Environment and Natural Resources Trust Fund
2019 Request for Proposals (RFP)

Project Title: **ENRTF ID: 193-EH**

Associations Between Extreme Weather and Harmful Vector Populations

Category: H. Proposals seeking $200,000 or less in funding

Sub-Category: E. Air Quality, Climate Change, and Renewable Energy

Total Project Budget: $ 199,531

Proposed Project Time Period for the Funding Requested: June 30, 2021 (2 yrs)

Summary:

Minnesota boasts extensive outdoor recreation, but harmful vectors present risk. Relationships between extreme weather and vectors will be quantified, while risk communication will inform public safety and insect-control strategies.

Name: Jesse Berman

Sponsoring Organization: U of MN

Title: Assistant Professor

Department: Sponsored Projects Administration

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Extreme weather events in Minnesota will be characterized and their relationship with harmful vectors (ticks and mosquitoes) quantified. Risk communication will inform public safety, reduce disease, and aid insect-control strategy.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%
____ If under $200,000, waive presentation?			

PROJECT TITLE: Associations Between Extreme Weather and Harmful Vector Populations

I. PROJECT STATEMENT

Outdoor recreation is a popular and important use of Minnesota public lands. In 2012, Minnesota had 8 million state park visitors, nearly 1 million overnight campers, and a half million deer hunters. Our robust outdoor culture puts people, and their pets, at increased exposure risk to harmful vectors, including ticks and mosquitoes. In 2016, the Minnesota Department of Health reported 39 Lyme disease cases per 100,000 people and Lyme disease incidence has increased by 250% in the past 20 years. Despite a substantial and growing health burden, we know little about the role of environmental conditions, including drought and extreme heat, on tick and mosquito populations. Understanding how weather influences tick and mosquito numbers is important for characterizing changes in exposure risk and reducing disease. Considering the heavy use of Minnesota's natural environment and increasing prevalence of extreme weather, understanding associations with ticks and mosquitoes has important implications for both citizen health and insect-control strategies.

The goal of this project is to characterize how extreme weather events impact harmful vector populations, known to transmit disease (e.g. ticks and mosquitoes). Our results will 1) characterize extreme weather in Minnesota, including drought, heat, and precipitation, 2) investigate how extreme weather impact populations of tick and mosquitoes, and 3) inform public awareness campaigns and inform pest mitigation strategies. The research will enhance informed decision making to protect Minnesotans from exposure to ticks and mosquitoes. It seeks to benefit people that utilize parks and open spaces, inform policies to reduce the spread of Lyme disease, and investigate an understudied hazard of extreme weather conditions.

The project will involve a collaborative effort between University of Minnesota School of Public Health, Metropolitan Mosquito Control District (MMCD), and Minnesota Department of Health (MDH). Led by Dr. Jesse Berman, we will use historical weather data on drought, precipitation, and temperature from 1991 to 2016 and characterize spatiotemporal extreme weather events across the state. Using statistical modeling, we will assess how these weather and environmental conditions influence counts of tick and mosquitoes collected at 100 sites across the 7-county metro area for 26 years. Working with the MDH, we will identify conditions that lead to increased exposure risk, and prepare summaries to communicate findings with the public and control agencies.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: *Characterize extreme weather conditions in the state of Minnesota (1991-2016), including drought, heat, and precipitation*

Using weather data from the U.S. Drought Monitor and the National Oceanographic and Atmospheric Administration, we will look at drought, daily temperature, precipitation, snowfall, and other meteorological measures at thousands of monitors across the state of Minnesota (1991-2016). Using big-data analysis, weather conditions will be classified into 'events,' such as extreme drought event or extended heat wave, that are potentially important for vector populations. We will map conditions of extreme weather event occurrences in Minnesota to create a visual picture across both space and time.

ENRTF BUDGET: $ 79,828

Outcome	Completion Date
1. Characterize and map extreme weather events in Minnesota across 26 years	*April 30, 2020*

Activity 2: *Assess the relationship between extreme weather events and populations of ticks and mosquitoes*

Using a Geographic Information System (GIS), we will overlay the conditions of extreme weather events with population counts of ticks and mosquitoes for each sample location and time. Additional environmental characteristics of the sample sites will be incorporated, including data on the surrounding land types, proximity to parks, geography, and community characteristics. Using statistical regression, we will quantitatively assess the

relationship between extreme weather events and vector-counts, while controlling for environmental characteristics and change across time.

ENRTF BUDGET: $ 68,934

Outcome	Completion Date
1. Comprehensive quantitative assessment of weather events and vector-populations	*December 31, 2020*

Activity 3: *Identify conditions contributing to increased vector risk, and prepare information to communicate findings with the public*

We will use the findings from Activity 2 to examine how extreme weather impacts vector-borne insect populations and identify environmental conditions associated with greater vector risk. We will work with MDH to prepare effective communication tools for both outdoor recreation seekers and insect-control planners. Our goal is to identify extreme weather conditions leading to increased vector-numbers, which can inform management strategy and reduce exposure that can cause harmful disease.

ENRTF BUDGET: $ 50,769

Outcome	Completion Date
1. Identify how extreme weather contributes to increased vector risk	*February 28, 2021*
2. Prepare communication tools for the public and insect-control planners	*June 30, 2021*

III. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

Name	Title	Affiliation	Role
Dr. Jesse Berman	Assistant Professor	University of Minnesota	Principal Investigator
Dr. Jon Oliver	Assistant Professor	University of Minnesota	Co-Principal Investigator

B. Partners NOT receiving ENRTF funding

Name	Title	Affiliation	Role
David Neitzel	VBD Unit Head	MN Dept. of Health	Collaborator
Kirk Johnson	Vector Entomologist	Metropolitan Mosquito Control District	Collaborator

IV. LONG-TERM- IMPLEMENTATION AND FUNDING:

Findings will be disseminated to the public on the MDH website and through U of MN Extension. Results from Activity 1 and 2 will be presented at a major public health conference and published in a peer reviewed journal. The findings will inform surveillance and control activities of MDH and MMCD. Future activities will expand the study in two directions: 1) Increase our analysis of vector populations and weather to other geographic regions and states and 2) support health research linking extreme weather to vector-borne disease (e.g. Lyme disease) throughout the upper Midwest. This will be a component of ongoing epidemiological health effects research of extreme weather and climate events. Support will be pursued through the National Institutes of Health (NIH).

V. TIME LINE REQUIREMENTS:

The proposed will require 24 months to complete. The first 10-months will be devoted to acquiring, cleaning, mapping, and characterizing extreme weather events in Minnesota. The next 8-months will statistically model associations between vector-populations and weather. The last 6-months will be devoted to analyzing environmental conditions leading to increased vector-risk and preparing public communication messaging.

VI. SEE ADDITIONAL PROPOSAL COMPONENTS: A) Proposal Budget Spreadsheet, B) Visual Component, F) Project Manager Qualifications and Organization Description

2019 Proposal Budget Spreadsheet

Project Title: Associations Between Extreme Weather and Harmful Vector Populations

IV. TOTAL ENRTF REQUEST BUDGET *2* **years**

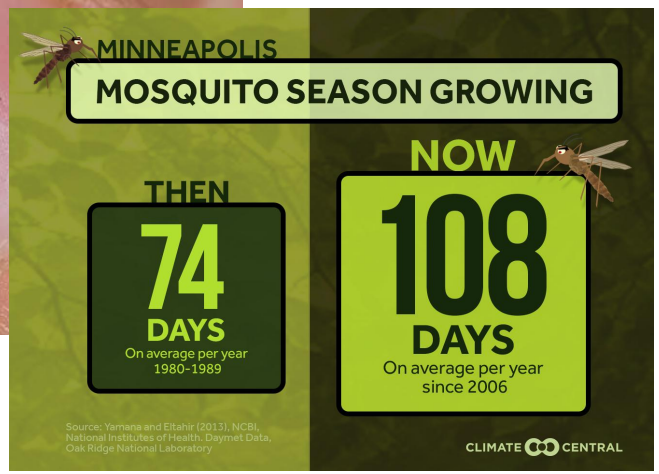
BUDGET ITEM (See "Guidance on Allowable Expenses")	**AMOUNT**
Personnel:	
Jesse Berman, Principal Investigator [30% Salary-Year 1; 25% Salary-Year 2 + Fringe (33.5%)]	$ 71,041
Jon Oliver, Co-Investigator [10% Salary-Year 1; 15% Salary-Year 2 + Fringe (33.5%)]	$ 33,032
Grad RA (PhD) [50% Salary + Fringe (15.0%) + Tuition]	$ 89,258
Travel: Conference travel to present project findings	$ 4,200
Additional Budget Items: Publication costs	$ 2,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 199,531

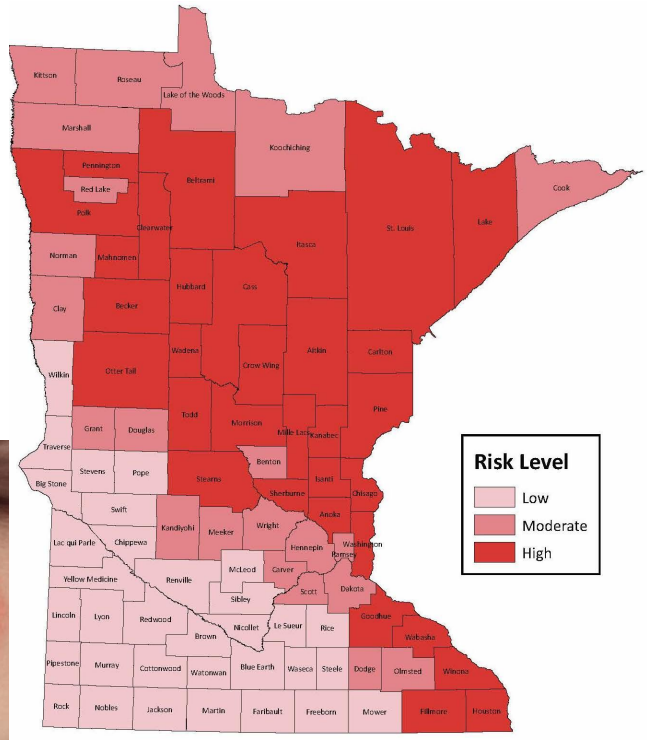
V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

SOURCE OF FUNDS	**AMOUNT**	**Status**
Other Non-State $ To Be Applied To Project During Project Period:	N/A	
Other State $ To Be Applied To Project During Project Period:	N/A	
In-kind Services To Be Applied To Project During Project Period: Indirect costs contributed in-kind by the University of Minnesota	$ 91,311	*Secured*
Past and Current ENRTF Appropriation:	N/A	
Other Funding History:	N/A	

Association Between Extreme Weather Events and Harmful Vector Populations

Characterize Minnesota extreme weather events, including drought and heat





Identify relationship between extreme weather and harmful vectors (e.g. ticks and mosquitoes)

Communicate risk to inform public safety, reduce disease, and aid insect-control strategy

Dr. Jesse Berman is an Assistant Professor in Environmental Health Sciences at the University of Minnesota School of Public Health. Dr. Berman earned a doctorate at the Johns Hopkins Bloomberg School of Public Health (JHSPH) and served in postdoctoral positions at Yale School of Forestry and Environmental Studies and in Epidemiology at JHSPH. His training has been in environmental epidemiology with an emphasis on exposure assessment and spatial statistics, including the use of Geographic Information Systems (GIS) to address public health problems. Dr. Berman has a particular interest in how extreme weather events impact health. Dr. Berman carried out an investigation of drought conditions and its association with cardiovascular- and respiratory-related hospitalizations among older adults in the western United States. The project received national media coverage, and was highlighted by the National Institute of Environmental Health Sciences as a 'Selected Extramural Publication' for significance and public health importance. This line of research has given Dr. Berman extensive experience assessing drought, weather exposure, and how these relate to environmental change.

Dr. Jon Oliver is an Assistant Professor in Environmental Health Sciences at the University of Minnesota School of Public Health. Dr. Oliver received his PhD from Iowa State and prior to joining the School of Public Health worked at the Department of Entomology at UMN. He is a public health entomologist who specializes in vector-borne disease, particularly in the relationship between ticks and emerging tick borne-pathogens relevant to health. Dr. Oliver has focused on multiple research themes including the effects of vector interactions on disease transmission and how environmental factors affect vector range expansion and human disease.

David Nietzel is head of the vector-borne disease unit at the Minnesota Department of Health. He has spent more than 30 years describing, monitoring, and preventing vector-borne disease in Minnesota, including launching the Metropolitan Mosquito Control disease surveillance and control program. He works closely to both monitor vector populations, distributions, and follow-up on all disease cases reported to the Minnesota Department of Health.

Kirk Johnson is an entomologist at the Metropolitan Mosquito Control District with extensive knowledge of vector ecology and monitoring. He has worked on numerous vector-related issues of concern for Minnesotans, including West Nile Virus, Zika virus, and Lyme disease.

The University of Minnesota and School of Public Health

The University of Minnesota in the Twin Cities is the flagship campus of the state of Minnesota's land grant university. The University houses 18-colleges and brings together a unique combination of agriculture, veterinary, medicine, law, liberal arts, engineering, public health, journalism, business, and design experts. Strong cross-disciplinary collaborations are common and strongly encouraged at the highest levels of University leadership. The School of Public Health is currently the 8th ranked public health school by US News and World Reports and 6th in NIH funding with about 130 full-time faculty and 1,500 enrolled students. It offers 19 graduate degrees (15 masters, 4 doctoral) and has 25 research centers collaborated across 4 academic divisions (Environmental Health Sciences, Biostatistics, Epidemiology and Community Health, and Health Policy and Management). We have close relationships with state agencies, including the Department of Health, Climatology Office, and Department of Natural Resources.