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DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF CLEAN WATER

Emerging Contaminants in Pennsylvania

Water Resources Advisory Committee

July 25, 2019

Tom Wolf, Governor

Patrick McDonnell, Secretary

Emerging Contaminants

- Contaminants of emerging concern (CECs) are those that were either not detected previously or are now found in higher concentrations than the past.
- They are NOT necessarily “new” compounds.
- These include many categories of chemicals.

Endocrine Disrupting Chemicals

- Many CECs are endocrine disrupting chemicals (EDCs).
- EDCs change the normal function of hormones in organisms.
- This can lead to reproductive and other effects, often at extremely low levels.
- For many of these compounds there are no benchmarks or water quality standards.

https://www.epa.gov/wqc/contaminants-emerging-concern-including-pharmaceuticals-and-personal-care-products

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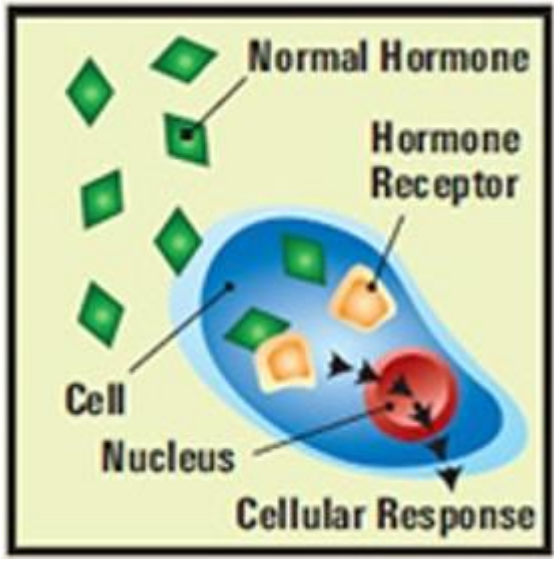
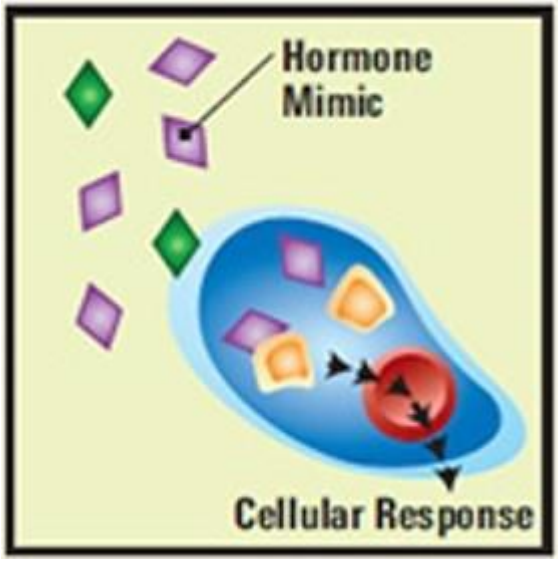
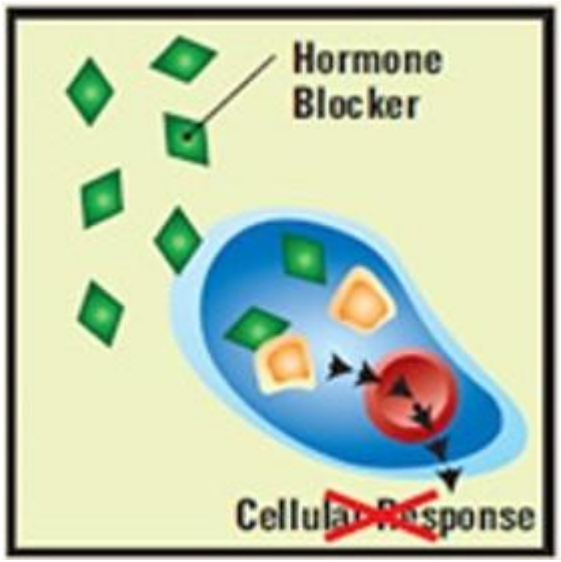
Endocrine Disrupting Chemicals

- Disruption of the endocrine system can cause issues with development, reproduction, cancer, and the immune/nervous systems.
- EDCs can mimic hormones, or stimulate/inhibit endocrine processes.







Picture credits: National Institutes of Health

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Susquehanna River Study

PA Fish & Boat Commission

- In the early 2000s, PA Fish & Boat Commission & anglers found smallmouth bass with lesions/other maladies and low numbers of both adults & young-of-year (YOY).
- Intensive study began by DEP in 2012 to find causes.

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Susquehanna River Study

Initial purposes of study:

- Determine if emerging contaminants are contributing to smallmouth bass die-offs in Susquehanna River watershed.
- Determine levels of emerging contaminants in surface waters.
- Assess attainment of Aquatic Life & Recreational Uses of the mainstem Susquehanna River.

Susquehanna River Study

Evolving purposes of study:

- Determine concentrations and extent of emerging contaminants in water & sediment throughout the state.
- Explore sources (i.e. sampling upstream and downstream point source discharges).

Emerging Contaminants

Emerging contaminants/ endocrine disruptors among the parameters studied in:

- Passive water samples
- Sediment samples
- Water grab samples

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Passive Water Samplers

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Passive Water Samplers

Polar Organic Chemical Integrated Sampler (POCIS):

Semi-Permeable Membrane Device (SPMD):

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Passive Water Samplers - Deployment

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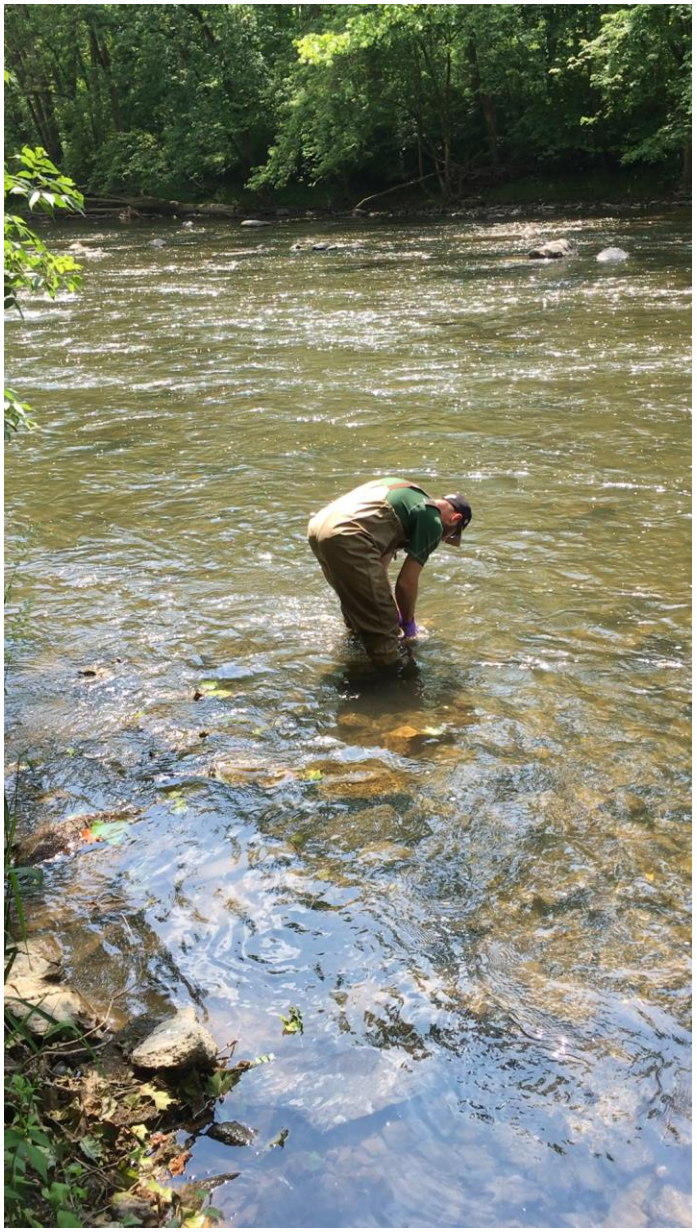
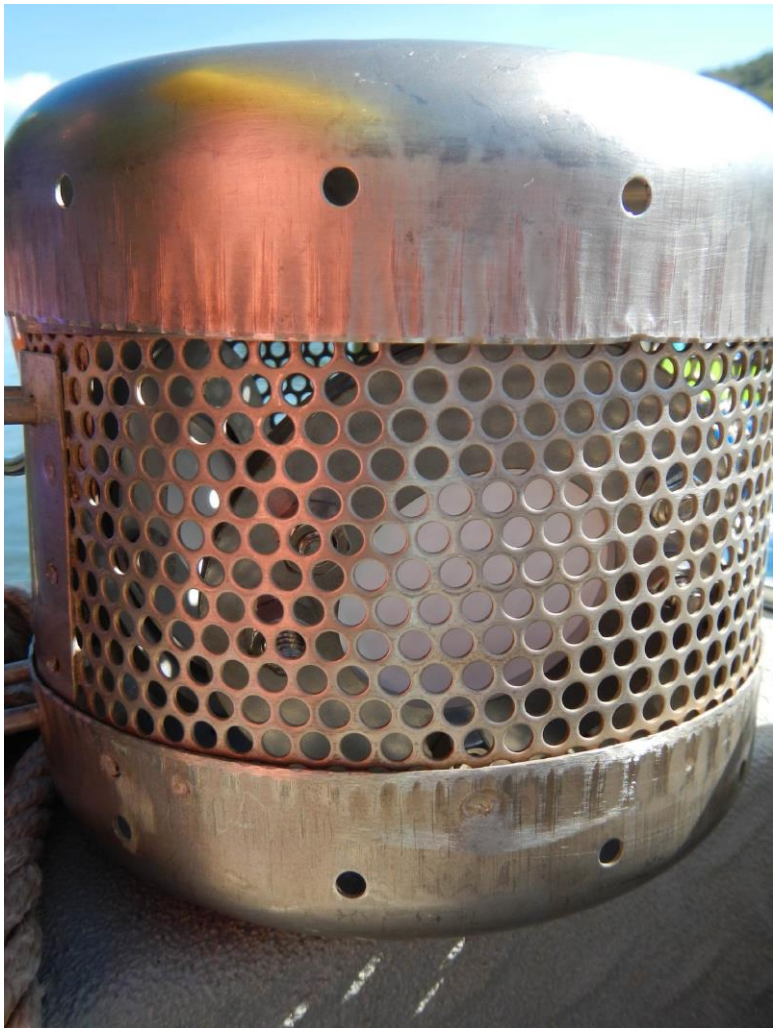
Passive Water Samplers - Retrieval



Testing began in 2012 with four locations:
3 Susquehanna @ Harrisburg
1 Delaware @ Morrisville

Increased to >70 locations total by 2018.



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Passive Samplers - Compounds Sampled

- **Total estrogenicity/hormones**
- **Pharmaceuticals**
- **Various wastewater compounds**
- **Pesticides (current & historical)**
- **PCBs**
- **PBDEs**
- **PAHs**

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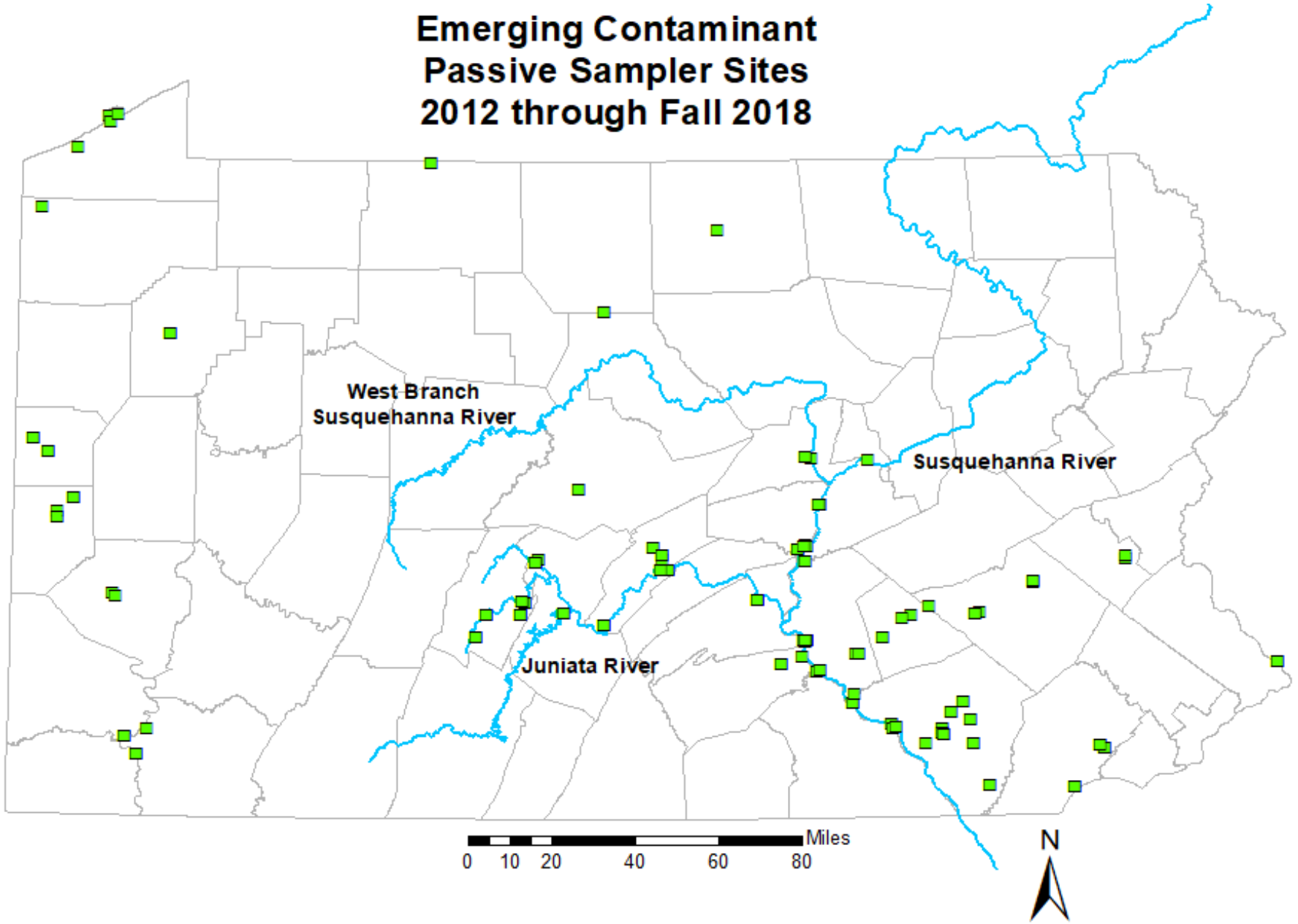
Emerging Contaminant Passive Sampler Sites 2012 through Fall 2018



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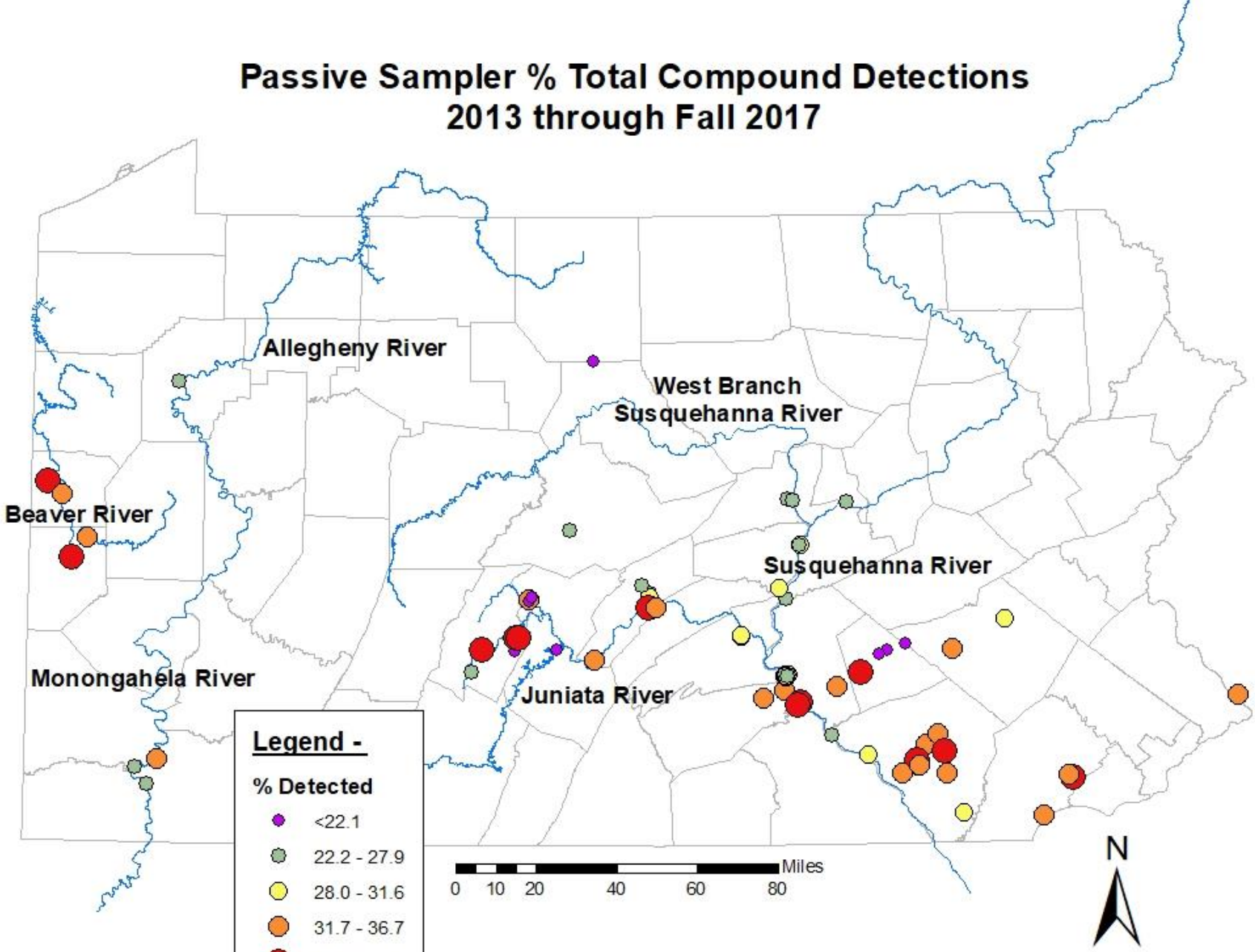
Passive Sampler % Total Compound Detections
2013 through Fall 2017



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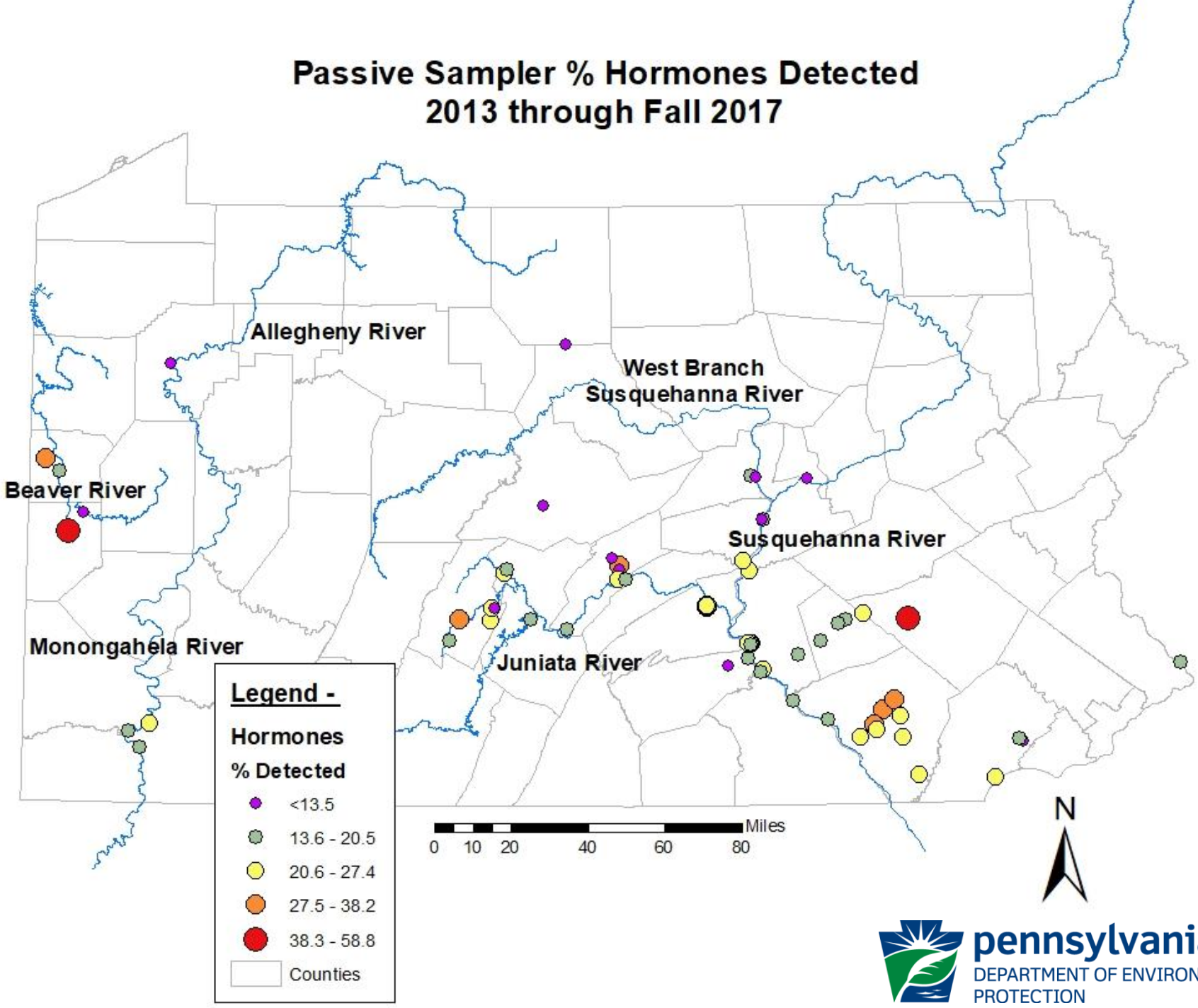
Passive Sampler % Hormones Detected
2013 through Fall 2017



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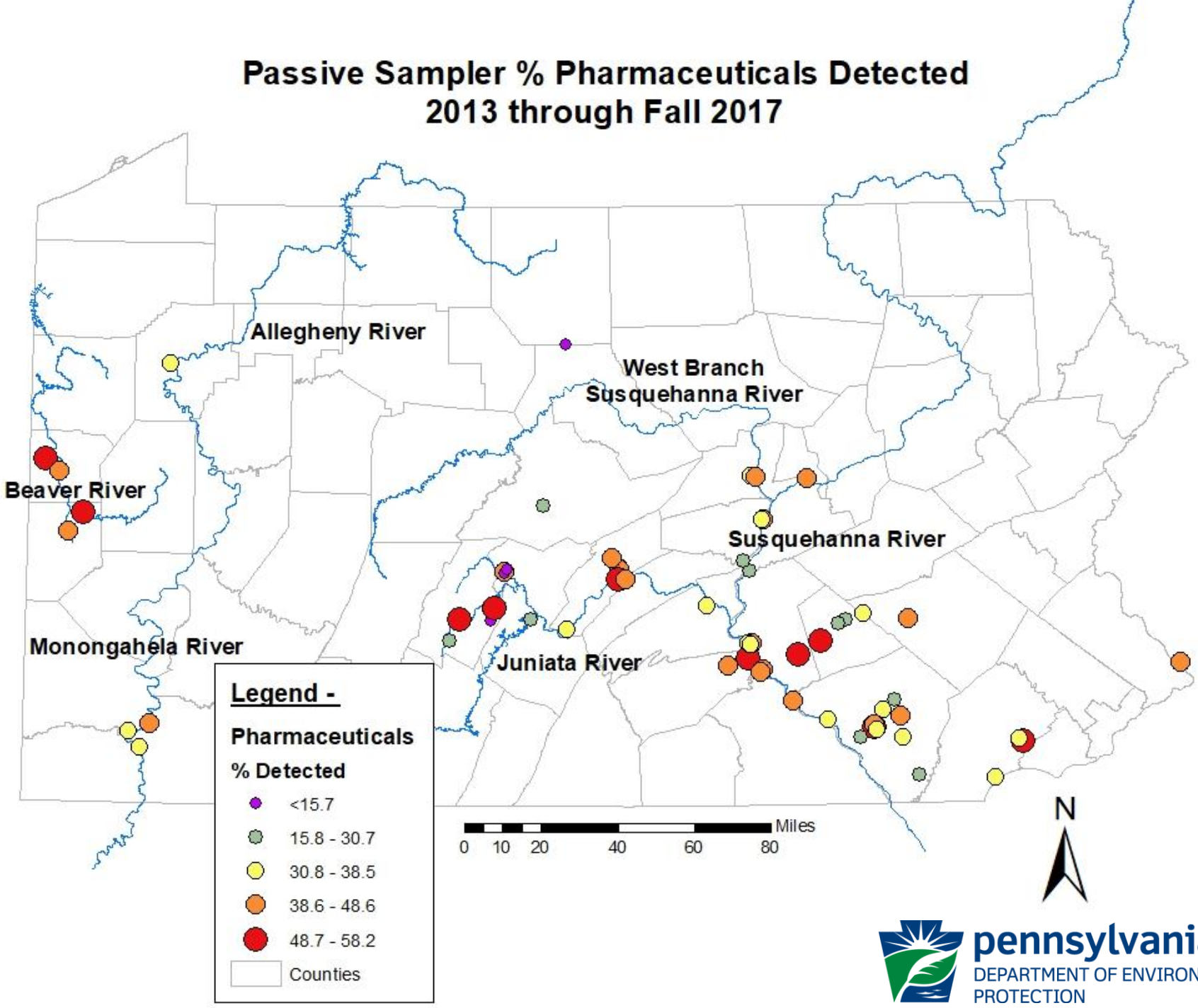
Passive Sampler % Pharmaceuticals Detected
2013 through Fall 2017



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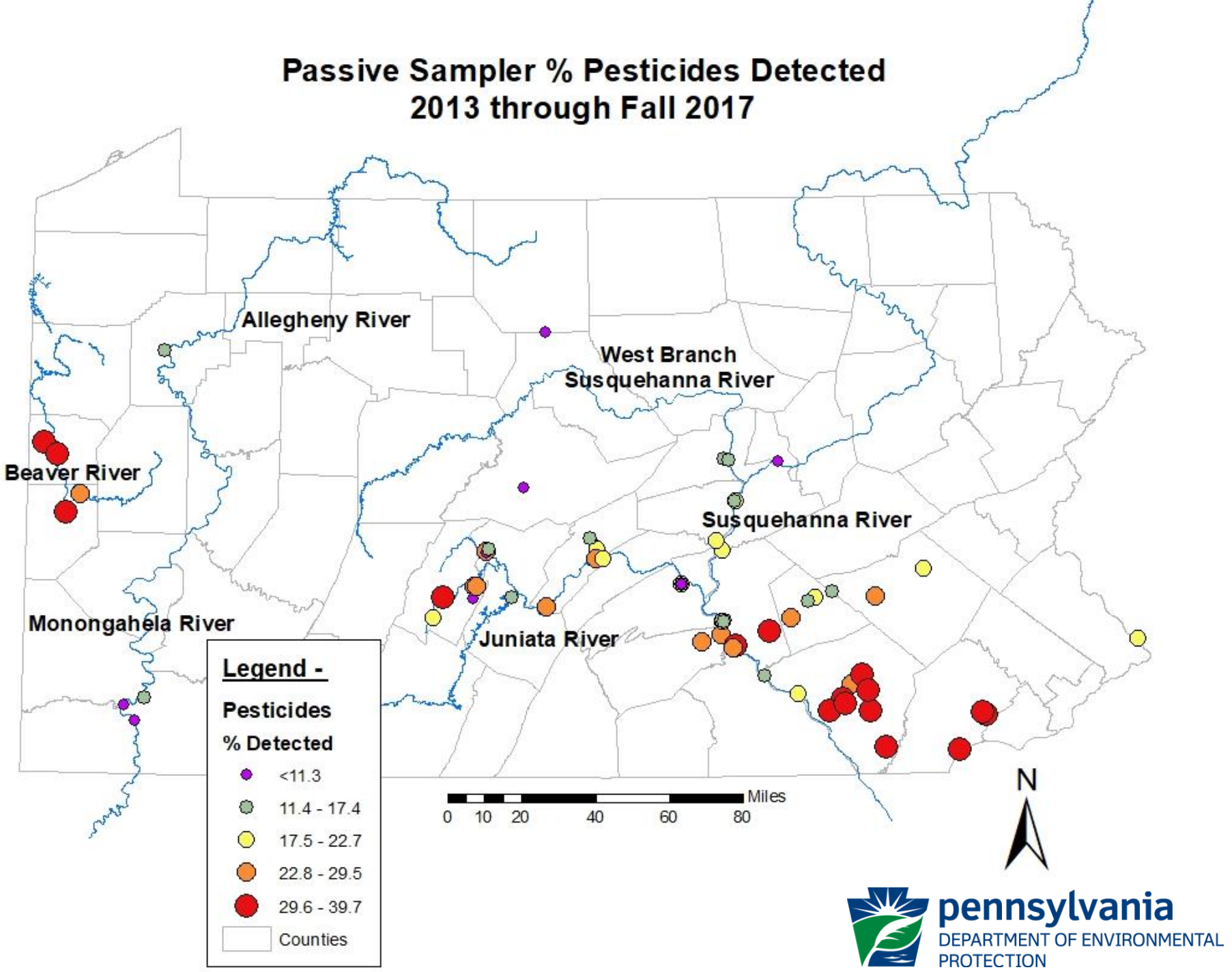
Passive Sampler % Pesticides Detected
2013 through Fall 2017



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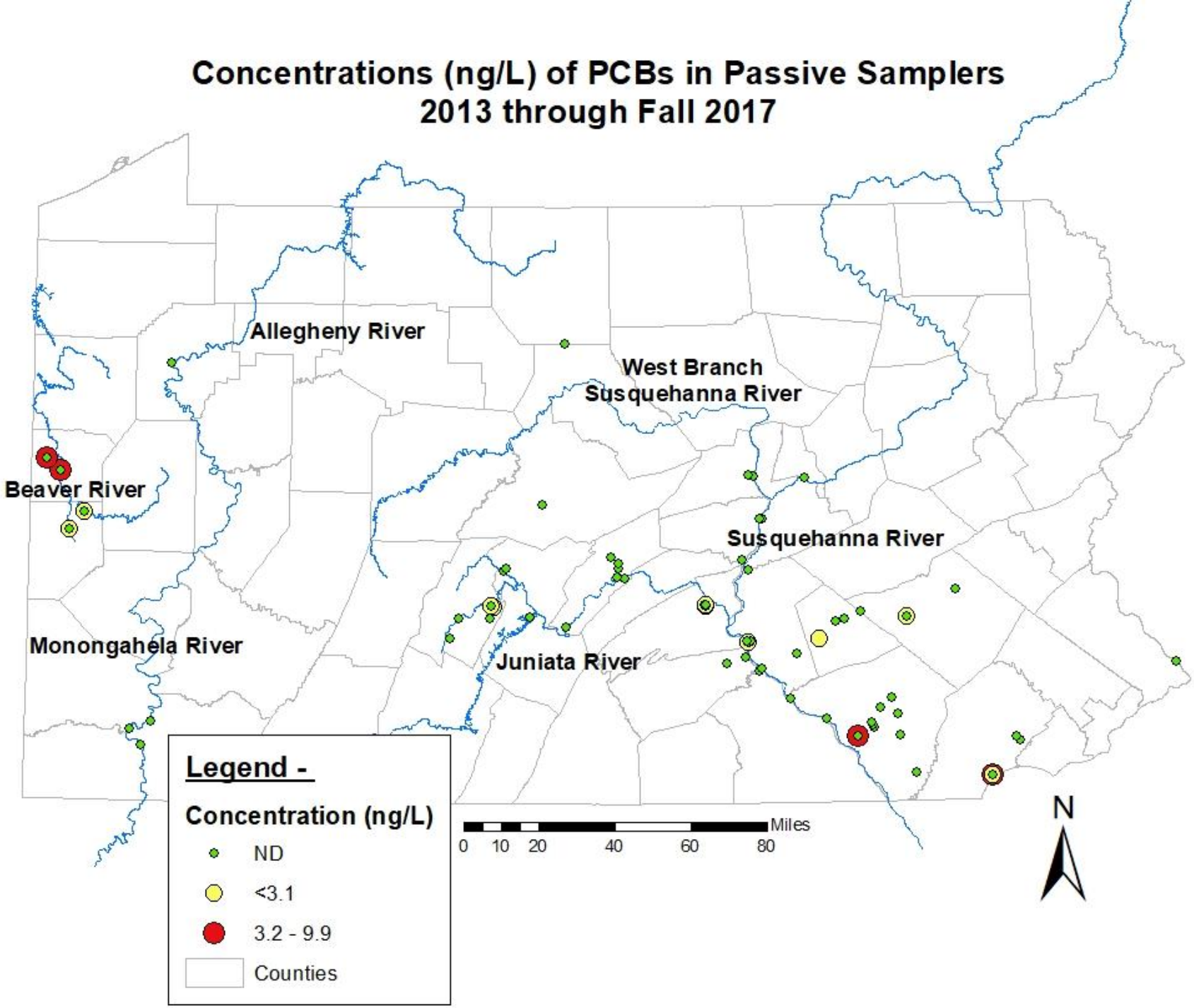
Concentrations (ng/L) of PCBs in Passive Samplers 2013 through Fall 2017



Sediment Samples

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Sediment - Collection

Sediment - Collection

Sediment - Compounds Sampled

- Pesticides
- Various wastewater compounds
- Hormones
- Metals

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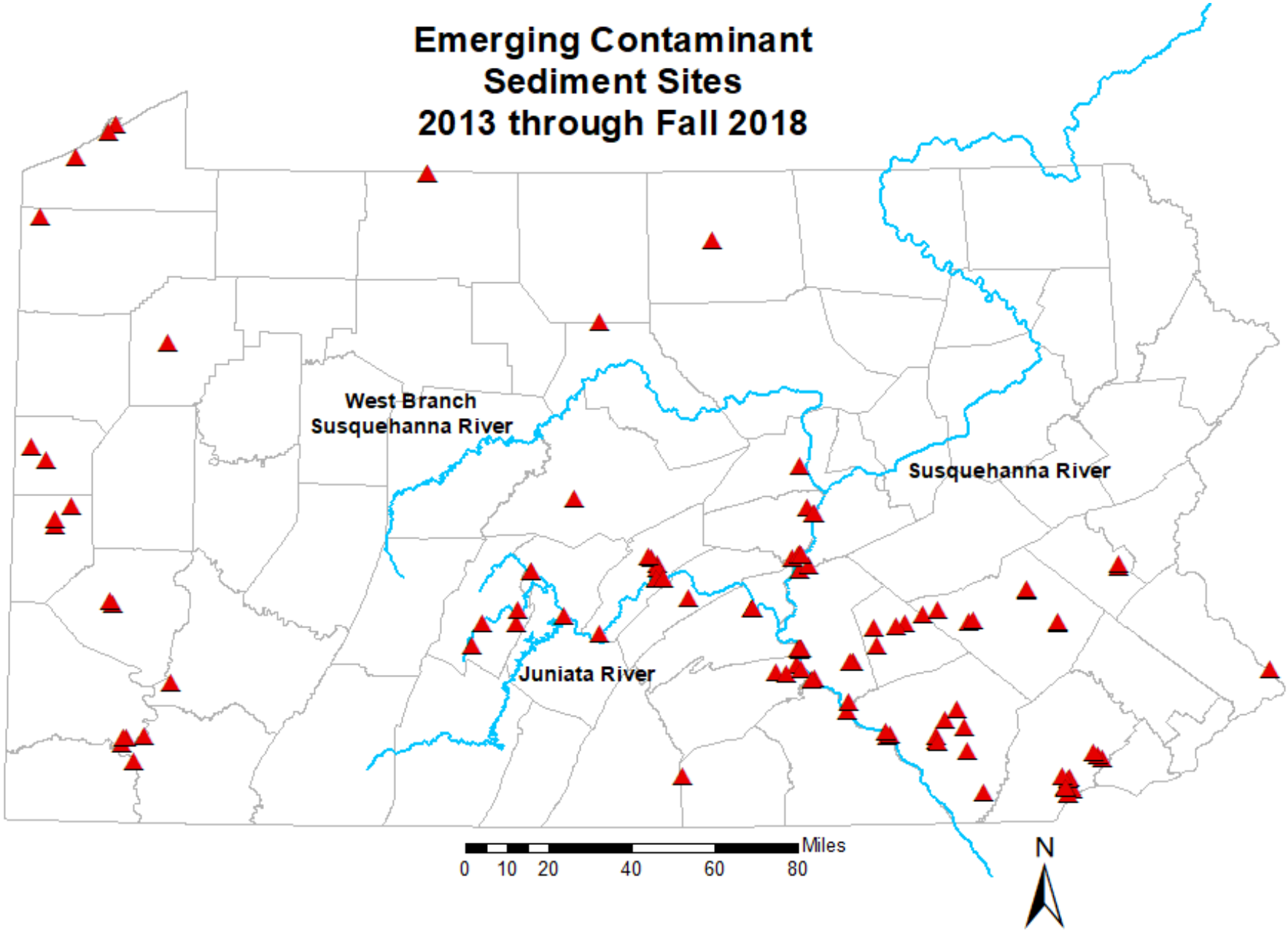
Emerging Contaminant Sediment Sites 2013 through Fall 2018



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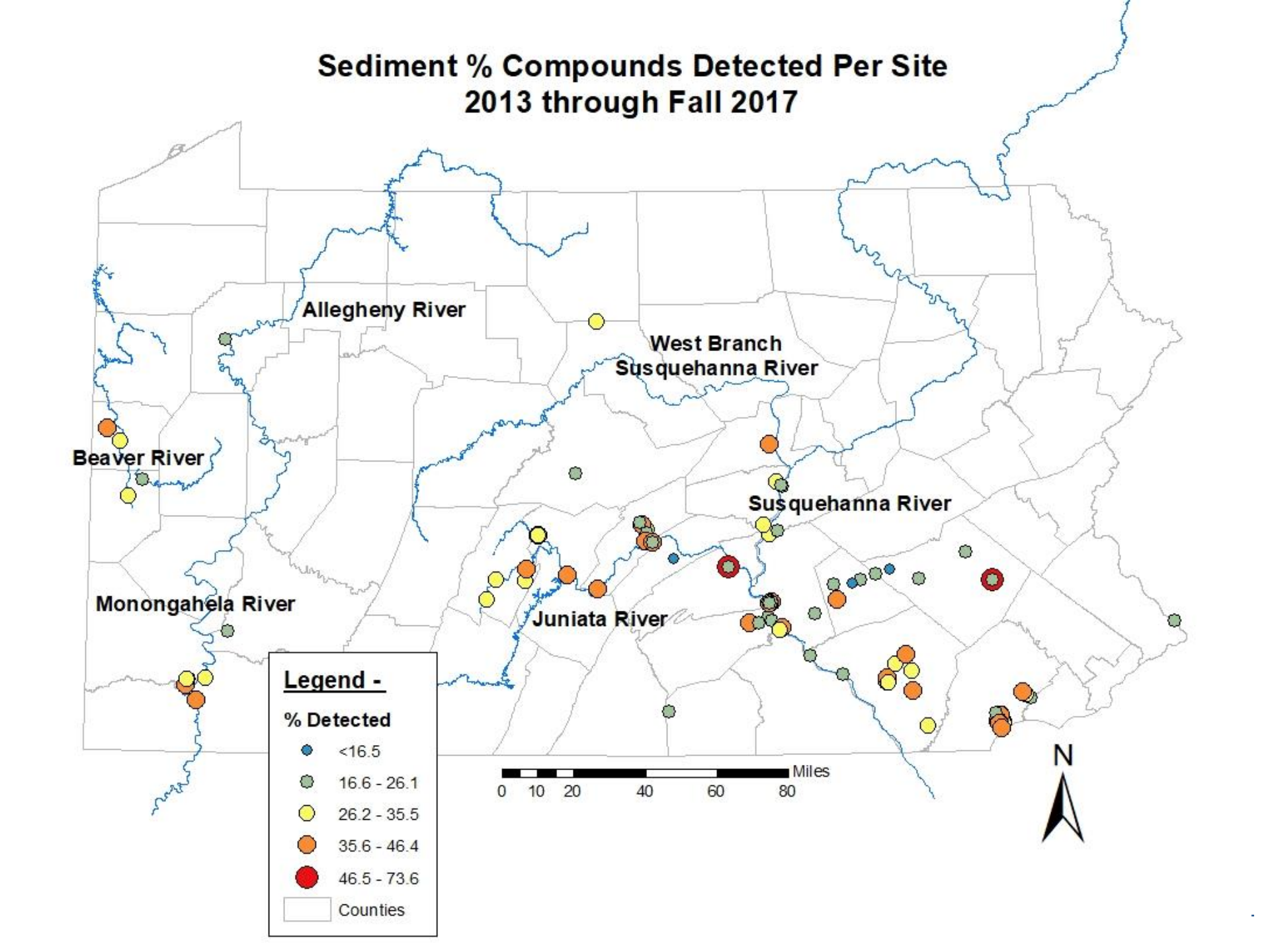
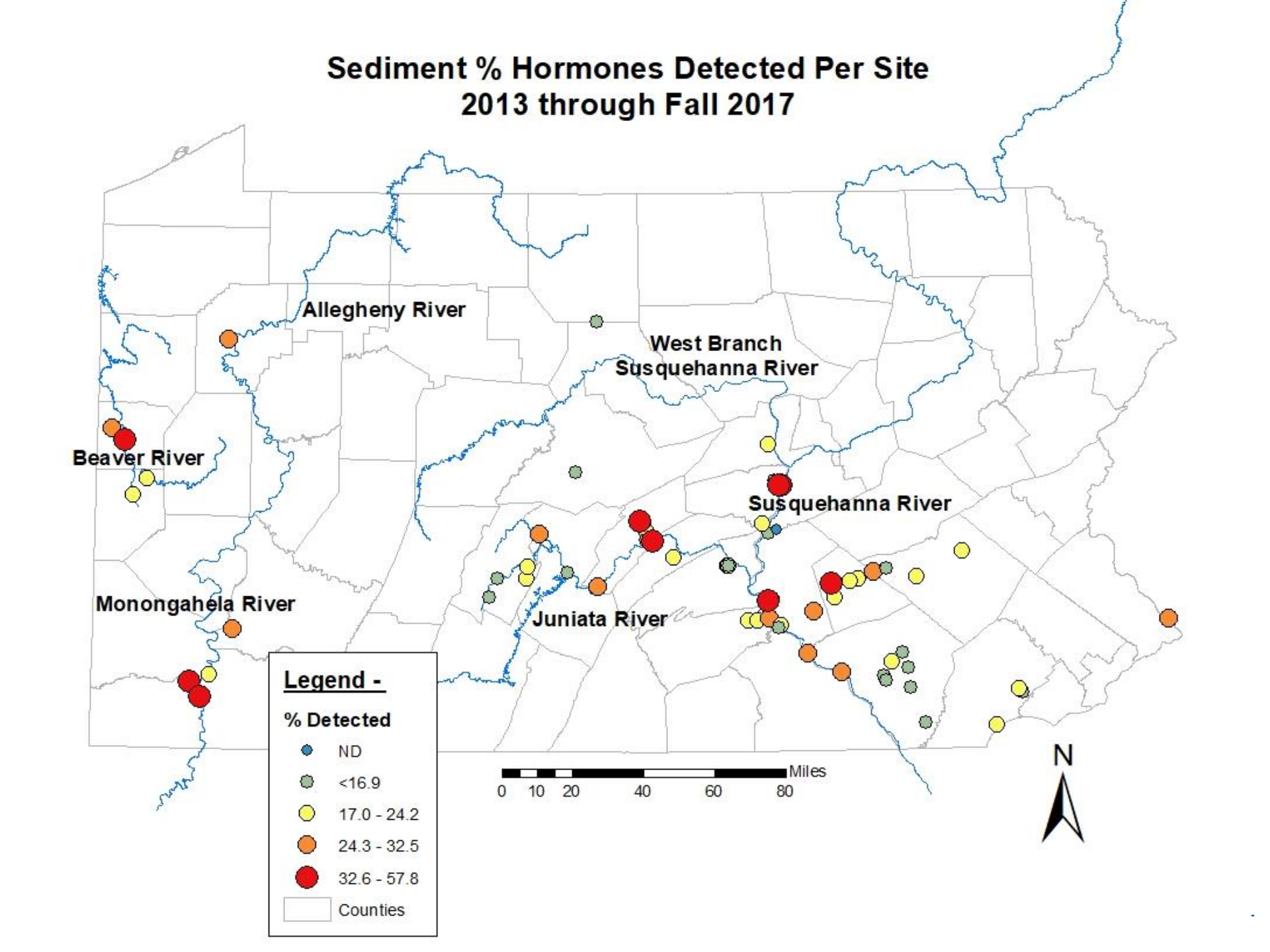
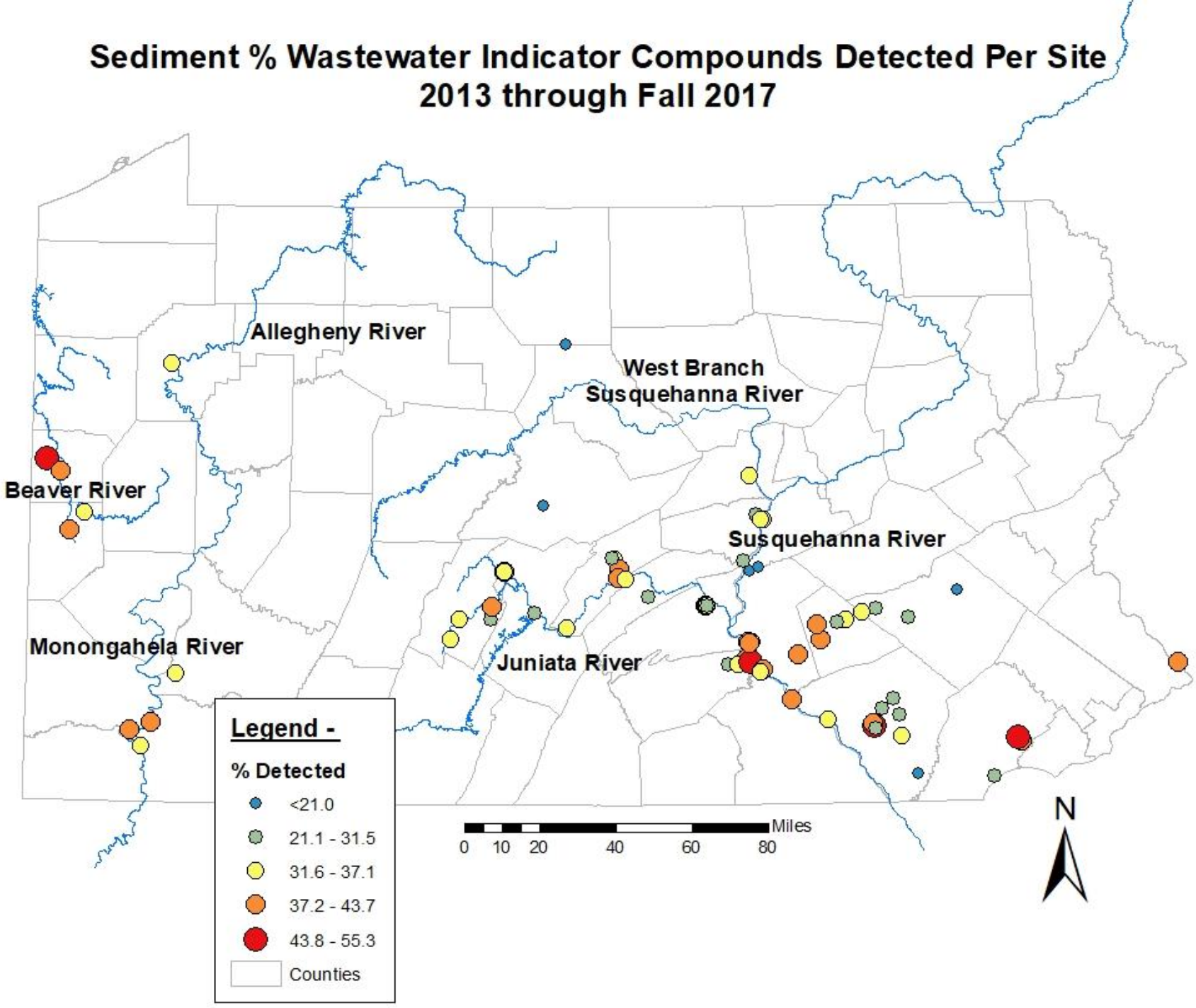

Sediment % Compounds Detected Per Site
2013 through Fall 2017
Allegheny River
West Branch
Susquehanna River
Beaver River
Susquehanna River
Monongahela River
Juniata River
Legend -
% Detected
<16.5
16.6 - 26.1
26.2 - 35.5
35.6 - 46.4
46.5 - 73.6
Counties
0 10 20 40 60 80
Miles
N


Sediment % Hormones Detected Per Site
2013 through Fall 2017
Allegheny River
West Branch
Susquehanna River
Beaver River
Susquehanna River
Monongahela River
Juniata River
Legend -
% Detected
ND
<16.9
17.0 - 24.2
24.3 - 32.5
32.6 - 57.8
Counties
0 10 20 40 60 80
Miles
N

Sediment % Wastewater Indicator Compounds Detected Per Site
2013 through Fall 2017



Grab Samples

- Total estrogenicity
- Pesticides
- Triazine pesticides
- Glyphosate

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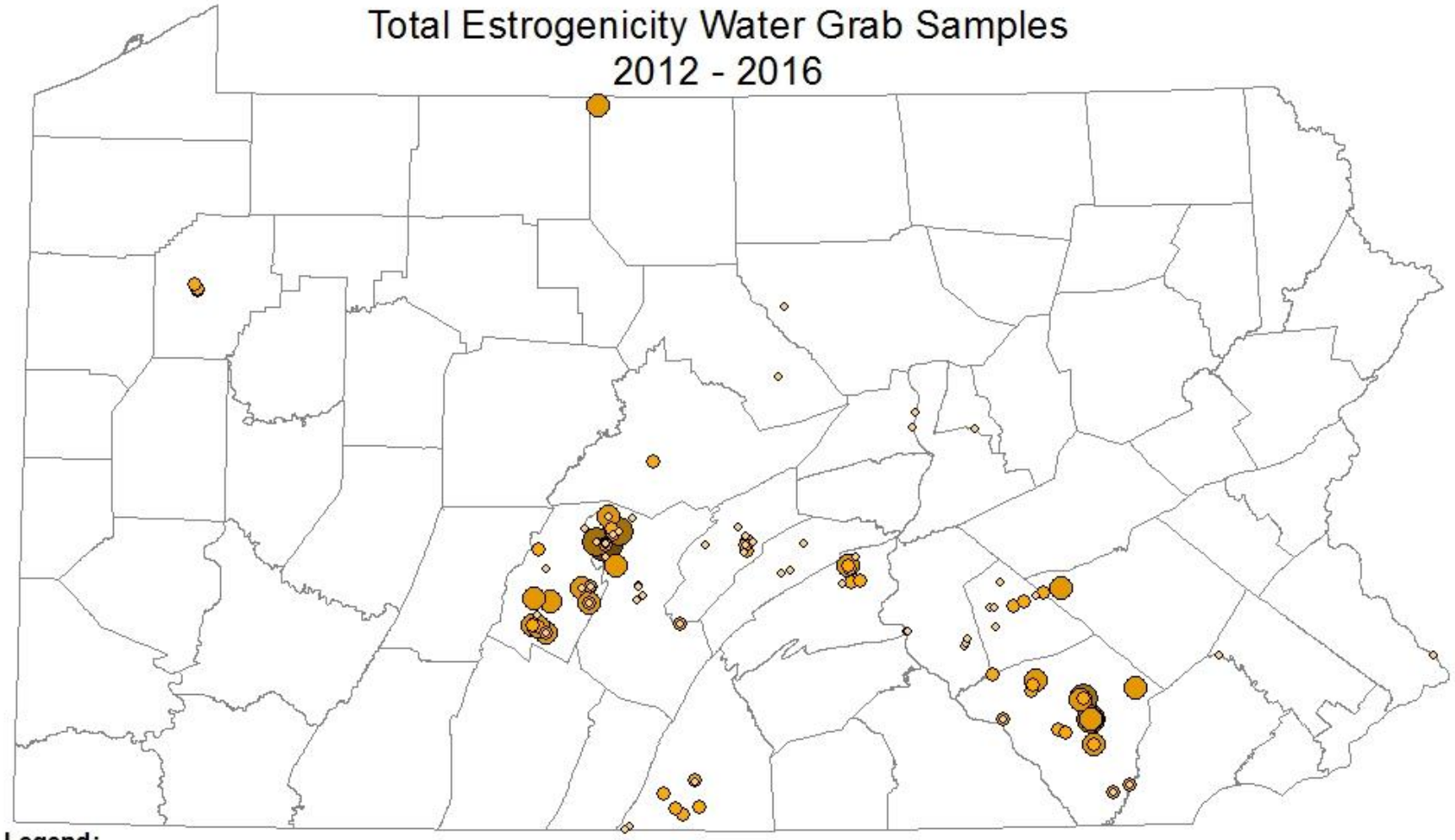
Estrogenicity of Samples

Total estrogenicity/estimated estradiol equivalent (EEQ):

- Measured as a bioluminescent yeast estrogen assay (BLYES)
- Measures all estrogenic activity that affects estrogen receptors
- Particularly important for changes in the reproductive system

Total Estrogenicity Water Grab Samples
2012 - 2016



Legend:

Estimated Estradiol Equivalents (EEQ)

- ND
- 0.18 - 0.73 ng/L
- 0.731 - 1.60 ng/L
- 1.61 - 2.72 ng/L
- 2.721 - 5.44 ng/L
- Counties

0 12.5 25 50 75 100 Miles

N

Take-home points

- **Hormones = ag areas**
- **Pesticides = ag areas**
- **Wastewater indicators = ubiquitous**
- **Control areas impacted**
- **Reference-quality sites = good**
- **Still receiving & analyzing data**

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Current & Future Plans

- Passive sampling to occur at 21 WQN sites in summer 2019 (including PFAS)
- Total estrogenicity grab sampling at 11 springs in summer 2019
- Analyses continue:
  - Presence/absence of compounds
  - Quantitative analyses of compounds
  - Comparison of compound detection vs. fish health sites
  - New ways to interpret data constantly underway
- Story Map(s) will be published
- Data to be available
- Documents to be published at:

https://www.dep.pa.gov/Business/Water/CleanWater/WaterQuality/Pages/CECs.aspx

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Bureau of Clean Water

Questions?

Amy Williams
717-772-4045
amywilli@pa.gov