

MAIN PROPOSAL

PROJECT TITLE: Evaluation of Biomass Harvesting Impacts on Minnesota's Forests

I. PROJECT STATEMENT

Minnesota's forests cover over 16 million acres and provide myriad benefits, including wildlife habitat, carbon storage, biodiversity protection, clean water, and forest products. Currently, these forests are being viewed as potential feedstocks for the production of renewable energy. A primary concern about harvesting forest biomass to generate renewable energy is the long-term impacts these harvests will have on soil nutrients and long-term ecosystem productivity. In particular, repeated nutrient removals in harvested material may result in soil nutrient depletion with negative cascading effects on important forest benefits by decreasing future forest growth, carbon storage, and reducing wildlife habitat. Despite these concerns and current plans for widespread application of biomass harvests across Minnesota, little is known about the long-term ecological impacts of forest biomass harvesting.

We initiated a project in 2008 through funding by the Minnesota Forest Resources Council (MFRC) and United States Department of Agriculture (USDA) to evaluate the ecological impacts of biomass harvesting on forest biodiversity and tree regeneration. That project is being conducted on relatively *nutrient rich* soils to evaluate current MFRC biomass harvesting guidelines. Since the initiation of this project and passage of these guidelines, questions have emerged in the environmental and forestry communities about potential adverse effects of biomass harvesting on *nutrient poor* soils, including long-term depletions of soil nutrients, reductions in carbon storage, and loss of native biodiversity. Notably, forests growing on nutrient-poor sites cover over 5 million acres (32% of Minnesota's forests and 10% of the state's landcover, Figure 1), making this research critical to maintaining the ecological integrity of the state's broader forested landbase. The overall goal of this proposed project is to assess the ecological impacts of biomass harvesting on nutrient poor sites by:

- Developing a network of research sites on nutrient poor soils to assess the impacts of biomass harvesting on biodiversity and soil productivity
- Quantifying the impacts of biomass harvesting on soil nutrients, regeneration and growth of ecologically and commercially important tree species and spread of invasive species
- Projecting the long-term ecological sustainability of biomass harvesting.

This proposed project complements the MFRC and USDA-funded project by expanding it to address a full range of forest conditions. The research team is recognized as a national leader in assessing the ecological impacts and sustainability of forest biomass harvesting. By building on our existing work, this project represents a unique opportunity to cost-effectively examine these pressing questions on the nutrient poor sites that have the highest potential to be adversely impacted. Our results will determine where and how biomass harvesting can occur without undermining the ecological integrity or productive capacity of Minnesota's forests. These insights are critical to the MFRC's assessment and revision of its biomass harvesting guidelines and for ensuring the ecological sustainability of the full range of Minnesota's forest resources.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Develop a network of research sites on nutrient poor soils to assess impacts of biomass harvesting on biodiversity and productivity **Budget: \$87,439**

We will locate and establish four new study sites to augment our existing four research sites examining the ecological impacts of biomass harvesting. New sites will be established on nutrient poor soils in northern Minnesota, allowing us to explicitly address impacts of biomass harvesting on low productivity sites. Experimental treatments include three levels of biomass removal and three levels of green tree retention, as well as untreated controls.

Outcome

1. Nutrient poor sites identified through work with MNDNR and counties
2. Pre-harvest measurements of forest and soil conditions completed
3. Timber sales completed on sites

Completion Date

October, 2011
 November, 2011
 March, 2012

Activity 2: Determine the impacts of biomass harvesting on regeneration and growth of ecologically important tree species and spread of invasive species *Budget: \$ 221,956*

We will measure soil nutrient availability and monitor the survival and growth of planted seedlings, as well as abundance of natural regeneration and invasive plants in unplanted areas. Seedlings will consist of a mix of long-lived conifers, allowing us to address questions related to how these harvests affect potential restoration of those species. Results concerning the immediate impacts of biomass harvesting on soils, forest growth, and tree regeneration will be summarized in project reports and conveyed to managers through outreach activities.

Outcome

1. Seedlings planted and post-harvest measurements conducted
2. Assessment of soil nutrients and forest vegetation for 2 years
3. Project summaries developed

Completion Date

October, 2012
 October, 2013
 June, 2014

Activity 3: Model long-term sustainability of biomass harvesting on nutrient poor soils

Budget: \$40,605

The ecological sustainability of biomass harvesting hinges on nutrient availability and potential nutrient limitations. We will integrate findings from Result 2 into a well-validated ecological computer model (PnET) to simulate multiple levels of biomass harvesting on a range of soil qualities. Results concerning sustainability of alternative biomass harvesting strategies will be summarized in project reports, conveyed to managers through outreach activities, and used to inform future revisions to Minnesota's forest management guidelines.

Outcome

1. Characterization of ecological consequences of biomass harvesting
2. Results incorporated into ecological models of long-term impacts
3. Project summaries published

Completion Date

November, 2013
 November, 2013
 June, 2014

III. PROJECT STRATEGY**A. Project Team/Partners**

The research will be led by Dr. Anthony D'Amato from the University of Minnesota (UMN), Dept. of Forest Resources and he will receive salary support from this project (0.1 FTE). Other researchers providing in-kind support are Dr. Charles Blinn (UMN), scientists at the U.S. Forest Service Northern Research Station (Dr. John Bradford, Dr. Brian Palik, Dr. Shawn Fraver, and Dr. Randy Kolka), and Dr. Rob Slesak of the MFRC. Cooperators will include the MNDNR, Saint Louis County Land Department, and other northern Minnesota counties.

B. Timeline Requirements

The duration of the project is three years. The requested time is necessary to identify sites, conduct harvests, analyze ecosystem responses and integrate the results into models of long-term ecological sustainability.

C. Long-Term Strategy

This proposed project will take advantage of a larger ongoing research program examining the impacts of biomass harvesting in Minnesota, building on funds already provided by MFRC and USDA. We are committed to long-term maintenance and monitoring of our existing sites, as well as those proposed here. Although we anticipate subsequent proposals to LCCMR, we are also seeking additional funds from the US Dept. of Energy, USDA, and National Science Foundation.

Project Budget

Evaluation of Biomass Harvesting Impacts on Minnesota's Forests

PIs: Dr. Anthony D'Amato, Dr. Charles Blinn, University of Minnesota; Dr. John Bradford, Dr. Brian Palik, Dr. Shawn Fraver, and Dr. Randy Kolka, USDA Forest Service, Dr. Rob Slesak, Minnesota Forest Resources Council

IV. TOTAL PROJECT REQUEST BUDGET (3 years)

BUDGET ITEM <i>(See list of Eligible & Non-Eligible Costs, p. 13)</i>	AMOUNT
Personnel: One month of faculty summer salary and fringe (0.1934) for three years(D'Amato, PI; 0.1FTE)	\$ 30,999
Salary and fringe (0.1812) for a post-doctoral researcher for two years (1.0 FTE)	\$ 100,709
Salary and fringe (0.3230) for a research associate for 2.75 years (1.0 FTE)	\$ 40,605
Salary and fringe (0.0743) for a work-study undergraduate student for 3 years	\$ 26,688
Contracts: U.S. Forest Service (Dr. John Bradford will administer these funds) this contract includes: -funds for hiring one half-time field technician for all three years of the study (0.5 FTE; \$87,000). - salary and fringe for two undergraduate summer employees for two years (\$28,000). The technician and summer students will be employed by the US Forest Service because that is the most cost-effective approach and our need to have personnel dedicated to this research study who are located close to the field sites. -lab analysis of soil samples (\$12,000; reduced rate donated by US Forest Service)	\$ 127,000
Equipment/Tools/Supplies: Equipment includes rebar for permanently marking plot centers (\$350), supplies for constructing resin bags for soil nutrient measurements (\$4000), soil cores and corer (\$110), Haglof distance measuring equipment (\$700), stake whiskers for marking subplots (\$110), scintillation vials for soil analyses (\$730)	\$ 5,999
Travel: Due to the high number of study sites and logistics associated with establishing the harvest treatments and baseline data collection, \$18,000 is budgeted for domestic travel within Minnesota. This money will be used to pay for mileage (75%) and lodging (25%) for researchers, the field technician, graduate students, and undergraduate students	\$ 18,000
TOTAL PROJECT BUDGET REQUEST TO LCCMR	\$ 350,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
In-kind Services During Project Period: In-kind salaries provided by U.S. Forest Service Researchers (0.5 FTE; J. Bradford, B. Palik, S. Fraver, R. Kolka), as well as in-kind use of Forest Service ATV, vehicle, and trailer	\$ 30,000	Secured
Funding History: Minnesota Forest Resources Council: "Assessing the impacts of biomass harvesting on saproxylic communities, nutrient availability, and productivity in aspen systems" \$294,000 June 2009-2012	\$ 294,000	Secured
Funding History: U.S. Department of Agriculture: "Assessing the environmental sustainability and capacity of forest-based biofuel feedstocks within the Lake States region." September 2010-September 2014	\$ 2,710,500	Secured

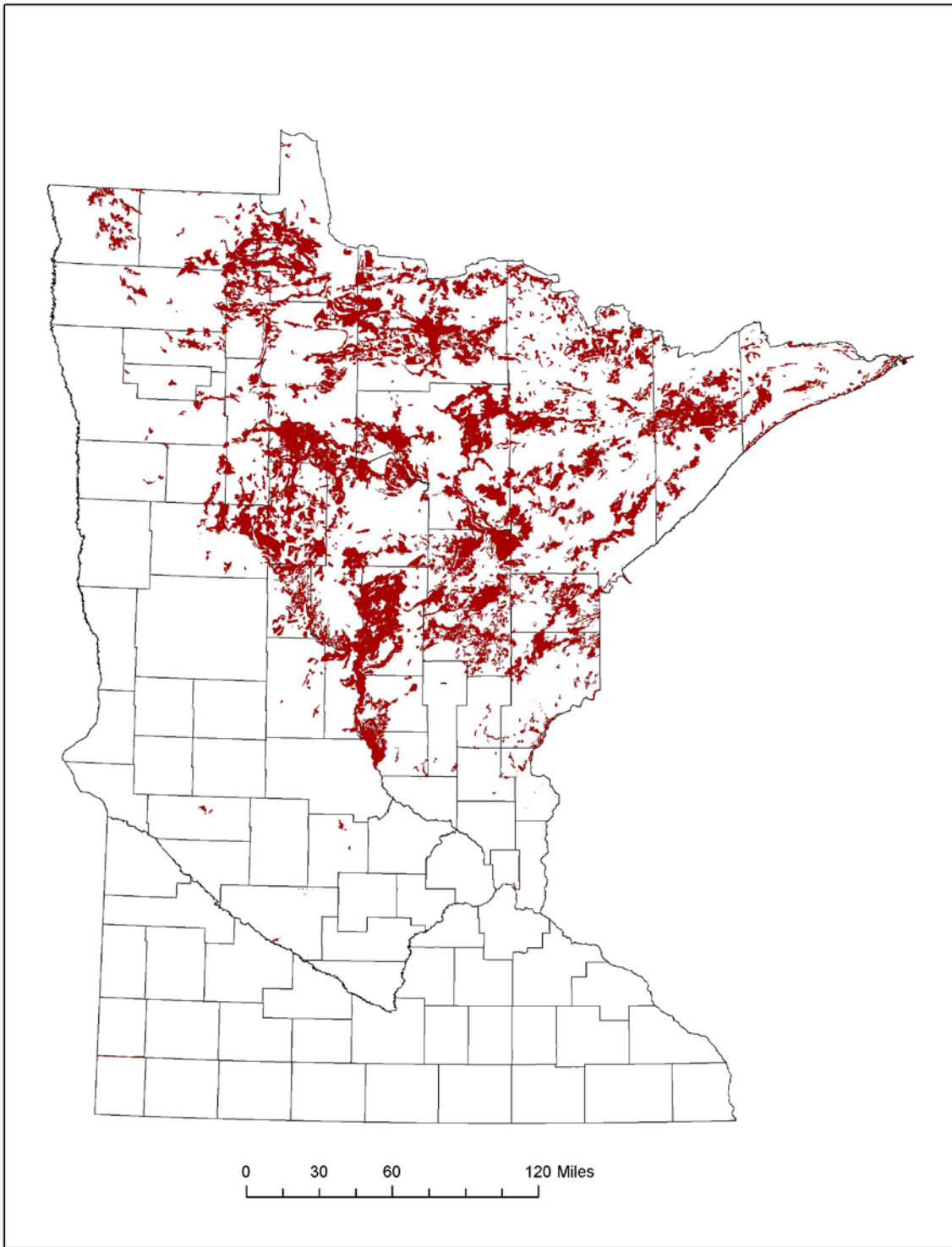


Figure 1. Forested areas within Minnesota with nutrient poor soils. Biomass harvesting will remove disproportionately more soil nutrient capital at these sites, increasing the likelihood of reduced forest growth over time relative to nutrient-rich forest sites. These removals can also adversely affect carbon storage and biodiversity. Nutrient poor forest systems within figure include areas with high sand content, shallow soils, jack pine barrens, and nutrient poor peatlands.

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Project Manager Qualifications

Anthony W. D'Amato

Qualifications

Anthony is an Assistant Professor of Silviculture and Applied Forest Ecology in the Department of Forest Resources, University of Minnesota. He conducts teaching, research, and participates in outreach/Extension programs. His research primarily focuses on traditional and experimental silvicultural strategies for meeting diverse forest management objectives ranging from the sustainable production of woody biomass for biofuels to the maintenance of native biodiversity within managed forests. His primary outreach audiences are natural resource managers.

Anthony has been the principal investigator and project manager on a large-scale Minnesota Forest Resources Council and United States Department of Agriculture project aimed at evaluating the effectiveness of Minnesota's biomass harvesting guidelines. He has published numerous peer-reviewed and non-technical articles which address the impacts of forest harvesting practices and natural disturbances on forest growth and development and has been involved with several outreach programs focused on the development of sustainable harvesting strategies for Minnesota's forests.

Responsibilities

As Project Manager, Anthony would coordinate and manage the overall project, coordinate the establishment of research sites and implementation of harvests and treatments in Activity 1, provide oversight for the establishment and measurement of seedling responses to each treatment (Activity 2), and provide oversight on the integration of research findings into long-term simulation models of the effects of repeated biomass harvesting treatments (Activity 3). In the coordination and management role, he would convene meetings of project participants throughout the life of the project to facilitate collaborative efforts, share results, discuss future directions, and identify additional outreach opportunities that could be pursued. His research would focus on evaluating the impact of biomass harvesting on forest regeneration and growth (Activity 2).

Organization Description

The Department of Forest Resources is part of the University of Minnesota.