



USGS SAMPLING IN THE WILLAMETTE RIVER BASIN

Jennifer Morace, US Geological Survey



NAWQA Program

National Water Quality Assessment



1991-2001

- 51 study units
- Establish a baseline

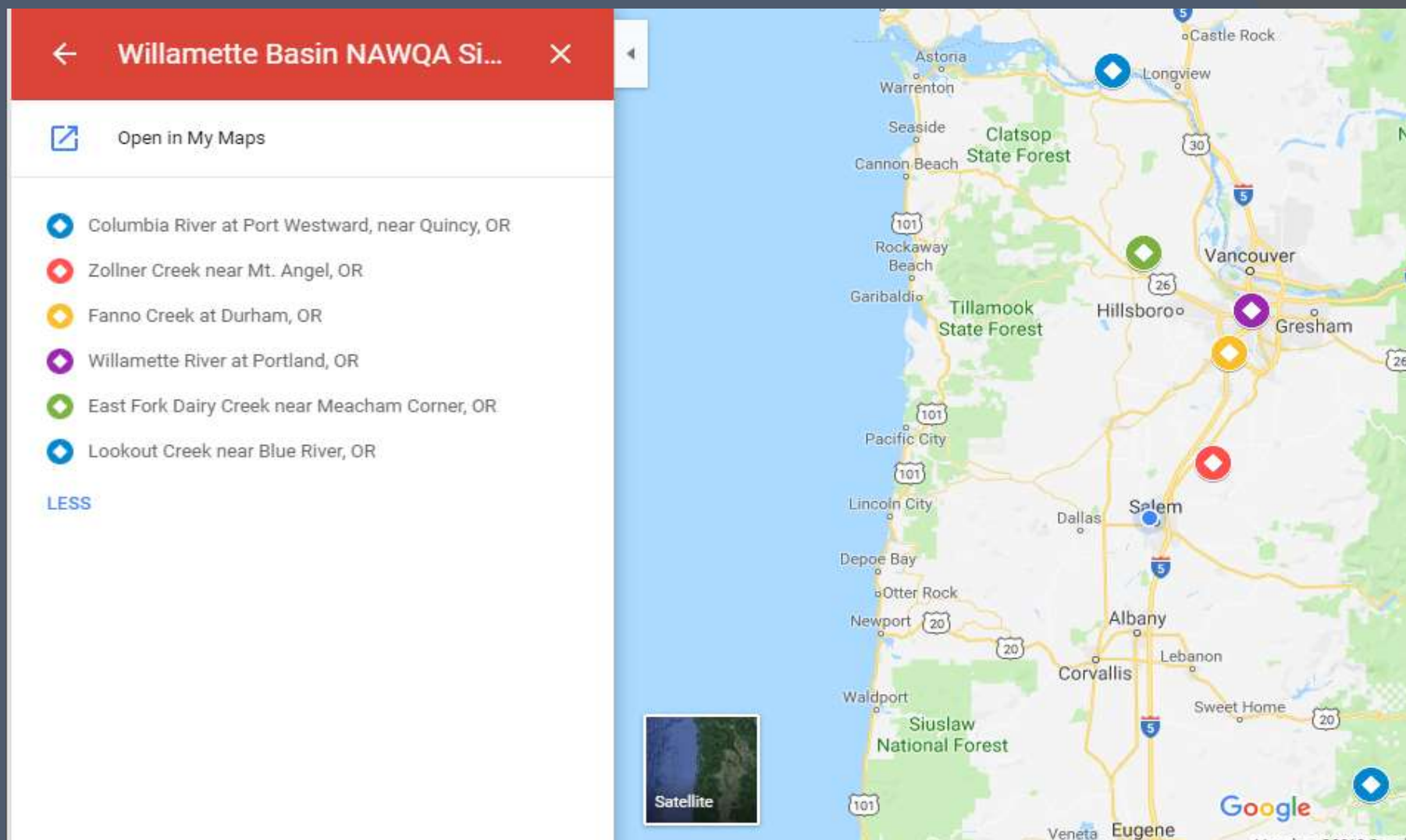
2001-2012

- 42 of 51 study units
 - Establish trends
 - Topical studies

2012-2021

- Continue trends and studies

Willamette Basin NAWQA Sites



What do these sites tell us?

● Indicator Sites

- AG - Zollner Creek near Mt Angel
- URBAN – Fanno Creek near Durham

● Integrator Sites

- Willamette River at Portland
- Columbia River downstream of Longview

● Reference Sites

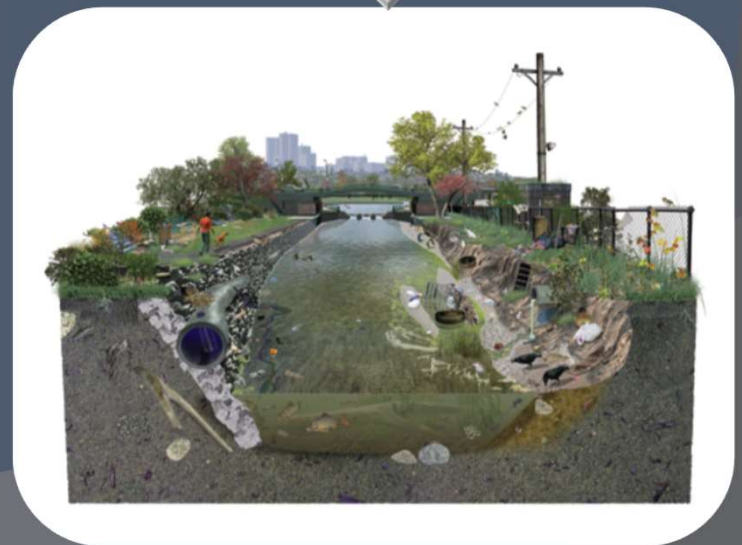
- EF Dairy Creek near Meacham Creek
- Lookout Creek near Blue River

What have we learned?

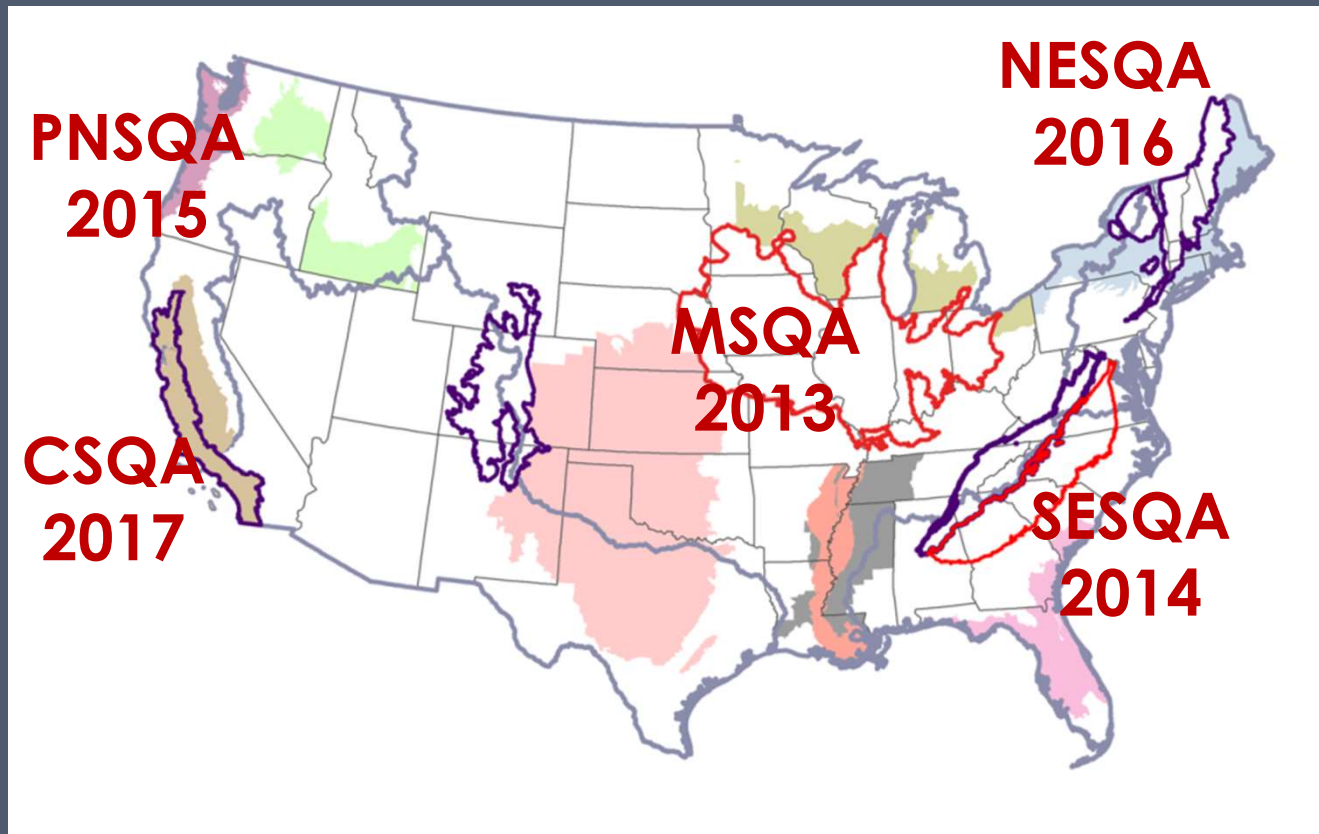
- Where, when, why, and how the Nation's water quality has changed, or is likely to change in the future, in response to human activities and natural factors
 - Cycle 1 – baseline understanding of conditions across the US
 - Cycle 2 – transport mechanisms and pathways
 - Cycle 3 – status, trends, and understanding

RSQA Objectives

- Status of the stream quality in each region
- Relations between stressors and ecological condition
- Relations between environmental setting and stream quality
- Develop regional models of stressors and ecological responses



Regional Stream Quality Assessment (RSQA)

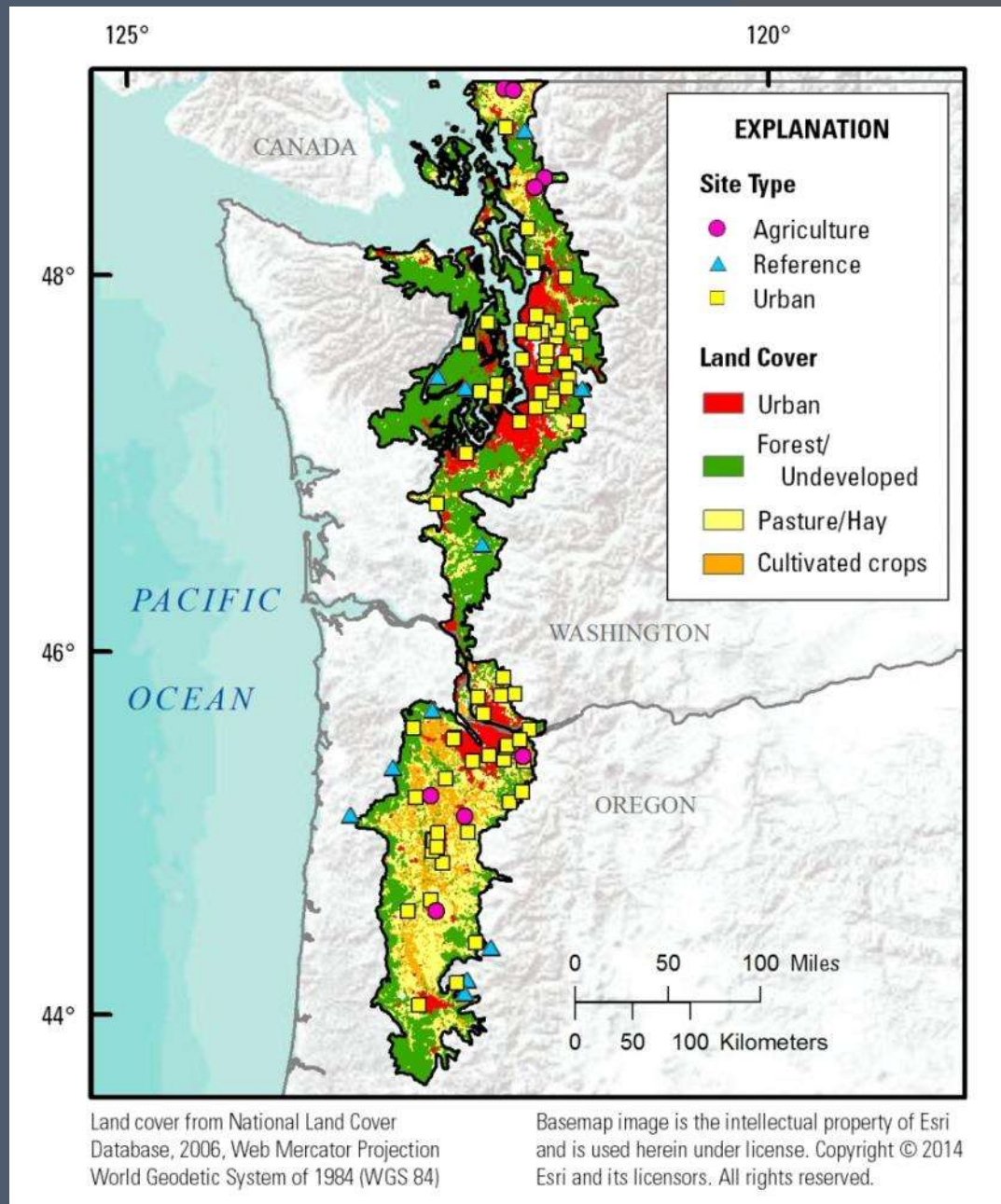


Regional approach to evaluating ecosystem stressors
and their effects

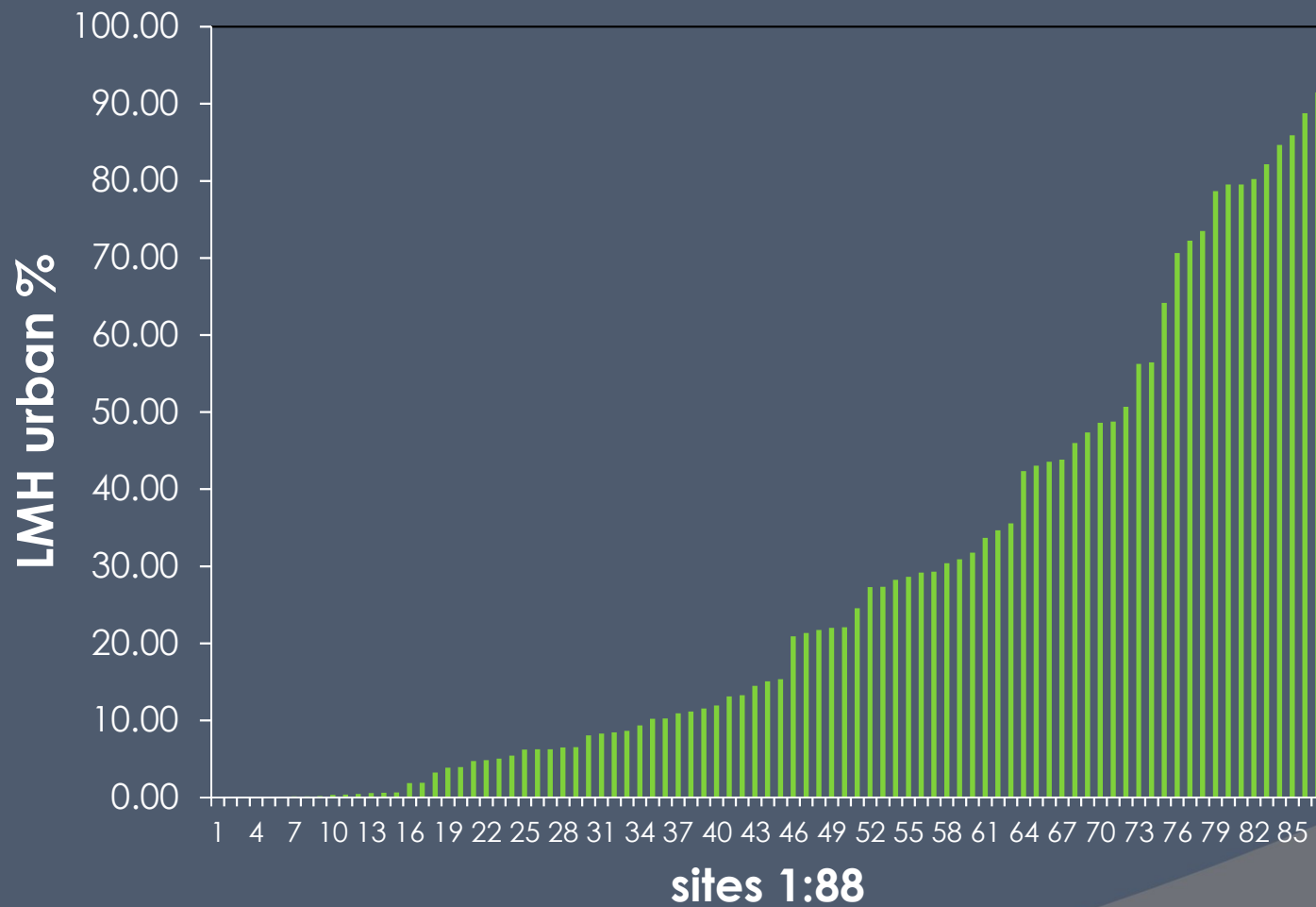
PNSQA

Pacific Northwest

- Willamette Valley and Puget Sound lowlands
- Urban stressors
- 88 sites



Urban gradient



70 Urban and Ag Sites

- Weekly samples: (10 weeks) pesticides, glyphosate (TX), nutrients, major ions, sediment, and DOC
- Four visits: Hg (WI)
- Three visits: OWI and PHARMs
- Two visits: glyphosate (KS) and N&O isotopes
- Sediment chem: HALO, SVOCs, metals, hormones, and OWI

18 Reference and rural sites

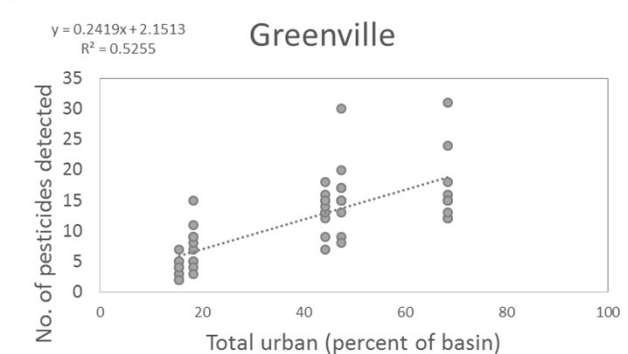
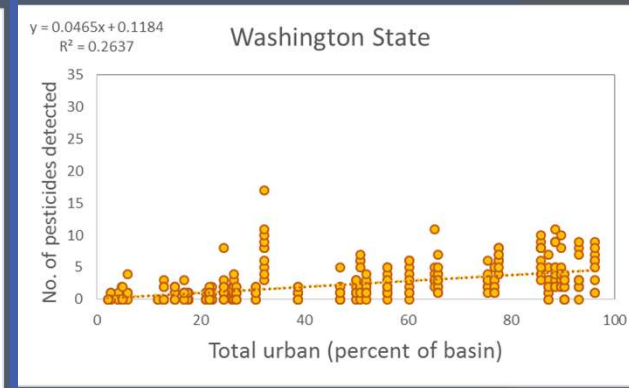
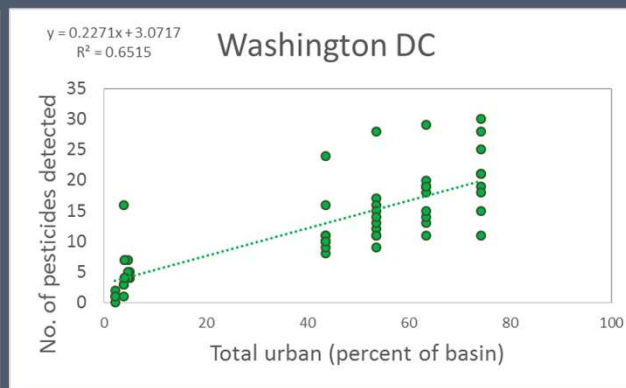
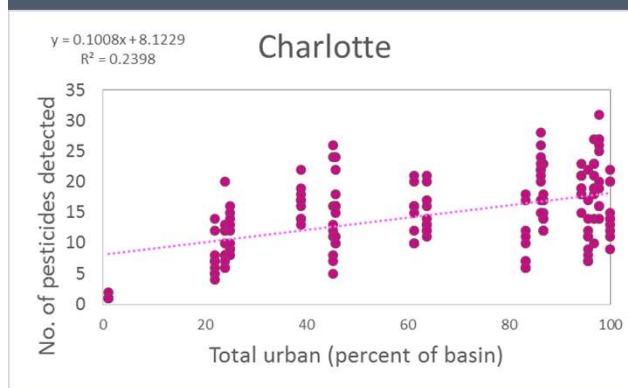
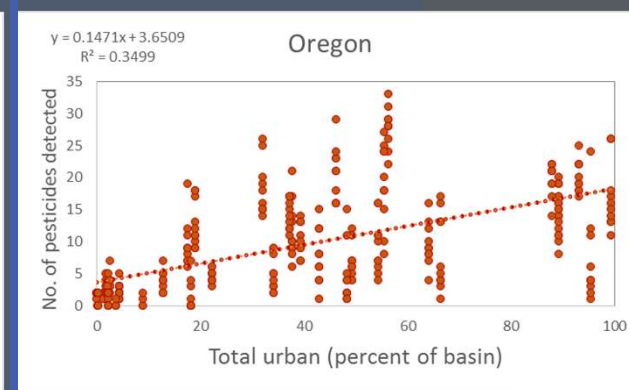
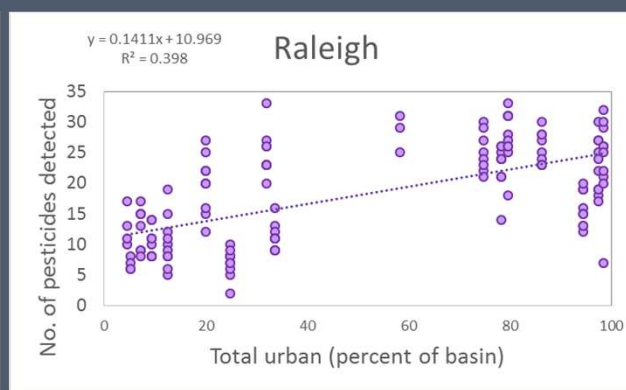
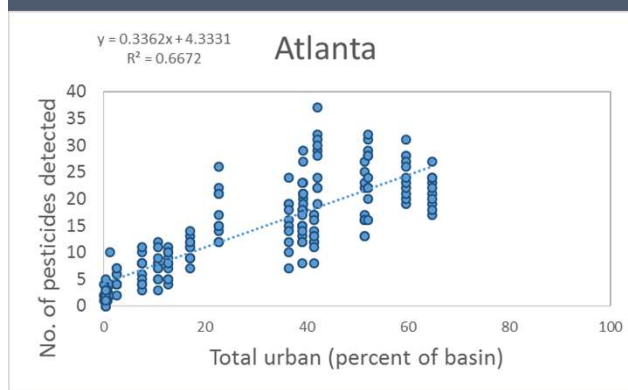
- Weekly samples: (4 weeks) pesticides (2437), nutrients, major ions, sediment, Hg, and DOC
- Sediment at half of the sites: for HALO (8093), SVOCs (5506), metals, PHARMs, hormones (6434), and OWI (5433)

Sampling timeline

Site type	Sampling	13-Apr	20-Apr	27-Apr	4-May	11-May	18-May	25-May	1-Jun	8-Jun	15-Jun	22-Jun	29-Jun
Regular Sites n=70	WATER CHEM	1	2	3	4	5	6	7	8	9	10		
	POCIS						POCIS						
	SED CHEM/TOX												
	ECO SURVEY												
Reference Sites n=18	WATER CHEM							1	2	3	4		
	POCIS						POCIS						
	SEDIMENT CHEM												
	ECO SURVEY												



The no. pesticides detected per sample increased with % urban land for the 5 urban centers in the Southeast study and for both States in Pacific Northwest study, however...



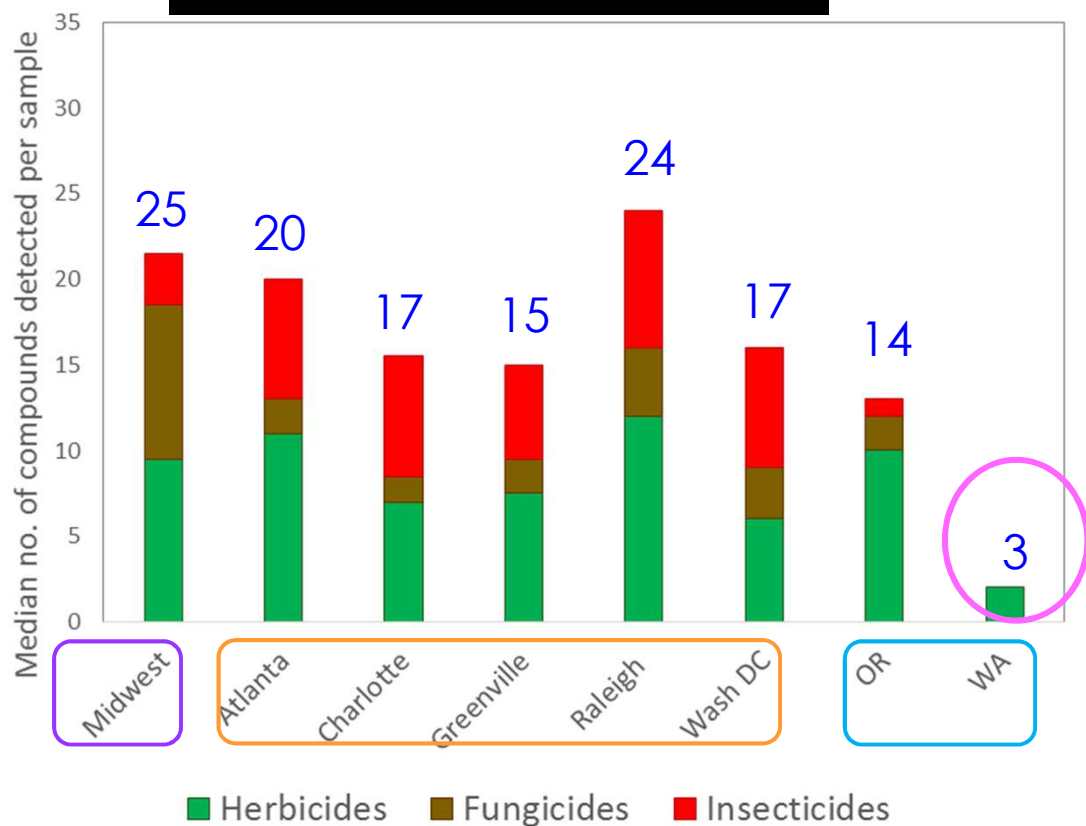
...the slope of the increase was much smaller for WA (0.05) than the other urban areas (0.1–0.3)

Provisional Data

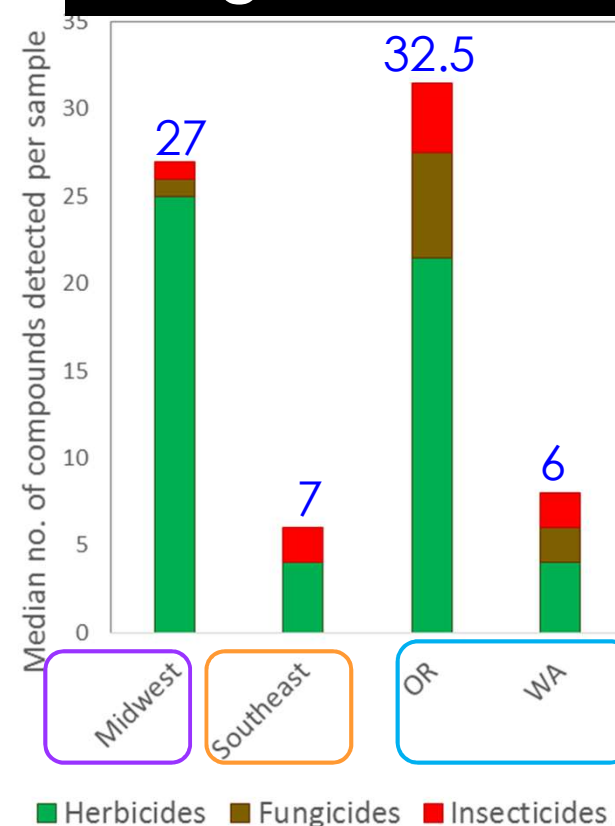


Regional comparison: median number of compounds detected by pesticide use group

Urban Streams



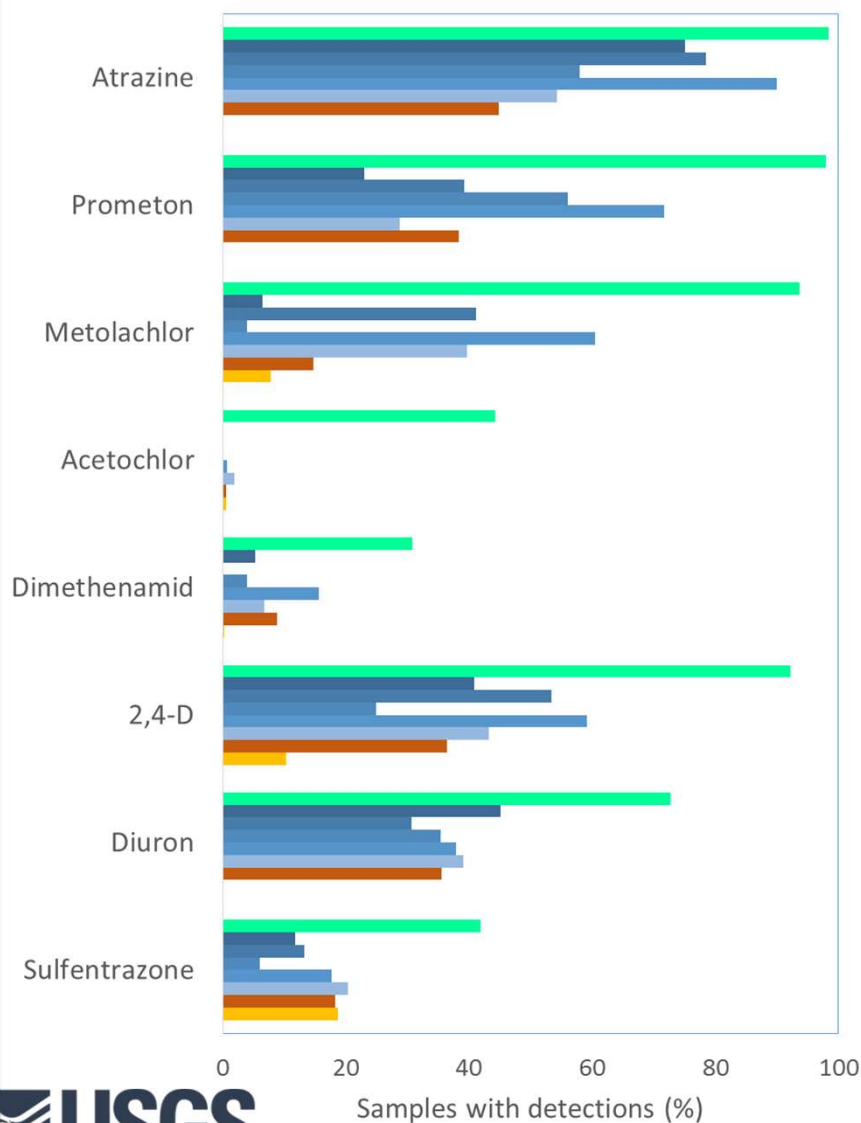
Ag Streams



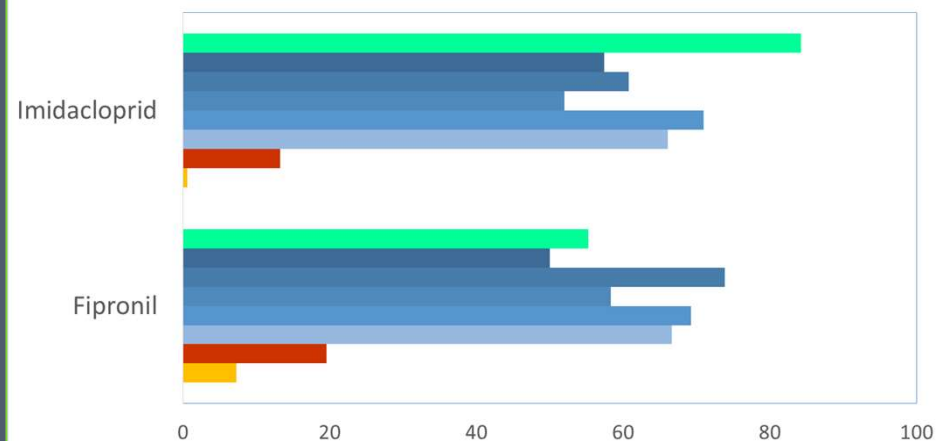
Provisional Data

Many of the top-detected pesticides were observed in Urban streams from all of the 1st three regional studies

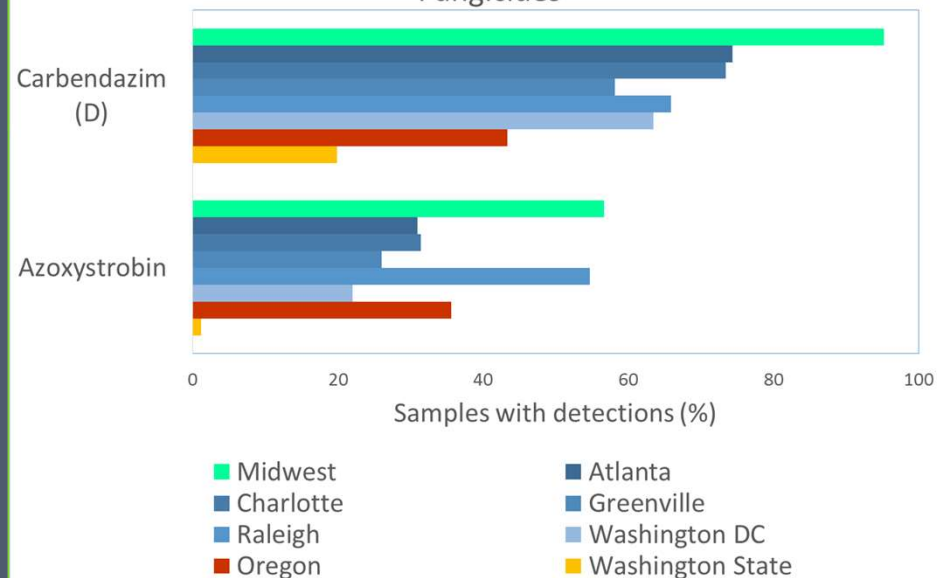
Herbicides

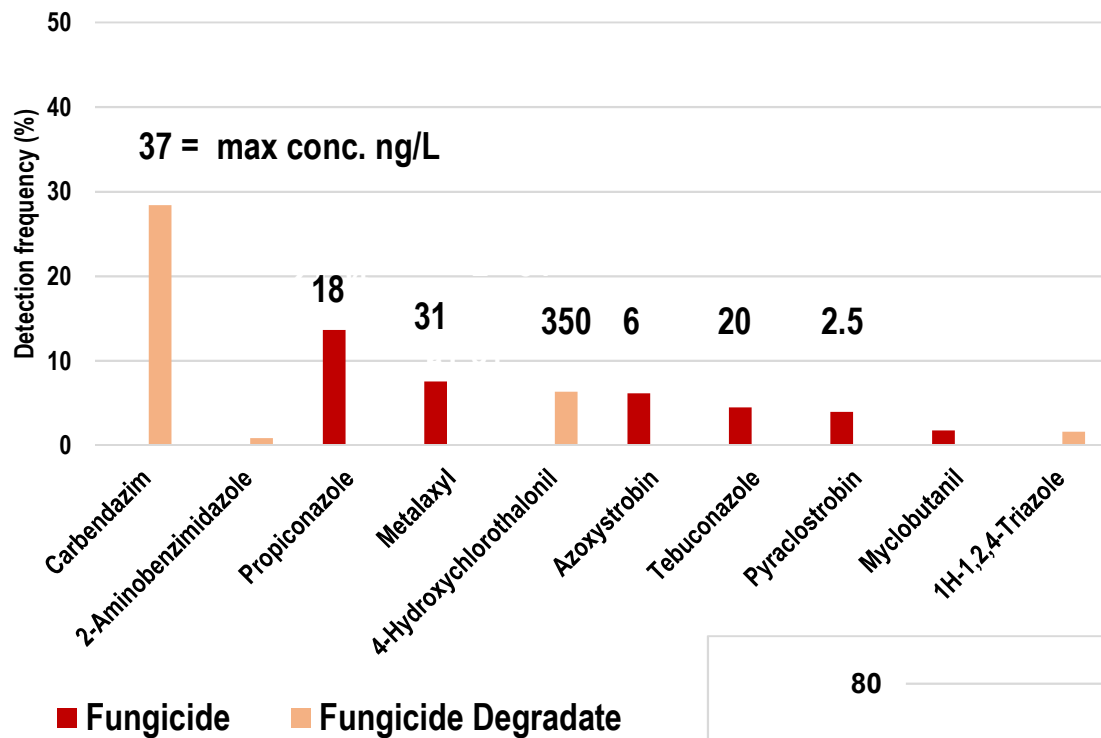


Insecticides



Fungicides

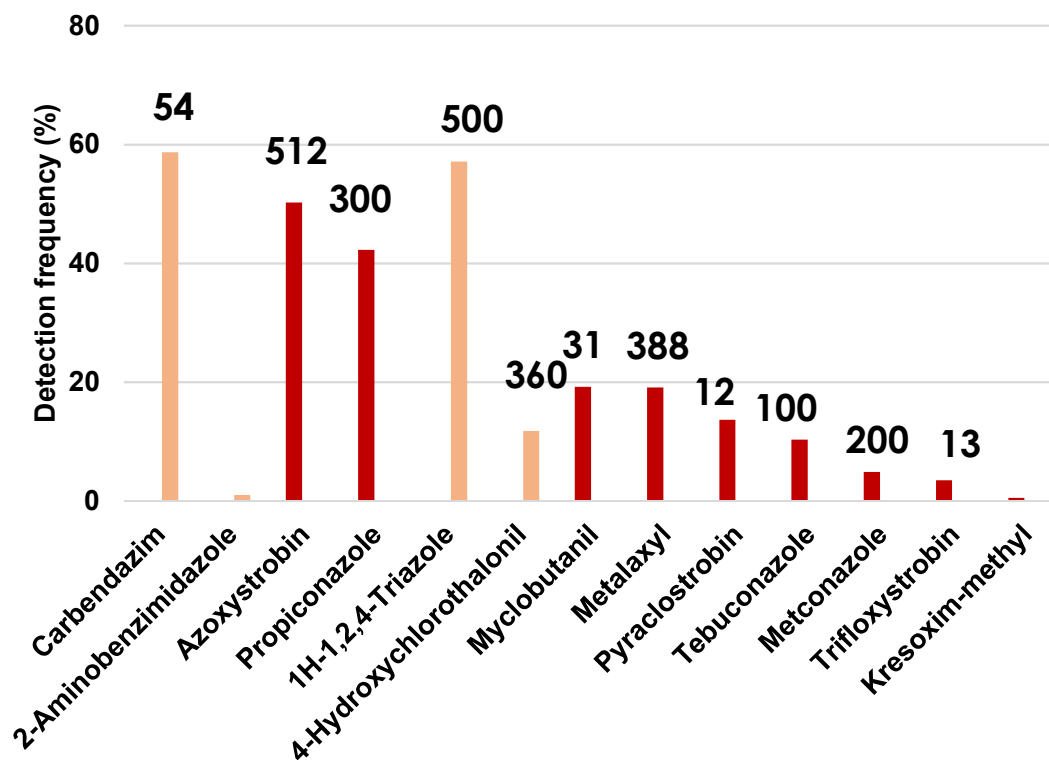


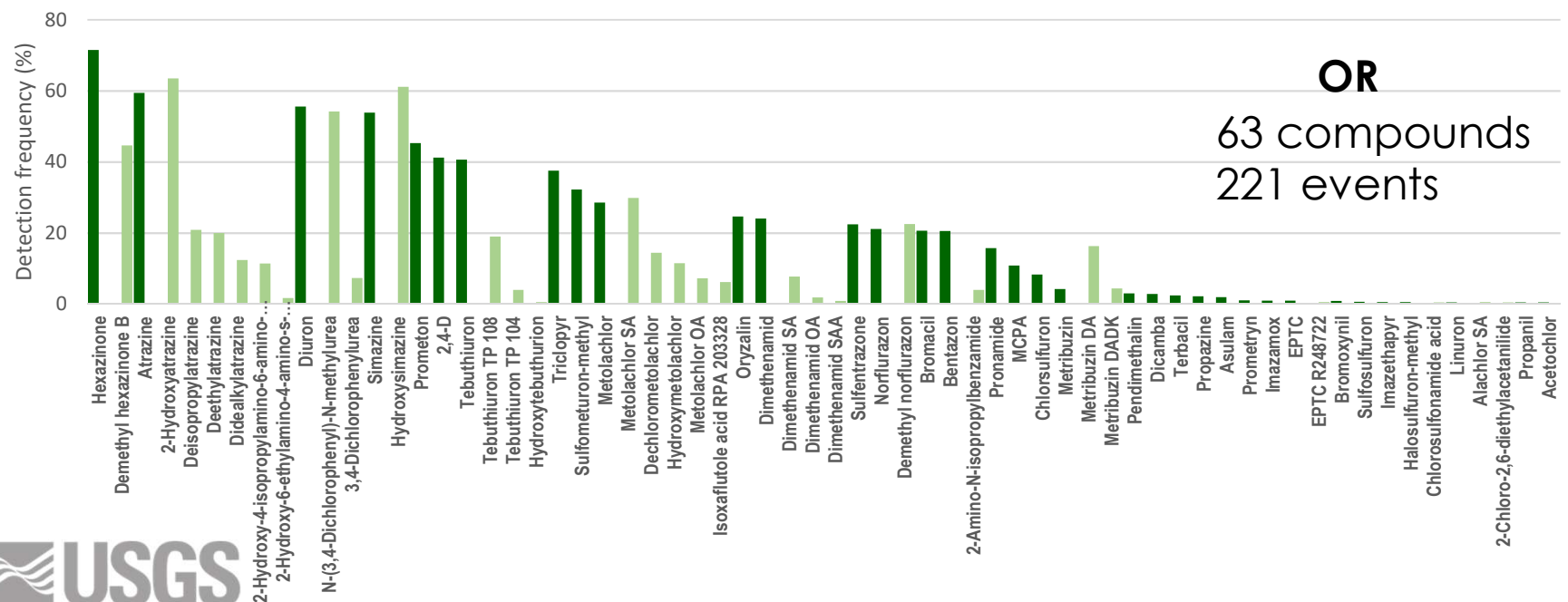
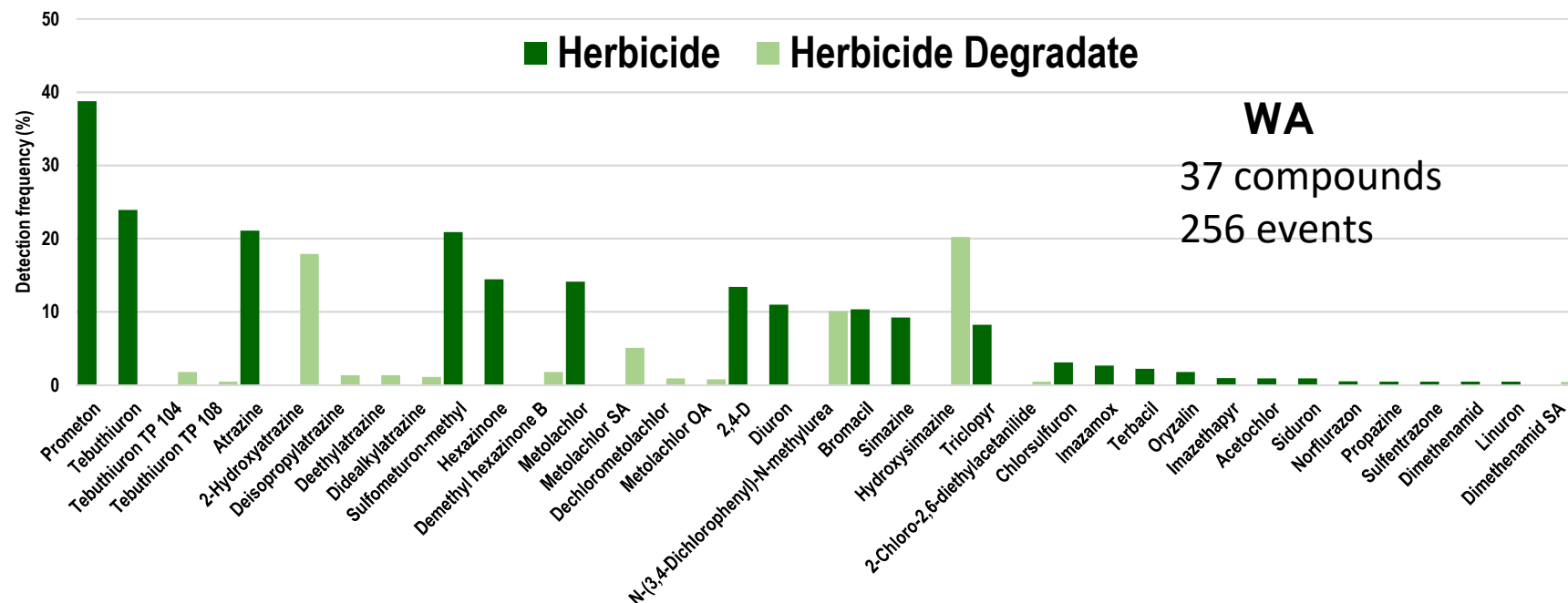


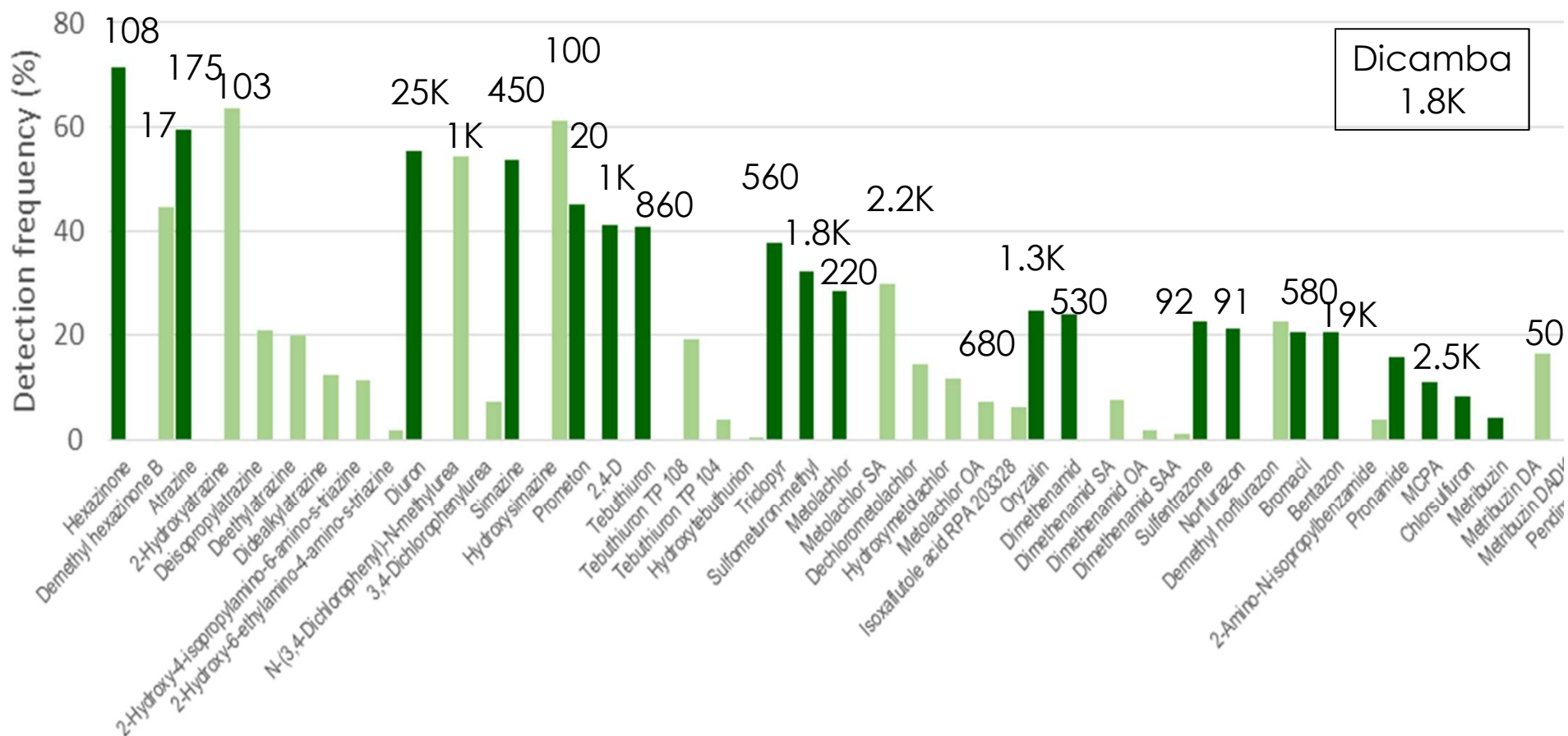
FUNGICIDES

Washington
n=256

Oregon
n=221*







Willamette Valley/Vancouver Herbicides

63 compounds, 221 events, ng/L

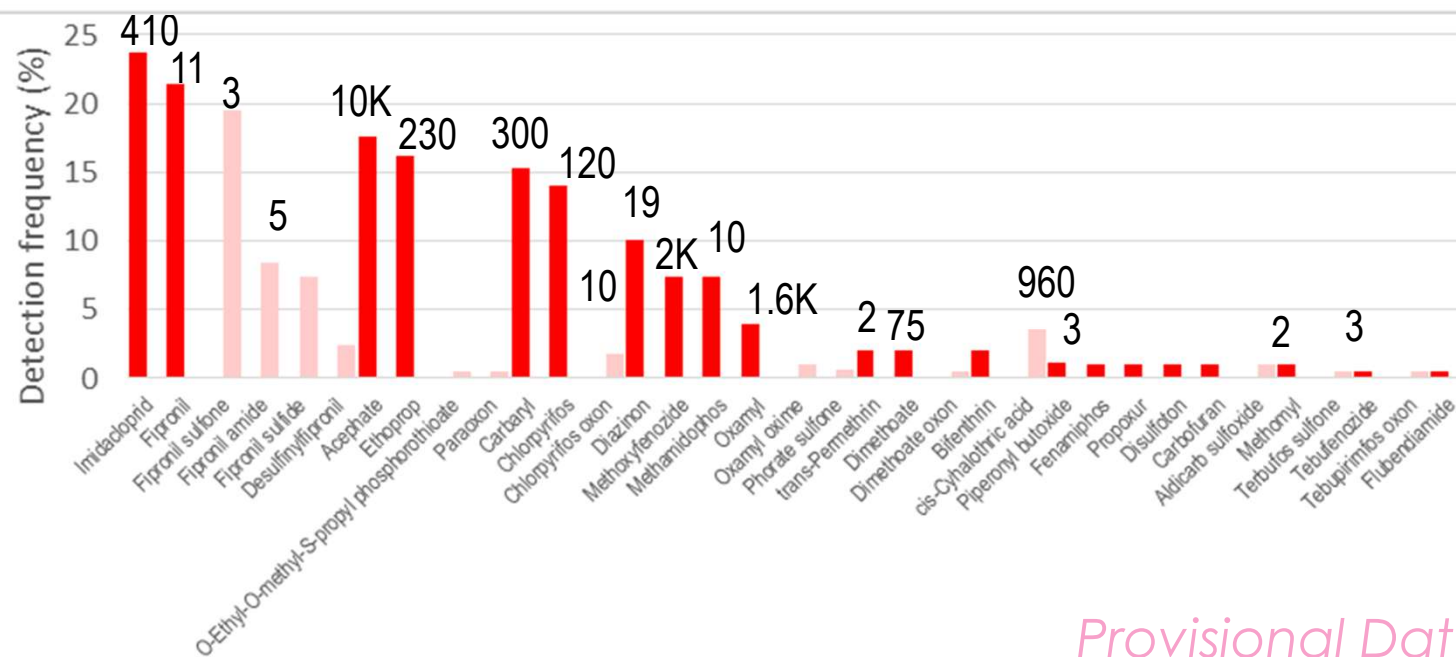
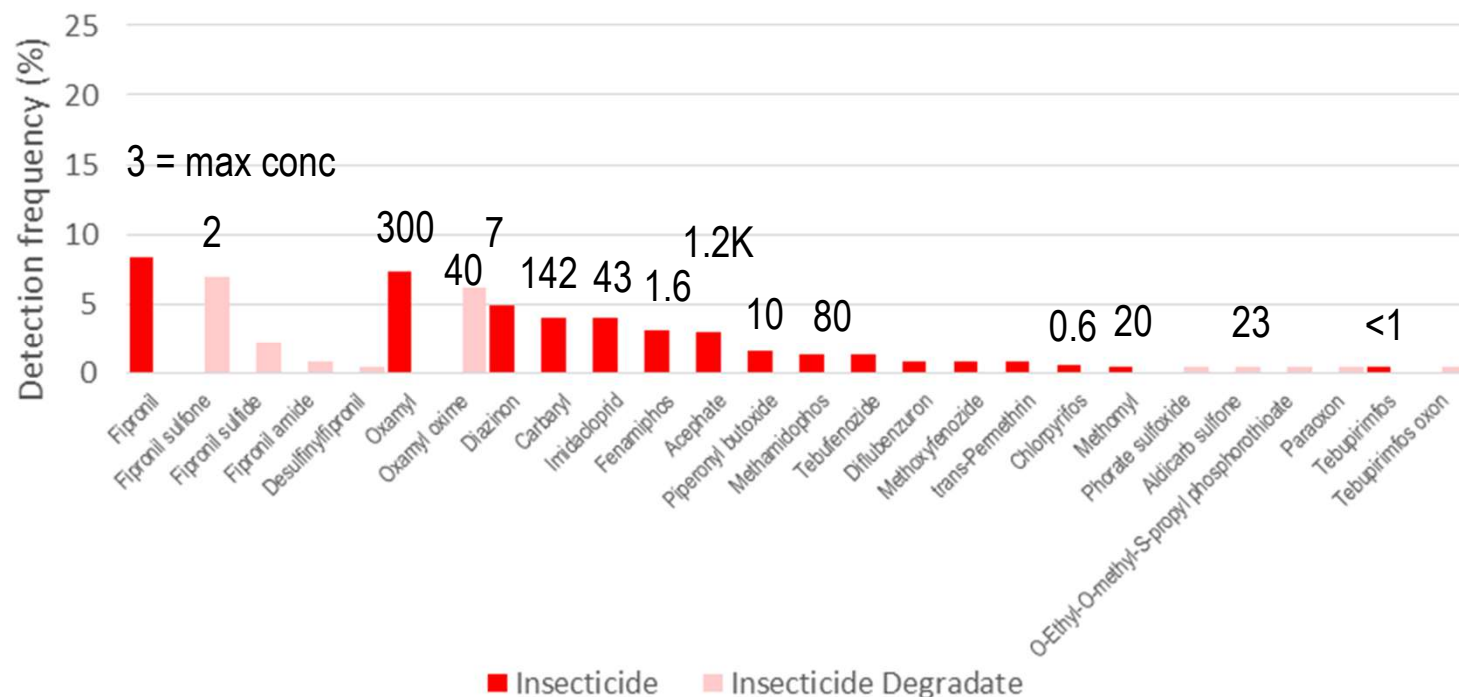


Provisional Data

INSECTICIDES

WA
25 compounds
n=256 samples

OR
34 compounds
n=221* samples



Provisional Data

Linking Landscape, Stressors, and Biology



Landscape

- URBANIZATION
- AGRICULTURE
- GEOLOGY, SOILS



Stressors

- HABITAT ALTERATION
- NUTRIENTS
- CONTAMINANTS



Biology

- ALGAE
- INVERTEBRATES
- FISH

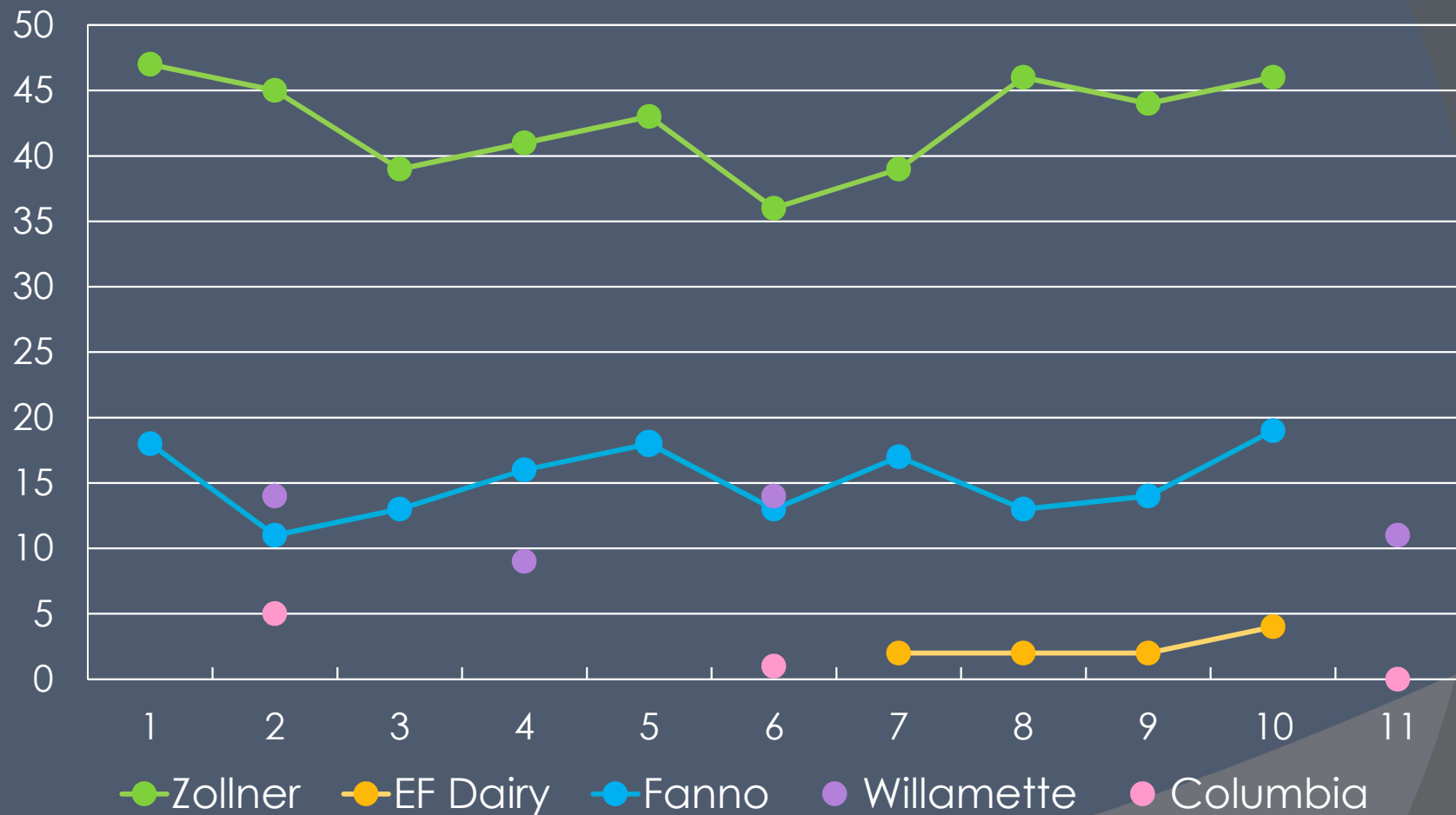


Ecological Modeling

- What environmental variables can best explain the variability we are seeing at the PNW sites?
 - Macroinvertebrates – Fungicides
 - Fish – Temperature
 - Algae – Nutrients (total P)



Number of Detections during PNSQA Study (2015)



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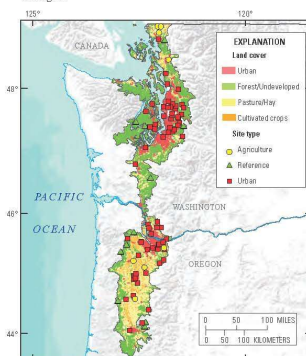
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National Water-Quality Assessment Program

The Pacific Northwest Stream Quality Assessment

In 2015, the U.S. Geological Survey (USGS) National Water-Quality Assessment (NAWQA) program is assessing stream quality in the Pacific Northwest. The goals of the Pacific Northwest Stream Quality Assessment (PNSQA) are to assess the quality of streams in the region by characterizing multiple water-quality factors that are stressors to aquatic life and to evaluate the relation between these stressors and biological communities. The effects of urbanization and agriculture on stream quality for the Puget Lowlands and Willamette Valley are the focus of this regional study (fig. 1). Findings will provide the public and policymakers with information regarding which human and environmental factors are the most critical in affecting stream quality and, thus, provide insights about possible approaches to protect or improve the health of streams in the region.



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Figure 1. The Pacific Northwest Stream Quality Assessment study area. Study area boundary is based on the Willamette Valley and Puget Lowlands level 3 ecological regions (ecoregions) of the United States.

U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet 2015-308
March 2015

Fact sheet and
methods report
available online



National Water-Quality Assessment Project

Design and Methods of the Pacific Northwest Stream Quality Assessment (PNSQA), 2015



Open-File Report 2017-1103

U.S. Department of the Interior
U.S. Geological Survey