

**Environment and Natural Resources Trust Fund
2016 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 008-A

Do Neonicotinoids Pose a Risk to Minnesotas Birds?

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: \$ 349,767

Proposed Project Time Period for the Funding Requested: 2 years, July 2016 to June 2018

Summary:

We propose to evaluate the potential risk to birds of neonicotinoid exposure using sharp-tailed grouse. Neonicotinoids are applied to agricultural seeds and are the most widely used pesticide worldwide.

Name: Julia Ponder

Sponsoring Organization: U of MN

Address: 1920 Fitch Ave
St. Paul MN 55108

Telephone Number: (612) 624-3431

Email ponde003@umn.edu

Web Address theraptorcenter.org

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Wild birds may consume neonicotinoid treated seeds spilled during seed loading or in recently planted crop fields.

_____ 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)

2016 Main Proposal

Project Title: Do neonicotinoids pose a risk to Minnesota's birds?

PROJECT TITLE: Do neonicotinoids pose a risk to Minnesota's birds?

I. PROJECT STATEMENT

We propose to examine sub-lethal exposure of neonicotinoid pesticides in birds, using sharp-tailed grouse as a model. Neonicotinoid pesticides, the most widely used pesticides worldwide, are applied as a seed treatment to most corn, soybean, sunflower, and wheat seeds. These crops comprise the majority of Minnesota's row crops. While their unintended impact on insect pollinators has caused the greatest amount of concern, recent studies have shown potential risk to birds. Risk assessments (American Bird Conservancy) have determined that the most likely route of exposure to large doses of neonicotinoids for birds is ingestion of treated seeds, although numerous other mechanisms exist (e.g., crops, soil, water, trophic transfer). Ingestion of a small number of treated seeds has been shown to be lethal to small birds. While larger birds are less likely to ingest a lethal dose through seed consumption, they may still be at risk for sub-lethal health impacts and may be exposed to multiple types of neonicotinoids. Sub-lethal effects found in the lab include behavioral abnormalities, declines in reproductive success, and immune suppression, but available studies have not adequately simulated field exposures nor provided tools to measure risk to wild birds.

Sharp-tailed grouse are a good model to understand risk to birds, as they utilize areas with high and low levels of agriculture in Minnesota; consume corn, wheat, and other crop types in which neonicotinoid-treated seeds would be available through spillage or after planting; and, are closely related to domestic chickens which are amenable to lab studies. Sharp-tailed grouse are also large making them less likely to consume a lethal dose yet have detectable sub-lethal effects. Based on current knowledge, it is calculated that a grouse would need to eat 14 seeds for a sub-lethal dose and approximately 80 corn seeds for a lethal dose, the latter being unlikely in one bout. Lastly, sharp-tailed grouse display at leks, an assembly area where multiple animals congregate for breeding displays and courtship. These leks are fairly stable in location among years, facilitating non-lethal collection of feces and blood from a large geographical area within and outside of agricultural areas, and allowing comparisons of naturally occurring low and high exposure groups.

The overall goal of this project is to assess whether birds are at risk from exposure to neonicotinoid-treated seeds in agriculture landscapes using sharp-tailed grouse as a model species. Our specific objectives are to:

- Assess exposure in wild grouse
 - Identify birds consuming neonicotinoid-treated seeds, quantify consumption per foraging bout, and measure neonicotinoid concentrations of seeds
 - Quantify grouse neonicotinoid residues in tissues
 - Quantify the rate of seed spillage along roads and edges of agricultural fields (transect study).
- Assess sub-lethal effects
 - Assess impacts of sub-lethal exposure to neonicotinoid mixtures on the immune system in the lab using chickens as a surrogate
- Link exposure and effects
 - Quantitatively link neonicotinoid exposure and tissue residue concentrations with sub-lethal effects in the lab to interpret tissue residue concentrations in wild birds.

This study will provide preliminary data to evaluate the risk to Minnesota's birds from neonicotinoids by documenting access to neonicotinoid-treated seeds, comparing tissue residue in wild birds from agricultural areas and non-agricultural areas, establishing non-lethal methods of assessing exposure, demonstrating sub-lethal impacts of exposure, and assessing whether exposure to multiple neonicotinoids worsens their impact.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: *Development of field tools to measure neonicotinoid exposed wild birds*

Budget: \$143,020



Environment and Natural Resources Trust Fund (ENRTF)

2016 Main Proposal

Project Title: Do neonicotinoids pose a risk to Minnesota’s birds?

Using laboratory studies to inform field collection protocols, we will determine how long neonicotinoid residues are detectable post-exposure to imidacloprid or clothianidin (the most common neonicotinoid seed treatments in Minnesota) in a model species (chickens). We will expose chickens to sub-lethal pesticide doses and collect tissues over 21 days. Results will be linked with Activity 2 to inform interpretation of field samples.

Outcome	Completion Date
1. Lab exposure study and sample collection	30 JUN 2017
2. Laboratory analysis of samples for neonicotinoid concentrations	30 NOV 2017
3. Validate novel sensitive immune assay	30 NOV 2017

Activity 2: Measure exposure to neonicotinoids in wild birds

Budget: \$ 22,022

Using trail cameras, we will document bird species that forage on spilled or recently planted seeds. Field observations will be used to quantify rate of seed spillage in agricultural areas. Seeds and tissues samples (feces, blood) will be collected from grouse at leks and analyzed for neonicotinoid residues. Additional samples will be collected from 40-60 hunter-harvested grouse in the fall for analysis.

Outcome	Completion Date
1. Camera study to document which species of birds consume spilled seeds	30 JUN 2017
2. Strip transect study to estimate seed spillage rates in Minnesota	30 JUN 2017
3. Analysis of grouse tissues for neonicotinoid residues	30 MAR 2018

Activity 3: Assessing sub-lethal impacts of exposure to neonicotinoid mixtures

Budget: \$184,725

We will test for effects of sub-lethal neonicotinoid exposures on the immune system, and link this information to both exposure and tissue residue concentrations in chickens and grouse. Chickens will be exposed to single and combined neonicotinoids (imidacloprid and clothianidin), and immunity will be measured using standard and novel tools that might be used in future field studies.

Outcome	Completion Date
1. Measurement of immune toxicity in exposed chickens	31 JAN 2018
2. Analysis of chicken tissue residues for neonicotinoids	31 JAN 2018
3. Complete data analysis of relationship between exposure and immune effects	30 JUN 2018

III. PROJECT STRATEGY

A. Project Team/Partners

This project is a partnership between the following individuals and institutions.

Dr. Julia Ponder, University of Minnesota, Avian and Conservation Medicine – PI, oversight of lab studies

Dr. Charlotte Roy, MN DNR, Research Scientist – co-PI, oversight of field studies

Dr. Mark Jankowski, MPCA, Research Ecotoxicologist – co-PI, lab study development and analytics

Dr. Da Chen, SIUC, Assistant Professor of Environmental Chemistry– co-PI, laboratory analysis of samples

B. Project Impact and Long-Term Strategy

This study will provide information about the safety of neonicotinoid seed treatments to birds, using sharp-tailed grouse as a model. It will provide information to assess the risk of consumption of seeds and evaluate whether other bird species are potentially at risk for exposure. This study would be the first to holistically examine exposure, to mixtures of these pesticides in wild birds. We know insects are at risk from neonicotinoids, but the information gained will be important for more informed management of risk to vertebrates.

C. Timeline Requirements

This study will take place over two years (July 2016 – June 2018). Sample collection from grouse leks will occur in April/May (2017) and samples from hunter-harvested grouse during the 2016 fall hunting season. Samples will be analyzed in the three months after each collection period and results used to inform future collections. The lab studies will be performed concurrently with field sample collection in a way that informs field collection efforts.

2016 Detailed Project Budget

Project Title: Does neonicotinoid exposure put Minnesota's birds at risk?

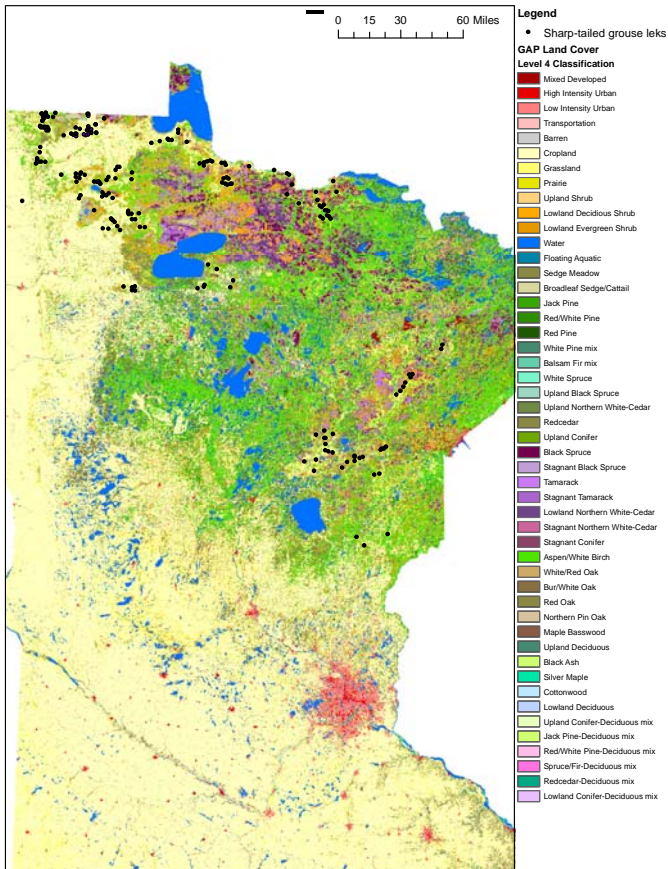
IV. TOTAL ENRTF REQUEST BUDGET 2 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel (UMN): Postdoctoral scholar (UMN) for laboratory studies: \$22/hour salary plus 22.4% fringe for 2-year duration of grant	\$ 112,020
Personnel (UMN): UMN School of Veterinary Medicine summer interns (2 interns @ \$2200 each = \$4,400) for lab studies; Laboratory technicians (\$22/hour for 540 hours)	\$ 16,280
Professional/Technical/Service Contracts (MN DNR): Field work to assess avian exposure and quantify seed spillage in western Minnesota. Includes funding for 5 temporary field staff (\$26/hr for salary and health insurance) for the duration of the project, travel expenses for 60 night (lodging @\$100/night and \$36/day per diem, and equipment.	\$ 87,010
Professional/Technical/Service Contracts (SIUC): Neonicotinoid residue analysis - 730 samples @ \$143 per sample. 576 lab collected tissue samples, 100 field collected tissue samples from live birds and 54 from hunter-harvested birds (No Minnesota lab available for this analysis)	\$ 104,295
Equipment/Tools/Supplies (UMN): Laboratory studies - acquisition and housing of research subjects (chickens)	\$ 10,312
Equipment/Tools/Supplies (UMN): Supplies for six different immune assays for laboratory studies. Approximately \$200 per assay.	\$ 3,050
Additional Budget Items: RNA sequencing for immune measurements, performed by U of M Genome Center, 56 samples, \$300 per sample	\$ 16,800
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 349,767

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ To Be Applied To Project During Project Period: <i>Not applicable</i>	N/A	
Other State \$ To Be Applied To Project During Project Period: <i>52% indirect rate at UM.</i>	\$ 182,552	<i>Pending</i>
In-kind Services To Be Applied To Project During Project Period: For each of the four investigators, each institution will provide 5% T/E + fringe for the two year duration of the grant. Also includes in-kind chemical analysis of seeds collected near spill sites.	\$ 56,060	<i>Secured</i>
Funding History: <i>DNR pilot funding for camera work and small numbers of grouse samples for residue analysis to inform LCCMR study</i>	\$ 96,500	<i>Pending</i>
Remaining \$ From Current ENRTF Appropriation: <i>Not applicable.</i>	N/A	

Do neonicotinoids pose a threat to Minnesota's birds?



Sharp-tailed grouse lek locations and landcover data illustrating range overlap with croplands in the northwest and areas with less agriculture in the east-central part of their range

Wild birds may consume neonicotinoid treated seeds spilled during seed loading into farm machinery or available in recently planted crop fields at a rate sufficient to cause health impacts.



A treated seed spill (photo by G. Hoch)



Neonicotinoid treated seeds
Photo from Scientificbeekeeping.com

Project Manager Qualifications and Organizational Description

Dr. Julia Ponder, Principal Investigator. Dr. Ponder is the Executive Director for The Raptor Center and College of Veterinary Medicine faculty member. Dr. Ponder is a veterinary expert in avian health working in a clinical and research environment devoted to birds. She has extensive project management experience, as well as international experience working with non-profits and governmental agencies. She has managed projects varying from \$10,000 to \$2 million, addressing issues as diverse as wildlife health surveillance, community partnerships and international field research.

The Raptor Center (TRC) is a University research and outreach center focused on health issues found at the intersection of raptors and humans. TRC provides medical care of over 700 injured and ill raptors each year, trains veterinarians and veterinary students from around the world in conservation medicine and has extensive experience in outreach and environmental education, averaging over 1,000 programs reaching more than 200,000 people throughout Minnesota, Wisconsin, and Iowa annually. For over 30 years, staff at TRC has studied contaminants in raptors. In addition, the faculty of The Raptor Center have appointments in the **College of Veterinary Medicine, University of Minnesota**, a research university.