Environment and Natural Resources Trust Fund
2019 Request for Proposals (RFP)

Project Title: **ENRTF ID: 006-A**

Optimizing Minnesotas Forest Products and Ecosystem Services

Category: A. Foundational Natural Resource Data and Information

Sub-Category:

Total Project Budget: $ 789,649

Proposed Project Time Period for the Funding Requested: June 30, 2022 (3 yrs)

Summary:

To ensure a healthy forest industry we will provide data and tools to help identify the optimal uses of forest resources, considering both goods (bioproducts) and services (habitat, clean water).

Name: Lucinda Johnson

Sponsoring Organization: U of MN - Duluth

Title: Associate Director

Department: Natural Resources Research Institute

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Duluth MN 55811-1442

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Web Address

Location

Region: Northeast

County Name: Aitkin, Carlton, Cook, Itasca, Kanabec, Koochiching, Lake, Pine, St. Louis

City / Township:

Alternate Text for Visual:

We will quantify the value of the goods and services provided under alternative forest management, highlighting tradeoffs and synergies to provide a clear understanding of the consequences of management decisions.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%
____ If under $200,000, waive presentation?			

PROJECT TITLE: Optimizing Minnesota's Forest Products and Ecosystem Services

PROJECT STATEMENT One third of Minnesota is covered by forest. Minnesota's forests generate many benefits for the people of Minnesota, from forest products and the timber, paper, and wood products industries they supply, to the amenities and services they provide including clean water, wildlife habitat, and recreational opportunities. New research on renewable biofuel and bio-based chemical industry (e.g., renewable plastics, adhesives and glues; safe solvents and cleaning products) promises further opportunities for economic development and job creation based on high-value products. The multiple uses of forest resources, however, sometimes conflict, such as between fiber, fuels, or amenity-based services. The proposed work will help inform economic development and forest management by providing data and decision-making tools to industry, government agencies, and the public. The work will quantify the value of the goods and services provided under alternative forest management, highlighting tradeoffs and synergies among goods and services. The work will provide a clear and unbiased platform that can help build shared understanding among stakeholders of the consequences of management decisions, with the ultimate goal of ensuring long-term viability of Minnesota's forest products industry and sustaining the delivery of ecosystem services. Agency, industry, and NGO end users will be consulted and involved from start to finish to ensure relevancy.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Create a new database of potential bioproducts integrated with existing forest inventory data.
We will use existing and newly derived laboratory data to develop a comprehensive database of the physical-chemical characteristics of tree species. We will: 1) conduct laboratory analyses using important tree species and harvest residues to characterize physical-chemical properties including BTU potential and chemical composition (lignin, cellulose, and hemicellulose fractions); 2) build on existing forest inventory data to characterize current forest composition and structure using state, county, and federal records, along with data on private lands derived from existing remotely sensed data (LiDAR, satellite imagery, and classified aerial imagery); 3) create maps depicting potential forest products (e.g., fiber, saw timber, biofuel, solvents, adhesives, etc.) based on forest composition and structure within boreal and northern hardwood forests; 4) assess future forest resource availability under alternative management strategies using a forest landscape change model.
ENRTF BUDGET: $308,035

Outcome	Completion Date
1. Database of physical-chemical characteristics for important tree species and harvest residues and suitability for paper and wood products; laboratory analyses to fill in data gaps on chemical characteristics of tree species and harvest residues.	June 2020
2. Spatial database of current forest composition and structure.	Dec 2020
3. Predictions of future forest composition and structure under alt. mgmt. scenarios.	June 2021
4. Map of current and future resource potential based on outcomes 1, 2, and 3	Sept 2021

Activity 2: Characterize the distribution and value of forest products and ecosystem services
Forests provide wood for timber, paper, and wood products. Forests also provide ecosystems services, defined as the benefits provided to humans by ecosystems, which include provision of clean water, wildlife habitat, and recreation opportunities. At present, it is difficult to quantify the monetary value of many of these services, and as a result these values are often left out of benefit-cost calculations. Economic valuation methods will be used to assess the monetary value of a set of important forest products and ecosystem services under current and future forest conditions. The spatial distribution of services will then be mapped as set out in Activity 1, Outcome 4.
ENRTF BUDGET: $191,598

Outcome	Completion Date
1. Economic valuation of products and services (water purification, provision of deer habitat; carbon storage; winter recreation) associated w/ current and future forests	March 2021
2. Map of the distribution and value of products and ecosystem services	Sept 2021

Activity 3: Show the benefits and costs of alternative forest management and optimize the value of potential uses of forests for forest-based products and delivery of essential ecosystem services

Minnesota's forests produce a wide range of potential goods and services whose economic values can be quantified. Based on Activities 1 & 2, we will evaluate the net benefits of alternative forest management and map where that will generate benefits on the landscape. We will also use optimization techniques to search for forest management that maximizes the net benefits to end users. Optimization will be done for different weighting of end uses to highlight tradeoffs among uses. We will compare alternative forest management to the optimal outcomes to show how performance could be improved. We will apply this methodology to two landscape regions (boreal, northern hardwoods) having tree species with different potential uses and ecosystem services. A committee of end users involving personnel from the Dept. of Natural Resources, the USFS, other agencies, industries, and NGOs will be assembled at the start of the project and will be involved in the development of the model and output.

ENRTF BUDGET: $ 290,016

Outcome	Completion Date
1. Framework and methods for calculating spatially-explicit cost-benefit for potential end uses of forest resources applied to two contrasting landscape regions.	March 2021
2. Spatially explicit forest projection tool that allows assessment of alternative management strategies.	March 2022
3. Training and outreach to stakeholders.	June 2022

III. PROJECT PARTNERS:

A. Partners receiving ENRTF funding: none

B. B. Partners NOT receiving ENRTF funding

Name	Title	Affiliation	Stakeholder Consultants
Mark White	Forest Ecologist	The Nature Conservancy	Forest conservation
Brendon Jordan	Vice President	Great Plains Institute	Bioeconomy Coalition Leader
Todd Campbell	President	Consultant	Former USDA Rural Develop. Pgm.

IV. LONG-TERM- IMPLEMENTATION AND FUNDING: This project will support traditional and emerging forest products industries that can sustain the ecological services of the state's forests while simultaneously sustaining family-supporting jobs and economic growth of the region. One major product will be a protocol to quantify and evaluate both market and non-market valuation of forest-based resources and services.

V. TIME LINE REQUIREMENTS: This project will require three years. July 1, 2019 – June 30, 2022.

IX. SEE ADDITIONAL PROPOSAL COMPONENTS:

A. Proposal Budget Spreadsheet
B. Visual Component or Map
C. Parcel List Spreadsheet
D. Acquisition, Easements, and Restoration Requirements
E. Research Addendum (not required at proposal stage)
F. Project Manager Qualifications and Organization Description
G. Letter or Resolution
H. Certified Audit or 990 Tax Information

2019 Proposal Budget Spreadsheet

Project Title: Optimizing Minnesota's Forest Products and Ecosystem Services

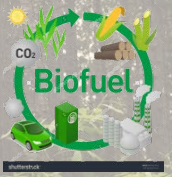
IV. TOTAL ENRTF REQUEST BUDGET 3 years

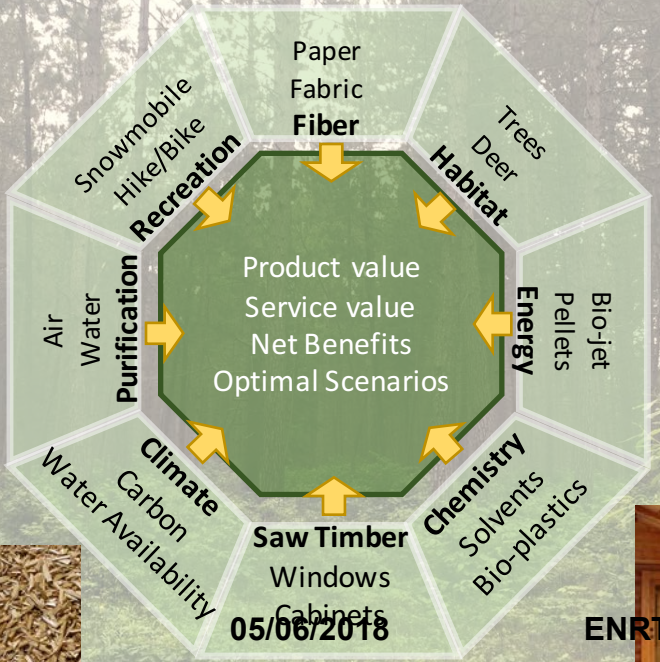
BUDGET ITEM	AMOUNT
Personnel:	**$ 770,616**
Lucinda Johnson, Principal Investigator: $41,568 (fringe rate 33.5%); 6% FTE each year	
George Host, Co-Investigator: $14,206 (fringe rate 33.5%); 6% FTE in Y1, 1% FTE in Y2 & Y3	
Eric Singsaas, Co-Investigator: $14,106 (fringe rate 33.5%); 6% FTE in Y1, 1% FTE in Y2 & Y3	
Stephen Polasky, Co-Investigator: $3,461 (fringe rate 33.5%); 1% in SUM each year	
Ron Moen, Co-Investigator: $9,666 (fringe rate 33.5%); 1% FTE in Y1 & Y3, 4% FTE in Y2	
Chris Wright, Co-Investigator: $7,647 (fringe rate 33.5%); 5% FTE in Y1, 1% FTE in Y2 & Y3	
Dan Buchman, Research Professional, Forest: $16,621 (fringe rate 27.2%); 20% FTE in Y1	
Chemist: $49,162 (fringe rate 33.5%); 50% FTE in Y1, 20% FTE in Y2	
Nathan Springer, Economic Analyst: $93,497 (fringe rate 33.5%); 10% FTE in Y1, 50% FTE in Y2, 25% FTE in Y3	
Peter Hawthorne, Optimization: $151,866 (fringe rate 33.5%); $10% FTE in Y1, 40% FTE in Y2, 75% FTE in Y3	
GIS Analysts/Computer Programmers (4): (fringe rate 27.2%); cumulative effort of 105% FTE in Y1, 100% FTE in Y2, 75% FTE in Y3	
Will Bartsch, Data Management & Project Oversight: $124,758 (fringe rate 33.5%); 50% FTE each	
Field Crew member: $9,693 (fringe rate 7.7%); 25% FTE in Y1	
Professional/Technical/Service Contracts:	**$ -**
Nature Conservancy, Mark White ($25,000): Mr. White will assist with the LANDIS modeling and development of future forest cover scenarios.	
Equipment/Tools/Supplies:	**$ 6,786**
Lab supplies for chemists ($5,486): lab wear, reagents, solvents for chromatography, yeasts and nutrients for fermentation experiments ($4,000); Chromatograph column ($1,486)	
GIS data storage ($300): 2 TB storage for GIS data	
Forestry field supplies ($1,000): wedge prisms, meter tapes, and data recorders	
Acquisition (Fee Title or Permanent Easements):	**$ -**
Travel:	**$ 7,447**
Meetings in Minneapolis ($2,543): 2 each year for 3 years: $149 lodg one night per trip, $64 full per diem ($50.25 per travel day, two days per trip, $100.50/trip), 320 mi at $0.545/mi ($174.40/trip). Totals: $894 lodging, $603 per diem, $1,046 mileage.	
Travel to present findings at 2 conferences in Minneapolis ($1,972) (one each in Y2 and Y3): 2 ppl, separate conferences in MSP, per person: 320 mi RT @ $0.545/mi ($174), 3 days with $64 per diem per day full ($64 + 2*$50.25 partial days = $164), 2 nights at $149/night ($298), $350 registration and abstract submission fee	
Remote sensing fieldwork ($2,932): $0.545/mi * 80mi/day plus $10 truck fee for 10 days=$536; $34 per diem to camp*10 days*2=$680; $25 campsite*10 nights=$250. Total: $1,466 each year in Y1 & Y2.	
Additional Budget Items:	**$ 4,800**
GIS lab use ($2,460): 200 hours at $4.10/hr each year for 3 years	
Outreach training ($2,340): In Y3 only: $705 for 40 trainees and 7 NRRI project ppl @ $15 ea for lunch for all-day training session at NRRI + $1,635 for mileage reimbursement (20 cars, 150 mi avg RT * $0.545/mi)	
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	**$ 789,649**

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	$ -	N/A
Other State $ To Be Applied To Project During Project Period:	$ -	N/A
In-kind Services To Be Applied To Project During Project Period:		
Unrecovered indirect: 54% on modified total direct costs ($789,592 base)	$ 426,379	Secured
Past and Current ENRTF Appropriation:	$ -	N/A
Other Funding History: "Using Statewide LiDAR to Quantify the Distribution and Productivity of Minnesota's Red Pine and Aspen Forests" funded by Blandin Foundation. Total project funding: $50,097. Project dates: 12/31/2016–06/30/2018.	$ 50,097	Secured

Optimizing Minnesota's Forest Products and Ecosystem Services





PROJECT TITLE: Optimizing Minnesota's Forest Products and Ecosystem Services

Dr. Lucinda Johnson, Natural Resources Research Institute (NRRI), University of Minnesota Duluth (UMD)

Key Qualifications
Lucinda Johnson is an Associate Director at NRRI-UMD, and a landscape and aquatic ecologist; for the past three decades she has conducted landscape scale research assessing the role of human activities on the health of aquatic ecosystems. She has recently worked on multiple projects predicting effects of climate change on aquatic resources embedded in forested landscapes. These projects involved use of forest inventory data, forest growth models, and climate change models. Johnson has led three previous LCCMR projects (2005; 2007; 2016) quantifying climate change impacts on aquatic resources in Minnesota. Johnson has also worked with multidisciplinary teams mapping the distribution of ecosystem services. Johnson has considerable experience leading large projects, including a current project to validate indicators of coastal ecosystem conditions ($1.67M, funded by USEPA).

EDUCATION
Ph.D., Zoology, Michigan State University, 1999
M.S., Environmental Science and Forestry, State University of New York, 1984
B.A., Duke University, 1976

Project Team:
This team brings a very broad set of skills including research and work experience in development of bioproducts such as bio-fuels and bio-chemicals that a part of the emerging forest-based industry in Minnesota, along with identification and economic valuation of ecosystem services, forest mapping, and computer programming. The assembled research team will consist of **Dr. Eric Singsaas**, **Dr. George Host**, **Dr. Ron Moen**, **Dr. Christopher Wright**, **Dr. Stephen Polasky**, and **Mr. Mark White**. **Dr. Singsaas** is the Bio-Economy and Wood Products director at NRRI-UMD. He is a plant physiologist and biochemist who studies biological hydrocarbon production and forest product utilization. **Dr. George Host** is the Director of the Forest and Land Initiative at NRRI-UMD and a forest ecologist with deep experience characterizing and mapping the distribution of forest cover types across Minnesota. **Dr. Christopher Wright** is a remote sensing specialist with deep experience quantifying land use change. **Dr. Ron Moen** is a Wildlife Ecologist and Research Lab Manager at NRRI-UMD. He has over 25 years of research experience focusing on mammals, telemetry, and wildlife ecology. **Dr. A. Stephen Polasky** is a natural resource economist whose work focuses on the market and non-market valuation of natural resources and the quantification of ecosystem services. **Mr. Mark White**, a forest ecologist with The Nature Conservancy, specializes in modeling forest growth under current and future management and climate scenarios. We will work with stakeholders including Dr. Todd Campbell, a former USDA Rural Development program manager, Mr. Brendon Jordan, Vice President of the Great Plains Institute and project leader for the Bioeconomy Coalition of Minnesota.

ORGANIZATION DESCRIPTION
The Natural Resources Research Institute is a University of Minnesota Duluth applied research organization. NRRI's mission is to deliver research solutions to balance Minnesota's economy, resources and environment for resilient communities.