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Bird use of heterogeneous prairie biofuel production plots in Black Hawk County, Iowa

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Bird use of heterogeneous prairie biofuel production plots in Black Hawk County, Iowa

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Lark Sparrow (*Chondestes grammacus*) nestlings

Dickcissel (*Spiza americana*) nestlings

ABSTRACT

Agricultural intensification has driven the loss of >90% of native grassland habitats in the Midwest. Consequently, grassland birds have declined more drastically than any other North American guild. Current biofuel production systems rely on high input monoculture crops that provide little habitat value to most grassland birds. The University of Northern Iowa's Tallgrass Prairie Center is exploring the feasibility of growing and harvesting diverse mixes of native prairie vegetation for use as a sustainable biofuel in a manner that also provides high quality bird habitat. In 2009, we seeded 48 research plots on three soil types with one of four treatments of native prairie vegetation: switchgrass monoculture, a 5 species warm-season grass mix, a 16 species biomass mix, or a 32 species prairie mix. In 2011, I conducted visual breeding bird surveys and monitored bird nesting in the biomass production plots. I hypothesized that more diverse plant communities would support more abundant and diverse bird communities with higher nest densities and nest success rates. Preliminary results indicate that bird species richness and abundance were significantly greater in the biomass and prairie mixes compared to the grass plots. Three grassland birds classified as "species of greatest conservation need" in Iowa successfully nested in the biomass production plots, but nest density did not vary significantly among treatments or soil types. My results suggest that cultivation of diverse native prairie vegetation for biomass production on marginal lands could have positive impacts on the maintenance of bird populations.

BACKGROUND

Before European settlement in North America, Iowa was a vast sea of grasses speckled with flowers of every color. The conversion of the native tallgrass prairie ecosystem to row crop agriculture in the Midwestern USA over the past 150 years has been described as one of the most rapid and comprehensive environmental alterations in human history (Smith 1998). Each year more and more of Iowa's lost landscape is being converted into row crop agriculture. As a society, we must come to terms with the fact that this is not without cost. Analysis of North American Breeding Bird Survey data estimated that >50% of the grassland bird species in the Midwest declined by >50% from 1966-1993 and that these declines can be attributed to changing land management practices (Herkert 1995). Research has shown that cultivating low-input high diversity grassland biomass not only provides significant energetic advantages over corn-based ethanol, but also provides improved habitat conditions for wildlife and biodiversity (Fargione et al. 2009; Tilman et al. 2006). In 2009, the University of Northern Iowa's Tallgrass Prairie Center initiated a study to investigate the productivity of four native prairie plant communities for biofuel production across three soil types. My project investigates these four candidate native prairie biofuel crops in terms of their habitat value for Iowa's grassland birds.

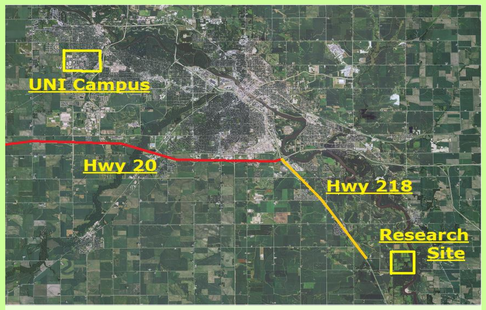

Figure 1. Research site location in Black Hawk County, Iowa.

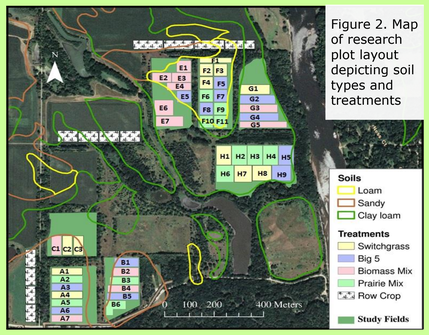

Figure 2. Map of research plot layout depicting soil types and treatments

STUDY AREA

- 40 ha site within the Cedar River Natural Resource Area (CRNRA) in Black Hawk County, Iowa.
- CRNRA is owned and managed by the Black Hawk County Conservation Board.
- Research site has a 20 year management history of row crop production.
- Site contains 48 research plots ranging from 0.30 to 0.56 ha.
- Four vegetation treatments: 1) **switchgrass** monoculture, 2) **warm-season grass mix** (five grass species), 3) **biomass mix** (16 species of grasses, forbs, and legumes), or 4) **prairie mix** (32 species of grasses, forbs, legumes, and sedges).
- Each treatment was replicated four times across three soil types: sandy, loam, and clay loam.

Figure 1. Searching for nest

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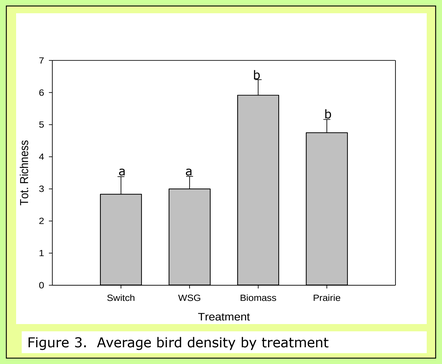

Figure 3. Average bird density by treatment

Lark Sparrow (*Chondestes grammacus*)

Lark Sparrow nest

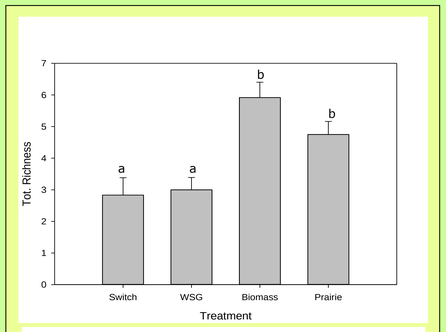

Figure 4. Bird species richness by treatment

Dickcissel (*Spiza americana*)

Dickcissel nest

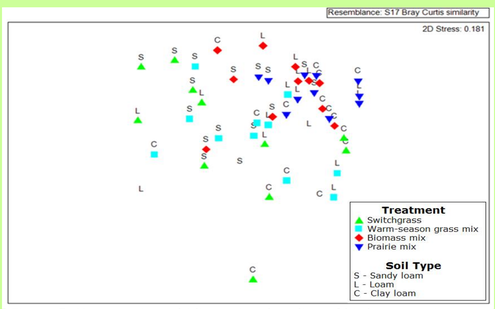

Figure 5. Non-metric multidimensional scaling of bird community composition by treatment and soil type.

ACKNOWLEDGEMENTS

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University of Northern Iowa | Tallgrass Prairie Center — Restoring a National Treasure | State of Iowa, Office of Energy Independence

METHODS

Vegetation characteristic surveys.

- Surveyed vegetation composition and structure in each plot in15 randomly placed 1 m^2 quadrats along a 50 m transect
- Vegetation data recorded: litter depth, height of living and dead grass, height-density/visual obstruction, and percent bare ground, litter, and canopy coverage.

Breeding bird surveys.

- Visually surveyed birds walking transects bisecting each plot by its longest dimension.
- Recorded all birds observed or heard within the survey plot, including species, location, and behavior.
- Surveys conducted between a half hour after sunrise and 1000.
- Surveys conducted in favorable weather conditions. No surveys in precipitation, fog, or wind >25 km/h (Ralph et al. 1993).
- Each plot surveyed seven times between May and July 2011.
- Adjacent plots surveyed at least 30 min. apart or simultaneously by two observers to avoid double counting or flushing birds into adjacent plots.

Nest searches and monitoring.

- Nest surveys conducted mid-day on a weekly basis between 17 May and 19 July 2011.
- Surveyors dragged a weighted nylon rope (4.5-6.5 km/h) over the vegetation in each survey plot.
- Nests found opportunistically were also incorporated in analysis.
- Nest data recorded: geographic coordinates, host species, number of host eggs/young, number of cowbird eggs/young, and surrounding vegetation type (grass, forb, and legume) and species.
- Conducted nest checks every 3-4 days to maximize observation data and minimize nest exposure.
- Nest site vegetation characteristics and concealment measurements were measured within a 1m^2 quadrat and 20 cm diameter circular plot around the nest between 21 June to 3 August.

PRELIMINARY RESULTS AND CONCLUSION

Breeding bird survey species richness and abundance:

- Observed 852 individuals representing 23 species using the research plots.
- Bird abundance (Figure 3) was significantly greater in the biomass and prairie mixes compared to switchgrass and warm-season grass plots (ANOVA, F= 23.4, $p < .001$).
- Species richness (Figure 4) was significantly greater in the biomass and prairie mixes compared to switchgrass and warm-season grass plots (ANOVA, F= 10.2, $p < .001$).
- Bird community composition (Figure 5) varied among treatments (PERMANOVA, F= 4.7, $p < 0.001$). Bird communities in biomass and prairie mix were similar to one another but significantly different from those in switchgrass and warm-season grass plots
- Bird community composition (Figure 5) varied among soil types (PERMANOVA, F= 4.3, $p < 0.001$) with commnunities on sandy loam distinct from those on loam and clay loam.
- No significant differences between biomass and prairie plots nor switchgrass and warm-season grass plots.

Nest Survey:

- Three grassland birds classified as "species of greatest conservation need" in Iowa successfully nested in the biomass production plots : Dickcissel (*Spiza americana*), Lark Sparrow (*Chondestes grammacus*), and Sedge Wren (*Cistothorus platensis*).
- Located and monitored 22 Dickcissel (*S. americana*) and 19 Lark Sparrow (*C. grammacus*) nests.
- Nest density did not vary significantly among treatments or soil types.
- For Dickcissels, Mayfield daily nest survival probability was 97.7% and overall nest survival probability was 61.6%.
- For Lark Sparrows, Mayfield daily nest survival probability was 93.8% and overall nest survival probability was 24.6%.
- Nest survival probabilities were comparable to those reported in other Midwestern grassland habitats (Jacobson et al. 2011; Hughes et al. 1999; Long et al. 2011; Winter 1999).

➤ Our results suggest that cultivation of native diverse prairie vegetation for biomass production on marginal lands could have positive impacts on the maintenance of bird populations in agricultural landscapes.

Predated nest

Parasitized Lark Sparrow nest

Successfully hatched nest

FUTURE DIRECTION

- Plots were harvested for biomass for the first time in March 2012.
- In the summer 2012, I will continue collecting data on vegetation characteristics and bird use of the biomass plots.
- Future research and analysis will focus on: 1) the effects of harvest on bird communities, 2) the relationship between bird activity in plots and biomass yields, 3) the relationship between vegetation characteristics and bird habitat use, and 4) the influence of landscape effects on bird community composition.
- Long-term studies are needed to determine whether native prairie biomass production will serve as a source or sink habitat for grassland birds over time.