Restoration Notes

Restoration Notes have been a distinguishing feature of *Ecological Restoration* for more than 25 years. This section is geared toward introducing innovative research, tools, technologies, programs, and ideas, as well as providing short-term research results and updates on ongoing efforts. Please direct submissions and inquiries to the editorial staff (ERjournal@aesop.rutgers.edu).

Grassland Bird Nesting on Restored and Remnant Prairies in South Central Nebraska

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Approximately 64% (402,000 km²) of mixed-grass prairie has been lost, especially to agricultural production, since European settlement in North America (Samson and Knopf 1996). This loss has reduced wildlife habitat; 77% of grassland birds tracked by breeding bird surveys have decreased populations from 1966 to 1996 (Sauer et al. 2000). The Platte River Whooping Crane Maintenance Trust has been restoring grasslands in south central Nebraska since 1986, measuring success primarily through native vegetation establishment and cover. While evaluating restored grassland as nesting habitat for migratory birds, we encountered some important differences in grassland bird use between restored and native grasslands. We present preliminary findings on both plant composition and structure, and grassland bird densities in natural undisturbed areas and restored sites.

The study area is located in the Platte River Valley in a landscape formerly characterized by grasslands and currently dominated by corn fields. Our study sites consisted of six former farmlands restored to grassland ranging from 5 to 15 years old, and six remnant grasslands moderately affected by common introduced grass species such as smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*); all restored and native plots were at least 40 ha and less than 1.5 km from the river. Restored grasslands were contoured to re-create former rolling terrain and planted with a high-diversity seed mix (100+ species). Management has typically consisted of light grazing (<1 AUM), and in some cases prescribed burning starting at least three years after restoration.

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We identified the territory for individual males or breeding pairs, and located nesting sites of bobolink (*Dolichonyx oryzivorus*), dickcissel (*Spiza americana*), and grasshopper sparrow (*Ammodramus savannarum*) using Martin and Guepel's technique (1993). We selected these three species for evaluation because they are important in mixed-grass prairie ecosystems and have different habitat requirements. Bobolinks require areas with tall vegetation structure and density, while grasshopper sparrows prefer low and sparse vegetation; dickcissel was selected as an intermediate indicator, with nesting requirements of continuous herbaceous cover with woody perches. We used the spot mapping technique (Bibby et al. 2000) to determine breeding bird pairs between May and July. In each site, the locations of all birds (especially singing males) and nest sites are mapped in a square 16 ha plot during a series of weekly visits (>8 total) during the breeding season. We recorded a total of 242 nests in native remnants and 264 in restored sites.

We measured vegetation vertical structure and height; aerial cover by functional group (grasses, forbs, woody, litter, bare ground, and standing dead); litter depth, at paired random points 25 m away from nest sites to obtain a better description of site variation; and plant species composition, richness, and frequencies at site level. To obtain a more accurate description of vegetation at each nest site, we measured vertical cover using a density board (10 cm × 2 m, with 10 cm increments). Initial trials determined that the most accurate readings of visual obstruction occurred at 1 m height and 4 m away. To describe vegetation aerial cover we used five Daubenmire frames (20 × 50 cm) at each nest site, located at the center and 1 m away in each cardinal direction. Litter depth was measured at the center of each Daubenmire frame using a ruler to record thickness from ground level to the top of the litter layer. Species composition was sampled using the step point method (Owensby 1973), recording species encountered at basal level. Five 100 m transects were randomly established per site in July 2009, and individual species were identified at each step. We used ANOVA to compare treatments (site type).

Densities of the three grassland bird species were significantly different in restored and native sites (Figure 1). Bobolinks and grasshopper sparrows, the two species at the extremes of the structural gradient, had more than twice as many nests on native remnant sites ($p < 0.001$).

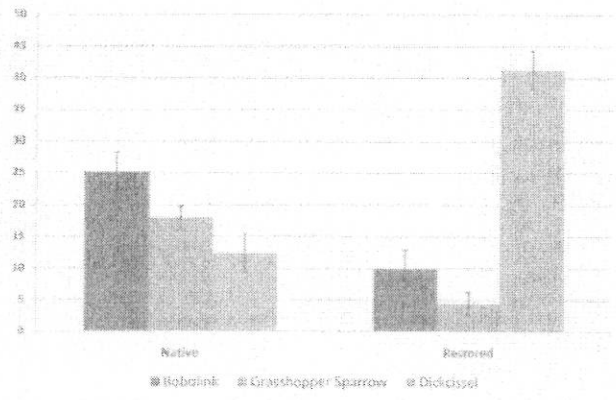

Figure 1. Average number of nests per 16 ha study plot observed in 2009 in restored and remnant grasslands along the Platte River in south central Nebraska.

Dickcissels, our indicator of intermediate vegetation structure, showed the opposite pattern, with three times more nests on restored sites ($p < 0.001$).

Vegetation variables were also different between restored and remnant native sites. Aerial cover of forbs was the only variable that was similar in both areas (Table 1). In contrast, average vegetation height was greater in restored sites. Vegetation structure was higher in restored sites, with vegetation averaging 96 cm of height compared to 59 cm in native remnants. Both of these could be important factors affecting grassland habitats and bird use.

Dickcissel, a species with preference for areas with random perches, showed higher numbers in restored areas. Restored sites had a greater frequency of tall forbs, such as goldenrods (*Salidago* spp.), and sunflowers (*Helianthus* spp.), providing excellent singing perches for Dickcissels and increasing suitable available nesting habitat. Although grass aerial cover was higher on restored sites ($p < 0.001$), grasses are more frequent on native grasslands with a greater abundance of low aerial cover grasses such Heller's rossette (*Dichanthelium oligosanthes*) and dropseed grasses (*Sporobolus* spp.), a pattern also observed with forbs. Field observations indicate that some fairly common to rare species such as little bluestem (*Schizachyrium scoparium*) and Canada wildrye (*Elymus canadensis*) have abundance similar to that of more common grass species such as Indiangrass (*Sorghastrum nutans*) and big bluestem (*Andropogon gerardii*). This grass composition pattern and the higher frequency of tall forbs could be a main reason for different habitat selection by grassland birds.

Our preliminary data suggest that these restorations, at this point in time, are not creating the nesting habitat required or preferred by birds in more natural grasslands. Most restoration practices focus on vegetation reestablishment and cover (Martin et al. 2005), which represent the restoration of primary production but do not ensure the recuperation of essential habitat components needed by native fauna (Whisenant 2005). Our preliminary results have promoted a change in our philosophy to include wildlife habitat requirements at the planning stage of restorations.

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Table 1. Vegetation components comparison between restored and native remnant grasslands in south central Nebraska.

	Habitat Type			
	Native	Restored	*F*	*p*
% Cover ($n = 484$, native; $n = 527$, restored)				
Grass	26.94	36.49	70.23	<0.001
Forb	17.78	16.97	1.05	0.307
Woody	0.06	0.31	14.59	<0.001
Litter	32.43	24.94	39.49	<0.001
Bare ground	14.49	18.83	12.25	<0.001
Litter depth (cm)	13.31	55.00	356.90	<0.001
Vegetation height (cm) ($n = 327$, native; $n = 199$, restored)	59.04	96.01	170.20	<0.001
Species richness (per transect) ($n = 30$ for each habitat)	23.52	20.24	8.23	0.006
Frequency (%) ($n = 30$ for each habitat)				
Grass	73.92	62.60	8.57	0.005
Forb	26.00	37.32	8.63	0.005

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Do Private Land Owners Support Species Conservation? Results of a Local Survey (Oregon)

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Engaging private landowners in habitat restoration and conservation is crucial for protecting species with geographic ranges fragmented by multiple ownership types. Like many grasslands that have declined in the United States, Oregon's Willamette Valley has lost an estimated 99% of historic prairie in the past 150 years due to agricultural and residential development, and many rare prairie remnants are privately owned. In the Willamette Valley, several prairie species are conservation targets, including Fender's blue butterfly (*Plebejus icarioides fenderi*), federally listed by the U.S. Fish & Wildlife Service (USFWS) as endangered; Kincaid's lupine (*Lupinus oreganus*, threatened), Willamette daisy (*Erigeron decumbens*, endangered), Nelson's checker-mallow (*Sidalcea nelsoniana*, threatened), Bradshaw's desert-parsley (*Lomatium bradshawii*, threatened), Taylor's checkerspot butterfly (*Euphydryas editha taylori*, candidate for listing), and peacock larkspur (*Delphinium* × *pavonaceum*, listed by the state of Oregon as endangered) (USFWS 2010). In Benton County (population 81,859 and area 1,751 km^2), midvalley, these species occur on isolated remnant wet and upland prairies across a variety of ownerships, and their long-term conservation may depend on coordination among many parties (Benton County, Oregon 2010).

In 2006, Benton County began a countywide process to develop a USFWS Habitat Conservation Plan, the first of its scope in Oregon. This plan is required to apply for an incidental take permit. This type of USFWS permit is required in advance for nonfederal activities that may harm threatened and endangered species to ensure that any harm is balanced with protections and enhancements. The 50-year Habitat Conservation Plan, expected to be completed in 2011, outlines steps to avoid or minimize impacts to these species, obtain permits and mitigate for impacts where they are forecasted, and promote habitat conservation on public and private lands. The plan also contains a Prairie Conservation Strategy, which guides voluntary conservation actions for these and other at-risk species.

Because public support for this plan will be important for its long-term success, the County held several public meetings as well as consultations with stakeholder and technical groups (Benton County, Oregon 2010). Stakeholders included federal, state, county, city, and university representatives as well as private landowners, watershed councils, and natural resource groups; technical advisors included university professors and natural resource professionals with expertise in the relevant habitats and species. In addition, as contractors developing the plan, we conducted an online survey of local residents, land owners, and land managers that allowed us to quickly and inexpensively solicit input from diverse stakeholders who might not otherwise have engaged in the process. While personal interviews can provide greater understanding of the motivations of landowners to conserve species (Fischer and Bliss 2008), online surveys provide convenience and anonymity to respondents, while allowing researchers to survey large groups at a low cost (Wright 2005). The goals of our survey were to gauge public receptivity to conservation on public and private lands, identify obstacles to private landowner engagement, and identify and develop tools for effective conservation of species in the region.

The survey was sent via email on June 3, 2009, to 230 recipients through a local watershed council's membership list (primarily private landowners); 150 land management professionals through a Cooperative Weed Management Area; and 74 private landowners in an area with high-quality remnant prairies and federally protected prairie species through a local community group. Some recipients may have been contacted twice because they were in more than one of these groups. This allowed us to reach a large but local group of private landowners and land managers. Also, the survey format allowed us to ask specific questions and solicit rankings of ideas from a large group in a manner not easily accomplished in the setting of a public meeting. The survey concluded on July 1, 2009 after about four weeks.

We used SurveyMonkey (www.surveymonkey.com), an online survey administration tool. The survey was designed to take ten minutes or less to complete and consisted of ten questions divided into five sections: 1) background information about the planning process; 2) survey respondent information; 3) respondent interest in species/habitat conservation; 4) strategy development (understanding of regulations and ranking of plan goals); and 5) conservation tools (Institute for Applied Ecology 2009). Respondents were invited to write in ideas and comments.

We received 132 completed anonymous surveys (response rate ≥ 29%), and 92 respondents identified themselves as Benton County residents. Of these, 51 described themselves as rural landowners in Benton County, 33 as landowners inside city limits in Benton County, and the remainder did not identify as landowners. Twenty-one respondents identified themselves as Public or NGO land managers. To inform our planning process, we compared