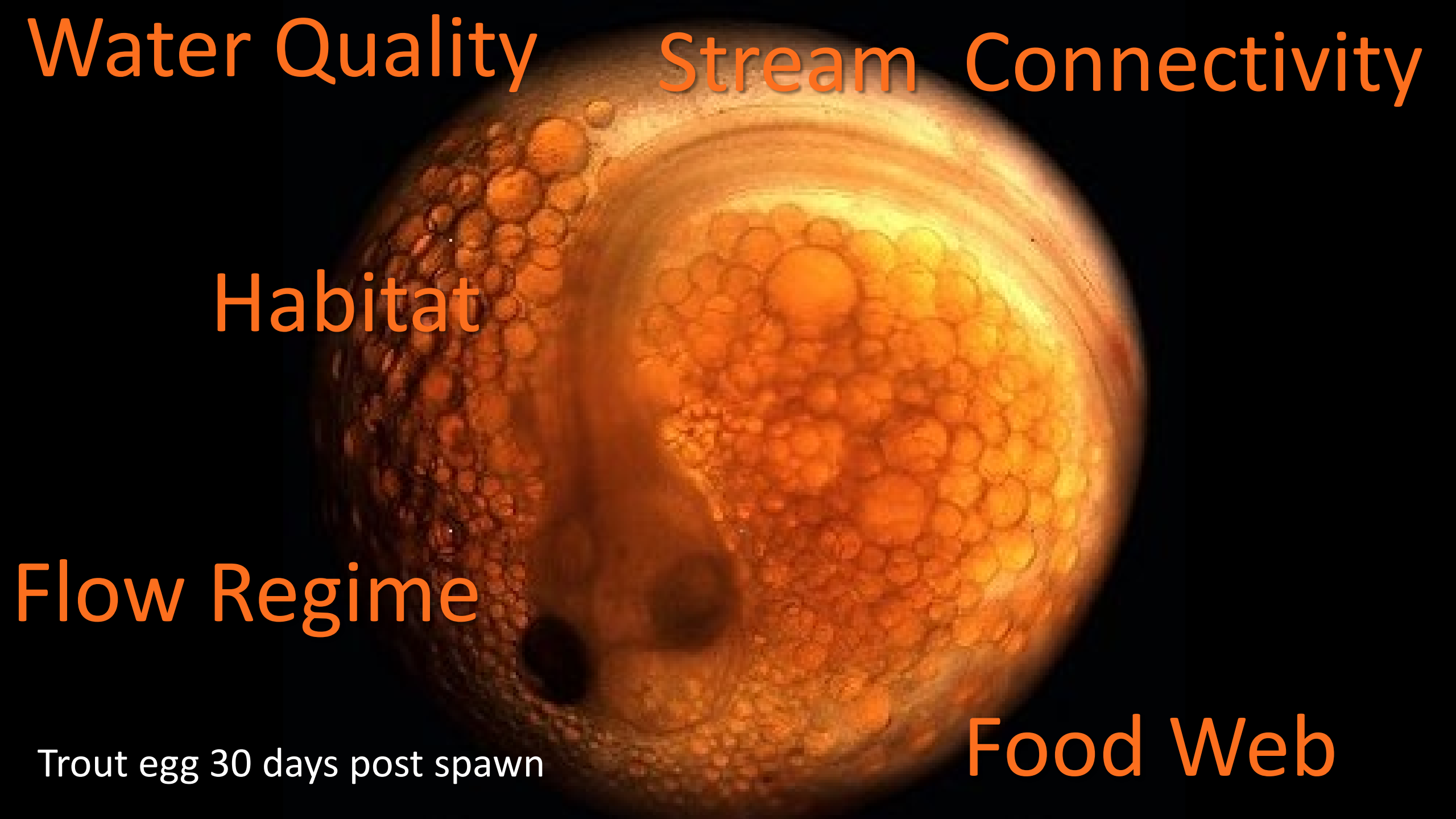
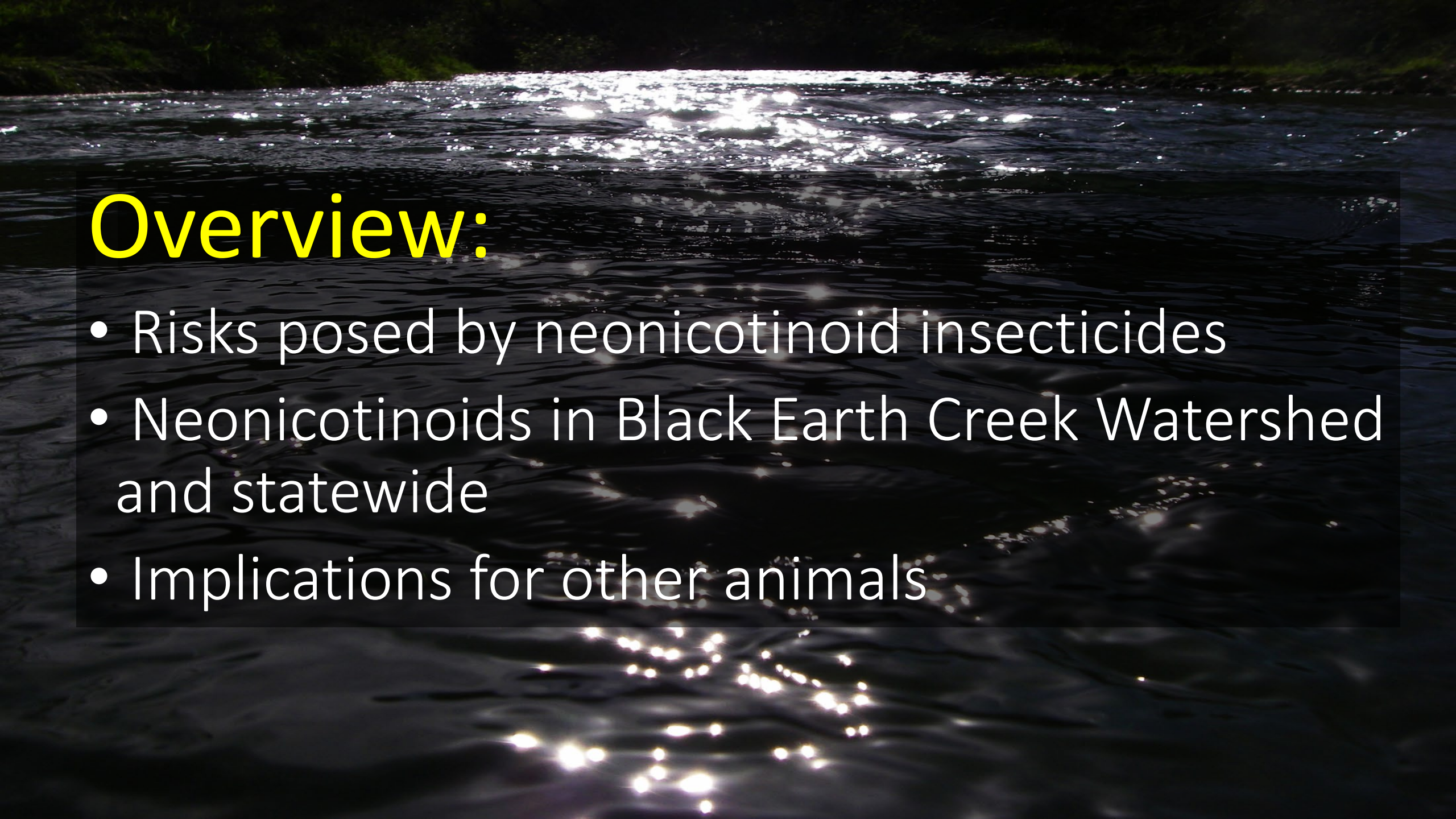

Water Quality
Stream Connectivity
Habitat
Flow Regime
Food Web
Trout egg 30 days post spawn

Risks Neonicotinoids Pose to the Black Earth Creek Watershed

Mike Miller
Wisconsin's Department of Natural Resources

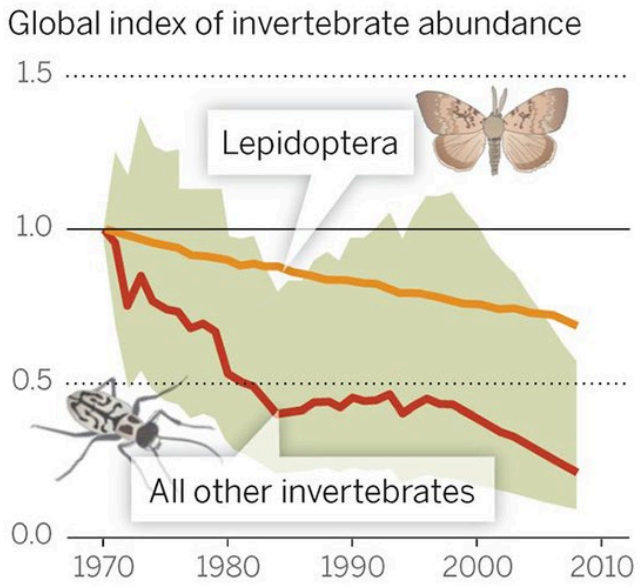


Overview:

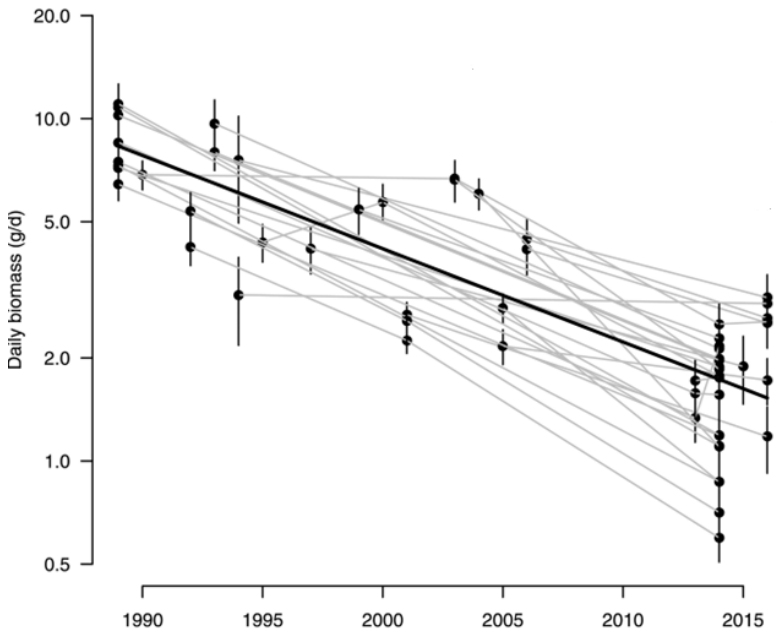
- Risks posed by neonicotinoid insecticides
- Neonicotinoids in Black Earth Creek Watershed and statewide
- Implications for other animals

The Problem:

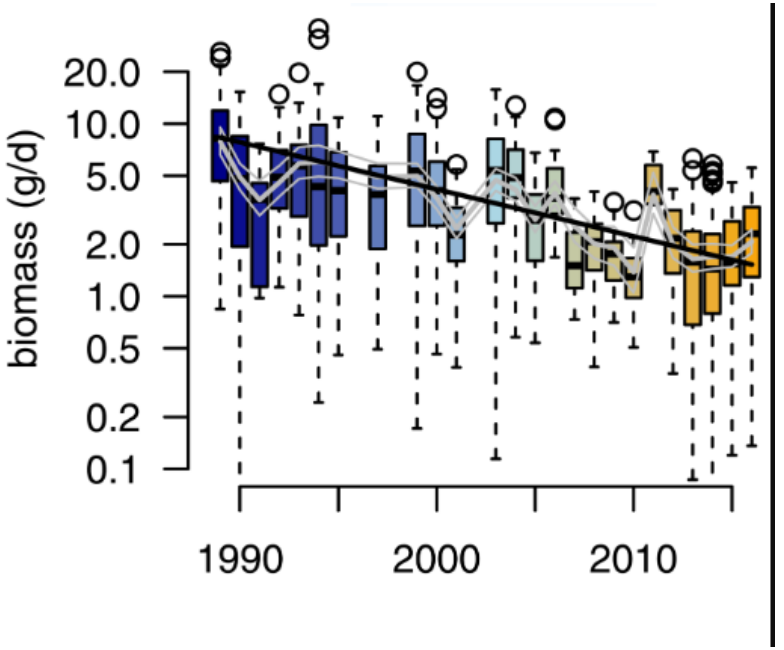
GLOBAL INSECT POPULATIONS ARE IN DECLINE! …AND THEY ARE <u>REALLY</u> IMPORTANT FOR THE HEALTH OF OUR PLANET!!



45% decline in invert populations
Past 40 years (452 species)
Dirzo 2014



5% annual decline in flying insect biomass in Germany
Hallman et al. 2017

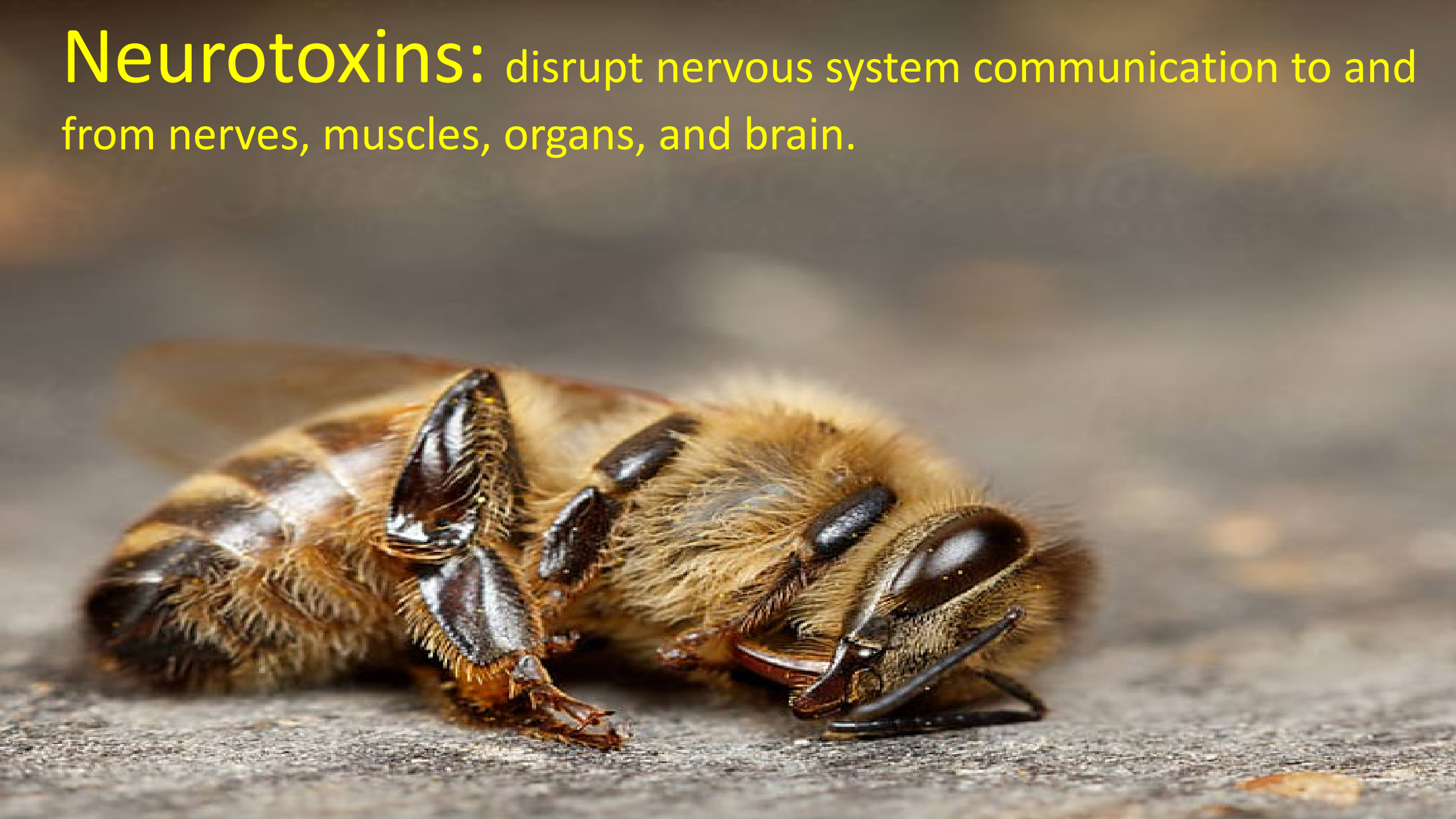


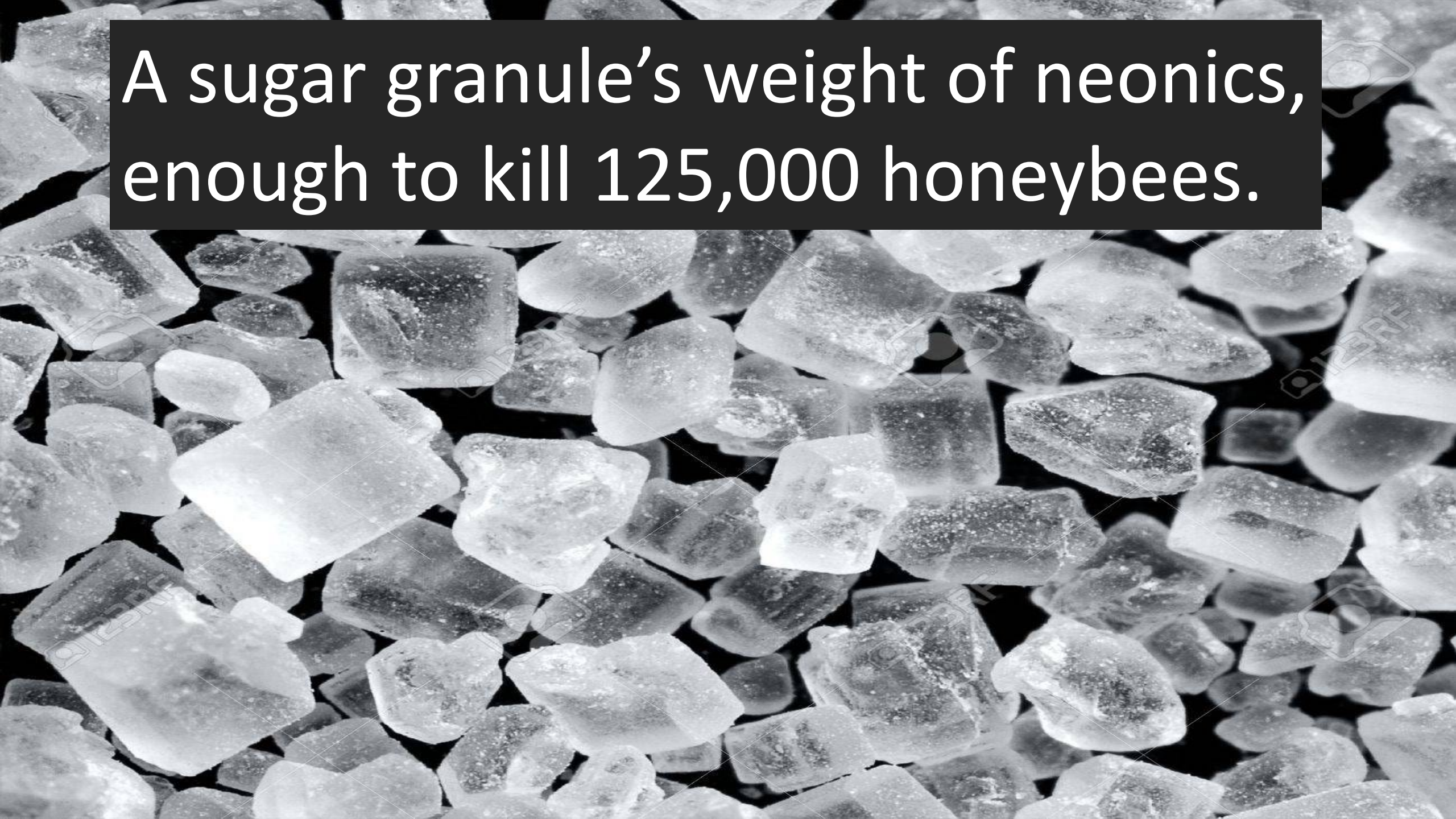
Summarization of multiple global studies
Sanchez-Bayo and Wyckhuys 2019

Neonicotinoid insecticides: synthetic versions of nicotine compounds produced by Solanaceae plants (e.g. tobacco, tomatoes, potatoes) to kill insect pests.

Aphids feeding

Neurotoxins: disrupt nervous system communication to and from nerves, muscles, organs, and brain.




A sugar granule’s weight of neonics, enough to kill 125,000 honeybees.

Neonicotinoids are the most widely used insecticide in Midwest, U.S., and globally

Primary Applications:

- Seed dressing (~ 90% of use in Midwest)
- Foliar sprays
- Granulated
- Root drenches
- Baits
- Topical

500+ different products containing neonics labeled for use in Wisconsin

Neonic Properties:

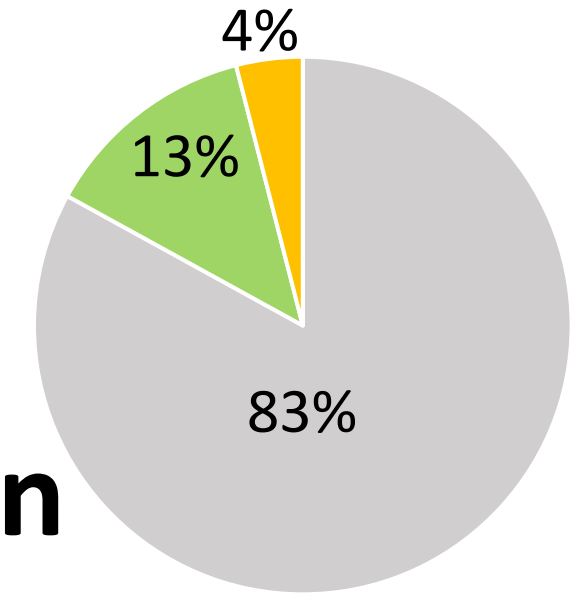
- Water soluble
- Mobile in environment
- Long - lived (7 – 6000 day ½ lives)
- > 90% washes off crop seeds and not taken up by the crop plants

Benefits of Neonic Use to Grain Producers*

Comparisons of **crop yields** when using neonic-treated versus untreated seeds

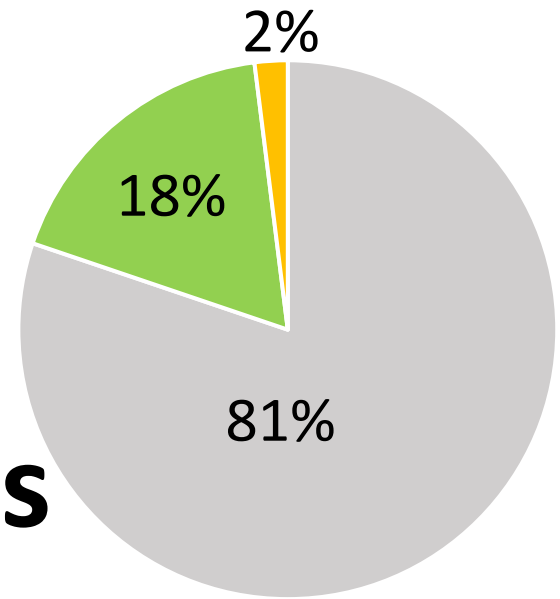
- Yield Increase
- Yield Decrease
- No Change

Corn



331 Field Trials:
15 States, 2 Provinces

Soybeans

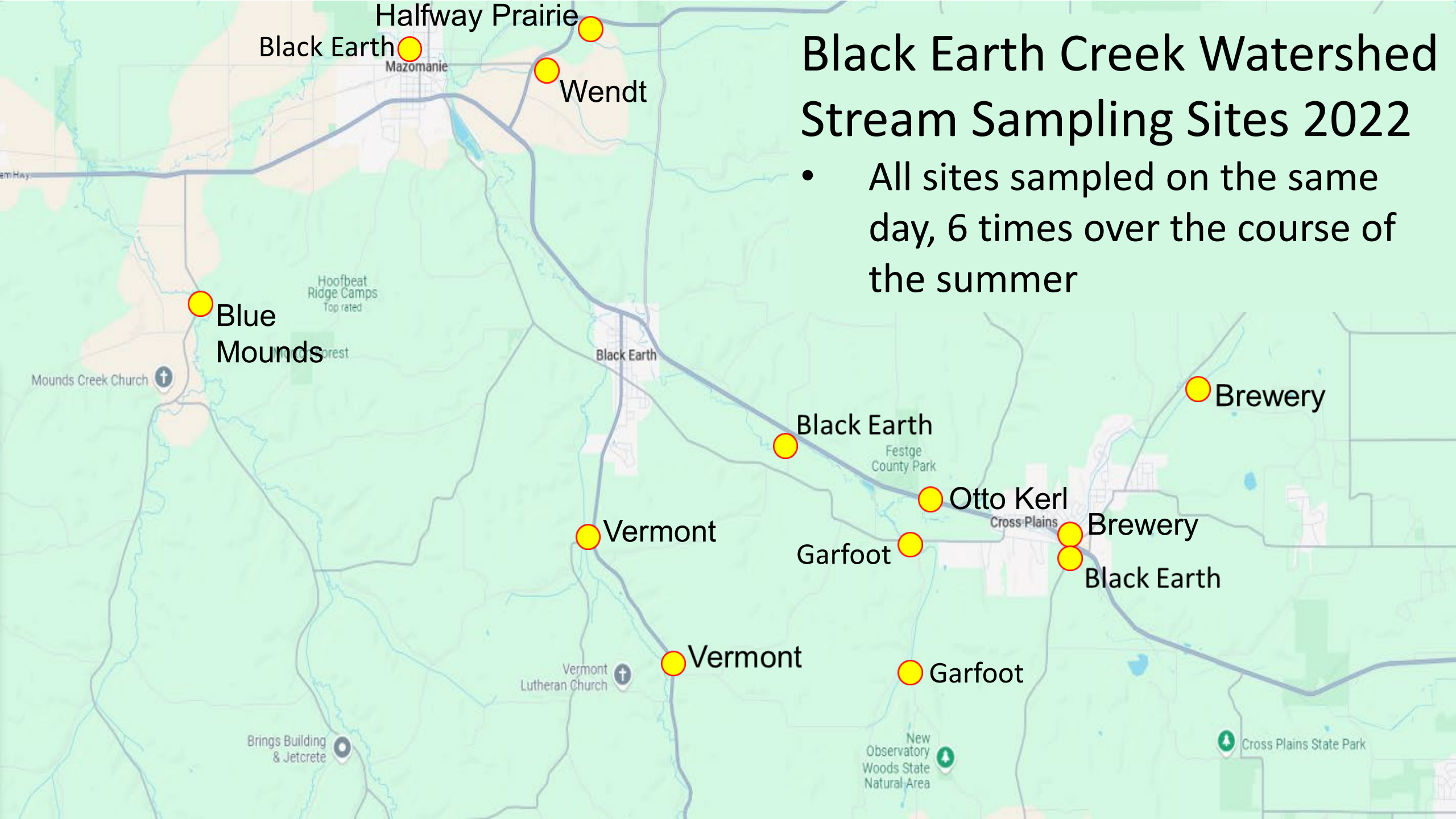


347 Field Trials:
22 States, 2 Provinces

*UW-Madison, Mourtzinis et al. 2019
*Cornell Univ., Grout et al. 2020

Overview:

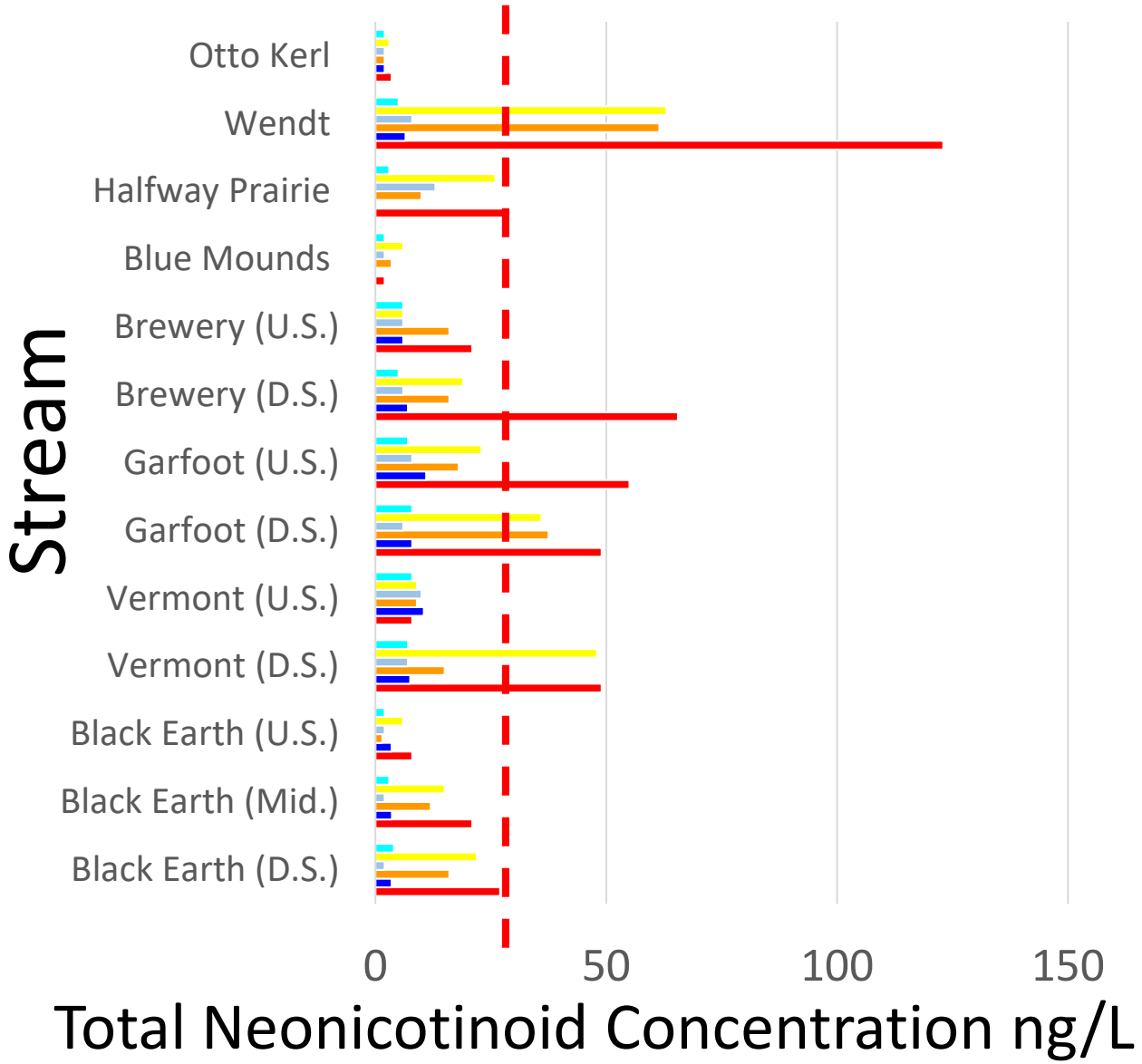
- Risks Neonicotinoids Pose
- Neonics in Black Earth Creek Watershed
- Statewide Stream Survey Findings



Black Earth Creek Watershed Stream Sampling Sites 2022

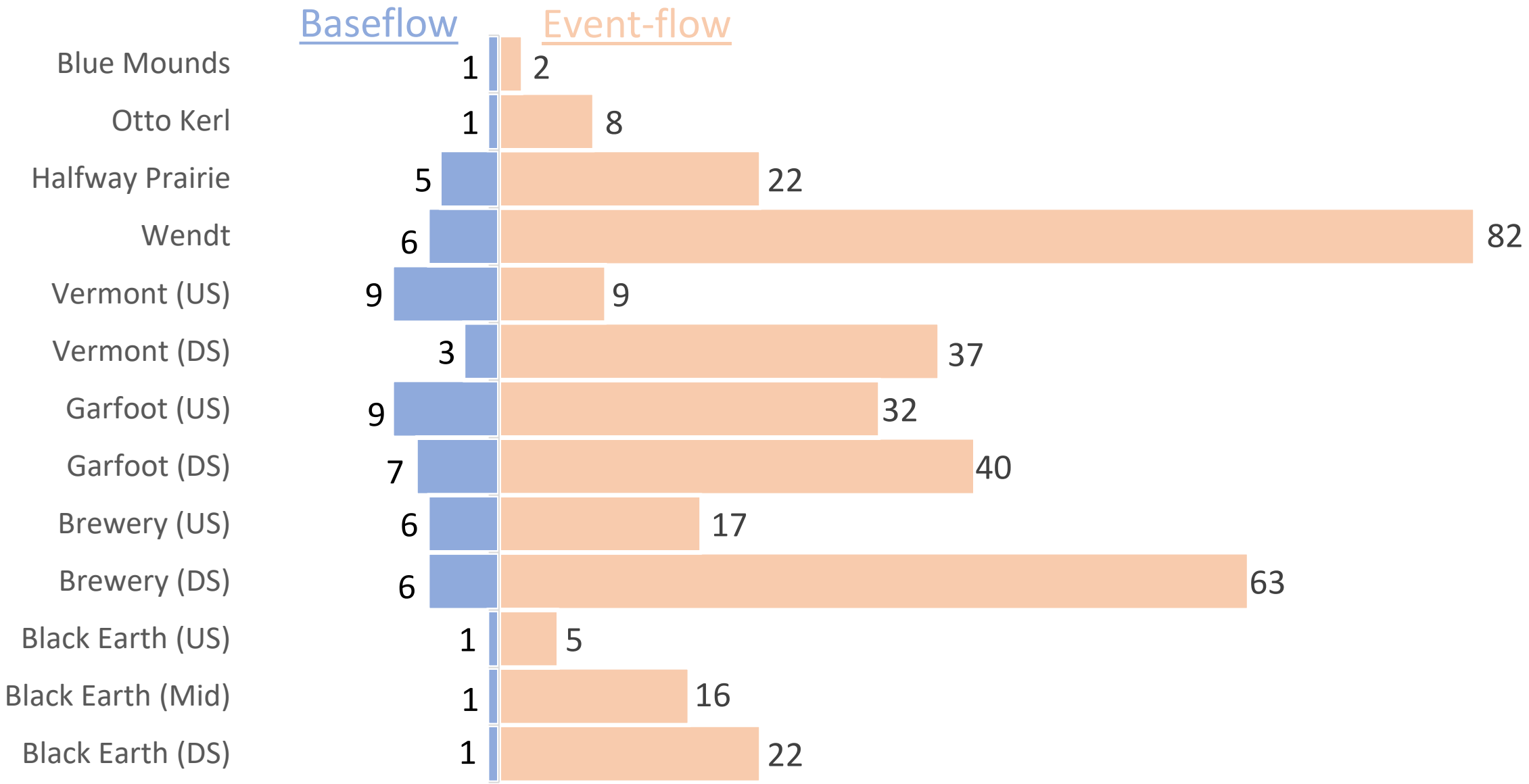
- All sites sampled on the same day, 6 times over the course of the summer

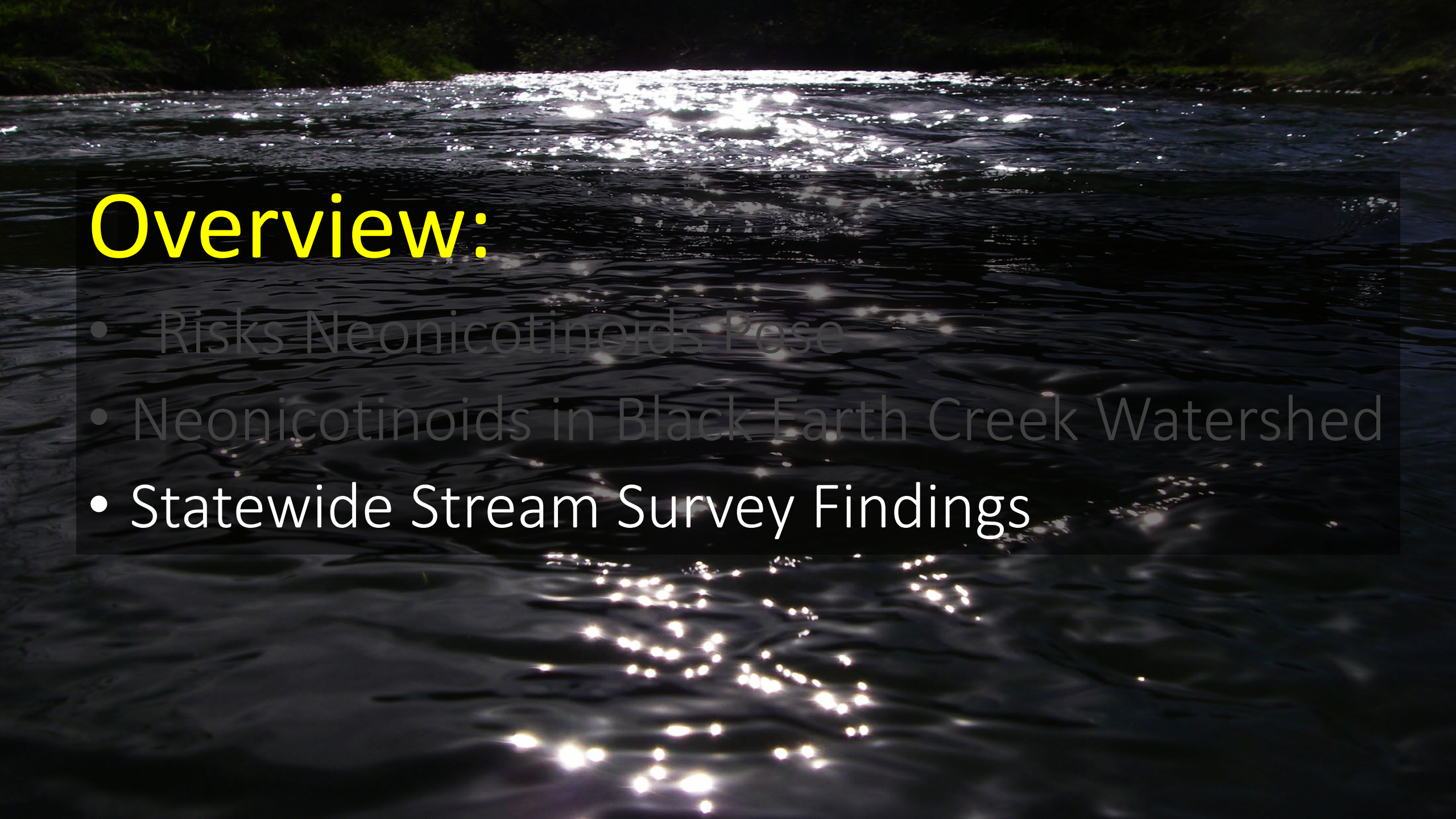
Total neonic concentrations at each site visited bi-weekly May – August 2022 (n = 6)



Threshold for chronic toxicity
35 ng/L (Morrissey et al. 2015)

Average Total Neonicotinoid Concentrations (ng/L) in Black Earth Creek Watershed Streams During Baseflow and Event-flow Conditions





Overview:

- Risks Neonicotinoids Pose
- Neonicotinoids in Black Earth Creek Watershed
- Statewide Stream Survey Findings

Pesticides and Transformation Compounds Found in Wisconsin Streams and Rivers 2022

Neonicotinoids

Found at every sample site in state

Acetachlor
Alachlor
Metolachlor
Metalaxyl
Tetrhydrophthalimide
Aldrin
Dimethachlor
Atrazine
Propachlor
Procymidone
Clothianidin
Diphenylamine

Azoxystrobin
Biphenyl
Sulfentrazone
Aldicarb sulfoximide
Bifenthrin
Chlorantraniliprole
Terbutylazine
Meviphos
Imidacloprid
Flutolanil
Terbutryn
Thiabendazole
Transfluthrin
Propiconazole
Boscalid
Prothioconazole
Promenton

Flutriafol
Halofenozide
Metribuzin
Fenarimol
Flusilazole
Penconazole
Mesotrione
Tebuconazole
Thiamethoxam
BHC, delta-
Tetraconazole
Cyromazine
Paclobutrazol
Aminacarb
Cyproconazole
Pymetrozine
Linuron
Tetrachloroanaline
2,3,5,6-Ethiprole
Thiofanox
Tricyclozole
Dicrotophos
Etaconazole
Flonicamid
Mycloburtanil
Propamocarb
Metconazole
Picoxystrobin

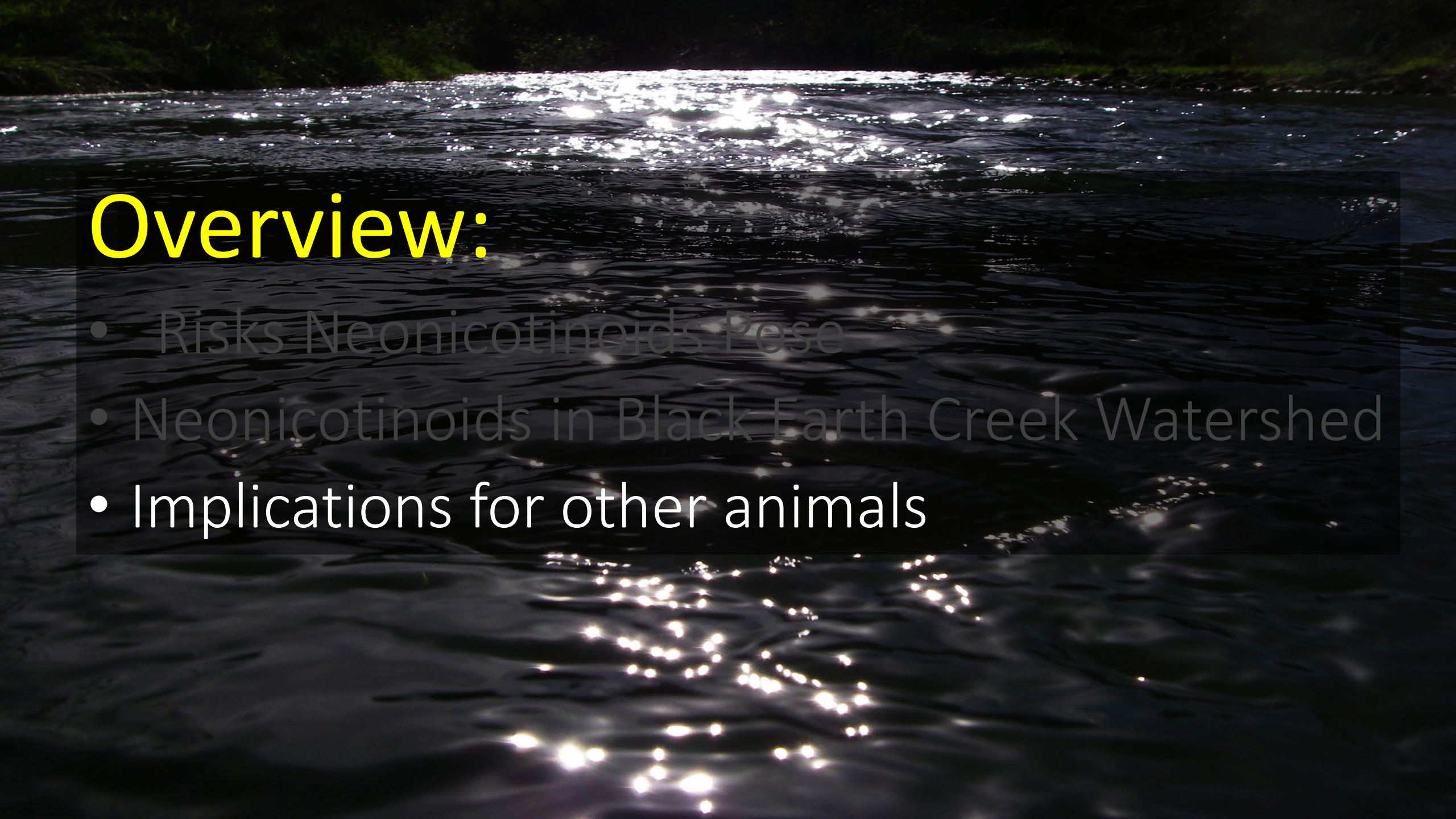
Norflurazon
Fluoxastrobin
Dimethomorph
Fenhexamid
Methooxyfenozide
Bromuconazole
Nuarimol
Tebufenozide
Triadimefon
Terbacil
Benalaxyl
Diclobutrazol
Dimoxystrobin
Epoxiconazole
Flufenacet
Hexaconazole
Mepronil
Pirimicarb
Tebuthiuron
Mandipropamid
Mefenacet
Triticonazole
Prometryne
Propoxur
Pentachlorobenzene
Acephate
Mepanipyrim
Methiocarb
Methomyl

Methoprotryne
Siduron
Monocrotophos
Cymoxanil
Iprovalicarb
Simetryn
Difenoconazole
Chloroxuron
Cycluron
Forchlorfenuron
Furalaxyl
Isoproturon
Fenuron
Metobromuron
Oxadixyl
Piperonyl butoxide
Trifloxystrobin
Acetamiprid
Clofentezine
Ethirimol

Phenmediphama
Zoximide
Carfentrazone ethyl
Aldicarb sulfone
Bifenazate
Bitertanol
Carbofuran
Chlorotoluron
Clethodim
Diethofencarb
Dimethoate
Diuron
Fluometuron
Fuberidazole

Methabenzthiazuron
Methamidophos
Monolinuron
Nitenpyram
Propham
Spirotetramat
Teflubenzuron
Thiobencarb

- Pesticides found in at all sites including forested north
- 9 – 84 compounds per site
- Median number of 21 compounds per site



Overview:

- Risks Neonicotinoids Pose
- Neonicotinoids in Black Earth Creek Watershed
- Implications for other animals

Aquatic Insects, food for:

- Fish
- Frogs,
- Birds,
- Bats,
- Turtles
- Snakes
- Salamanders,
- Other insects,
- Other invertebrates,
- Mammals (large and small),
- List goes on…

Jeninga et al. 2023. (Fathead Minnow Larvae)

- 160 ng/L Exposure to Clothianidin resulted in 10% Mortality

U.S. Bird Population Declines

- Estimated 25% decline (3 billion birds) since 1970
- 304 species where insects are essential
- 64 species where insects are not essential

800,000 Private Wells in WI

40% (of 380 tested) had detectable concentrations of pesticides

½ of compounds detected not regulated in groundwater by State or Federal government

Neonic Effects on Deer Berheim et al. 2019

- Decreased jawbone length
- Decreased body and organ weights: (liver, spleen, genitals)
- Increased fawn mortality (still births)
- Decreased thyroxine levels
- Lethargy

Human Health

- Half of Americans exposed to neonics on any given day. (CDC, 2019)

Study of 171 pregnant women across U.S., >95%, had neonics in their bodies (Buckley 2022)

Exposure linked to potential:

- Birth defects in heart and brain
- Autism-like symptoms
- Cognitive impairment

Review:

- Extensive use, toxicity, mobility, and persistence of neonics pose significant environmental risks.
- Cursory 2022 assessment of neonics in Black Earth Creek Watershed and streams and rivers statewide suggest impacts to aquatic life.
- Pesticide risks are not limited to aquatic life.


Questions?
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