Managing conservation grasslands for bioenergy and wildlife: Measuring the effects of biomass harvest on waterfowl and pheasants

University of Minnesota

Jacob Jungers[1], Todd Arnold[2], and Clarence Lehman[3]
[1]Conservation Biology Graduate Program, University of Minnesota
[2]Dept. Fisheries and Wildlife, University of Minnesota
[3]College of Biological Sciences, University of Minnesota

Abstract: Renewable energy standards have largely focused on producing corn-grain ethanol, thus further incentivizing the conversion of grassland habitat into row-crop agriculture. Alternative biomass sources include native perennial grassland plants that can be grown on land unsuitable for agriculture while also providing ecosystem services including wildlife habitat. Recent consideration has been given to harvesting restored grasslands for biomass energy without compromising these ecosystem services. Our objective was to determine if harvesting grasslands for bioenergy in Minnesota negatively affected nesting success of waterfowl and upland game birds.

Figure 1. Blue-winged teal was the most common species found nesting in our study (n=48). Mallards (n=30) and Ring-necked pheasants (n=12) rounded out our sample.

Management Implications:

- ♥ Harvesting biomass for renewable energy from grasslands managed for wildlife may provide additional revenues for landowners, further incentivizing expansion of conservation grasslands.
- ♥ Biomass harvest could replace other required management efforts (e.g. grazing, mowing, burning), thereby reducing management expenses.
- ♥ However, biomass harvest could negatively impact nesting success of upland nesting game birds.

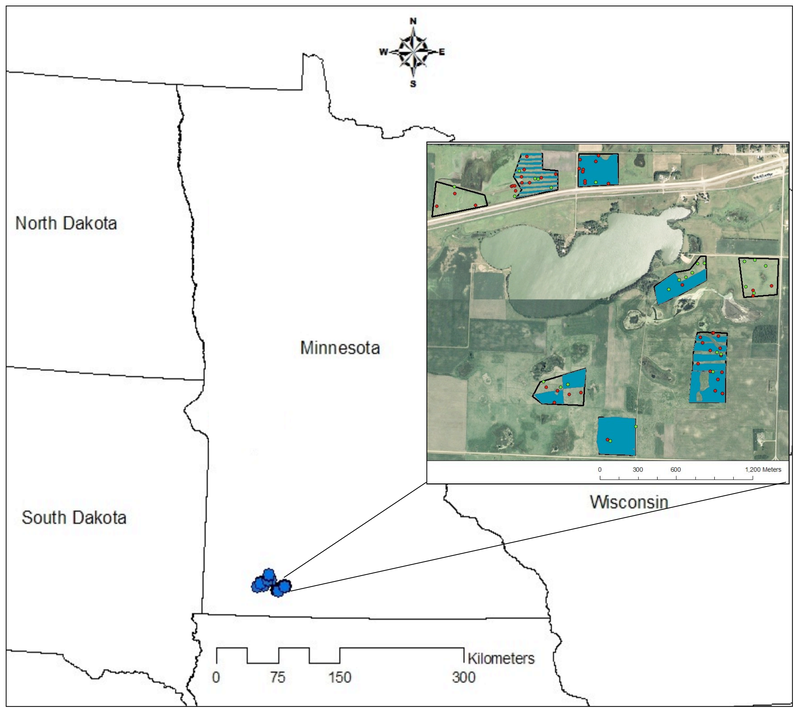

Figure 2. Blue dots on the state-scale map show the location of 28 plots sampled for nests in 2009 and 2010. Map inset shows nine plots and at least one replicate of all harvest treatments. Blue areas indicate areas that were harvested in the fall of 2009. Red and green dots are nest locations in 2009 (pre-harvest) and 2010 (post-harvest).

Methods: We utilized a before-after control-impact (BACI) study design to assess the effect of biomass harvest on nest success in 2009-2010. Biomass was harvested from 23 wildlife management areas in Southwestern MN from 16 Nov to 12 Dec 2009 using production-scale machinery (Fig. 3). Harvest intensity ranged from 0-100% in blocks or strips (Fig. 2)

Each plot was sampled 2 times for nests using the chain drag method. Nest age was determined by candling and nests were revisited every 7 days to assess fate.

Using program MARK, daily survival rates (DSR) were estimated for nests in harvested and un-harvested plots to assess the effect of plot-scale treatment and other covariates of interest (Table 1).

Cooperators: University of Minnesota, Minnesota Native Landscapes, Minnesota Conservation Corps., and the Minnesota Dept. of Natural Resources.

Funding agencies: Legislative-Citizen Commission on Minnesota Resources, National Fish and Wildlife Foundation, USDA-NRCS Conservation Innovation Grant

Cedar Creek Ecosystem Science Reserve

Figure 3. Each 20 acre plot was assigned a harvest treatment which ranged from no harvest (control) to full harvest. Plots were harvested in early winter with production-scale tools and techniques.

Results: We monitored and determined the fate of 90 nests over 1365 exposure intervals (Rotella et al., 2004). Daily survival rate averaged 0.9616 (SE = 0.0052), which translates to 25.4% nest success.

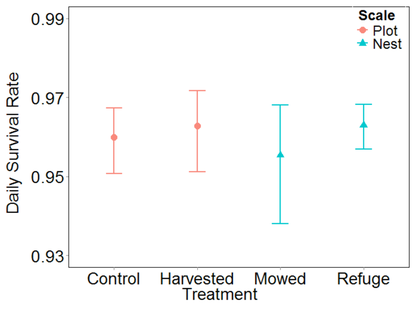

Figure 4. Daily survival rates (DSR) of nests in conservation grasslands. DSR of nests at the plot level are shown in red. Since some nests in partial harvest plots were established in the refuge (areas within harvest plots that were not cut; see Figure 2), we separated nests by those found in refuge and mowed areas (in blue).

Table 1. Model selection results from analysis of duck and pheasant nest success in Minnesota conservation grasslands. Potential variables included nest age, year (2009 or 2010), plot level treatment (Control or Harvested), and nest level treatment (Mowed or Un-mowed). Models were ranked according to differences in Akaike's Information Criteria (ΔAICc).

Model	k*	AICc	ΔAICc
Null	1	238.24	0.00
Nest Age	2	239.80	1.56
Harvested	2	239.95	1.71
Year	2	239.96	1.72
Mowed	2	240.17	1.93
Nest Age +Year	3	241.34	3.10

*Number of model parameters

Nests established in areas of conservation grasslands that were harvested the autumn prior to establishment had a similar daily survival rate compared to nests in un-harvested grasslands. Likewise, nests located in refuge areas near harvested areas did not have lower survival rates. Based on our findings, managers can expect to sustain waterfowl and pheasant production rates following short-term autumn harvest.