

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

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Project Title:

Minnesota Deers Risk of Invading Epizootic Hemorrhagic Disease

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: \$ 135,847

Proposed Project Time Period for the Funding Requested: 1.5 Years, July 2014 to December 201

Other Non-State Funds: \$ 0

Summary:

Minnesota is on the edge of invasion by epizootic hemorrhagic disease; a significant threat to white-tailed deer. Research is critical to assess risk, enabling agency partners to mitigate disease impacts.

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Sponsoring Organization: U of MN - College of Veterinary Medicine

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Web Address:

Location

Region: Statewide

County Name: Statewide

City / Township:

MP: 0613-2-110-proposa

Budget: 0613-2-110-bud

Qual: 0613-2-110-qualifi

Map: 0613-2-110-map-E

Resolution: 0613-2-11

List:

	_____	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)

2014 Main Proposal

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I. PROJECT STATEMENT

In 2012 epizootic hemorrhagic disease (EHD) swept through the Midwest killing thousands of white-tailed deer. Die offs disrupted deer harvests in some neighboring states, but Minnesota deer remained unaffected. Why? Are there genetic factors making our deer less susceptible to the EHD virus? Or is it merely a matter of time until EHD invades and impacts our deer population? Our project aims to investigate these questions.

EHD is a fatal viral disease infecting white-tailed deer (*Odocoileus virginianus*) and other ungulates, causing high fever, cell degradation, and internal hemorrhaging leading to death within days. EHD has long been a normal burden of deer management in the southeastern USA, but this pathogen is a new invader to the Midwest. The ecology of EHD relies on biting midges (*Culicoides variipennis*) to transmit the virus from infected to susceptible deer. The emergence of EHD has been linked to environmental factors. Mild winters improve survival of the midges that transmit the EHD virus and summer droughts provide ideal transmission conditions when animals congregate and midges breed in reduced wetlands. Climate conditions were blamed for the severity of the 2012 EHD outbreak which killed over 14,000 in 53 Michigan counties. Our closer neighbors also suffered losses; Iowa lost nearly 3,000 deer in 63 counties, South Dakota lost over 3,500 deer and stopped hunting license sales in 6 counties, in North Dakota large die-offs forced refunds of licenses from 11 hunt units and suspension of sales in three others, and Wisconsin lost hundreds of deer. Deer die-offs reported in counties at the MN border, lead to suspicion that the EHD virus and the midges that carry it have likely crossed into MN. Further, the 2012 case of EHD in a Brown County cattle herd suggests that both the virus and the vector are already present in MN. As a warming climate continues to alter the MN landscape, we are likely to face growing risk of EDH invasion and threats to our deer population and other hoofstock.

Our goal is to assess the status of EHD invasion into MN and the threat it poses to the local deer population.

It is crucial to determine how prevalent EHD is in midges in order to understand the disease risk harbored in Minnesota's wetlands. The recent impacts of EHD in neighboring states speak to the need to better understand the ecology of the disease in the Midwest. Do Minnesota deer, for instance, harbor resistance to the virus or is the disease simply going undetected? To better understand the future disease risk to our deer herd, this project will: **1) Use DNA-based tests to detect EHD virus in midges from areas at high risk for EHD presence; 2) Use genetic methods to determine the susceptibility of Minnesota deer to EHD; and 3) Based on this information, make recommendations for EHD control in the state.**

The outcomes of our project will lead to early detection efforts for EHD and population-level risk assessment.

This will provide tools for wildlife management planning to mitigate disease risks in the deer population, and ensure sustained enjoyment of this beloved wildlife resource. Deer are an important part of the MN ecosystem and these charismatic animals are also culturally and economically important to Minnesotans. Deer hunting generates an estimated \$500 million into MN's economy annually. It is important that we work to detect and understand EHD before it becomes established and impacts deer populations and harvests.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Determine whether EHD has invaded MN

Budget: \$ 51,992

We will use Geographical Information System (GIS) mapping to target wetland areas likely to harbor breeding midge populations and sample midges from these wetlands using specialized insect light traps. Trapping will focus on wetlands in Brown County and throughout the southern portion of MN where the EHD pathogen could have invaded from neighboring states. Sampling will be conducted at up to 50 sites during late summer months when midges breed. We will test groups of midges sampled from each wetland using a test that amplifies and detects DNA from the EHD virus. We will plot all EHD-positive wetlands in a GIS to map the scope of pathogen



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invasion. This will establish a sampling protocol that can be repeated in future years to serve as an early detection system to alert wildlife managers about the danger of EHD outbreaks.

Outcome	Completion Date
<i>1. Sample collection– midges from 50 wetlands</i>	<i>Summer 2014</i>
<i>2. Determine invasion status of EHD virus in wetland midge populations</i>	<i>Fall-Winter 2014</i>
<i>3. Map risk of EHD outbreak based on prevalence of virus and vector</i>	<i>Winter 2014</i>

Activity 2: Evaluate EHD susceptibility in MN deer

Budget: \$ 83,925

Previous experimental research has demonstrated that different white-tailed deer subspecies can vary in susceptibility to EHD. And breaking research findings from Georgia suggests that some herds can maintain transmission of EHD while showing little of the typical mortality. The lack of EHD in MN despite neighboring outbreaks leads to questions about local herd susceptibility. Newly developed DNA markers can show the taxonomic and evolutionary relationships between individual deer. By using these DNA profiles, we will distinguish whether MN deer belong to the more susceptible or resistant subspecies. Additionally, by comparing our deer to those in neighboring EHD outbreak states, we can determine whether genetic differences exist between MN deer and hard-hit populations. We will use deer tissue samples banked by the MN DNR (from chronic wasting disease surveillance) representing southeast MN, and collect fecal samples to represent additional areas (using sample sites above). Comparison samples are available from WI and IL through previous work by Project Manager Robinson, and we expect samples from IA and ND through DNR collaborations.

Outcome	Completion Date
<i>1. Sample collection– deer feces for DNA analysis from 50 wetlands</i>	<i>Summer 2014</i>
<i>2. Determine genetic susceptibility of MN deer to EHD</i>	<i>Spring-Summer 2015</i>
<i>3. Predict EHD impacts on MN deer based on similarity with neighbors</i>	<i>Fall-Winter 2015</i>

III. PROJECT STRATEGY

A. Project Team/Partners

We have assembled a team uniquely suited to assess the potential for an EHD invasion in MN including experts from the Department of Veterinary Population Medicine at the UMN, the state’s primary academic institution, and the MN DNR, which oversees the state’s wildlife management. UMN team members receiving ENRTF funds include Dr. Stacie Robinson (deer diseases and genetics), Dr. Meggan Craft (epidemiological modeling), Dr. Katey Pelican (wildlife epidemiology), Dr. Dominic Travis (disease risk assessment), Dr. Timothy Johnson (molecular diagnostics). DNR team member (no ENRTF) is Dr. Michelle Carstensen (wildlife disease ecology and management).

B. Timeline Requirements

This project will be completed within 18 months. Field sampling to collect midges for EHD detection and deer feces for genetic susceptibility analysis will be conducted during the summer of 2014. Genetics lab work will take place Fall 2014 - Spring 2015. Analysis, reporting, and outreach will take place Summer - Winter 2015.

C. Long-Term Strategy and Future Funding Needs

This project will break new ground in invasive disease detection and establish a framework for future disease surveillance. Our field sampling protocol and laboratory tests will aid disease monitoring. This will prepare MN wildlife managers for rapid response in case of future EHD outbreaks, including contingency planning in case of impacts to deer harvests. EHD risk is likely to increase as climate warming makes outbreak conditions more common. By building collaborations with neighboring states, future extensions of this project would be eligible for national-level funding, reducing the funding burden on MN.

2014 Detailed Project Budget

Project Title: Minnesota deer's risk of invading epizootic hemorrhagic disease

IV. TOTAL ENRTF REQUEST BUDGET 1.5 years

BUDGET ITEM	AMOUNT
Personnel:	\$ 71,847
1 of 4 Professors (Dr. Meggan Craft) , 2 weeks summer salary	\$ 3,774
1 of 4 Professors (Dr. Meggan Craft), 2 weeks summer salary, 33% fringe	\$ 1,268
1 of 4 Professors (Dr. Katey Pelican) , 2 weeks summer salary	\$ 4,230
1 of 4 Professors (Dr. Katey Pelican), 2 weeks summer salary, 33% fringe	\$ 1,421
1 of 4 Professors (Dr. Timothy Johnson) , 2 weeks summer salary	\$ 3,200
1 of 4 Professors (Dr. Timothy Johnson), 2 weeks summer salary, 33% fringe	\$ 1,087
1 of 4 Professors (Dr. Dominic Travis) , 2 weeks summer salary	\$ 6,218
1 of 4 Professors (Dr. Dominic Travis), 2 weeks summer salary, 33% fringe	\$ 2,089
1 Research Associate (Dr. Stacie Robinson), 1.5 years @ 50%	\$ 33,277
1 Research Associate (Dr. Stacie Robinson), 1.5 years @ 50% (20% fringe)	\$ 6,655
1 Field Technician, 2 month @ 100%	\$ 3,235
1 Field Technician, 2 month @ 100% (7% fringe)	\$ 237
1 Laboratory Technician, 6 month @ 50%	\$ 4,800
1 Laboratory Technician, 6 month @ 50% (7% fringe)	\$ 355
Equipment/Tools/Supplies:	\$ 59,000
Sample collection supplies for sampling midges and deer feces (from 50 wetland areas)	\$ 1,000
DNA purification and amplification reagents and supplies	\$ 6,000
DNA sequencing of markers of EHD susceptibility in deer (500 MN deer tissue samples)	\$ 30,000
DNA sequencing of markers of EHD susceptibility in deer from neighboring states (100 WI deer + 100 IL deer)	\$ 12,000
Detection of EHD viral DNA in midge samples (100 midge group samples)	\$ 10,000
Travel: Lodging and transportation costs for research assistants to collect midge samples from MN wetlands to be tested for environmental presence of EHD virus	\$ 5,000
Mileage for travel to approximately 50 field sites, avg 57 mi/trip, mileage rate \$0.565	\$ 1,620
Per Diem for 40 days of travel, GSA rate 46\$/day	\$ 1,840
Hotel costs for 20 nights (assume approximately half are day trips), GSA rate 77\$/night	\$ 1,540
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 135,847

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period:	\$ -	
Other State \$ Being Applied to Project During Project Period:	\$ -	
In-kind Services During Project Period:		
Samples of deer tissue for use in genetic analysis will be provided by the MN Dept of Natural Resources (estimated value of sample collection and storage of 500 samples \$5000)	\$5,000	<i>Secured</i>
Sequencing, molecular, and microbiological laboratory space and equipment will be provided by the University of Minnesota (estimated equipment value \$5 million dollars)	\$25,000	<i>Secured</i>
DNA extracted from WI and IL deer to provide region context for comparison with MN deer will be provided by Stacie Robinson through previous work in collaboration with the University of Wisconsin, WI DNR and IL DNR (estimated value of sample collection, storage, and DNA extraction from 200 samples \$5,000)	\$5,000	<i>Secured</i>
Genetic data from deer in neighboring states to be provided through collaborators at University of Iowa, Iowa and North Dakota Departments of Natural Resources (estimated value of sample provision and processing approximately \$10,000 from each)	\$20,000	<i>requested</i>
Remaining \$ from Current ENRTF Appropriation (if applicable): N/A	\$ -	
Funding History:		

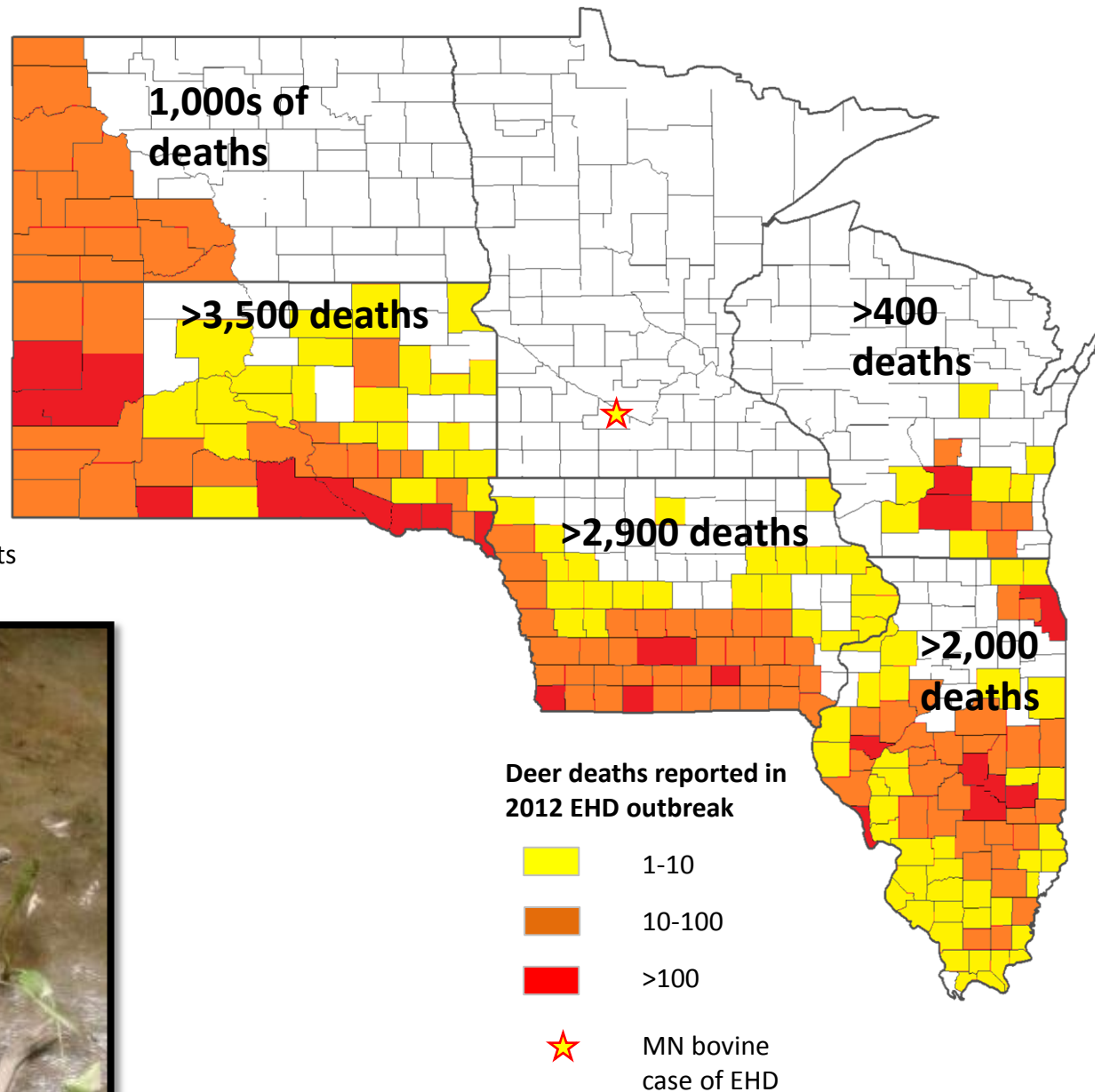
Epizootic Hemorrhagic Disease Outbreaks: Are Minnesota Deer Next?

What's EHD?

- Viral disease causing fever and hemorrhaging
- Spread by biting midges
- Infects deer – severe and deadly
- Sometimes infects cattle – can be treated

What's the risk of EHD in Minnesota?

- EDH invaded the Midwest causing major outbreaks in 2012
- No EHD cases in deer were reported in MN
- 1 EHD case detected in a cow in MN in 2012
- Invasion status is unknown in MN
- Susceptibility in MN deer is unknown
- Outbreaks are likely to increase as climate warming brings mild winters and summer droughts



EHD is often fatal in deer, due to severe hemorrhaging.



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Project Manager Qualifications & Organization Description

Minnesota deer's risk of invading epizootic hemorrhagic disease

Stacie Robinson, UMN Department of Veterinary Population Medicine, Project Manager. Dr. Robinson is a wildlife disease ecologist with expertise in the epidemiology and genetics of white-tailed deer diseases. Her research has contributed greatly to the understanding of chronic wasting disease spread in the Midwest and the natural selection for disease resistance in deer populations. This experience will put our team a step ahead in answering questions about the genetics of Minnesota's deer population and the emergence dynamics of EHD. She will lead the research on deer genetic susceptibility and detection of EHD in Minnesota wetlands. Through previous deer research in the Midwest, she will contribute samples from IL and WI to provide regional context for Minnesota deer genetic samples.

Michelle Carstensen, MN Dept. of Natural Resources, Wildlife Health Program, Co-Investigator. Dr. Carstensen is the Supervisor of the DNR's Wildlife Health Program, she plays a key role in monitoring and protecting the health of Minnesota's wildlife resources. She will contribute samples to this project and brings connections to wildlife agencies and wildlife health experts in neighboring states.

Meggan Craft, UMN Department of Veterinary Population Medicine, Co-Investigator. Dr. Craft is an infectious disease ecologist specializing in theoretical disease models at the intersection of environmental, human, and animal health. She will develop vector-borne disease models to predict EHD invasion risk based on prevalence of the virus detected in midge populations and genetic susceptibility of MN white-tailed deer.

Katey Pelican, UMN Department of Veterinary Population Medicine, Co-Investigator. Dr. Pelican is a wildlife veterinarian and head of the Ecosystem Health Initiative at the University of Minnesota and is focused on improving health at the intersection of animals, humans, and the environment. She will explore intersections between the pathogens and their environments.

Dominic Travis, UMN Department of Veterinary Population Medicine, Co-Investigator. Dr. Travis is a wildlife veterinarian and researcher in the Ecosystem Health Initiative at the University of Minnesota. He has expertise in wildlife disease surveillance and risk assessment, with particular focus on diseases at the intersection of animals, humans, and the environment. He will contribute to EHD risk assessment.

Timothy Johnson, UMN Department of Veterinary and Biomedical Sciences, Co-Investigator. Dr. Johnson is an expert in veterinary microbiology and molecular genetics. Genetic tests for EHD detection and genetic profiling of white-tailed deer will take place in Dr. Johnson's laboratory at UMN.

The College of Veterinary Medicine is a top-ranked professional institution dedicated to research, training, and service toward the improvement of animal health, CVM is part of the University of Minnesota, the state's premiere academic institution, which provides an outstanding environment for both research and education.

The MN Department of Natural Resource is the state's primary natural resource management agency and oversees the protection and management of wildlife populations in Minnesota.

In addition to our research team, we also have collaborations with other agencies concerned about the animal health impacts of EHD. Collaborators will provide expertise and assist with sampling design and outreach.

- **Linda Glaser, Senior Veterinarian, MN Board of Animal Health**
- **Dan Grove, Wildlife Veterinarian, North Dakota Game & Fish**
- **Dale Garner, Chief of Wildlife, Iowa DNR**
- **Michael Samuel, Professor of Wildlife Ecology, USGS Co-op Unit, University of Wisconsin**
- **Paul Shelton, Forest Wildlife Program Manager, Illinois DNR**