

**Environment and Natural Resources Trust Fund  
2012-2013 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 091-E2**

Understanding Minnesota's Changing Seasons to Improve Resource Management

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**Topic Area:** E2. NR Info Collection/Analysis

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**Total Project Budget:** \$ 266,138

**Proposed Project Time Period for the Funding Requested:** 3 yrs, July 2013 - June 2016

**Other Non-State Funds:** \$ 0

**Summary:**

An online database of timing of biological events (e.g. leafing, migration) recorded by a network of citizen-observers will improve prediction and management of the effects of climate on natural resources.

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**Name:** Rebecca Montgomery

**Sponsoring Organization:** U of MN

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St. Paul MN 55108

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**Email:** rebeccam@umn.edu

**Web Address:** <http://ecophys.cfans.umn.edu/>

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:**

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



# Environment and Natural Resources Trust Fund (ENRTF)

## 2012-2013 Main Proposal

**PROJECT TITLE:** Understanding Minnesota's changing seasons to improve resource management

### I. PROJECT STATEMENT

To everything there is a season. From deciding *when* to spray mosquitoes, trim trees, plant corn or apply fertilizer to deciding *where* to go to fish for trout, see spring wildflowers or fall colors – timing is everything. Phenology, the timing of seasonal biological events like leafing, blossom dates, migration, insect emergence or fish spawning, is critical to understanding interactions among species (e.g. plant-pollinator, predator-prey); determines growing season length for plants; and affects human health (e.g. pollen, tick, mosquito season). The timing of seasonal biological events is a critical ecological process that ensures the health, productivity and integrity of our natural resources.

What happens if the timing of our seasons changes? This question is becoming increasingly relevant to anyone making decisions related to Minnesota's natural resources. Our overarching goal is to better understand the timing of seasonal biological activity and its relation to climate. This new knowledge will provide a critical scientific foundation for management of Minnesota's natural resources now and in the future. For example, forest managers seeking to increase timber productivity may favor tree species shown to lengthen their growing season in warm years. There is growing worldwide evidence of recent unprecedented change in both plant and animal phenology likely related to changing climate. Changes in phenology could jeopardize not only the health and productivity of our natural resources but also the economic gains realized from activities as diverse as visiting a park, harvesting a tree or fishing. We ask:

- How has the timing of seasonal biological events (i.e. phenology) changed in Minnesota?
- How might phenology change in the future?
- What are the consequences for natural resource management?

To answer these questions we will engage in the following activities:

- Examine historical records of events such as leafing, flowering and bird migration to ascertain whether the phenology of Minnesota's plant and animal species has changed in the recent past
- Create a network of trained citizen-observers to monitor and record phenology of key species

Current efforts to track phenology are often made in personal written journals or on paper calendars. When formal data is collected, the species and the events recorded vary greatly among observers. These approaches hinder the accessibility and usefulness of the data for science and management. Statewide monitoring and a standardized, accessible database will result in the following positive outcomes:

- Identification of key areas likely to be impacted by phenological change including timber productivity; pollination services to fruit and row crops; plant, wildlife and human disease risk; pest outbreaks and ecosystem health
- Dramatic increase in amount and quality of data collected
- Potential to document other phenomena such as invasive species using network observers#
- Direct engagement of citizens with the land that fosters good stewardship #

### II. DESCRIPTION OF PROJECT ACTIVITIES#

**Activity 1: *Rescue historic phenology records and make publicly available* Budget: \$ 98,845**

Following the changing of the seasons has always been a part of Minnesota's heritage. Many nature centers and state parks have journals that go back decades: the Eloise Butler Wildflower Garden has ~ 100 years of data. These records are a valuable and endangered Minnesota resource, yet they are scattered, piece-meal across the state and at risk. Historical data could be lost if it is not digitized, documented and stored in a permanent database. Existing records provide important historical context for current observations. For example, a record from St. Paul, MN (AC Hodson 1941-1991) shows an average aspen leafing date of April 30 with a 1.5 month range in leafing from April 9, 1987 (earliest) to May 20, 1950 (latest). This year (2012) leaves emerged on aspens in St. Paul on March 19. At present we know of at least ten localities with datasets longer than 25 years. These represent daily to weekly observations on >50 species for a total of >500,000 individual observations. We expect that phenology datasets awaiting discovery in MN number in the 100s. We will locate, digitize and analyze handwritten

historical records to examine whether and how phenology has changed in recent years. We will use these data to model the relationship between climate and phenology. As a result, hundreds of thousands of observation hours spanning decades and a range of ecosystems will become publicly accessible.

Outcome	Completion Date
1. <i>Online searchable database of historical phenological observations</i>	<i>December 2015</i>
2. <i>Report "Trends in timing of biological events in MN during the last century"</i>	<i>June 2016</i>

**Activity 2: Create a statewide observer network to monitor phenology Budget: \$ 167, 293**

A new statewide citizen-science network will focus on monitoring easy to identify, iconic species (e.g. sugar maple, loon) of ecological and/or economic importance that occur across the state's major ecoregions. We will develop simple data collection guidelines delivered via a web site with online training materials and data entry systems. The USA-National Phenology Network will host this web portal and provide QA/QC. Data will be accessible for review and visualization using tools already developed by USA-NPN and local software designers. New tools will be developed that depict the changing of the seasons across the state in real time. For example, viewers could 'watch' the green wave of spring spread from south to north. A statewide outreach campaign and training workshops will create a core set of observers. Our goal is to have a minimum of one observer per county with more in large counties like St. Louis. The resultant database could be used in real-time to make seasonal decisions. For example, a forest manager in northern MN might use the database to track leafing of buckthorn in southern MN to plan when to apply an early season foliar herbicide treatment. As a result of this effort, it will be possible to implement more effective and efficient timing of resource management actions.

Outcome	Completion Date
1. <i>Key species lists, training manuals, on-line training materials</i>	<i>October 2014</i>
2. <i>Web portal for data entry and visualization of phenological observations</i>	<i>January 2015</i>
3. <i>Statewide training workshops on monitoring and recording phenology</i>	<i>Feb 2015-Jun 2016</i>
4. <i>Online database of current phenological observations</i>	<i>Feb 2015-ongoing</i>

**III. PROJECT STRATEGY**

**A. Project Team/Partners**

*Team.* Rebecca Montgomery (Department of Forest Resources, FR-UMN, in-kind) is the overall Project Manager. Chris Buyarski (FR-UMN, 50% time) will lead development of key species lists and monitoring protocols. A graduate student (FR-UMN, 25% time) will coordinate work on historical phenological records. Barbara Coffin (Bell Museum of Natural History, in-kind) and a Partnership Coordinator (50%) will work with partners statewide, develop and coordinate training workshops and recruit observers with input from Bell Museum communication and marketing staff.

*Coordinating Partners* include long-term phenology observers: John Latimer (rural mail carrier, host of KAXE Phenology show, Grand Rapids, MN), Jim Gilbert (retired Gustavus Adolphus professor, St. Peter, MN); David Palmquist (retired naturalist, Whitewater State Park, Winona, MN) and Larry Weber (retired teacher, Carlton, MN) as well as MN Naturalists Association, Belwin Outdoor Science (Josh Leonard, Director), Wolf Ridge Environmental Learning Center (Peter Harris, science coordinator), Freshwater Society, Will Steger Foundation, Trout Unlimited and the USA-National Phenology Network.

**B. Timeline Requirements**

This project will require 36 months of funding, from July 1, 2013-June 30, 2016. This is conceived as a 3-year project since year one begins in the middle of the growing season. Moreover, including a full year for citizen observations will allow evaluation and revision of online systems during the project period.

**C. Long-Term Strategy and Future Funding Needs**

Our goal is to develop the resulting observer network into a registered non-profit organization providing on-going data on timing of biological events to resource managers, scientists, businesses and individuals.

## 2012-2013 Detailed Project Budget

### IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
<b>Personnel:</b>	
Project coordinator (50% time), 71% salary 29% benefits, 3 yrs, Chris Buyarski	\$ 87,349
Partnership coordinator (50% time), 73% salary 27% benefits, 2 yrs, 1 person	\$ 49,694
Graduate student (25% time), 54% salary 46% benefits, 3 yrs, 1 person	\$ 55,170
<b>Contracts:</b>	
Web developer to build website, web blog and new visualization tools (estimate 500 h * 50\$/h)	\$ 25,000
Graphic designer to support design of website, brochures and training materials (estimate 250 h * 50\$/h)	\$ 12,500
<b>Equipment/Tools/Supplies:</b>	
Printing brochures	\$ 350
Printing training manuals	\$ 6,000
Workshop materials (large paper/post its, markers, printed handouts)	\$ 150
<b>Acquisition (Fee Title or Permanent Easements):</b>	
	N/A
<b>Travel:</b>	
Project team meetings: mileage. 3 years * 2/year * 10 persons * ~250mi/person * 0.51cents/mile	\$ 7,650
Project team meetings: per diem. 3 years * 2/year * 10 persons * 2 d * (\$77/lodging + \$46 Meal&Incidentals [based on standard MN GSA rate])	\$ 14,760
Travel to conduct training workshops: 1 year * 5 workshops * 3 persons * 2 d * (mileage [250 mi/person*0.51 cents/mile] + per diem [\$77 lodging + \$46 M&I])	\$ 7,515
<b>Additional Budget Items:</b>	
	N/A
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 266,138</b>

### V. OTHER FUNDS

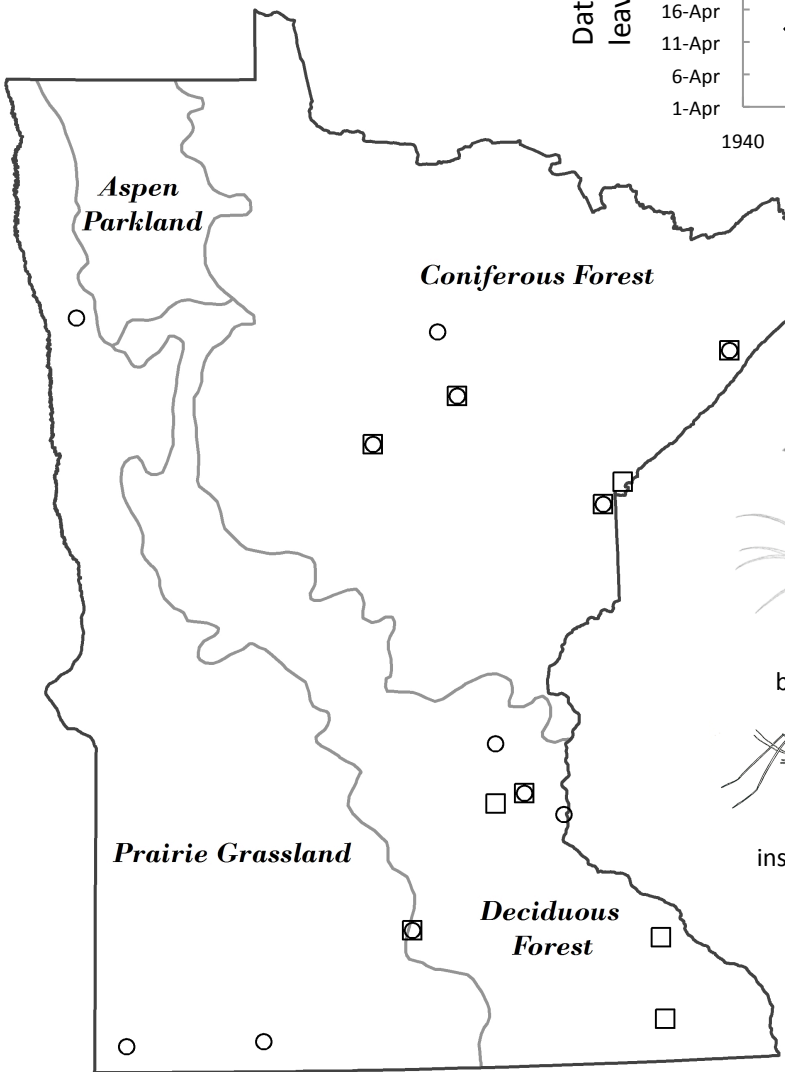
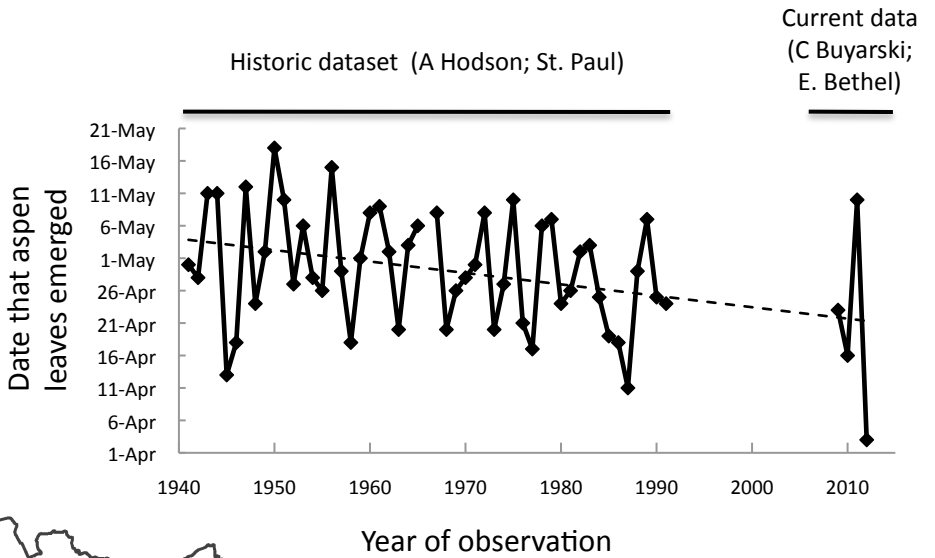
<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
<b>Other Non-State \$ Being Applied to Project During Project Period:</b>		
US National Science Foundation Preproposal "Understanding cues for budbreak in trees at the temperate-boreal forest ecotone: community phenology in an era of climate change"	\$ 500,000	<i>Pending</i>
University of Minnesota Institute on Environment Resident Fellow Program "Minnesota Phenology Network (MnPN): an observer network to measure the pulse of the state and connect people to the land"	\$ 10,000	<i>Pending</i>
<b>Other State \$ Being Applied to Project During Project Period:</b>		
	N/A	
<b>In-kind Services During Project Period:</b>		
Rebecca Montgomery, 2 week salary + benefits	\$ 16,703	
Barbara Coffin, 2 week salary + benefits	\$ 14,381	
USA-National Phenology Network web portal development & data hosting	\$ 30,000	
<b>Remaining \$ from Current ENRTF Appropriation (if applicable):</b>		
	N/A	
<b>Funding History:</b> University of Minnesota Institute on the Environment Mini-Grant "Phenology: the Pulse of the Planet – developing science and engagement initiatives that explore plant and animal response to climate change"	\$ 2,500	

# UNDERSTANDING MINNESOTA'S CHANGING SEASONS TO IMPROVE RESOURCE MANAGEMENT

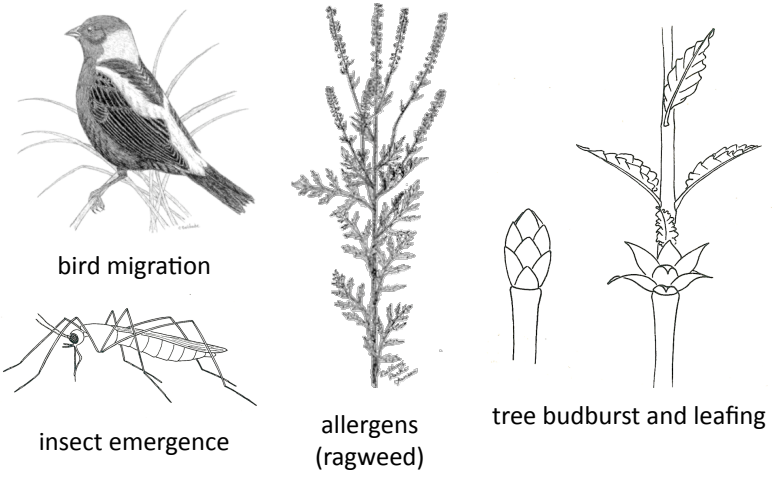
Has the timing of seasonal biological events changed in Minnesota?

Where do we know of data and/or observers?

- Known Current Observers
- Known Historic Datasets (>25 yrs)



What kinds of events could be monitored by a trained citizen-observer network?



What are the potential ecological and economic consequences?

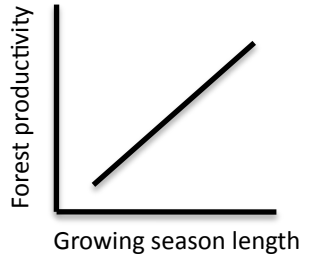


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SHORT SPRING =



LONG SPRING =



## **Project Manager Qualifications and Organization Description**

### **Project Manager: Rebecca A. Montgomery**

Associate Professor, Dept. of Forest Resources, University of Minnesota, St. Paul, MN 55108.

### **Professional Appointments and Preparation**

Associate Professor, Forest Resources, University of Minnesota, 2011-present  
Assistant Professor, Forest Resources, University of Minnesota, 2004-2011  
Research Associate, Forest Resources, University of Minnesota, 2003-2004  
Instructor, Forest Resources, University of Minnesota, 2003-2004  
Ph.D., Ecology and Evolutionary Biology, University Connecticut, 1999.  
B.A., Biology, *magna cu laude*, Occidental College, 1994.

### **Honors, Professional Recognition and Service (Selected)**

Invited speaker at regional, national and international symposia, seminars, and workshops, e.g. MN Sustainable Forest Education Cooperative, Michigan State, UW-Madison, University of Toronto, US-Japan Workshop on Photosynthetic Plasticity and Global Change. Received Richard C. Newman Art of Teaching award (2010) and College of Food, Agricultural and Natural Resources Sciences Distinguished Teaching Award (2010). I serve as chair of the Physiology Working Group of the Society of American Foresters and subject editor of *Forest Science*. I serve on the Science Team for the Minnesota Climate Change Vulnerability Assessment and on the Falcon Heights Environment Commission.

### **Areas of Expertise**

Plant ecophysiology, forest ecology, forest regeneration and dynamics, herbivory, competition, invasive species, rare and endangered species biology. Research spans temperate and tropical forests, managed and unmanaged ecosystems.

### **Project Management Experience**

Principal investigator or co-principal investigator on >15 research grants from National Science Foundation, Minnesota Department of Natural Resources, US Department of Energy, US National Park Service and USDA Forest Service projects. Principal investigator on a seed grant from the University of Minnesota's Institute on Environment related to creating a phenology network in Minnesota. Supervise research staff, post-doctoral scholars, graduate students and undergraduate students.

### **Peer-reviewed publications**

Twenty-four publications, including articles, book chapters, and reports. Twenty-two publications in the peer-reviewed literature, and 8 in preparation.

### **Project Management Qualifications and Responsibilities for this Project**

Ten years of research experience in oak savanna, deciduous and boreal forest of Minnesota; organized of the highly successful workshop "Phenology the Pulse of the State" (Bell Museum of Natural History, February 2012); co-organized annual Minnesota Phenologist meetings (2010-2012); manage a Facebook page aimed at bringing together researchers and citizens interested in phenology in Minnesota. Montgomery will provide scientific leadership, supervise funded staff, mentor the graduate student and both oversee and participate in all project activities.

### **Organization Description**

The University of Minnesota has a strong tradition of education and public service through its role as both the state land-grant university, and the state's primary research university. The Department of Forest Resources is the leading research and educational institution on forest related issues in Minnesota. For over 100 years the department has played a key role in discovering and fostering sustainable forest resource management activities in Minnesota.