.

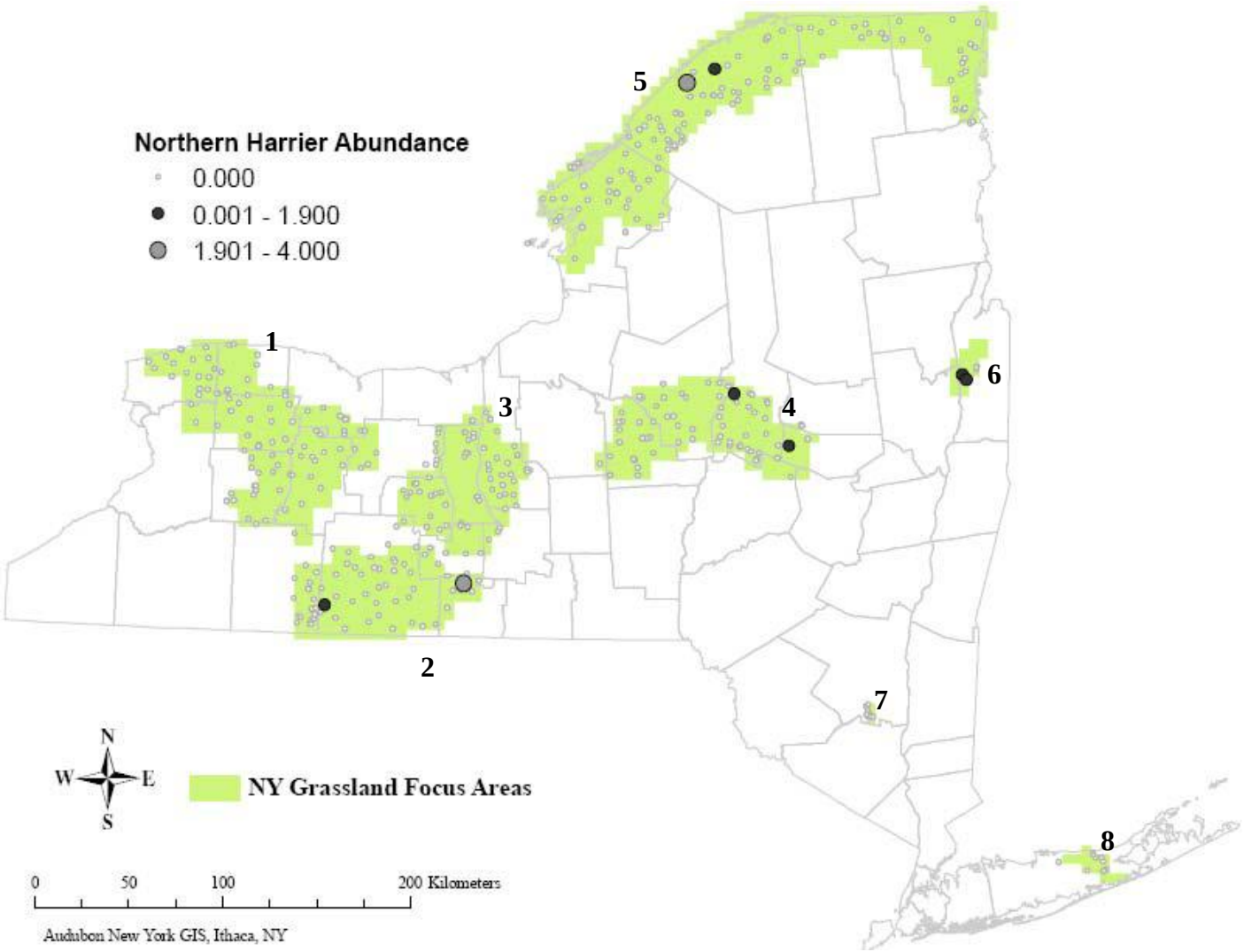

Figure 26. Corrected relative abundance of Northern Harriers detected during the 2005 Grassland Breeding Bird Focus Area Surveys.

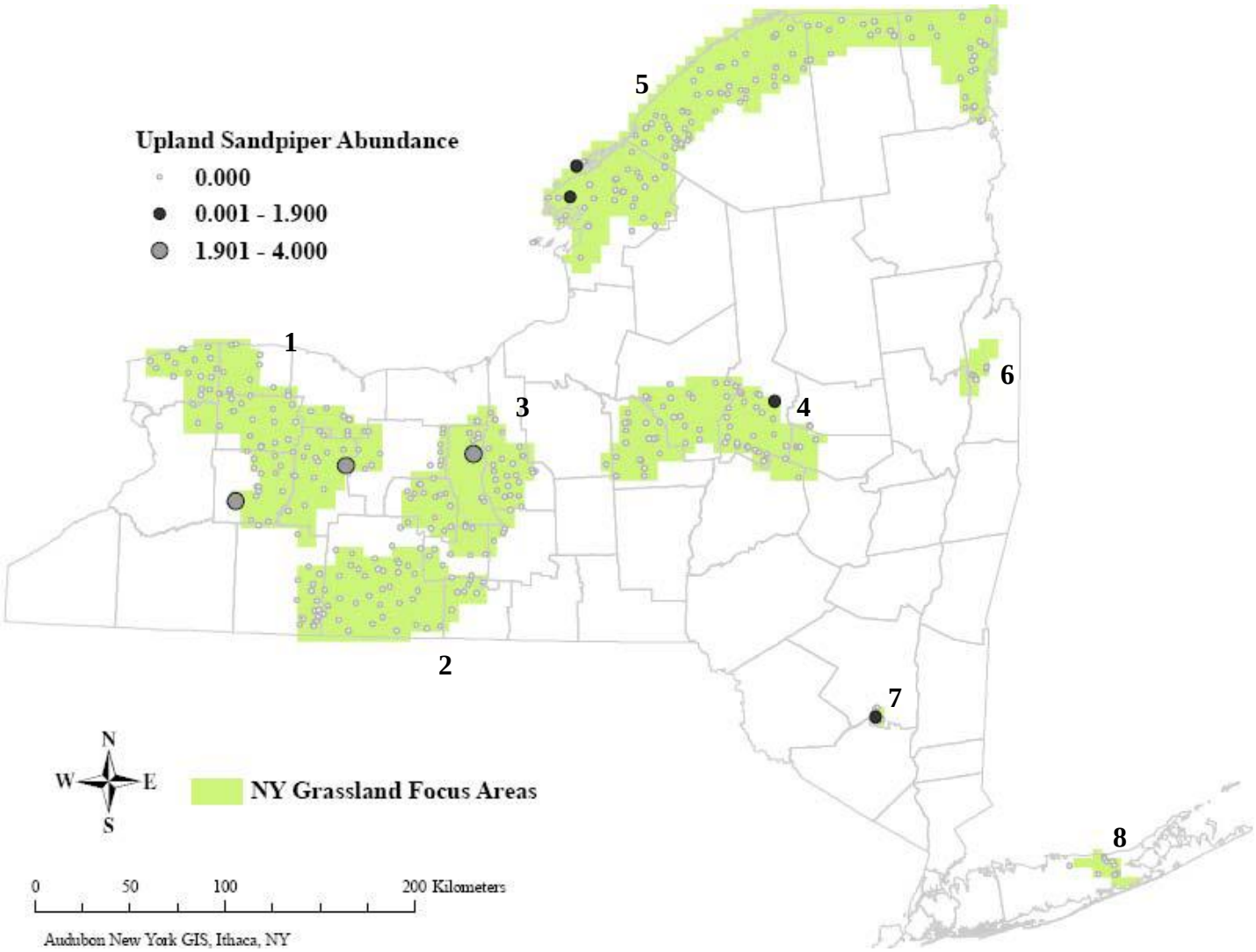

Figure 27. Corrected relative abundance of Upland Sandpipers detected during the 2005 Grassland Breeding Bird Focus Area Surveys.

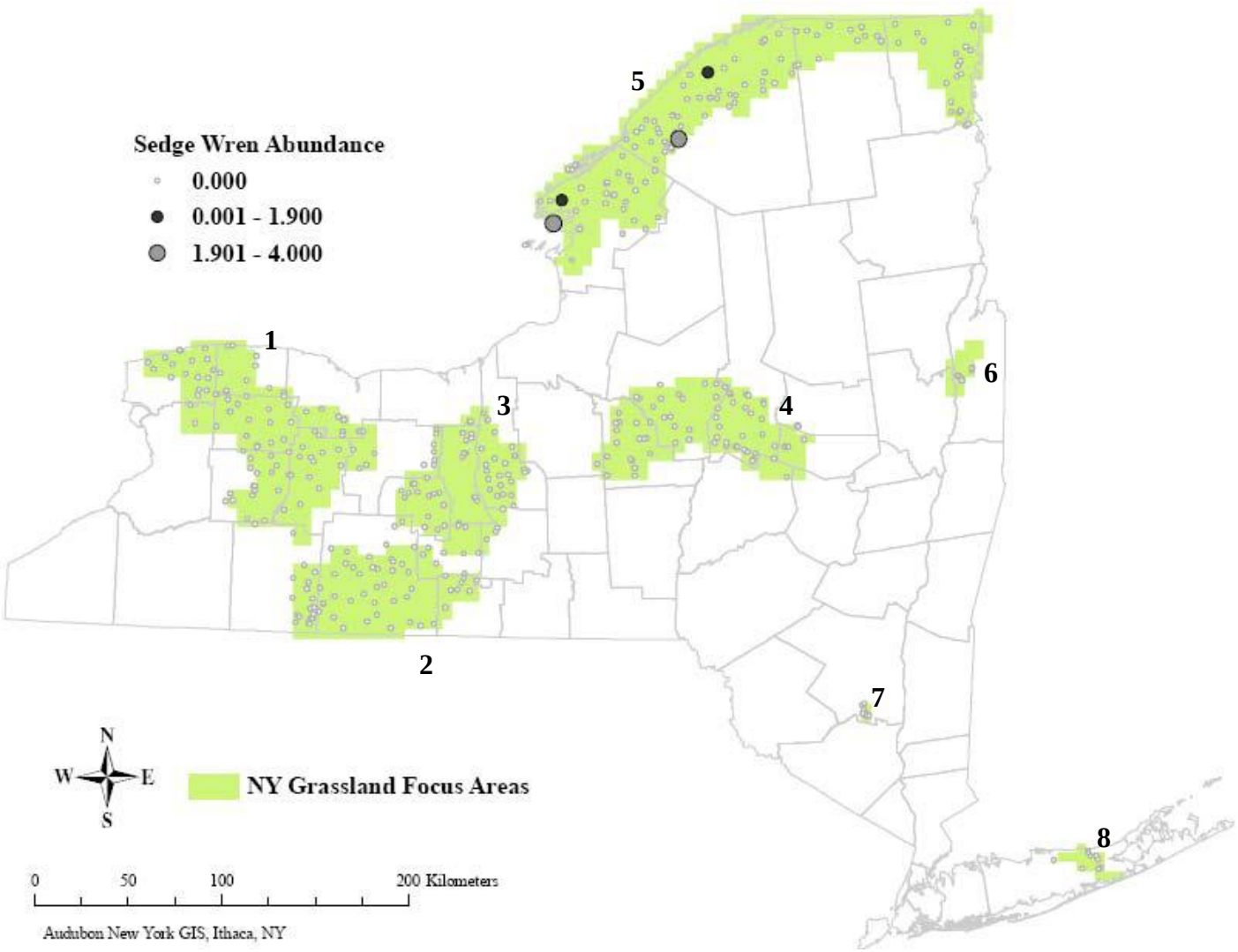

Figure 28. Corrected relative abundance of Sedge Wrens detected during the 2005 Grassland Breeding Bird Focus Area Surveys.

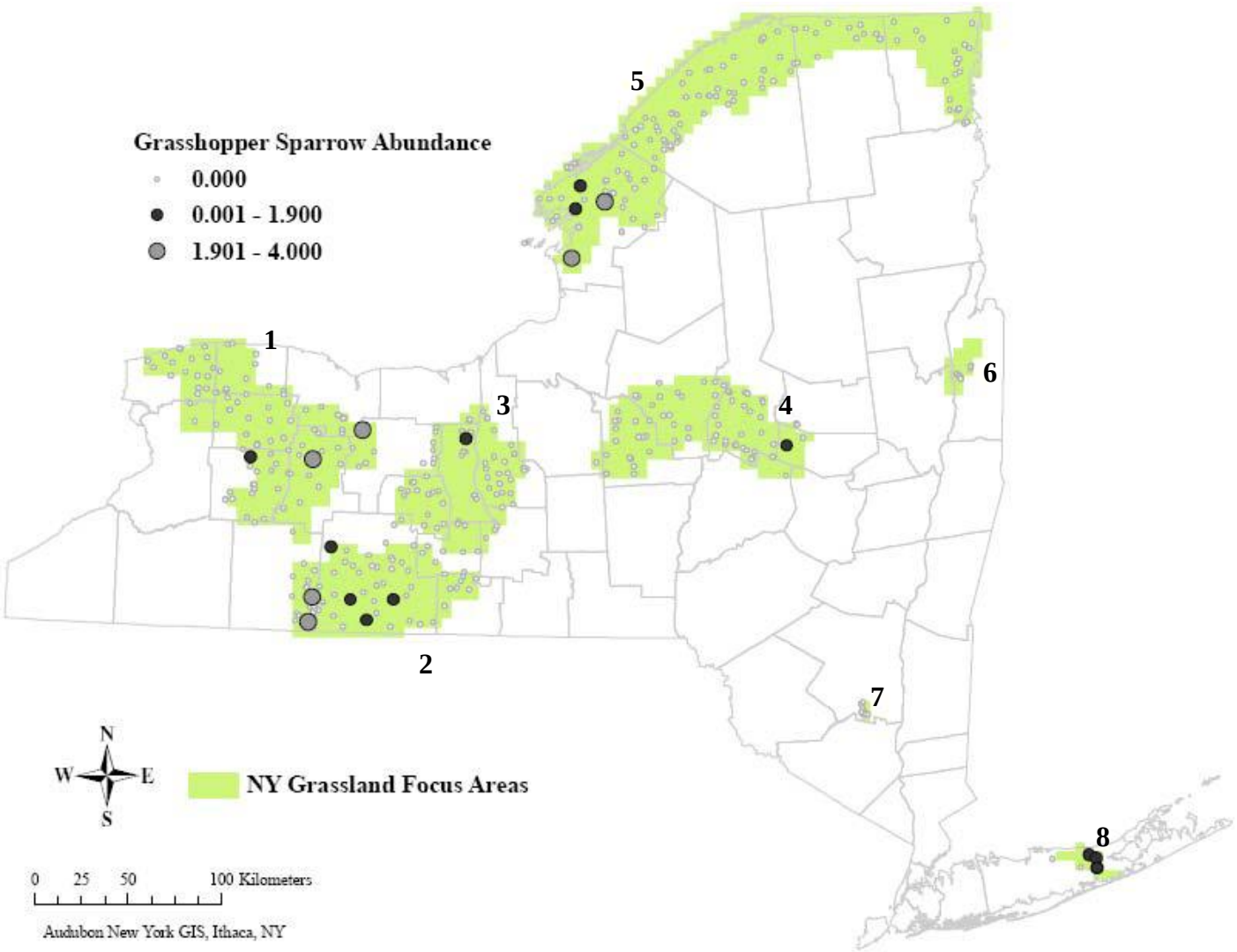

Figure 29. Corrected relative abundance of Grasshopper Sparrows detected during the 2005 Grassland Breeding Bird Focus Area Surveys.

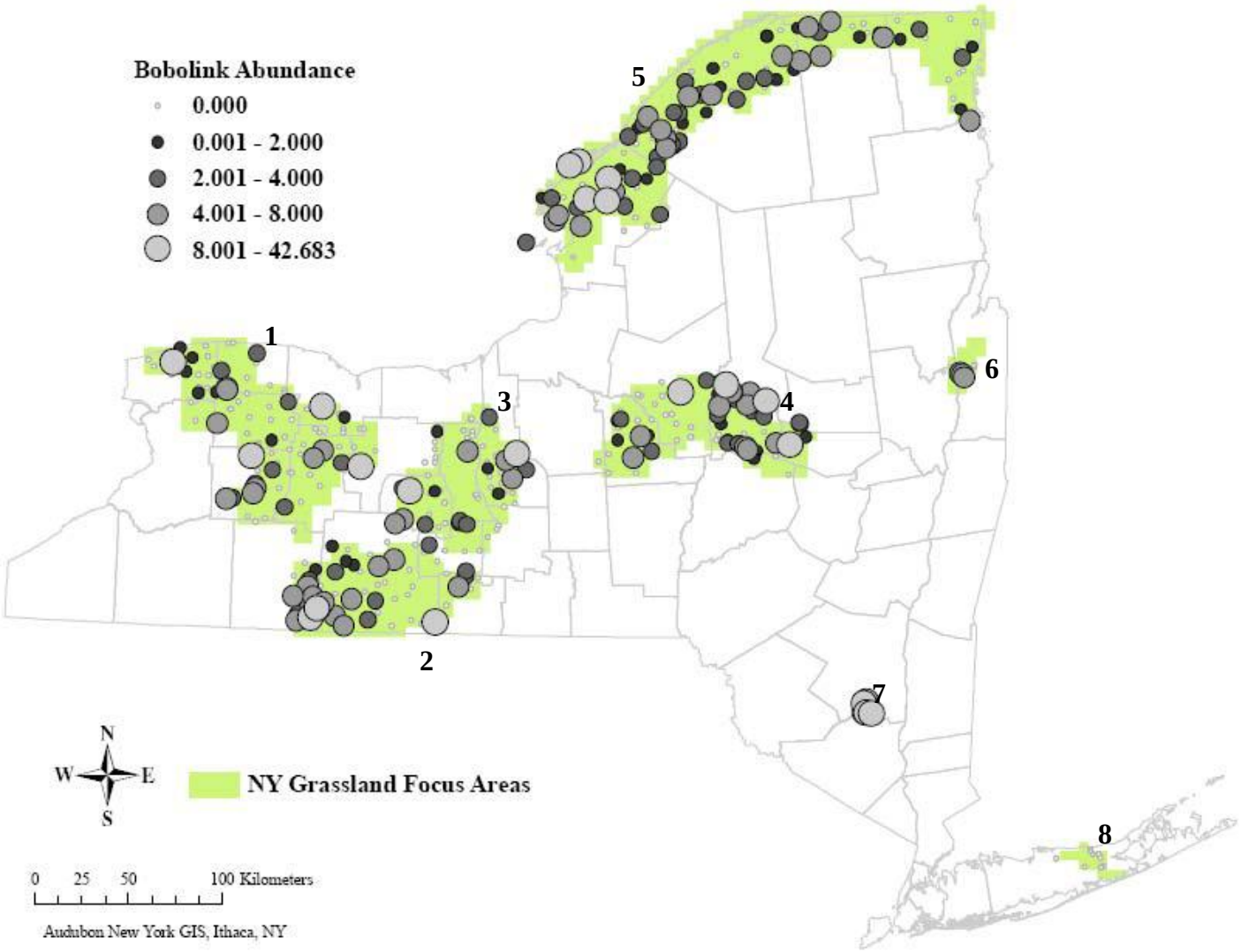

Figure 30. Corrected relative abundance of Bobolinks detected during the 2005 Grassland Breeding Bird Focus Area Surveys.

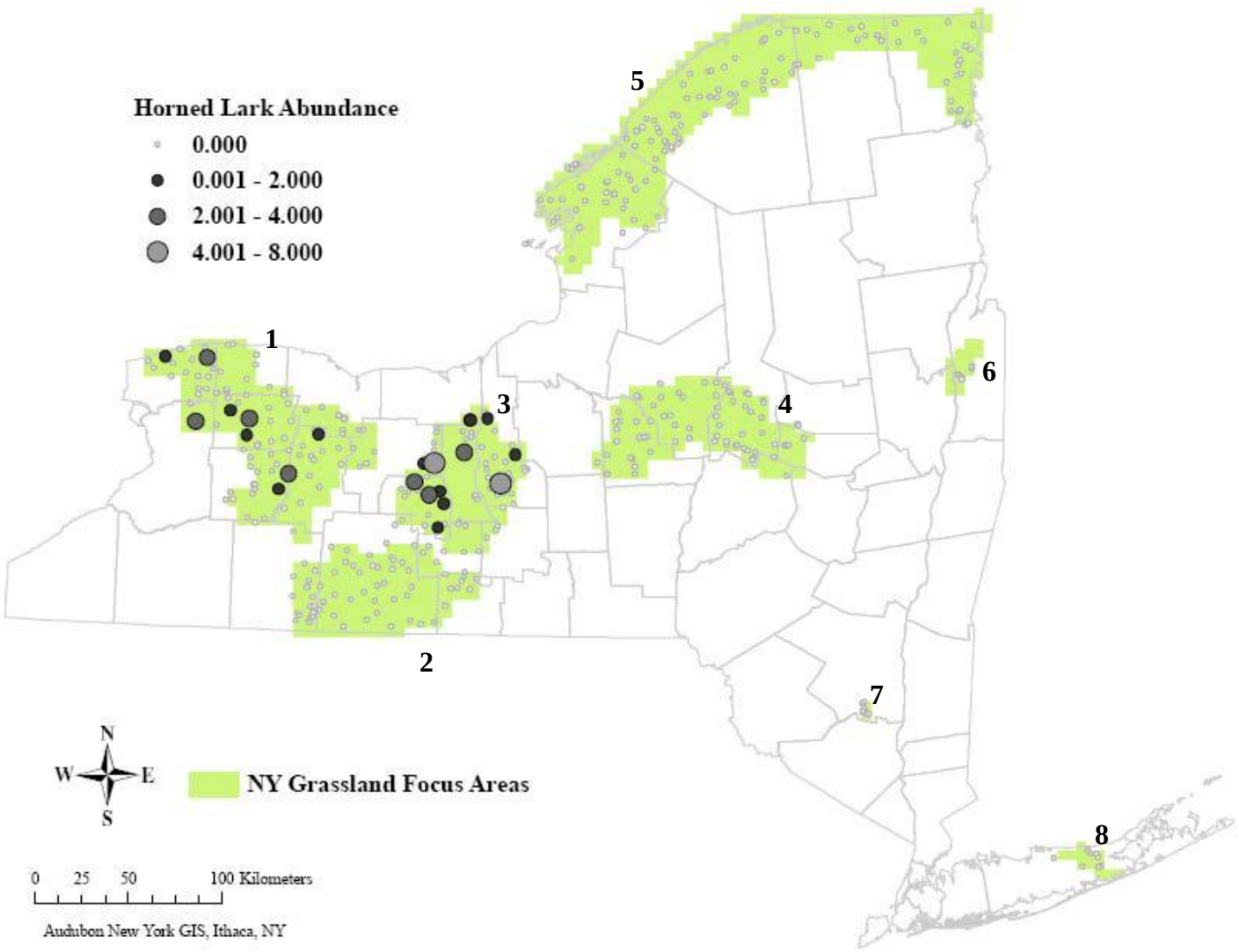

Figure 31. Corrected relative abundance of Horned Larks detected during the 2005 Grassland Breeding Bird Focus Area Surveys.

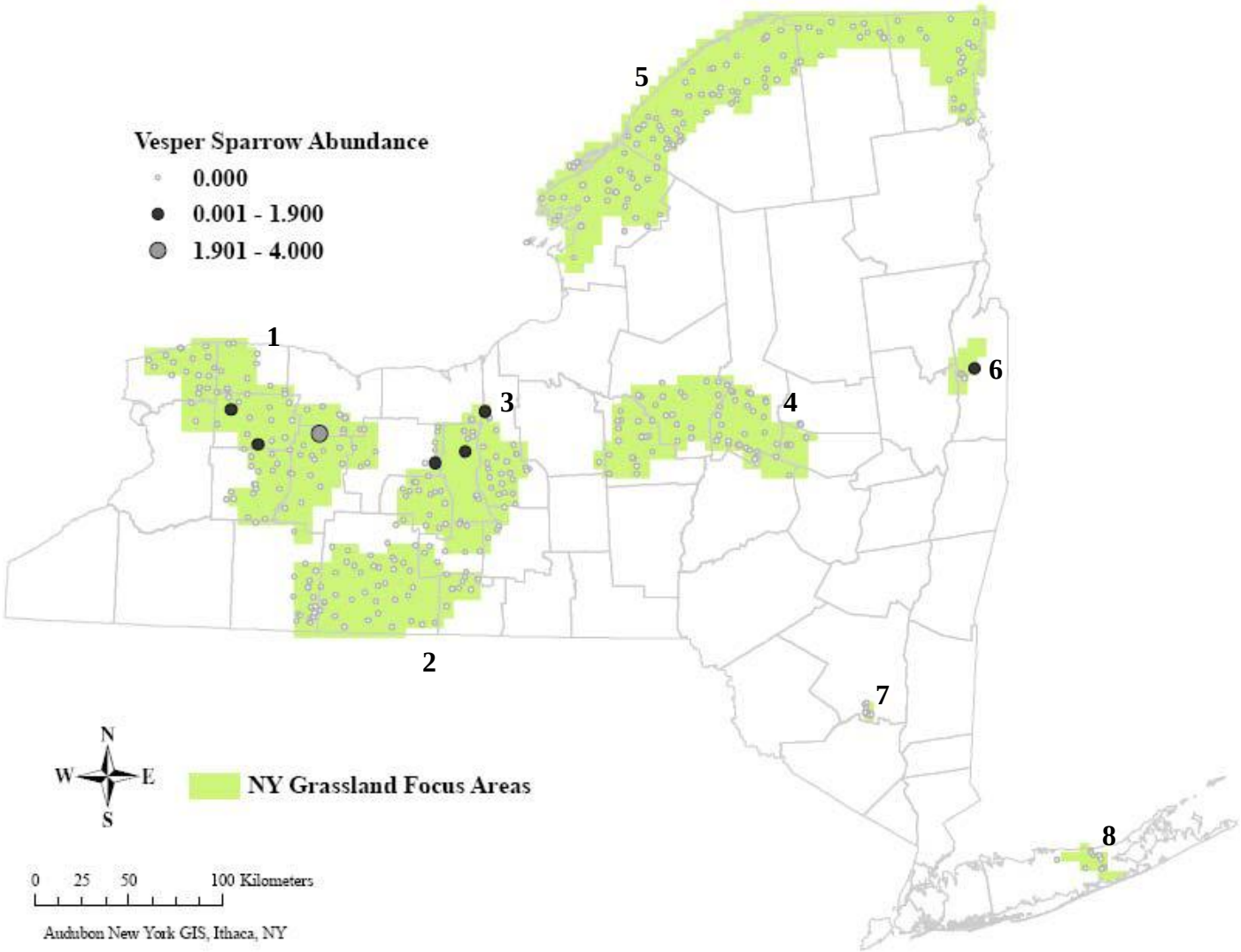

Figure 32. Corrected relative abundance of Vesper Sparrows detected during the 2005 Grassland Breeding Bird Focus Area Surveys.

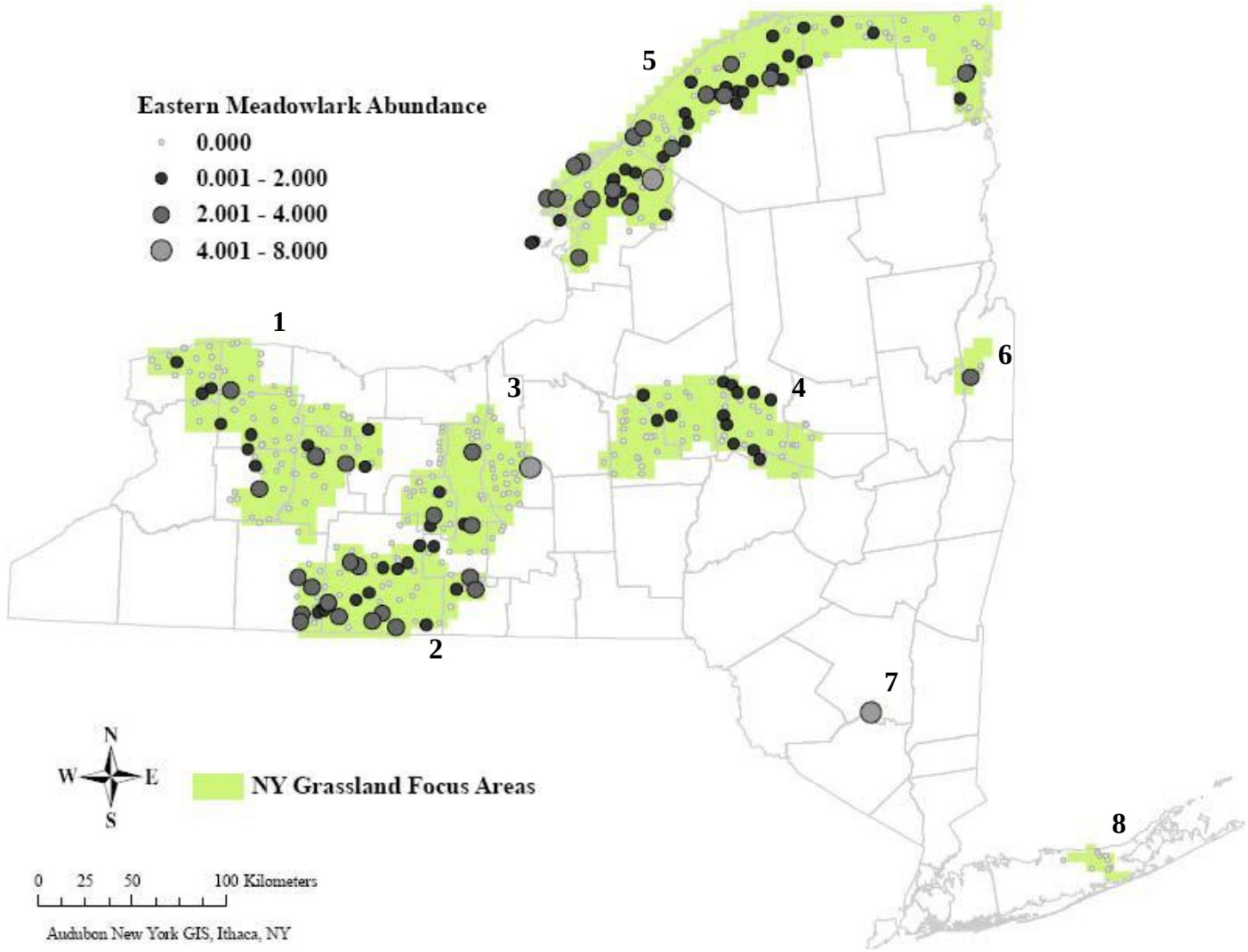

Figure 33. Corrected relative abundance of Eastern Meadowlarks detected during the 2005 Grassland Breeding Bird Focus Area Surveys.

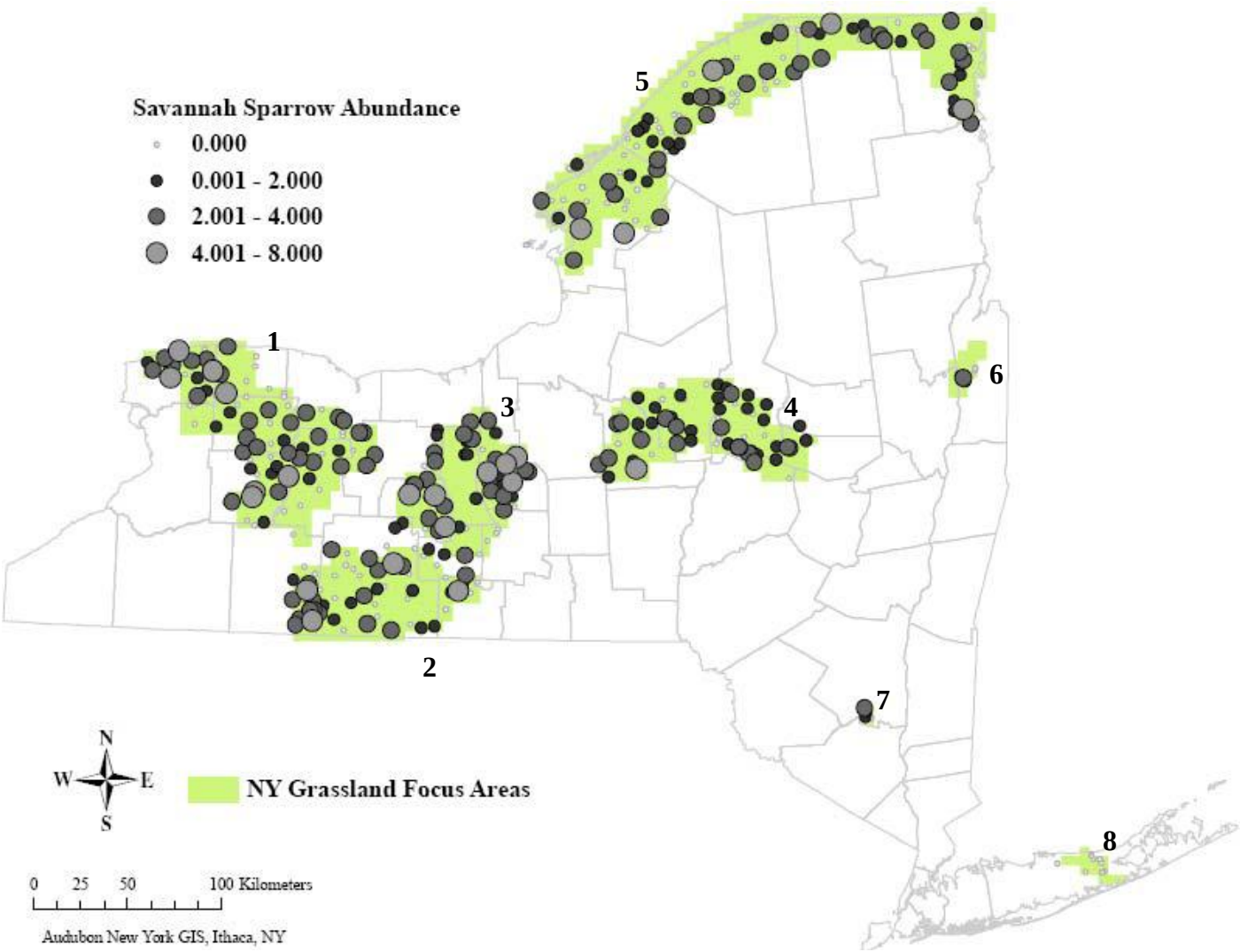

Figure 34. Corrected relative abundance of Savannah Sparrows detected during the 2005 Grassland Breeding Bird Focus Area Surveys.

Appendix D - Potential important areas for wintering Short-eared Owls.

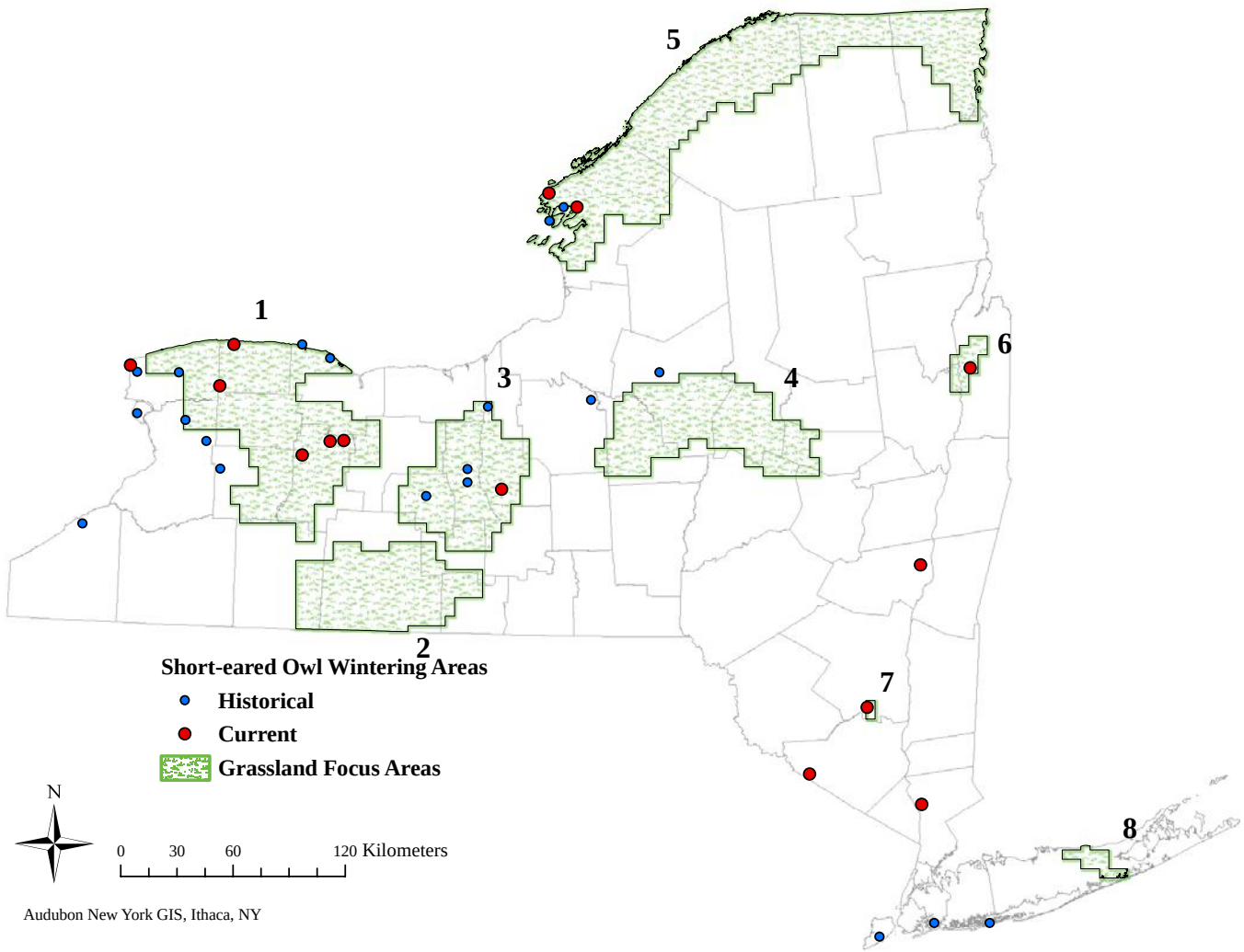

Figure 35. Approximate locations of probable Short-eared Owl wintering areas based on observations from 1995 -2006 (Schneider 2004, 2006).

Appendix E – Estimated and ranked relative abundances of each grassland bird species interpolated across each focus area using kriging.

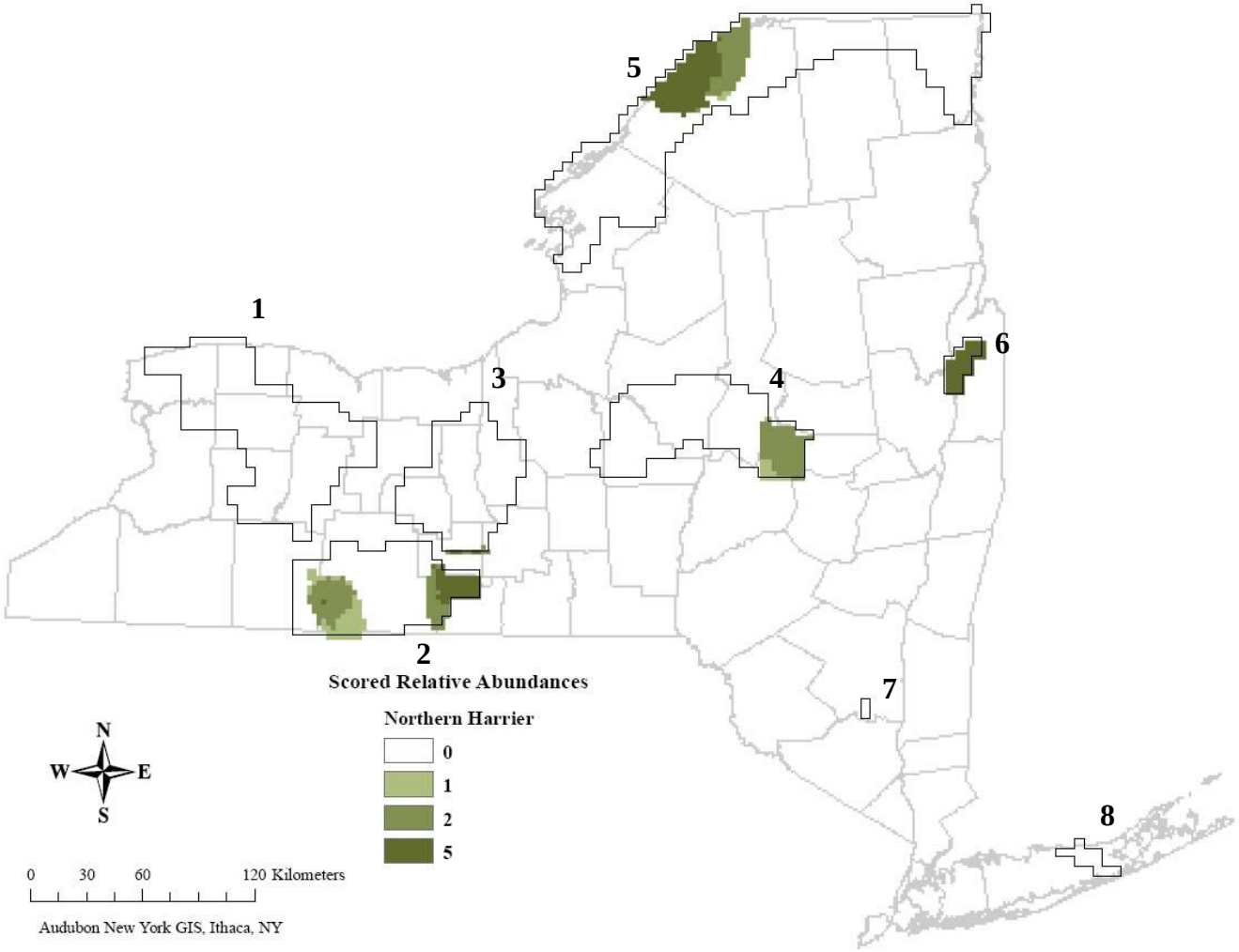

Figure 36. Ranked and scored estimates of Northern Harrier relative abundances interpolated across the Focus Areas using kriging.

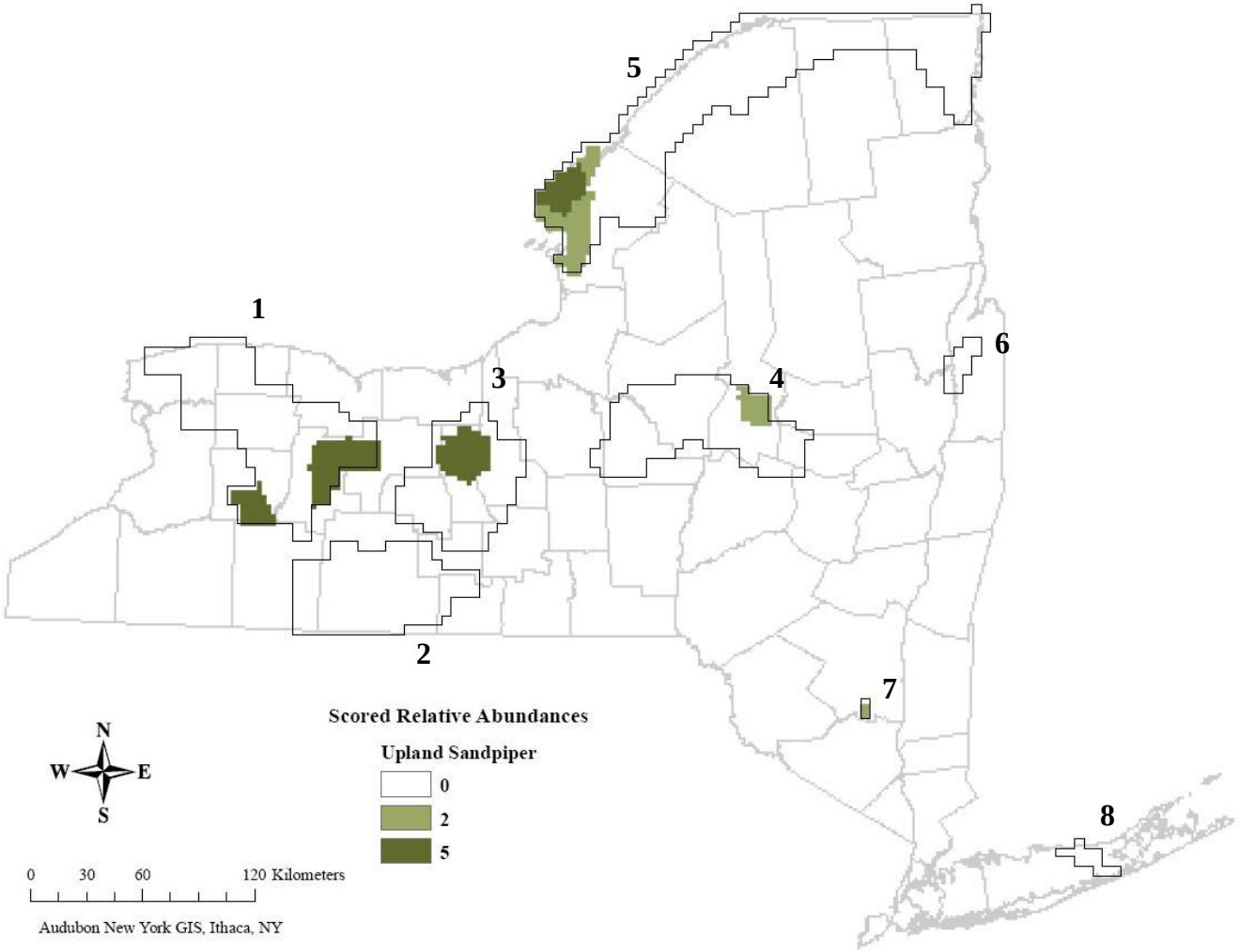

Figure 37. Ranked and scored estimates of Upland Sandpiper relative abundances interpolated across the Focus Areas using kriging.

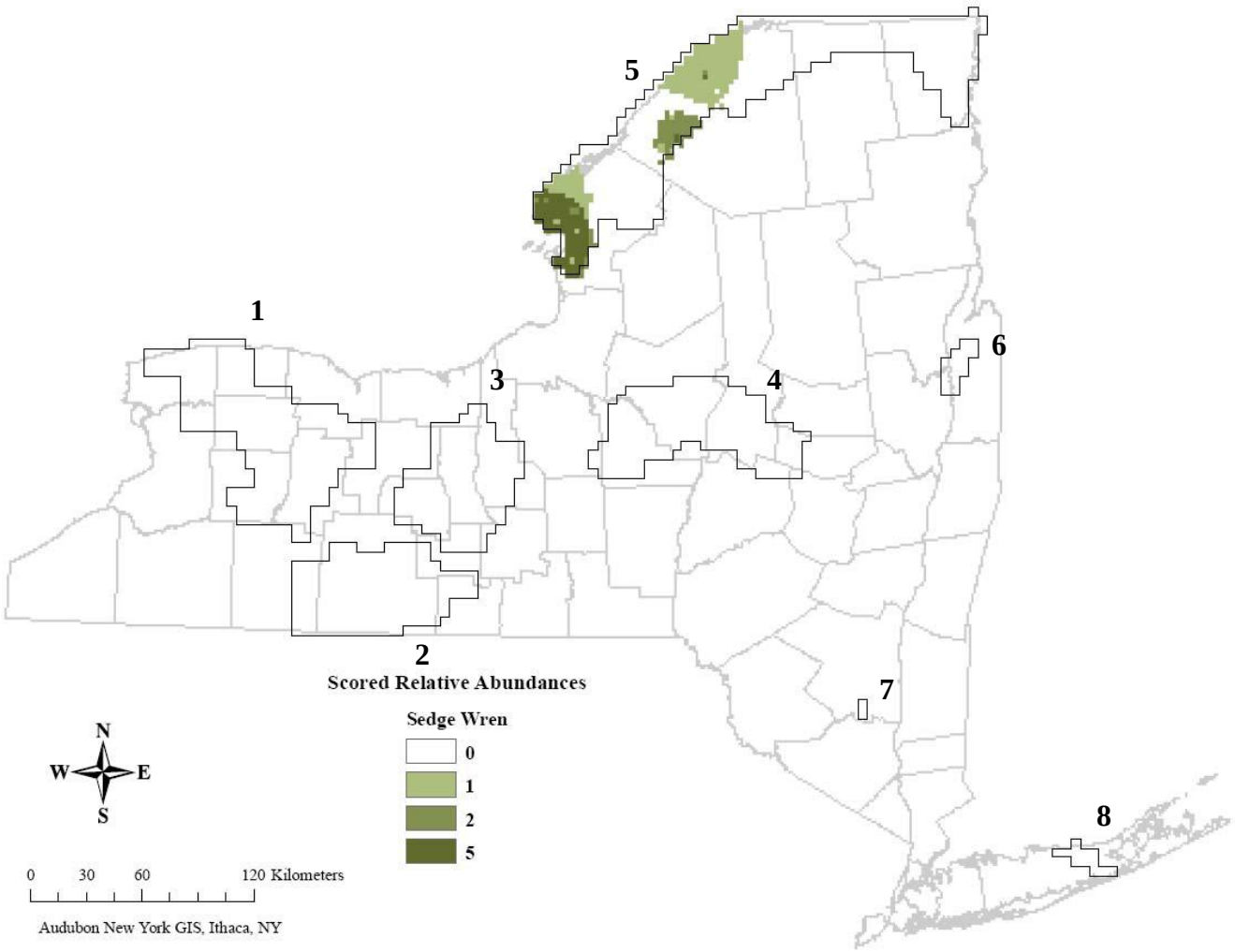

Figure 38. Ranked and scored estimates of Sedge Wren relative abundances interpolated across the Focus Areas using kriging.

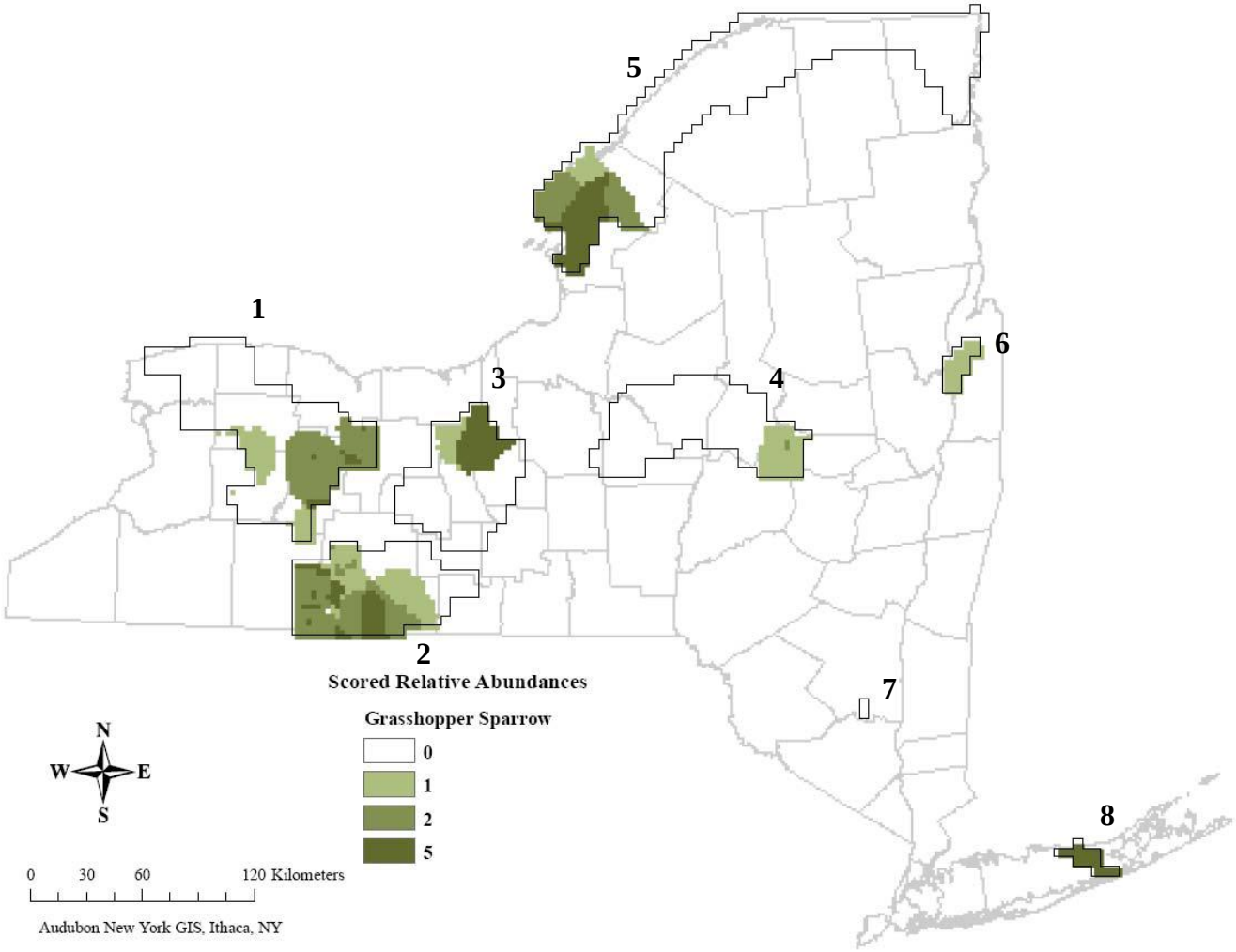

Figure 39. Ranked and scored estimates of Grasshopper Sparrow relative abundances interpolated across the Focus Areas using kriging.

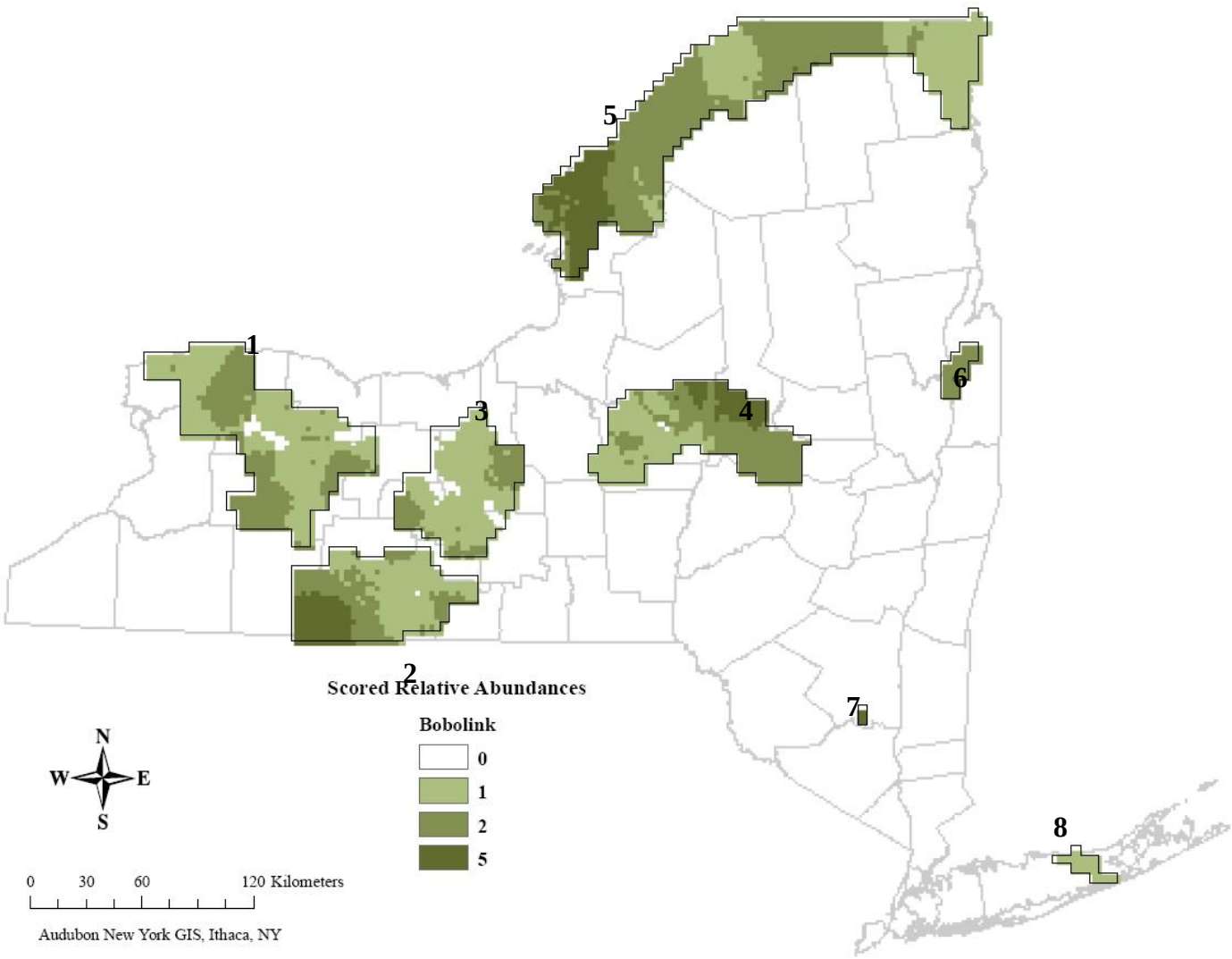

Figure 40. Ranked and scored estimates of Bobolink relative abundances interpolated across the Focus Areas using kriging.

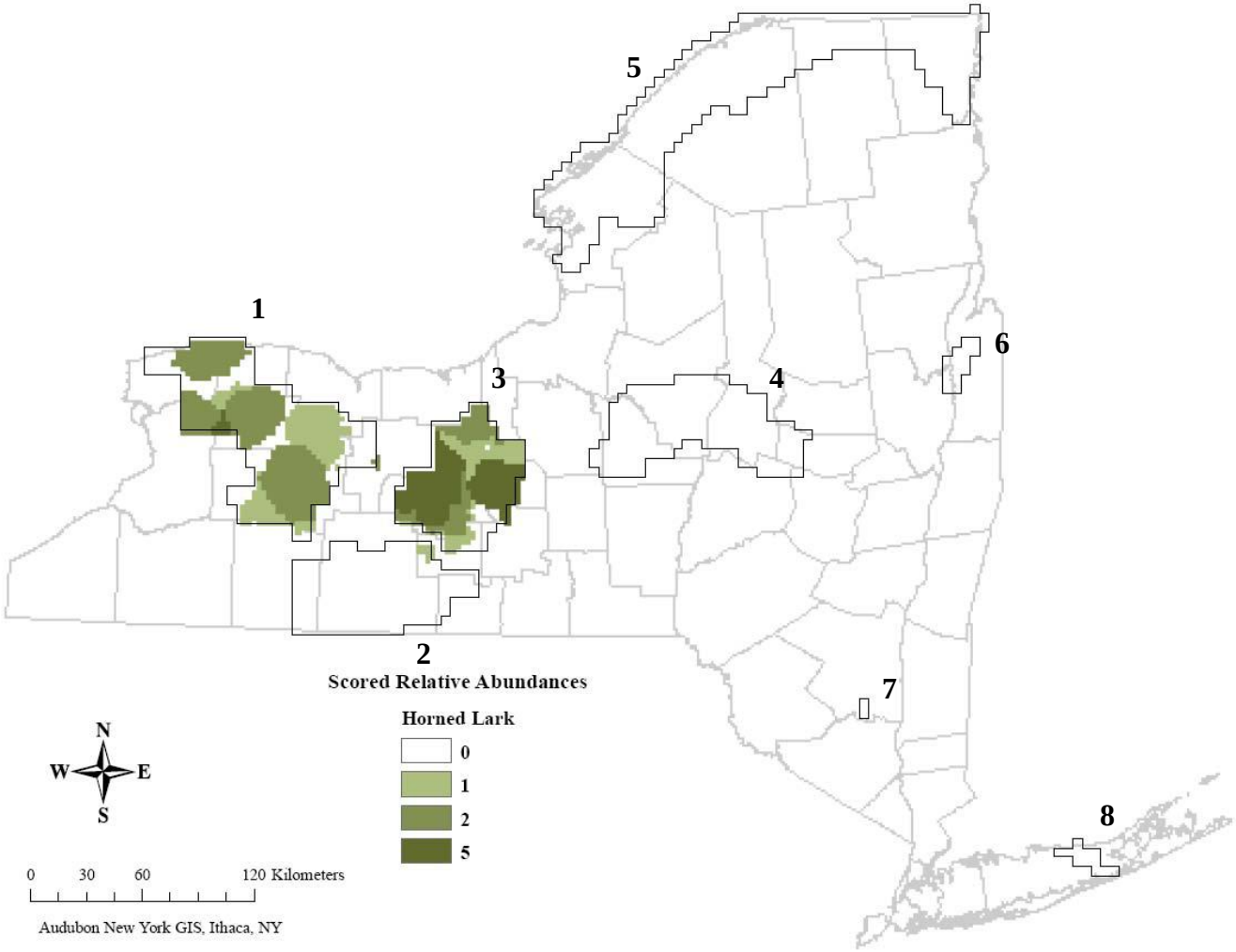

Figure 41. Ranked and scored estimates of Horned Lark relative abundances interpolated across the Focus Areas using kriging.

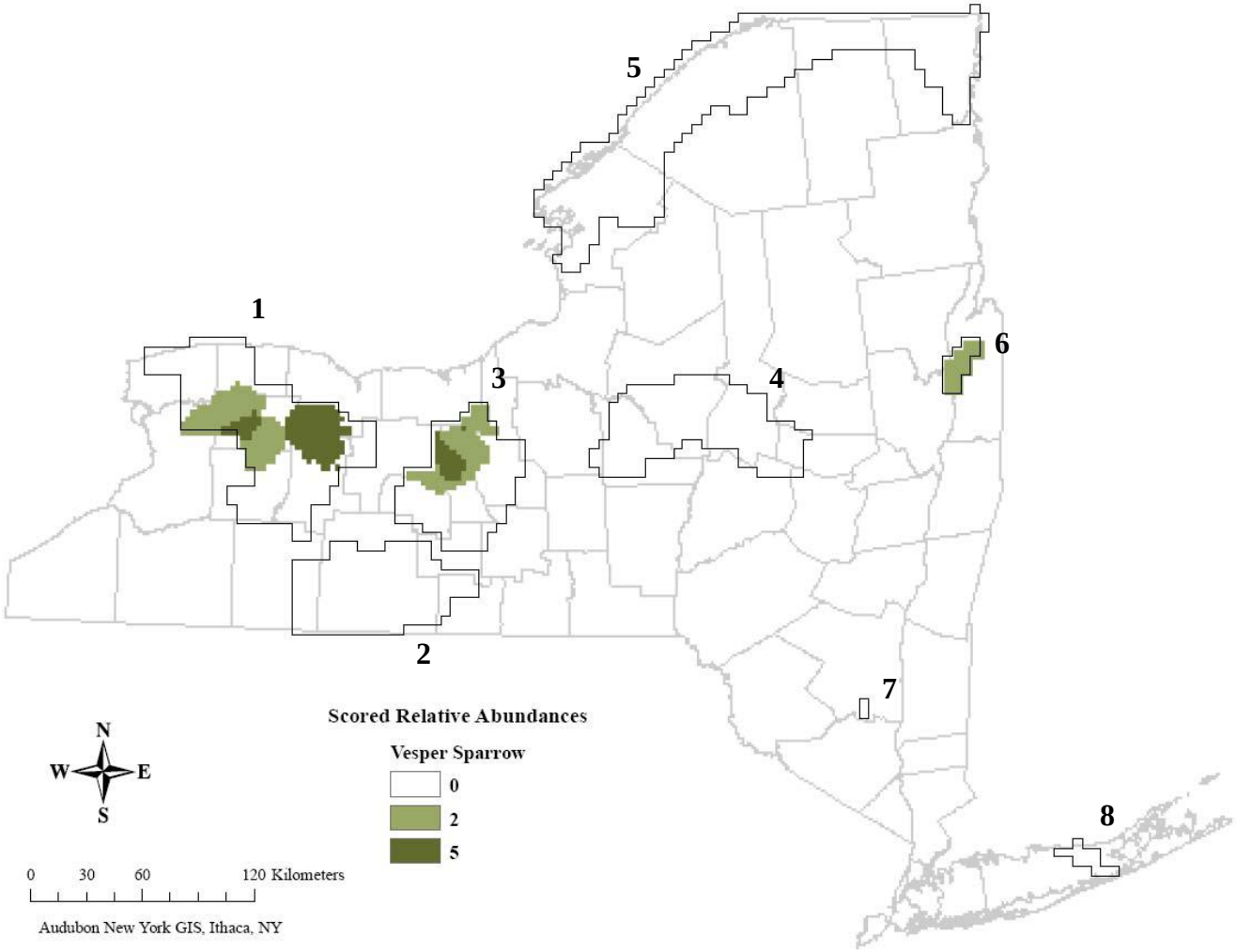

Figure 42. Ranked and scored estimates of Vesper Sparrow relative abundances interpolated across the Focus Areas using kriging.

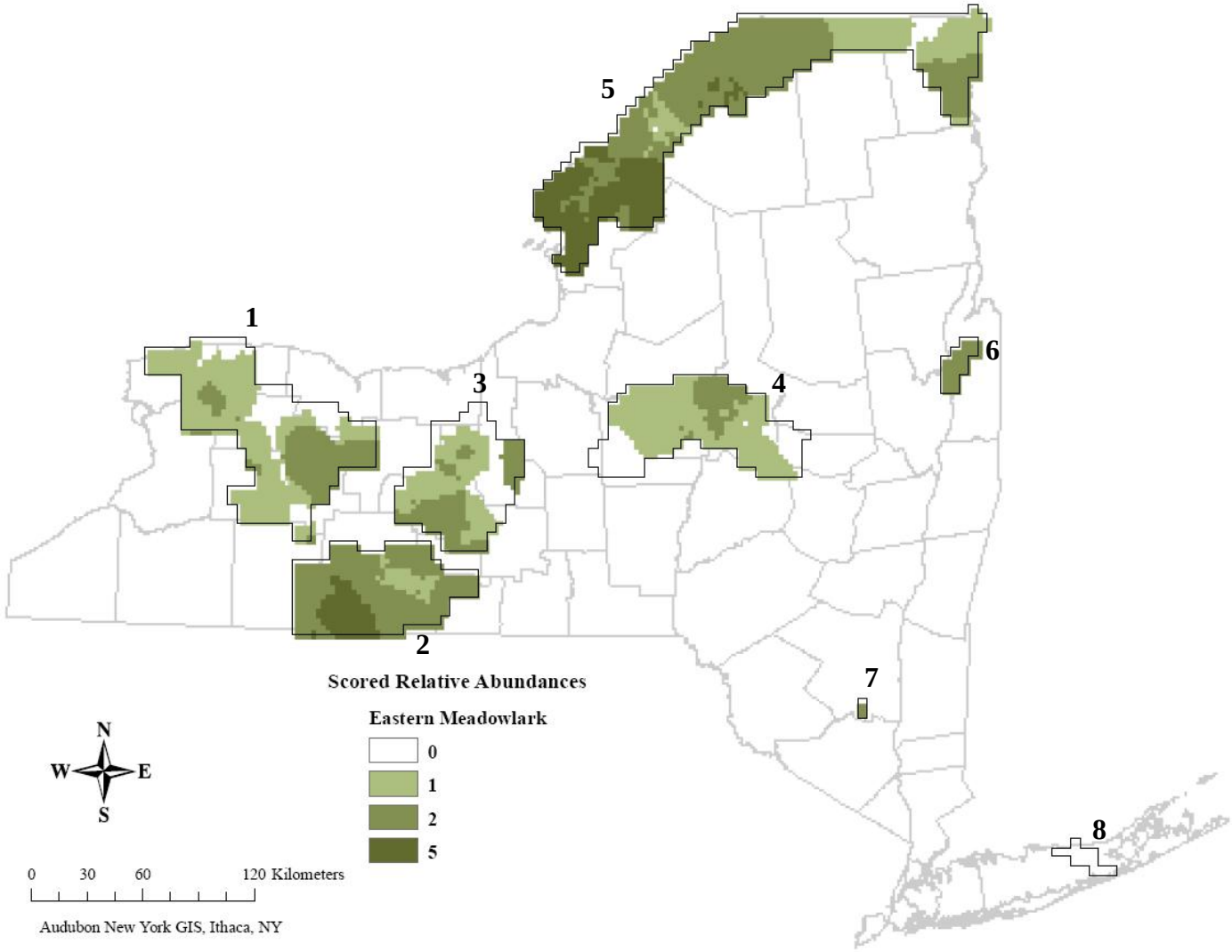

Figure 43. Ranked and scored estimates of Eastern Meadowlark relative abundances interpolated across the Focus Areas using kriging.

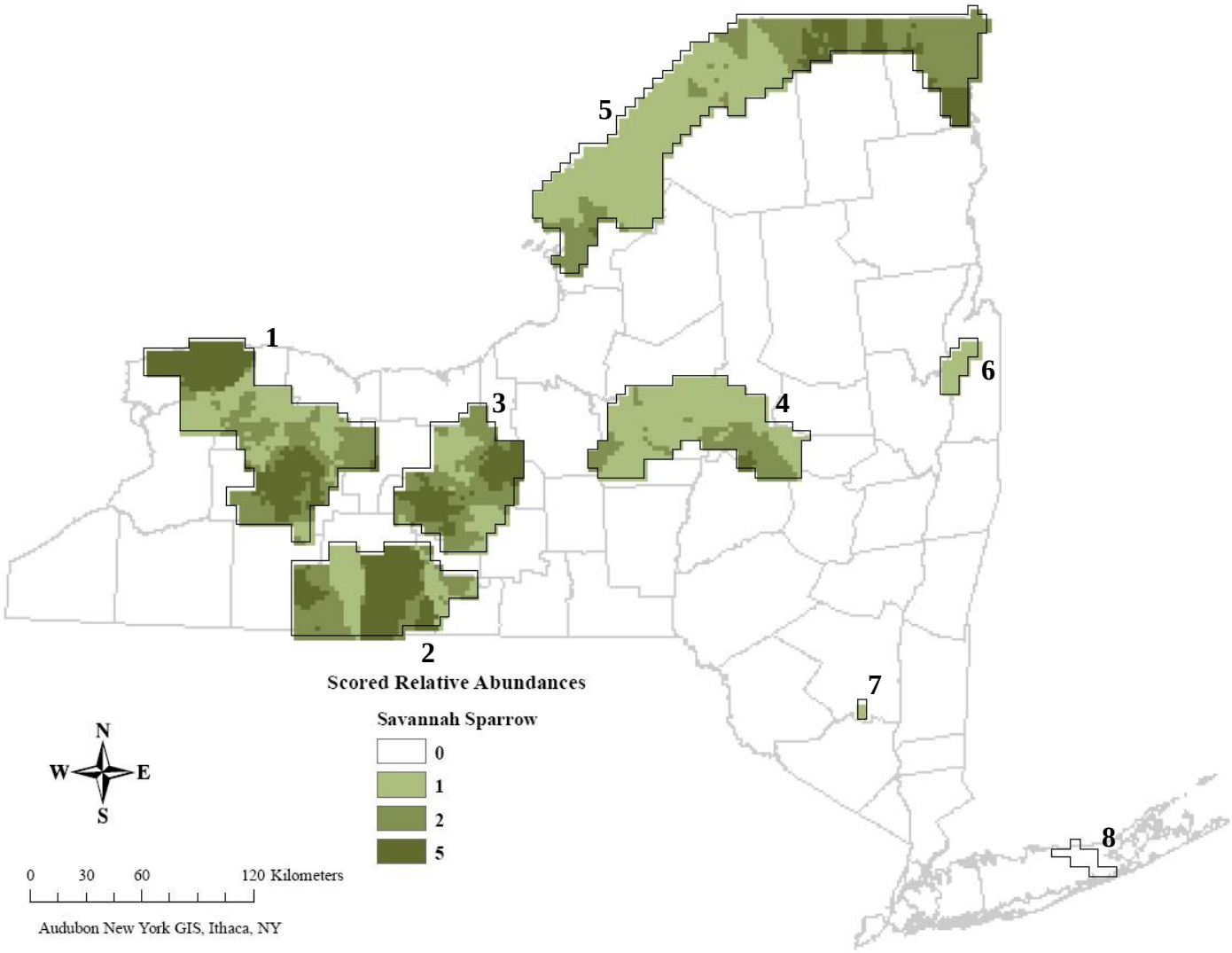

Figure 44. Ranked and scored estimates of Savannah Sparrow relative abundances interpolated across the Focus Areas using kriging.

Appendix F – Maps and keys of publicly-owned lands within the Grassland Focus Areas.

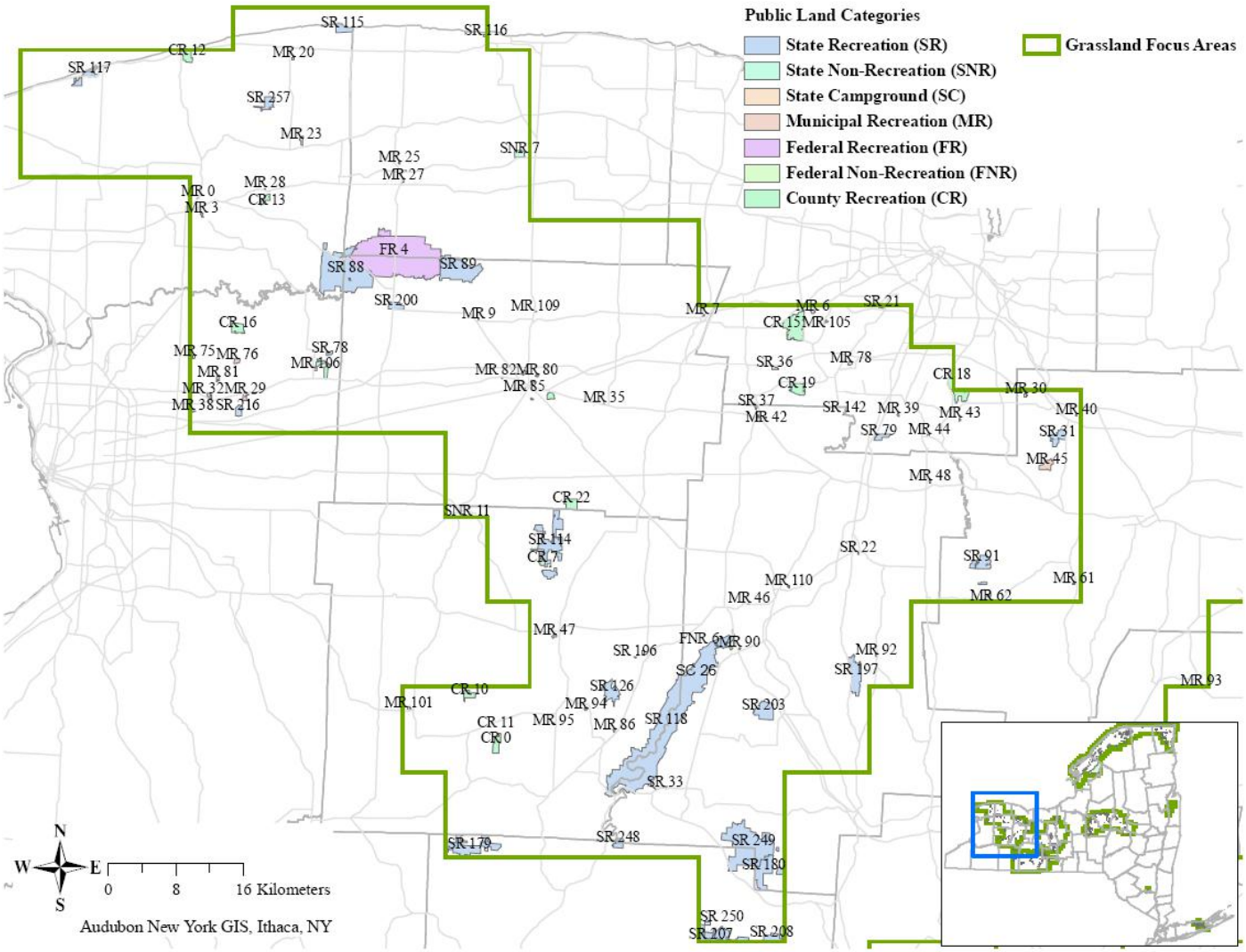

Figure 45. Public lands within focus area 1 (key in Table 12; from NYS Accident Location Information System-Public Land Boundaries 2006).

Table 14. Key for map of public lands within focus area 1.

Key	Site Name	Key	Site Name	Key	Site Name
SNR 7	Albion State Correctional Facility	MR 3	Joseph E Kibler Park	MR 80	MacArthur Park
SNR 11	Attica State Correctional Facility	MR 6	Chili Heights Nature Trail	MR 81	Town Place Park
SR 21-22	State Boat Launch	MR 7	Hickory Park	MR 82	Kiwanis Mini Park
SR 31	Ganondagan State Historic Site	MR 9	Elroy Parkins Memorial Town Park	MR 84	Austin Park
SR 33	Genesee Valley Canal Historic Site	MR 20	Somerset Town Park	MR 85	Williams Park
SR 36	Cedar Springs State Fish Hatchery	MR 21	Calvin E Krueger Park	MR 86	Castile Village Park
SR 37	Caledonia State Fish Hatchery	MR 23	Hartland Town Park	MR 89	Centennial Park
SR 78	Onondaga Escarpment Unique Area	MR 25	Gulf Street Park	MR 90	Francis Bellamy Memorial Park
SR 79	Oak Openings State Unique Area	MR 26	State Street Park	MR 91	Lake Street Park
SR 88	Tonawanda State WMA	MR 27	John E Butts Memorial Park	MR 92	Ricky Greene Memorial Park
SR 89	Oak Orchard State WMA	MR 28	Royalton Veterans Park	MR 94	Silver Springs Municipal Park
SR 91	Honeoye Creek State WMA	MR 29	Clarence Town Park	MR 95	Gainesville Village Park
SR 114	Carlton Hill State Multiple Use Area	MR 30	Fishers Park	MR 101	Veterans Park
SR 115	Golden Hill State Park	MR 31	Parker Commons	MR 105	Town Park
SR 116	Lakeside Beach State Park	MR 32	Thompson Road Park	MR 106	Town Park
SR 117	Wilson Tuscarora State Park	MR 33	Kibbe Park	MR 109	Veterans Memorial Park
SR 118	Letchworth State Park	MR 35	Emery Park	MR 110	Highland Park
SR 126	Silver Lake State Park (undeveloped)	MR 38	Harris Hill Park	FR 4	Iroquois National Wildlife Refuge
SR 142	Genesee Valley Greenway State Trail	MR 39	Stonybrook Park	FNR 6	Reservation (US Army Corps of Engineers)
SR 179-181	State Reforestation Area	MR 40	Harlan Fisher Park	FNR 18	VA Medical Center
SR 196	Silver Lake Outlet State WMA	MR 41	Tenant Park	CR 0, 7, 10-11	County Forest
SR 197	Conesus Inlet State WMA	MR 42	Washburn Park	CR 12	Krull County Park
SR 200	John White Memorial Game Farm	MR 43	Semmel Road Sports Facility	CR 13	Royalton Ravine County Park
SR 203	State Reforestation Area	MR 44	Monroe Street Village Park	CR 14	Genesee Valley County Park
SR 206-208	State Reforestation Area	MR 45	Boughton Park	CR 15	Black Creek County Park
SR 216	Tillman Road Swamp State WMA	MR 46	Boyd Parker Park	CR 16	Beeman Creek County Park
SR 248	Mudville State WMA	MR 47	Warsaw Village Park	CR 17	Akron Falls County Park
SR 249	Rattlesnake Hill State WMA	MR 48	Mark Tubbs Memorial Park	CR 18	Mendon Ponds County Park
SR 250	Keaney Swamp State WMA	MR 51	Attica Memorial Park	CR 19	Oatka Creek County Park
SR 257	Hartland Swamp State Wetlands	MR 61	Levi Corser Memorial Park	CR 22	Genesee County Park and Forest
SC 19	Golden Hill SPC	MR 62	Sandy Bottom Park	CR 23	Livingston County Park
SC 26	Letchworth SPC	MR 75	Meadowlakes Park	CR 29	DeWitt County Recreational Facility
MR 0	Dolan Park	MR 76	Clarence Soccer Center		
MR 1	Upson Park	MR 78	Riverbend Park		

WMA stands for Wildlife Management Area; SPC stands for State Park Campground.

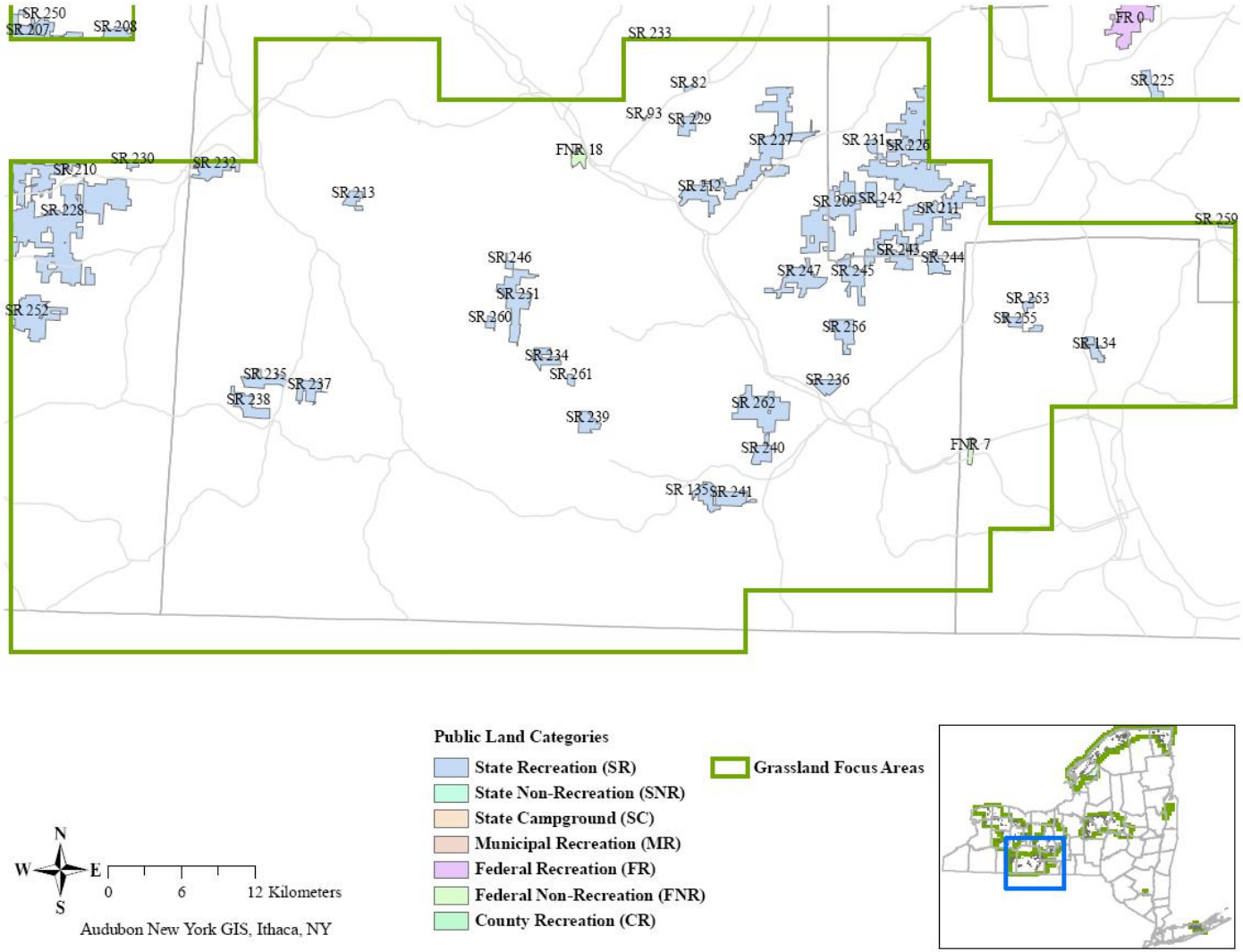

Figure 46. Public lands within focus area 2 (key in Table 13; from NYS Accident Location Information System-Public Land Boundaries 2006).

Table 15. Key for map of public lands within focus area 2.

Key	**Site Name**
SR 82	State Wetland
SR 93	Bath State Fish Hatchery
SR 134	Mark Twain State Park
SR 135	Pinnacle State Park
SR 209-213	State Reforestation Area
SR 226-247	State Reforestation Area
SR 251-256	State Reforestation Area
SR 259	Connecticut Hill State WMA
SR 260	West Cameron State WMA
SR 261	Rathbone State WMA
SR 262	Erwin State WMA
FR 2	Almond Lake (US Army Corps of Engineers)
FNR 7	Big Flats Plant Material Center (US Dept of Agriculture)
FNR 16	Bath National Cemetery
FNR 18	VA Medical Center

WMA stands for Wildlife Management Area

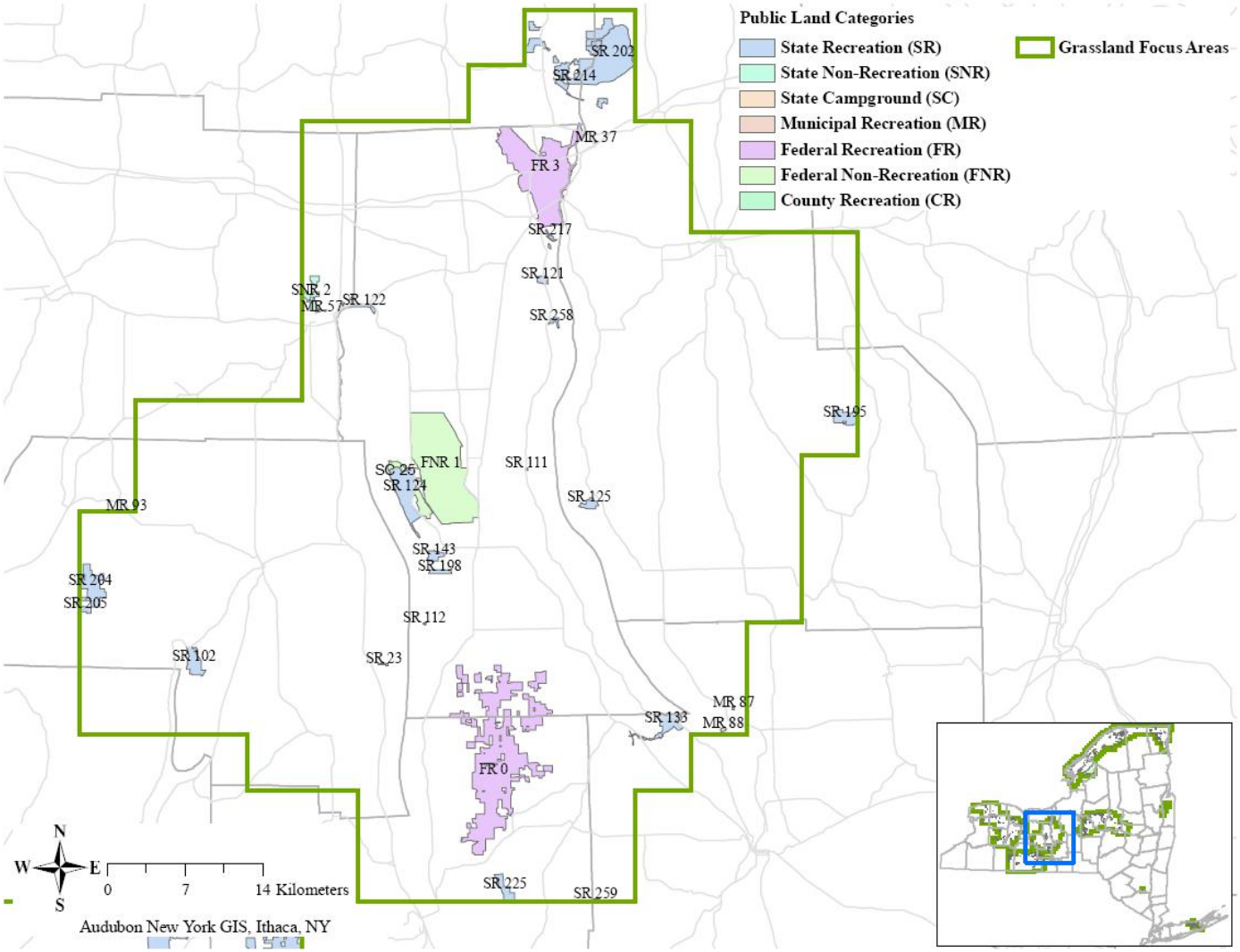

Figure 47. Public lands within focus area 3 (key in Table 14; from NYS Accident Location Information System-Public Land Boundaries 2006).

Table 16. Key for map of public lands within focus area 3.

Key	Site Name	Key	Site Name
SNR 2	State Agricultural Experiment Station	SR 259	Connecticut Hill State WMA
SR 23	State Boat Launch	SC 23	Cayuga Lake SPC
SR 102	Keuka Lake State Park	SC 25	Sampson SPC
SR 111	Deans Cove State Marine Park	SC 27	Keuka Lake SPC
SR 112	Lodi Point State Marine Park	SC 28	Taughannock Falls SPC
SR 121	Cayuga Lake State Park	MR 37	Montezuma Memorial Park
SR 122	Seneca Lake State Park	MR 52	Charters Playground
SR 124	Sampson State Park	MR 53	Gulvin Park
SR 125	Long Point State Park	MR 54	Brook Street Park
SR 133	Taughannock Falls State Park	MR 55	Mc Donough Park
SR 143	Bonavista State Golf Course	MR 56	Ridgewood Park
SR 195	State Reforestation Area	MR 57	Lakefront Park
SR 198	Willard State WMA	MR 87	Ludlowville Park
SR 202	Howland Island State WMA	MR 88	Myers Park
SR 204-205	State Reforestation Area	MR 93	Potter Town Park
SR 214	Northern Montezuma Wetlands State WMA	FR 0	Finger Lakes National Forest
SR 217	Cayuga Lake State WMA	FR 3	Montezuma National Wildlife Refuge
SR 225	State Reforestation Area	FNR 1	Seneca Army Depot Activity
SR 258	Canoga Marsh State Wetlands		

WMA stands for Wildlife Management Area; SPC stands for State Park Campground.

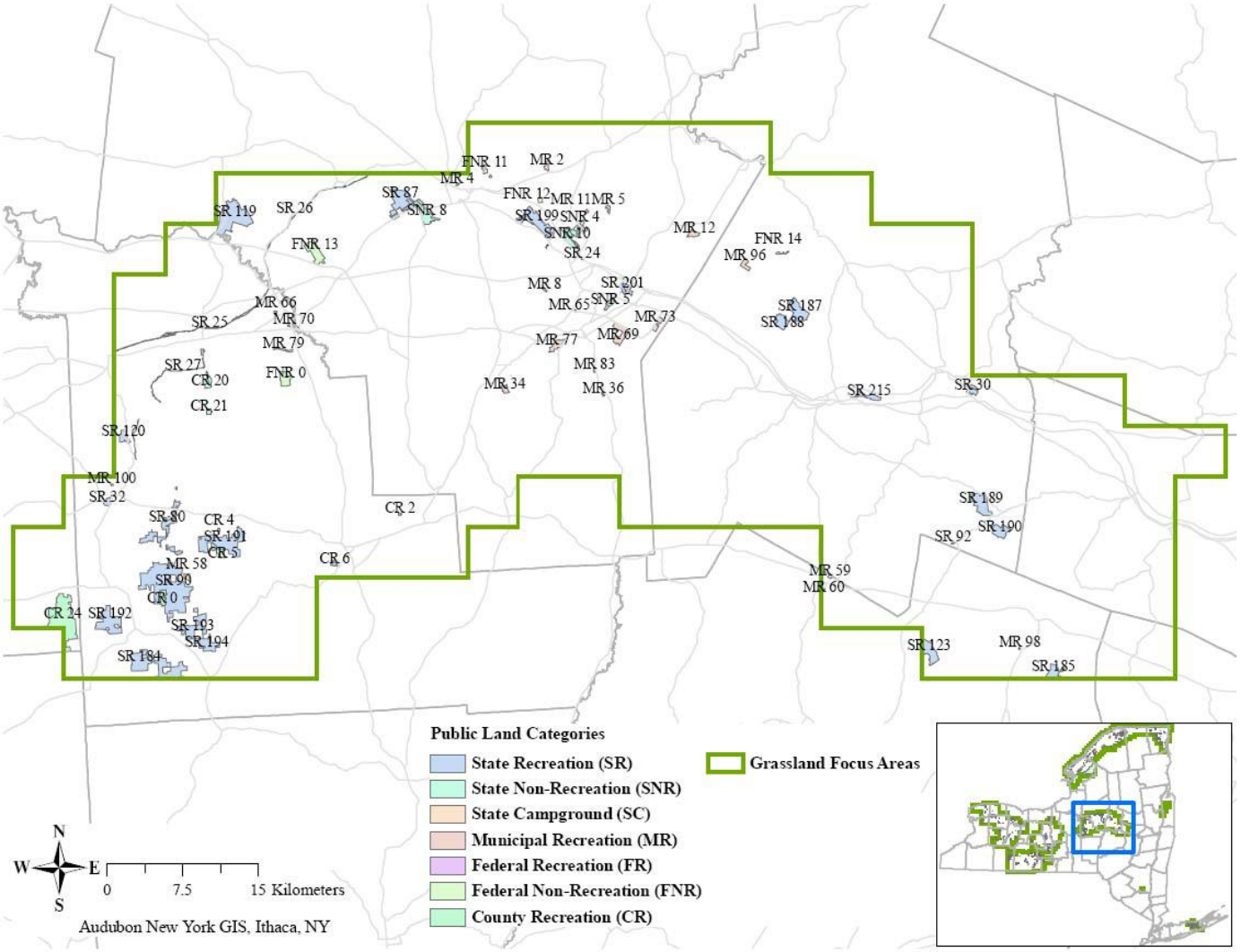

Figure 48. Public lands within focus area 4 (key in Table 15; from NYS Accident Location Information System-Public Land Boundaries 2006).

Table 17. Key for map of public lands within focus area 4.

Key	Site Name	Key	Site Name
SNR 4	Central New York State Psychiatric Center	MR 34	Kirkland Town Park
SNR 5	Mohawk Valley State Psychiatric Center	MR 36	Donovan Memorial Park
SNR 8	Oneida State Correctional Facility	MR 49	Lakeland Park
SNR 9	Midstate State Correctional Facility	MR 50	Gypsy Bay Park
SNR 10	Marcy State Correctional Facility	MR 58	Tuscarora Nature Park
SR 24	Lock 20 State Canal Park	MR 59	John D Carey Park
SR 25	Erie Canal State Park	MR 60	Richfield Springs Municipal Park
SR 26	Old Erie Canal State Park	MR 63	Veterans Memorial Playfield
SR 27	Canastota Cazenovia State Trailway	MR 64	Sconondoa Playground
SR 29	Oriskany Battlefield State Historic Site	MR 65	Pietryka Park
SR 30	Herkimer Home State Historic Site	MR 66	Harmon Field
SR 32	Lorenzo State Historic Site	MR 67	F T Proctor Park
SR 80	Nelson Swamp State Unique Area	MR 68	Maxwell Field
SR 87	Rome State WMA	MR 69	Roscoe Conkling Park
SR 90	Tioughnioga State WMA	MR 70	Du Ross Conservancy
SR 92	Van Hornesville State Fish Hatchery	MR 71-73	T R Proctor Park
SR 119	Verona Beach State Park	MR 74	Oneida Castle Village Park
SR 120	Chittenango Falls State Park	MR 77	Sherrill Brook Park
SR 123	Glimmerglass State Park	MR 79	Mount Hope Park
SR 184-194	State Reforestation Area	MR 83	Washington Mills Athletic Park
SR 199	Oriskany Flats State WMA	MR 96	Schuyler Town Park
SR 201	Utica Marsh State WMA	MR 98	Village Park
SR 215	Lock 18 State WMA	MR 100	Lakeside Park
SC 21	Verona Beach SPC	MR 108	Allen Park
SC 22	Chittenango Falls SPC	FR 1	Fort Stanwix National Monument
SC 24	Glimmerglass SPC	FNR 0	USAF Stockbridge Test Annex
MR 2	Floyd Town Park	FNR 11	USAF Rome Research Site (Laboratory)

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MR 4	Pinti Field	FNR 12	USA Floyd Test Site
MR 5	Toby Road Park	FNR 13	USAF Verona Test Site
MR 8	Whitestown Town Park	FNR 14	USAF Newport Test Annex
MR 10	Frank J Robak Park	CR 0, 2-6, 8-9	County Forest
MR 11	Link Park	CR 20	Oxbow County Park
MR 12	Wilderness Park	CR 21	Nichols Pond County Park
MR 13	Little League Park	CR 24	Highland County Forest

WMA stands for Wildlife Management Area; SPC stands for State Park Campground.

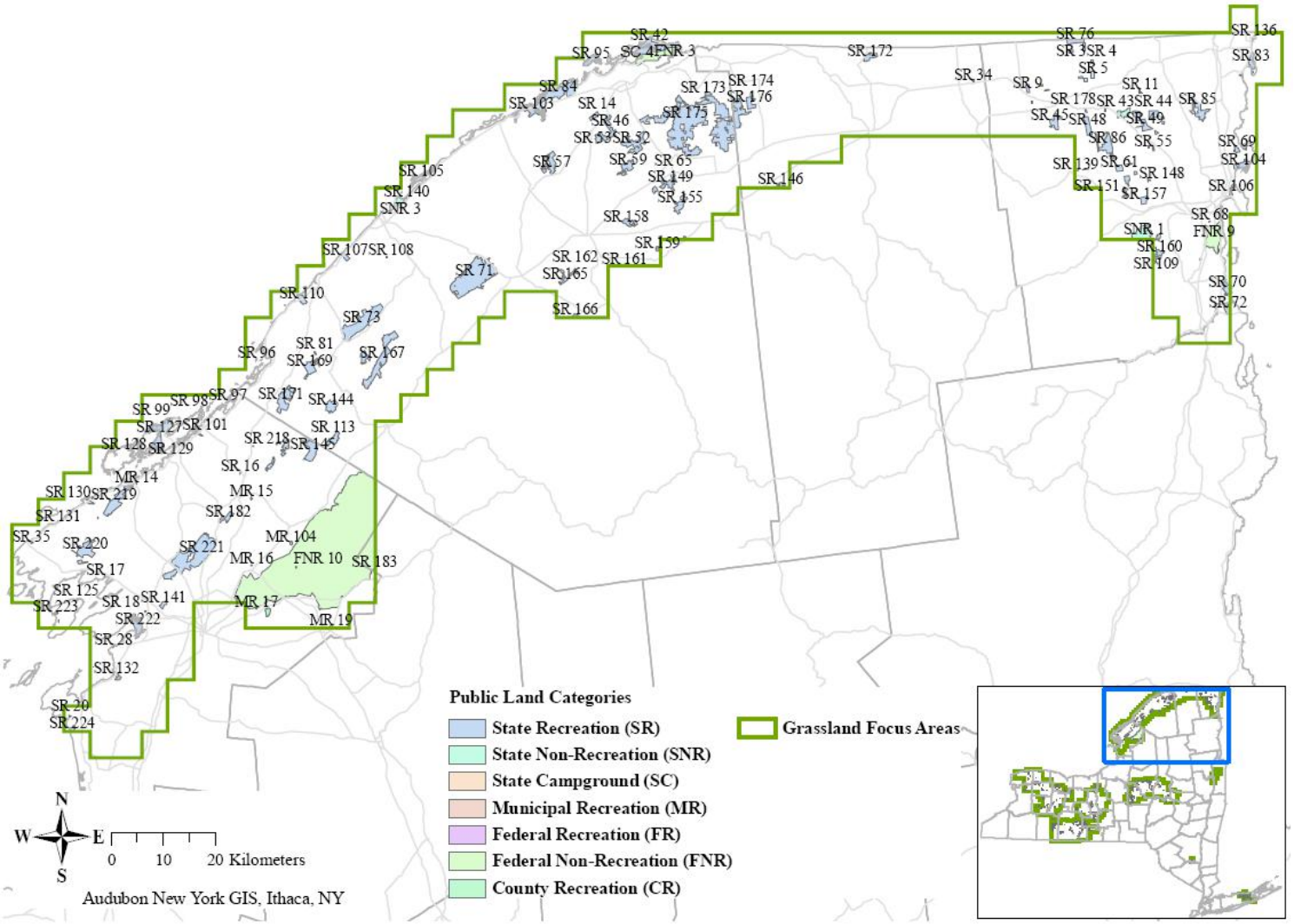

Figure 49. Public lands within focus area 5 (key in Table 16; from NYS Accident Location Information System-Public Land Boundaries 2006).

Table 18. Key for map of public lands within focus area 5.

Key	Site Name	Key	Site Name	Key	Site Name
SNR 1	State Land (Restricted)	SR 100	Dewolf Point State Park	SC 1	Burnham Point SPC
SNR 3	St Lawrence State Psychiatric Center	SR 101	Keewaydin State Park	SC 2	Long Point SPC
SNR 6	Cape Vincent State Correctional Facility	SR 103	Coles Creek State Park	SC 3	Westcott Beach SPC
SR 1-14	State Forest Preserve	SR 104	Point Au Roche State Park	SC 4	Robert Moses SPC
SR 15-20	State Boat Launch	SR 105	Galop Island State Park	SC 5	Coles Creek SPC
SR 28	Sackets Harbor Battlefield Historic Site	SR 106	Cumberland Bay State Park	SC 6	Cumberland Bay SPC
SR 34	Chateaugay State Fish Hatchery	SR 107	St Lawrence State Park	SC 7	Eel Weir SPC
SR 35	Cape Vincent Fisheries Research Station	SR 108	Eel Weir State Park	SC 8	Macomb Reservation SPC
SR 42	Robert Moses State Park	SR 109	Macomb Reservation State Park	SC 9	Ausable Point SPC
SR 43-65	State Reforestation Area	SR 110	Jacques Cartier State Park	SC 10	Jacques Cartier SPC
SR 68	Imperial Dam Fish Ladder (State)	SR 113	Yellow Lake State Multiple Use Area	SC 11	Cedar Island SPC
SR 69	Montys Bay State WMA	SR 125	Long Point State Park	SC 12	Kring Point SPC
SR 70	Ausable Marsh State WMA	SR 127	Wellesley Island State Park	SC 13	Mary Island SPC
SR 71	Upper and Lower Lakes State WMA	SR 128	Canoe and Picnic Point State Park	SC 14	Dewolf Point SPC
SR 72	Wickham Marsh State WMA	SR 129	Grass Point St Park	SC 15	Keewaydin SPC
SR 73	Fish Creek Marsh State WMA	SR 130	Cedar Point State Park	SC 16	Wellesley Island SPC
SR 74	Cranberry Creek State WMA	SR 131	Burnham Point State Park	SC 17	Canoe and Picnic Point SPC
SR 75	Collins Landing State WMA	SR 132	Westcott Beach State Park	SC 18	Grass Point St Park Cmpgrd
SR 76	The Gulf State Unique Area	SR 136-141	State Land	MR 14	Gordon D Cerow Recreation Park
SR 77	Gull Island State Unique Area	SR 144-178	State Reforestation Area	MR 15	Santaway Village Park
SR 81	State Wetland	SR 178	State Reforestation Area	MR 16	Jack Williams Community Park
SR 83	Kings Bay State WMA	SR 182-183	State Reforestation Area	MR 17	Maple Street Park
SR 84	Wilson Hill State WMA	SR 218	Indian River State WMA	MR 18	Dexter Memorial Field
SR 85	Lake Alice State WMA	SR 219	French Creek State WMA	MR 19	Carthage Recreation Park
SR 86	Lewis Preservation State WMA	SR 220	Ashland Flats State WMA	MR 104	Town Park
SR 95	Croil Island State Park	SR 221	Perch River State WMA	FNR 3	US DOT St Lawrence Seaway

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SR 96	Cedar Island State Park	SR 222	Dexter Marsh State WMA	FNR 5	US Coast Guard Station
SR 97	Kring Point State Park	SR 223	Point Peninsula State WMA	FNR 9	Plattsburgh USAF Base (Closed)
SR 98	Mary Island State Park	SR 224	Black Pond State WMA	FNR 10	Fort Drum (US Army)
SR 99	Waterson Point State Park	SC 0	Cedar Point SPC	CR 0-1	County Forest

WMA stands for Wildlife Management Area; SPC stands for State Park Campground.

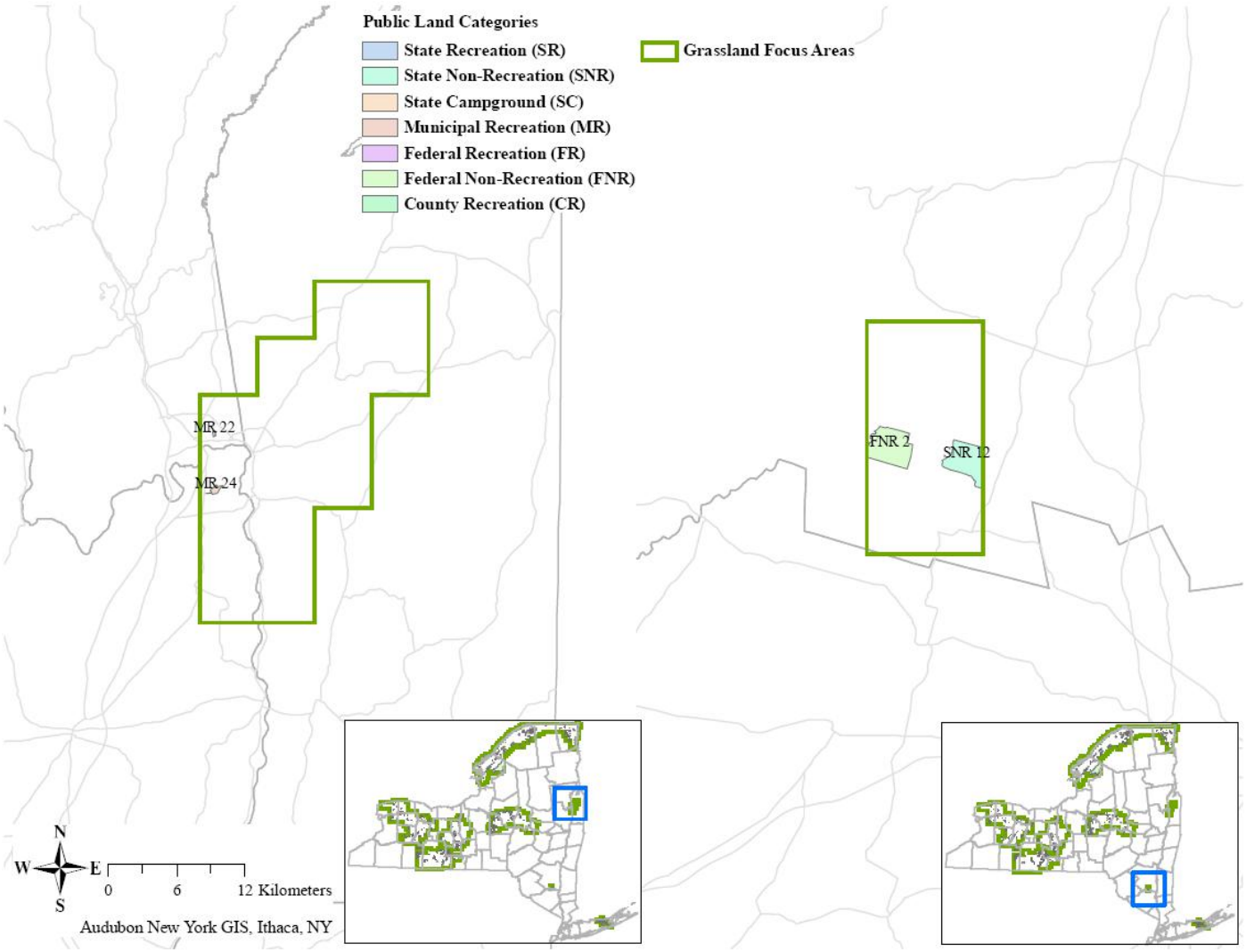

Figure 50. Public lands within focus areas 6 and 7 (key in Table 17; from NYS Accident Location Information System-Public Land Boundaries 2006).

Table 19. Key for map of public lands within focus areas 6 and 7.

Focus Area 7		Focus Area 6	
Key	**Site Name**	**Key**	**Site Name**
SNR 12	Wallkill State Correctional Facility	MR 22	East Field Park
FNR 2	Ganiff Training Complex (US Army)	MR 24	Town Of Moreau Recreation Park

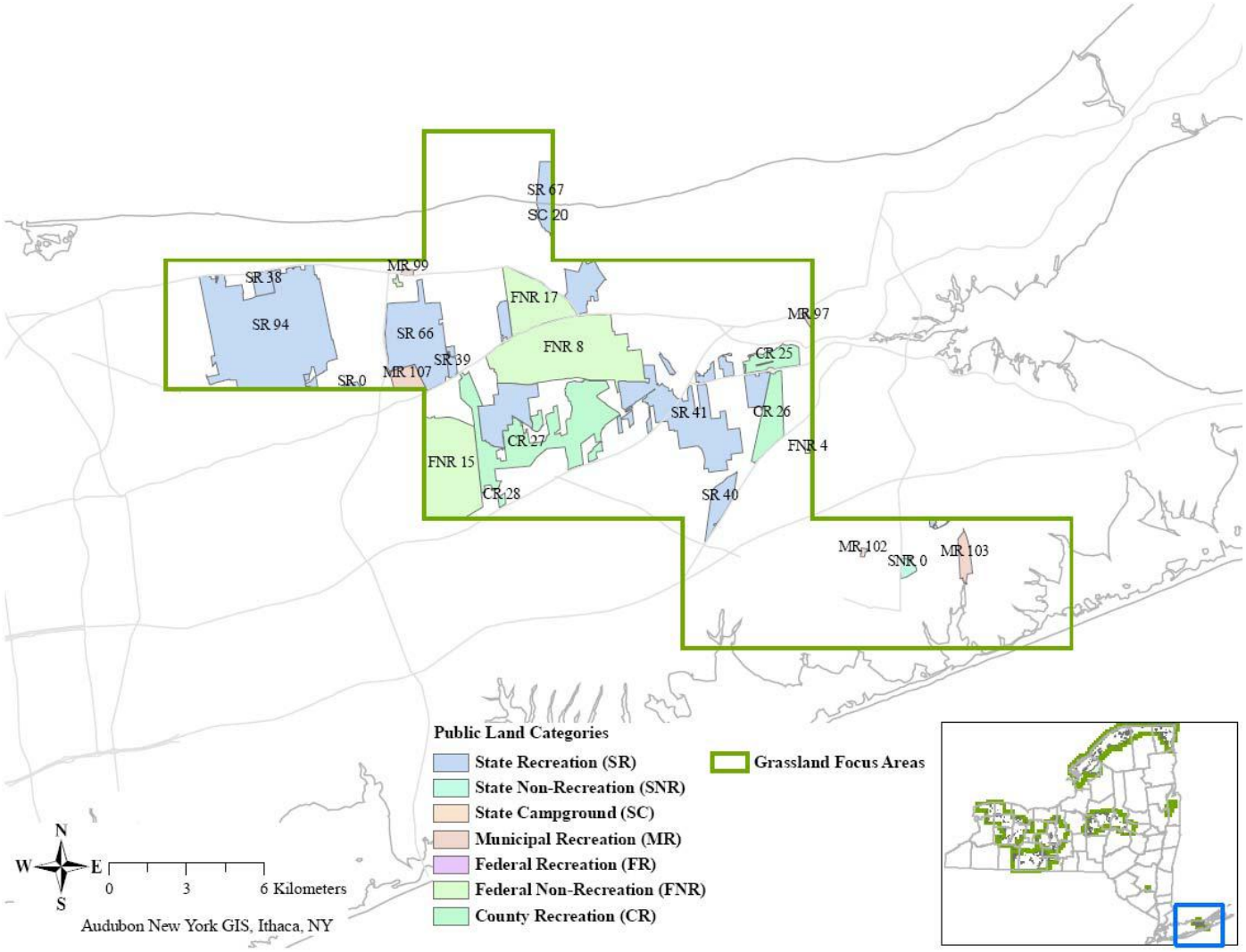

Figure 51. Public lands within focus area 8 (key in Table 18; from NYS Accident Location Information System-Public Land Boundaries 2006).

Table 20. Key for map of public lands within focus area 8

Key	Site Name
SNR 0	New York Air National Guard
SC 20	Wildwood SPC
SR 0	Middle Island State Environmental Education Center
SR 38	Rocky Point State Pine Barrens Preserve
SR 39	State Pine Barrens Preserve
SR 40	Manorville State Pine Barrens Preserve
SR 41	Long Island State Pine Barrens Preserve
SR 66	Brookhaven State Park (undeveloped)
SR 67	Wildwood State Park
SR 94	Rocky Point State Natural Resource Management Area
MR 97	Stotzky Memorial Park
MR 99	Town Recreational Center
MR 102	Hampton West Park
MR 103	Quogue Wildlife Refuge
MR 107	Firemens Memorial Park
FNR 4	US Dept Of Transportation (FAA)
FNR 8	Naval Weapons Industrial Reserve Plant
FNR 15	US Reservation (Brookhaven National Laboratory)
FNR 17	Calverton National Cemetery
CR 25	Peconic Bog County Park
CR 26	Peconic Hills County Park
CR 27	Robert Cushman Murphy County Park
CR 28	RC Murphy County Park
SC 20	Wildwood SPC

SPC stands for State Park Campground.

Appendix G – Land trusts operating locally, statewide, and nationally in New York (list maintained by the Land Trust Alliance at www.lta.org).

Land Trust Alliance Member Land Trusts Operating Locally

Name	Main Office Location
Adirondack Land Trust/Nature Conservancy *S&P	Keene Valley, NY
Agricultural Stewardship Association *S&P	Greenwich, NY
Avalonia Land Conservancy *S&P	Old Mystic, CT
Bergen Swamp Preservation Society *S&P	Bergen, NY
Bronx Land Trust *S&P	Bronx, NY
Brooklyn Queens Land Trust *S&P	Brooklyn, NY
Cape Vincent Village Green, Inc. *S&P	Cape Vincent, NY
Cazenovia Preservation Foundation *S&P	Cazenovia, NY
Chautauqua Watershed Conservancy *S&P	Jamestown, NY
Chenango Land Trust *S&P	Norwich, NY
Columbia Land Conservancy *S&P	Chatham, NY
Cragsmoor Conservancy, Inc. *S&P	Cragsmoor, NY
Delaware Highlands Conservancy *S&P	Hawley, PA
Dutchess Land Conservancy *S&P	Millbrook, NY
Eddy Foundation *S&P	Essex, NY
Esopus Creek Conservancy *S&P	Saugerties, NY
Finger Lakes Land Trust *S&P	Ithaca, NY
Friends of the Outlet *S&P	Dresden, NY
Genesee Land Trust *S&P	Rochester, NY
Genesee Valley Conservancy *S&P	Geneseo, NY
Greene Land Trust *S&P	Cairo, NY
Harlem Valley Rail Trail *S&P	Millerton, NY
Heritage Conservancy *S&P	Doylestown, PA
Hudson Highlands Land Trust *S&P	Garrison, NY
Indian River Lakes Conservancy *S&P	Redwood, NY
Keep Conservation Foundation *S&P	New York, NY
Lake Champlain Land Trust *S&P	Burlington, VT
Lake George Land Conservancy *S&P	Bolton Landing, NY
Manhattan Land Trust *S&P	New York, NY
Mendon Foundation, Inc. *S&P	Mendon, NY
Mianus River Gorge Preserve, Inc. *S&P	Bedford, NY
Mohawk Hudson Land Conservancy *S&P	Slingerlands, NY
Mohonk Preserve *S&P	New Paltz, NY
Mount Sinai Heritage Trust, Inc. *S&P	Mount Sinai, NY
Nassau Land Trust *S&P	East Norwich, NY
Natural Lands Trust *S&P	Media, PA
North Elba Land Conservancy *S&P	Lake Placid, NY
North Salem Open Land Foundation *S&P	North Salem, NY
North Shore Land Alliance *S&P	Old Westbury, NY

Oblong Land Conservancy, Inc.	*S&P	Pawling, NY
Ontario Bays Initiative	*S&P	Chaumont, NY
Open Space Institute	*S&P	New York, NY
Orange County Land Trust	*S&P	Middletown, NY
Otsego Land Trust, Inc.	*S&P	Cooperstown, NY
Peconic Land Trust	*S&P	Southampton, NY
Placid Lake Foundation	*S&P	Lake Placid, NY
Post-Morrow Foundation	*S&P	Brookhaven, NY
Pound Ridge Land Conservancy	*S&P	Pound Ridge, NY
Putnam County Land Trust	*S&P	Brewster, NY
Queensbury Land Conservancy	*S&P	Queensbury, NY
Rensselaer-Taconic Land Conservancy	*S&P	Troy, NY
Rev. Linnette C. Williamson Memorial Park Association	*S&P	New York, NY
Rondout-Esopus Land Conservancy	*S&P	High Falls, NY
Saratoga P.L.A.N.	*S&P	Saratoga Springs, NY
Save the County Land Trust	*S&P	Syracuse, NY
Scenic Hudson, Inc.	*S&P	Poughkeepsie, NY
Schodack Area Land Trust	*S&P	East Schodack, NY
Schoharie Land Trust, Inc.	*S&P	Cobleskill, NY
Serpentine Art and Nature Commons, Inc.	*S&P	Staten Island, NY
Shawangunk Conservancy	*S&P	Accord, NY
Somers Land Trust	*S&P	Somers, NY
Southern Madison Heritage Trust	*S&P	Hamilton, NY
St. Lawrence Land Trust	*S&P	Canton, NY
Teatown Lake Reservation, Inc.	*S&P	Ossining, NY
The Catskill Center for Conservation and Development	*S&P	Arkville, NY
The Trust for Public Land, Mid-Atlantic Regional Office	*S&P	New York, NY
Thousand Islands Land Trust	*S&P	Clayton, NY
Three Village Community Trust, Inc.	*S&P	Setauket, NY
Tug Hill Tomorrow Land Trust	*S&P	Watertown, NY
Wallkill Valley Land Trust, Inc.	*S&P	New Paltz, NY
Westchester Land Trust	*S&P	Bedford Hills, NY
Western New York Land Conservancy	*S&P	East Aurora, NY
Williamstown Rural Lands Foundation	*S&P	Williamstown, MA
Wilton Wildlife Preserve & Park	*S&P	Gansevoort, NY
Winnakee Land Trust	*S&P	Rhinebeck, NY
Woodstock Land Conservancy	*S&P	Woodstock, NY
Yorktown Land Trust	*S&P	Yorktown Heights, NY

Land Trust Alliance Member Land Trusts Operating Statewide

North American Land Trust	*S&P	Chadds Ford, PA
Northeast Wilderness Trust	*S&P	Boston, MA
The Nature Conservancy, New York State Office	*S&P	Albany, NY

Land Trust Alliance Member Land Trusts Operate Nationally

American Farmland Trust *S&P

American Land Conservancy *S&P

The Conservation Fund

The Great Outdoors Conservancy *S&P

The Humane Society of the United States Wildlife Land Trust *S&P

National Park Trust *S&P

The Nature Conservancy *S&P

Trust for Public Land *S&P

Wilderness Land Trust *S&P

S&P** indicates adoption of ***Land Trust Standards & Practices, guidelines for responsible and ethical operation of a land trust.