The Prairie Naturalist
Great Plains Natural Science Society

6-2011

Assessing the Role of Conspecific Attraction in Habitat Restoration for Henslow's Sparrows in Iowa

Jennifer A. Vogel

Rolf R. Koford

David L. Otis

The Prairie Naturalist 43(1/2):23–28; 2011

Assessing the Role of Conspecific Attraction in Habitat Restoration for Henslow's Sparrows in Iowa

JENNIFER A. VOGEL[1], ROLF R. KOFORD, AND DAVID L. OTIS

Department of Natural Resource Ecology and Management, Iowa State University, Ames, IA 50011, USA (JAV)
U.S. Geological Survey, Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University, Ames, IA 50011, USA (RRK, DLO)

ABSTRACT The presence of conspecific individuals may provide important cues about habitat quality for territorial songbirds. We tested the ability of a conspecific song playback system to attract Henslow's sparrows to previously unoccupied restored habitat. We successfully attracted Heslow's sparrows to 3 of 7 treatment plots using conspecific song playbacks and we found no Henslow's sparrows in control plots. The addition of social cues using playback systems in restored grassland habitats may aid conservation efforts of Henslow's sparrows to available habitat.

KEYWORDS *Ammodramus henslowii*, conspecific attraction, Henslow's sparrow, Iowa

Many grassland-bird populations have declined over the past several decades (Knopf 1994, Herkert 1995). The primary factor thought to be associated with declining grassland-bird populations is habitat fragmentation and destruction (Herkert 1995, Fletcher and Koford 2003, Herkert et al. 2003). The tallgrass-prairie region of North America is one of the most endangered ecosystems on Earth (Smith 1981, Noss et al. 1995) and in Iowa, less than 0.01% of the original 12 million hectares of prairie remains (Sampson and Knopf 1994). Loss of habitat over the past century restricted grassland-dependent species to small isolated remnants.

Recent habitat restoration efforts focused on mitigating external environmental threats alone, such as habitat destruction, may not be enough to conserve imperiled songbird species (Ward and Schlossberg 2004, Ahlering and Faaborg 2006). Animal behavior has recently been recognized as playing an important role in species conservation (Ward and Schlossberg 2004, Ahlering and Faaborg 2006). Social information and conspecific attraction may be important for many species. In fact, a recent review found that in 20 out of 24 studies examining conspecific attraction in songbirds, birds were successfully attracted using social cue manipulation (Ahlering et al. 2010).

In territorial songbirds, the presence of conspecific individuals may provide important cues about habitat use. For some bird species, research has demonstrated that settlement decisions are likely influenced by the presence of conspecifics (Danchin et al. 1998, Ward and Schlossberg 2004, Fletcher 2007). Most of these studies have focused on forest species (Ward and Schlossberg 2004, Fletcher 2007) or colonial nesting species (Danchin et al. 1998). Past research on the effects of conspecific attraction in grassland species has focused on the establishment of new lek sites for re-introduced or translocated gallinaceous birds (Rodgers 1992). More recently, however, the role of conspecific attraction in the settlement decisions of grassland songbird species has been explored (Ahlering et al. 2006, Nocera et al. 2006). For example, successful attraction of Baird's sparrows (*Ammodramus bairdii*) by use of song playbacks in previously unoccupied sites has been demonstrated (Ahlering et al. 2006).

The Henslow's sparrow (*A. henslowii*) has been recognized as a species of particular conservation concern by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 2002) and is listed as threatened in the state of Iowa (Iowa Department of Natural Resources 2005). We were interested in evaluating the efficacy of using social cues to aid in the recovery of Henslow's sparrow populations. Specifically, our objective was to test the ability of a conspecific song playback system to attract Henslow's sparrows to previously unoccupied restored habitat.

STUDY AREA

The Spring Run Wetland Complex was a mix of over 1600 hectares of wetlands and reconstructed grasslands located in Dickinson County in northwest Iowa, USA (Fig. 1). The area was managed by the Iowa Department of Natural Resources and was one of the largest prairie pothole complexes in the state. Historically, the region was characterized by a mix of mesic to dry tallgrass prairies. The vegetation community of the area was dominated by several species of grasses such as big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), and side-oats

[1] Corresponding author email address: jenvogel@iastate.edu

grama (*Bouteloua curtipendula*). Forbs included lead plant (*Amorpha canescens*), compass plant (*Silphium laciniatum*), rattlesnake master (*Eryngium yuccifolium*), pale purple coneflower (*Echinacea pallida*), and gray-headed coneflower (*Ratibida pinnata*) (Thompson 1992, Ladd 1995, Christiansen and Muller 1999). Land use in Iowa was approximately 94% agricultural, with corn (*Zea mays*) and soybeans (*Glycine max*) as the primary crop types (Jackson et al. 1996). Iowa's climate consists of warm, humid summers and cold winters. The average annual precipitation of Iowa was approximately 81 cm and the average growing season length was 158 days (Iowa Department of Natural Resources 2005). The average annual temperature in Iowa was approximately 9.4° C (Thompson 1992) with an average summer temperature of approximately 22° C (Iowa Department of Natural Resources 2005).

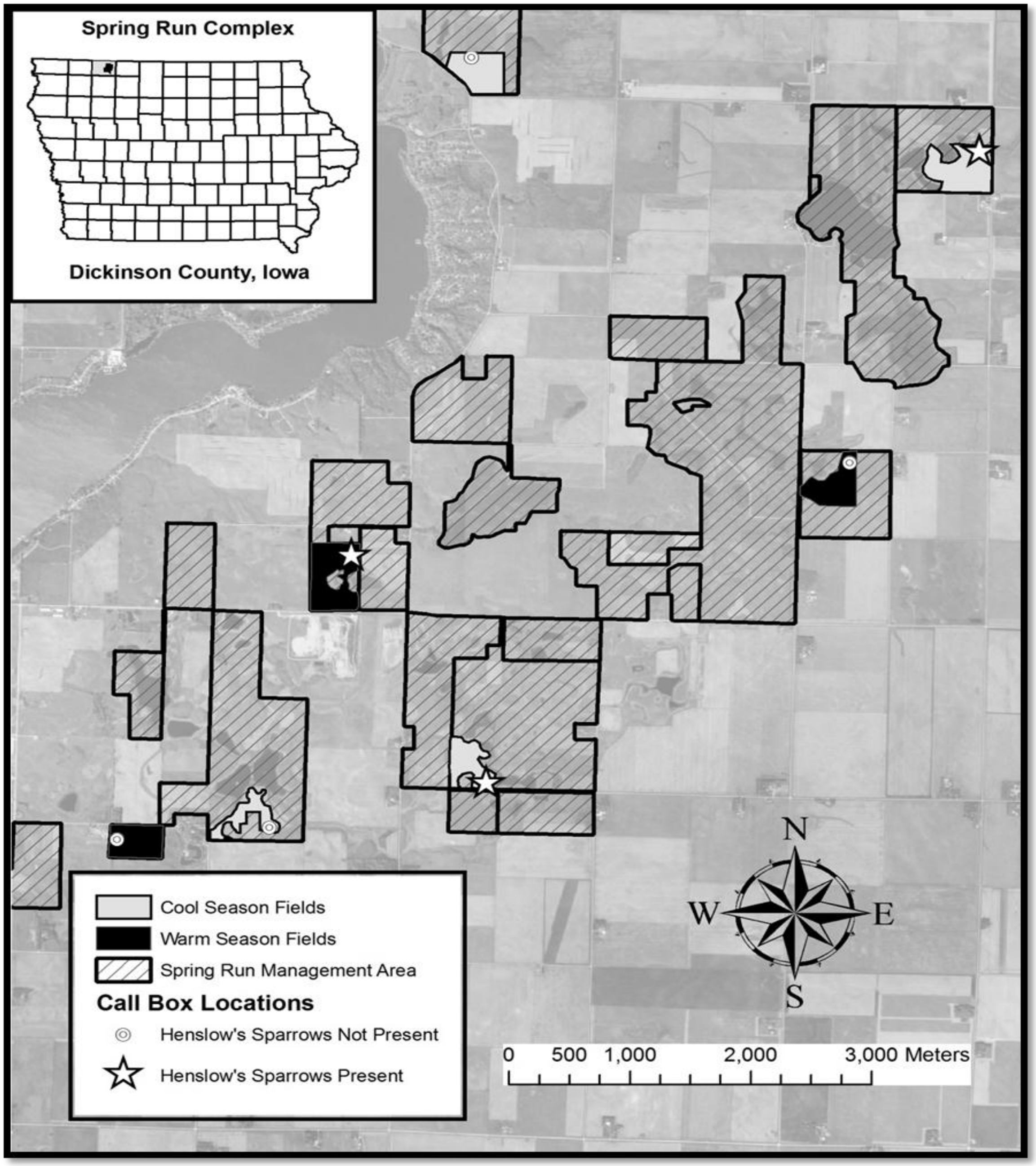

Figure 1. Field locations of Henslow's sparrow playback stations during the 2008 and 2009 seasons on the Spring Run Complex, Dickinson County, Iowa, USA. Black polygons indicate fields planted to warm season grasses and light gray polygons indicate fields planted to cool season grasses. Stars indicate the locations where Henslow's sparrows were observed during 2009 surveys.

METHODS

Within the Spring Run Complex, we located seven fields with available habitat for Henslow's sparrows (Fig. 1). All of the fields contained mature grassland vegetation (age of planting > 10 years). Four fields were planted to a cool season grass mixture of smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), reed canary grass (*Phalaris arundinacea*), and Kentucky bluegrass (*Poa pratensis*), with scattered forbs of Canada thistle (*Cirsium arvense*), common milkweed (*Asclepias syriaca*), and alfalfa (*Medicago sativa*). The remaining 3 fields were planted to a warm season grass mixture of switch grass (*Panicum virgatum*), Indian grass, big bluestem, little bluestem, and side-oats grama, with several forb species of Canada thistle (*Cirsium arvense*), common milkweed (*Asclepias syriaca*), and goldenrod (*Solidago* sp.). Recent records of Henslow's sparrows in Iowa are rare, although it was once a common species in the state (Jackson et al. 1996, Melde and Koford 1996). Habitat for Henslow's sparrows in Iowa consists of fields with moderate vegetation height (45–85cm), a small forb component (5–20%), and dense litter comprised of previous years' growth (Melde and Koford 1996). All of the proposed fields met these criteria. Extensive line transect surveys of the proposed study sites conducted weekly from 4 June to 12 July 2007 revealed that Henslow's sparrows were not present (J. Vogel, unpublished data), however, a single male was heard singing within a few (0.75 to 6.2) kilometers before 2007 (R. Koford, unpublished data).

We divided each of the seven study fields into two plots (plots were equal in size to one-half of the overall size of the field or approximately four hectares). Henslow's sparrows tend to have relatively small territories of less than one hectare (Herkert 1998, O'Leary and Nyberg 2000, Monroe and Ritchison 2005). We randomly assigned one plot on each field to the treatment and the other as a control plot. On the treatment plots, we established a playback station using pre-recorded songs (Elliot et al. 1997) of Henslow's sparrows only. Observations of Henslow's sparrows have indicated that individuals are responsive to song playbacks (Zimmerman 1988, Melde and Koford 1996), making it a good candidate for this experiment.

We constructed playback stations after Ahlering et al. (2006). Each station consisted of a portable compact disc player connected to a programmable timer (model TA0005, Borg General Controls LLC, Elk Grove Village, IL, USA; Fig. 2). The timers were connected to rechargeable 12-volt batteries and solar panels (model BP310, Online Solar, Inc., Hunt Valley, MD, USA). We mounted playback stations in aluminum boxes for protection from the elements. Large holes approximately the same size as the speaker diameter were drilled in front of the speakers to allow for sound transmission. The drilled holes were covered by a thin screen (to keep insects, etc. out of the boxes) and the speakers were placed right up against the openings so that sound transmission was directly from the speakers through the openings. Boxes were mounted to posts at approximately one meter high, the typical perching/singing height for Henslow's sparrows in each field (Hanson 1994). We located each playback station (one playback station per plot) at the far edge of each plot (away from the control plot) and broadcast toward the interior of the experimental plot. Song playbacks could not be heard from the control plots.

In mid-May 2008, we constructed and erected playback stations on each of the 7 sites to test their operation and reliability (Fig. 1). Playback stations remained on the study sites during the equipment test period until the beginning of August 2008. We modified the design of the playback stations slightly for the 2009 field season to increase the song volume by using computer software to digitally amplify the songs. In addition, we enlarged the holes to allow for greater sound transmission. We placed playback stations in each of the treatment plots during the first week of April 2009 to coincide with the arrival time of the first Henslow's sparrow individuals (Herkert 1998). We programmed playback stations to broadcast songs starting one hour before sunrise and ending at 0930 CST and again in the evening just before sunset. We played broadcasts for 1 hr at a time, with 30-min intervals in between for a total of 4 hrs in the morning and 2 hrs in the evening; we continued playbacks through the beginning of August 2009. We checked and maintained the playback stations weekly and parts were replaced as necessary for continuous operation throughout the study period.

We monitored study plots weekly by walking 100 m long transects placed throughout each field to record observations of Henslow's sparrows on each plot from 2 June to 18 July 2008 (equipment test period) and from 1 June to 10 July 2009. We chose locations for bird survey transects to maximize the number of transects in each field. We placed transects only in upland vegetation, and we did not locate transects near field edges or wetlands.

We conducted six rounds of bird surveys in 2008 and 2009. We repeated bird surveys once each week along the same transects within each field during each round of surveys. We conducted bird surveys between sunrise and 1000 CST. We did not conduct bird surveys on days where weather conditions could have impeded visibility or audibility (rain, fog, or wind in excess of 30 km/hr). Surveys consisted of 1 observer walking along transects at a constant pace identifying birds by sight and sound within 35 m on either side of transects. We recorded distance of birds from the observer and compass bearings using laser rangefinder binoculars.

Figure 2. Henslow's sparrow playback stations established on the Spring Run Complex in 2008 and 2009. Playback stations consisted of a portable compact disc player connected to a programmable timer. Timers were connected to rechargeable 12 volt batteries and solar panels. Playback stations were mounted in aluminum boxes for protection from the elements. The aluminum boxes were drilled out in front of the player speakers to allow for sound transmission. Boxes were mounted to 4 × 4 posts at the typical perching/singing height for Henslow's sparrows in each field.

Data Analysis

The recommended minimum sample size is 60–80 individuals for using line transect methods to adjust for imperfect detectability and estimate density (Buckland et al. 1993). Because we detected a small number of Henslow's sparrows during our surveys, we chose a presence/absence response for our statistical analysis. Using McNemar's Test (McNemar 1947) for paired data, we tested the null hypothesis that the number of control/treatment pairs where birds were present in the treatment but absent in the control was equal to or less than the number of control/treatment pairs where birds were present in the control but absent in the treatment (SAS Version 8.2, SAS Institute, Cary, NC, USA). McNemar's Test is a non-parametric test based on a Chi-square distribution with one degree of freedom (Park 2002). McNemar's Test is used to test for marginal homogeneity in 2 × 2 contingency tables (McNemar 1947, Park 2002). We used the asymptotic test (Park 2002) because of our small sample size and considered the one-tailed p-value to evaluate the significance of the test. A 2 × 2 contingency table containing zeros is problematic because calculations produce an undefined test statistic (Park 2002). To deal with zeros in our contingency table, we added a small constant (0.00001) to each cell containing a zero (Park 2002). Given our small sample size, the resulting low power of the test increased the chance of a Type II error; therefore we chose an alpha level of 0.1 instead of 0.05 to decrease the possibility of a Type II error.

RESULTS

We recorded a total of 10 Henslow's sparrows during our surveys. We did not detect Henslow's sparrows in any surveys during the 2008 equipment test period. We successfully attracted Henslow's sparrows to some treatment plots in 2009 using conspecific song playbacks. Henslow's sparrows were more likely to be found in treatment plots than in control plots ($\chi_1^2 = 3.0$, $P = 0.08$). Specifically, we found Henslow's sparrows in 3 of 7 treatment plots during our 2009 surveys and in none of the control plots in 2009. Two treatment plots where we found Henslow's sparrows were cool season grass fields and 1 was a warm season grass field (Fig. 1). In 2 fields (one cool season and one warm season) we found only males in the treatment plots, but in 1 field (cool season) we found both males and females. We did not observe Henslow's sparrows perching on the playback structures at any time during the study.

DISCUSSION

Although our sample size was small, we successfully attracted Henslow's sparrows to previously unoccupied habitat using conspecific song playbacks. Our results are similar to those reported by Ahlering et al. (2006) for another grassland songbird, the Baird's sparrow, and by Harrison et al. (2009) for a shrub-steppe obligate, the Brewer's sparrow (*Spizella breweri*). For Baird's sparrows, half of the experimental playback plots (three out of six) in their study were successful in attracting Baird's sparrows, whereas none of the control plots were (Ahlering et al 2006). Similarly, more Brewer's sparrows were attracted to the playbacks plots than the control plots (Harrison et al. 2009). In contrast, an examination of conspecific attraction in the Nelson's sharp-tailed sparrow (*Ammodramus nelsoni*) had opposite results and no evidence of a treatment response to song playbacks was reported (Nocera et al. 2006).

The influence of social cue manipulation may have unintended effects on both target and non-target species (Betts et al. 2008, Fletcher 2008, Betts et al. 2010). For target species, the addition of song playbacks may attract individuals to poor quality habitat (Betts et al. 2008, Fletcher 2008). In fact, it is possible to mislead individuals of some species into settling in poor quality habitat simply by broadcasting their songs in sink areas (Betts et al. 2008). In addition, manipulation of social cues can affect non-target species through both attraction and avoidance of heterospecifics (Fletcher 2008). Avoidance behavior in heterospecifics has been demonstrated as a response to social cue manipulation and in one case, resulted in a reduction of non-target species richness of 30% (Fletcher 2008).

Henslow's sparrows have very specific habitat and nesting requirements with regard to vegetation height, vegetation density, and litter depth (Zimmerman 1988, Herkert 1994, Melde and Koford 1996, Skipper 1998, Cully and Michaels 2000). As a result, Henslow's sparrows may have low site fidelity caused by changing grassland habitat conditions due to regular management activities, such as prescribed burning and mowing (Hands et al. 1989). For managers, this presents a difficult problem of maintaining Henlow's sparrow populations under constantly changing grassland conditions (Mills et al. 2006). Future studies should include collection of vegetation conditions in association with social behavior.

Social information has been included in resource selection models for bobolinks (*Dolichonyx oryzivorus*) and Savannah sparrows (*Passerculus sandwichensis*; Nocera and Forbes 2010). For some species, social information can be more influential than habitat cues, such as vegetation structure, in settlement decisions (Betts et al. 2008). Traditional habitat models that do not consider social factors may not be adequate for informing conservation strategies for some species (Harrison et al. 2009) including Henslow's sparrows.

ACKNOWLEDGMENTS

Funding for this project was provided by a grant from the U.S. Fish and Wildlife Service Upper Midwest Migratory Bird Conservation Program and by the Iowa Department of Natural Resources and U.S. Fish and Wildlife Service through the State Wildlife Grants Program. We would like to thank B. Wilsey, S. Dinsmore, and P. Dixon from Iowa State University; S. Shepherd, M. McInroy, T. Bogenschutz, K. Kinkead, R. Howing, and C. LaRue from the Iowa Department of Natural Resources; project assistants: J. Vaughn, E. Kilburg, N. Behl, H. VanWaus, T. Paulsen, H. Reinhard, C. Hammond, and E. Briggs. Mention of trade names does not imply endorsement by the U. S. Government.

LITERATURE CITED

Ahlering, M. A., D. Arlt , M. G. Betts , R. J. Fletcher, J. J. Nocera, and M. P. Ward. 2010. Research needs and recommendations for the use of conspecific-attraction methods in the conservation of migratory songbirds. Condor 112:252–264.

Ahlering, M. A., and J. Faaborg. 2006. Avian habitat management meets conspecific attraction: if you build it, will they come? Auk 123:301–312.

Ahlering, M. A., D. H. Johnson, and J. Faaborg. 2006. Conspecific attraction in a grassland bird, the Baird's Sparrow. Journal of Field Ornithology 77:365–371.

Betts, M. G., A. S. Hadley, N. Rodenhouse, and J. J. Nocera. 2008. Social information trumps vegetation structure in breeding-site selection by a migrant songbird. Proceedings of the Royal Society B-Biological Sciences 275:2257–2263.

Betts, M. G., J. J. Nocera, and A. S. Hadley. 2010. Settlement in novel habitats induced by social information may disrupt community structure. Condor 112:265–273.

Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance sampling: estimating abundance of biological populations. Chapman and Hall, London, U.K.

Christiansen, P., and M. Müller. 1999. An illustrated guide to Iowa prairie plants. University of Iowa Press, Iowa City, USA.

Cully, J. F., Jr., and H. L. Michaels. 2000. Henslow's Sparrow habitat associations on Kansas tallgrass prairie. Wilson Bulletin 112:115–123.

Danchin, E., T. Boulinier, and M. Massot. 1998. Conspecific reproductive success and breeding habitat selection: implications for the study of coloniality. Ecology 79:2415–2428.

Elloit, L., D. Stokes, and L. Stokes. 1997. Stokes field guide to bird songs. Time Warner, New York, New York, USA.

Fletcher, R. J., Jr. 2007. Species interactions and population density mediate the use of social cues for habitat selection. Journal of Animal Ecology 76:598–606.

Fletcher, R. J., Jr. 2008. Social information and community dynamics: nontarget effects form simulating social cues for management. Ecological Applications 18:1764–1773.

Fletcher, R. J., Jr., and R. R. Koford. 2003. Changes in breeding bird populations with habitat restoration in northern Iowa. American Midland Naturalist 150:83–94.

Hands, H. M., R. D. Drobney, and M. R. Ryan. 1989. Status of the Henslow's Sparrow in the northcentral United States. Missouri Cooperative Fish and Wildlife Research Unit, Colombia, USA.

Hanson, L. G. 1994. The Henslow's sparrow (*Ammodramus henslowii*) of Minnesota: population status and breeding habitat analysis. Thesis, Central Michigan University, Mount Pleasant, USA.

Harrison, M. L., D. J. Green, and P. G. Krannitz. 2009. Conspecifics influence the settlement decisions of male Brewer's Sparrows at the northern edge of their range. Condor 111:722–729.

Herkert, J. R. 1994. Status and habitat selection of the Henslow's Sparrow in Illinois. Wilson Bulletin 106:35–45.

Herkert, J. R.1995. An analysis of Midwestern breeding bird population trends: 1966–1993. American Midland Naturalist 134:41–50.

Herkert, J. R. 1998. Effects of management practices on grassland birds: Henslow's Sparrow. Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.

Herkert, J. R., D. L. Reinking, D. A. Wiedenfeld, M. Winter, J. L. Zimmerman, W. E. Jensen, E. J. Fink, R. R. Koford, D. H. Wolfe, S. K. Sherrod, M. A. Jenkins, J. Faaborg, and S. K. Robinson. 2003. Effects of prairie fragmentation on the nest success of breeding birds in the midcontinental United States. Conservation Biology 17:587–594.

Iowa Department of Natural Resources. 2005. The Iowa Comprehensive Wildlife Conservation Plan: Securing a Future for Fish and Wildlife: A Conservation Legacy for Iowans. <http: //www.iowadnr.gov/wildlife/diversity/plan.html>. Accessed 10 November 2007.

Jackson, L. S, C. A. Thompson, and J. J. Dinsmore. 1996. The Iowa Breeding Bird Atlas. University of Iowa Press, Iowa City, USA.

Knopf, F. L. 1994. Avian assemblages on altered grasslands. Studies in Avian Biology 15:247– 257.

Ladd, D. 1995. Tallgrass Prairie Wildflowers a Field Guide. Falcon Publishing, Inc., Helena, Montana, USA.

McNemar, Q. 1947. Note on the sampling error of the difference between correlated proportions or percentages. Psychometrika 12:153–157.

Melde, P. B., and R. Koford. 1996. Henslow's Sparrow nesting observations, habitat associations and history in Iowa. Iowa Bird Life 66:117–122.

Mills, A. M., J. D. Rising, and D. A. Jackson. 2006. Conspecific attraction during establishment of east Flycatcher clusters. Journal of Field Ornithology 77:34–38.

Monroe, M. S., and G. Ritchison. 2005. Breeding biology of Henslow's Sparrows on reclaimed coal mine grasslands in Kentucky. Journal of Field Ornithology 76:143–149.

Nocera, J. J., and G. J. Forbes. 2010. Incorporating social information to improve the precision of models of avian habitat use. Condor 112:235–244.

Nocera, J.J., G.J. Forbes, and L.A. Giraldeau. 2006. Inadvertent social information in breeding site selection of natal dispersing birds. Proceedings of the Royal Society B 273:349–355.

Noss, R. F., E. T. LaRoe III, and J. M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. U.S. Department of the Interior, National Biological Service. Biological Report 28, Washington, D.C., USA.

O'Leary, C. H., and D. W. Nyberg. 2000. Treelines between fields reduce the density of grassland birds. Natural Areas Journal 20:243–249.

Park, T. 2002. Is the exact test better than the asymptotic test for testing marginal homogeneity in 2 x 2 tables? Biometrical Journal 44:571–583.

Rodgers, R. D. 1992. A technique for establishing sharp-tailed grouse in unoccupied range. Wildlife Society Bulletin 20:101–106.

Sampson, F., and F. Knopf. 1994. Prairie conservation in North America. Bioscience 44: 418–421.

Skipper, C. S. 1998. Henslow's Sparrows return to previous nest site in Western Maryland. North American Bird Bander 23:36–41.

Smith, D. 1981. Iowa prairie – an endangered ecosystem. Proceedings of the Iowa Academy of Science 88:7–10.

Thompson, J. R. 1992. Prairies, forests, and Wetlands: The restoration of natural landscape communities in Iowa. University of Iowa Press, Iowa City, USA.

U.S. Fish and Wildlife Service. 2002. Birds of conservation concern 2002. Division of Migratory Bird Management, Arlington, Virginia, USA.

Ward, M. P, and S. Schlossberg. 2004. Consepecific attraction and the conservation of territorial songbirds. Conservation Biology 18:519–525.

Zimmerman, J. L. 1988. Breeding season habitat selection by the Henslow's sparrow *Ammodramus henslowii* in Kansas. Wilson Bulletin 100:17–24.

Submitted 8 October 2010. Accepted 18 December 2010. Associate Editor was Chad P. Lehman.