Monitoring Surface Waters for Pesticides in North Dakota

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Background and Introduction

Goals of monitoring

- Determine the occurrence and concentration of pesticides in North Dakota rivers
- Determine whether any pesticides may be present at concentrations that could adversely affect human health, aquatic life, or fish-eating wildlife
- Determine the temporal and spatial frequency of sampling needed to assess contamination, thereby helping to further refine future pesticide monitoring design

Surface Water Monitoring in North Dakota

- Four years of data
- 180 pesticides and degradates monitored
- 2008- 9 sites, 2009- 29 sites, 2010-33 sites throughout the state
- 2008 sampled every three weeks April-October
- 2009 and 2010 sampled every six weeks May-October
- Collaborated with NORTH DAKOTA DEPARTMENT of HEALTH

Materials and Methods

Methods

- Measured dissolved oxygen, temperature, pH, and specific conductivity
- Grab samples
- Samples taken at depth of approximately 60 percent of total water depth below surface
- replicates
- Used 500 mL amber glass jars with Teflon-coated lids
- Packed with ice and shipped via FedEx to lab

Analytical Methods

Pesticide Class	Method Description
Organochlorine pesticides	Modified EPA method 608 (GC-ECD)
Organophosphorous pesticides	Modified EPA method 614 (GC-FPD)
Organonitrogen pesticides	Modified EPA method 625 (GC-MS)
Chlorinated pesticides	Modified EPA method 8321A (HPLC-MS)
Imidazolinone herbicides	Am. Cyanamid method (HPLC-MS)
Miscellaneous pesticides	Modified EPA method 8321A (HPLC-MS)

Assessing risk

- Risk of pesticides to human health or the environment is a function of both toxicity and exposure
- The EPA has established Maximum Contaminant Levels (MCLs) for pesticides in drinking water based on risk to human health-maximum concentration of a chemical allowed in public drinking water system, those that are thought to pose the most serious risk
- The EPA has also established Aquatic Life Benchmarks (ALBs) based on risk of pesticides to aquatic ecosystems

2008 monitoring

2008 monitoring

- Nine sample sites
- Three watersheds-Souris, Sheyenne and Yellowstone
- Sampled every three weeks April-October (10 sampling events)
- Samples tested for 184 different pesticides

2008 sampling locations

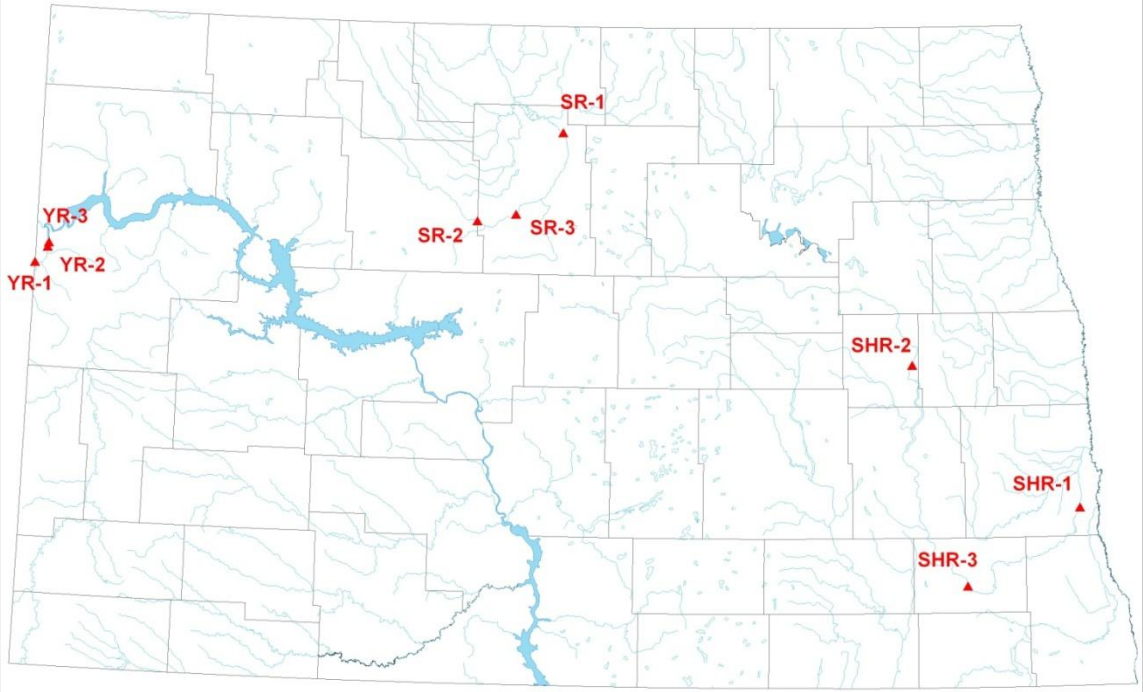


Figure 1. General Sampling Locations

2008 pesticide detections

N/A means aquatic life benchmark not available for 2008 report

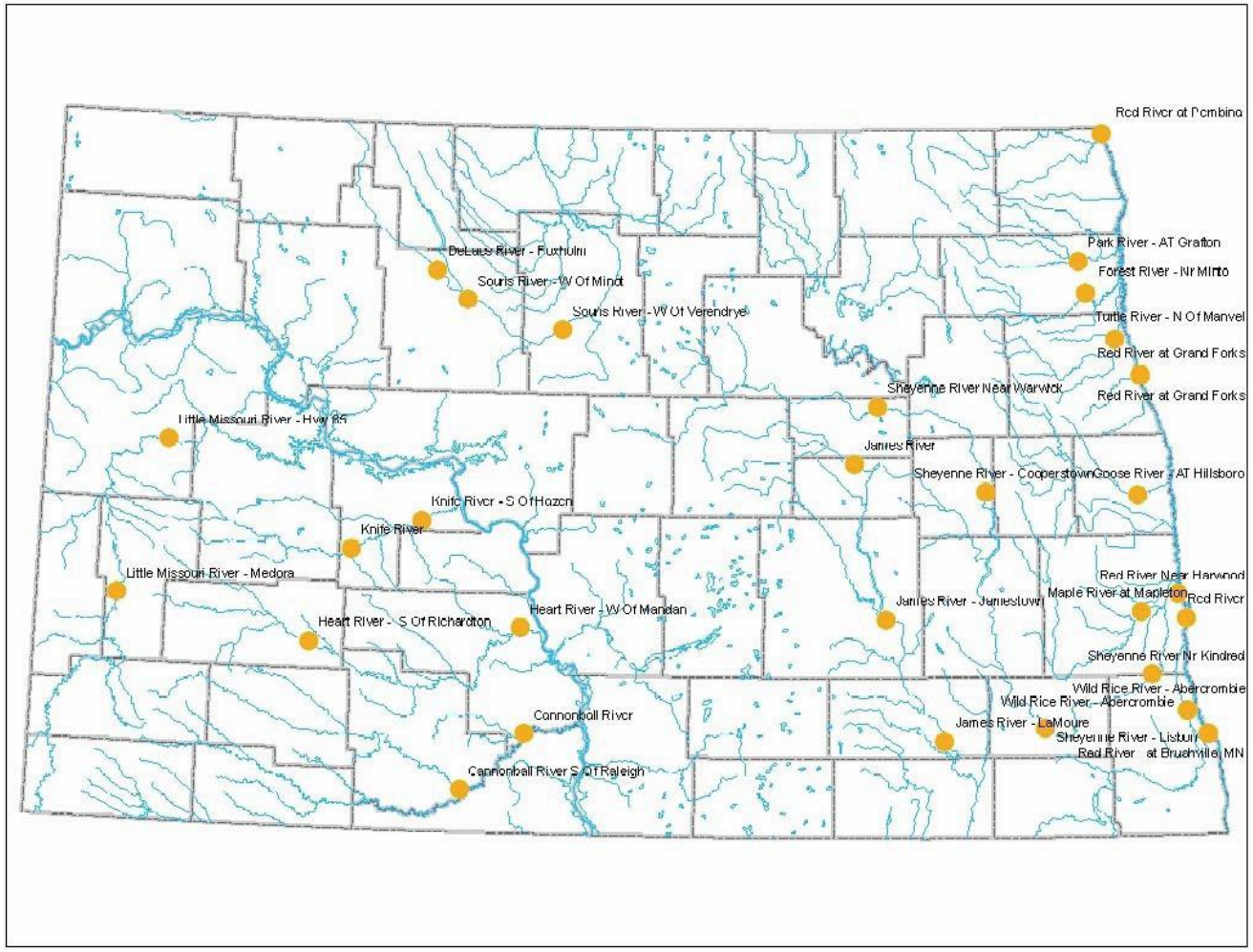
Pesticide	Trade name	# of detects	Maximum concentration (ppb)	EPA AL benchmark	MCL
2,4-D	2,4-D	13	0.35	299.2	70
Atrazine	Aatrex	1	0.48	17.5	3
Bentazon	Basagran	1	0.014	4500	N/A
Clopyralid	Stinger, Curtail	5	0.17	N/A	N/A/
DCPMU	Diuron degradate	9	0.92	N/A	N/A
Dicamba	Banvel	4	0.49	61	N/A
Dichlorprop	Weedone, Strike	1	0.14	N/A	N/A
Diuron	Direx, Karmex	14	4.2	2.4	N/A
Imazapyr	Stalker	2	0.056	N/A	N/A/
Triclopyr	Garlon	1	0.11	100	N/A

2009 monitoring

2009 monitoring

- 29 sites-representing all major watershed of North Dakota
- 180 different pesticides tested for
- Every six weeks
- June through November

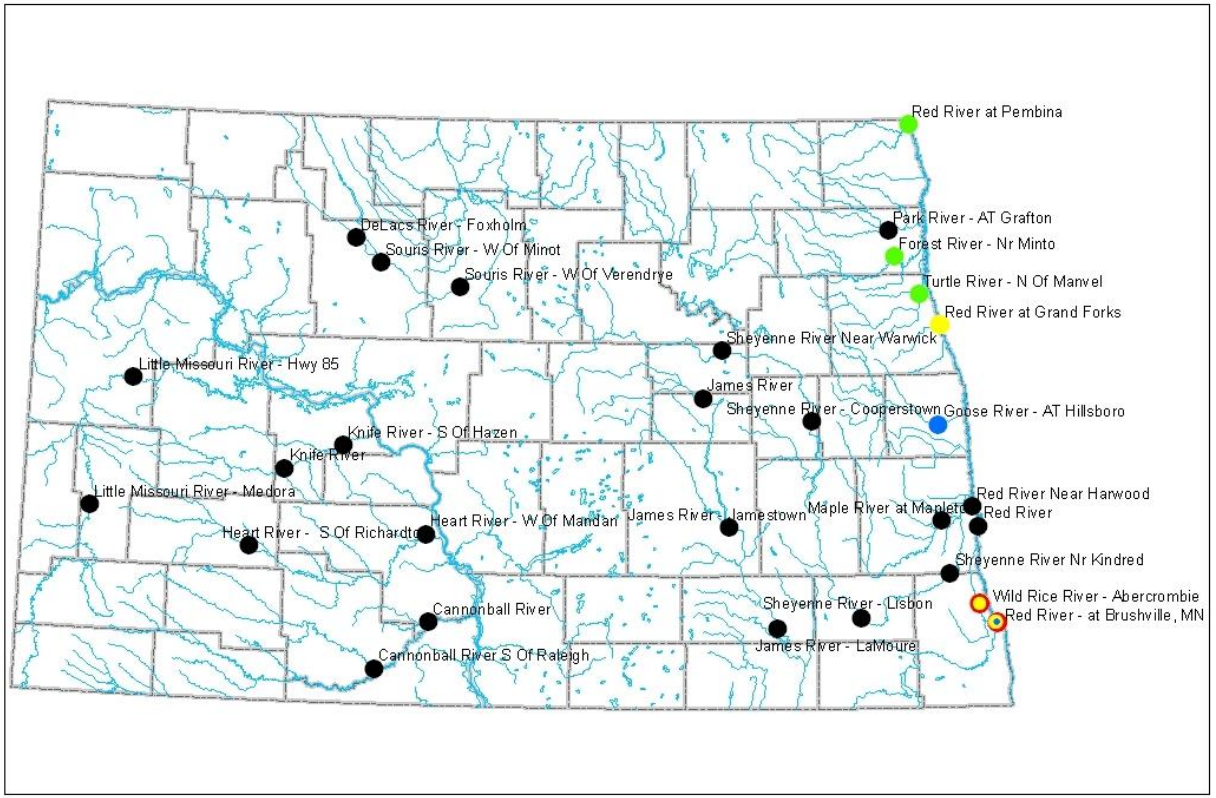
2009 sites


Red River at Pembina
Park River - AT Grafton
Forest River - Nr Minto
Turtle River - N Of Manvel
Red River at Grand Forks
Red River at Grand Forks
Sheyenne River Near Warwick
James River
Sheyenne River - Cooperstown
Goose River - AT Hillsboro
Little Missouri River - Hwy 85
Knife River - S Of Hazen
Knife River
Little Missouri River - Medora
Heart River - S Of Richardton
Heart River - W Of Mandan
James River - Jamestown
Red River Near Harwood
Maple River at Mapleton
Red River
Sheyenne River Nr Kindred
Wild Rice River - Abercrombie
Wild Rice River - Abercrombie
James River - LaMoure
Sheyenne River - Lisbon
Red River at Brushville, MN
Cannonball River
Cannonball River S Of Raleigh

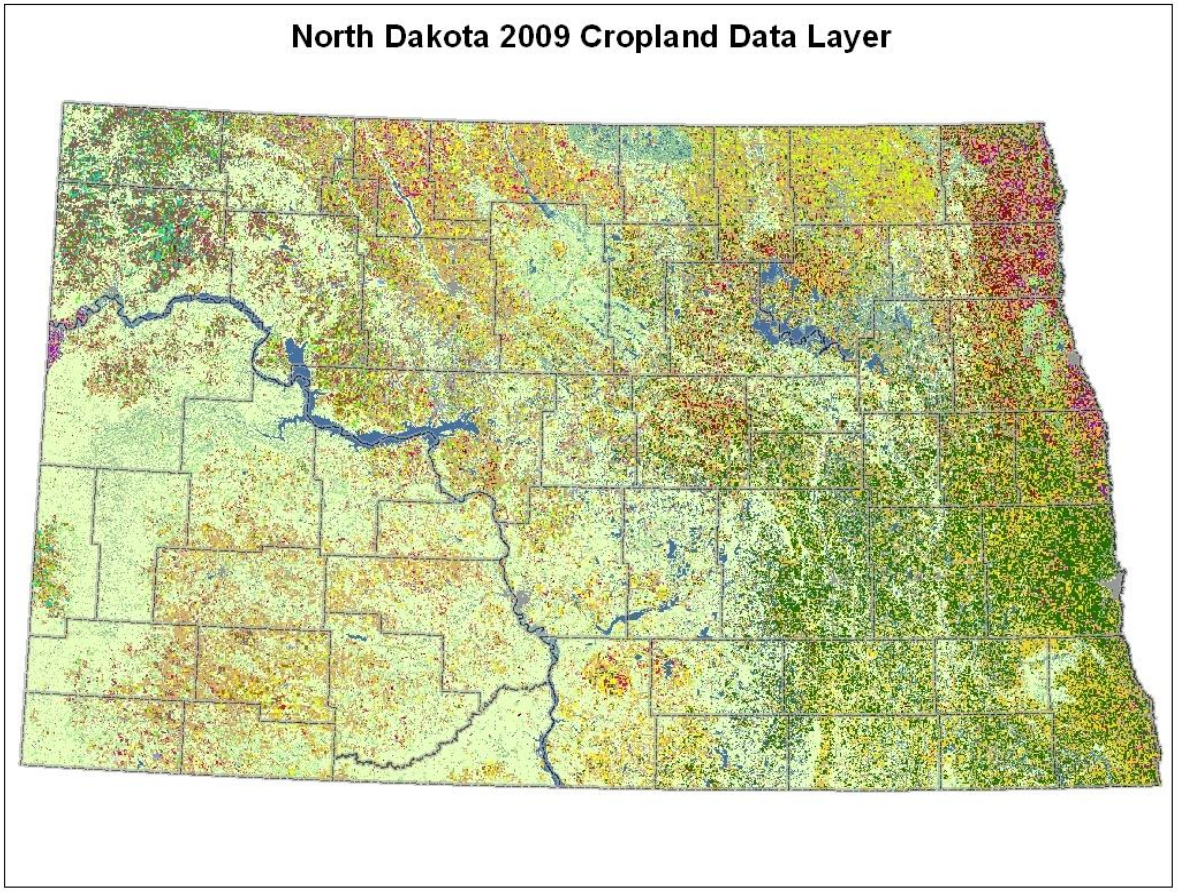
2009 Pesticide detections in surface water

Pesticide	Trade name	# of detects	Maximum concentration (ppb)	EPA benchmark (ppb)	MCL (ppb)
Atrazine	Aatrex	4	0.46	17.5	3
Bentazon	Basagran	3	0.70	4500	N/A
Dimethanamid	Outlook	2	0.36	8.9	N/A
MCPA	MCPA	2	1.5	177	N/A

Locations of detections 2009



North Dakota Cropland



Land Cover Categories (by decreasing acreage)

Agriculture

- Pasture/Grass
- Spring Wheat
- Soybeans
- Other Hays
- Corn
- Durum Wheat
- Canola
- Sunflowers
- Dry Beans
- Barley
- Winter Wheat
- Peas
- Alfalfa
- Fallow/Idle Cropland
- Flaxseed
- Sugarbeets
- Lentils
- Oats
- Potatoes
- Millet
- Safflower
- Sorghum
- Other Crops
- Rye
- Mustard
- Seed/Sod Grass
- Clover/Wildflowers
- Other Small Grains
- Camelina
- Misc. Vegs. & Fruit
- Herbs

Non-Agriculture

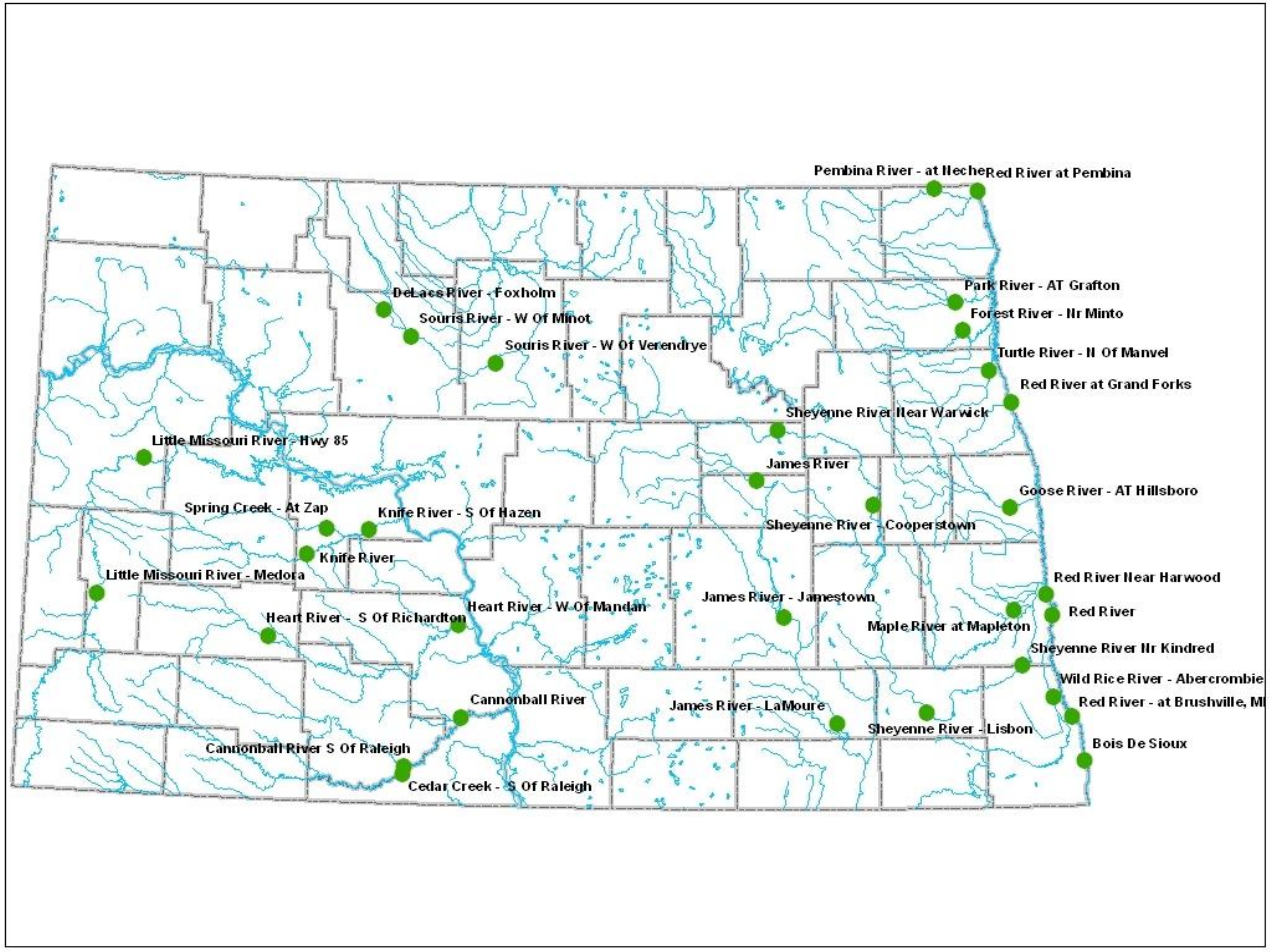
- Urban/Developed
- Wetlands
- Water
- Woodland
- Shrubland
- Barren

2010 monitoring

2010 Monitoring

- 33 sites, representing all major watersheds in state
- Sampled every six weeks April through October (5 events)
- 180 pesticides tested for

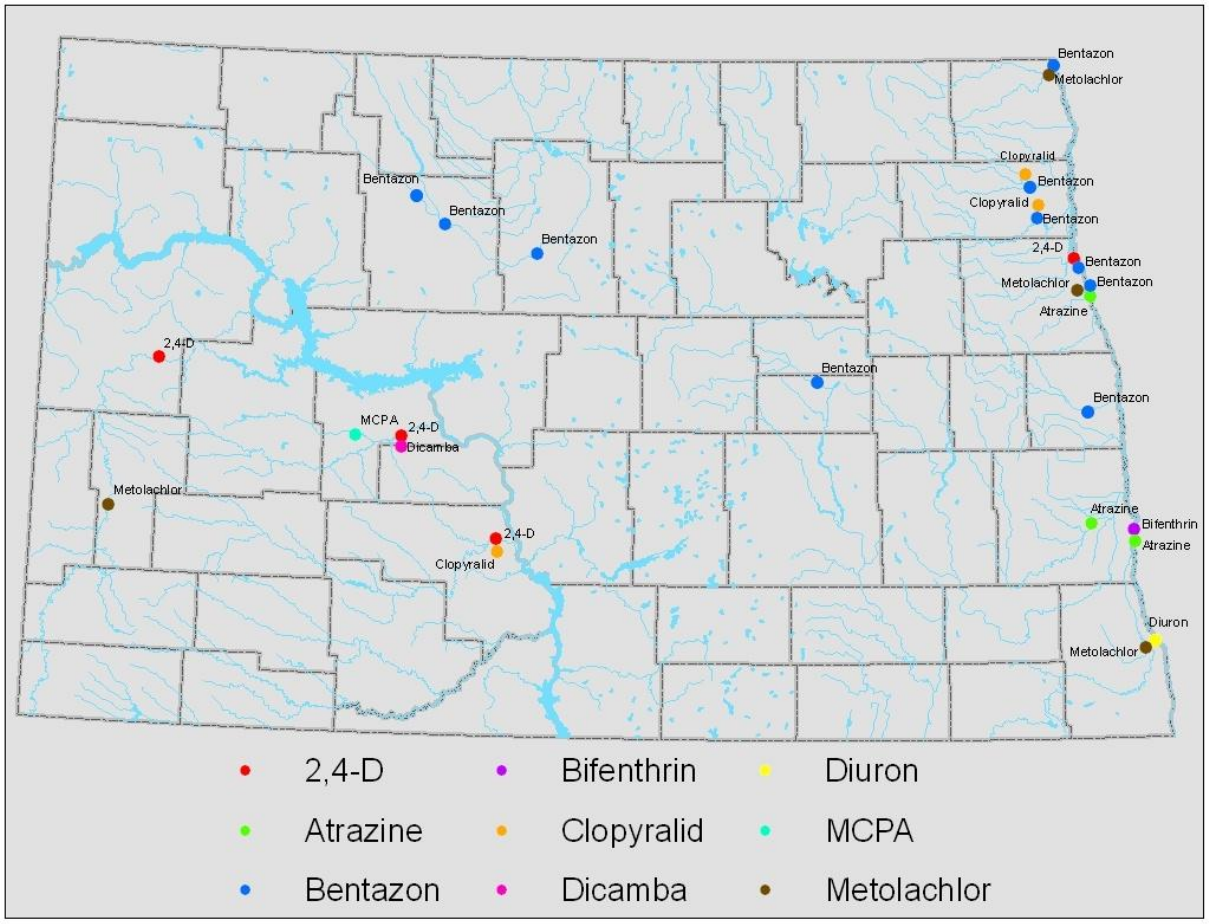
2010 sampling locations



2010 Pesticide detections in Surface Water

Pesticide	Common name	# of detections	Highest ncentration (pp	Aquatic Life Benchmark (ppb)
2,4-D	2,4-D	4	1.5	N/A
Atrazine	Aatrex	3	0.87	1
Bentazon	Basagran	22	5.2	4,500
Bifenthrin	Talstar, Capture	1	0.13	N/A
Clopyralid	Stinger, Curtail	3	0.78	56,500
Dicamba	Banvel	1	0.52	61
Diuron	Direx, Karmex	1	0.19	2.4
MCPA	MCPA	1	0.61	170
Metolachlo	Dual, Magnum	4	0.91	1

2010 detection sites

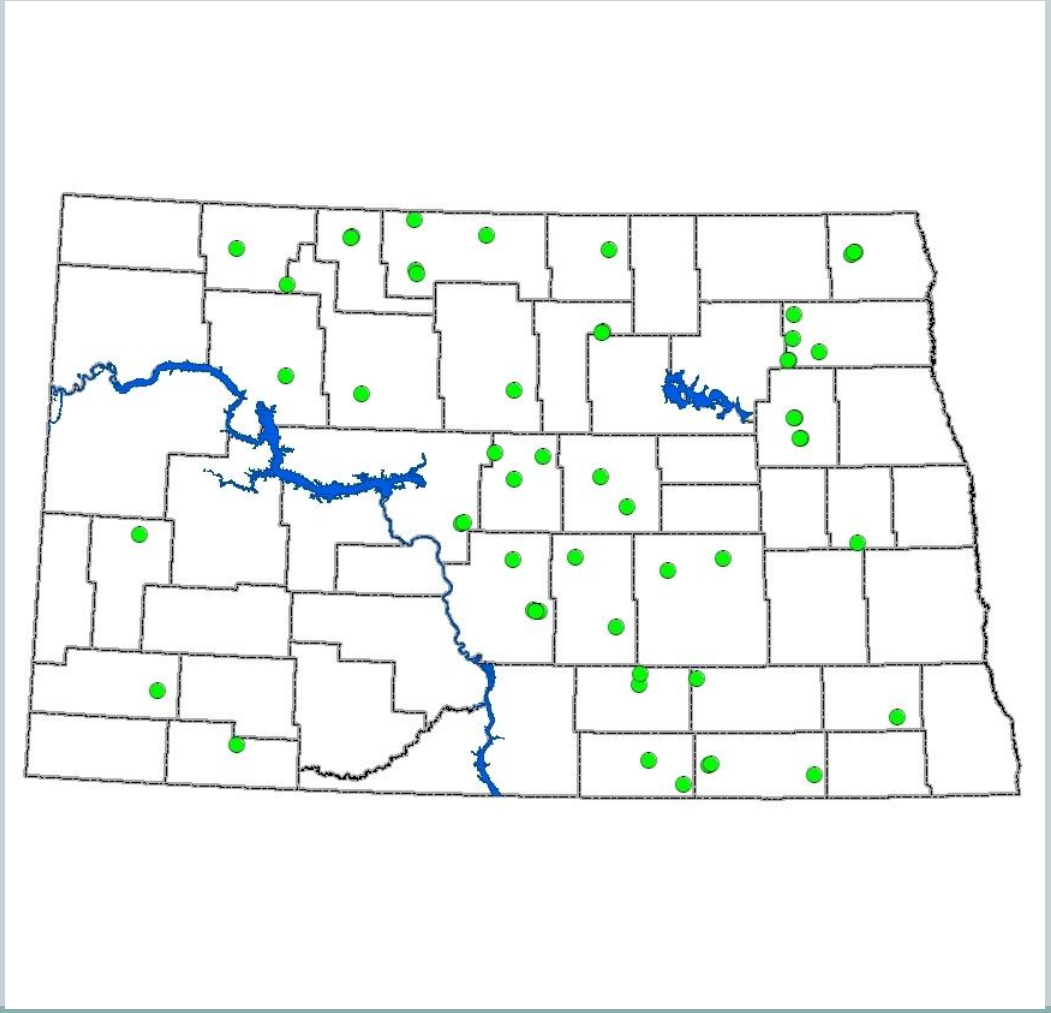


2011 monitoring

2011 Wetland Monitoring

- Part of EPA's National Wetland Condition Assessment
- In ND conducted by NDSU and Department of Health
- Measured vegetation, soils, physical attributes and buffers
- 54 wetlands analyzed for 180 pesticides

2011 Wetland Sites



Wetland monitoring results 2011

Pesticide	Common Name	# of detections	Highest concentration (ppb)
Atrazine	**Aatrax**	1	0.68
Endosulfan	**Thionex**	1	0.12
Pendimethalin	**Prowl**	2	0.16
Metolachlor	**Dual, Magnum**	2	0.41

2009 through 2011Yellowstone Monitoring

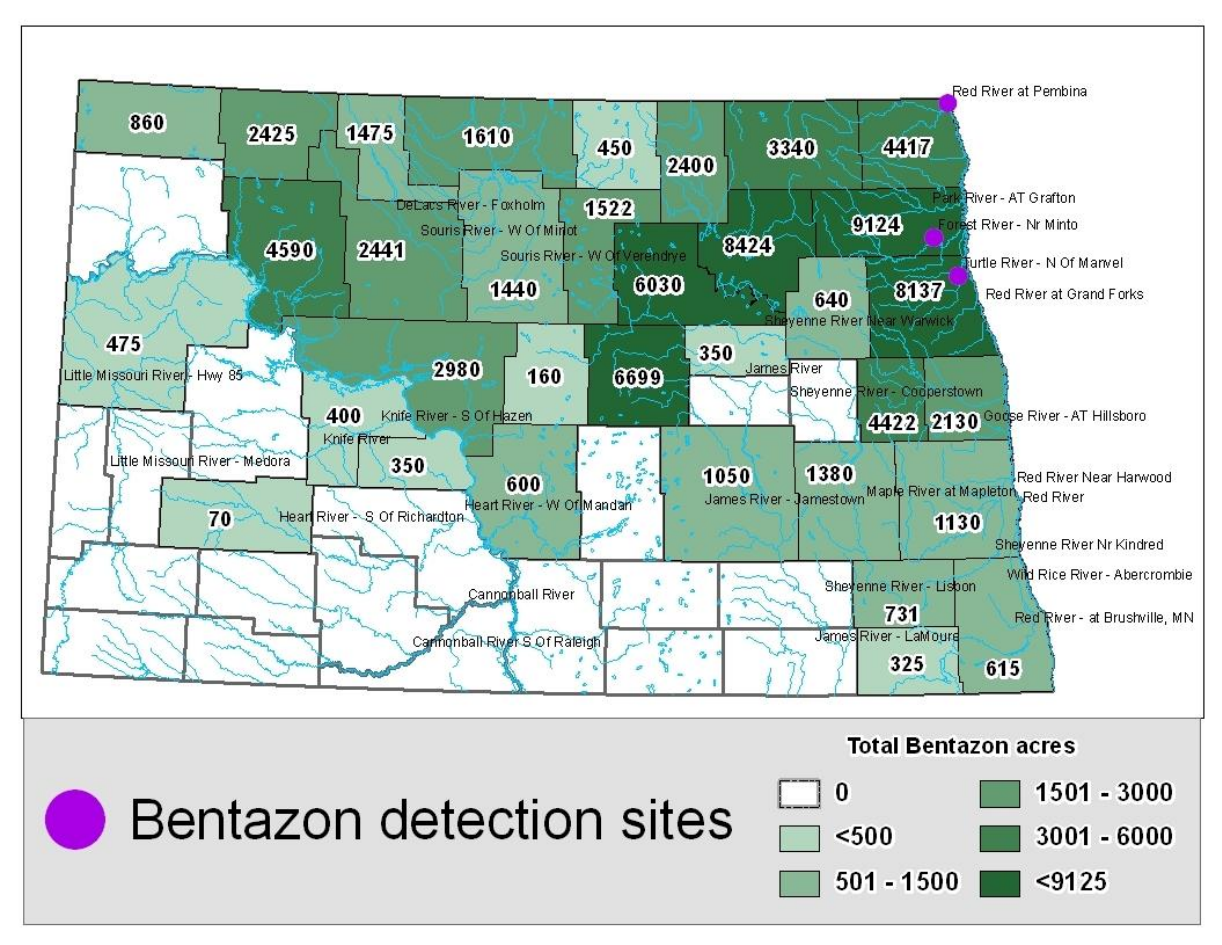
- Samples collected by ND Game and Fish Dept.
- Worked with USFWS and EPA Region 8 Lab
- Three sites sampled every four weeks
- Sites selected because of proximity to suspected Pallid Sturgeon spawning locations

Yellowstone Sampling 2009 results

Analyte	No. of Analyses	No. of Detections	Average Conc. ppb	Max Conc. ppb	Detection Freq.	ALB (ppb)
2,4-D	39	13	.0421	.1250	33.3%	N/A
MCPA	39	9	.0338	.0872	23.1%	170
Bentazon	39	5	.0153	.0217	12.8%	4,500
Imazethapyr	33	4	.0108	.0110	12.1%	N/A
Dimethenamid ESA	39	2	.0218	.0302	5.1%	8.9
Dimethenamid OA	39	2	.0148	.0180	5.1%	8.9
Diuron	33	1	.0238	.0238	3.0%	2.4
Imazaquin	33	1	.0180	.0180	3.0%	N/A
Bromoxynil	39	1	.0346	.0346	2.6%	N/A
Metolachlor ESA	39	1	.0594	.0594	2.6%	1
Propachlor OA	39	1	.0279	.0279	2.6%	13.5

Discussion and Conclusions

Example of data gathered through this program



When problems arise ex. diuron

- Can investigate sources
- The Department has authority to increase inspections, mandate buffer distances, reduce use rates, cancel product

Conclusions

- North Dakota rivers and streams have minimal pesticide contamination
- shows that current regulations are effective in mitigating the risk of pesticide contamination to surface water
- If impairments of rivers are found, these can be addressed through regulation and education
- EPA could rely on real world data instead of models for policy decisions

Questions?

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