

**Environment and Natural Resources Trust Fund  
2010 Request for Proposals (RFP)**

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**LCCMR ID: 046-B1**

**Project Title:**

Evaluating Impacts of Biomass Harvests on Minnesota Forests

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**LCCMR 2010 Funding Priority:**

B. Renewable Energy Related to Climate Change

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**Total Project Budget: \$** \$397,352

**Proposed Project Time Period for the Funding Requested:** 3 years, 2010 - 2013

**Other Non-State Funds: \$** \$148,000

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**Summary:**

The project assesses impacts of biomass harvests for energy on Minnesota's forests. Results will quantify the impacts on native forest vegetation, invasive species spread, forest soils, and long-term site productivity.

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**Location:**

**Region:** NW, NE, Central

**County Name:** Aitkin, Becker, Beltrami, Carlton, Cass, Clearwater, Cook, Crow Wing, Hubbard, Itasca, Kanabec, Koochiching, Lake, Lake of the Woods, Mille Lacs, Morrison, Pine, Roseau, St. Louis, Stearns

**City / Township:**

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|                      |                  |                  |
|----------------------|------------------|------------------|
| _____ Knowledge Base | _____ Broad App. | _____ Innovation |
| _____ Leverage       | _____ Outcomes   |                  |
| _____ Partnerships   | _____ Urgency    | _____ TOTAL      |

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# MAIN PROPOSAL

**PROJECT TITLE:** Evaluating the Impacts of Biomass Harvests on Minnesota Forests

## I. PROJECT STATEMENT

Minnesota's forests cover over 16 million acres and provide myriad benefits, including wildlife habitat, biodiversity protection, clean water, recreation opportunities, and forest products. Currently, forests in the state are being viewed as potential feedstocks for the production of renewable energy. A primary concern about the harvesting of forest biomass to generate renewable energy is the eventual soil nutrient depletion as a consequence of repeated nutrient removals in harvested material. Importantly, these nutrient depletions and biomass removals could have negative cascading effects on important forest benefits by decreasing future forest growth 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 removals.

This project builds on our existing study in northern Minnesota, which is evaluating the ecological impacts of biomass harvesting on forest biodiversity and tree regeneration. That project was initiated in 2008, is funded by the Minnesota Forest Resources Council (MFRC), and 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. This proposed project will allow us to extend our current work on nutrient rich sites and address these questions about ecological impact to 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 the regeneration and growth of ecologically and commercially important tree species and the spread of invasive species
- Projecting the long-term ecological sustainability of biomass harvesting.

This proposed project complements the MFRC-funded project by expanding it to address how biomass harvesting impacts nutrient poor sites. Notably, forests growing on such sites cover over 5,000,000 acres in Minnesota, making this research critical to maintaining the ecological integrity of the broader forested landbase in the state. By building on our existing project, we have a unique opportunity to examine these pressing questions in a cost-effective framework. Importantly, our results will determine if 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 our forest resources.

## II. DESCRIPTION OF PROJECT RESULTS

**Result 1: Develop a network of research sites on nutrient poor soils to assess impacts of biomass harvesting on biodiversity and productivity** **Budget: \$122,200**

We will locate and establish four new study sites to augment our existing research 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 an untreated control.

### **Deliverable**

1. Work with MNDNR and counties to identify sites with nutrient poor soils
2. Conduct pre-harvest measurements of forest and soil conditions

### **Completion Date**

- October, 2010
- November, 2010

3. Carry out timber sales on sites

March, 2011

**Result 2: Determine the impacts of biomass harvesting on regeneration and growth of ecologically important tree species and spread of invasive species** *Budget: \$ 172,000*

To assess the impact of the above mentioned treatments on forest growth, soils, tree regeneration, and invasive species, we will plant containerized seedlings and monitor planted seedling survival and growth, as well as abundance of natural regeneration and invasive plant species in unplanted areas. Seedlings will consist of a mix of long-lived conifers, allowing us to address questions related to how these harvests affect the potential restoration of those species to these forests. Results concerning the immediate impacts of biomass harvesting on forest growth and tree regeneration will be summarized in public project reports and conveyed to managers through outreach activities.

**Deliverable**

1. Plant seedlings and conduct post-harvest measurements
2. Assess natural regeneration and planted seedlings for 2 years
3. Develop project summaries

**Completion Date**

October, 2011  
October, 2012  
June, 2013

**Result 3: Determine long-term ecological impact of biomass harvesting** *Budget: \$103,152*

The ecological sustainability of biomass harvesting hinges on nutrient availability and potential nutrient limitation. 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 public project reports, conveyed to managers through outreach activities, and used to inform future revisions to Minnesota's forest management guidelines.

**Deliverable**

1. Characterize ecological consequences of nitrogen manipulations
2. Incorporate results into ecological computer models
3. Publish project summaries

**Completion Date**

November, 2012  
November, 2012  
June, 2013

### III. PROJECT STRATEGY

#### A. Project Team/Partners

The research team will be led by scientists at the University of Minnesota, Department of Forest Resources, namely Dr. Anthony D'Amato and Dr. Charles Blinn, and scientists at the U.S. Forest Service Northern Research Station, namely Dr. John Bradford, Dr. Brian Palik, Dr. Shawn Fraver, and Dr. Randy Kolka. Cooperators will include the Minnesota Forest Resources Council, including Dr. Rob Slesak, the Minnesota Department of Natural Resources, Saint Louis County Land Department, and other counties in northern Minnesota.

#### 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. Total funding requested is: **\$397,352**.

#### C. Long-Term Strategy

This proposed project is a part of a larger research program examining the impacts and sustainability of biomass harvesting in Minnesota and would build upon \$294,000 already provided by the MFRC. Project participants are committed to the long-term maintenance and monitoring of the sites established in this proposed project. Although we anticipate subsequent proposals to LCCMR, we are also seeking additional funds from the US Department of Energy, US Department of Agriculture, and National Science Foundation.

# Project Budget

## Evaluating the Impacts of Biomass Harvests on Minnesota 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

### IV. TOTAL PROJECT REQUEST BUDGET (3 years)

| <b>BUDGET ITEM</b> <i>(See list of Eligible &amp; Non-Eligible Costs, p. 13)</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>AMOUNT</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>Personnel:</b> One month of faculty summer salary and fringe (0.1934) for three years(D'Amato, PI; 0.1FTE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | \$ 30,999     |
| Salary and fringe for two graduate students for two years: Graduate fringe is budgeted at 0.7694 of salary load and includes tuition for the academic year, health care for the fiscal year, and social security and Medicare for 6.5 pay periods (summer)                                                                                                                                                                                                                                                                                                                                                                                                                   | \$ 147,713    |
| Salary and fringe (0.3230) for a research associate for three years (0.25 FTE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | \$ 71,640     |
| <b>Contracts:</b> U.S. Forest Service (Dr. John Bradford will administer these funds) this contract includes:<br>-funds<br>for hiring one half-time field technician for all three years of the study (0.5 FTE; \$87,000).<br>-<br>salary and fringe for one undergraduate summer employees for each year of the study (\$24,000). 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.<br>-<br>lab analysis of soil samples (\$12,000; <b>reduced rate</b> donated by US Forest Service) | \$ 123,000    |
| <b>Equipment/Tools/Supplies:</b> Equipment includes rebar for permanent 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)                                                                                                                                                                                                                                                                                                                    | \$ 6,000      |
| <b>Travel:</b> 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     |
| <b>TOTAL PROJECT BUDGET REQUEST TO LCCMR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | \$ 397,352    |

### V. OTHER FUNDS

| <b>SOURCE OF FUNDS</b>                                                                                                                                                                                                                      | <b>AMOUNT</b> | <b>Status</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|
| <b>Other Non-State \$ Being Applied to Project During Project Period:</b> U.S. Forest Service: "Assessing the long-term consequences of biomass harvesting: toward sustainable management strategies."                                      | \$ 148,000    | Pending       |
| <b>Other State \$ Being Applied to Project During Project Period:</b> Minnesota Forest Resources Council: "Assessing the impacts of biomass harvesting on saproxylic communities, nutrient availability, and productivity in aspen systems" | \$ 70,416     | Secured       |
| <b>In-kind Services During Project Period:</b> 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       |
| <b>Funding History:</b> 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    |               |

# **Evaluating the Sustainability of Biofuel Harvests in Minnesota Forests**

## **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 project manager on a large-scale Minnesota Forest Resources Council project aimed at evaluating the effectiveness of Minnesota's biomass harvesting guidelines. He has published several 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 Result 1, provide oversight for the establishment and measurement of seedling responses to each treatment (Result 2), and provide oversight on the integration of research findings into long-term simulation models of the effects of repeated biomass harvesting treatments (Result 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 (Result 2).

### **Organization Description**

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

