ENVIRONMENTAL AND ECONOMIC RESEARCH AND DEVELOPMENT PROGRAM

Identifying Trade-offs Between Biomass Production and Biological Diversity in Wisconsin's Forests and Grasslands to Meet Tomorrows Bioenergy and Biofuel Needs

Executive Summary
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Title of Project: Identifying trade-offs between biomass production and biological diversity in Wisconsin's forests and grasslands to meet tomorrow's bioenergy and biofuel demands

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Project Period: July 1, 2008 to May 31, 2011

EXECUTIVE SUMMARY:

This research project examined trade-offs within two bioenergy production systems, grasslands in southern Wisconsin and aspen forests in northern Wisconsin. Our primary goal was to quantify the potential benefits and costs of producing bioenergy feedstocks and maintaining wildlife populations on the same piece of land within these systems. The factors that influence the costs and benefits of the emerging bioeconomy are complex and will require a synthetic and data rich approach. Key trade-offs examined included biomass productivity in grasslands and aspen forests and biodiversity within the production system.

Grassland fields spanned a range of plant community diversity from virtual monocultures to diverse restored prairies. In planted grasslands, bird species abundance was influenced by the evenness of the distribution of plant functional groups and the landscape context of the field. In general, landscapes with fewer forest patches and more regular patterning of non-woody perennial cover were associated with higher abundances of grassland birds. While individual species models were idiosyncratic and variable between years, they suggest that increasing the representation of planted grasslands on the landscape would enhance local grassland bird abundance. Our vegetation results suggest that productivity in planted grasslands may be substantially correlated with the floristic quality of the plant community. In other words, the productivity of a field was higher when the vegetation was comprised of native plant species with low tolerance for human disturbance. Consequently, plantings with an even distribution of functional groups (i.e., groups of species with similar morphological traits) comprised of locally adapted native plant species could provide high-levels of biomass production as well as valuable habitat for grassland birds.

Aspen forests ranged from clear-cut with no legacy tree retention to clear-cut with scattered hardwood trees retained and clear-cut with scattered conifer trees retained. Each of these three aspen forest management types was represented by a range of aspen age classes. Aspen forests with legacy trees supported a more diverse breeding bird community and legacy trees were a very important habitat component for several species of high conservation concern including the Golden-winged Warbler (*Vermivora chrysoptera*). Retention of legacy trees enhanced wildlife value with minimal short-term impacts on aspen stand-level productivity. Reductions in aspen growth due to shading by dispersed and clumped residual overstory trees were minor and initially offset by growth of residual trees. Retention of hardwood legacy trees did not reduce aspen biomass but conifer retention at the levels in this study reduced aspen biomass production for the first decade and a half after harvest; however, there was a strong indication in our data that aspen in conifer retention stands would "catch up" to the other treatments at approximately 35 years post harvest. Another advantage of legacy tree retention was that stands had greater standing stocks of biomass than no retention stands for the first three decades following harvest.

Funding from Focus on Energy, together with project support provided by the National Science Foundation, has allowed us to train two masters students (Chad Fortin, Max Henschell), and one Ph.D student (Amber Roth, expected defense February 2012). The students gained valuable new field and analytical skills that will serve them well in their careers. We expect to publish several articles in peer-reviewed journals in the next year or two which will further establish the research credentials of the students involved. We have also given numerous talks at professional meetings and talks to local teacher and high school groups (see Publications and Presentations Resulting from this Research at the end of this report). Amber Roth plans to continue to develop outreach programs around current conservation and ecological issues so this has been an important experience for her professional interests.

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