

## Trust Fund 2009 Work Program

**Date of Report:** May 29, 2009

**Date of Next Progress Report:** January 1, 2010

**Date of Work Program Approval:**

**Project Completion Date:** June 30, 2011

**I. PROJECT TITLE:** Projecting Environmental Trajectories for Energy-Water-Habitat Planning

**Project Manager:** Peter Reich

**Affiliation:** University of Minnesota

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**Location:** Saint Paul

<b>Total Trust Fund Project Budget:</b>	<b>Trust Fund Appropriation</b>	<b>\$</b>	<b>180,000</b>
	<b>Minus Amount Spent:</b>	<b>\$</b>	<b>0</b>
	<b>Equal Balance:</b>	<b>\$</b>	<b>180,000</b>

**Legal Citation:** M.L. 2009, Chp. 143, Sec. 2, Subd. 7b

### **Appropriation Language:**

\$180,000 is from the trust fund to the Board of Regents of the University of Minnesota to combine detailed climatic records of Minnesota with present and past ecosystem boundaries to forecast future fine-scale flow of climate across the state impacting human activities and natural resources.

### **II. PROJECT SUMMARY AND RESULTS:**

Just as weather flows across the surface of the earth, so does climate—only much more slowly. We will apply new methods for understanding this flow, to start with the climatic changes of the 20th-century dust-bowl era and project the flow of climate and its environmental effects forward into the foreseeable future. Because Minnesota encloses the triple junction of the three great ecosystems of North America—western prairie, northern coniferous forests, and eastern deciduous forests—conditions here are particularly sensitive to local changes and also relevant to the nation as a whole.

This project aims to provide climatic information on a broad scale and relate it to the plants, animals, and waterways of Minnesota. Since the prototype mathematical algorithms have already been tested and demonstrated in a pilot program (see attached map), and the raw data are already available, this proposed project can produce an important result for a relatively limited expenditure.

### III. PROGRESS SUMMARY AS OF MAY 2009

The project has not yet begun.

### IV. OUTLINE OF PROJECT RESULTS:

#### Result 1: Data and software assembly, computer runs.

##### Description:

We will use the millions of observations that are maintained in established databases of century-long climatological records, available across Minnesota and the bordering regions. From this vast collection of observations we will construct mathematical representations of prevailing conditions, interpolating to any point on the ground and at any time within the range of the data.

We will use the mathematical representations to determine how regional conditions across Minnesota changed on a fine grid during the 20th century, and then make best estimates of how they are expected to change in the foreseeable future. We will pay special attention to areas that could undergo abrupt change, as has happened in the past.

**Summary Budget Information for Result 1:** Trust Fund Budget: \$90,000  
Amount Spent: \$ 0  
Balance: \$ 90,000

Deliverable	Completion Date	Budget
1. Data assembly, unification, database construction	11/30/2009	\$43,000
2. Software adaptation and automation of pilot programs	1/30/2010	\$27,000
3. Computer runs and production of working maps and tables	6/30/2010	\$20,000

**Result Completion Date:** 06/30/2010

**Result Status as of 12/15/2009:**

**Result Status as 2/15/2010:**

**Final Report Summary 7/30/2010:**

#### Result 2: Analysis, documentation, and publication.

##### Description:

Beginning concomitantly with Result 1, but emphasized after and following from the previous result, we will use the working maps and tables to provide information relevant to, and as feasible evaluate, (1) delineation of areas having future potential for renewable bioenergy production, (2) future effects on energy consumption for heating, cooling, and other climate-

induced consumption, (3) future supply of water to reservoirs or aquifers, (4) local trends in extreme rainfall events relevant to flood control, (5) ranges of locally threatened or endangered species, (6) areas of increased dangers of fire, insect damage, or other ecological change.

**Summary Budget Information for Result 2:** Trust Fund Budget: \$ 90,000  
 Amount Spent: \$ 0  
 Balance: \$ 90,000

Deliverable	Completion Date	Budget
1. <i>Correlation with ecological, physical, and local conditions</i>	11/30/2010	\$42,000
2. <i>Web-based time-lapse video files of results across Minnesota</i>	1/30/2011	\$11,000
3. <i>Analysis and reporting</i>	6/30/2011	\$37,000

**Result Completion Date:** 06/30/2011

**Result Status as of 12/15/2009:**

**Result Status as 2/15/2010:**

**Result Status as 7/30/2010:**

**Result Status as of 12/15/2010:**

**Result Status as 2/15/2011:**

**Final Report Summary 7/30/2011:**

**V. TOTAL TRUST FUND PROJECT BUDGET:**

**Personnel:** \$166,890. This represents the sum of \$73,991 to C Lehman who will provide software expertise to carry out the computer computations, data processing, and geographic mapping, and working with graduate assistants (will work an average of 33% on this project); \$64,801 to a postgraduate researcher (postdoctoral associate or graduate student to be determined) who will assist in developing the underlying mathematics for the climate projections (80% time); \$14,195 to P Reich who will manage the project, interaction with all participants in developing goals, interpreting data, and writing reports (4% time); \$12,421 to L Frelich who will contribute to the evaluation of plant community responses to climate projections (8% time on average), and \$11,482 to a technician to assist with overall project management logistics as well as map and report preparation (12% on average).

**Contracts:** \$ none

**Equipment/Tools/Supplies:** \$ 1,110 (specialized inks and papers for mapping)

**Acquisition, including easements:** \$

**Travel:** \$ 2,000 for reviews with local climatologists, agronomists, ecologists, plus any necessary visits to climatological stations, plus in-state presentations at public events and scientific symposia.

**Other:** \$

**TOTAL TRUST FUND PROJECT BUDGET: \$ 180,000**

**Explanation of Capital Expenditures Greater Than \$3,500:**

## **VI. PROJECT STRATEGY:**

### **A. Project Partners:**

**Peter Reich** is project manager. In addition: (1) **Clarence Lehman** (Ecology) will provide software expertise to carry out the computer computations, data processing, and geographic mapping, working with graduate assistants. (2) **Richard McGehee** (Mathematics) will provide numerical and topological expertise to interpret the multi-dimensional surfaces associated with the project, and to guide its mathematical applications. (3) **Lee Frelich** (Forest Ecology) will lend his expertise on the plant communities of Minnesota and how they are responding to present-day change in their conditions. (4) **Mark Seeley** (Climatology) will apply his expertise with long-term climatic trends in the region to guide and interpret project results. He will also open a powerful conduit for public awareness of the project and its results. Public understanding and public involvement is a key to successful adaptation in a democracy, and Dr. Seeley will be providing one of those keys. (5) **Donald Wyse** (Agronomy) will contribute his expertise on agricultural systems, including parameters related to their maintenance and long-term sustainability. He will provide essential connections to industry, relating bioenergy production to agribusiness realities. (6) **Jeannine Cavender-Bares** (Ecology) will relate the physiological tolerances of species to their climatic distributions to predict range shifts and risks of invasive species. (7) We will also employ undergraduate and/or graduate assistants.

### **B. Project Impact and Long-term Strategy:**

This project has a broad scope, covering all four areas in the LCCMR 2009 Phase-2 Funding Priorities by providing information important for planning the future of land, habitat, water, invasive species, and renewable bioenergy. In particular, the project will provide information on or relevant to the following issues, among others: (1) the future supply of water to our natural and artificial watersheds, (2) locations of lands suitable for future grassland, woodland, and potentially wetland bioenergy, (3) locations of lands suitable for food crops in the future, (4) conditions that affect invasive species, (5) the fate of carbon sequestration in Minnesota's vast peatland complexes, (6) future spatial boundaries of our state's ecosystems, (7) validation of other climate models, and (8) other various conditions involving human, animal, and ecosystem health.

The project will address the above topics and assess their scope, but will focus in more detail on that subset of topics determined to be most relevant and feasible during the first phase of the effort. For all topics we will assess and describe projected climatic features relevant to each specific issue, while evaluating qualitatively and wherever feasible quantitatively how projected climate features will influence the specific issues in focus. The project also aims to increase awareness of the effects of global environmental change and thereby encourage actions that could ultimately help prevent or reverse some of its effects.

Our goal is to provide information for planners to adapt to climate changes before they actually occur, including adaptive management of the next-generation bioenergy industry. For example, increased inter-annual variability in rainfall might favor certain mixed species over single species, and potentially favor grassland biofuels over woodland ones. The techniques will apply to the entire state of Minnesota, but they will also be able to be adapted by all other states of the union to later form a nation-wide assessment of the topics considered here locally.

**C. Other Funds Proposed to be Spent during the Project Period:**

No other funds allocated. Other funds will be sought from relevant sources throughout the course of this project to leverage this funding and encompass additional results.

**D. Spending History:**

The project has not yet begun.

**VII. DISSEMINATION:**

This is a two-year project. Its first year will involve data assembly, algorithm validation, analysis, and preparation of preliminary maps and tables. Its second year will correlate the results with ecological, hydrological, physical, and social aspects. Included in the second year are final reports, public presentations, web dissemination, and publication in scientific journals.

**VIII. REPORTING REQUIREMENTS: Periodic work program progress reports will be submitted not later than 12/15/2009, 2/15/2010, 7/30/2010, 12/15/2010, and 2/15/2011. A final work program report and associated products will be submitted between June 30 and August 1, 2011 as requested by the LCCMR.**

**IX. RESEARCH PROJECTS:**

Attachment A: Budget Detail for 2009 Projects - Summary and a Budget page for each partner (if applicable)								
<b>Project Title:</b> <i>Projecting Environmental Trajectories for Energy-Water-Habitat Planning</i>								
<b>Project Manager Name:</b> <i>Peter Reich</i>								
<b>Trust Fund Appropriation:</b> \$ <b>180,000</b>								
1) See list of non-eligible expenses, do not include any of these items in your budget sheet								
2) Remove any budget item lines not applicable								
2009 Trust Fund Budget	Result 1 Budget:	Amount Spent (date)	Balance (date)	Result 2 Budget:	Amount Spent (date)	Balance (date)	TOTAL BUDGET	TOTAL BALANCE
	<i>Data, software, computer runs</i>			<i>Analysis, documentation, publication</i>				
<b>BUDGET ITEM</b>								
<b>PERSONNEL: Academic wages and benefits</b> (Result1:Reich \$6891, 4% FTE; Lehman \$43938, 40% FTE; Frelich \$3045, 4% FTE. Result 2: Reich \$7304, 4% FTE; Lehman \$30053, 27% FTE; Frelich \$9377, 12% FTE)	53,874			46,734				
<b>PERSONNEL: Graduate research analyst</b> (Result 1: 80% FTE, Result 2: 80% FTE)	31,798			33,003				
<b>PERSONNEL: Technical specialist, GIS/database</b> (Result 1: 8.3% FTE, Result 2: 17% FTE)	3,680			7,802				
<b>Contracts</b>								
Professional/technical (with whom?, for what?)								
Other contracts (with whom?, for what?) list out: personnel, equipment, etc.								
Other direct operating costs (for what? – be specific)								
Non-capital Equipment / Tools (what equipment? Give a general description and cost)								
Office equipment & computers - NOT ALLOWED unless unique to the project								
Capital equipment over \$3,500 (list specific items)								
Land acquisition								
Easement acquisition								
Professional Services for Acq.								
Printing								
Supplies (specialized inks and papers for mapping)	248			862				
Travel expenses in Minnesota (Reviews with local climatologists, agronomists, ecologists, plus any necessary visits to climatological stations, plus in-state presentations at public events and scientific symposia.)	400			1,600				
Travel outside Minnesota (Presentation of results at regional symposium)				0				
Other (Describe the activity and cost) be specific								
<b>COLUMN TOTAL</b>	<b>\$90,000</b>	<b>\$0</b>	<b>\$90,000</b>	<b>\$90,000</b>	<b>\$90,000</b>	<b>\$90,000</b>	<b>\$180,000</b>	<b>\$180,000</b>