Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)

Project Title: **ENRTF ID: 033-A**

An Economy-Wide, Sub-Regional Tool for Economic and Environmental Decision-Making in Minneso

Category: A. Foundational Natural Resource Data and Information

Sub-Category:

Total Project Budget: $ 597,973

Proposed Project Time Period for the Funding Requested: June 30, 2023 (3 yrs)

Summary:

We propose to create an environmentally extended input-output (EEIO) tool to inform State and local decision-makers on regional sustainable development and sustainable product and procurement policy and legislation.

Name: Timothy Smith

Sponsoring Organization: U of MN

Job Title: Professor

Department: Department of Bioproducts and Biosystems Engineering

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Location:

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

This project extends a national input-output model to a regional and sub-regional Minnesota context and will inform stakeholders of economic and environmental trade-offs associated with changes across supply chains.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

PROJECT TITLE: An economy-wide, sub-regional tool for economic and environmental decision-making in Minnesota

I. PROJECT STATEMENT

Regional sustainable development analyses require detailed and accurate information about dynamics happening within and between regional economies that create benefits and burdens across economic, social and environmental dimensions. It is critical that public and private decision-makers have access to relevant and timely information to facilitate sustainable development interventions and evaluate potential mitigation or adaptation policies affecting Minnesota and its sub-regions. **We propose to create a regionalized, commodity flow enhanced, environmentally extended input-output (EEIO) model for Minnesota, to inform State and local decision makers across a wide range of applications from regional sustainable development to sustainable product and procurement-oriented policy and legislation.** The model will assess where changes to economic activity in a particular industry and region is likely to create benefits and burdens, across its supply chain, as well as within and between regions. For example, it can provide information to stakeholders on the regional economic and environmental trade-offs associated with the expansion of copper-nickel mining or agriculture in Greater Minnesota, while also guiding enterprise-level consumption of state agencies and local governments addressing energy and water efficiency, emissions reductions or sustainable procurement targets.

EEIO models track inputs (energy, materials, capital, labor) and outputs (shipments, emissions and waste) for industries across an economy, and are used to inform sustainable production and consumption policies. EEIO models are currently being built around the world. In the U.S., EPA has recently developed a national-scale EEIO model (USEEIO), with leadership from key personnel of our research team (Yang et al., 2017), and is exploring a pilot "State" model to support Sustainable Materials Management. The EEIO model we propose for the State of Minnesota will build upon the national USEEIO model, extending it by incorporating recent advancements in sub-regional commodity flow analysis developed at the University of Minnesota (Smith et al. 2017). Working with key stakeholders across the State, a user-inspired user interface will be designed and integrated into NRRI's MN Natural Resource Atlas for wide dissemination and use.

Among its many uses, our multi- and sub-regional MN-US EEIO tool will be used to 1) evaluate regional economic and environmental trade-offs associated with creation or expansion of a particular industrial activity (e.g. mining, agriculture); 2) prioritize regional economic development opportunities that balance the economy and environmental impacts; 3) provide insight on the impacts of major disruptions or changes in commodity supply chains due to government policies, best management practices, or economic conditions; or, 4) provide guidance to agencies for assessing potential options for meeting newly established targets for energy and water efficiency, emissions reductions or sustainable procurement.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1 Title: *build MN environmentally extended input-output model* **ENRTF BUDGET: $ 239,189**

Description: *We will collaborate with the USEPA and MNPCA to develop a regionalized EEIO model for MN (MN-US EEIO), taking into account the unique economic and environmental performance situations in the State for major sectors (e.g. electricity, agriculture, and mining). Outputs of this activity will include an MN-US input-output table which captures transactions between industries within and without MN, and an MN-specific environmental table which records environmental releases from industries within MN.*

Outcome	Completion Date
1. Produce an economy-wide input-output (IO) table for Minnesota, nested within the national IO table developed by the Bureau of Economic Analysis	*Jan 1st, 2021*
2. Quantify pollutants released by productive sectors in Minnesota, based primarily on EPA's toxic release inventory (TRI) and national emissions inventory (NEI)	*Aug 1st, 2021*

Activity 2 Title: *further regionalize the MN-US EEIO model by estimating and integrating inter-county flows of major economic sectors* **ENRTF BUDGET: $ 179,392**

Description: *We will expand on previous work done at the University of Minnesota* (Smith et al. 2017) to estimate flows of major economic sectors within the State and to other states (e.g., mining and agricultural commodities). We will apply *the commodity flow enhanced MN-US EEIO to several case studies of interest to stakeholders to understand benefits and environmental burdens of regional economic planning in the State.*

Outcome	Completion Date
1. Estimate inter-county flows of major sectors (e.g., mining, agriculture)	*Feb 1st, 2022*
2. Engage stakeholders on application of the commodity flow enhanced model in sustainable development and supply chain decision-making	*Sep 1st,2022*

Activity 3 Title: *Identify drivers of pollution, develop mitigation strategies, and incorporate results into the MN Natural Resource Atlas* **ENRTF BUDGET: $ 179,392**

Description: *Besides engaging stakeholders on case studies of their interest, we will apply the model to 1) identify major drivers of pollution in the State, and 2) develop supply chain mitigation strategies for reducing pollution. We will also incorporate the model results into the MN Natural Resource Atlas, and disseminate the model for public policy and managerial use.*

Outcome	Completion Date
1. Analyze major social-economic drivers of air, water, soil pollution in Minnesota	*Jun 30th, 2023*
2. Develop economy-wide and sector-specific supply chain pollution mitigation strategies	*Jun 30th, 2023*
3. Incorporate results into the MN Natural Resource Atlas	*Jun 30th, 2023*

III. PROJECT PARTNERS AND COLLABORATORS:

A. Partners receiving ENRTF funding

Name	Title	Affiliation	Role
Dr. Timothy Smith	Professor	UMN Dept of Bioprod Biosys Eng	PI
Dr. Yi Yang	Research associate	UMN Dept of Bioprod Biosys Eng	Co-PI
Dr. Lucinda Johnson	Associate director	UMD, NRRI	Co-PI
Dr. Christopher Wright	Research associate	UMN, NRRI	Coordinator

B. Partners not receiving ENRTF funding

Name	Title	Affiliation	Role
Dr. Wesley Ingwersen	Environmental engineer	USEPA	Supporter/collaborator
Colleen Hetzel	Planner Principal	MPCA	Supporter/collaborator
Madalyn Cioci	Water prevention specialist	MPCA	Supporter/collaborator

Our colleagues at the US EPA will provide data and technical support, especially with respect to religionizing the national USEEIO model to the State. Our colleagues at Minnesota Pollution Control Agency (MPCA) will provide data support and feedback on potential applications of the model at the agency.

IV. LONG-TERM IMPLEMENTATION AND FUNDING:

The MN-US EEIO model proposed is the first of its kind in Minnesota. It will be of immediate value to state environmental policy making, such as MPCA, corporate sustainability management, and research institutes. We expect this to be a long-term project. We will work with EPA to assure compatibility with future state EEIO version, so the EPA state models are advanced, the MN-specific enhancements will remain compatible, and we will document how data updates can be seamlessly integrated. Future cost is expected to be much less, and may be financed by stakeholders interested in continuous use of the model.

Yang, Y., Ingwersen, W. W., Hawkins, T. R., Srocka, M., & Meyer, D. E. (2017). USEEIO: A new and transparent United States environmentally-extended input-output model. Journal of cleaner production, 158, 308-318.
Smith, T. M., Goodkind, A. L., Kim, T., Pelton, R. E., Suh, K., & Schmitt, J. (2017). Subnational mobility and consumption-based environmental accounting of US corn in animal protein and ethanol supply chains. Proceedings of the National Academy of Sciences, 114(38), E7891-E7899.

Attachment A: Project Budget Spreadsheet
Environment and Natural Resources Trust Fund
M.L. 2020 Budget Spreadsheet
Legal Citation:
Project Manager: Timothy M. Smith
Project Title: An economy-wide, sub-regional tool for economic and environmental decision-making in Minnesota
Organization: University of Minnesota, Twin Cities
Project Budget: $597,973
Project Length and Completion Date: 3 years through June 30, 2023
Today's Date: April 14, 2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	$ 582,365	$ -	$ 582,365
Timothy Smith, project manager (734.5% salary + 26.5% fringe), professor at UMN, 9 month appointment, 6% FTE (3 weeks effort) for 3 years; project coordination, results dissemination, and stakeholders engagement; $67,471			
Yi Yang, co-project manager (73.5% salary + 26.5% fringe), postdoc at UMN, 12 month appointment, 50% FTE for 3 years; data compilation and model building; $126,275			
Lucinda Johnson, co-project manager (73.5% + 26.5% fringe), senior research associate at NRRI, 5% FTE for 3 years; project coordination, results dissemination, stakeholder engagement; $36,069			
Chris Wright, Atlas coordinator (73.5% + 26.5% fringe), research associate at NRRI, 25% FTE for 3 years; data compilation and model building; $64,906			
NRRI Atlas programmer (77% salary + 23% fringe), 30% FTE year 3; $29,357			
NRRI Atlas web programmer (77% salary + 23% fringe), 10% FTE year 3; $7,788			
1 Postdoc (81% salary + 19% fringe), 100% FTE for years 2-3; data compilation and model building; $129,224			
1 graduate research student (59% salary + 41% fringe), 50% for years 1-2 and 25% for year 3; data compilation and model building; $121,275;			
Professional/Technical/Service Contracts			
	$ -	$ -	$ -
Equipment/Tools/Supplies			
Non-capital equipment such as computers and software, $6,243	$ 6,243	$ -	$ 6,243
Capital Expenditures Over $5,000			
	$ -	$ -	$ -
Fee Title Acquisition			
	$ -	$ -	$ -
Easement Acquisition			
	$ -	$ -	$ -
Professional Services for Acquisition			
	$ -	$ -	$ -
Printing			
	$ -	$ -	$ -
Travel expenses in Minnesota			
Travel for meetings with stakeholders and project partners, and attendance for postdoc and graduate students at in-state conferences to disseminate project findings; $7,804	$ 7,804	$ -	$ 7,804
Other			
Scientific journal publication	$ 1,561	$ -	$ 1,561
COLUMN TOTAL	$ 597,973	$ -	$ 597,973

SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		$ -	$ -	$ -
State:		$ -	$ -	$ -
In kind: Unrecovered F&A	Secured	$ 301,951	$ -	$ 301,951

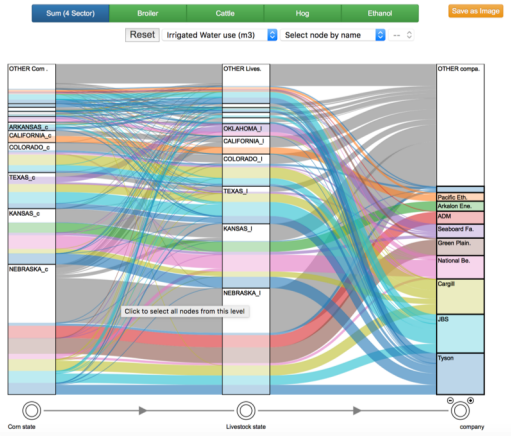
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	Amount legally obligated but not yet spent	Budget	Spent	Balance
		$ -	$ -	$ -

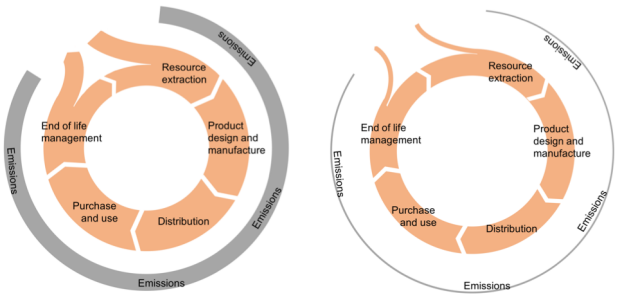
An economy-wide, sub-regional tool for economic and environmental decision-making in Minnesota

Project Overview

Regionalized EEIO Tables establishing production-consumption relationships between industrial sectors

Commodity Trade Flow Model enhancing locational specificity of EEIO sector relationships

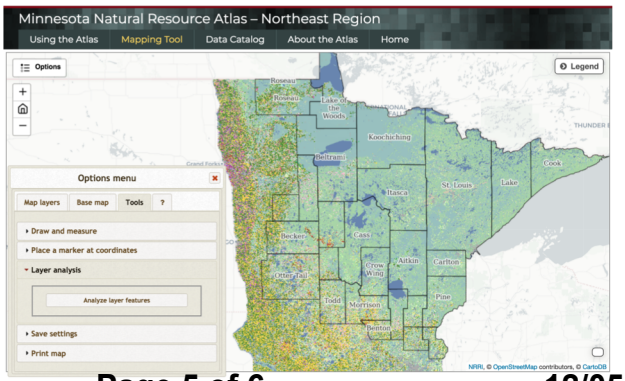




Regionalized MN-US EEIO enabling policy-makers, private decision-makers and civil society actors to assess sub-regional economic and environmental trade-offs and mitigation strategies.

Project Outputs & Outcomes

Results integrated with existing regionalized decision-support tools: allowing users easy access to MN-US EEIO information along side addition regional data within the MN Natural Resource Atlas



Enable effective decision-making through leading science based economy-wide, sub-regional information

Assess disruptions or changes in commodity supply chains due to policies or economic conditions

Inform legislative, regulatory, legal and managerial decision-making for regional sustainable development.

Guide State agencies and local governments in meeting energy and water efficiency, emissions reductions or sustainable procurement targets.

F. Project Manager Qualifications and Organization Description

Dr Timothy M. Smith, Department of Bioproducts and Biosystems Engineering, UMN
Dr. Smith will serve as the project manager and be responsible for overall project coordination. Dr. Smith is professor of sustainable systems management and International Business at the University of Minnesota, where he is also the founding director of the NorthStar Initiative for Sustainable Enterprise at the Institute on the Environment. Throughout his career, he has developed integrative approaches to sustainable systems performance measurement and decision-making within the contexts of supply chain management, product/process design, marketing and public policy. Smith's research has been published in a broad array of top-tier scholarly journals, including the Proceedings of the National Academies of Science, Nature Sustainability, Environmental Science & Technology, Journal of Industrial Ecology, Bioresource Technology, Global Environmental Change, Energy Policy, International Journal of Research in Marketing, and Journal of Marketing Research, among others. His work has also been highlighted in Bloomberg, The Conversation, Huffington Post, The Guardian, GreenBiz, Sustainable Brands, and other trade and local press. Dr. Smith has served on the faculty at INCAE Business School in Costa Rica (2007; 2017), and held the rotating chair in sustainable entrepreneurship at Wageningen University, Netherlands (2011). He teaches undergraduates, graduate students and executives in courses on sustainability management systems and strategy, systems thinking and analysis, and corporate sustainability and social responsibility – earning him numerous awards for teaching excellence and community engagement. Dr. Smith is a former USDA National Needs Fellow, AT&T Industrial Ecology Fellow and recipient of the President's Community-Engaged Scholar Award. He also actively advises governmental agencies on energy and public procurement policies, and consults numerous companies and organizations on advancing sustainability.

Dr. Lucinda Johnson, Natural Resources Research Institute (NRRI), UMD
Dr. Johnson will serve as co-project manager, be responsible for proposed work at NRRI, and assist with overall project coordination. Dr. Johnson is associate director of Land, Water, and Environment at NRRI. Johnson has worked in areas such as environmental assessment and bioindicators, impacts of climate change, and decision-making in the environmental sciences. She has also served on the International Joint Commission Science Advisory Board, EPA Science Advisory Board Committee for Ecological Processes and Effects, UPM Blandin Technical Advisory Committee, and Healing Our Waters Technical Advisory Committee.

Dr. Yi Yang, co-Project Manager, Postdoc, Department of Bioproducts and Biosystem Engineering, UMN
Dr Yang will serve as co-project manager, be responsible for environmentally extended input-output (EEIO) modeling, and assist with overall project coordination. Dr. Yang has worked with the Environmental Protection Agency, and co-developed the USEEIO model, which is now widely used by government agencies such as the Department of Energy (DOE) and research institutes such as National Renewable Energy Laboratory and Yale University.

Organization Description
The University of Minnesota is one of the largest, most comprehensive, and most prestigious public universities in the United States. The Department of Bioproducts and Biosystems Engineering integrates engineering, science, technology, and management toward solutions for the sustainable use of renewable resources and enhancement of the environment. Associated with the University of Minnesota Duluth, and with research facilities in Duluth and Coleraine, Natural Resource Research Institute is a leading research arm of the greater University of Minnesota community. The laboratories and offices of the PI and co-PIs contain all of the necessary fixed and moveable equipment and facilities needed for the proposed studies.