Environment and Natural Resources Trust Fund
2009 Phase 2 Request for Proposals (RFP)

LCCMR ID: 095-D1

Project Title: Forest Biomass LCA: Carbon, Economics, and Ecological Sustainability

Total Project Budget: $ $149,136

Proposed Project Time Period for the Funding Requested: 2 years: July 2009 - June 2011

Other Non-State Funds: $ $0.00

Priority: D1. Renewable Energy Life Cycle Costs and Impacts

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Sponsoring Organization: U of M

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Region:	County Name:	City / Township:
NW, NE, Central	Aitkin, Becker, Beltrami, Carlton, Cass, Clearwate	

Summary: The proposed Life Cycle Analysis of forest biomass availability and carbon sequestration potential will demonstrate how bioenergy and biofuels markets can maximize forest based economic and environmental benefits in Minnesota.

Main Proposal: 0908-2-013-proposal-LCCMR Project Proposal - Forest Biomass LCA (Becker).do

Project Budget: 0908-2-013-budget-LCCMR Project Budget - Forest Biomass LCA (Becker).xls

Qualifications: 0908-2-013-qualifications-LCCMR Manager Qualificationss - Forest Biomass LC

Map:

Letter of Resolution:

MAIN PROPOSAL

PROJECT TITLE: Forest Biomass LCA: Carbon, Economics, and Ecological Sustainability

I. PROJECT STATEMENT

The use of forest biomass for the production of biobased products has the potential to lessen dependency on imported fossil fuels while reducing carbon emissions and, under proper management, improve forest productivity and health while providing traditional forest products. Given the increasing potential and interest in using biomass in the production of bioenergy and biofuels, careful analysis is urgently needed to determine the total availability of biomass in Minnesota forests, subsequent impacts on sustainability, and how management practices affect the net carbon balance. Lifecycle analysis (LCA) of management scenarios by forest type would allow for a more accurate picture of the volume of biomass available for various outputs and opportunities to maximize terrestrial carbon storage. This would help to reduce confusion about carbon storage in Minnesota forests, which would help in the planning and siting of new bioenergy and biofuels facilities.

Terrestrial ecosystems have the potential to take up carbon (C) from the atmosphere and store it, thereby mitigating atmospheric carbon dioxide (CO2) occurring largely as a result of fossil fuel emissions. Forest ecosystems offer the largest long-term sink of C of all above-ground terrestrial ecosystems in the state. Site-level management practices can both impact the rate of carbon sequestration and storage as well as impact the release of CO2 into the atmosphere associated with various harvesting and manufacturing options. Measurement of these impacts and the long- and short-term storage capacity of forests to sequester CO2 would allow for development of informed policies aimed at reducing net CO2 emissions. Accurate C measurement would also provide a useful tool to the Minnesota Pollution Control Agency when assessing the carbon footprint of development projects.

Given the demand for forest biomass, there are opportunities to harvest more biomass from existing forests by increasing the intensity of management. This in turn can increase sales and subsequent revenue to the state, increase jobs and economic development opportunities, make productivity-enhancing forest treatments economical, improve forest health, and reduce wildfire risk. This study will assess the carbon flow balance and impacts on rates of C sequestration by forest age-class and the application of best management practices like green tree and harvest residue retention. It will also assess growth and yield carbon accumulation rates under different silvicultural treatments.

The *long-term goal* of this project is to identify sustainable forest management practices that may serve to increase the volume of biomass available for expanding bioproducts industries while maximizing the potential for offsetting CO2 emissions. The *primary objective* is to assess the long term physical availability of biomass across northern Minnesota forests and to compare this to measures of environmental and economic availability. This information is needed to model existing and potential forest harvest practices by forest type, which is then used to estimate net carbon flux over a 100-year period.

The study builds on recommendations of the Minnesota Terrestrial Carbon Sequestration Project, interest expressed by state and county land managers, and the biomass harvesting guidelines issued by the Minnesota Forest Resource Council. The study also builds on research recently conducted for Minnesota Power in which a preliminary carbon assessment was completed for a proposed 26-megawatt power plant and the impacts from harvesting biomass and transportation within a 100-mile radius of the project site. The proposed research builds on the methods developed for Minnesota Power to conduct an LCA for public and private forests in northern Minnesota and expansion of research to evaluate the sensitivity of C to different management scenarios, harvesting practices, transportation distances, and bioproduct markets. The proposed management scenarios to be modeled include:

- **Scenario #1:** Forest management as practiced today (multiple use with timber production)
- **Scenario #2:** Forest management with increased use of competition control, thinnings, and combinations of silvicultural treatments to increase productivity, including conversion to products providing for short-term carbon storage.
- **Scenario #3:** Forest management with increased use of competition control, thinnings, and combinations of silvicultural treatments to increase productivity, including conversion to products providing for long-term carbon storage.

To accomplish the research tasks, we propose to look at the relative physical and economic availability of forest biomass by landowner type using data from USDA Forest Service, Forest Inventory and Analysis (FIA) plots throughout the state, as well as geospatial analyses of biophysical and transportation infrastructure data. Outputs could include total above-ground terrestrial carbon storage, net C by scenario, net C by county of origin, sensitivity of biomass availability by price point, landowner, and management practices. The analysis would also include consideration of non-target species (tamarack, mixed hardwoods, bottomlands) and stocking scenarios on brushlands and understocked sites.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Net Carbon Balance for Northern Minnesota Forests **Budget: $** 111,852

Deliverable **Completion Date:** July 2011

1. Provide estimates of C sequestration and emissions under the different management scenarios by northern Minnesota forest type over a 100-year period.
2. Provide silvicultural options for balancing carbon flows throughout a forest rotation period.
3. Model to assess the net carbon footprint of development projects to be used for conducting analyses for environmental review and permitting required by the Minnesota Pollution Control Agency.

Result 2: County-Level Estimate of Forest Biomass Availability **Budget: $** 37,284

Deliverable **Completion Date:** July 2010

1. County-by-county estimate of available forest biomass based on the physical supply, environmental constraints, and delivered chip prices.

III. PROJECT STRATEGY AND TIMELINE

A. Project Partners

The research team will consist of scientists and staff at the University of Minnesota, Department of Forest Resources including Dr. Dennis Becker, Dr. Anthony D'Amato, Dr. Dean Current, Dr. Michael Kilgore, and Grant Domke. The project partners will also include UPM-Kymmene/Blandin Paper and St. Louis County Land Department who will assist with data collection, harvest site access, and information dissemination.

B. Project Impact

The direct project impacts expected from this study include:

- Identification of sustainable levels of forest biomass production for energy and biofuel applications under the Minnesota Forest Resource Council guidelines for biomass harvesting.
- Forests provide the greatest opportunity for long-term terrestrial carbon storage. Utilization of forest biomass can be used to increase carbon storage potential through increased productivity but only if done in a sustainable manner and with attention to the LCA of biofuels and energy production. This study will identify thresholds of productivity to carbon storage potential.
- This analysis may provide a tool for businesses and counties seeking to quantify above-ground terrestrial carbon to fulfill Minnesota Pollution Control Agency requirements for modeling C as part of the environmental review and permitting process.
- Provide impetus for the restoration of forest ecosystems with intermediate treatments that in the past were not economically viable for boreal mixed woods and northern hardwoods.
- Development of tangible linkages between current best management practices for forest management and carbon flows over the course of forest rotation periods.
- Identify scenarios that will allow the state to increase biomass productivity under sustainable management options.

C. Time

The duration of the project is two years from the transfer of funds. The requested time is necessary to maximize the summer field seasons and time necessary for report preparation and review. Total funding requested is: **$149,136**

D. Long-Term Strategy

This project is part of a larger effort within the Department of Forest Resources to characterize the availability of forest biomass for biofuels and energy applications, and the economic and ecological impacts of it use. An important aspect is the carbon storage and release associated with different harvest scenarios, transportation thresholds and harvesting practices, which can be used in policy development.

Project Budget

Forest Biomass LCA: Carbon, Economics, and Ecological Sustainability

IV. TOTAL PROJECT REQUEST BUDGET

BUDGET ITEM	AMOUNT	% FTE
Personnel (salary and fringe benefits):		
Dr. Dennis Becker	$ 14,321	9%
Dr. Anthony D'Amato	$ 15,648	9%
Dr. Dean Current	$ 14,321	9%
Dr. Mike Kilgore	$ 9,547	5%
Grant Domke (Research Associate)	$ 56,072	100%
Graduate Research Student (with tuition support)	$ 31,847	100%
	$ -	
Travel: Meetings with project cooperators and county parnters	$ 5,380	
Printing and Publication: Report preparation and dissemination	$ 2,000	
	$ -	
TOTAL PROJECT BUDGET REQUEST TO LCCMR	$ 149,136	

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Remaining $ From Previous Trust Fund Appropriation (if applicable):	$ -	
Other Non-State $ Being Leveraged During Project Period:	$ -	
Other State $ Being Spent During Project Period: Minnesota Next Generation Energy Board proposal for assessment of biomass availability from private and public lands	$ 115,039	Pending
In-kind Services During Project Period:	$ -	
Past Spending: Minnesota Power LCA for Laskin Bioenergy Facility	$ 49,428	

Project Manager Qualifications and Organization Description

PROJECT TITLE: Forest Biomass LCA: Carbon, Economics, and Ecological Sustainability

Faculty in the ***Department of Forest Resources*** at the ***University of Minnesota*** have a long history of working with forest resources in the state and anticipating key research problems. The interdisciplinary team assembled for this project is especially well-suited for modeling forest dynamics related to woody biomass production and assessing terrestrial carbon storage. The long standing relationships that project personnel have developed with the forest industry, private landowners and county, state and federal agencies tasked with land management and regulatory activities will increase the opportunity for realistic results and dissemination of findings.

Dennis R. Becker, Ph.D. (Principle Investigator) is an Assistant Professor of Natural Resource Policy in the Department of Forest Resources. Dr. Becker conducts research on the social and economic impacts of natural resource policy focusing on program development and evaluation in the areas of biomass utilization, wildfire management, community development, and environmental review. Relevant projects include: 1) assessing barriers to biomass removal on public lands, 2) assessment of federal community assistance programs for forest restoration, and 3) terrestrial carbon analyses of forest biomass energy development and facility siting. He also conducts research on state environmental review policies and community forestry. Dr. Becker conducts policy analysis for various agency, industry, international, congressional, and stakeholder inquiries. He holds a Ph.D. in Natural Resources from the University of Idaho.

Anthony W. D'Amato, Ph.D. (Co-PI) is an Assistant Professor of Silviculture and Applied Forest Ecology in the Department of Forest Resources. Dr. D'Amato conducts research on traditional and experimental silvicultural strategies for meeting forest management objectives ranging from production of woody biomass to the maintenance of native biodiversity in managed forests. Relevant projects include: 1) assessing the impacts of biomass harvesting on the productivity and biodiversity of aspen-dominated systems, 2) evaluation of gap-based silvicultural strategies for regenerating northern hardwoods, 3) assessing silvicultural approaches for enhancing carbon storage and sequestration, and 4) analyses for cutting cycle length and stocking levels on long-term growth and yield of northern hardwoods. Dr. D'Amato holds a Ph.D. in Forest Resources Management from the University of Massachusetts.

Dean A. Current, PhD (Co-PI) is a Research Associate in the Department of Forest Resources and is Program Director of the Center for Integrated Natural Resources and Agricultural Management. Dr. Current is a Natural Resource Economist and has researched the costs and benefits of biomass harvest from forests and perennial crops in Minnesota. Dr. Current has managed several projects related to biomass energy including: 1) an analysis of the costs and income from biomass sales related to the removal of hazardous fuels, 2) preparation of information for the development of biomass harvest guidelines, and 3) research into the environmental benefits associated with the production of perennial biomass feedstocks.

Michael Kilgore, Ph.D. (Co-PI) is an Associate Professor of Natural Resource Economics and Policy in the Department of Forest Resources and director of the Center for Environment and Natural Resource Policy. Dr. Kilgore's research interests include evaluating economic impacts of natural resource programs, use and effectiveness of policy tools to promote sustainable management, administration of forest policies and programs, and trends in and influences on the valuation and taxation of natural resources lands. He chairs the MN Master Logger Certification Program Board, is on the Advisory Board for Blandin Foundation's Vital Forests/Vital Communities and The Freshwater Society's Guardianship Council, and is the economics editor for the *Journal of Forestry*. Dr. Kilgore served on the Society of American Foresters' National Committee on Forest Policy and holds a Ph.D. in forest economics from the University of MN.