Audubon NEW YORK

Developing a Regional Monitoring Framework Applicable to Patchily Distributed Bird Species in Grassland, Scrub-shrub, and Forest Habitats

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Note: the work described in this report is one component of a multipart trial to coordinate and implement a robust monitoring program for grassland breeding birds across the Northeast. Three separate grants funded through the American Bird Conservancy are supporting this program, and as the grants were awarded at various stages of the program's development, the deliverables and reports vary slightly in scope and objectives. The three complementary reports include Tsipoura et al. (2008), Morgan and Burger (2008a), and Burger et al. (2008). The problem statements and backgrounds for these separate reports are nearly identical, along with some descriptions of protocols and standard operating procedures, in an effort to allow each report to stand alone if necessary. To differentiate between the three reports, an overly simplistic comparison of the key messages of the three reports is:

1. Burger et al. (2008; "Developing a Regional Monitoring Framework Applicable to Patchily Distributed Bird Species in Grassland, Scrub-shrub, and Forest Habitats") – Concepts for (and the 2008 trial effort) incorporating a spatially explicit sampling framework into the grassland monitoring program in partnership with a similar monitoring program for Golden-winged Warblers.

2. Morgan and Burger (2008a; "Monitoring the Effectiveness of Grassland Bird Conservation") – Efforts and perspectives from New York on developing a grassland bird monitoring program.

3. Tsipoura et al. (2008; "Development of avian indicators and measures for monitoring threats and effectiveness of conservation actions – Grassland Birds") – Guidelines (following Oakley et al., 2003) to direct future collaboration on an expanded monitoring program for grassland birds in the Northeast.

1. Background and objectives

The Breeding Bird Survey (BBS) shows many grassland bird populations as rapidly declining and even approaching extirpation throughout significant portions of their ranges. As a result of these declines, 15 grassland bird species are listed by State Wildlife Action Plans in the Northeast as high priorities for conservation action (see Table 1), and many other species will benefit from relevant conservation efforts. Habitat loss, fragmentation, and deterioration are the

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main culprits in the loss of this important habitat. Needs pertaining to the conservation of grassland birds, include 1) increasing the amount of grassland habitat on public and private land in regions with the highest concentrations of grasslands, 2) implementing the new Landowner Incentive Programs and supporting existing private lands cooperative management programs to improve habitat for grassland birds on private lands, 3) working with public land managers, including NRCS, USFWS, and state wildlife agencies, to better direct funding and other resources to the highest priority areas and projects for grassland habitat management, and **4) developing and implementing a monitoring program to determine population trends and evaluate effectiveness of existing conservation efforts**. This project focuses on the fourth objective (monitoring), which must be intimately linked to any efforts addressing the other three.

As various strategies and techniques are implemented, assessing their effectiveness of requires additional effort, and is often overlooked. While the trends documented by the BBS demonstrate the need for conservation, it is rapidly losing its ability to track changes in ever-smaller grassland bird populations. In addition, the need exists for a coordinated and uniform approach to assessing the effectiveness of conservation actions. As a result, developing and implementing a monitoring program to determine population trends and evaluate effectiveness of conservation efforts has been identified as a critical need.

Table 1. Bird species listed as grassland Species of Greatest Conservation Need (SGCN) by states in the northeastern US.

Species	**States listing species as SGCN**
*American Kestrel**	*CT, MA, NJ, RI, VT*
*Barn Owl**	*CT, DE, MA, MD, NJ, NY, PA, RI, VA, VT, WV*
Bobolink	CT, DC, DE, MD, ME, NJ, NY, PA, RI, VT, WV
*Dickcissel**	*NJ, NY, PA, WV*
Eastern Meadowlark	CT, DC, MA, MD, ME, NH, NJ, NY, PA, RI, VT, VA
Grasshopper Sparrow	CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT, VA, WV
Henslow's Sparrow	DE, MA, MD, NJ, NY, PA, VT, VA, WV
Horned Lark	CT, ME, NH, NJ, NY, RI, WV
Loggerhead Shrike	DE, MD, ME, NJ, NY, PA, VA, WV
Northern Harrier	CT, DE, MA, MD, NH, NJ, NY, PA, RI, VA, VT, WV
Savannah Sparrow	CT, DE, MD, NJ, RI
Sedge Wren	CT, DE, MA, MD, ME, NH, NJ, NY, VT, VA, WV
Short-eared Owl	CT, DE, MA, MD, ME, NJ, NY, PA, RI, VT, WV
Upland Sandpiper	CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT, VA, WV
Vesper Sparrow	CT, DE, MA, MD, ME, NH, NJ, NY, VT, WV

*Not finalized as members of the target population.

To maintain an effective scale for these efforts, very similar conservation and monitoring strategies are developing on a state-by-state basis across the Northeast. Initial partners in the collaborative monitoring component of the grassland conservation community include New Jersey (led by New Jersey Audubon Society), New York (Audubon New York) and Connecticut (Connecticut Department of Environmental Protection). The results of the collaboration are described in the joint report "Development of avian indicators and measures for monitoring threats and effectiveness of conservation actions – Grassland Birds" (Tsipoura et al. 2008) which includes the framework for progressing with a closely coordinated monitoring program across

the Northeast, and will not be repeated in detail in this report. The approach for coordinating grassland bird monitoring across the Northeast (e.g. expanding beyond the three states participating in 2008), while also discussed by Tsipoura et al. (2008), will be described in this report.

The framework being developed for the identification and selection of monitoring points is applicable to monitoring for a variety of patchily distributed habitat-species suites. The original proposed deliverables included a paired framework applied to both grassland birds and Golden-winged Warblers (GWWA). Because the award provided by the American Bird Conservancy was reduced from the original proposed amount, the focus of the scope of work shifted to primarily the grassland bird component, although the partnership with the GWWA effort continued, and paired deliverables were maintained in the contract.

2. Deliverable Products

Most of the following deliverables will be paired, one each for the Grassland Breeding Bird component and the GWWA component:

A. A statistically relevant process for selecting sample sites, potentially a Generalized Random Tessellation Stratified process (GRTS), or other tessellation method.

Process for selecting grassland bird sample sites

A critical need for an effective grassland bird monitoring program is a spatially explicit sampling framework that balances the assessment of management success on "conservation grasslands" with regional population trends on all available (or "potential") grassland habit. Several relatively new techniques have been proposed or implemented (on a limited basis) using Geographic Information Systems to randomly select sampling points by combing landcover datasets and applicable suitability models to ensure that truly representative (unbiased) datasets are created. These include Generalized Random Tessellation Stratified sampling (GRTS; Stevens and Olson 2004) and Reversed Randomized Quadrant-Recursive Raster (RRQRR; Theobald et al. 2007).

The grassland bird component attempted to implement RRQRR for the 2008 field season with limited success. The National Landcover Dataset (NLCD 2001) was used to identify all patches of potential grassland habitat within the New York focus areas. This served as the geographic scope of the survey project, and identifies the sample

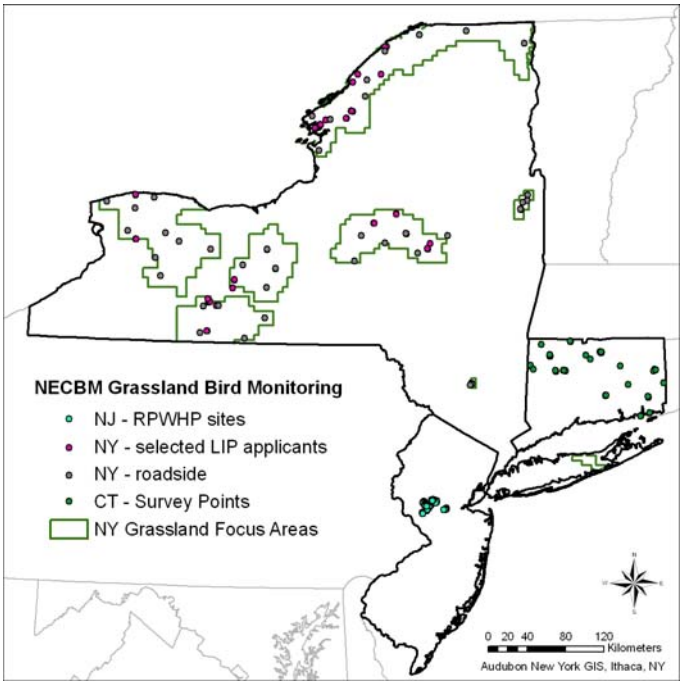

Fig. 1. Points surveyed in 2008 by members of the grassland working group of the NE CBM partnership.

population. The various relevant landcover classes assigned by the NLCD (Developed, Open Space; Barren Land; Scrub/Shrub; Grassland/Herbaceous; Pasture/Hay; Cultivated Crops; and Emergent Herbaceous Wetland) could be used to assign probabilities of inclusion with the spatial framework based on previous land cover modeling efforts coordinated by Audubon New York (e.g. despite errors in classification, Pasture/Hay is more likely to be true grassland habitat than Scrub/Shrub; however, Pasture/Hay is not always grassland habitat).

An additional probability model can be incorporated in the sampling framework according to the management of the habitat patches. Habitat patches enrolled in LIP, WHIP, and other conservation programs (including public lands) are nearly certain to be true grassland habitat, and additionally, are likely to be surveyed simply according to programmatic or contractual requirements. To ensure results are representative of the true variation in habitat conditions across the sample population, these probability assessments are critical.

New York attempted to include these considerations in an RRQRR output for the 2008 pilot season, but failed to create a fully useable product. Authors of the spatially-balanced sampling tools are continuing to develop the associated extensions and programs, and additional expertise is being included in the monitoring program with the objective of full implementation in upcoming field seasons.

Process for selecting Golden-winged Warbler sample sites (adapted from Rosenberg et al. 2008)

The process for selecting sites for GWWA monitoring is virtually identical, with simple substitutions for the layers uses to model probability of inclusion. Habitat modeling can be limited to simply the Scrub/Shrub portion of the NLCD (2001), or more localized modeling efforts such as GAP analyses can be used. For this season, the site selection process limited the geographic scope to Pennsylvania Breeding Bird Atlas (BBA) blocks in which GWWA had previously been documented (see Figure 2), and that occurred within the GWWA focus area. In addition, given the topography and difficulty of traveling to point locations within the focus areas, additional probabilities based on closeness to roads or trails can be incorporated (and were for the 2008 pilot season).

In this pilot test year, we were able sample 21 of the top 40 sites selected by the RRQRR program. Golden-wings were detected at 5 (24%) of the 21 sites. Although we did have some success, we experienced difficulties with software compatibility, map projections, and a lack of recent habitat data to build good probability layers for selecting sites. In 2009, we plan to refine and test the RRQRR sampling scheme again in Pennsylvania

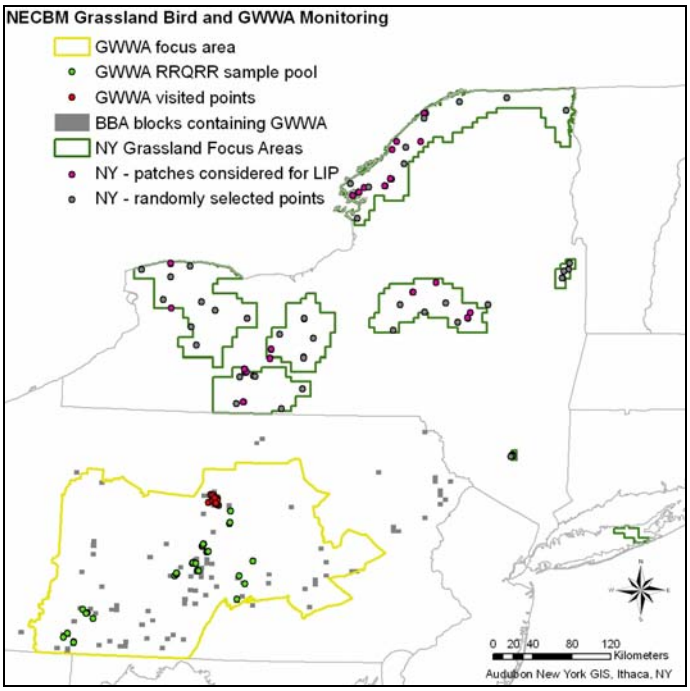

Fig. 2. Focus areas (and sampled points) for grassland birds in New York, and geographic data used to select GWWA sample points using RRQRR in Pennsylvania.

and perhaps other states.

B. A shapefile of selected sampling sites.

Appended to this report are two compressed files, one each containing relevant data used to select sample sites for the grassland bird project and GWWA RRQRR projects and the actual sample sites for both projects. A representation of the spatial data is shown in Figure 2.

C. Standard Operating Procedures (protocol) for data collection at sampling sites. These protocols will follow the commonly accepted standards, such as Oakley et al. 2003, or the standards being drafted for the US Fish and Wildlife Service)

Grassland bird protocol for the 2008 pilot season in New York

The protocol for conducting the grassland bird point counts is included below, and is also discussed in Morgan and Burger 2008a and Tsipoura et al. 2008.

1. Timing of surveys.

The approximate survey period is 23 May to 10 July. Each point will be surveyed twice during this period (> 10 days between surveys), and all points should be initially surveyed no later than the midpoint of the survey period (16 June).

Vegetation characteristics are simple measurements should a more rigorous assessment not be conducted. Average several measurements around the point location, while estimating cover of shrubs (woody vegetation), grass, and forbs within 100 m of the point location (and within the boundaries of the habitat patch).

1. Environmental conditions within prescription for conducting grassland bird monitoring.

Condition	Acceptable Range
Time	½ hr < sunrise → 4 hrs > sunrise*
*Temperature	< 85 degrees F
Cloud cover	0-100%
Wind	Beaufort 0 – Beaufort 3 (0 to ~ 12 mph)
Rain	None, slight fog or mist (datasheet stays dry during count)
Visibility	Clear to 300 m
Traffic (roadside counts)	*If unsafe conditions exist (no shoulder or no suitable parking), do not depart vehicle.*

2. Travel to the point location.

Predetermined points

A. Utilize GPS to navigate to the point locations provided (entering the point locations as waypoints in your GPS prior to beginning surveys for the day can facilitate navigation).

B. Navigate to within 5-10 m of the point location. Needless backing up and moving left and right to arrive within 1 m of the point wastes time and unnecessarily tramples a large amount of vegetation (and is not good for landowner relations when surveying alfalfa or clover fields).

Other points (e.g. randomly selected habitat patches)

A. If landowner permission for access is not provided, move to the roadside bordering or bisecting the habitat patch. If road frontage is < 400 m (i.e. not allowing multiple points 400 m apart), center the point location on the road frontage.

3. Wait 2 minutes for the initial burst of activity by territorial birds to subside. Fill out relevant data sheet fields while waiting (see Appendix A).
-Distance to trail/road will be zero (0) for roadside counts. For in-field counts, use rangefinders to get distance to road.
-The other general point fields are self-explanatory.

4. Conducting the count.
-A programmable, audible "countdown and repeat" timer is useful for tracking the count periods.
-Record each grassland species observed (see table of targeted grassland species) using either 2 or 4 letter Alpha codes. Each new individual should be entered on a new row on the datasheet.
-For each individual recorded, additionally record sex (if possible), the actual distance of first observation (using range finder), observation code (within each time period during which the individual is observed), and any breeding activities.
→ balancing binoculars, rangefinder, clipboard, and pencil while trying to count grassland birds is tricky, but gets easier with practice.
→ if a target species is observed outside of the count period, DO NOT ENTER AN OBSERVATION CODE in the associated field, but list the species, while including a note in the margin of the sheet indicating when the bird was observed (e.g. before count, after count, en route to point, in adjacent field, etc.).

5. Recording habitat information.
Fill out all possible fields within the habitat evaluation section.
-Evidences of disturbance include tire tracks, freshly cut hay/hay bales, drastic differences in vegetation (or tilled soil).
-Distinguishing between pasture and hayfields can be tricky. Presence of cowpies, established trails, or well maintained fencing can indicate use (or planned) use of a patch as pasture.

6. Submitting datasheets.
-For 2008, an Excel spreadsheet was created to guide data entry. Each individual is responsible for entering their own data to minimize transcription errors.
-The development of an online database for New York's survey effort is being planned, but will not be finalized until the 2009 protocol is established.

Golden-winged Warbler protocol for the 2008 field season in Pennsylvania (from Rosenberg et al. 2008)

The 2008 protocol was designed to test the relative effectiveness of passive observation, conspecific playbacks, and mobbing playbacks. The ultimate goal of the experiment was to identify the most efficient and reliable field survey technique for GWWA. The 17-minute long experimental protocol consisted of the following segments:

1) Passive Point Count: 3-minute silent point count divided into 3, 1-minute time bands, with all detections recorded in the appropriate band.

2) Conspecific Playback: 5-minute GWWA type I song, then 1-min silent observation period, then 1-minute GWWA type II song, then 1-minute silent observation period.
3) Mobbing Playback: 5-minute mobbing sequence (Black-capped Chickadee and Eastern Screech -owl) followed by 1-minute silent observation period.

When point count sites were visited two times in a season, the order of the playback sections was reversed for the second visit. On the first visit the field observer flipped a coin to determine whether "Conspecific" or "Mobbing" would follow the Passive Point Count. On the second visit, the order of the playbacks was reversed from the first visit. This strategy allowed us to test the effectiveness of conspecific versus mobbing playbacks without them being confounded in the same way during each trial.

D. One year of pilot data collected in 2008 throughout the defined geographic scope.

Attached to this report is a spreadsheet of the grassland data collected in 2008, and currently being reviewed for an analysis of the effectiveness of the survey methods. This analysis will guide the modification of the protocol prior to a second season in 2009.

E. A preliminary analysis and summary of data collected.

Grassland birds

79 points were surveyed twice following the described protocol by two observers in New York during the 2008 field season (see Figure 1 for the distribution of the survey points in the New York focus areas). The points were equally distributed between applicants to the Landowner Incentive Program (both enrolled and unfunded applicants) and randomly selected habitat patches (>50 ha). All the targeted grassland bird species were encountered other than Henslow's Sparrow (nearly extirpated as a breeder in NY) and Short-eared Owl (extirpated as a breeder but winters in New York).

The most common grassland bird encountered was Bobolink, and the relative abundance of this species (along with their frequent aerial displays) occasionally overwhelmed the ability of the observers to fully implement the detection history and distance sampling aspects of the survey protocol (along with frustrating even skilled observers). A full analysis is underway to determine the usefulness of the modeling afforded by this protocol, but some modifications will likely be necessary. Data have been transferred to Frank Rivera at Patuxent and he is the process of analyzing them. However, below is the methodology we are undertaking and also recommend for future statistical analyses.

We will combine distance and repeated sampling for parameter estimation and modeling (Buckland 2001, 2004; Royle and Dorazio 2008). Conventional and multiple covariate distance sampling will be used to estimate detection probability, density, and abundance of grassland birds across points. Following Royle and Dorazio (2008), distance sampling will be extended to estimate density at point level. For comparison, repeated sampling with covariates will be used to estimate detection, abundance (lambda) and density (lambda/area) at point level using mixture models (e.g., Royle-Nichols abundance-induced heterogeneity and Royle repeated count models).

Abundance and detection can be affected by similar or different covariates. We will study the effect of factor and continuous covariates, such as observer, habitat type, time of day, date, and form of detection (Marques et al. 2007, Kéry 2008), and will use an information-

theoretic approach for model selection and inference (Burnham and Anderson 1998). Classical and Bayesian frameworks will be combined for data analysis. Data analyses conducted for grassland birds will replicate analyses conducted for high-elevation forest birds to refine and standardize survey protocol. Improvements to survey design and counting methods will add credibility to point-count data generated by monitoring programs as part of the Northeast Coordinated Bird Monitoring Partnership.

Implementation of a spatially-balanced sample design for grassland birds met serious hurdles, which ultimately frustrated its full development for the 2008 field season. The primary obstacles included issues with compatibility among nominally user-friendly applications designed to facilitate the process, and the scope at which the process was attempted. Due to the ephemeral nature of grassland habitat in agriculture dominated landscapes, along with inherent issues with accuracy of the available landcover data used to predict the location of suitable habitat, much area is included in the dataset that has limited probability of being classified as true habitat, resulting in extremely large data files, and requires extremely large amounts of processing time when running the applications at the scale attempted.

Additional expertise has been recruited for the 2009 field season, and additional refinements to the current standards for a spatially-balanced sampling design hold promise for a smoother process.

Golden-winged Warbler (from Rosenberg et al. 2008)

From both technical and biological perspectives, developing and implementing a spatially balanced sampling design for an occupancy-based monitoring scheme proved difficult. From the technical perspective, there were compatibility issues between the modeling software (RRQRR) and various forms of GIS software. RRQRR was originally developed for ArcMap 9.1 and later adapted to work with ArcMap 9.2; however, it is not compatible with other ESRI products, such as ArcView or earlier versions of ArcMap. Furthermore, the current RRQRR version designed to run with ArcMap 9.2 still has major glitches, which negatively impact usability. In addition, RRQRR does not recognize some GIS map projections. Unfortunately, the most complete and up to date landscape data that we had available to us was in a projection (Lambert Conical) that was incompatible with RRQRR.

From the biological perspective, there are issues related to the types of habitat that golden-wings use and the availability of useful remotely sensed data. GWWA use early successional habitat of various types, such as regenerating clear cuts, shrubby fields, and powerline rights-of-way. Within and among these habitats, it's not clear what differentiates high quality sites from areas of lesser value. In addition, due to ecological succession, these early successional habitats are dynamic, causing the suitability of areas to change over short periods (3-5 years) of time. Spatially balanced sampling designs require an accurate probability layer composed of known physical and habitat characteristics to select sampling locations with varying ability to support the target species (in this case, golden-wing). Acquiring, interpreting, and synthesizing appropriate and recent habitat data to develop the probability layer is non-trivial and might be impossible for some states where these landscape-level data sets do not exist.

Despite these challenges, again in 2009 we plan test a version of spatially balanced sampling in Pennsylvania and perhaps other locations. During winter 2008/09 we will work to remedy the problems described above.

3. Support

Support for this project was provided by the American Bird Conservancy through the NE CBM Survey Design and Implementation Fund and the Sport Fish and Wildlife Restoration Programs of the U.S. Fish and Wildlife Service, the monitoring component of Audubon New York's contract with the NYSDEC's Landowner Incentive Program, the USFWS Neotropical Migratory Bird Conservation Act grant program, and donors and supporters of Audubon New York's mission to conserve birds and their habitats.

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Appendix A – 2008 Datasheet used in New York

NECBM Grassland Bird Monitoring Program
2008 Data Collection Sheet

Distance from trail/road:

Observer: UTMs Easting:

Location: Northing:

Point #: Visit: 1st 2nd Date: Datum:
e.g. WGS1984

Precipitation: None Fog* Mist Light rain* Heavy Rain* (*outside prescription for survey)

Wind: 0 1-5 6-10 >10* Temp:

Cloud cover: 0% 1-15% 16-40% 41-75% 76- 90% 91-100%

Time started:

Detection codes:
0 - undetected 1 - seen only 2 - singing only
3 - seen and heard 4 - calling/chipping only
or
0 - undetected 1 - seen only 2 - singing only
3 - seen and heard 4 - calling/chipping only

	Species	Distance	Minutes 1-3	4-5	6	7	8	9	10	Breeding behaviors (code)
ex.	*SAVS*	*47*	*0*	*2*	*3*	*3*	*2*	*0*	*1*	*F*
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

N - carrying nesting material
F - carrying food
G - carrying egg fragments
S - carrying fecal sack
L - local young

Note: Ignore BOBO and SAVS >100 m unless none detected <100 m

1) Habitat disturbed (e.g. mowed/hayed) during breeding season: Yes No
1a) If yes, % disturbed: 1-25% 26-50% 51-75% 76-100%

2) Point landuse: Cons. Grass Hayfield Pasture Fallow RowCrop Seed Crop
Open Space/Park Successional (~ >25% shrub cover)

3) Vegetation (Ignore the following fields when more rigorous sampling will be occurring):

Vegetation height: % Grass Dominant Grass:

Litter depth: % Forb Dominant Forb:

Shrub cover: Nearest: Averaged Height/Density (Robel Pole):

(7/1/2008)