Environment and Natural Resources Trust Fund
2014 Request for Proposals (RFP)

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Project Title:

River Management Strategy Before Asian Carp Invasion

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: $ 279,868

Proposed Project Time Period for the Funding Requested: 3 Years, July 2014 - June 2017

Other Non-State Funds: $ 0

Summary:

Project will develop a management framework to address invasion of Asian carp in the Upper Mississippi River. Predictive models will identify vulnerable aquatic habitats, reducing costs for river management and mitigation.

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Sponsoring Organization: Winona State University

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Location

Region: Metro, Southeast

County Name: Dakota, Goodhue, Houston, Wabasha, Washington, Winona

City / Township:

MP: 0613-2-075-proposa
Budget: 0613-2-075-bud
Qual: 0613-2-075-qualifi
Map: 0613-2-075-map-L
Resolution:
List:

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

PROJECT TITLE: River Management Strategy in Advance of Asian Carp Invasion

I. PROJECT STATEMENT

Current Asian carp research has emphasized prevention of their invasion into Minnesota waters and options to control them. The great dread among managers, however, is how carp will affect native species and aquatic ecosystems should they become established despite efforts for control. These concerns are well founded given the biology of carp. Where found in other parts of the Mississippi River, Asian carp exhibit preferences for habitats off the main channel. These locations provide key ecological services to many river species, particularly food. Carp are consumers of microscopic primary producers (phytoplankton) in the water column, which are the major resource supporting food webs in the main channel of the Mississippi River and are very likely to be critical to supporting animals in other riverine habitats. Carp will compete with other species that rely on phytoplankton, including: mussels, larval and juvenile fish, and many aquatic insects. Decreased availability of food for these organisms would reduce food available for larger fish, birds, and reptiles. Given the risks involved, it is essential we consider an adaptive management approach so we can protect an aesthetically and economically important ecosystem from this threat. The proposed project would provide critical tools to anticipate problems

Goals of Project

- Develop food web models that reflect the current condition of potentially vulnerable habitats within different sections of the Upper Mississippi River
- Combine information on the food web where Asian carp are already established in the Upper Mississippi to build models that reveal their impact on vulnerable habitats
- Provide models to state and federal agencies responsible for management of the river for development of management plans in advance of Asian carp becoming established

Project Outcomes

- A knowledge base not previously available for management of the Upper Mississippi River
- A tool for identifying habitats and regions of the Upper Mississippi, including major tributaries, where management may be required to mitigate negative impacts of Asian carp
- Reduce costs for future monitoring and management by being able to predict and assess impacts of Asian carp and other potential invasive species
- Invaluable educational experience for undergraduate students

The Upper Mississippi River is relatively well studied and we have a good understanding of functional dynamics of the main channel. However, our knowledge of the dynamics of resource use within its diversity of habitats (e.g., backwaters, sloughs, lakes) is very limited. The proposed modeling approach will address project goals because food webs integrate all aspects of the river ecology – from what species are present (and why) to what provides the energy for growth and reproduction of river-dependent species. Two years of field work will allow collection of all representatives of the food web from different habitats, including major tributaries, within five regions of the river. Samples will be used to determine natural stable isotope ratios, which provide more accurate measures of what is going into animal growth than gut contents. Stable isotopes allow for construction of models by linking resources supporting the food web to consumers. Information from areas of the river where carp are established will make models predictive by relating their impacts there to what could happen in Minnesota rivers.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Collection and Analysis of Samples for Food Web Models Budget: $254426

Samples will be collected from all five locations from July – August 2014 and 2015. Multiple habitats (channels and slackwaters – areas with no flow, major tributaries) will be sampled within all locations to capture the diversity of habitats. Fish will be collected by electrofishing and nets. Tissue samples will be removed and fish returned to the river. Invertebrates will also be collected. Scrapings will be taken from the outer layer of mussel shells before returning mussels to the water. Items representing the base of the food web will be collected using

standard methods used in past food web studies. All samples will be dried, ground, and packaged in the lab for stable isotope analysis. Samples will be sent to a laboratory for determination of carbon and nitrogen stable isotope ratios, which will be used in development of food web models. Stable isotopes combined with mixing models will lead to the generation of food web models.

Outcome	Completion Date
1. Completed field collection of samples 55 days/ year (Year 1 and Year 2)	Sep 2014; 2015
2. Completion of processing and shipment to isotope lab	Jan 2014; 2015
3. Receipt of isotopic data, allowing for start of model development	May 2015; 2016

Activity 2: Development of Predictive Model for Management of Asian Carp Budget: $25442

Model development will incorporate stable isotope mixing models, which identify links between fish and the base of the food web. This is a critical focal point because the direct impact of Asian carp will be at the bottom of the food web, from where their effect will cascade to higher consumers (i.e., fish-eating fish). Other calculations, such as determination of where fish and invertebrates are on the food chain and food web complexity, will be generated to aid in determining where changes by carp may occur. Iowa samples will take project to the next step by allowing for predictions of responses in Minnesota water. A mixing model that allows input of prior knowledge (SIAR) to predict ecosystem changes will be used to create predictive models using Iowa data. Models will be presented to agency partners for feedback with subsequent re-evaluation as required. In-kind contribution goes toward this activity.

Outcome	Completion Date
1. Food web models for first year data; second year	Jan 2016; 2017
2. Completed food web models with potential impacts of Carp in Minnesota	April 2017
3. Modifications in response to state and federal agency input	June 2017

III. PROJECT STRATEGY

A. Project Team/Partners

Calculation of hydrological and habitat measures used with food web measures to identify vulnerable habitats will be completed with project team members Martin Thoms and Michael Reid, Univ. of New England. MN Aquatic Invasive Species Research Ctr. (Peter Sorensen) and Large River Studies Center will share data and samples to contribute toward better understanding types of food consumed by carp and implications for food web-related differences between habitats and rivers. Minnesota DNR (Lake City) U.S. Fish & Wildlife Service (Winona), and USGS's Upper Midwest Environmental Sciences Center (La Crosse, WI) will receive models and input on application and implementation of the model in conjunction with their current projects.

B. Timeline Requirements

Project will be completed in 3 years. Two field seasons allow for examination of differences in annual hydrological conditions. Processing of samples will begin after they are collected and will continue into the fall of each year. Lab analysis will take an additional 3–4 months. Food web models will require data entry, model verification, and preparation for presentations to partners.

C. Long-Term Strategy and Future Funding Needs

This project will ultimately lower costs for future assessment and management of Asian carp, with applications to other invasive species because it will allow for prior identification of vulnerable regions and habitats within these regions. No additional funding is not expected from ENTRF. Dissemination to partners included in activities. Peer-reviewed publications, meeting presentations, and web-based information will provide broader dissemination. Web-based information will be designed for use for the general public to emphasize linkages between research and management.

2014 Detailed Project Budget

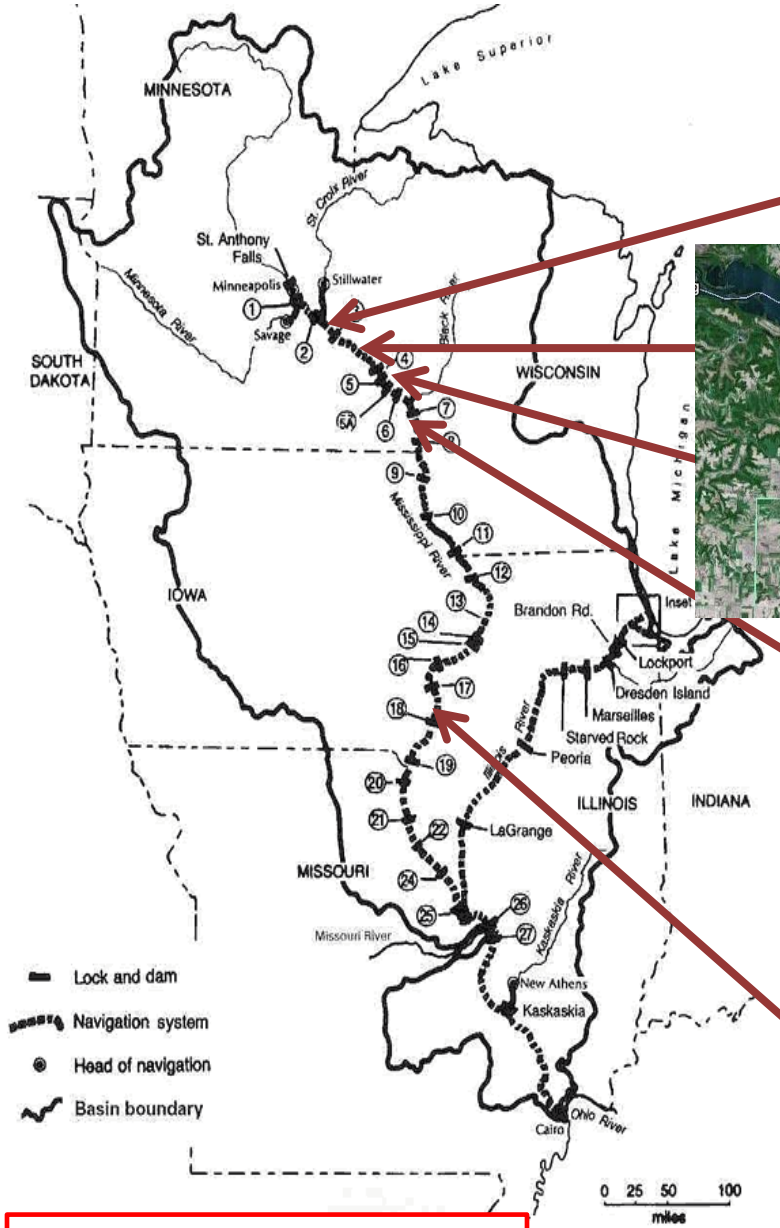
Project Title: River Management Strategy Before Asian Carp Invasion

IV. TOTAL ENRTF REQUEST BUDGET (Three years)

BUDGET ITEM	AMOUNT
Personnel: Undergraduate Research Assistants (4 positions each for Yr 1 & 2 of project; 100% full-time; 16-week; 30-hr/wk; $10/hr). Salary=$4800/positions/yr; Benefits=7.625% of salary ($366/yr). Duties = field work and lab processing of samples as per QA/QC protocols. Total Yr 1 = $20664; Yr 2=$20664.	$ 41,328
Personnel: Michael Delong - project director. 1-month summer salary based on 12 duty days in calendar month @$425/duty day in Yr 1 & 2 Total/yr = $5100; Benefits for insurance, retirement, FICA/Medicare = 18% salary ($918/yr). Total Yr 1=$6018; Yr 2=$6018. Time commitment to 3-yr project: 50% summer; 25% academic year	$ 12,036
Personnel: Field/Lab technician. Eight-month position for field and lab support. Salary Yr 1=$24,790; Yr 2=$25534; Benefits for insurance, retirement, FICA/Medicare = 33% salary Yr 1=$8181; Yr 2=$8426; Time commitment to project 100%	$ 66,931
Equipment/Tools/Supplies: Vials for storing tissue samples 12,870 @ $0.44 each	$ 5,663
Equipment/Tools/Supplies: Capsules for ground samples 12,870 @ 0.14 each	$ 1,802
Equipment/Tools/Supplies: Colloidal silica for separating live and dead organic matter from water and bottom samples. 12 liter @ $78.8/liter	$ 237
Equipment/Tools/Supplies: Shipping samples to isotopic analysis lab	$ 400
Equipment/Tools/Supplies: Tubes processing for organic matter samples 500/case	$ 77
Equipment/Tools/Supplies: 500 vials@$0.44 =$429; 500 capsules@0.14 (Iowa samples)	$ 290
Travel: Total miles = 3140 miles@$0.29/mile plus 50 days@$23/day for university vehicle. All travel with return to Winona same day.	$ 2,061
Travel: Iowa Travel - 4 nights*2 rooms*$70/night = $560; Meals = 5 days*3 people*$31/d =$465; University vehicle: 700 miles @ $0.29/mile, 5 day @ $23/day = $318.	$ 1,343
Additional Budget Items: Analysis of stable isotope 12870 samples @$12/sample	$ 140,580
Additional Budget Items: Iowa analysis of stable isotope 500 samples @$11/sample	$ 5,500
Additional Budget Items: Boat use (gas, oil, maintenance) 90 d @ $18/day	$ 1,620
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 279,868

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Applied to Project During Project Period:	n/a	
Other State $ Being Applied to Project During Project Period:	n/a	
In-kind Services During Project Period: College of Science and Engineering allows workload during academic year for direction of undergraduate research. Estimated 17% assignment (3 years). Additional 8% comes from independent time	$ 39,000	Pending Funding by ENRTF
Remaining $ from Current ENRTF Appropriation (if applicable):	n/a	
Funding History:	n/a	



Upper Mississippi River with navigation dams and location of proposed sample areas.

Above Lake Pepin

Lake Pepin

Wabasha to Rollingstone

Winona to Brownsville

Pool 18 Area

Project Manager Qualifications

Michael Delong, Ph.D., has 26 years experience in the study of large rivers, including systems throughout out the central U.S.: the Mississippi (Upper and Lower), Ohio, Missouri, and Tennessee rivers. This includes 21 years of work in the Upper Mississippi River, including the Chippewa and St. Croix rivers, as professor of biology and director of the Large River Studies Center (LRSC). Delong's expertise includes fish and invertebrate community structure, the ecological response to invasive species (zebra mussels), hydrology, geomorphology, and food web ecology. He has published 27 peer-reviewed papers on river science has been an author or co-author on two book chapters and a book. He has also contributed to 135 conference presentations. As director of the LRSC, he has managed $600,000 in grants from the National Science Foundation, US Environmental Protection Agency, Minnesota DNR, Wisconsin DNR, and the New South Wales Environmental Trust. Undergraduates have participated in all of these projects, including the collection and processing of >10,000 samples for the USEPA grant. Delong will direct the ENRTF project, including training of undergraduate students participating in the project, data management, budget management (in conjunction with the WSU Business Office), model development, and submission of reports on findings. Delong will also serve as expert in the application of models with state and federal agency partners as needed for their application in development of management strategies.

Relevant Publications

Delong, M. D., Thorp, J. H., M. C. Thoms and L. M. McIntosh. 2011. Trophic niche dimensions of fish communities as a function of historical hydrological conditions of a Plains river. Invited paper, River Systems 19:177-187.

Delong, M. D. 2010. Food webs and the Upper Mississippi River: contributions to our understanding of ecosystem function in large rivers. Invited paper, Hydrobiologia 640:89-101.

Delong, M. D. and J. H. Thorp. 2006. Significance of instream autotrophs in the trophic dynamics of the Upper Mississippi River. Oecologia 147:76-85.

Delong, M.D. 2005. The Upper Mississippi River. Pages 327 – 373, In Benke, A.C. and C.E. Cushing (eds.), The Rivers of North America. Academic Press.

Delong, M. D., J. H. Thorp, K. S. Greenwood, and M. C. Miller. 2001. Responses of consumers and food resources to a high magnitude, unpredicted flood in the upper Mississippi River Basin. Regulated Rivers: Research and Management 17:217-234.

Thorp, J. H., M. D. Delong, and A. F. Casper. 1998. In situ experiments on predatory regulation of a bivalve mollusc (*Dreissena polymorpha*; zebra mussel) in the Mississippi and Ohio Rivers. Freshwater Biology 39:649-661.

Recent Relevant Grants as Principal Investigator/co-PI

Preliminary Research: Historical changes in ecosystem structure and function in Australian rivers. New South Wales Environmental Trust ($20,000; 2011-2012).

Landscape legacies: retrospective analyses of changes in ecosystem function across two centuries. National Science Foundation, ($80,000; 2010-2011).

Determination of ecological thresholds through an historical perspective of trophic dynamics in rivers. U.S. Environmental Protection Agency STAR program, ($297,489, 2005-2008).

Large River Studies Center of Winona State University

The mission of the LRSC is to provide educational opportunities for undergraduate students at WSU and to be a source of knowledge on river systems for the local, regional, and international communities. As director, Delong has directed 126 undergraduate research projects over the last 21 years. To meet these goals, the LRSC has developed partnerships with the US Geological Survey's Upper Midwest Environmental Sciences Center, the Riverine Landscapes Laboratory, University of New England, Australia, and the Minnesota Aquatic Invasive Species Research Center.