

**Environment and Natural Resources Trust Fund  
2018 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 014-A**

An Early Warning System for Wildlife Health Threats

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**Category:** A. Foundational Natural Resource Data and Information

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**Total Project Budget:** \$ 280,000

**Proposed Project Time Period for the Funding Requested:** 2 years, July 2018 to June 2020

**Summary:**

This project will establish a surveillance system to monitor wildlife health in Minnesota through development of information management and analytical systems utilizing wildlife rehabilitation data.

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**Sponsoring Organization:** U of MN

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St. Paul MN 55108

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**Web Address** raptor.umn.edu

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:**

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**Alternate Text for Visual:**

Schematic of early warning information system for monitoring wildlife health

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



**Environment and Natural Resources Trust Fund (ENRTF)**

**2018 Main Proposal**

**Project Title:** An early warning system for wildlife health threats: using wildlife rehabilitation data to monitor wildlife health

**PROJECT TITLE:** An early warning system for wildlife health threats: using wildlife rehabilitation data to monitor wildlife health

**I. PROJECT STATEMENT**

We propose to advance *surveillance for wildlife health threats within Minnesota through the development of information management and analytical systems that utilize wildlife rehabilitation data*. Threats to animal health include toxins and diseases such as avian influenza, West Nile Virus, and canine distemper. Lack of information on the occurrence of these threats in wildlife makes it challenging to identify concerning trends in wildlife population health, but sampling free-ranging wildlife is expensive, challenging, and time-consuming. In contrast, over 13,000 animals are admitted annually to wildlife rehabilitators in Minnesota. Health information routinely recorded on these animals (e.g., species, age, location, reason for admission, and symptoms/clinical signs) could be utilized for tracking health trends. However, we lack systems to aggregate and analyze these data and thus wildlife rehabilitation data is currently a missed opportunity. This project will develop information systems to monitor wildlife health in Minnesota and provide an early warning system with the potential to detect new health threats or emerging environmental issues impacting health. This monitoring system may also identify geographic areas or species experiencing health events, which will allow for more strategic use of resources in that these populations can be targeted for more in-depth health investigations or interventions, leading ultimately to more effective control and prevention of emerging health threats.

Our specific aims are to:

- 1) Establish data systems that utilize wildlife rehabilitation data to monitor wildlife population health trends
- 2) Develop an alert system for detecting anomalies in wildlife rehabilitation data that may indicate emerging health threats
- 3) Investigate environmental and land-use drivers of wildlife health trends

The Raptor Center (TRC) and Wildlife Rehabilitation Center of Minnesota (WRC) have maintained electronic medical databases on rehabilitated animals since 1990 and 1999, respectively. These animals can be used as sentinels for underlying health issues in wild populations, for detecting emerging health threats, and for monitoring the relative abundance of species across time. To maximize the utility of data, TRC, WRC, and others developed a standardized terminology for health records at wildlife care centers as part of a previous ENRTF project. These standards facilitate the integration and analysis of medical records from different wildlife rehabilitators for surveillance purposes. As a proof-of-concept, analysis of TRC rehabilitation data shows that we could have detected the arrival of West Nile Virus in Minnesota in 2002. However, for effective and timely surveillance, we urgently need systems to monitor these data in real-time rather than analyzing the data after the event has occurred. This project will enhance our ability to understand drivers of health in wildlife populations and to conduct surveillance for emerging health threats.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1:** *Establish data systems utilizing rehabilitation data to monitor wildlife health* **Budget: \$120,000**

We will build a central database for MN wildlife rehabilitation data. Aggregated data will include retrospective data from the 1990s to present as well as prospective data on animals admitted for rehabilitation. Data will be used to **a)** quantify seasonal patterns of wildlife admissions based on species, age, and clinical signs, and **b)** evaluate long-term trends in wildlife rehabilitation data. Results will be used to establish baselines of what are “typical” patterns of admission. We will **c)** build an online platform to facilitate data aggregation across facilities, data analysis, visualization, and reporting of health trends to allow easy access and use by different stakeholders (e.g. veterinarians, researchers, policy makers).

<b>Outcome</b>	<b>Completion Date</b>
a. Quantify seasonal patterns of wildlife admission data	30 DEC 2018
b. Establish baselines and evaluate long-term wildlife health trends	30 DEC 2018



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c. Build online platform for data aggregation, analysis, and reporting	30 JUN 2020
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**Activity 2:** *Develop an alert system for detecting anomalies in wildlife rehabilitation data that may indicate an emerging health threat* **Budget: \$ 105,000**

Using time series analysis of retrospective data, we will **a)** forecast expected patterns based on seasonal and long-term trends. We will then, **b)** develop analytical pipelines to detect aberrations in the data that deviate from forecasted patterns that may indicate a new or changing health threat (such as a new disease). We will also apply spatial tools to **c)** identify spatial and temporal clusters of cases that may indicate a health event is occurring. Alerts will be issued when data anomalies or case clusters are detected. Validation of alert system will focus on optimizing the sensitivity of the system to detect health concerns while minimizing “false alarms.”

Outcome	Completion Date
a. Forecast expected number of animals admitted for rehabilitation based on seasonal patterns and long-term trends	30 JUN 2019
b. Develop analytics to detect anomalies in the data that may serve as an early warning for an emerging health concern	30 DEC 2019
c. Identify spatial/temporal clusters of cases that may indicate a health event is occurring	30 DEC 2019

**Activity 3:** *Investigate environmental and land-use drivers of wildlife health* **Budget: \$55,000**

Using Geographic Information Systems (GIS) and ecological modeling, we will **a)** analyze relationships between spatial patterns in health data and landscape factors, such as roads, land cover, land use, etc. We will also **b)** assess relationships between temporal patterns in health data and changes in climatic and weather conditions. Results from this activity will help describe drivers of health trends, and identify high-risk areas where wildlife populations may be experiencing poor health or environmental threats to their health.

Outcome	Completion Date
a. Analyze relationships between wildlife health data and landscape factors	30 JUN 2020
b. Assess relationships between temporal patterns in health data and changes in climatic and weather conditions	30 JUN 2020

**III. PROJECT STRATEGY**

**A. Project Team/Partners** (\*receiving funding)

**Project manager:** *Dr. Kimberly VanderWaal\**: College of Vet. Medicine, University of Minnesota (UMN): Wildlife disease ecology, Quantitative analysis; **Advisory team:** *Dr. Julia Ponder, Dr. Michelle Willette*: TRC / UMN: Avian and conservation medicine; *Philip Jenni, Dr. Renee Schott*: WRC: Wildlife medicine. **Dr. Andres Perez**: UMN: Epidemiological methods. *Dr. Petra Muellner*: Epi-Interactive: Advises on surveillance and information systems.

**B. Project Impact and Long-Term Strategy**

Monitoring of wildlife health in free-ranging animals is costly and time-consuming. In contrast, rehabilitation data is already available and will continue to be routinely collected, though it is not currently used to systematically monitor health. Our online platform will ensure long-term sustainability of this initiative, given that data aggregation, analysis, and alerts will be automated through analytical pipelines within the system. In the future, the system can easily be scaled to surrounding states to gain additional insights about potential health threats to Minnesota wildlife. The system will also be widely accessible to health and natural resources agencies, including the MN DNR and Board of Animal Health, for management of natural resources and disease surveillance. Our monitoring and alert system will also assist wildlife managers and decision makers in targeting follow-up animal health investigations and interventions, leading to more strategic use of resources for sampling wildlife populations and ultimately improve our ability to monitor and manage the health of Minnesota wildlife.

**C. Timeline Requirements:** This study will take place over two years. July 2018 – June 2020.

## 2018 Detailed Project Budget

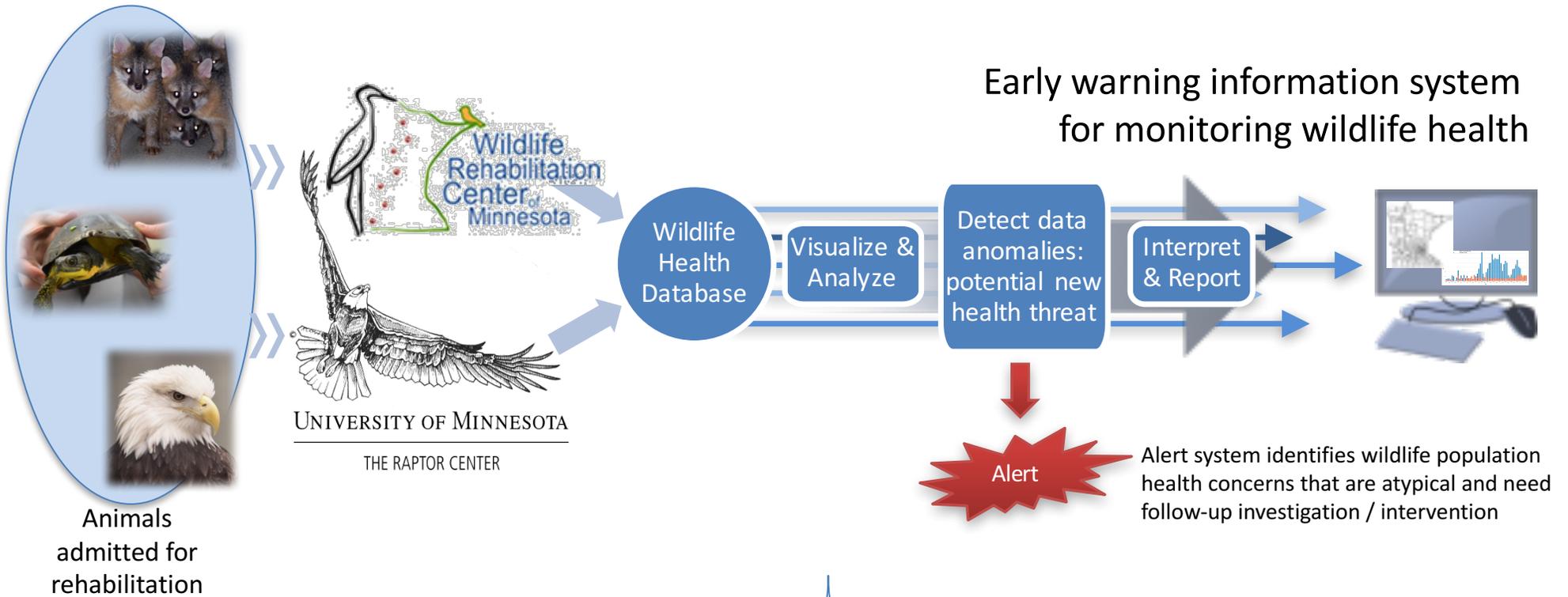
**Project Title:** An early warning system for wildlife health threats: using wildlife rehabilitation data to monitor wildlife

### IV. TOTAL ENRTF REQUEST BUDGET 2 years

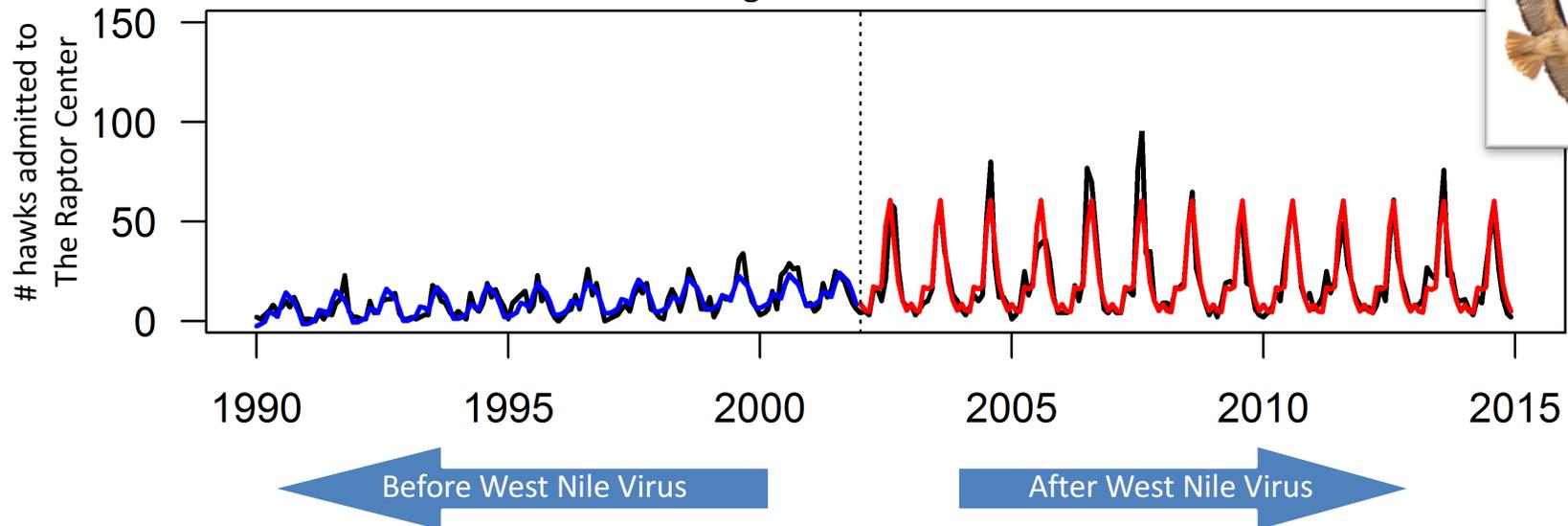
<u>BUDGET ITEM</u>	<u>AMOUNT</u>
<b>Personnel: Dr. Kim VanderWaal</b> , Project manager - responsible for overall grant management and deliverables, sponsor reporting, scientific oversight, and quantitative data analysis. 25% effort Y1 and Y2 (75% salary, 25% fringe)	\$ 46,074
<b>Personnel: Post-doctoral researcher</b> - responsible for data collection, data clean-up, scientific analysis, and reporting. 100% effort Y1 and Y2 (82% salary, 18% fringe)	\$ 116,425
<b>Personnel: Technician (TBD)</b> - responsible for accessing TRC data and information management. 200hours each Y1 and Y2 (78% salary, 21% fringe)	\$ 8,327
<b>Professional/Technical/Service Contracts:</b> The Wildlife Rehabilitation Center will be paid to contribute to the project, provide data and data clean-up, and review data and analysis (2000 hours@120/hr).	\$ 24,000
<b>Professional/Technical/Service Contracts:</b> A consultant (Company: Epi-Interactive) will be paid to develop the on-line platform and tools required for the surveillance and alert systems	\$ 83,000
<b>Equipment/Tools/Supplies:</b> Office supplies and incidentals	\$ 474
<b>Travel:</b> Travel within Minnesota to meet with wildlife health professionals	\$ 1,700
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 280,000</b>

### V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
<b>Other Non-State \$ To Be Applied To Project During Project Period:</b>	N/A	
<b>Other State \$ To Be Applied To Project During Project Period:</b>	N/A	
<b>In-kind Services To Be Applied To Project During Project Period:</b> 1% effort for each of three University faculty:Dr. Julia Ponder (avian and conservation medicine expertise); Dr. Michelle Willette (wildlife medicine expertise); and Dr. Andres Perez (expertise in quantitative epidemiology methods)	\$ 10,338	Secured
<b>Past and Current ENRTF Appropriation:</b> In 2008, a 2 year grant received by the University of Minnesota funded the development of the standardized terminology for clinical wildlife medicine that makes this project possible	\$ 100,000	Completed grant
<b>Other Funding History:</b>	N/A	



Case study: Detecting the arrival of West Nile Virus in MN using rehabilitation data



Project Manager Qualifications and Organizational Description  
**Dr. Kimberly VanderWaal, Project Manager / Principal Investigator.**

### **I. Qualifications**

Dr. VanderWaal is a research associate in the College of Veterinary Medicine and a member of the graduate faculty of the Veterinary Population Medicine. Dr. VanderWaal is an expert in the ecology of diseases in wildlife populations and in the application of “big data” analytical tools to disease surveillance in animal populations. She has worked on diseases of concern to Minnesota animal populations since 2013. She has extensive project management experience, and has working internationally and locally with organizations involved in management of natural resources and wildlife, including NGOs state and tribal agencies. She has managed over \$300,000 of funding, and written over 20 scientific papers on epidemiology of animal diseases.

#### **Education**

2013 Ph.D., Disease Ecology. University of California – Davis.

2007 B.S. *summa cum laud.* Ecology, Evolution, and Behavior. University of Minnesota – Twin Cities

#### **Selected Publications (of 25 peer-reviewed scientific publications)**

1. Alba, A., A. Perez, P. Puig, A. Wunschmann, J. Ponder, K. VanderWaal, J. Alvarez, M. Willette. *In review*. Syndromic surveillance for West Nile Virus using raptors in rehabilitation.
2. VanderWaal, K., EA. Enns, C. Picasso, J. Alvarez, A. Perez, F. Fernandez, A. Gil, M. Craft, S. Wells. *In review*. Optimal surveillance strategies for bovine tuberculosis in a low-prevalence country. *Scientific Reports*.
3. Escobar, L.E.\*, VanderWaal, K.\*, Moen, R., Craft, M.E., Harris, T. *In review*. Parasite transmission risk from white-tailed deer to a declining moose population. *PLoS One*.
4. VanderWaal, K., R. Morrison, C. Neuhauser, C. Vilalta, A. Perez. *In press*. Translating big data into smart data for veterinary epidemiology. *Frontiers in Veterinary Science*
5. VanderWaal, K.L., S. K. Windels, T. Vannatta, R. Moen. Landscape influence on spatial patterns of meningeal worm and liver fluke in white-tailed deer. *Parasitology* 142: 706-718.
6. VanderWaal, K.L., E.R. Atwill, L.A. Isbell, B. McCowan. Linking social and pathogen transmission networks using microbial genetics in giraffe (*Giraffa camelopardalis*). *Journal of Animal Ecology* 83: 406-414.

### **II. Responsibilities**

Dr. VanderWaal will coordinate and manage the overall project, including coordination of a team that includes Dr. Julia Ponder (Director of The Raptor Center, TRC), Dr. Michelle Willette (Veterinarian and professor, TRC), and Dr. Renee Schott (Veterinarian, Wildlife Rehabilitation Center). She will be responsible for sponsor reporting, scientific oversight of all analysis and information system development, mentoring of the researcher that will be hired to assist with analysis, and timely and successful completion of proposed outputs and outcomes.

### **III. Organizational Description**

**The Raptor Center** (TRC) is a University research and outreach center focused on health issues found at the intersection of raptors and humans. In addition to providing medical care of over 700 injured and ill raptors each year, TRC was a leader in creating standardized veterinary terminology and codes to be used for data management across wildlife rehabilitation facilities. This effort, known as the Clinical Wildlife Health Initiative, was funded by a previous LCCMR grant and lays the groundwork for using rehabilitation data for surveillance.