

**Priority grassland bird distribution and abundance in
Illinois, Indiana, Kentucky, and Tennessee, with a special
emphasis on Henslow's Sparrow**

Annual Report 2008



photo by R. Schaefer

Tiffany Beachy
David A. Buehler

University of Tennessee, Knoxville
Department of Forestry, Wildlife and Fisheries

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INTRODUCTION

Grassland birds are experiencing some of the greatest population declines of any group North American birds (Peterjohn and Sauer 1999). This decline has been evidenced by data from the Breeding Bird Survey (BBS), a continent-wide survey initiated in 1966. Nine out of fourteen grassland species that occur east of the Mississippi River declined more than 2% per year between 1966 and 1994 (Askins 1999). Additionally, 61% of grassland breeding species in North America experienced a significant negative trend during the period from 1966-2007 (Sauer et al. 2008). Grassland-nesting species appeared to fare better in recent years (2002-2003, Pardieck and Sauer 2007), but several of the species are still experiencing rapidly declining populations (Sauer et al. 2008).

This decline may be caused by loss or alteration of breeding habitat due to succession of grassland or scrubland to forest, intensification of agriculture or mowing, lack of management by fire, range deterioration, or increased human development (Askins 1993, Herkert et al. 1996, Peterjohn and Sauer 1999, Moss 1999, Brennan and Kuvlesky 2005). The tallgrass prairie that once existed east of the Missouri River is now considered a critically endangered ecosystem because it has declined by 99% (Noss et al. 1995). The native prairie that historically covered over 100,000 km² in Illinois now encompasses 10.4 km² (Mlot 1990). Grassland and early successional ecosystems require regular disturbance (e.g. fire or grazing) or directed management to be maintained (Askins et al. 2007).

One of the most well-known and economically important species occupying this ecosystem is the Northern Bobwhite (*Colinus virginianus*, Brennan 1999). The Southeast

Quail Study Group Technical Committee and the Northern Bobwhite Conservation Initiative (NBCI) were formed to discuss and implement habitat management options to benefit the species (Dimmick et al. 2002). It became apparent that other early successional species that are also experiencing population declines may be affected by, and could potentially benefit from, management conducted by NBCI (Giocomo and Buehler 2007, unpub. data). Giocomo and Buehler (2007) identified priority grassland and scrub-shrub species that may be affected by habitat management conducted by NBCI, and used focal areas (counties) identified by the Central Hardwoods BCR Joint Venture to conduct remote analyses on species population goals and habitat area requirements. These counties were initially identified due to their location in proximity to high priority Northern Bobwhite conservation areas in the Central Hardwoods BCR predicted by W. Burger and others (unpub. data).

One of the greatest limitations Giocomo and Buehler (2007) encountered when gathering bird population information was the lack of fine-scale data on a level smaller than a few counties. This occurred because the most reliable source of population information available comes from BBS routes, which often span more than one county and do not adequately cover all open-area habitats within a region. For this reason, BBS data are insufficient at the county scale to determine population trends and distribution for priority grassland birds.

This project is therefore an effort to develop an adequate and readily repeatable methodology for surveying the available early successional habitat across the Central Hardwoods BCR in an attempt to document priority grassland bird species' distributions and habitat associations. Another advantage to working at the county scale is the

availability of agriculture census data from the USDA that is maintained at the county level. Because open areas are in a constant state of change, it is useful to keep track of the amount of certain habitat types available across a county. Our goal after development of the monitoring program is to have state wildlife personnel and other cooperators conduct the field work annually to monitor habitat availability and population trends of the priority grassland and scrub-shrub species.

Henslow's Sparrow population status and research objectives

The Henslow's Sparrow (*Ammodramus henslowii*) is one of the most rapidly declining grassland species in North America, with an adjusted annual rate of decline of -3.84% / year from 1966-2007 (Sauer et al. 2008). Their population has decreased by an estimated 91% since the beginning of the BBS (Peterjohn and Sauer 1999, Sauer et al. 2008). Henslow's Sparrows are listed as a species of management concern by the U.S. Fish and Wildlife Service (USFWS), and they were given a high priority score by the Southeast Partners in Flight (PIF, 27/30, Ford et al. 2000).

A pilot project initiated by D. A. Buehler and J. J. Giocomo to test the effectiveness of an atlas project for Henslow's Sparrows and other grassland birds proved successful in 2006 (Giocomo and Buehler 2006). Six volunteer observers reported Henslow's Sparrows in five counties where no historic records existed previously (4 in Tennessee and 1 in Kentucky). The current project was therefore initiated in 2008 to document the distribution and range of possible breeding habitats of Henslow's Sparrows and other priority grassland species across the Central Hardwoods BCR. From the location information, we will be able to build a landscape model incorporating satellite-

derived habitat information to model habitat at the regional scale. The information from the sites without Henslow's Sparrows would allow us to build a presence-absence model to further discriminate habitat needs. Because we collected presence and abundance information for a suite of priority grassland birds, we will be able to build landscape-and local-scale habitat models for those species as well.

PROJECT OBJECTIVES

- 1) Develop and implement a large-scale atlas project for Henslow's Sparrows and other priority grassland birds. This project initially focused on parts of Illinois, Indiana, Kentucky, and Tennessee in the Central Hardwoods Bird Conservation Region (BCR 24) in year 1, but will be expanded to cover other regions in year 2 based on the availability of willing partners.
- 2) Develop a pilot monitoring protocol that will document Henslow's Sparrow and other priority grassland bird occurrence and relate the occurrence to agricultural land use classes.

STUDY AREA

We surveyed a broad region within the Central Hardwoods BCR, including parts of middle Tennessee, western Kentucky, southern Indiana, and southern Illinois.

Counties were considered the experimental units. We surveyed nine counties in Tennessee (Coffee, Franklin, Giles, Lawrence, Lincoln [1 route], Maury, Montgomery, Robertson, Sumner), eight counties in Kentucky (Breckinridge, Butler, Hart, Livingston, Logan, Ohio, Warren, Webster), and four counties in Indiana (Orange, Ripley, Sullivan,

Warrick) and Illinois (Franklin, Hamilton, Jackson, White) for a total of 25 counties in four states (Table 1¹).

Henslow's Sparrow historical distribution in the study area

In Illinois, the BBS yielded a total of 71 individual Henslow's Sparrows since the survey began in 1966, with 29 of those being recorded in the last five years (2003-2007). They were found on 16 different routes (of an average 61 routes per year in the state) in 15 counties: Bureau, Calhoun, Christian, Henderson, Henry, Jo Daviess, Lee, Livingston, Marion, Ogle, Pope, Tazewell, Vermilion, Will, and Winnebago.

In Indiana, the BBS reported 307 individuals since 1966, with 110 of these having been recorded in the last five years. They were found on 28 different routes (of an average of 30 routes per year in the state) in 25 counties: Benton, Clay, Delaware, Dubois, Franklin, Hamilton, Harrison, Jackson, Kosciusko, Lake, Lawrence, Martin, Newton, Owen, Porter, Rush, Scott, Shelby, Starke, Steuben, Vanderburgh, Vigo, Warrick, Washington, and White.

In Kentucky, the BBS reported 97 individuals since 1966, with 47 of those being recorded in the last five years. They were found on 14 different routes (of an average of 29 routes per year in the state) in the following 12 counties: Anderson, Calloway, Grayson, Hardin, Livingston, Monroe, Muhlenburg, Oldham, Shelby, Taylor, Webster, and Woodford. Henslow's Sparrows are considered locally distributed summer residents in Kentucky (Palmer-Ball 1996). Historical records indicate that they have been found in the following areas: Boone, Clinton, Jefferson and Oldham counties, east to Carter,

¹ All tables and figures located in the Appendix

Lewis and Morgan counties, west to Crittenden and Caldwell counties (Palmer-Ball 1996). The largest colony, made up of 6 singing males, was found in Pendleton county.

The BBS records indicated that no Henslow's Sparrows were recorded in Tennessee from 1966-2007. Historic records report sporadic sightings in Roane county (1957) and Cheatham county (1994, Nicholson 1997). Breeding individuals were discovered on Fort Campbell Military Reservation in the late 1990's (Moss 2001).

METHODS

Monitoring protocol

We identified counties in each state according to the focal counties used for Northern Bobwhite conservation monitoring by NBCI. Within each of the counties, we randomly located five 25-mile routes along rural roads that cross appropriate open land habitats. In this way, we were able to opportunistically sample the available open areas in the focal counties.

Field work was conducted from mid-May 2008 through mid-July 2008. We began surveys about 30 minutes before local sunrise and continued until five hours later. We recorded GPS locations for each starting location and all points along the route, using Decimal Degrees in the WGS84 Datum. We recorded sky conditions and wind velocity at each point using the scales employed by the BBS. All routes were marked clearly on a state DeLorme Atlas for use in following years.

We conducted 5-minute point counts (divided into 5 one-minute intervals) every ½ mile along the route. If any point had less than 50% open, suitable habitat, it was skipped and another point was established as soon as there was an area with greater than

50% open habitat. An average day yielded about 30 point counts along a route about 15-25 miles in length. Some routes had fewer suitable points because they were located in more forested or developed sections of a county. We limited observations to the following priority grassland birds to facilitate use of a more rigorous and complex sampling protocol (described below): Bachman's Sparrow (*Aimophila aestivalis*, BACS), Blue-winged Warbler (*Vermivora pinus*, BWWA), Dickcissel (*Spiza americana*, DICK), Field Sparrow (*Spizella pusilla*, FISP), Grasshopper Sparrow (*Ammodramus savannarum*, GRSP), Henslow's Sparrow (HESP), Prairie Warbler (*Dendroica discolor*, PRAW), and Northern Bobwhite Quail (NOBO).

We recorded the American Ornithologists' Union's (AOU) 4-letter code for each species observed during the count (indicated above). Rather than practicing removal sampling, where each individual is only recorded during the first time interval that it is observed, we decided to track the presence or absence of each individual during each 1-minute time interval. This yields a history of five 0's (absences) or 1's (presences) for each individual observed during a count. For example, if a Henslow's Sparrow is observed singing during the first, third, fourth and fifth minutes of the count, its encounter history would be: 1 0 1 1 1. This method better enables us to examine detection probabilities. We plan to analyze these data in Program MARK.

We recorded how each individual was first detected: either by auditory (A) or visual (V) cues, or as a flyover (F). We also recorded the distance band within which each bird was first detected: 0-25 m, 25-50 m, 50-100 m, 100-250 m, 250-500 m. We used laser rangefinders to check distance estimation.

If the bird was located within 100 m of the point center, we recorded the habitat type where it was first observed, using a series of three habitat type columns (habitat types described in Table 2). If the bird was first detected within a homogenous habitat type (e.g. in the middle of a pasture), only Habitat column 1 was filled in with the appropriate abbreviation. A homogenous habitat has > 70% cover of the vegetation type in question. If the bird was located in an edge, fencerow, isolated patch or roadside habitat (e.g. fencerow with pasture on one side and corn field on the other), then Habitat columns 1-3 were filled in according to the following guidelines:

1. Use the three habitat columns provided, recording 'fencerow' for Habitat 1, and pasture and corn for Hab. 2 and 3.
2. Birds should be considered within an edge, fencerow, isolated patch, or roadside if they are observed within 10 meters of that edge/fencerow/patch/roadside.
3. Only record the fencerow as a separate habitat type if the habitat changes significantly on either side of the fence, or if there is a great amount of vegetation growing beside the fence. (e.g. A FISP sitting on a fence with uniform cornfields on both sides is not considered to be in a 'fencerow.').
 - a. For roadside birds, record the adjacent habitat type (past 10 m) on the same side of the road for Hab. 2, and record the adjacent habitat type on the other side of the road (past 10 m) as Hab. 3.
 - b. For roadsides where a fence runs parallel to the road, count birds within 10 m of the road as being in the roadside habitat type, disregarding the fence.

- c. For birds in an isolated patch (usually forest within an open field), record isolated patch as Hab. 1, indicate the habitat type that creates the isolated patch for Hab. 2, and record the surrounding habitat for Hab. 3.
- d. An Edge must be a major change between habitat types, where the habitat changes from suitable open area to a less suitable, more closed area, such as a forest or young forest. Edges will usually be linear in shape (running along the border of a field).
 1. Within one point count, record each edge type where birds are observed as Edge 1 (ED1), Edge 2 (ED2), or Edge 3 (ED3).
 2. Write ED1 (or ED2 or 3 if it is a new edge type for that point) in the Hab. 1 column. Record the adjacent habitat types in Hab. 2 and 3 (including the habitat type that is creating the edge).
 3. Record the percent cover of each edge type in the Edge type box at the bottom of the datasheet whether or not a bird was observed in that habitat. This value includes the area encompassed by the 10m-wide area that stretches into the suitable habitat and the 10m-wide area that reaches into the edge habitat. Specify the type of edge it is.
 1. If, after estimating the percent cover of edge habitat, there is remaining cover of the edge type within the 100-m radius circle (e.g. forest), estimate the remaining forest cover outside the 10 m edge area and record your estimate in the forest habitat type category.

The available habitat types at each point were recorded by estimating the percent cover of each habitat type within a 100-m radius of the point center. We always recorded 10% for the roadside category, unless a second road intersected the survey road within 100 m. For fencerows, edges, and isolated patches, we estimated the percent cover by incorporating the area 10 m on either side of the fence or edge. By recording habitat associations of birds observed within 100 m, we were able to compare bird habitat use with habitat availability at each point.

In addition to the observations recorded for each of the focal species, we also noted the presence of the following priority grassland birds: American Kestrel (*Falco sparverius*, AMKE), Bell's vireo (*Vireo bellii*, BEVI), Bewick's wren (*Thryomanes bewickii*, BEWR), Bobolink (*Dolichonyx oryzivorus*, BOBO), Eastern Kingbird (*Tyrannus tyrannus*, EAKI), Eastern Meadowlark (*Sturnella magna*, EAME), Lark Sparrow (*Chondestes grammacus*, LASP), Loggerhead Shrike (*Lanius ludovicianus*, LOSH), Northern Harrier (*Circus cyaneus*, NOHA), Savannah Sparrow (*Passerculus sandwichensis*, SAVS), Short-eared Owl (*Asio flammeus*, SEOW), Sedge Wren (*Cistothorus platensis*, SEWR), Vesper Sparrow (*Pooecetes gramineus*, VESP), and Willow Flycatcher (*Empidonax traillii*, WIFL).

Atlas protocol

After the point count survey was completed each morning, the route was re-traced to search for potential habitat for the following priority species: Bachman's Sparrow, Henslow's Sparrow, Grasshopper Sparrow, Lark Sparrow, Loggerhead Shrike, Bewick's Wren, Northern Harrier, and Short-eared Owl. Stops were made only at locations where

a point count did not occur earlier that day; GPS points were taken at each location. Sometimes additional roads in the area were explored in search of suitable habitat.

The observer listened and scanned the area for several minutes, recording the presence of any of the target species. If a target species was discovered, the observer recorded the time, total number of males, females, and individuals of unknown sex, the habitat type that the first individual of each species observed was utilizing, and the behavior that was most supportive of the presence of breeding individuals. These behaviors included, in increasing order of importance to indicate breeding: auditory, visual, adult with nesting material, adult carrying food, active nest, chicks in a nest, and fledglings.

If no Henslow's Sparrows, Bachman's Sparrows, or Grasshopper Sparrows were encountered, the observer used playback equipment to broadcast the songs of each of these species. Each song was played repeatedly for 2 minutes, with a 1-3 minute pause between songs to listen for a response.

RESULTS

Point Counts

The protocol for the roadside point counts was successfully implemented in Illinois, Indiana, Kentucky, and Tennessee during May-July 2008. One observer worked in Illinois and Indiana (R. Schaefer), one observer worked in Kentucky (A. West), and three observers worked in Tennessee (T. Beachy, D. Moss, M. Welton). We completed a total of 122 surveys in 25 counties across the four states, averaging 28.8 point counts per route, yielding >3500 point counts.

Of the target species, we never encountered a Bachman's Sparrow during a point count and we rarely observed Blue-winged Warblers and Loggerhead Shrikes (Table 3). The species observed most often was the Field Sparrow, with 3087 individual records. We found 108 Henslow's Sparrows during the point count surveys; the majority of these individuals were encountered in Kentucky (45, or 41.7%). Additionally, we observed 169 Prairie Warblers, 512 Grasshopper Sparrows, 1554 Northern Bobwhite Quail, and 1659 Dickcissels. There were 694 point count locations where none of the target species were observed during the 5-minute count. More individuals of all species combined were observed in Kentucky; the fewest individuals overall were observed in Indiana (Figure 1).

The distribution and prevalence of the various land uses in open areas differed from state to state (Table 4). In Illinois, the dominant land cover type was fallow fields ($16.52\% \pm 1.22$, 95% CI). The dominant land cover type in Indiana was corn ($15.2\% \pm 1.49$, 95% CI). In Kentucky, the most common land cover type consisted pasture and hayfields dominated by a mixture of cool season grasses and forbs ($19.74\% \pm 1, 95$, 95% CI). In Tennessee, there was more pasture than other land use types ($15.9\% \pm 0.96$, 95% CI). When combined across the four states, the most common land cover type, aside from the roadside habitat ($10.81\% \pm 0.05$, 95% CI), included areas with a mixture of cool season grasses and forbs ($10.22\% \pm 0.45$, 95% CI). We encountered no cotton and little sorghum or tobacco across the study area.

The coverage of each land use type where the target species occurred also differed (Table 5). Dickcissels were found in areas with a great percentage of fallow fields ($12.57\% \pm 1.49$, 95% CI). Field Sparrows tended to be found in areas that had fields with a mixture of cool season grasses and forbs ($10.5\% \pm 1.53$, 95% CI). Grasshopper

Sparrows occurred in areas with a greater percentage of mowed fields ($10.76\% \pm 1.92$, 95% CI). Henslow's Sparrows occurred in areas dominated by cool season grass fields ($21.6\% \pm 5.92$, 95% CI). Areas where Northern Bobwhites were found were characterized by fields with a mixture of cool season grasses and forbs ($10.64\% \pm 2.88$, 95% CI). Prairie Warblers occurred in areas where a great percentage of the land cover was scrub-shrub ($19.44\% \pm 6.53$, 95% CI).

The target species used the various habitat types differently according to their availability across the study area (Table 6). The proportion of individuals of a species observed in each habitat type was compared to the average (\pm 95% CI) amount of each habitat type available where the species was found and across the study area. In this way, we were able to describe species habitat selection at two spatial scales. Strong positive responses can be implied from greater numbers of individuals of a species that were observed in a certain habitat type, while strong negative responses can be implied from fewer numbers of individuals observed in a certain cover type. For example, Dickcissels were observed in roadside habitat ($n = 287$), cool season grass fields ($n = 93$), and old fields ($n = 44$) proportionally more than they were available. At the same time, they appeared to select against forest ($n = 3$) and young forest ($n = 2$), using them proportionally less than they were available. Field Sparrows appeared to select for roadside habitat ($n = 117$) and fencerows ($n = 77$). They appeared to select against crop fields where the 'no till' practice was implemented ($n = 2$). Grasshopper Sparrows used pasture ($n = 91$) and mowed fields ($n = 62$) proportionally more than they were available and appeared to select against some of the row crops and areas with trees, such as forest, woodland and riparian areas ($n = 0$). Henslow's Sparrows were observed using fields

with a mixture of native warm season grasses and cool season grasses (n= 19) and fields with a mixture of cool season grasses and forbs (n = 13) more than they were available. They appeared to select against some of the row crops, mowed fields, and most areas with trees (n = 0). Northern Bobwhites were observed using roadsides (n = 40) and fields dominated by cool season grasses (n = 27) more than they were available. They tended to select against plowed fields, riparian areas, and young forests (n = 0). Prairie Warblers seemed to select for scrub shrub areas (n = 20) and edge habitat (n = 10) while appearing to select against almost every other habitat type that was not associated with woody cover (n = 0). All priority species selected against urban areas, using them proportionally less than they were available.

Of the additional priority species of interest, we found mostly Eastern Kingbirds and Eastern Meadowlarks. In Illinois, Eastern Kingbirds were observed at 4.1% of the points and Eastern Meadowlarks were observed at 56.3% of the points. Of the other priority species, one American Kestrel, three Willow Flycatchers, two Bobolinks, and one Savannah Sparrow were observed. In Indiana, Eastern Kingbirds were observed at 10.4% of the points and Eastern Meadowlarks were observed at 49.9% of the points. Six American Kestrels, one Bobolink and one Savannah Sparrow were recorded in Indiana. In Kentucky, Eastern Kingbirds were observed at 17.2% of the points and Eastern Meadowlarks were observed at 41.8% of the points. Six American Kestrels and one Bobolink were observed in Kentucky. In Tennessee, American Kestrels were observed at 2.1% of the points, Eastern Kingbirds were recorded at 20.3% of the points, and Eastern Meadowlarks were observed at 42.3% of the points. Two Willow flycatchers were recorded in Tennessee.

Atlas Results

The atlas effort yielded the only locations for Bachman's Sparrow (2) and additional locations for Grasshopper Sparrow (n = 166), Henslow's Sparrow (n = 48) and Loggerhead Shrike (n = 7) (Table 7).

Henslow's Sparrow Distribution

This project was able to successfully document the presence of breeding Henslow's Sparrows in a number of new counties across the study area where they were previously unrecorded (Figure 2). We found them to be present in four new counties in Illinois: Franklin, Hamilton, Jackson, and White (Figure 3). We found them in two new counties in Indiana: Orange and Sullivan (Figure 4). We observed them in five new counties in Kentucky: Breckinridge, Butler, Hart, Logan, and Ohio (Figure 5). We recorded them in three new counties in Tennessee: Coffee, Lawrence, and Robertson (Figure 6).

DISCUSSION

This report represents a preliminary summary of the data collected. We have not completed an in-depth analysis of the protocol to address specific questions about optimization of protocol design. We were able to successfully implement both the monitoring and atlas protocols during the breeding season of 2008 with only a 3-person team. At the outset, concerns were raised about whether it would be possible to complete the point-count protocol and keep up with all of the individual birds across five consecutive 1-minute intervals. Because the target list of species was limited and because

the number of target individuals present at any one point was also limited, the protocol was successfully accomplished. Implementation of the protocol on wildlife management areas with more target species and individuals present may be more difficult. One solution would be to divide the species list up and conduct two consecutive counts if there are too many individuals to monitor at a given point.

Coupled together, the point count and atlas protocols provided an adequate scheme for assessing population trends, habitat associations, and distribution of relatively abundant species like Field Sparrows and rare species like Henslow's Sparrows. Using counties as the experimental unit and stratifying the random placement of routes to encompass available open areas provided a more thorough survey of grassland birds than the traditional, completely random, BBS routes. Many state wildlife agencies work at the county level, so well-trained observers who are familiar with the road systems and species assemblages of their counties will be the ideal workers to carry on this monitoring effort. By continuing this endeavor, we will be able to learn more about the range of suitable breeding areas and habitat requirements of the Henslow's Sparrow and other priority birds, which will enable us to predict target areas for conservation and management recommendations.

By working together to satisfy the habitat needs of Northern Bobwhite, the Henslow's Sparrow and other early successional birds, the Central Hardwoods Bird Conservation Region (BCR) Joint Venture can come closer to accomplishing its goal of promoting the 'full spectrum of bird conservation' (Fitzgerald et al. 2003). Our research is also consistent with the USFWS's stated approach to conservation priorities "...by focusing first on species assemblages and identifying those areas where their ecological

needs come together (USFWS 2002).” Through our atlas, we are “provid[ing] key information that increases our understanding of limitations to conservation” by identifying demographically limited populations (USFWS 2002). Also, through our atlas efforts we are able to identify areas with high potential for grassland bird conservation to take steps to “overcome key obstacles preventing achievement of [USFWS] desired outcomes,” including “inadequate conservation planning or action” (USFWS 2002).

PLANS FOR 2009

We plan to implement the protocol again in 2009, revisiting some of the same counties that were monitored in 2008 to provide data on annual variation, while expanding the effort to new states (MO, AR, IA). To do this, we will need additional personnel for conducting the monitoring from the cooperating states. In addition, we are seeking potential sources of funding to support a graduate student on the project.

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Table 1: Summary table showing the states and counties surveyed for priority grassland birds during May-July 2008, with the number of routes established per county, the average number of point counts (PC's) conducted per route in each county, the total number of point counts conducted per county, and the total number of point counts conducted per state.

State	County	# Routes	Avg # PC's / route	Total # PC's / county	Total # PC's / state
Illinois	Franklin	5	29.6	148	
	Hamilton	5	26.6	133	
	Jackson	5	28.0	140	
	White	5	27.8	139	560
Indiana	Orange	5	27.2	136	
	Ripley	5	28.6	143	
	Sullivan	5	28.6	143	
	Warrick	5	27.4	137	559
Kentucky	Breckinridge	5	28.6	143	
	Butler	5	28.8	144	
	Hart	5	29.4	147	
	Livingston	5	26.4	132	
	Logan	5	29.4	147	
	Ohio	5	27.8	139	
	Warren	5	29.8	149	
	Webster	5	31.6	158	1159
Tennessee	Coffee	5	30.6	153	
	Franklin	5	29.0	145	
	Giles	5	29.0	145	
	Lawrence	5	30.8	154	
	Lincoln	1	-	-	
	Maury	5	28.4	142	
	Montgomery	6	27.7	166	
	Robertson	5	30.6	153	
	Sumner	5	29.0	145	1235
Total					3513

Table 2: Habitat types used to classify land-use in open areas of Illinois, Indiana, Kentucky, and Tennessee, May-July 2008.

Habitat Code	Habitat Type	Description
CR	Corn	Corn for grain or silage
SO	Soybeans	Soybeans
SG	Sorghum	Sorghum
TO	Tobacco	Tobacco
WO	Wheat/Oats	Winter wheat, oats or other cereal grains
CT	Cotton	Cotton
OC	Other row crop	Other row crop - specify type if known
MF	Mowed field	Unknown grass type because it's too short to tell or any field that has been mowed since May 15
NG	NWSG	Field dominated by native warm season grasses - >70%
CG	Cool season grass field	Un-mowed field dominated by cool season grasses, (e.g. fescue, alfalfa, etc): >70%
GM	Grass mixture	Field with a mixture of 30-70% NWSG, cool season grasses, or forbs
FB	Fescue with forbs	Field with a mixture of 30-70% fescue (or other cool season grass) and forbs
PA	Pasture	Active pasture for livestock
FF	Fallow field	Fallow this year, typically in grasses and forbs
OF	Old field	Field left abandoned undergoing succession (at least 20% woody invasion), limited saplings, often with blackberry, thistle, etc.
SC	Scrub-Shrub	Abandoned fields that are dominated by woody saplings and shrubs – at least 50% woody invasion
PL	Plowed field	Field with bare ground showing, no crops identifiable yet
NT	No till	Field where the 'no till' method is implemented - sprayed grasses and forbs where a crop is planted w/o plowing
FO	Forest	Mature forest with closed canopy, well-developed under and midstory
WD	Woodland	Not quite a savannah, more forested (~50% canopy cover); widely spaced trees with significant understory
SV	Savannah	Rare habitat type; widely-spaced trees with grass and scrub in between
YF	Young forest	Area dominated by dense saplings – looks like a regenerating clearcut
CD	Cedar glade	Cedars surrounded by grasses and scrub
IP	Isolated patch	Isolated patch of habitat within an otherwise homogenous setting - e.g. woodlot, scrub-shrub island in a corn field or NWSG field - include birds in this category if they are w/in 10 m of an IP
NB	NWSG field buffer	Field buffer planted in NWSG – usually for CP33

Table 2 continued

Habitat Code	Habitat Type	Description
UR	Urban/developed	Residential area, small town, rural houses and barns, etc.
RI	Riparian	Forested zone surrounding a creek or river; treat riparian areas as a fencerow
FE	Fencerow	Fencerow b/w two fields with significant vegetation surrounding it (not just a fence with nothing growing around it) – include 10 m on either side of the fence
ED1-3	Edge	Major, linear edge between two completely different habitat types where the habitat changes from ‘suitable’ to ‘unsuitable’ – e.g. between row crop and forest – include 10 m into the suitable habitat and 10 m into the unsuitable habitat
RD	Roadside	Includes 10 m on either side of the road; include intersecting roads if significant vegetation is growing beside the road because of the presence of the road (includes dirt farm roads, etc.)
OT	Other	Indicate in the comments what this habitat type is. (e.g. farm pond)

Table 3: Summary data for the point counts for priority grassland birds in Illinois, Indiana, Kentucky, and Tennessee, May-July 2008. Species codes are defined in the text. 'NONE' indicates point count locations where no species were observed.

State	BWWA	DICK	FISP	GRSP	HESP	LOSH	NOBO	PRAW	NONE
IL	1	813	247	146	17	0	369	0	50
IN	0	174	356	67	24	0	231	16	136
KY	0	442	992	173	45	0	599	131	244
TN	2	230	1492	126	22	3	355	22	264
Total	3	1659	3087	512	108	3	1554	169	694

Table 5: Mean percent cover of each habitat type (with 95% Confidence Intervals) along survey routes in Illinois (IL), Indiana (IN), Kentucky (KY), and Tennessee (TN) and for all states combined during May-July 2008. Compare means and confidence intervals from the combined data to target species habitat use vs. availability (Table 6).

Habitat type	IL	95% CI	IN	95% CI	KY	95% CI	TN	95% CI	Combined	95% CI
Corn	9.41	8.48, 10.34	15.2	13.71, 16.69	9.74	8.98, 10.49	7.69	7.0, 8.39	9.74	9.3, 10.18
Soybeans	4.43	3.75, 5.1	6.65	5.61, 7.7	6.22	5.57, 6.88	2.47	2.07, 2.87	4.72	4.34, 5.04
Sorghum	0	-	0.17	0.02, 0.32	0.21	0.09, 0.32	0	-	0.09	0.05, 0.14
Tobacco	0	-	0	-	0.49	0.36, 0.63	0.29	0.16, 0.41	0.26	0.2, 0.32
Wheat/Oats	10.87	9.88, 11.87	1.94	1.37, 2.52	3.15	2.7, 3.6	5.16	4.56, 5.76	5.27	4.93, 5.61
Cotton	0	-	0	-	0	-	0	-	0	-
Other crop	0.14	0.005, 0.27	0.28	0.07, 0.48	0.08	0.03, 0.13	0.56	0.37, 0.75	0.27	0.2, 0.34
Mowed field	2.67	2.17, 3.16	3.55	2.87, 4.24	9.85	9.13, 10.56	12.9	12.16, 13.67	8.46	8.08, 8.83
Native warm season grass	0.44	0.24, 0.64	0	-	1.88	1.54, 2.23	0	-	0.74	0.61, 0.86
Cool season grass	6.99	6.25, 7.72	5.5	4.71, 6.3	9.65	8.96, 10.33	7.06	6.41, 7.72	7.73	7.36, 8.09
Grass mixture	1.49	1.1, 1.87	1.93	1.27, 2.58	0.54	0.36, 0.71	0.18	0.09, 0.27	0.81	0.67, 0.95
Pasture	5.56	4.88, 6.23	6.94	5.92, 7.97	0.9	0.68, 1.13	15.9	15.0, 16.86	7.41	7.03, 7.8
Cool season grass/forb mix	3.1	2.56, 3.64	4.08	3.36, 4.8	19.74	18.7, 20.74	7.27	6.65, 7.9	10.22	9.77, 10.67
Fallow field	16.52	15.3, 17.74	8.29	7.05, 9.53	2.59	2.19, 3.0	0.71	0.51, 0.9	5.72	5.35, 6.08
Old field	1.7	1.32, 2.07	7.79	6.63, 8.95	0.93	0.68, 1.18	1.36	1.1, 1.65	2.13	1.91, 2.34
Scrub shrub	0.53	0.37, 0.69	0.72	0.47, 0.97	1.78	1.42, 2.13	1.05	0.84, 1.26	1.14	1.0, 1.29
No till	5.34	4.62, 6.12	2.92	2.22, 3.63	1.59	1.27, 1.91	1.1	0.83, 1.36	2.41	2.18, 2.65
Plowed field	6.1	5.34, 6.84	4.02	3.28, 4.77	2.19	1.84, 2.54	0.32	0.19, 0.45	2.68	2.45, 2.91
Forest	3.35	2.89, 3.82	4.3	3.62, 4.99	5.53	5.06, 6.0	4.9	4.48, 5.33	4.71	4.46, 4.96

Table 4. continued

Habitat type	IL	95% CI	IN	95% CI	KY	95% CI	TN	95% CI	Combined	95% CI
Woodland	0.92	0.67, 1.17	1.14	0.78, 1.49	0.73	0.58, 0.88	1.03	0.87, 1.19	0.92	0.82, 1.02
Savannah	0.26	0.15, 0.38	1.17	0.71, 1.62	0.15	0.06, 0.24	0.22	0.09, 0.34	0.33	0.25, 0.41
Young forest	0.64	0.43, 0.84	1.43	1.05, 1.81	0.38	0.26, 0.5	1.75	1.42, 2.09	1	0.87, 1.13
Cedar glade	0.01	-0.004, 0.03	0.19	0.01, 0.37	0	-	0.22	0.12, 0.33	0.1	0.06, 0.14
Riparian	0.59	0.47, 0.7	0.67	0.53, 0.8	0.39	0.3, 0.47	0.72	0.62, 0.83	0.57	0.52, 0.62
Isolated patch	0.26	0.21, 0.3	0.58	0.47, 0.69	0.22	0.17, 0.26	0.41	0.34, 0.48	0.33	0.30, 0.37
Warm season grass buffer	0.003	-0.003, 0.009	0	-	0.26	0.15, 0.37	0	-	0.09	0.05, 0.13
Cool season grass buffer	0.53	0.43, 0.64	0.27	0.16, 0.38	0.53	0.41, 0.65	0.02	0.008, 0.03	0.34	0.29, 0.39
Urban	3.68	3.31, 4.06	5	4.33, 5.66	6.13	5.74, 6.51	11.3	10.64, 11.86	7.07	6.8, 7.34
Fencerow	1.13	0.99, 1.26	0.9	0.75, 1.05	0.86	0.77, 0.95	1.84	1.68, 1.99	1.23	1.16, 1.3
Roadside	11.07	10.93, 11.2	11.3	11.08, 11.42	10.51	10.44, 10.58	10.8	10.7, 10.87	10.81	10.76, 10.86
Other	1.51	1.23, 1.79	1.66	1.3, 2.03	0.7	0.55, 0.85	1.06	0.81, 1.31	1.11	0.99, 1.23
Edge	0.81	0.68, 0.93	1.46	1.28, 1.63	1.81	1.67, 1.96	1.69	1.56, 1.82	1.51	1.44, 1.59

Table 5: Mean percent cover of each habitat type (with 95% Confidence Intervals) at point count locations where target species occurred along survey routes in Illinois (IL), Indiana (IN), Kentucky (KY), and Tennessee (TN) during May-July 2008.

Habitat type	DICK	95% CI	FISP	95% CI	GRSP	95% CI	HESP	95% CI	NOBO	95% CI	PRAW	95% CI
Corn	7.26	6.19, 8.33	7.31	5.9, 8.73	5.21	3.86, 6.56	0.94	-0.06, 1.94	6.2	4.09, 8.3	1.97	0.03, 3.91
Soybeans	3.68	2.8, 4.54	3.25	2.33, 4.17	5.31	3.73, 6.9	1.13	-0.19, 2.44	3.5	1.96, 5.04	0.35	-0.35, 1.05
Sorghum	0.05	-0.047, 0.15	0.07	-0.07, 0.21	0.57	0.07, 1.06	1.13	-0.45, 2.7	0.34	-0.05, 0.73	0	-
Tobacco	0.11	-0.007, 0.23	0.17	-0.02, 0.36	0.26	0.01, 0.51	0.31	-0.31, 0.93	0.22	-0.06, 0.49	0	-
Wheat/Oats	9.34	8.07, 10.6	2.17	1.43, 2.9	4.14	2.85, 5.42	2	0.2, 3.80	8.4	6.07, 10.72	0	-
Cotton	0	-	0	-	0	-	0	-	0	-	0	-
Other crop	0.35	0.1, 0.6	0.2	-0.007, 0.41	0.15	-0.07, 0.37	0	-	0.31	-0.15, 0.78	0	-
Mowed field	4.94	4.12, 5.75	8.69	7.35, 10.0	10.76	8.83, 12.68	3.88	1.53, 6.22	5.12	3.39, 6.85	4.86	1.47, 8.25
Native warm season grass	0.98	0.59, 1.36	1.13	0.59, 1.67	1.59	0.73, 2.44	4.75	1.41, 8.09	1.79	0.63, 2.95	0	-
Cool season grass	8.72	7.59, 9.84	8.97	7.59, 10.34	6.84	5.22, 8.46	21.6	15.6, 27.52	10.14	7.77, 12.5	10.92	6.95, 14.88
Grass mixture	1.69	1.09, 2.29	1.03	0.47, 1.6	2.79	1.6, 4.0	12.8	7.53, 18.02	1.27	0.34, 2.19	0	-
Pasture	8.36	7.14, 9.57	8.3	6.85, 9.74	6.24	4.62, 7.9	7.14	3.58, 10.69	3.44	1.78, 5.11	3.27	0.52, 6.02
Cool season grass/forb mix	8.58	7.28, 9.88	10.5	8.94, 12.03	14.4	12.14, 16.65	12	7.99, 16.01	10.64	7.76, 13.52	10.77	5.84, 15.71
Fallow field	12.57	11.08, 14.06	3.28	2.33, 4.23	8.36	6.32, 10.4	0.25	-0.25, 0.75	9.17	6.31, 12.03	0.35	-0.35, 1.05
Old field	3.41	2.58, 4.24	3.2	2.3, 7.16	1.38	0.65, 2.1	3.63	0.94, 6.31	3.37	1.65, 5.08	7.86	3.38, 12.34
Scrub shrub	0.51	0.27, 0.74	3.11	2.23, 4.0	0.96	0.4, 1.5	0.38	-0.15, 0.9	1.7	0.53, 2.86	19.44	12.9, 25.97
No till	2.59	1.9, 3.28	1.35	0.75, 1.95	5.7	4.06, 7.38	1.13	-1.11, 3.36	2.72	1.29, 4.16	1.2	-0.28, 2.67
Plowed field	4.75	3.92, 5.57	1.41	0.85, 1.96	1.85	1.07, 2.62	0	-	4.58	2.9, 6.26	0.42	-0.42, 1.27

Table 5. continued

Habitat type	DICK	95% CI	FISP	95% CI	GRSP	95% CI	HESP	95% CI	NOBO	95% CI	PRAW	95% CI
Forest	1.47	1.08, 1.86	7.08	6.09, 8.07	2.78	1.93, 3.64	5.69	2.78, 8.6	2.33	1.26, 3.4	14.65	10.55, 18.74
Woodland	0.22	0.1, 0.34	1.44	1.01, 1.86	0.44	0.17, 0.71	1.25	0.24, 2.26	1.35	0.56, 2.15	1.2	-0.33, 2.73
Savannah	0.19	0.03, 0.35	0.79	0.35, 1.22	0.7	0.09, 1.31	2.38	-0.46, 5.21	0.89	0.01, 1.78	0.14	-0.14, 0.42
Young forest	0.73	0.45, 1.0	2.11	1.39, 2.83	0.5	-0.02, 1.02	1.44	-0.82, 3.69	1.35	0.53, 2.18	2.46	0.37, 4.56
Cedar glade	0.12	-0.03, 0.26	0.13	0.004, 0.26	0	-	0	-	0	-	0	-
Riparian	0.41	0.29, 0.54	0.71	0.5, 0.92	0.45	0.26, 0.65	0.44	-0.003, 0.88	0.21	0.03, 0.38	0.14	-0.14, 0.42
Isolated patch	0.37	0.29, 0.45	0.55	0.38, 0.72	0.19	0.1, 0.29	0.09	-0.01, 0.19	0.4	0.21, 0.59	0.14	-0.06, 0.34
Warm season grass buffer	0.24	0.1, 0.38	0.15	-0.06, 0.35	0	-	0	-	0	-	0	-
Cool season grass buffer	0.76	0.56, 0.96	0.21	0.05, 0.37	0.13	0.03, 0.22	0	-	0.27	0.06, 0.47	0	-
Urban	3.81	3.28, 4.35	5.7	4.84, 6.57	4.83	3.88, 5.78	3.94	1.79, 6.09	6.28	4.88, 7.67	2.54	1.26, 3.81
Fencerow	0.86	0.7, 1.0	2.15	1.8, 2.49	0.67	0.46, 0.87	0.38	0.08, 0.67	1.39	0.98, 1.8	1.2	0.49, 1.9
Roadside	11.01	10.83, 11.19	10.56	10.42, 10.7	10.73	10.52, 10.94	10.13	9.96, 10.3	10.98	10.63, 11.32	10.56	10.14, 10.99
Other	1.37	1.02, 1.71	1.3	0.8, 1.8	0.32	0.18, 0.47	0.31	-0.1, 0.72	0.83	0.2, 1.45	1.2	-0.25, 2.65
Edge	0.61	0.48, 0.75	2.98	2.63, 3.33	1.05	0.78, 1.32	1	0.46, 1.54	0.82	0.51, 1.13	4.37	2.82, 5.91

Table 6: Summary of bird habitat use compared with habitat availability across Illinois, Indiana, Kentucky and Tennessee, May-July 2008. Species abbreviations defined in the text. All individuals were observed within 100 m of point center. Column A: Bird habitat use compared with available habitat within 100 m of where the individuals of each species were observed. Column B: Bird habitat use compared with available habitat within 100 m of all survey points. Column n: Number of individuals of each species observed in each habitat type.

- Habitat type used proportionally less than it was available
- 0 Habitat type used in proportion to the amount available
- + Habitat type used proportionally more than it was available

Habitat type	DICK			FISP			GRSP			HESP			NOBO			PRAW		
	A	B	n	A	B	n	A	B	n	A	B	n	A	B	n	A	B	n
Corn	-	-	8	-	-	9	-	-	0	0	-	0	-	-	4	-	-	0
Soybeans	-	-	6	-	-	6	0	-	17	0	-	1	-	-	2	0	-	0
Sorghum	0	-	0	0	-	0	-	-	0	0	-	0	0	-	0	0	-	0
Tobacco	0	-	1	0	-	0	-	-	0	0	-	0	0	-	0	0	-	0
Wheat/Oats	-	0	49	+	-	3	-	-	7	-	-	0	0	+	18	0	-	0
Cotton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other crop	0	-	1	0	-	1	+	+	2	0	-	0	0	+	1	0	-	0
Mowed field	-	-	19	-	-	7	+	+	62	-	-	0	-	-	2	-	-	0
Native warm season grass (NWSG)	+	+	14	0	+	9	+	+	14	+	+	9	0	+	4	0	-	0
Cool season grass	+	+	93	-	-	40	0	-	24	-	-	24	+	+	27	0	-	5
Grass mixture	0	+	17	0	+	6	+	+	23	+	+	19	0	+	4	0	-	0

Table 6. continued

Habitat type	DICK			FISP			GRSP			HESP			NOBO			PRAW		
	A	B	n	A	B	n	A	B	n	A	B	n	A	B	n	A	B	n
Pasture	0	+	80	0	0	47	+	+	91	0	-	3	+	+	20	0	-	3
Cool season grass / forb mixture	0	-	78	-	-	17	-	-	13	+	+	13	-	-	9	-	-	0
Fallow field	-	+	81	0	-	22	+	+	61	0	-	0	0	+	18	0	-	0
Old field	+	+	44	+	+	33	0	0	8	0	+	5	+	+	12	+	+	9
Scrub shrub	0	-	4	+	+	35	0	-	3	0	-	0	0	+	4	+	+	20
No till	-	-	8	-	-	2	+	+	39	0	-	0	-	-	1	0	-	0
Plowed field	-	-	10	0	-	6	-	-	1	0	-	0	-	-	0	0	-	0
Forest	-	-	3	-	-	15	-	-	0	-	-	0	0	-	6	-	-	2
Woodland	0	-	1	0	+	7	-	-	0	-	-	0	0	0	2	0	-	0
Savannah	0	-	2	+	+	12	0	+	2	0	+	2	+	+	4	0	-	0
Young forest	-	-	2	-	0	6	0	-	0	0	-	0	-	-	0	+	+	4
Cedar glade	0	-	0	+	+	3	0	-	0	0	-	0	0	-	0	0	-	0
Riparian	+	+	6	+	+	11	-	-	0	0	-	0	-	-	0	+	+	1
Isolated patch	+	+	13	+	+	16	-	-	0	0	-	0	+	+	2	+	+	1
NWSG buffer	+	+	5	+	+	4	0	-	0	0	-	0	0	-	0	0	-	0
Cool season grass buffer	+	+	15	0	-	1	-	-	0	0	-	0	+	+	1	0	-	0
Urban	-	-	4	-	-	5	-	-	0	-	-	0	-	-	2	-	-	0
Fencerow	+	+	26	+	+	77	-	-	0	-	-	0	+	+	14	+	+	6
Roadside	+	+	287	+	+	117	-	-	28	-	-	3	+	+	40	+	+	8
Other	+	+	25	0	+	8	+	-	2	+	+	1	-	-	0	+	+	2
Edge	+	0	10	+	+	93	-	-	0	-	-	0	+	+	10	+	+	10
Total number of individuals			912			618			397			80			207			71

Table 7: Summary data for the atlas locations for priority grassland birds in Illinois, Indiana, Kentucky, and Tennessee, May-July 2008. Species codes are defined in the text.

State	BACS	GRSP	HESP	LOSH
IL	0	43	4	0
IN	0	31	12	0
KY	0	29	29	0
TN	2	63	3	7
Totals	2	166	48	7

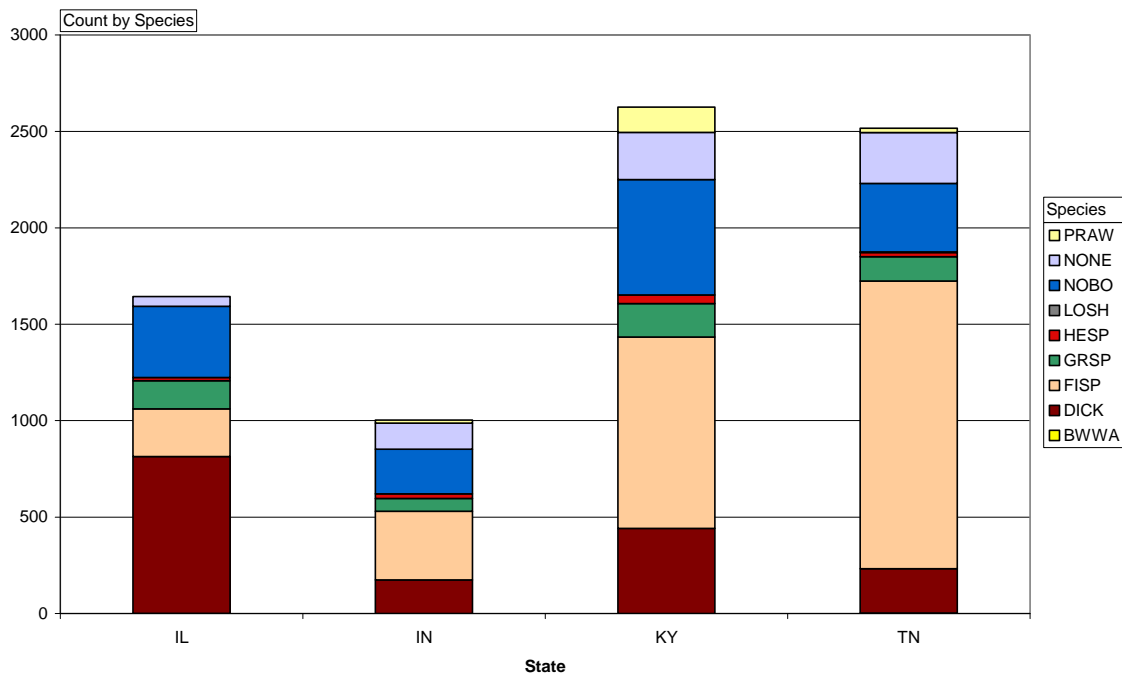


Figure 1: Graph depicting total number and proportion of individuals of priority grassland bird species observed in each state during point counts conducted in Illinois (IL), Indiana (IN), Kentucky (KY), and Tennessee (TN), May-July 2008. Species codes are defined in the text. ‘NONE’ indicates point count locations where no species were observed.

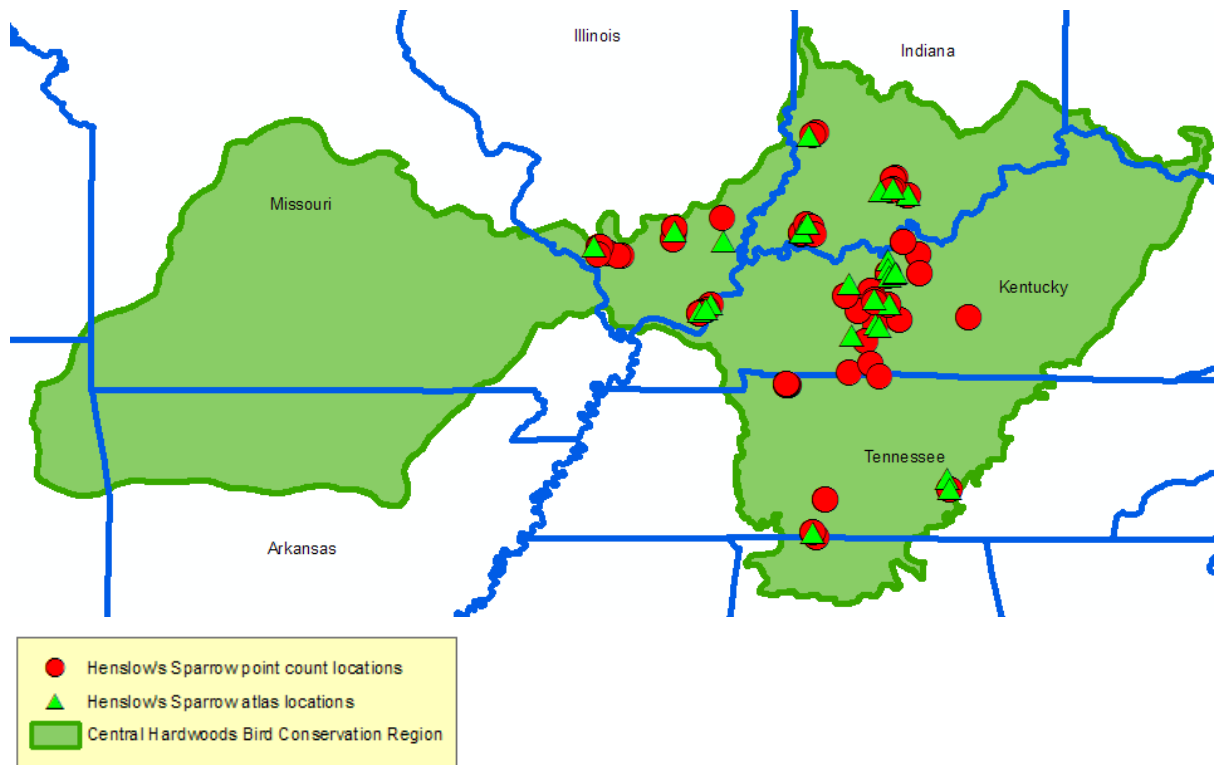


Figure 2: Map showing all Henslow's Sparrow locations recorded in Illinois, Indiana, Kentucky, and Tennessee, May-July 2008.

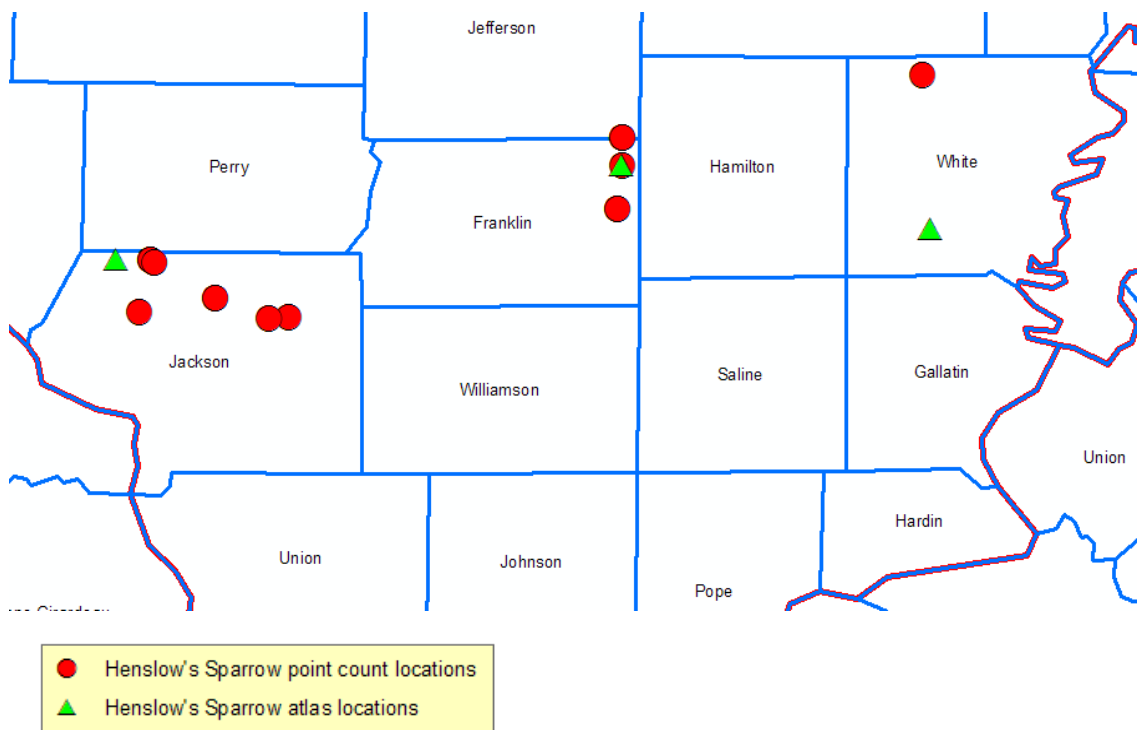


Figure 3: Map showing Henslow's Sparrow locations in Illinois, May-July 2008; counties labeled.

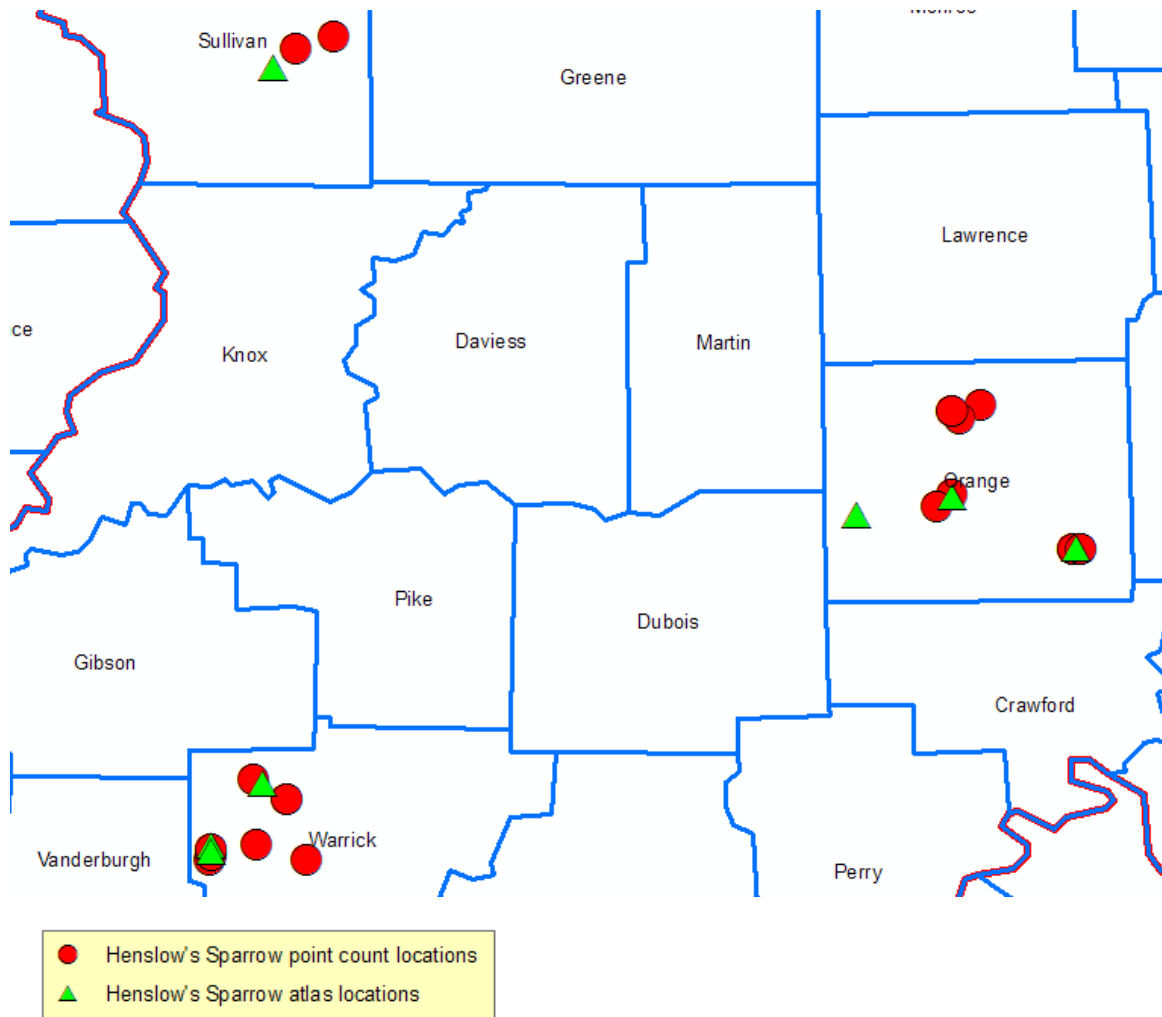


Figure 4: Map showing Henslow's Sparrow locations in Indiana, May-July 2008; counties labeled.

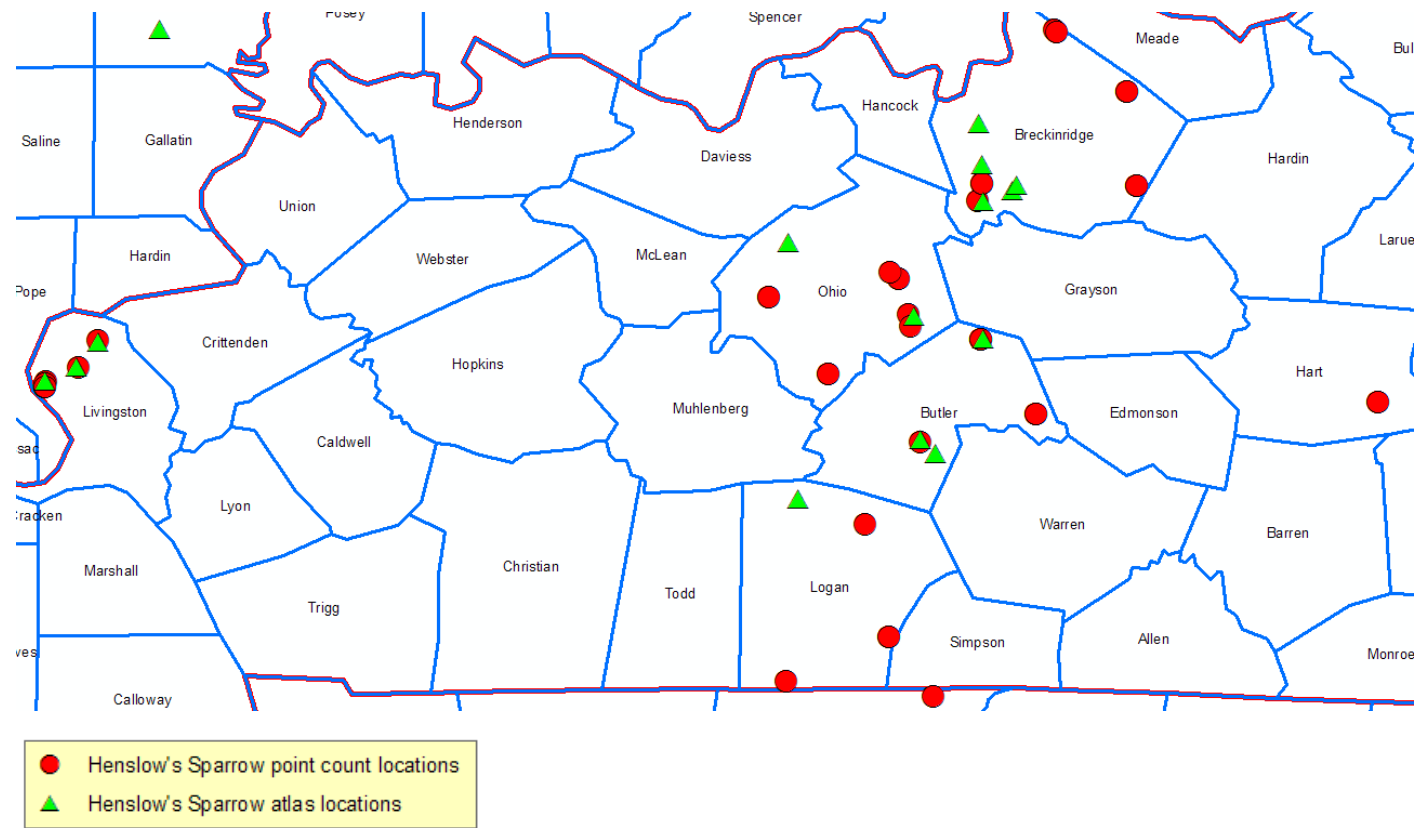


Figure 5: Map showing Henslow's Sparrow locations in Kentucky, May-July 2008; counties labeled.

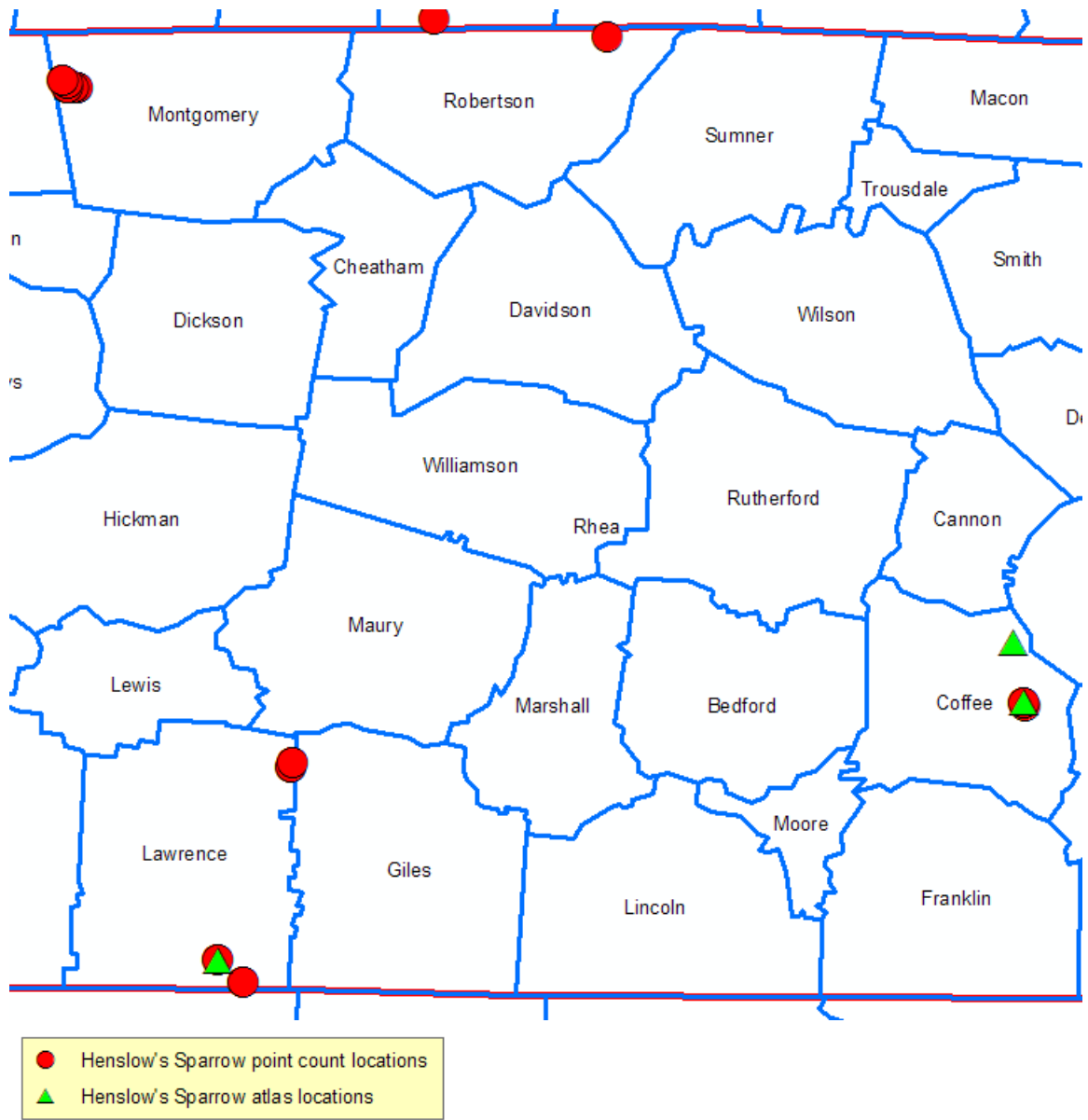


Figure 6: Map showing Henslow's Sparrow locations in Tennessee, May-July 2008; counties labeled.