

**Environment and Natural Resources Trust Fund (ENRTF)
2010 Work Program**

Date of Report: November 24, 2009
Date of Next Progress Report: January 10, 2011
Date of Work Program Approval:
Project Completion Date: June 30, 2013

I. PROJECT TITLE: Healthy Forests to Resist Invasion

Project Manager: Peter Reich
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Location: Regions: Northeast, Central, Southeast **Counties:** Aitkin, Anoka, Becker, Beltrami, Benton, Carlton, Carver, Cass, Chisago, Clearwater, Cook, Crow Wing, Dakota, Dodge, Douglas, Faribault, Freeborn, Goodhue, Hennepin, Houston, Hubbard, Isanti, Itasca, Kanabec, Kandiyohi, Koochiching, Lake, Lake of the Woods, Le Sueur, Meeker, Mille Lacs, Morrison, Mower, Nicollet, Olmsted, Otter Tail, Pine, Ramsey, Rice, Roseau, Scott, Sherburne, Sibley, St. Louis, Steele, Todd, Wabasha, Wadena, Waseca, Washington, Winona, Wright

See Map (Figure1.)

Total ENRTF Project Budget:	ENRTF Appropriation	\$ 359,000
	Minus Amount Spent:	\$ 0
	Equal Balance:	\$ 359,000

Legal Citation: M.L. 2010, Chp. 362, Sec. 2, Subd. 6c

Appropriation Language:

\$359,000 is from the trust fund to the Board of Regents of the University of Minnesota to assess the role of forest health management in resisting infestation of invasive species. This appropriation is available until June 30, 2013, by which time the project must be completed and final products delivered.

II. PROJECT SUMMARY AND RESULTS:

In Minnesota, invasive plants cause considerable ecological and economic damage, and their control is difficult to achieve in a long-term cost-effective manner. Although not immune from invasion, healthy forests may be somewhat resistant to invasion; therefore

management aimed at maintaining, restoring, or enhancing key forest characteristics might be a useful strategy for slowing forest invasion. This type of preemptive tool could help maintain diverse forest systems and might be cheaper and more effective in some instances than trying to remove invaders after they are present. Consequently, our goal is to better understand whether forest characteristics, especially those amenable to management, can be effective deterrents to plant invasion. We will establish 80 forest study sites and assess invasive plant species and a set of key indicators relevant to invasion, including disturbance history; degree of tree canopy cover; native plant diversity; levels of light and soil resources; and other. We will determine the links between forest attributes and plant invasion, attempt to discern cause and effect, and based on this information develop guidelines for forest management to resist invasion. These will be provided to resource managers and the public. Information learned in the study can aid in the development of land management prescriptions that incorporate the current invasive status of the plant community and the health and integrity of the ecosystem, which will serve as an indicator of vulnerability to invasion. This information is critical to maintaining a resilient forest system in the face of future climate change coupled with invasive species.

III. PROGRESS SUMMARY AS OF

IV. OUTLINE OF PROJECT RESULTS:

RESULT/ACTIVITY 1: Finalize research plans, select 80 forest study sites located throughout Minnesota, and establish 16 research plots in each site

Description: We will finalize the list of attributes of forests and of forest plant species to be measured, the specific protocol for such measurements, and the design for the measurements, based on prior studies, as well as our knowledge of Great Lakes forests and taxa based on prior studies of forest ecosystem, community, and organismal attributes, processes, and interactions.

Even with 80 sites, there will not be enough replication to allow a completely random selection of forests across all topographic, soil, hydrological, climate, compositional, age, management, and disturbance continuums, because such variation could overwhelm our ability to detect and interpret the relationship of forest attributes to invader diversity and abundance. Thus we will select sites to narrow the range of variation, and will likely limit sites to upland ecosystems, and narrow the stand age, history, and composition.

We will include geographic variation and forest management history in the experimental design. Information such as regional and state-wide forest inventories (i.e. Forest Inventory and Monitoring (FIM) and Minnesota County Biological Survey (MCBS) native plant community data) will be used to select candidate sites. Study sites will be located on lands owned by the USDA Forest Service, Minnesota Department of Natural Resources, Minnesota counties, the Nature Conservancy, and the University of Minnesota. The relatively small fraction of state forests already heavily invaded will not be selected for the study.

At each site 16 plots will be established, likely in a grid, with each plot separated by 20 or 25 meters. Each of the 16 plots will be centered around a single point, but different radii will be used to sample the different elements of the forest composition.

Summary Budget Information for Result/Activity 1: ENRTF Budget: \$ 45,000
 Amount Spent: \$ 0
 Balance: \$ 45,000

Deliverable/Outcome	Completion Date	Budget
1. Identify, locate 80 forest sites	12/15/2010	\$20,000
2. Establish 16 plots at each site	6/30/2011	\$25,000

Result 1 Completion Date: 6/30/2011

Result Status as of (January 10, 2011):

Result Status as of (July 10, 2011):

Result Status as of (January 10, 2012):

Result Status as of (July 10, 2012):

Result Status as of (January 10, 2013):

Final Report Summary (July 10, 2013):

RESULT/ACTIVITY 2: Assess degree of plant invasion, disturbance history, and health and structural integrity of native plant communities.

Description: Over the course of two years, all plots in all sites will be surveyed for ecosystem attributes and the native and invasive plant community. Other data on climate and distance to roads and/or settlements will be obtained and maintained in a geographical information system. The ecosystem attributes will likely include degree of tree canopy cover, soil depth, soil texture, soil pH, soil disturbance history, earthworm community composition and abundance, level and type of prior disturbance, abundance and diversity of native overstory and understory plant communities native plant (by species). We will also census invasive plant species at each site (how many species, their identity, and their relative abundance). Measured plant traits will likely include growth form, taxonomy, mature height, specific leaf area, and woody density (if woody).

Summary Budget Information for Result/Activity 2: ENRTF Budget: \$ 228,000
 Amount Spent: \$ 0
 Balance: \$ 228,000

Deliverable/Outcome	Completion Date	Budget
1. Field data collection completed on forest health and invasion status sites	9/30/2012	\$198,000
2. Final data base on plant invasion, forest health and integrity	12/31/2012	\$ 30,000

Result 2 Completion Date: 12/31/2012

Result Status as of (January 10, 2011):

Result Status as of (July 10, 2011):

Result Status as of (January 10, 2012):

Result Status as of (July 10, 2012):

Result Status as of (January 10, 2013):

Final Report Summary (July 10, 2013):

RESULT/ACTIVITY 3: Analyze data, develop management guidelines, disseminate results via outreach presentations, workshops, and reports, DNR/UM web site, scientific publications.

Description: We will analyze data to determine the links between forest attributes and plant invasion. We will develop management strategies and guidelines for optimizing resistance to invasion (“preventive environmental care”). We might suggest that there should be modifications to management guidelines and/or new economic incentives for landowners, public and private, to maintain, sustain, and/or restore forest integrity in part because of the added value that will provide for limiting invasion and thus maintaining overall forest health in the state. Specific management for any location would need to fit the site conditions and goals. These management strategies will be provided to resource managers and the public through a series of presentations and workshops as well as via an interactive web site.

Summary Budget Information for Result/Activity 3: ENRTF Budget: \$ 86,000
Amount Spent: \$ 0
Balance: \$ 86,000

Deliverable/Outcome	Completion Date	Budget
1. Final report, “Do Healthy Forests Resist Invasion?”	6/30/2013	\$26,000

2. Forest management guidelines	6/30/2013	\$25,000
3. Outreach via presentations, workshops, web site	6/30/2013	\$10,000
4. Scientific publications written	6/30/2013	\$25,000

Result 3 Completion Date: 6/30/2013

Result Status as of (January 10, 2011):

Result Status as of (July 10, 2011):

Result Status as of (January 10, 2012):

Result Status as of (July 10, 2012):

Result Status as of (January 10, 2013):

Final Report Summary (July 10, 2013):

V. TOTAL ENRTF PROJECT BUDGET:

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	
1 Research associate, 100%, coordination of day to day project activities (\$44,596 salary + \$14,405 fringe) for 2 years	\$118,002
1 Graduate student, 50%, develop dissertation research project from some aspect of project research (\$21,000 salary + \$3,536 health insurance + \$ 11,170 tuition for 2 years	\$71,412
1 Project assistant, 50% (\$36,000 salary + \$6,660 fringe) for 2 years	\$49,320
4 undergrad students (summer, 100%) 2000 hours @ \$11/hour + \$1,795 fringe) for 2 summers	\$47,590
3 undergrad students (academic year, 25%) 8 hrs/week, 960 hours @ \$11/hour for 2 academic years	\$21,120
Equipment/Tools/Supplies: Misc. field supplies and tools (data sheets, labels, bags, vials, etc.) for 2 years; and laser range finders (2) and light sensors (2)	\$15,976
Travel: Intensive in-state travel to 80 scattered and remote field sites, for 2 years, includes lodging and mileage on personal vehicles	\$21,500
Chemical analyses of plants and soils: cost based on one vegetation and one soil sample per plot (16 plots x 80 sites, at a total cost of \$11 for the two analyses), for 2 years	\$14,080
TOTAL ENRTF PROJECT BUDGET	\$359,000

See Attachment A: Budget Detail

Explanation of Capital Expenditures Greater Than \$3,500: None

VI. PROJECT STRATEGY:

A. Project Partners:

Ann Pierce, Conservation Management and Rare Resources Unit, Ecological Resources, MNDNR

Kathleen Knight, U.S. Forest Service

All funds will be administered through the University of Minnesota. Hence, each partner will receive none of the funds from the appropriation.

B. Project Impact and Long-term Strategy: In the long term this information can be used to help land managers develop management prescriptions that incorporate the current invasive status of the plant community and the health and integrity of the ecosystem, which will serve as an indicator of vulnerability to invasion. Results of this project can be used to inform silvicultural interpretations being developed based on the Ecological Classification System. This information is critical to maintaining a resilient forest system in the face of future climate change coupled with invasive species.

C. Other Funds Proposed to be Spent during the Project Period: In-kind time donated by Peter Reich (estimated at \$20,000), as well as in-kind time donated by Ann Pierce (estimated at \$9800) and Kathleen Knight (estimated at \$4900).

D. Spending History: No funds will be spent prior to the start of this project.

VII. DISSEMINATION:

We will work to ensure that the results of the study are widely disseminated and used. The third deliverable of our project is by definition the translation of our work to relevant public and private organizations and groups. This includes a variety of means, including workshops, reports available on the web, presented seminars, and the like. Additionally, we will work through relevant units within and outside management agencies (e.g., DNR Forestry, the Minnesota Forest Resources Council) to make recommendations widely known, and as appropriate, we will urge their adoption and implementation. Research results will be published in peer reviewed journals and other outlets. Publications resulting from this work will be posted on <http://forestecology.cfans.umn.edu/> as they become available, as well as information relating to this project.

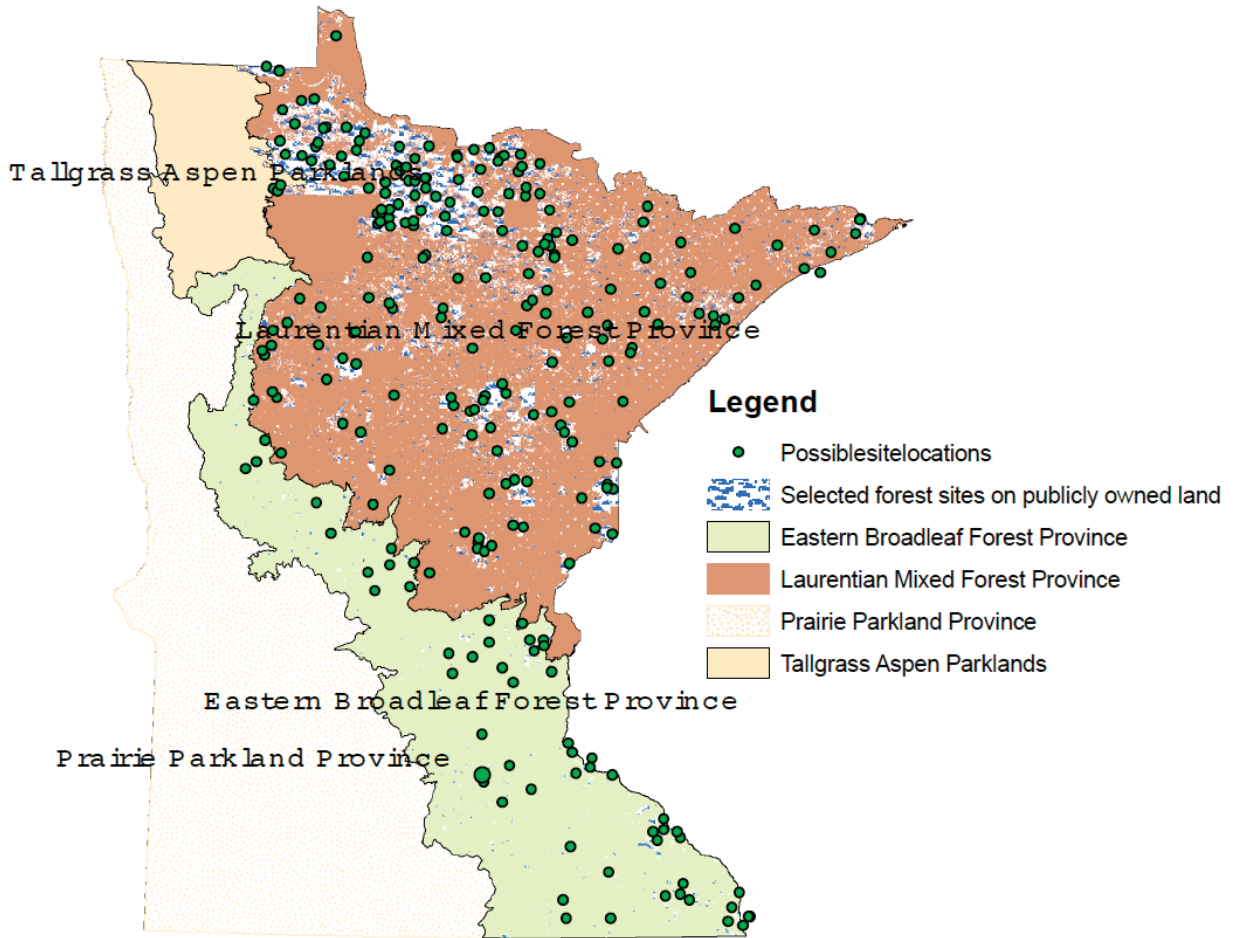
VIII. REPORTING REQUIREMENTS:

Periodic work program progress reports will be submitted not later than January 10, 2011, July 10, 2011, January 10, 2012, July 10, 2012 and January 10, 2013. A final work program report and associated products will be submitted between June 30 and August 1, 2013 as requested by the LCCMR.

IX. RESEARCH PROJECTS:

See attached research addendum

Figure 1.



Attachment A: Budget Detail for 2010 Projects											
Project Title: Healthy Forests to Resist Invasion											
Project Manager Name: Peter Reich											
Trust Fund Appropriation: \$ 359,000											
2010 Trust Fund Budget	<u>Result 1 Budget:</u>	<u>Amount Spent</u> <i>(date)</i>	<u>Balance</u> <i>(date)</i>	<u>Result 2 Budget:</u>	<u>Amount Spent</u> <i>(date)</i>	<u>Balance</u> <i>(date)</i>	<u>Result 3 Budget:</u>	<u>Amount Spent</u> <i>(date)</i>	<u>Balance</u> <i>(date)</i>	TOTAL BUDGET	TOTAL BALANCE
	Finalize research plans, select 80 sites, and establish 16 research plots in each site			Assess degree of plant invasion, disturbance history, and health and structural integrity of native plant communities.			Analyze data, develop management guidelines, disseminate results via outreach presentations, workshops, and reports, DNR/UM web site, scientific publications.				
BUDGET ITEM											
PERSONNEL: 1 Research associate , 100%, coordination of day to day project activities (\$44,596 salary + \$14,405 fringe) for 2 years	19,600		19,600	59,142		59,142	39,260		39,260	118,002	118,002
PERSONNEL: 1 Graduate student , 50%, develop dissertation research project from some aspect of project research (\$21,000 salary + \$3,536 health insurance + \$ 11,170 tuition for 2 years	11,070		11,070	36,542		36,542	23,800		23,800	71,412	71,412
1 Project assistant , 50% (\$36,000 salary + \$6,660 fringe) for 2 years	3,000		3,000	27,880		27,880	18,440		18,440	49,320	49,320
4 undergrad students (summer, 100%) 2000 hours @ \$11/hour + \$1,795 fringe) for 2 summers	5,830		5,830	41,760		41,760				47,590	47,590
3 undergrad students (academic year, 25%) 8 hrs/week, 960 hours @ \$11/hour for 2 academic years				21,120		21,120				21,120	21,120
Non-capital Equipment / Tools: laser range finders (2) @ \$450 each and light sensors (2) @ \$1,107 each				3,114		3,114				3,114	3,114
Supplies: Misc. field supplies (data sheets, labels, bags, vials, etc.) for 2 years				12,862		12,862				12,862	12,862
Travel expenses in Minnesota: Intensive in-state travel to 80 scattered and remote field sites, for 2 years, includes lodging and mileage on personal vehicles	5,500		5,500	11,500		11,500	4,500		4,500	21,500	21,500
Other: Chemical analyses of plants and soils: cost based on one vegetation and one soil sample per plot (16 plots x 80 sites, at a total cost of \$11 for the two analyses), for 2 years				14,080		14,080				14,080	14,080
COLUMN TOTAL	\$45,000	\$0	\$45,000	\$228,000	\$0	\$228,000	\$86,000	\$0	\$86,000	\$359,000	\$359,000