Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)

Project Title: **ENRTF ID:** **066-AH**

Understanding Environmental Factors that Impact Minnesota Tick Populations

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

Sub-Category: A. Foundational Natural Resource Data and Information

Total Project Budget: $ 199,938

Proposed Project Time Period for the Funding Requested: June 30, 2022 (2 yrs)

Summary:

Ticks and tick-borne disease are a major problem in Minnesota. Improved understanding of the environment and tick relationship can reduce risk of disease and inform pest control strategies.

Name: Jesse   Berman

Sponsoring Organization: U of MN

Job Title: Dr.

Department: School of Public Health

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Location:

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Understand how extreme weather conditions links to the numbers of ticks, in order to protect Minnesotans who are shown enjoying the great outdoors.

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

PROJECT TITLE: Understanding Environmental Factors that Impact Minnesota Tick Populations

I. PROJECT STATEMENT

Minnesota is at the forefront of a nationwide tick invasion. Over the past 20 years, ticks have expanded their geographic range and are found in places they hadn't been previously seen. As a consequence, tick-borne disease is on the rise. Prevention of tick-borne illnesses is a priority of most health agencies, but we struggle to understand what causes variation in tick populations by year, state, or even across counties. Cold winters, regional droughts, heavy rainfalls, or persistent heat are likely to impact tick numbers and subsequent disease risk; however, the exact relationship is poorly understood. We propose to investigate the environmental factors that impact numbers of ticks in Minnesota by taking advantage of robust tick and weather data collected by the state of Minnesota. Our findings will elucidate the link between weather and ticks, and inform both insect-control strategies and public awareness campaigns to reduce the spread of tick-borne illnesses.

Ticks are tiny arachnids inhabiting wooded or brushy environments, which will bite and feed on human blood. Some ticks are known to spread harmful disease, including Lyme disease, babesiosis, and ehrlichiosis. While common symptoms often include rashes, fever, and fatigue, untreated tick-borne disease can spread to the joints, heart, and nervous system. Tick-borne disease is a major problem in Minnesota. In 2016, the Minnesota Department of Health (MDH) reported 39 Lyme disease cases per 100,000 people and this number has increased by 250% over the past 20 years. However, these numbers are considered to be low estimates of the true burden. Considering that Minnesota had 8 million state park visitors, nearly 1 million overnight campers, and a half million deer hunters in 2012, we have a significant population at-risk for tick exposure.

Our long-term goal is to reduce tick-borne disease and inform tick control strategies for the state of Minnesota through improved understanding of the tick and environment relationship. Our overall project objectives are to:

- Characterize historical weather conditions in Minnesota, including drought, heat, cold, and precipitation
- Identify the weather conditions that lead to changing tick populations
- Provide data to inform public awareness campaigns and disease reduction strategies when ideal tick conditions are forecasted

The rationale for this project is to inform decision making and protect Minnesotans from tick-borne disease. It seeks to benefit people that utilize parks and open spaces, advise insect control policies, and decrease the spread of Lyme disease. The project will involve a collaborative effort between University of Minnesota School of Public Health, Metropolitan Mosquito Control District, and Minnesota Department of Health. Led by Dr. Jesse Berman, we will characterize weather events across the state (1991 to 2016). Using statistical modeling, we will investigate how weather conditions influence historical tick abundance from 100 sites across the 7-county metro area for 26 years. Working with MDH, we will refine our understanding of environmental conditions leading to greater tick exposure risk, and prepare summaries to communicate with the public and control agencies.

II. PROJECT ACTIVITY - UNDERSTANDING THE ENVIRONMENTAL FACTORS THAT IMPACT TICK POPULATIONS IN MINNESOTA

Outcome 1. *Characterize historical Minnesota weather, including drought, heat, cold, and precipitation*
Using weather station and online climate data, we will identify drought, daily temperature, precipitation, snowfall, and other meteorological measures at hundreds of monitors across the state of Minnesota (1991-2016). Using spatial analysis, weather conditions will be classified into 'events,' such as drought or heatwave, that are important for tick populations. We will map conditions of event occurrences in Minnesota to create a visual picture of weather across both space and time. **ENRTF BUDGET: $ 79,828**

Outcome 2: *Determine weather conditions associated with changes in tick abundance*

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Using a Geographic Information System (GIS), we will combine weather events with pre-existing tick data collected by the Metropolitan Mosquito Control District across 100 sample sites covering 26 years. Additional environmental characteristics of the sample sites will be incorporated, including the surrounding land types, proximity to parks, geography, and community characteristics. Using statistical modeling, we will quantitatively assess the relationship between weather and tick abundance, to determine how environmental conditions influence tick populations. **ENRTF BUDGET: $ 68,934**

Outcome 3: *Identify "ideal" conditions for ticks, and prepare summaries to communicate risks to the public*
We will use the findings from Activity 2 to discover how weather and environment lead to changes in tick abundance. This knowledge can be used for identification of early tick risks. We will work with the Minnesota Department of Health to prepare effective communication tools for both outdoor recreationalists and insect-control planners. This information will be used in tick management strategy, such as early warning systems and behavioral education to reduce harmful disease.

ENRTF BUDGET: $ 50,769

Outcome	Completion Date
1. Characterize and map weather events in Minnesota across 26 years	*April 30, 2020*
2. Determine the relationship between weather conditions and tick-populations	*December 31, 2020*
3. Prepare communication tools for the public and insect-control planners	*June 30, 2021*

III. PROJECT PARTNERS AND COLLABORATORS:
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:
The project will enhance our understanding of environmental conditions that lead to increased tick populations where people live, work, and play. The results will inform surveillance and control activities of the Department of Health and Metropolitan Mosquito Control Department. It will provide information to reduce tick and disease exposure for Minnesota residents. We will disseminate our findings through the Department of Health website and through UMN Extension. Results from Outcomes 2 and 3 will also be presented at public health conferences and published in scientific journals, where they can be useful for other Midwest states looking to inform tick disease strategies.

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 26 years of weather events in Minnesota. The next 8-months will statistically model associations between tick populations and weather. The last 6-months will be devoted to analyzing environmental conditions leading to increased tick-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

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Attachment A: Project Budget Spreadsheet
Environment and Natural Resources Trust Fund
M.L. 2020 Budget Spreadsheet
Legal Citation:
Project Manager: Jesse Berman
Project Title: Understanding and Reducing Risk from Minnesota's Growing Tick Problem
Organization: University of Minnesota
Project Budget: $290,635 [$199,938 ENTRF]
Project Length and Completion Date: 2 years; 06/30/2022
Today's Date: March 27,2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
BUDGET ITEM				
Personnel (Wages and Benefits)		$ 197,938	$ -	$ 197,938
Jesse Berman, Principal Investigator [30% Salary-Year 1; 20% Salary-Year 2 + Fringe (36.0%)]				
Jon Oliver, Co-Investigator [9% Salary-Year 1; 15% Salary-Year 2 + Fringe (36.0%)]				
Grad RA (PhD) [50% Salary + Fringe (16.1%) + Tuition]				
Travel expenses in Minnesota				
One Conference trip to present project findings at the American Public Health Association conference; $400 airfare, $759 lodging, $276 per diem, $65 transportation, $500 registration. GSA rates used per the University of Minnesota travel policy.		$ 2,000	$ -	$ 2,000
Other				
		$ -	$ -	$ -
COLUMN TOTAL		$ 199,938	$ -	$ 199,938

SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		$ -	$ -	$ -
State:		$ -	$ -	$ -
In kind: Unrecoverable University Indirect Costs @ 54% MTDC, $167,958 x 0.54 = $90,697	secured	$ 90,697	$ -	$ 90,697

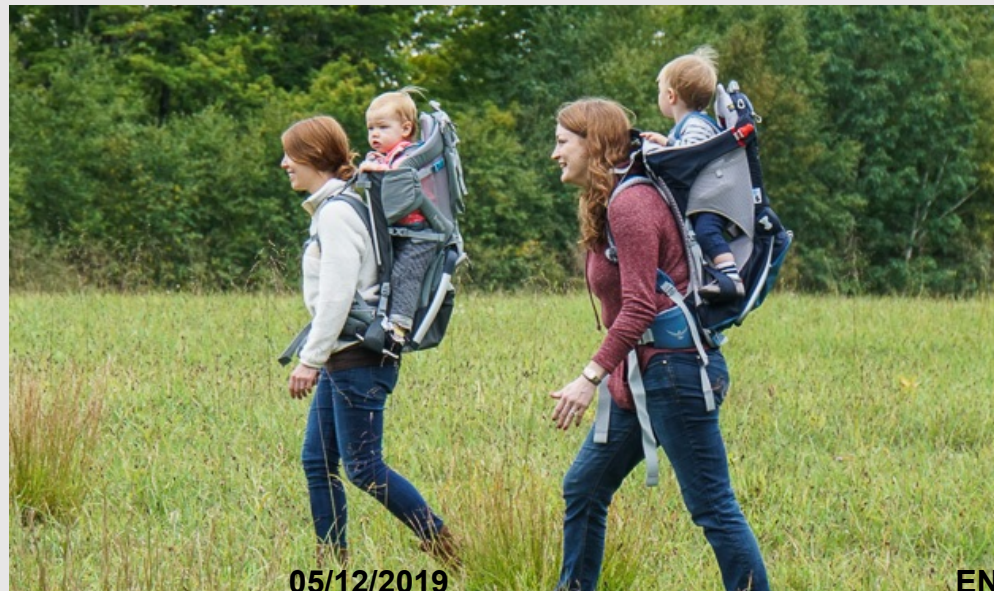| Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	Amount legally obligated but not yet spent	Budget	Spent	Balance
		$ -	$ -	$ -

Understand How Conditions like This…

Affects the Numbers of These…

To Help Protect Minnesotans Like Them…

05/12/2019

ENRTF ID: 066-AH

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 weather events impact health. His past research has looked at the association between drought conditions and hospitalizations among older adults in the western United States. The project received national media coverage, and was highlighted by the National Institute Health (NIH) as a 'Selected Extramural Publication' for significance and public health importance. Dr. Berman has additionally performed a number of health based assessments looking at the impacts of weather and environment on health and behavior. He is familiar with existing weather and land use data sets, and employing GIS to understand how they relate to environmental change.

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.

The Division of Environmental Health Sciences in the School of Public Health

The Division of Environmental Health Sciences provides a rich environment for conducting academic research. Faculty expertise includes exposure science, epidemiology, environmental chemistry, vector-borne diseases, tick-borne disease, industrial hygiene, and environmental and occupational policy. The Division faculty are extremely collaborative and have experience in applying multi-disciplinary approaches to complex environmental and occupational issues. One of the strengths of the Division is the expertise in the development and application of biomarkers to assess exposure. Weekly seminars in the Division of Environmental Health Sciences include nationally- and internationally-known speakers on a wide range of topics ranging from methodological issues to cutting edge approaches to investigate exposure and health effects. The Academic Health Center (including the School of Public Health, Medical School, School of Pharmacy, Nursing School, Veterinary School, and Dental School) and the University of Minnesota encourage multi-disciplinary research and offer many opportunities for such collaborative work.