Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2016 Work Plan

Date of Report: May 29, 2016

Date of Next Status Update Report: January 1, 2017

Date of Work Plan Approval: June 7, 2016

Project Completion Date: June 30, 2019

Does this submission include an amendment request? No

PROJECT TITLE: Evaluating Insecticide Exposure Risk for Grassland Wildlife on Public Lands

Project Manager: Nicole M. Davros

Organization: Minnesota Department of Natural Resources (MN DNR), Division of Fish and Wildlife, Section of Wildlife

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Location:

Regions - Study sites will be located across the Southwest and South Central regions of Minnesota (Fig. 1). However, the results from our study will have implications for the Southeast, West Central, Central, East Central, and Northwest regions where these insecticides are commonly used in agricultural applications.

Counties - Specific sites are yet to be determined but may be located in Blue Earth, Brown, Cottonwood, Faribault, Freeborn, Jackson, Le Sueur, Lincoln, Lyon, Martin, Murray, Nicollet, Nobles, Pipestone, Redwood, Rice, Rock, Steele, Waseca, or Watonwan Counties.

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$250,000**
	Amount Spent:	**$0**
	Balance:	**$250,000**

Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 03n

Appropriation Language:

$250,000 the second year is from the trust fund to the commissioner of natural resources to evaluate exposure risks of grassland wildlife to soybean aphid insecticides, to guide grassland management in farmland regions of Minnesota for the protection of birds, beneficial insects, and other grassland wildlife. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Insecticide exposure risk of wildlife on public grasslands

II. 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 farmland regions that may also have negative effects on non-target organisms. Minnesota Department of Natural Resource (MN DNR) wildlife managers and members of the public have reported concerns about foliar-application insecticides in particular, especially chlorpyrifos. 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 regions. 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, the two most common insecticides used to treat soybean aphids in Minnesota, 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 agricultural landscape under typical application conditions. Distance of travel for spray drift is dependent on weather conditions (e.g., humidity, wind speed) at the time of application and the drift distances reported vary widely (e.g., 16 ft to 1 mi). Renewed interest in riparian buffers to help protect water quality and provide wildlife habitat was a key outcome of the 2014 Minnesota Pheasant Summit. In 2015, a new buffer law was established that will require perennial vegetation buffers up to 50 ft wide along public waters and ditches, 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 habitats set aside for Minnesota's wildlife.

The goal of our research project is to assess the environmentally-relevant exposure risk of grassland wildlife to common soybean aphid insecticides, especially chlorpyrifos, in Minnesota's farmland region. In particular, we will: 1) quantify the concentration of insecticides along a gradient from soybean field edge to grassland interior to assess the potential for grassland wildlife (e.g., nesting birds and their young, beneficial insects) to be exposed to chemicals directly via contact with spray drift and indirectly through insect prey items exposed to the insecticides, and 2) quantify and compare the relative abundance, richness, diversity, and biomass 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 grassland nesting birds and other wildlife.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of January 1, 2017:

Project Status as of June 30, 2017:

Project Status as of January 1, 2018:

Project Status as of June 30, 2018:

Project Status as of January 1, 2019:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Data Gathering and Analysis – *Assess the potential for grassland wildlife to be exposed directly and indirectly to spray drift from common soybean aphid insecticides, especially chlorpyrifos.*

Description: We will choose Wildlife Management Areas (WMAs) and other MN DNR properties adjacent to soybean fields in Southwest and South Central Minnesota as study sites in consultation with DNR staff, private landowners and operators, and partner agency personnel. Within each study site, we will conduct sampling at stations placed at multiple distances (<5 m to ≥100 m) along each of three transects extending from a treated soybean field edge to an adjacent grassland interior (Fig. 2). Our sampling will be conducted to assess both direct and indirect exposure risk of grassland wildlife, especially birds and insects, immediately after spraying and at additional time periods post-application. Invertebrates in grasslands adjacent to untreated soybean fields will also be sampled as a control.

a) *Direct exposure risk* will be assessed by placing sampling devices at mid-canopy and ground level at each station prior to insecticide spraying. We will collect sampling devices ≤3 days post-spraying for chemical analysis. The sampling devices will be made of a silicone material that will passively absorb organic chemicals, representing the potential for a grassland-dwelling animal to come into direct contact with spray drift during insecticide application.

b) *Indirect exposure risk* will be assessed by collecting invertebrates via sweep-net and pitfall trap sampling at each station prior to insecticide spraying and at ≤3 days, 10 days, and 20 days post-spraying. We will combine sweep-net and pitfall trap samples into one sample per station for chemical analysis. This sampling approach will assess the potential for grassland birds, predatory insects, and other insectivores to be exposed to insecticides indirectly through consumption of insects that were directly exposed to spray drift.

c) *Indirect effects of exposure* will be assessed by collecting invertebrates and sorting them to estimate their relative abundance, richness, diversity, and biomass prior to insecticide spraying and ≤3 days, 10 days, and 20 days post-spraying. We will focus our sampling on two insect orders [Orthoptera (including grasshoppers, crickets, katydids) and Coleoptera (beetles)] due to their importance in grassland nesting bird diets. This sampling approach will help assess potential reductions in prey items due to insecticide spray drift.

Summary Budget Information for Activity 1:

ENRTF Budget: $250,000
Amount Spent: $ 0
Balance: $250,000

Outcome	Completion Date
1. ***Assess risk of direct exposure to insecticide spray drift:*** Quantify the concentration of soybean aphid insecticides through passive absorption sampling within 3 days post-application at multiple distances from soybean field edge to grassland interior.	6/30/2018
2. ***Assess risk of indirect exposure to insecticide spray drift:*** Quantify the concentration of soybean aphid insecticides in invertebrates at multiple distances and multiple time periods post-application; compare with control fields.	1/1/2019
3. ***Assess indirect effects of insecticide exposure on prey food resources:*** Quantify and compare the relative abundance, richness, diversity, and biomass of insect prey items important to grassland nesting birds at multiple distances and multiple time periods post-application; compare with control fields.	1/1/2019
4. Report findings and make recommendations	6/30/2019

Activity Status as of January 1, 2017:

Activity Status as of June 30, 2017:

Activity Status as of January 1, 2018:

Activity Status as of June 30, 2018:

Activity Status as of January 1, 2019:

Final Report Summary:

V. DISSEMINATION:

Description: The results of this study will be reported in the annual MN DNR Summaries of Wildlife Research Findings publication, in a Master's thesis, in peer-reviewed scientific journal(s), and in presentations at professional conferences. The results will also be shared with MN DNR personnel (especially area wildlife managers and prairie habitat team members), University of Minnesota (UM) Cooperative Fish & Wildlife Research Unit, other government agencies [e.g., U.S. Geological Survey (USGS), MDA, U.S. Fish and Wildlife Service (USFWS), U.S. Department of Agriculture/Natural Resources Conservation Service (USDA/NRCS), U.S. Environmental Protection Agency (EPA)], and other partner groups [e.g., Minnesota Zoo, The Xerces Society, Pheasants Forever (PF), The Nature Conservancy (TNC)] via summary reports and direct consultation. We will work with MN DNR's Office of Communications and Outreach to publicize the progress and findings of the research. Finally, we will also work with partners to help inform the public about additional best management practices (BMPs; e.g., biocontrol) that can be used to help control crop pests.

Status as of January 1, 2017:

Status as of June 30, 2017:

Status as of January 1, 2018:

Status as of June 30, 2018:

Status as of January 1, 2019:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	$ Amount	Overview Explanation
Professional/Technical/Service Contracts:	$240,000	1 graduate student ($80,000) recruited through University of Minnesota – Twin Cities (Dr. David Andersen, MN Cooperative Fish & Wildlife Research Unit) on a 50% research assistantship for 2 years to lead fieldwork, lab work, and analysis of data Lab analysis ($160,000) – lab (to be determined) to complete chemical analysis of samples
Equipment/Tools/Supplies:	$653	Miscellaneous sampling equipment & supplies (e.g., insect sample collection jars, tweezers, sorting trays, chemical protection body suits, gloves, etc.)
Travel Expenses in MN:	$7,000	Fleet & mileage ($5,500) Lodging ($1,000) Meals ($500)
Other:	$2,347	Direct & Necessary Costs ($2,347) – services to support this appropriation (*Please see footnote)
TOTAL ENRTF BUDGET:	**$250,000**	

*Department Support Services. MN DNR's Direct & Necessary costs pay for activities that are directly related to and necessary for accomplishing appropriated programs/projects. In addition to itemized costs captured in our proposal budget, direct and necessary costs cover Financial Support ($138) that is necessary to accomplishing our funded project. Department Support Services are described in the agency Service level Agreement, and billed internally to divisions based on rates that have been developed for each area of service. These services are directly related to and necessary for the appropriation. Department leadership services (Commissioner's Office and Regional Directors) are not assessed. Those elements of individual projects that put little or no demand on support services (e.g., large single-source contracts, large land acquisitions, and funds that are passed through to other entities) are not assessed Direct & Necessary costs for those activities.

Explanation of Use of Classified Staff:

Funds will not be used to pay for classified staff.

Explanation of Capital Expenditures Greater Than $5,000:

N/A

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:

N/A

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:

1.0 FTE

B. Other Funds:

The MN DNR Section of Wildlife has provided $11,100 in funding from the State Game and Fish Fund during FY16 to directly support this research project for expenses that will be incurred during spring 2016, prior to ENRTF funds being available: $1,600 for travel and $9,500 for project supplies. Additionally, multiple employees from the MN DNR Section of Wildlife, Farmland Wildlife Populations and Research Group will devote effort to

the project throughout its 36-month duration: Nicole Davros @ approximately 20% effort and three field technicians @ approximately 5% effort for a total salary of $50,040.

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
State			
MN DNR Section of Wildlife (Game and Fish Fund)	$1,600	$0	Travel to project-related meetings, travel to select study sites, meals for project staff and graduate student while traveling
MN DNR Section of Wildlife (Game and Fish Fund)	$9,500	$0	Supplies (field and lab sampling equipment, GPS units, safety & first aid equipment, etc.)
MN DNR Section of Wildlife, Farmland Populations and Research Group	$50,040	$0	Multiple employees (36 months, 1 FTE @ 20% effort, 3 FTE @ 5% effort) – project management, field work, data management & analyses, reporting
TOTAL OTHER FUNDS:	**$61,140**	**$0**	

VII. PROJECT STRATEGY:

A. Project Partners:

Dr. Nicole Davros, MN DNR, project manager
Dr. Theresa Kissane Johnston, EPA, co-investigator
Dr. David Andersen, UM Cooperative Fish & Wildlife Research Unit, co-investigator & graduate student advisor

Additional project partners (e.g., MDA, USDA/NRCS) will be included as we begin implementing this research project.

No project partners other than the University of Minnesota (through which the graduate student is being recruited) will be receiving funds. The university will receive $80,000 to support the graduate student.

B. Project Impact and Long-term Strategy:

Concerns have previously been raised about the impacts of chlorpyrifos and other agricultural insecticides on water quality and human health, prompting the MDA to release guidelines for voluntary BMPs for their use. Our research will address additional mounting concerns about the impacts of these insecticides on wildlife in Minnesota's farmland regions by determining exposure risk of grassland wildlife to commonly-used soybean aphid insecticides 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. Additionally, results from our study will assist in improving riparian buffer designs to better protect waterways, their associated wildlife, and humans who may recreate in or consume water from these water bodies. We will also work with partners to help inform the public about additional BMPs that can be used to control crop pests, thereby potentially reducing our reliance on pesticides.

C. Funding History:

No portions of this project have been previously funding by the Environment and Natural Resources Trust Fund (ENRTF).

VIII. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS:

A. Parcel List:

N/A

B. Acquisition/Restoration Information:
N/A

IX. VISUAL COMPONENT or MAP(S):
Please see attached map (Fig. 1) and graphic (Fig. 2).

X. RESEARCH ADDENDUM:
Please see attached Research Addendum.

XI. REPORTING REQUIREMENTS:
Periodic work plan status update reports will be submitted no later than January 1, 2017; June 30, 2017; January 1, 2018; June 30, 2018, and January 1, 2019. A final report and associated products will be submitted between June 30 and August 15, 2019.

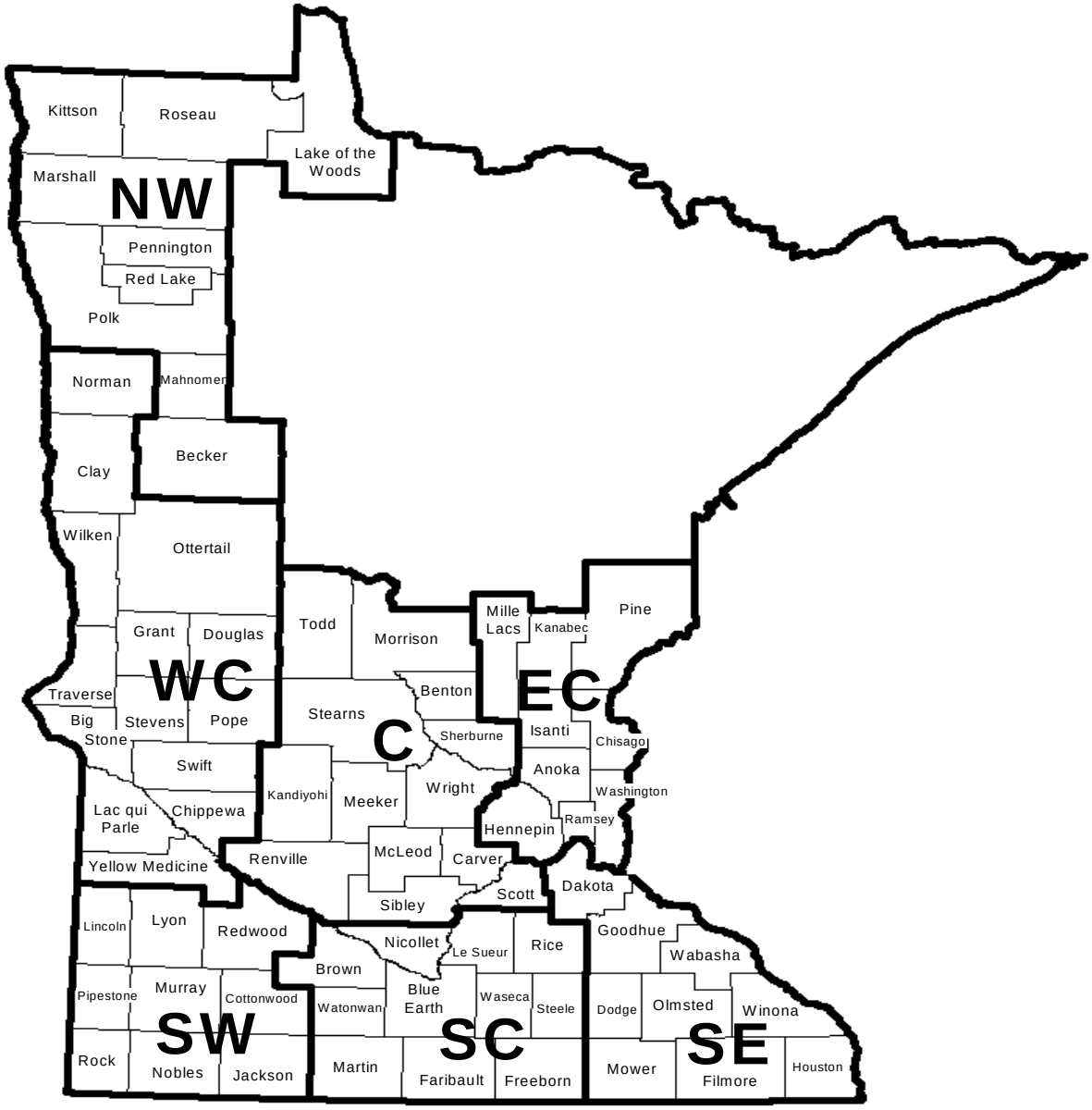

Figure 1. Minnesota's agricultural regions as outlined in MN DNR's annual August Roadside Surveys.

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

Figure 2. Example field sampling design that will be used to assess the exposure risk of grassland wildlife to common soybean aphid insecticides, especially chlorpyrifos, used in Minnesota's farmland regions. Sampling will be conducted on MN DNR-owned grasslands (outlined in black) adjacent to privately-owned soybean fields sprayed for aphid infestations. White lines indicate sampling transects established perpendicular to the soybean field edge and extending ≥100 m into the grassland.

Environment and Natural Resources Trust Fund
M.L. 2016 Project Budget

Project Title: Evaluating Insecticide Exposure Risk for Grassland Wildlife on Public Lands
Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 03n
Project Manager: Nicole M. Davros
Organization: Minnesota Department of Natural Resources, Division of Fish & Wildlife, Section of Wildlife
M.L. 2016 ENRTF Appropriation: $250,000
Project Length and Completion Date: 3 years; June 30, 2019
Date of Report: May 29, 2016

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	***Data Gathering & Analysis***				
Professional/Technical/Service Contracts					
University of Minnesota - Twin Cities (single-source contract): 1 graduate student; research assistantship @ 0.5 FTE for 2 years ($40,000/yr); 75% salary, 25% benefits; recruited in collaboration with Dr. David Andersen, Minnesota Cooperative Fish & Wildlife Research Unit	$80,000		$80,000	$80,000	$80,000
TBD competitive bid process: Lab analysis of samples using thermal desorption gas chromatography-mass spectrometry (GC-MS) method; 310-457 samples @ $350-$515/sample	$160,000		$160,000	$160,000	$160,000
Equipment/Tools/Supplies					
Miscellaneous sampling equipment & supplies (e.g., insect sample collection jars, tweezers, sorting trays, chemical protection body suits, gloves, etc.)	$653		$653	$653	$653
Travel expenses in Minnesota					
Travel to and between study sites in south-central and southwest Minnesota by graduate student and MN DNR research staff. Fleet & mileage: $5,500; lodging: $1,000; meals: $500	$7,000		$7,000	$7,000	$7,000
Other					
Direct and Necessary Costs: These expenses include Department Support Services (specifically, Financial Support @ $2,347) necessary to accomplish the funded project.	$2,347		$2,347	$2,347	$2,347
COLUMN TOTAL	**$250,000**		**$250,000**	**$250,000**	**$250,000**