2022 Pesticide Sediment Monitoring Pilot Report

Jerry Sauter
Pesticide and Fertilizer Division
North Dakota Department of Agriculture

Commissioner Doug Goehring

Acknowledgements

The North Dakota Department of Agriculture thanks Dr. Marinus Otte, Christine Cornish, Kui Hu, Whitney Sauskujos, and Kyle Boutin from NDSU for Coordinating and implementing this project. The North Dakota Department of Agriculture also thanks the staff at the Agriculture and Food Laboratory at the University of Guelph in Guelph Ontario.

The Department also thanks the Water Quality Advisory Committee for its input and advice. The Committee consists of the following state and federal agencies:
ND Department of Environmental Quality
ND Department of Parks and Recreation
ND Game and Fish Department
ND Geological Survey
ND State University Extension Service
ND State Water Commission
US Department of Agriculture-NRCS
US Fish and Wildlife Service
US Geological Survey

Summary

The North Dakota Department of Agriculture, working in cooperation with North Dakota State University completed a pesticide sampling pilot project on sediment in North Dakota wetlands in 2022. This project consisted of collecting and analyzing samples from twenty wetlands, one time in July of 2022. These samples were analyzed by the Agriculture and Food Laboratory at the University of Guelph, in Guelph Ontario. Samples were analyzed for 2,4-D, glyphosate, AMPA, acetochlor, atrazine, desethyl-atrazine, and metolachlor. Of all the analyses, glyphosate was found present below the reporting limit one time and all other analyses resulted in non-detections.

Introduction

The North Dakota Department of Agriculture (hereafter "Department") is the lead pesticide regulatory agency in the state through the authority provided in Chapters 4-35, 4-35.1, and 19-18 of the North Dakota Century Code. Under a cooperative agreement with the U.S. Environmental Protection Agency (EPA), the Department is charged with regulating pesticides in the public's interest to ensure that they do not pose a risk of unreasonable adverse effects to human health or the environment. The goal of the Department's Pesticide Water Quality Program (hereafter "Program") is to prevent unacceptable contamination of ground and surface water by pesticides. The Department has a Water Quality Advisory Committee (WQAC) in place to advise them on ground and surface water issues and to guide monitoring programs. Agencies represented on the committee include the ND Department of Environmental Quality (NDDEQ), US Department of Agriculture Natural Resource Conservation Service, ND State University Extension Service, US Geological Survey (USGS), ND Geological Survey, ND State Water Commission, US Fish and Wildlife Service, ND Game and Fish Department, and the ND Parks and Recreation Department.

Identifying pesticide surface water issues is a priority for the Department and the WQAC. Before the first monitoring project in 2006, no agency routinely monitored North Dakota's surface waters for pesticides. Including the pilot project in 2006, surface water sampling has focused on rivers and streams and has become more comprehensive.

During the summer of 2022, the Department partnered with North Dakota State University (NDSU) to perform a small, pilot project examining pesticides in wetland sediment. As part of an EPA grant, Dr. Marinus Otte from NDSU has been studying ecosystem functions of restored prairie pothole wetlands in relation to time since restoration. Christine Cornish, a Ph.D. graduate student at NDSU, working with Dr. Otte is studying accumulation of glyphosate in restored wetlands. Since the Department doesn't have any pesticide-sediment data, this project served to develop a small, baseline dataset for commonly used pesticides in sediment and to benefit Christine's research.

The goal of the project was to assess levels of commonly used pesticides in sediment in wetlands and determine if program expansion is necessary and feasible in the future to include robust sediment sampling for pesticides.

Materials and Methods

Pesticide samples were collected once in 2022 at 20 sites in North Dakota wetlands located within Cavalier, Lamoure, McIntosh, Mercer, Ramsey, Stutsman, Towner, and Wells counties in July of 2022 (Table 1 and Figure 1). Five of the wetlands are natural and fifteen of the wetlands were restored between 1987 – 2016.

Upon arrival at each site, a paddleboard, sediment corer and extruder, GPS, data sheets, and sample containers will be prepared for sampling. The date, time, and site name will be documented on sample containers, as well as on a data sheet, which will also include wetland observations (e.g., dominant plants, turbidity) and core coordinates. A paddleboard will be used for sampling to reduce sediment disturbance; and a gravity sediment corer (ARI Instruments) will be used to collect one sediment core at an approximate central location within the wetland. The sediment sample will be collected before any other samples. At the central location, an anchor will be slowly released, if necessary, the location coordinates will be documented, and the sediment corer deployed on the side of the boat opposite of the anchor. The corer tube will be carefully pushed into the sediment, slowly removed, and capped as quickly as possible to prevent the loss or mixing of sediments. A 5 cm sediment sample will then be extruded from the sediment core into a 32 oz. black HDPE container using fixed extruder inserts to ensure the same amount of sediment is collected at each site. Containers will be capped with unlined PP lids. All samples will be immediately stored in coolers on ice for transport to NDSU facilities.

The corer, extruder and any other pesticide sampling equipment were decontaminated using the following protocol: rinse with water from site, rinse with tap water, rinse with isopropyl alcohol, rinse with HPLC water, air dry, supplies will be stored to prevent dust contamination during travel.

Replicate samples were collected at two randomly selected sampling events in 2022. For replicate sampling, the following protocol occurred. Collect the original sample following the Sampling Methods section above. Decontaminate sampling equipment following Sampling Equipment Decontamination Methods above. Collect a replicate sample near the original sample following the Sampling Methods section above.

Upon arrival at NDSU, sediment samples were stored in a secured, -20 °C freezer until transportation to the lab. For transportation, samples will be placed in a Styrofoam cooler with dry ice, and then in a cardboard shipment box with bubble wrap (or equivalent padding). The dry ice and insulation provide approximately 72 hours of freezer storage, but samples were held in coolers for no longer than 48 hours before arrival at the lab. Samples were transported directly to a shipping facility in Winnipeg, Manitoba by researcher, and then securely shipped overnight priority to Guelph, Ontario. An analyte list with minimum reporting limits can be found in Table 2.

Table 1. 2022 wetland monitoring project sites and sample collection dates.

Site Name	Latitude	Longitude	Sample Date
Kindischi	47.6113703	-100.3317605	7/19/2022
Beulah	47.4315833	-101.9569391	7/18/2022
Banner	48.5610555	-98.8059561	7/12/2022
Mellin 1	48.4693771	-98.734148	7/13/2022
Hawks Nest 1	47.3154935	-99.273383	7/20/2022
Hawks Nest 2	47.3177972	-99.2751981	7/20/2022
Phil Aus 1	48.501787	-98.596864	7/15/2022
Pilgrim's	46.3772096	-98.0841347	7/18/2022
kneeling Moose 2	48.475474	-98.778992	7/13/2022
Phil Aus 2	48.502803	-98.594198	7/15/2022
Mellin 10	48.466779	-98.735516	7/13/2022
kneeling Moose 1	48.475402	-98.783229	7/13/2022
Niko 5	48.5852587	-99.2185663	7/12/2022
Niko 1	48.5846975	-99.2160336	7/12/2022
Sweetgrass 1	47.360794	-99.57918	7/20/2022
Sweetgrass 2	47.3566677	-99.5806578	7/20/2022
Cottonwood P8	47.09908	-99.104295	7/21/2022
Cottonwood T1	47.0984758	-99.1018688	7/21/2022
Dense Nesting Cover	47.4613063	-100.068331	7/19/2022
Cottonwood P3	47.101692	-99.101982	7/21/2022

Figure 1. 2022 pesticide wetland sampling sites.

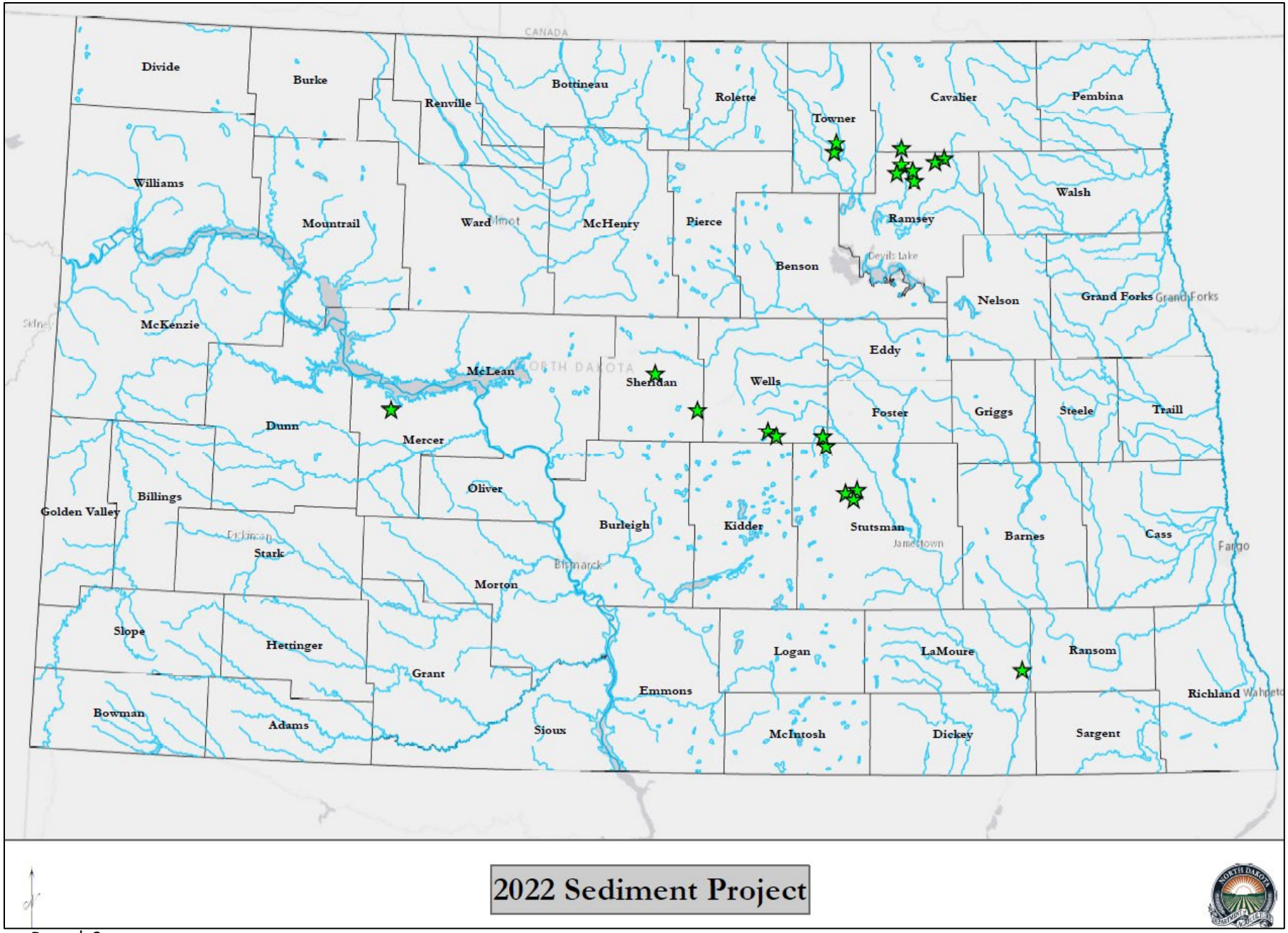

Table 2. List of analytes and reporting limits.

List of analytes and reporting limits		
Analyte	**Common trade names**	**Minimum detection limit (ppm)**
Acetochlor	Surpass, Harness	0.007
Atrazine	Aatrex	0.002
Desethyl-Atrazine	Atrazine degradate	0.006
Metolachlor	Dual Magnum	0.002
Glyphosate	Roundup	0.005
AMPA	Glyphosate degradate	0.005
2,4-D	2,4-D, Curtail	0.001

Results and Discussion

There was a total of 20 sediment samples analyzed for seven pesticides including 2,4-D, glyphosate, AMPA, acetochlor, atrazine, desethyl-atrazine, and metolachlor. For 19 sites, all analyses for all pesticides resulted in non-detections. At the Sweetgrass 2 site, glyphosate was determined to be present below the minimum detection limit (0.005 ppm) and all other analyses resulted in non-detections.

Twenty sites were analyzed for seven pesticides equating to a total of 140 possible individual detections. There were 139 analyses resulting in non-detections and one determined to be present below the detection limit. This project was intended to collect some initial data and provide direction for future sediment sampling.

Glyphosate

Glyphosate is the most commonly used pesticide in North Dakota. It is labeled for use on most crops and controls several grasses and broadleaf weeds. The Preliminary Problem Formulation for the Ecological Risk and Drinking Water Exposure Assessments for Glyphosate and Its Salts (Environmental Protection Agency 2009) lists the most sensitive aquatic endpoint at 11.9 ppm which is the level found to impact 50% of Duckweed populations at a constant, 14-day exposure. Glyphosate readily binds to soil, and it is unclear how much is potentially bioavailable in waterbodies with suspended sediment. Given one sample contained glyphosate present below 0.005 ppm (or over 2,000 times lower than the most sensitive aquatic toxicity endpoint), this project indicates minimal risk from glyphosate in the sampled wetlands. It should be noted however, that this project was small and there is a lot to be learned about pesticides in wetlands before drawing broad conclusions.

REFERENCES

Environmental Protection Agency. (2009). *The Preliminary Problem Formulation for the Ecological Risk and Drinking Water Exposure Assessments for Glyphosate and Its Salts.* https://www.regulations.gov/document/EPA-HQ-OPP-2009-0361-0007.