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

Project Title: **ENRTF ID: 013-A**

Insecticide Exposure Risk of Wildlife on Public Grasslands

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: $ 263,299

Proposed Project Time Period for the Funding Requested: 3 years, July 2016 to June 2019

Summary:

We will investigate exposure risk of grassland wildlife to soybean aphid insecticides with known toxicity to birds and beneficial insects. Results will guide management of grasslands in Minnesota's farmland regions.

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Sponsoring Organization: MN DNR

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Location

Region: Central, SW, SE

County Name: Big Stone, Blue Earth, Brown, Chippewa, Cottonwood, Dodge, Douglas, Faribault, Freeborn, Grant, Jackson, Kandiyohi, Lac qui Parle, Le Sueur, Lincoln, Lyon, Martin, McLeod, Meeker, Mower, Murray, Nicollet, Nobles, Otter Tail, Pipestone, Pope, Redwood, Renville, Rice, Rock, Sibley, Stearns, Steele, Stevens, Swift, Traverse, Waseca, Watonman, Wilkin, Yellow Medicine

City / Township:

Alternate Text for Visual:

The figure shows an aerial photo of a small section of agricultural land with a soybean field to the north and a Wildlife Management Area to the south. Three transects that are perpendicular to the soybean field edge and extend at least 40 meters into the grassland are shown. One smaller inset photo shows the aerial application of insecticides via a plane flying low over a soybean field. A second inset photo shows an aphid infestation on a soybean plant.

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

PROJECT TITLE: Insecticide exposure risk of wildlife on public grasslands

I. PROJECT STATEMENT

Grassland habitat loss due to agricultural intensification has been implicated as a primary reason for the decline of many grassland-dependent wildlife species, but concerns are increasing about the impacts of pesticides on birds and other wildlife in agricultural landscapes. Indeed, some evidence exists that acute toxicity to pesticides may be more important than agricultural intensity in explaining grassland bird declines in the United States. Although neonicotinoids (a systemic insecticide routinely used on corn and soybeans) are currently under scrutiny for their effects on birds and pollinators, other insecticides are commonly used in Minnesota's agricultural landscape that may also have negative effects on non-target organisms. Minnesota Department of Natural Resource (MNDNR) wildlife managers and members of the public have reported concerns about two foliar-application insecticides in particular, chlorpyrifos and lambda-cyhalothrin. These insecticides are used on a variety of crops but their use has been especially important for controlling soybean aphid outbreaks in Minnesota's farmland zone. A common public perception is that indiscriminate aerial spraying without first scouting for aphid outbreaks has become the norm and many people have reported that they observe fewer birds and insects after aphid spraying has occurred. Many grasslands in Minnesota are highly fragmented and surrounded by row crops, including record-high soybean acres (>7 million acres planted) in recent years. Thus, the potential is high for grassland wildlife to be exposed to these common soybean aphid insecticides.

The public's concerns about the impact of these chemicals on wildlife may be well warranted. Lab studies have shown that chlorpyrifos and lambda-cyhalothrin are highly toxic to non-target organisms, including several grassland bird and pollinator species. Further, the Minnesota Department of Agriculture (MDA) released guidelines in July 2014 on voluntary best management practices (BMPs) for the use of pesticides in general and chlorpyrifos in particular due to water quality concerns. However, very little is known about the actual exposure risk of upland wildlife to these insecticides in Minnesota's farmland zone under typical application conditions. Distance of travel for spray drift is dependent on field conditions (e.g., humidity, wind speed) at the time of application and drift distances reported in the scientific literature vary widely (e.g., 16-246 ft). Renewed interest in buffer practices at least 50 ft wide has been a key outcome of the recent Minnesota Pheasant Summit, but buffer practices may be less effective for wildlife conservation if grassland birds, their insect prey, and beneficial insects such as pollinators using these buffers are exposed to spray drift from adjacent field operations. Further, undisturbed grassland habitat acres in the form of Conservation Reserve Program (CRP) fields are declining. The Minnesota Prairie Conservation Plan aims to partially offset these habitat losses by establishing grassland/wetland habitat complexes within the agricultural matrix. However, we need better information on the environmentally-relevant exposure risk of wildlife under typical field application conditions to help land managers and private landowners alike better design grassland habitat for Minnesota's wildlife.

Goals of the project:

We will assess the environmentally-relevant exposure risk of grassland wildlife to two common soybean aphid insecticides, chlorpyrifos and lambda-cyhalothrin, in Minnesota's farmland region. In particular, we will:

1) Quantify the concentration of the two insecticides along a gradient from soybean field edge to grassland interior to assess the potential for grassland-nesting birds and their young to be exposed to the chemicals **directly** via contact with spray drift and **indirectly** through insect prey items exposed to the insecticides.

2) Quantify and compare the relative abundance and species richness of invertebrate prey items along a gradient from soybean field edge to grassland interior prior to and post-application to assess the **indirect** impact of the insecticides on food availability for nesting grassland birds and their young.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Assess the potential for grassland wildlife to be exposed directly and indirectly to spray drift from two common soybean aphid insecticides, chlorpyrifos and lambda-cyhalothrin. **Budget: $263,299**

Wildlife Management Areas (WMAs) in south-central, southwestern, and west-central Minnesota will be chosen as study sites in close coordination with DNR wildlife managers, private landowners, operators, and partner agency personnel. Within each study site, we will conduct sampling at stations placed along transects extending from soybean field edge to grassland interior (Fig. 1). Our experimental field design will incorporate sampling to look at both direct and indirect exposure risk of birds and insects at multiple distances (≤5 m to ≥40 m) from soybean field edge to grassland interior immediately after spraying and at additional time periods post-application.

Outcome	Completion Date
1. Assess risk of direct exposure: Quantify the concentration of chlorpyrifos and lambda-cyhalothrin through passive absorption sampling at 2 vegetation canopy heights and at multiple distances from soybean field edge to grassland interior within 1 day post-application.	*6/30/2019*
2. Assess risk of indirect exposure: Quantify the concentration of chlorpyrifos and lambda-cyhalothrin in invertebrates at multiple distances from soybean field edge to grassland interior and at multiple time periods post-application.	*6/30/2019*
3. Assess additional indirect effects on bird food resources: Quantify and compare the relative abundance and species richness of invertebrate prey items at multiple distances from soybean field edge to grassland interior pre- vs. post-application.	*6/30/2019*

III. PROJECT STRATEGY

A. Project Team/Partners

Dr. Nicole Davros, MNDNR, project manager
Dr. Theresa Kissane Johnston, Post-doctoral Fellow, U.S. Environmental Protection Agency, co-investigator

Additional project partners [e.g., Minnesota Department of Agriculture (MDA), U.S. Department of Agriculture/Natural Resource Conservation Service (USDA/NRCS)] will be included as we begin implementing this research project.

B. Project Impact and Long-Term Strategy

Our research will address mounting public concerns about the impacts of pesticides on wildlife in agricultural regions by quantifying the environmentally-relevant exposure risk of grassland wildlife to two insecticides, chlorpyrifos and lambda-cyhalothrin, under typical field application conditions. Our research will allow us to make recommendations to land managers and private landowners alike on how to better design grassland habitats surrounded by an agricultural matrix to reduce the impacts of spray drift on upland wildlife, including birds and beneficial insects. We will also work with partners to help inform the public about additional best management practices (BMPs; e.g., biocontrol, cover crops) that can be used to control crop pests.

C. Timeline Requirements

Our study will require 3 years from planning to the reporting of results. Project planning, including coordination with partner agencies and private landowners, will occur during FY17. Field sampling will occur in FY17-FY18 over a 3-month period during the summer growing season. Sample analysis in the lab will require 6-9 months. Data analysis and reporting will be completed within 12-15 months and conclude by June 2019.

2016 Detailed Project Budget

Project Title: Insecticide exposure risk of wildlife on public grasslands

IV. TOTAL ENRTF REQUEST BUDGET - 2 years

BUDGET ITEM	AMOUNT
Personnel:	N/A
Professional/Technical/Service Contracts:	
Graduate student for 2 years (50% research assistantship): leads coordination of field and lab work, data analysis, reporting of results	$ 80,000
Lab analysis of samples using thermal desporption gas chromatography-mass spectrometry (GC-MS) method; 300-445 samples @ $350-$515/sample; lab to be determined	$ 156,000
Equipment/Tools/Supplies:	
Silicone sampling sphere equipment, including sampling spheres ($1,000) and PVC pipe ($1,500)	$ 2,500
Insect sampling equipment: sweepnets ($200), pit-fall traps ($1,500), and collection jars ($4,000)	$ 5,700
GPS units (2 @ $400/unit)	$ 800
First aid and safety equipment	$ 500
Travel:	
Travel to study sites in south-central, southwest, and west central Minnesota by graduate student and MNDNR research staff (fleet @ $0.55/mi, estimated 20,000 mi); overnight travel with hotel rooms ($2,000)	$ 13,000
Additional Budget Items:	
Direct and Necessary Costs - These expenses include Department Support Services [HR ($0), IT Support ($0), Safety ($0), Financial Support ($2,499), Communications Support ($1,236), Planning Support ($829), and Procurement support ($235)] necessary to accomplishing funded programs/projects.	$ 4,799
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 263,299

V. OTHER FUNDS

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:		
MNDNR Farmland Wildlife Populations & Research Group: Nicole Davros - project management, assists with coordination of field & lab work, data analysis, reporting of results, outreach @ 20% effort for 24 months	$ 22,000	Secured
Funding History:	N/A	
Remaining $ From Current ENRTF Appropriation:	N/A	

Aerial application of insecticides. Photo by Marlin E. Rice.

Aphid infestation on a soybean plant. Photo courtesy of University of Minnesota Extension.

Figure 1. Example field sampling design that will be used to assess the exposure risk of grassland wildlife to chlorpyrifos and lambda-cyhalothrin, two common soybean aphid insecticides used in Minnesota's farmland region. Sampling will be conducted on state-owned Wildlife Management Areas (WMAs; outlined in black) adjacent to privately-owned soybean fields sprayed for aphid infestations. White lines indicate sampling transects established perpendicular to soybean field edges and extending ≥40 m into WMAs.

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I. PROJECT MANAGER QUALIFICATIONS: Nicole M. Davros, Ph.D.

Dr. Nicole Davros is the upland game project leader for the Minnesota Department of Natural Resources' Farmland Wildlife Populations & Research Group in Madelia, MN. Dr. Davros serves as an expert on upland game birds and avian ecology in farmland landscapes. She is responsible for designing, executing, and reporting independent and original research on farmland birds and their habitats, and for providing new knowledge that can be applied to the management of upland game birds, grassland birds, and their habitats.

Dr. Davros holds a Bachelor of Science degree in Ecology, Ethology, and Evolution from the University of Illinois at Urbana-Champaign, a Master of Science degree in Animal Ecology from the Department of Natural Resources Ecology and Management at Iowa State University in Ames, IA, and a Ph.D. in Ecology, Evolution, and Conservation Biology from the University of Illinois at Urbana-Champaign. Her previous research focused on better understanding the local- and landscape-level factors that influence grassland bird use of filter strips enrolled in Minnesota's Conservation Reserve Enhancement Program (CREP) and the effects of conspecific density on songbird behavior, reproduction, and stress physiology. Prior to beginning her career with MNDNR in 2012, she spent 15 years working as a seasonal avian ecologist and graduate research assistant for various research institutions. Dr. Davros has authored or co-authored several technical papers, including 2 peer-reviewed publications in the primary scientific literature.

As project manager, Dr. Davros will coordinate the planning, implementation, and reporting of results of the proposed study. She will direct staff, administer budgets and contracting, and act as a liason among the project team, partners (including private landowner cooperators), and LCCMR. Dr. Davros is proficient in managing projects, and these responsibilities are primary aspects of her current position.

II. ORGANIZATION DESCRIPTION: MNDNR, Section of Wildlife, Farmland Wildlife Populations & Research Group

The mission of MNDNR is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.

The MNDNR Section of Wildlife carries out research and management programs affecting all state wildlife species. The section acquires, develops, and manages wildlife management areas, most of which are open to public hunting during established seasons. The section also recommends hunting and other wildlife-related regulations, carries out census, survey, and research projects, and promotes wildlife habitat protection and development on public and private lands.

Within the Section of Wildlife, the Farmland Wildlife Populations & Research Group is responsible for providing information needed to manage major wildlife species in Minnesota's farmland zone which comprises all or parts of 74 counties and totals almost 49,000 square miles. To accomplish this responsibility, the group: (1) coordinates and interprets population surveys; (2) conducts research which provides wildlife management information; (3) develops techniques needed to monitor and manipulate wildlife populations, manage critical wildlife habitats, and reduce or prevent wildlife damage; (4) evaluate management practices and programs; and (5) provides technical assistance and information to other DNR staff and the public.