

Effects of Switchgrass Harvest as Biomass Fuel on Grassland-Nesting Birds



Coal-fired power plant

Efficiencies and environmental benefits of switchgrass harvest as biomass fuel explored in Iowa

Seventy percent of the electricity in the Midwest is generated by coal-fired power plants. Environmental planners project that burning switchgrass in conjunction with coal at some of these plants could lower the use of coal by up to 5 percent. Use of alternative fuels for electric generation is desirable to reduce reliance upon non-renewable resources and to decrease the emissions of some of the atmospheric pollutants associated with coal burning, including sulfur dioxide and mercury.

Biomass fuel is organic matter that is available on a renewable basis for energy production. Examples of biomass fuels include wood, straw, manure, sugar cane, switchgrass, and many other by-products from a variety of agricultural processes. Switchgrass (*Panicum virgatum*) is a vigorous warm-season grass that is common across much of the United States, including Iowa. This native perennial has potential as a biomass fuel because of its great abundance in the vicinity of midwestern power plants, high biomass production, and minimal maintenance requirements.



Grasshopper sparrow

Loss of midwestern grasslands contributes to declines in prairie wildlife

Historically, vast prairies, shrublands, and savannas that supported an abundance of diverse plant and animal life dominated the Midwest. However, since settlement by Europeans beginning in the mid-1800s, native habitats in this 94-million-acre ecosystem have been reduced by as much as 99 percent in some states. Predominantly large, contiguous tracts of grassland have been fragmented by conversion to row crops, hay fields, pastures, and towns. This has contributed to increased soil erosion, decreased water quality, and declines in native wildlife populations.

The grassland songbird community has been severely affected by these changes in land use. Two-thirds of all North American grassland bird species have shown population declines, and in the Midwest, at least 10 grassland species have shown significant negative trends in abundance. Examples of some species of concern to conservationists include the grasshopper sparrow, bobolink, dickcissel, sedge wren, and field sparrow.

Established in 1985, the United States Department of Agriculture's (USDA) Conservation Reserve Program (CRP) provides compensation to farmers for removing highly erodible cropland from production for contracted 10-year periods. The CRP has gained widespread acceptance by landowners in the Midwest where more than 6 million acres of perennial cover, primar-

ily grass, have been established. Although the original objectives of the programs were to diminish soil erosion and improve water quality, these fields also have provided critical habitat for grassland wildlife.



Nest survey in switchgrass field

Researchers at Iowa State University assess responses of grassland songbirds to switchgrass harvest

In the spring and summer of 1999 and 2000, researchers from Iowa State University (ISU) conducted a study in Appanoose, Lucas, Monroe, and Wayne counties of south-central Iowa to investigate how harvesting switchgrass cover established on CRP fields affects wildlife. They based their evaluation on the abundance and nesting success of grassland birds because regional wildlife conservationists are deeply concerned about the dramatic declines in these breeding bird populations.

Twenty-one CRP fields ranging from approximately 11 to 32 acres in size that were planted to switchgrass prior to 1995 were selected as study sites. Because birds respond to the structure of vegetation and may respond differently to different harvesting regimes, the 21 fields were divided into three treatment types. Switchgrass vegetation on seven fields was totally harvested, seven fields were left undisturbed (non-harvest), and the remaining seven fields received an intermediate treatment of partial harvest. The totally and partially harvested fields were cut during the winter months to avoid disturbance to breeding birds.

Birds were surveyed on each field between sunrise and 3 hours after sunrise once per week from mid-May to mid-July (approximately nine surveys per field per nesting season). In addition, five fields of each treatment type were searched for nests three times per season. Nest searches were conducted by systematically walking through fields while sweeping the vegetation with poles and scanning for nests and flushed birds.

Switchgrass fields received high use by birds

Approximately 50 different species of grassland birds were observed in the CRP field study sites during bird surveys. Total bird abundance did not differ significantly among treatments (total-, non-, and partial-harvest). However, the abundance of some bird species did differ between total- and non-harvest fields. For example, the grasshopper sparrow, a bird that prefers shorter, sparser vegetation, was observed in the greatest numbers in fields that were totally harvested. Dickcissels showed a similar trend. Conversely, sedge wrens and ring-necked pheasants, species that prefer denser vegetation, were more abundant in non-harvested fields. Other species of conservation concern that were sighted during the surveys included the bobolink, field sparrow, northern harrier, and eastern kingbird.

In addition to these field survey results, projections from computer simulations were generated to evaluate the effects of converting both row crop and unharvested CRP switchgrass fields to harvested switchgrass fields. The model revealed that total bird abundance remained stable when fields were converted from row crop to harvested switchgrass, but many species listed as priorities (bobolink, dickcissel, field sparrow, grasshopper sparrow, sedge wren) by bird conservationists increased in abundance. In con-



Sedge wren

trast, species not currently listed as conservation concern (brown-headed cowbird, horned lark, Killdeer) declined as a result of the habitat conversion. Transforming unharvested CRP switchgrass fields to harvested switchgrass fields in the computer model revealed results similar to the field surveys. Some species, like the grasshopper sparrow, benefited from the harvest, whereas others (sedge wren, ring-necked pheasant) did not.



Common yellowthroat nest with cowbird egg

Nesting success in switchgrass fields is adequate to support stable populations of grassland birds

Forty-four percent of all nests monitored in this study were successful, fledging at least one nestling. Nests failed for various reasons including predation, brown-headed cowbird parasitism (cowbirds lay their eggs in the nests of other species, thereby decreasing the nest success of the host species), adverse weather conditions, and farming practices. Despite the nesting failures that did occur, the researchers believe that the nesting success, specifically among grasshopper sparrows and common yellowthroats, might be great enough to sustain healthy populations of these grassland songbirds.

In both 1999 and 2000, the proportion of nests that were successful was greatest in non-harvest fields. This was due primarily to the lower rate of predation in these fields and the lack of disturbance from farming machinery. It is interesting to note that several species of conservation concern, including the northern harrier and sedge wren, nested exclusively in fields with residual vegetation (partially harvested and unharvested fields). In contrast, with the exception of one nest, all dickcissel and grasshopper sparrow nests were found in totally harvested fields.



Harvested switchgrass

A landscape that includes harvested switchgrass fields would support a diverse grassland bird community

To continue to uphold the original goals of CRP, economically benefit farmers, and best serve grassland species of management concern, the southern Iowa landscape should include both harvested and unharvested switchgrass fields. Periodic disturbance of all fields is necessary to maintain the health of the vegetation community and promote diversity of grassland bird species. Furthermore, the winter harvesting schedule of switchgrass biomass fields reduces breeding season disturbances associated with traditional farming practices.

Additional harvesting considerations include using discretion with the application of fertilizers and herbicides. Although biomass fuel production could be increased, the taller, denser growth of vegetation resulting from heavy fertilizer distribution may severely limit the benefits of switchgrass for some birds, particularly the grasshopper sparrow. The reduction of forb abundance through repeated herbicide use would create less attractive habitat for species that nest in forbs and potentially reduce overall bird species abundance and diversity.

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