

**Environment and Natural Resources Trust Fund
2010 Request for Proposals (RFP)**

LCCMR ID: 114-D

Project Title:

Managing Invasive Plants in the Mississippi River Blufflands

LCCMR 2010 Funding Priority:

D. Invasive Species

Total Project Budget: \$ \$227,000

Proposed Project Time Period for the Funding Requested: 3 years, 2010 - 2013

Other Non-State Funds: \$ \$0

Summary:

By reducing invasive plants in the Mississippi River Blufflands and studying impacts of different restoration approaches, this project will provide managers with improved and cost-effective approaches to managing invasive plants.

Name: Mark Davis

Sponsoring Organization: Macalester College

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Fax: _____

Web Address: _____

Location:

Region: Metro

County Name: Dakota

City / Township: Inver Grove Heights

_____ Knowledge Base	_____ Broad App.	_____ Innovation
_____ Leverage	_____ Outcomes	
_____ Partnerships	_____ Urgency	_____ TOTAL

MAIN PROPOSAL

PROJECT TITLE: Managing Invasive Plants in the Mississippi River Blufflands

I. PROJECT STATEMENT

Garlic mustard (*Alliaria petiolata*), common buckthorn (*Rhamnus cathartica*), and honeysuckle (*Lonicera tatarica*) are some of Minnesota's most prominent invasive plant species and the subject of eradication efforts throughout the state. They are particularly common and spreading in the bluffland environments along the Mississippi River in Dakota County. Management of invasive species is often a time-intensive and costly enterprise. It is important that management approaches are based on sound science and are cost-effective. Prior studies by the Project Manager and others have shown that the susceptibility of an environment to invasion, often referred to as invasibility, can be reduced through effective management practices. The first goal of this project is to reduce the abundance of these invasive species in these bluffland environments. The project's second goal is to evaluate the extent to which the invasion susceptibility of an environment can be reduced following the removal of invasive plants by the immediate reintroduction of native plants (herbaceous plants and tree/shrubs). The project will also evaluate the effectiveness of reintroducing fire as a way to restore and maintain the historical vegetation. In addition, the project will examine some of the ecological impacts of invasive plant removal, including effects on litter and soil properties and litter invertebrates, the latter the primary diet for many small forest mammals and birds. Finally, the project will study the extent to which different invasive plant patches may differ in their potential to spread. If highly invasive patches can be identified, then managers would be able to focus their efforts on these patches. The first four objectives will be accomplished through a series of carefully designed restoration activities conducted in the oak woodlands of the Macalester field station, the Katharine Ordway Natural History Study Area (Ordway Study Area), a 275 acre reserve owned and managed by Macalester since 1967, and in the adjacent Pine Bend Bluffs SNA (256 acres), both located in Dakota County along the Mississippi River corridor. The final objective will be addressed through genetic analyses of garlic mustard plants from populations differing in their rate of spread.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Removal and management of invasive plant species SNA Budget: \$ 120,000

With the help of students and volunteers, patches of garlic mustard, buckthorn, and honeysuckle will be removed at both the Ordway Study Area and the Pine Bend Bluffs SNA. Following removal of the invasive species, native plants (forest herbs, tree and shrub seedlings) will be transplanted into the vacant sites. The transplants are expected to utilize most of the soil nutrients in these sites. With most of the nutrients taken up by the native plants, the susceptibility of the patches to reinvasion by the invasive plants is expected to be reduced. We will use the herbarium at the Ordway Study Area, containing specimens collected at the site in the early 1970s, to identify appropriate native plants to transplant. In addition, we will use fire as an alternative and supplementary method to remove the invasive species from the two sites, and also as a way to promote the growth and spread of native species while reducing the likelihood of establishment and spread of the invasive species.

Result 2: Ecological impacts of different management practices Budget: \$ 67,000

Litter and soil properties will be analyzed in the different management treatment plots, as well as the composition and abundance of litter-dwelling invertebrates, a primary food source for many small mammals and birds. Deer impact on management will be studied using exclosures.

Result 3: Rate of spread of garlic mustard throughout the study sites Budget: \$ 40,000

Using teams of students, during year 1, we will identify locations and map garlic mustard patches at KONHSA, and at the PBB SNA. During years 2 and 3, we will record spread rates of patches and, through early detection efforts, record the founding of new patches. Using DNA analysis capabilities at Macalester, we will monitor the genetic relationship among plant patches to determine if there are any genetic markers that distinguish the high invasive from the less invasive populations.

Deliverables	Completion Date
1. Removal of patches of garlic mustard, buckthorn, and honeysuckle, from the Ordway Study Area and Pine Bend Bluffs SNA, and the transplanting into the vacant sites of native herbs, shrubs and trees	Sept 2010
2. Technical report describing the success in reducing the susceptibility of environments to reinvasion by invasive plants, the impacts of different management practices on native organisms, and the rates of spread and genetic relatedness of different garlic mustard patches	Aug 2013
3. A set of recommendations to facilitate the long-term success of invasive plant management in the most cost-effective way possible, presented in a report and at state and national conferences.	Aug 2013

III. PROJECT STRATEGY

A. Project Team/Partners

Macalester College: Mark Davis, DeWitt Wallace Professor of Biology and Director, KONHSA (Project Manager); Paul Overvoorde, Associate Professor of Biology (geneticist), Sarah Boyer, Assistant Professor of Biology (geneticist); Michael Anderson, Assistant Director, KONHSA; Jerald Dosch, Visiting Professor of Biology (ecologist). **Friends of the Mississippi River:** Tom Lewanski, Conservation Director; Karen Schik, Ecologist and Project Manager; Karen Solas, Stewardship Coordinator; Sue Rich, Volunteer Coordinator.

B. Timeline Requirements

July-September 2010: Locations of existing invasive plant patches will be identified and mapped; plots will be established for the field experiments, and invasive plants removed. **April-Aug 2011:** native plants transplanted into invasive removal plots. **April-Aug 2011:** spread of existing garlic mustard patches documented and any new patches located and mapped; DNA analyses begun. **April-Aug 2012, and April-June 2013:** extent of reinvasion of plots by garlic mustard, buckthorn, and honeysuckle documented; ongoing spread of existing patches documented and any new patches located and mapped; impacts of different management practices documented, DNA analyses continued and data analyzed.

C. Long-Term Strategy

This project is part of Macalester College's long-term commitment to preserving the diversity of native habitats at the Ordway Study Area, an objective it has vigorously pursued since it acquired the property more than forty years ago. The project is also part of the DNR's and FMR's long term effort to reduce the abundance of non-native invasive plants in the Mississippi bluffland habitats. Finally, the project is part of the Project Manager's decade long interest in invasive species and in developing more effective invasive species management practices.

Project Budget

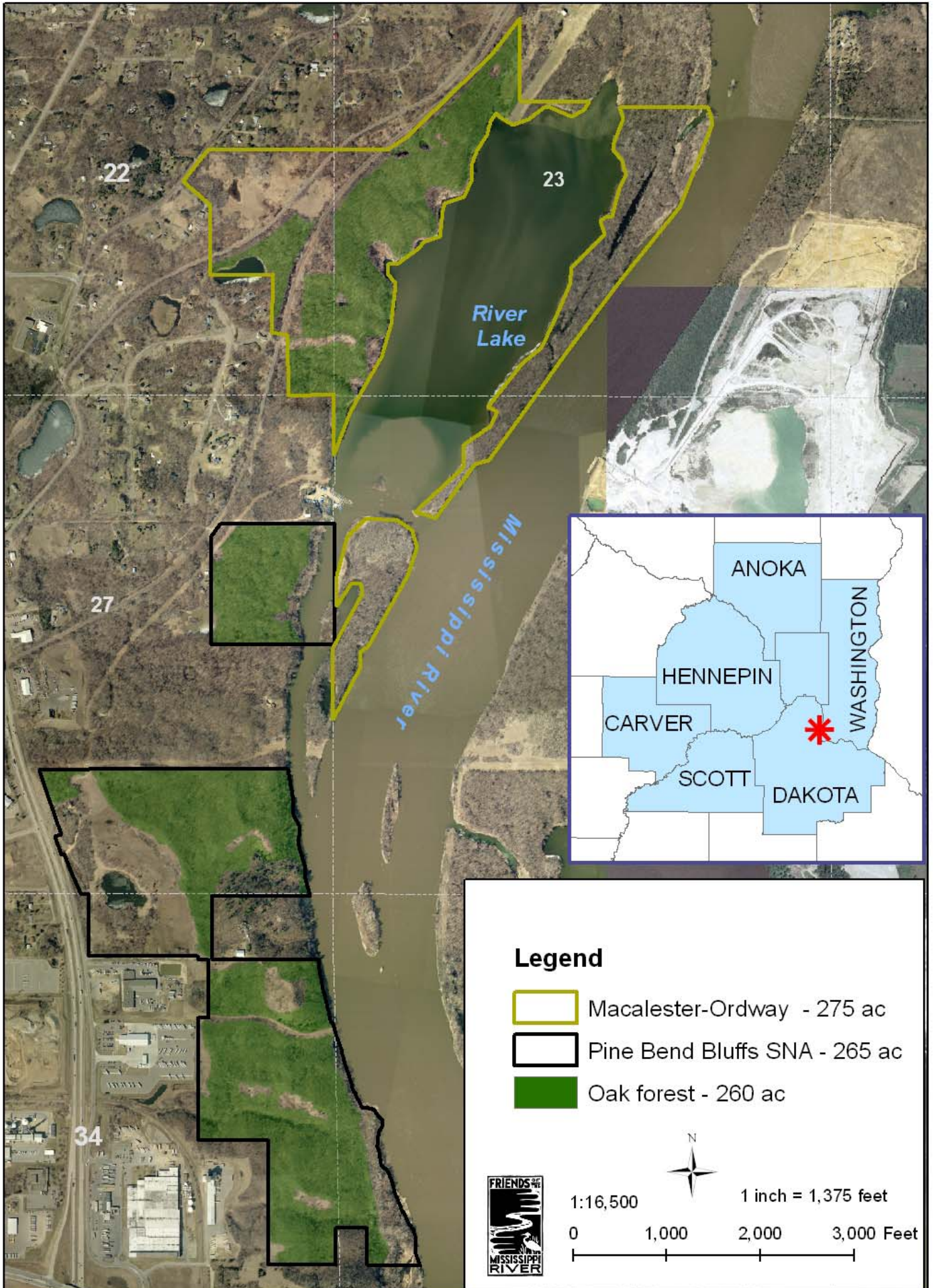
IV. TOTAL PROJECT REQUEST BUDGET (3 years)

BUDGET ITEM <i>(See list of Eligible & Non-Eligible Costs, p. 13)</i>	AMOUNT
Personnel:	
Note: Summer fringe benefits equal 10% summer salary for Macalester faculty, 30% for Macalester staff.	
Dr. Mark Davis, Macalester College - Project Manager (1.5 months summer salary (0.5 month per summer), 5% FTE)	\$ 21,895
Fringe Benefits	\$ 2,189
Dr. Jerald Dosch, Macalester College (4.5 months summer salary (1.5 months per summer), 15% FTE)	\$ 31,278
Fringe Benefits	\$ 3,128
Dr. Sarah Boyer, Macalester College (3 months summer salary (1 month per summer), 10% FTE)	\$ 22,502
Fringe Benefits	\$ 2,250
Dr. Paul Overvoorde, Macalester College (3 months summer salary, (1 month per summer) 10% FTE)	\$ 26,482
Fringe Benefits	\$ 2,648
Mike Anderson, Macalester College (3 months summer salary (1 month per summer), 10% FTE)	\$ 15,602
Fringe Benefits	\$ 4,681
Undergraduate restoration assistants (3 per summer, 10 weeks @ \$10/hr)	\$ 36,000
Fringe Benefits	\$ 3,600
Dr. Thomas Lewanski, Conservation Director, Friends of the Mississippi River (3 weeks summer salary, (1 week per summer) 2% FTE)	\$ 1,216
Karen Schik, Ecologist, Friends of the Mississippi River (18 weeks summer salary, (6 week per summer) 12% FTE)	\$ 7,500
Karen Solas, Stewardship Coordinator, Friends of the Mississippi River (3 weeks summer salary, (1 week per summer) 12% FTE)	\$ 1,300
Sue Rich, Volunteer Coordinator, Friends of the Mississippi River (3 weeks summer salary, (1 week per summer) 12% FTE)	\$ 1,300
Construction of 5 deer exclosures (20 x 20 m) at Pine Bend Bluffs SNA	\$ 10,000
Two controlled burns at Pine Bend Bluffs SNA	\$ 12,000
Field Equipment and Supplies: fencing, flagging, shovels	\$ 2,560
Native Plant Seedlings	\$ 7,000
Laboratory costs: analysis of soil samples	\$ 5,000
Laboratory costs: primers and other supplies for DNA analyses conducted at Macalester	\$ 5,000
Travel: Mileage reimbursements for travel to study site during the three year study, 100 trips (34 miles round trip from campus)	\$ 1,870
TOTAL PROJECT BUDGET REQUEST TO LCCMR	\$ 227,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period: summer housing provided for undergraduate students provided by Macalester.	\$ 6,300	<i>Secured</i>

Pine Bend Bluffs Natural Area



PROJECT MANAGER: Mark Davis, DeWitt Wallace Professor of Biology
Macalester College, St. Paul, MN

EDUCATION

1981 Ph.D. Dartmouth College (Department of Biology)
1974 Ed.M. Harvard University (Graduate School of Education)
1972 A.B. Harvard College (History of Science)

APPOINTMENTS

2008-Present Chair, Biology
2007-Present DeWitt Wallace Professor of Biology, Macalester College, St. Paul, MN
1992-Present Professor of Biology, Macalester College, St. Paul, MN
1981-1998 Director, Environmental Studies Program, Macalester College
1991-1995 Chair, Department of Biology, Macalester College
1987-1992 Associate Professor of Biology, Macalester College
1981-1987 Assistant Professor of Biology, Macalester College

CONTRIBUTIONS TO INVASION BIOLOGY

An internationally recognized scholar and researcher in the field of invasion biology.

Proposed the fluctuating resources availability theory of invasibility. Cited more than 500 times in scientific publications since it was first proposed nine years ago, this theory has developed into a core organizing concept for the field.

Authored the book *Invasion Biology*, published in 2009 by Oxford University Press.

In the past two years, presented invited talks on invasive species to international audiences in South Africa, Sardinia, and Switzerland, as well as to national and state audiences, including the February '09 invasibility workshop held at Bemidji State University where he was the keynote speaker.

SELECTED INVASION AND RESTORATION-RELATED PUBLICATIONS

Davis, M.A. 2009. *Invasion Biology*. Oxford University Press. Oxford, UK.
Davis, M. A. 2006. Invasion biology 1958-2005: The pursuit of science and conservation. Chapter 2 in M. W. Cadotte, S. M. McMahon, T. Fukami, eds. *Conceptual ecology and invasions biology: reciprocal approaches to nature*. Springer, London.
Davis, M. A., Thompson, K., Grime, J. P. 2005. Invasibility: the local mechanism driving community assembly and species diversity. *Ecography* 28: 696-704.
Davis, M. A. and Slobodkin, L. B.. 2004. The science and values of restoration ecology. *Restoration Ecology* 12: 1-3.
Davis, M. A. and L. B. Slobodkin. 2004. Restoration ecology: the challenge of social values and expectations. *Frontiers in Ecology and Evolution* 2:44-45.
Davis, M. A. 2003. Biotic globalization: does competition from introduced species threaten biodiversity? *Bioscience* 53:481-489.
Davis, M. A. and Pelsor, M. 2001. Experimental support for a resource-based mechanistic model of invasibility. *Ecology Letters* 4:421-428.
Davis, M. A., J. P. Grime, and K. Thompson. 2000. Fluctuating resources in plant communities: a general theory of invasibility. *Journal of Ecology* 88:528-536.

PRIOR INVASION GRANT SUPPORT

2002-2006 National Science Foundation (\$263,080) "Fluctuating resources and mechanisms of invasibility along the prairie-forest border"