Environment and Natural Resources Trust Fund
2016 Request for Proposals (RFP)

Project Title: **ENRTF ID:**   135-E

High Resolution Climate Projections to Aid Planning Efforts

Category: E. Air Quality, Climate Change, and Renewable Energy

Total Project Budget: $ 411,389

Proposed Project Time Period for the Funding Requested: 3 years, July 2016 to June 2019

Summary:

Minnesota's climate is changing and local scale climate projections are needed to ensure the development of sound adaptation strategies to help protect and sustain Minnesota's environment, infrastructure, economy, and health.

Name: Peter   Snyder

Sponsoring Organization: U of MN

Address: Dept. of Soil, Water, and Climate, 439 Borlaug Hall, 1991 Upper Buford Circle

St. Paul   MN   55108

Telephone Number: (612) 625-8209

Email pksnyder@umn.edu

Web Address   http://www.swac.umn.edu/People/Faculty/PeterSnyder/index.htm

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

The image shows the different sectors of the Minnesota environment, infrastructure, economy, and health at risk from climate change and how this project can assist those studying impacts and adaptation.

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

PROJECT TITLE: High Resolution Climate Projections to Aid Planning Efforts

I. PROJECT STATEMENT

Minnesota's climate is changing, as indicated by observed temperature increases and extremes in precipitation. These changes are impacting valuable resources, such as swimmable, fishable lakes and rivers; productive forests that sustain iconic species, like moose and birch; fertile farmland cultivated for local food systems and commodity export; and many aspects of the built environment that support our daily lives, such as roads and bridges, stormwater/sewer infrastructure, potable water supply, and power utilities. Projections at the local level of further change in temperature, precipitation and other weather-related variables are urgently needed by researchers, planners, engineers, farmers and businesses to ensure sound planning and implementation of appropriate adaptation strategies for maintaining and protecting our natural environment, built infrastructure, economy and health. **The goals of this project are to 1) produce high-resolution (areas equivalent to a quarter size of a township) climate model projections for the entire state of Minnesota; 2) develop a publicly-accessible web-based portal for obtaining the data; and 3) develop educational resources and train professionals on using and interpreting the data for planning and adaptation purposes.**

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: *Produce Minnesota-specific climate model projections*   **Budget: $224,675**
Dr. Peter Snyder will use a computational technique called dynamical downscaling to take global climate models results used by the Intergovernmental Panel on Climate Change to produce new high-resolution climate model projections for the entire state of Minnesota from the present to 2099. Dr. Snyder will use resources at the Minnesota Supercomputing Institute to produce the projections. Ten high-resolution climate projections will be produced for Minnesota that represent moderate and high emission scenarios of projected climate change. This approach will provide a lower and upper bound of plausible outcomes for planning purposes. Model results will be produced statewide at 3 miles by 3 miles resolution with data available for different time frames.

Outcome	Completion Date
1. Produce results for first group of four climate projections	July 2017
2. Produce results for second group of four climate projections	July 2018
3. Produce results for third group of two climate projections	December 2018

Activity 2:Develop *Web Portal and Deploy Server to Disseminate Model Results*   **Budget: $83,218**
As modeling efforts near completion, Dr. Snyder will begin transferring the projected information to a data server to be housed at the Minnesota Supercomputing Institute at the University of Minnesota for at least 5 years. The server will be used to disseminate data through a publicly accessible web portal. The web portal will be designed with input from a user's group identified through the Minnesota Climate Adaptation Partnership – a collaboration of universities, nonprofits, businesses and local, state and federal agencies working on climate adaptation. The portal will allow users to specify information of interest (e.g., temperature, precipitation, snow cover), time period of interest (e.g., 2020–2050), averaging required (e.g., annual, seasonal, monthly, daily), area of interest (the whole state, a single location), and options of file formats for downloading.

Outcome	Completion Date
1. Determine members of User's Group for portal development	May 2018
2. Host two meetings of the User's Group to draft portal functionality and interface	October 2018
3. Deploy server at MSI	January 2019
4. Develop web portal for information dissemination and deploy	March 2019

1

Activity 3: *Education and Outreach*   **Budget: $103,496**
Dr. Snyder will use a three pronged approach to education and outreach regarding use of the data: 1) he will produce a comprehensive set of online tutorials on the basics of climate change, modeling of the climate system, and proper use of data that will be provided on the portal to the public; 2) he will partner with University of Minnesota Extension to incorporate information on portal use into their existing online climate adaptation training to help participants learn to access/use the data to lead climate adaptation activities in their organizations and municipalities (the course targets natural resources, water, municipal infrastructure and human resources professionals); and 3) he will provide two "train the trainer" workshops for state agencies, local municipalities and others who will then educate colleagues on best practices for using and interpreting the data for climate adaptation efforts.

Outcome	Completion
1. *Develop web-based educational materials on climate change and data usage*	*March 2019*
2. *Provide two "train the trainer" workshops*	*June 2019*

III. PROJECT STRATEGY
A. Project Team/Partners
Dr. Peter Snyder will lead the project. He will oversee a post-doctoral scholar and a graduate student who will conduct the model simulations and processing of the data. Dr. Snyder will work with university staff to deploy the server. He, the post-doc, student, and the Minnesota Climate Adaptation Partnership User's Group will work with the web developer to design the data portal. Dr. Snyder, in collaboration with University of Minnesota Extension, will develop a user's guide and educational content. Dr. Snyder, the post-doc, and the student will conduct two "train the trainer" workshops with state agencies, local municipalities, and others. Confirmation has already been secured from seven agencies that will train their respective constituents and colleagues on best practices.

B. Project Impact and Long-Term Strategy
The data derived from this project are essential for long-term planning and implementation of adaptation strategies for the protection of the state's natural resources, infrastructure and health. Examples of high resolution climate model projection data usages include: Department of Natural Resources: Understanding spatial variation in climate change across the state will help inform the management of sensitive natural resources, such as future changes in plant communities and fish and wildlife populations. Department of Transportation: This information will allow hydraulic designers to predict changes in river and stream flows over time and will be useful for assessing the vulnerability of bridges, culverts and roadways to flooding so that options to build in resilience or mitigate impacts can be considered. Department of Agriculture: This information will aid development and enhancement of best practices for soil and water management and help plan for and respond to livestock disease outbreaks. Pollution Control Agency: This information will help the agency to better assess and reduce future vulnerabilities to wastewater treatment plants, stormwater management systems, and solid waste management facilities. The data will also enhance the agency's ability to assist communities to plan for future climatic conditions. Department of Health: This information will enable epidemiologists to forecast how future climate change scenarios may impact people's health, particularly associated with extreme heat events, reduced air quality, rising pollen levels, drought, flood events, and diseases carried by ticks and mosquitoes. Each of the state agencies listed above has provided official agency support of the proposed effort.

C. Timeline Requirements
The project will begin in July 2016 and continue for 36 months. Project duration is dictated by the time it will take to produce the ten climate projections using the Minnesota Supercomputing Institute resources. Approximately three months is required for each projection statewide. Education and training on the use of the data portal will begin in the third year of the project.

2

2016 Detailed Project Budget

**Project Title:** High Resolution Climate Projections to Aid Planning Efforts

IV. TOTAL ENRTF REQUEST BUDGET *3* years

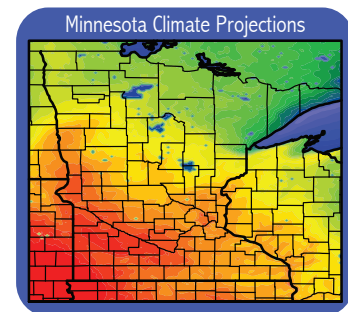| BUDGET ITEM	AMOUNT
Personnel:	
Peter Snyder, Project Manager (75% salary, 25% benefits); 11% FTE for each of three years	$ 41,041
1 Posdoctoral Scholar, numerical modeling, programming, data processing and analysis (82% salary, 18% benefits); 100% FTE for each of three years	$ 187,296
1 Graduate Research Assistant, programming, data processing and analysis, scientific communication (54% salary, 46% fringe); 50% FTE for each of three years	$ 125,052
Professional/Technical/Service Contracts:	
Web Development Consulting firm TBD: Professional services to develop and deploy web portal to disseminate model data and information on climate change and best use of data	$ 30,000
Equipment/Tools/Supplies:	
1 HP server to be housed at the Minnesota Supercomputing Institute (MSI) and maintained by MSI staff	$ 9,000
Purchase of long-term (five years) storage on existing MSI high-speed data drives	$ 11,000
Additional Budget Items:	
Printing and binding of training material to be used in disseminating education and outreach materials regarding use of the data and metadata.	$ 2,000
Publication costs associated with scientific articles on the dowscaling approach, research findings regarding climate change in Minnesota, and outreach strategies for working with state and other governmental agencies. 3 publications	$ 6,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 411,389

V. OTHER FUNDS

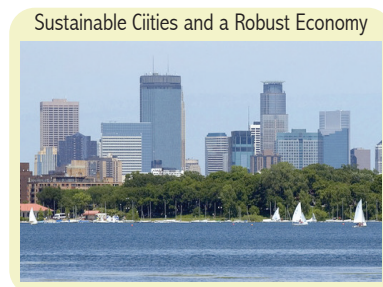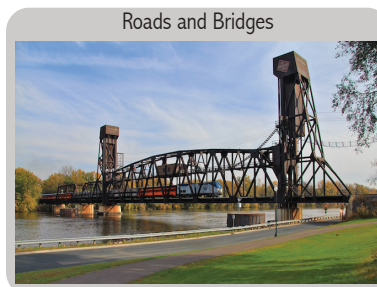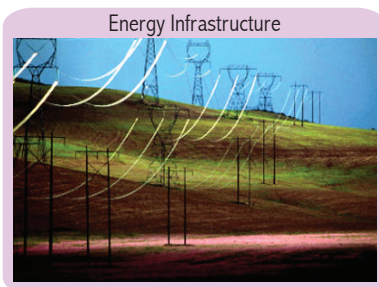| SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	N/A	
Other State $ To Be Applied To Project During Project Period:	N/A	
In-kind Services To Be Applied To Project During Project Period:		
In-kind services from Minnesota Supercomputing Institute (MSI) based on cost per "Supercomputing Unit". Current MSI in-kind rate is $0.15/SU. Total number of SUs to complete	$945,000	*Secured*
Snyder will contribute 1 month of in kind support per year.	$13,680 / year	*Secured*
Funding History:		
The research proposed relies on numerical modeling efforts developed as part of two National Science Foundation grants totalling $10.2 million dollars to the University of Minnesota since 2008. $586,097 was explicitly stated for the modeling efforts that will be expanded on in this project. Two NSF proposals are pending to continue the support.	$ 586,097	past funding
Remaining $ From Current ENRTF Appropriation:	N/A	

Our future depends...

Global Climate Projections
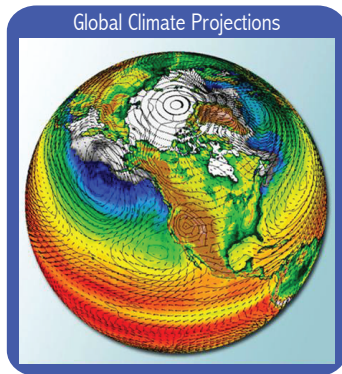
Credible Projections
of Minnesota's
Changing Climate →

Minnesota Climate Projections

on good information to respond to changes in the climate

Iconic Species

Fertile Farmland

Swimmable and Fishable Lakes and Rivers

Productive Forests

Human Health

Stormwater/Sewer Infrastructure

Energy Infrastructure

Roads and Bridges

Sustainable Ciities and a Robust Economy

This project will provide valuable Minnesota-specific climate change information
to those responsible for maintaining and protecting
our natural environment, infrastructure, economy, and health
as we transition to a stronger and more resilient Minnesota

Project Manager Qualifications & Organization Description:

Peter K. Snyder, Department of Soil, Water, and Climate, University of Minnesota

Dr. Peter K. Snyder is an Associate Professor in the Department of Soil, Water, and Climate at the University of Minnesota. He is an atmospheric scientist studying an array of research problems related to atmospheric dynamics, hydroclimatology, hydrometeorology, climate change, and land-atmosphere interactions. He has conducted research in the Arctic, the tropics, and across North America. In particular, Snyder has conducted research on the role of Great Plains Low Level Jet on moisture transport and precipitation events in the Upper Midwest, the role of climate change on the frequency of extreme events, the influence of Arctic warming on the boreal forest, monitoring and mitigation of urban heat islands, the climate response to boreal afforestation for carbon sequestration, and data mining of complex environmental systems. He has secured over $3 million dollars in funding from federal agencies such as the National Science Foundation, US Department of Agriculture, and the Department of Energy. Snyder teaches both undergraduate and graduate courses on meteorology, atmospheric dynamics, numerical modeling, and ecological climatology. In addition, he is an instructor in the University of Minnesota Early Career Teaching Program. He has performed over 50 media-related outreach activities including television, radio, newspaper, and web to discuss climate change and meteorology issues. He is a Fellow of the University of Minnesota Institute on the Environment.

Dr. Snyder has a doctorate in Atmospheric and Oceanic Sciences from the University of Wisconsin – Madison in 2004, a M.S. in Earth Science from the University of Georgia in 1991, and a B.A. in Geography from the University of California, Santa Barbara in 1989. Prior to beginning his doctorate program Snyder worked in the defense and environmental engineering fields.

Minnesota Supercomputing Institute, University of Minnesota

The Minnesota Supercomputing Institute (MSI) is a university resource for numerical modeling and other advanced computational work. The mission of the Supercomputing Institute is supercomputing research. This includes all aspects of high-performance computing and scientific modeling and simulation as well as graphics, visualization, high-performance network communications, informatics, and data mining. The supercomputing resources, as well as the Institute's Scientific Development and Visualization Laboratory and researcher and staff offices, are located in the Walter Library/Digital Technology Center. MSI has a long tradition of providing leading-edge computational resources and unrivaled technical user support. It has three state-of-the-art supercomputers, a wide variety of software and applications including tools developed in-house, and an experienced support/development team. A detailed list of the computing resources available through the Institute can be found at www.msi.umn.edu.