Chlorpyrifos Monitoring Results In Oregon's (PSP) Watersheds: 2013-2019

Chlorpyrifos Work Group

Oregon Department of Agriculture (ODA)

December 17, 2019

Kirk V. Cook, RG

Pesticide Stewardship Partnership

Background

Why Do We Monitor for Chlorpyrifos?

Chlorpyrifos is listed as one of the original 57 pesticides listed by the US EPA as a Pesticides of Interest:

- States are required to evaluate the status of each of the “57” per the State Water Quality Pesticide Management Plan
- Chlorpyrifos is toxic to both fish and aquatic invertebrates
- Chlorpyrifos is one of the few currently used pesticides that have a water quality criteria (.041 ug/L)
- The PSP Program has detected chlorpyrifos in numerous basin throughout the years

Why Do We Monitor for Chlorpyrifos?

US EPA derived aquatic life benchmarks:

Acute (Fish)	0.9	ug/L
Chronic (Fish)	.57	ug/L
Acute Invertebrate	.05	ug/L
Chronic Invertebrate	**.041**	**ug/L**
Acute Non Vascular Plant	140	ug/L

Factors Contributing to Chlorpyrifos Detections in Water

Koc	9930, not likely to leach from soils
½ life	~ 45-90 days
Solubility (water)	1.18 ppm (not soluble in water)
POC	CA, ID, MN, ND, NY, OR, WA

Occurrences likely from aerial/air blast/boom application or runoff resulting in soil erosion

Major Routes of Residue Occurrence in Water

Airbast Spray Application

Aerial Spray Application

Boom Spray Application

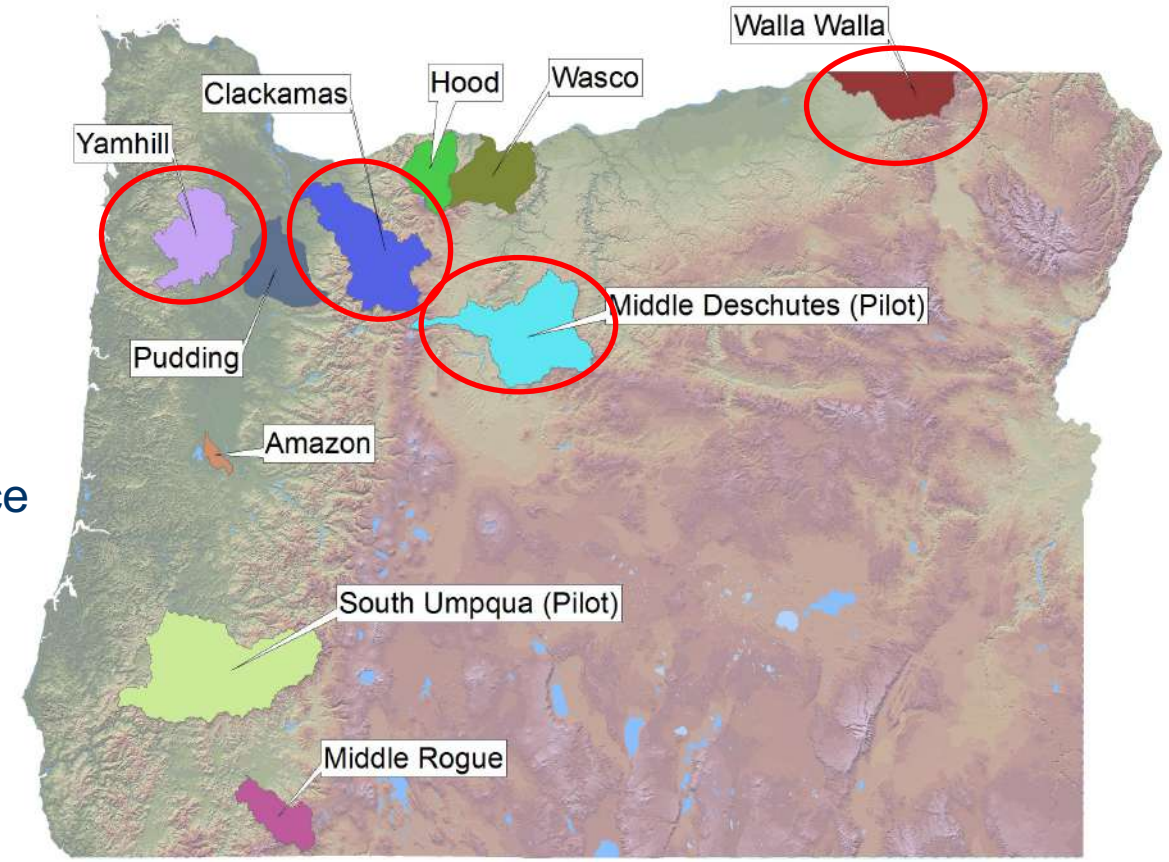
Irrigation Runoff

Chlorpyrifos and Surface Water Quality Summary

PSP areas where chlorpyrifos was detected above the water quality criteria (2018-2019).

Only Walla Walla and Yamhill reported exceedance in 2019*

* *Through 6/30/19*



Decision Matrix for Evaluating Pesticides based on Water Quality Data

Frequency of Detection in % Last 3 Years	≥ 1 detection at or above 50% of an acute ALB	≥ 3 detections at or above 50% of a chronic ALB	1 to 2 detections at or above 50% of a chronic ALB	No detections over 50% of any ALB
100 to 65.1	High Level of Concern	High Level of Concern	High Level of Concern	Moderate Level of Concern
65 to 35.1	High Level of Concern	High Level of Concern	Moderate Level of Concern	Moderate Level of Concern
35 to 0	High Level of Concern	High Level of Concern	Moderate Level of Concern	Low Level of Concern

Each Pesticide Stewardship Partnership area will determine the level of concern for detected pesticides. Pesticides that are deemed of high concern in over 30% of The PSP areas will be designated as statewide pesticide of high concern or statewide Pesticides of concern (POC's)

Aquatic Life Benchmarks are derived by the US EPA and provide a measure of the toxicity of a pesticide to various aquatic species

PSP Basins Where Chlorpyrifos is a Designated Pesticide of High Concern

PSP Area	POMC	POHC
Amazon	No	No
Clackamas		Yes
Hood River	No	No
Middle Deschutes		Yes
Middle Rogue*	Yes	No
Pudding*		Yes
Wasco	No	No
Walla Walla		Yes
Yamhill		Yes

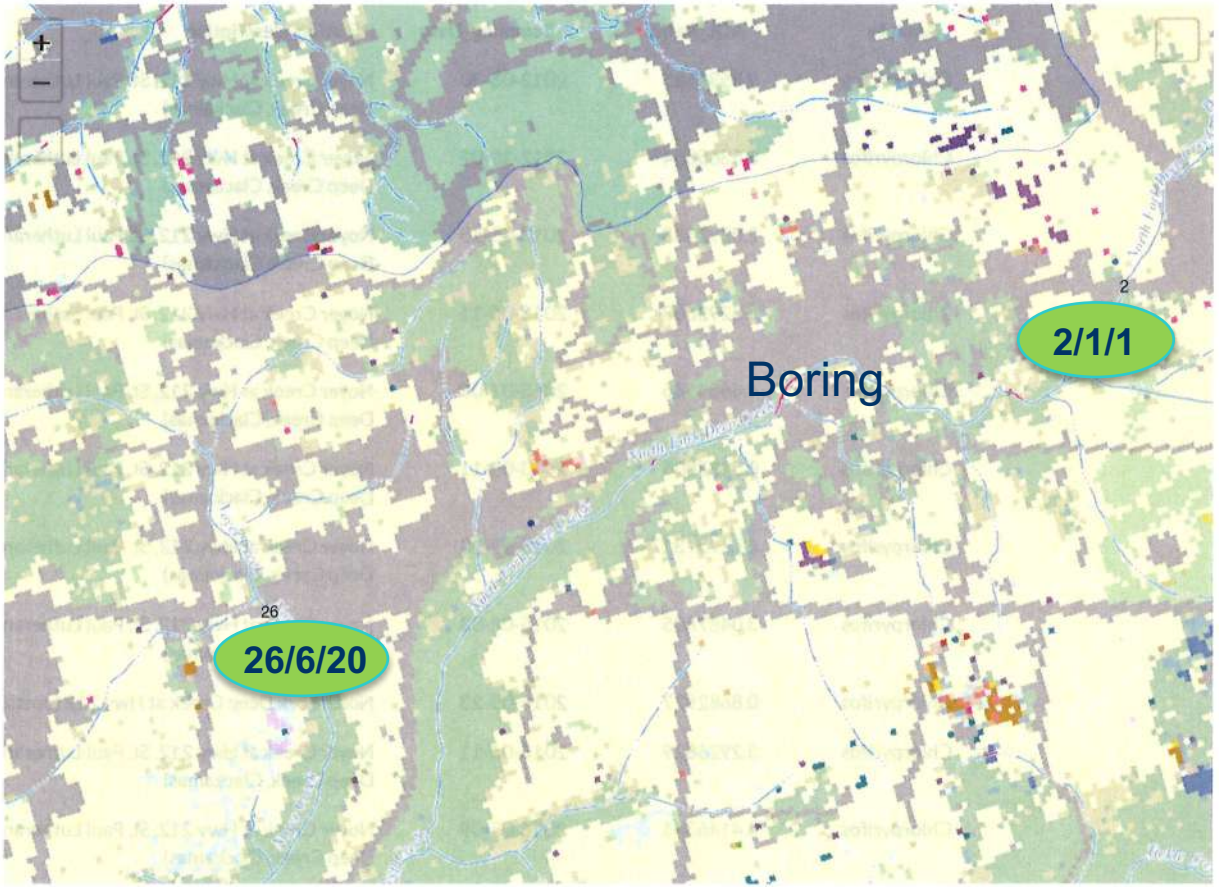
POMC = Pesticide of Moderate Level of Concern
POHC – Pesticide of High Level of Concern

Land Use and Chlorpyrifos Occurrence in Water

- Urban
- Forest
- Grapes
- Nursery
- Xmas Trees
- Grass/Pasture

20 / 4 / 20

Total Detections / 50-100% BM / Over BM



Clackamas Stations Where Chlorpyrifos was Detected 2012 - 2019

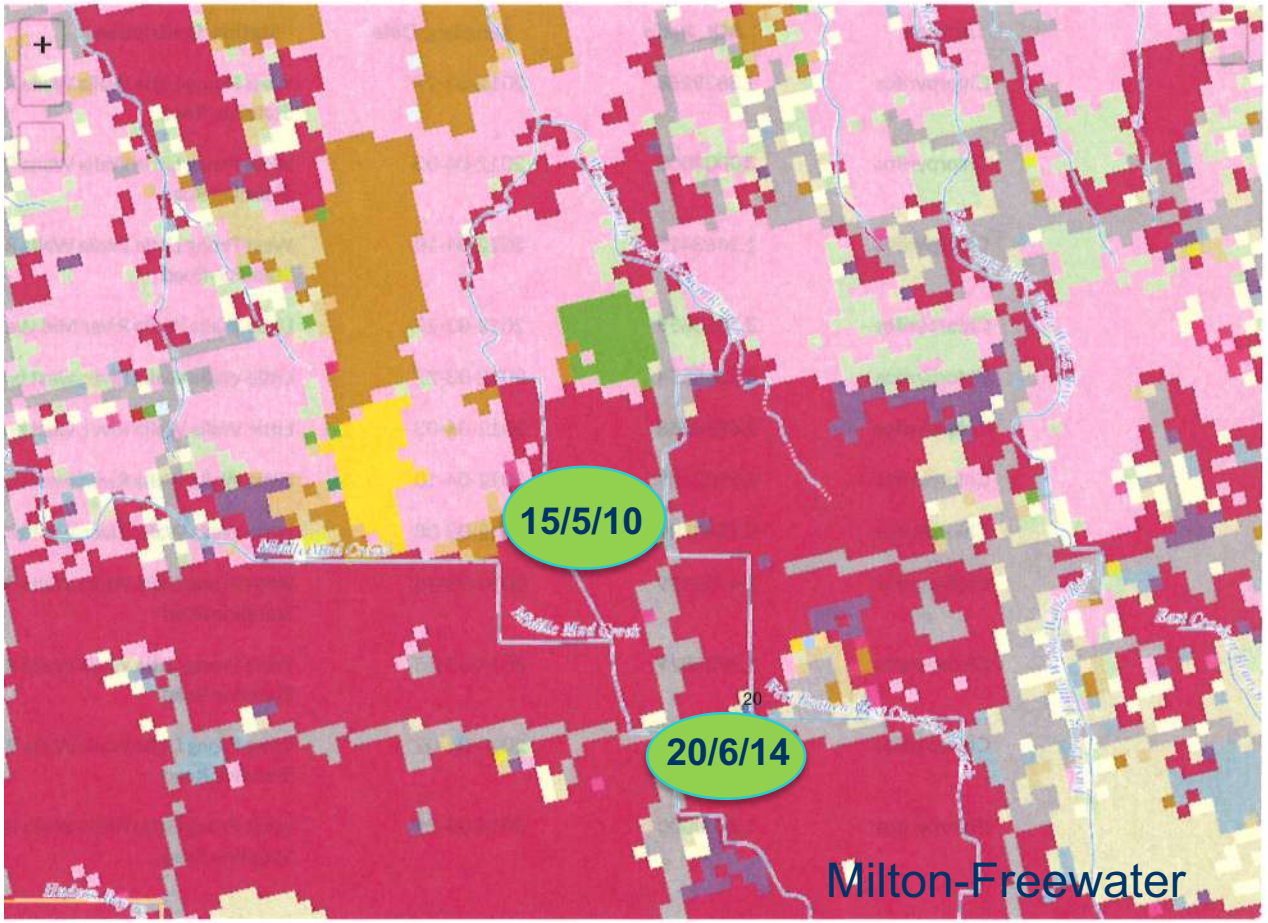
2017 CDL

Land Use and Chlorpyrifos Occurrence in Water

- Apples
- Alfalfa
- Corn
- Peas
- Winter Wheat

20 / 4 / 20

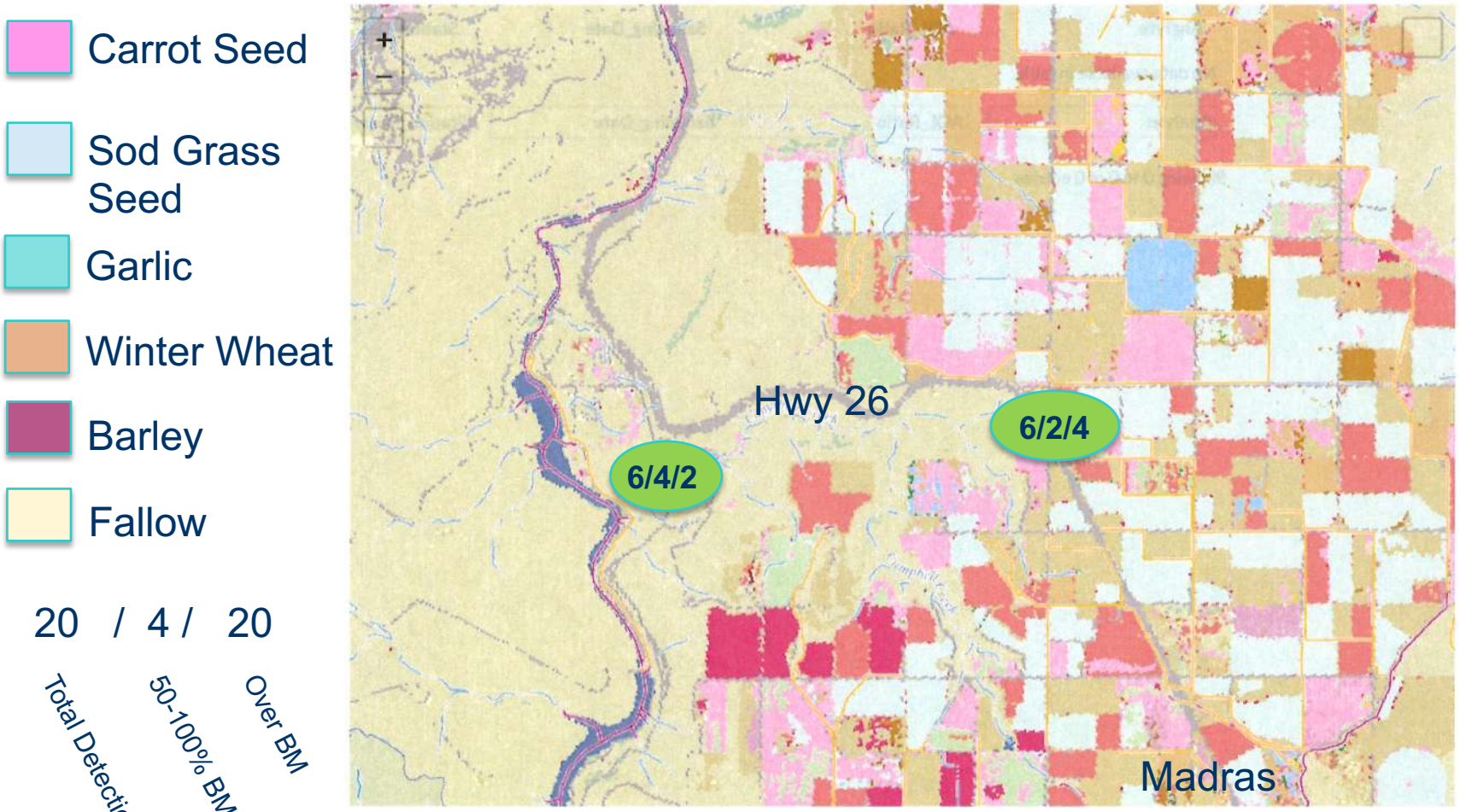
Total Detections / 50-100% BM / Over BM



Walla Walla Stations Where Chlorpyrifos was Detected 2012 - 2019

2017 CDL

Land Use and Chlorpyrifos Occurrence in Water



Middle Deschutes Stations Where Chlorpyrifos was Detected 2012 - 2019

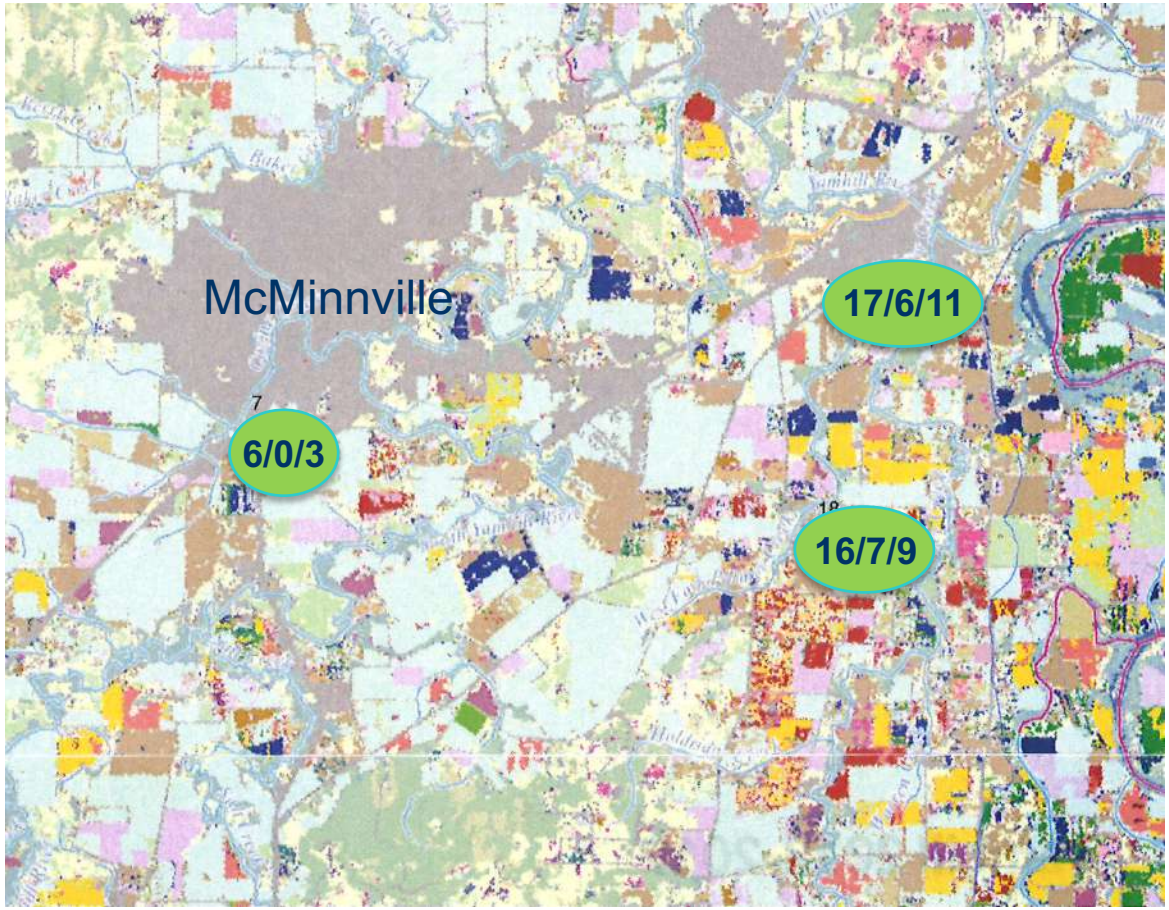
2017 CDL

Land Use and Chlorpyrifos Occurrence in Water

- Urban
- Tree Crops
- Corn
- Blueberries
- Hay
- Grass Seed
- Clover
- Beans

20 / 4 / 20

Total Detections / 50-100% BM / Over BM



Yamhill Stations Where Chlorpyrifos was Detected 2012 - 2019

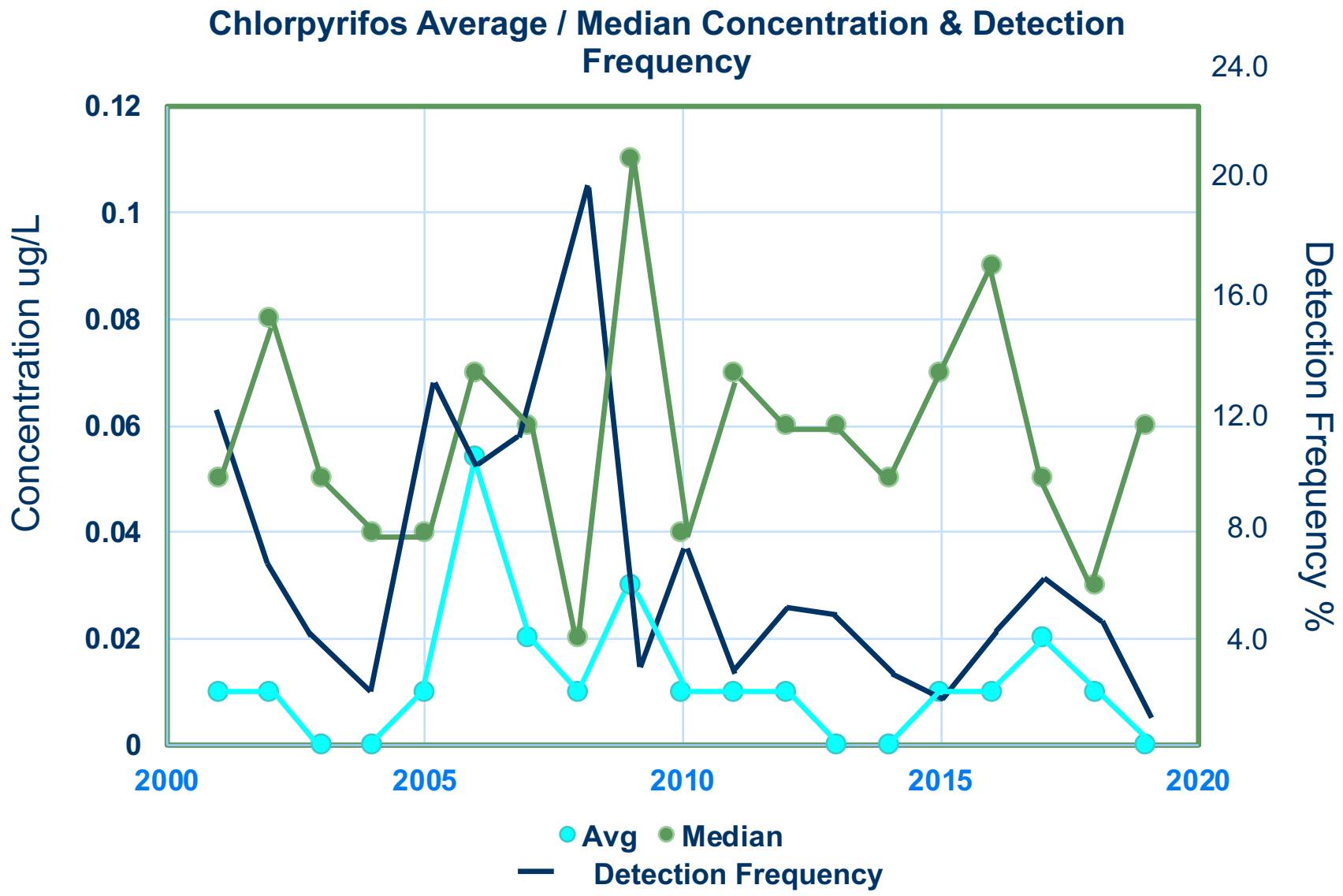
2017 CDL

Pesticides Exceeding US EPA Aquatic Life Benchmarks

Aquatic Life Ratio in URBAN Areas	
Current Use Pesticide	Aquatic Life Ratio
Bifenthrin (Brigade, et.al.)	176.15
Imidacloprid (Admire, et.al)	105.0
Chlorpyrifos (Lorsban) – *no urban uses*	43.17
Fipronil (Frontline, et.al.)	11.52
Ethoprop (Mocap)	3.69

Aquatic Life Ratio in AGRICULTURAL Areas	
Current Use Pesticide	Aquatic Life Ratio
Chlorpyrifos (Lorsban)	196.1
Imidacloprid (Admire, et.al)	125.0
Malathion	63.7
Diazinon	47.36
Bifenthrin (Brigade, et.al.)	37.69

Bolded compounds = statewide Pesticides of Concern

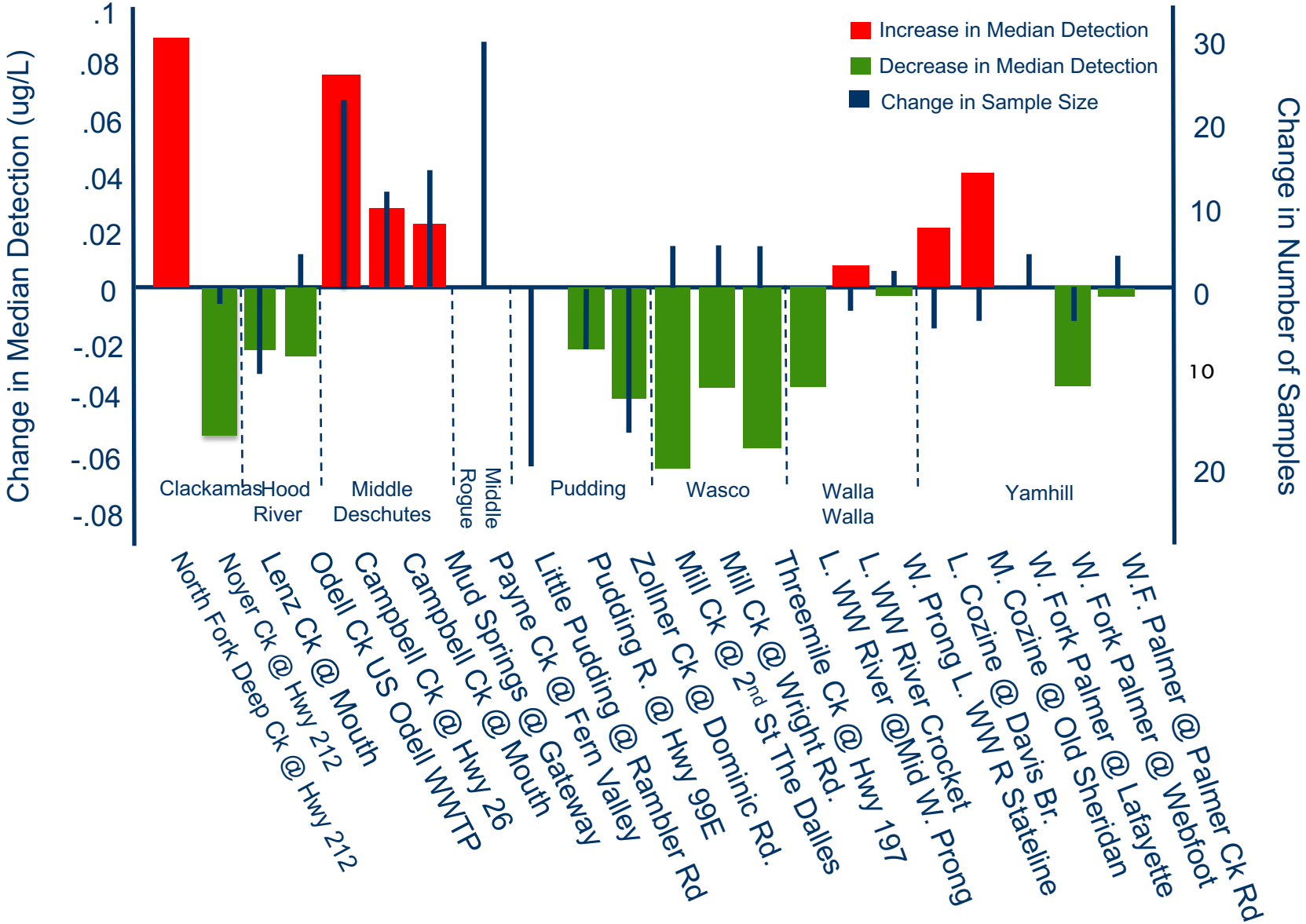

Chlorpyrifos Average / Median Concentration & Detection Frequency
Concentration ug/L
Detection Frequency %
0.12
0.1
0.08
0.06
0.04
0.02
0
24.0
20.0
16.0
12.0
8.0
4.0
2000
2005
2010
2015
2020
Avg
Median
Detection Frequency

Chlorpyrifos Detections Across All PSP Areas

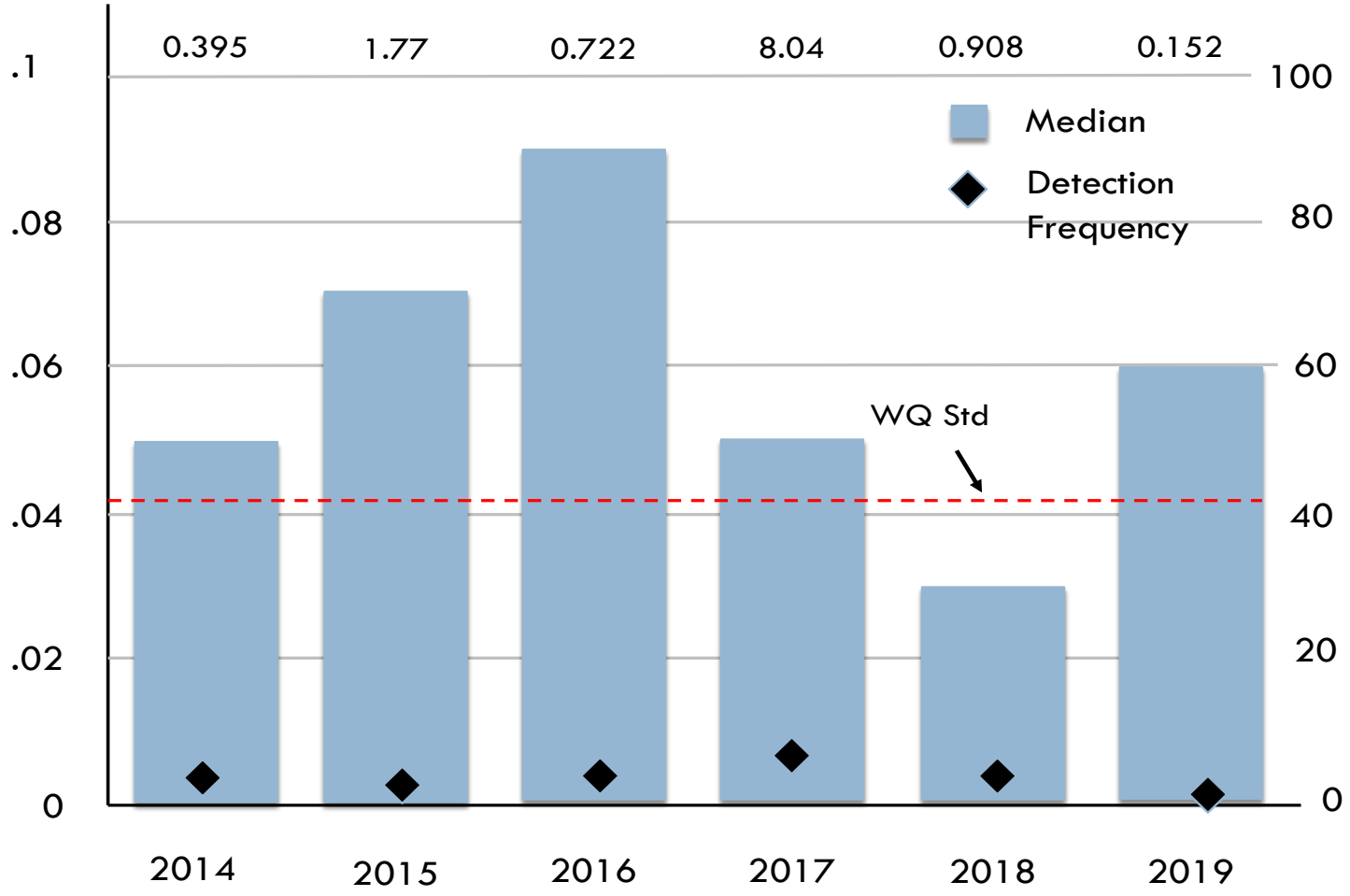
	Amazon	Clackamas	Hood River	Middle Rogue	Middle Deschutes	Pudding	South Yamhill	Walla Walla	Wasco	Yamhill
2010	N/A	(28) 4 / **2**	(100) 5 / **2**	N/A	N/A	(27) 0 / 0	(3) 0 / 0	(61) 8 / **6**	(62) 5 / **2**	(42) 5 / **4**
2011	(50) 0 / 0	(40) 2 / **2**	(42) 1 / 0	N/A	N/A	(34) 1 / **1**	(12) 0 / 0	(49) 3 / **3**	(65) 1 / **1**	(56) 4 / **4**
2012	(72) 0 / 0	(53) 2 / **2**	(49) 1 / 0	N/A	N/A	(26) 1 / **1**	(33) 0 / 0	(54) 8 / 6	(57) 1 / **1**	(37 4 / **2**
2013	(95) 0 / 0	(65) 4 / **3**	(78) 3 / **2**	N/A	N/A	(56) 4 / **4**	(43) 0 / 0	(59) 4 / **2**	(56) 2 / **1**	(57) 5 / **3**
2014	(84) 0 / 0	(56) 0 / 0	(75) 2 / 0	(61) 0 / 0	(46) 0 / 0	(45) 2 / **1**	(44) 0 / 0	(57) 6 / 5	(52) 4 / **3**	(73) 7 / **4**
2015	(78) 0 / 0	(66) 2 / **2**	(82) 0 / 0	(11) 0 / 0	N/A	(14) 0 / 0	(29) 0 / 0	(65) 5 / **4**	(65) 1 / 0	(80) 3 / **3**
2016	(68) 0 / 0	(56) 12 / **8**	(78) 0 / 0	(70) 0 / 0	N/A	(23) 0 / 0	(24) 0 / 0	(56) 5 / 3	(65) 0 / 0	(79) 4 / 3
2017	(70 0 / 0	(56) 5 / **5**	(40) 0 / 0	(76) 1 / 0	(39) 6 / 4	(23) 3 / 2	N/A	(54) 7 / **6**	(67) 0 / 0	(66) 14 / **6**
2018	(65) 0 / 0	(54) 4 / **1**	(44) 0 / 0	(72) 0 / 0	(32) 7 / **2**	(35) 0 / 0	N/A	(52) 13 / **2**	(66) 0 / 0	(65) 2 / **1**
2019	(44) 0 / 0	(36) 1 / 0	(32) 0 / 0	(56) 0 / 0	(22) 0 / 0	(32) 0 / 0	N/A	(35) 2 / **2**	(48) 0 / 0	(45) 3 / **3**

Numbers in parenthesis indicate number of samples collected
First number under samples collected indicates number of chlorpyrifos detections
Second number in bold under samples collected indicates number of detection exceeding the state water quality criterion
Squares in green indicate no detections, yellow indicates detection but no benchmark exceedance, red indicates benchmark exceedance

PSP Chlorpyrifos Monitoring By Sampling Station: 2013-15 and 2017-19 Biennium



Median Chlorpyrifos Concentrations for All PSP Areas



Background

Watershed Specific Conditions Regrading Chlorpyrifos

- Amazon

  Chlorpyrifos has not been detected in the Amazon Watershed began in 2011

- Clackamas

  Median concentrations of chlorpyrifos decreased in one stream and increased in another. Noyer Creek is the stream where most chlorpyrifos detections have occurred since 2005, and median concentrations dropped at that station by almost 0.05 ug/l since the 2013-15 Biennium. Chlorpyrifos was detected in North Fork Deep Creek in 2016 for the first time since 2010, although only one detection was observed in both 2016 and 2017.

- Hood

  Chlorpyrifos hasn't been detected in the Hood River Watershed since the 2013-15 Biennium. It was previously detected regularly in the early spring

Watershed Specific Conditions Regrading Chlorpyrifos

- Middle Deschutes

  The increases in chlorpyrifos concentrations in the Middle Deschutes are difficult to assess because of major changes in the monitoring locations over the past two years. For example, an upstream monitoring site on Campbell Creek was added in 2017. Earlier monitoring showed that Campbell Creek had the highest number of detections and concentrations (relative to benchmarks and standards) of any stream monitored in the watershed. As a result, the number of detections in the Middle Deschutes more than doubled after that new site was added. However, this does not mean the impacts to the stream from pesticides doubled

- Middle Rogue

  Only one detection of chlorpyrifos has been detected in the Middle Rogue Watershed since pilot monitoring began in 2014. That detection occurred in 2017 on Payne Creek at location that was added that same year. It wasn't detected in 2018 and or 2019.

Watershed Specific Conditions Regrading Chlorpyrifos

- Pudding

  Median concentrations of chlorpyrifos decreased in all 3 streams it has been detected. Monitoring was discontinued recently at the Little Pudding River (at Rambler Road) site, so only a couple of samples were collected there in the 2017-19.

- Wasco

  Chlorpyrifos hasn't been detected in the Wasco streams since the 2013-15 Biennium. It was previously detected regularly in the early spring time period.

- Walla Walla

  There were decreases in median concentrations in 2 of 3 Little Walla River "distributaries" (controlled canal systems that run through apple orchards) where chlorpyrifos has been detected since 2005, and a small increase in median concentration at another distributary monitoring site. In 2019 several growers began use of pyriproxyfen (Esteem) as a replacement for chlorpyrifos. Thus far no detections of pyriproxyfen have been noted.

Watershed Specific Conditions Regrading Chlorpyrifos

- Yamhill

  Median chlorpyrifos concentrations decreased at 2 monitoring stations, increased at 2 others and no change was observed at another. Two of the three West Fork Palmer Creek monitoring sites (where chlorpyrifos has been consistently detected) showed modest declines in median concentrations. However, chlorpyrifos was detected in 2017 at the Middle Cozine Creek site at the western edge of McMinnville for the first time since 2012, and was detected in 2017 for the first time since monitoring began in 2007 at the Lower Cozine Creek site (in the middle of the city). Based on the pattern of detected concentrations, it's likely the chlorpyrifos is coming into the city from agricultural areas.

Conclusions

- ✓ Progress has been made in reducing the frequency of chlorpyrifos detections statewide
- ✓ Several sub-watersheds continue to demonstrate high to moderate frequency of detection and concentrations that are of high concern
- ✓ Increased use of alternative products show promise in reducing of eliminating chlorpyrifos detections in some critical areas
- ✓ The vast majority of detections are associated with agricultural land use
- ✓ Spray application (air blast and aerial) are main causes of chlorpyrifos occurrences in water with irrigation practices (erosion) accounting for detections in at least two watershed

Thank you

Kirk V. Cook, RG
Pesticides Stewardship Partnership
Oregon Depart. of Agriculture
635 Capitol Street NE
Salem, Oregon 97301
kcook@oda.state.or.us