Bee-lieve It or Not!
The Fate of Pesticides

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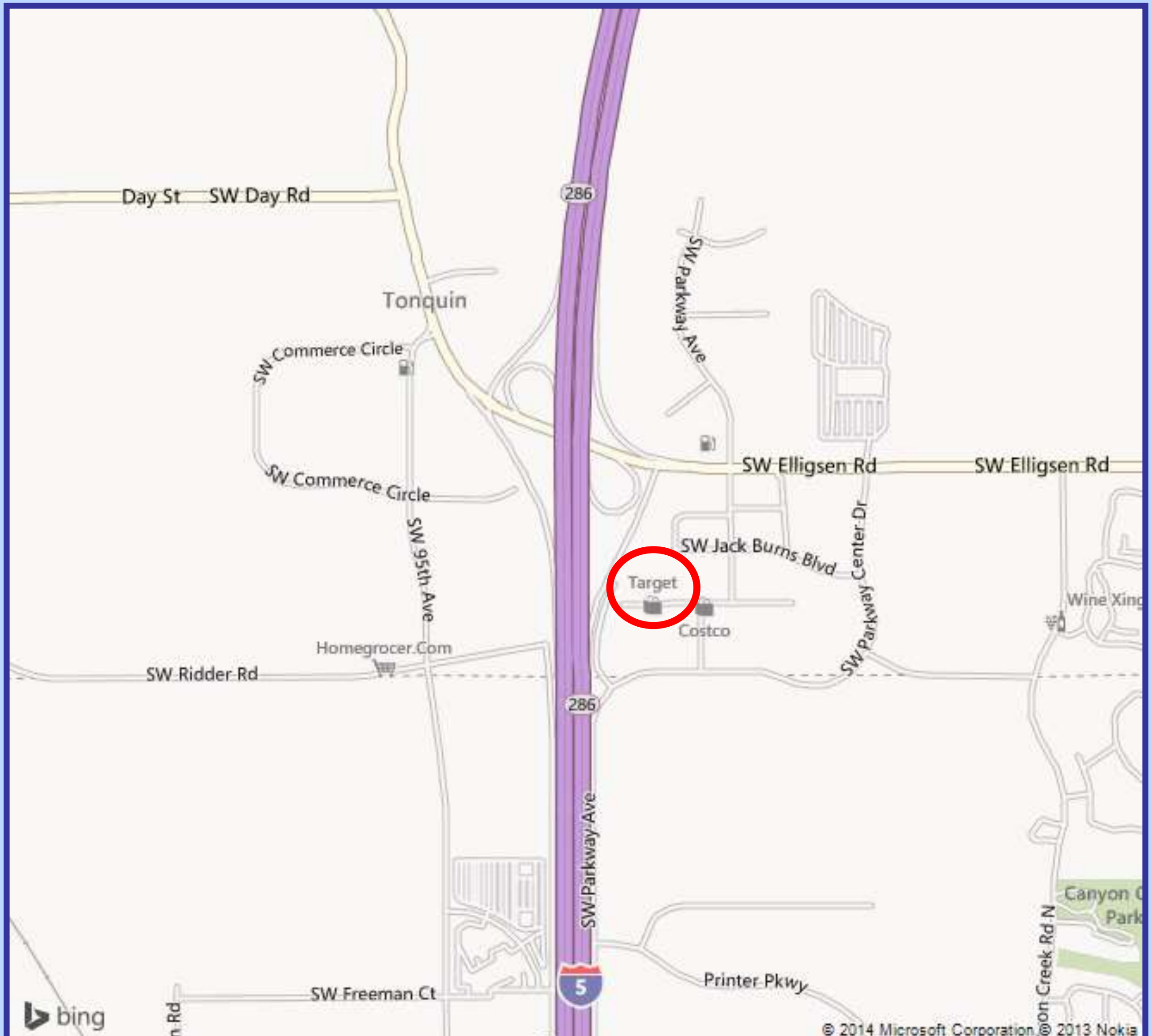
Water Environment School

March 28, 2017

Outline

- Bee incident in Wilsonville
- Response to the incident
- Pesticides and the environment
- NPDES permit and pesticide monitoring
- DEQ and partnerships


Day St
SW Day Rd
286
Tonquin
SW Parkway Ave
SW Commerce Circle
SW Commerce Circle
SW Elligsen Rd
SW Elligsen Rd
SW Jack Burns Blvd
SW Parkway Center Dr
Target
Costco
SW 95th Ave
Wine Xing
Homegrocer.Com
SW Ridder Rd
286
SW Parkway Ave
Canyon C
Park
5
Printer Pkwy
SW Freeman Ct
bing
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City of
Wilsonville
in Oregon


BEE KILL

Pesticide

- Dinotefuran (also known as Safari)
- Part of a group of insecticides called neonicotinoids (chemically similar to nicotine)
- They are systemic chemicals, meaning they are absorbed into plant tissue, making the plant itself toxic to insects
- They are long-lasting, and because they can be present in the pollen and nectar, they can be highly toxic to bees

Native Bees

- >4,000 native bee species in North America.
- The most important group of pollinators in temperate regions. They are (with the exception of a small group of pollen wasps and honey bees) the only insects that purposefully collect pollen to take back to their nests for their off- spring.
- Some very specialized – like squash bees which co-evolved with squash and cucumbers.

City of Wilsonville in Oregon

Response to the Incident

- ODA adopted a temporary rule (180-day limit) restricting the use of 18 pesticide products containing dinotefuran (exp. Dec. 24, 2013)
- In its place, ODA adopted permanent restrictions on the use of certain pesticide products containing dinotefuran and imidacloprid (As of Jan. 1, 2014 labels prohibit the pesticide from being used on linden, basswood, and Tilia species)
- ODA issued six civil penalties totaling $2,886, which included incidents in Wilsonville, Portland, Hillsboro, and West Linn
- SB 928 & 929 (2017) – Proposed legislation to require labeling and restricted-use of products containing neonicotinoids. The City of Wilsonville has provided testimony in support of these bills.

Bee Stewards

- Create pollinator habitats
- Develo... plan
- Provid... lkit and worksh...
- Expos... and involve...
- Provid... or habitat...

Establishing Habitat & Food for Pollinators

- Variety, year-round, native wherever possible.
- Xerces Society for plant recommendations
- Procurement of plants free of neonicotinoid pesticide residues.
- Potential for [illegible] with existing habitat.

- **Prevent** pest issues in the first place!
- **Monitor** and correctly identify pests
- Deal with problems **early**
- Establish **thresholds** of action
- Try **non-hazardous approaches first**
- If we must use pesticides, use the least risky kinds, preferably OMRI-labeled. **Pesticides are a "last resort"**.

City of Wilsonville in Oregon

Pesticides

- Chemical or biological agent that deters, incapacitates, kills, or otherwise discourages pests
- The first known pesticide was elemental sulfur dusting used in ancient Mesopotamia 4,500 years ago
- In the U.S., federal pesticide regulations were first adopted in 1910
- In 2006 and 2007, the world used approximately **5.2 billion pounds of pesticides**, with herbicides 40%, insecticides 17%, and fungicides 10% the largest percentages
- During the same time period, the U.S. used approximately **1.1 billion pounds of pesticides**, accounting for 22% of the world total

Ten Most Commonly Used Conventional Agricultural Pesticide Active Ingredients

Active Ingredient	Type*	2007		2005		2003		2001	
		Rank	Range**	Rank	Range	Rank	Range	Rank	Range
Glyphosate	H	1	180-185	1	155-160	1	128-133	1	85-90
Atrazine	H	2	73-78	2	70-75	2	75-80	2	74-80
Metam sodium	Fum	3	50-55	3	39-44	3	45-50	3	57-62
Metolachlor-S	H	4	30-35	5	27-32	6	28-33	9	20-24
Acetochlor	H	5	28-33	6	26-31	5	30-35	4	30-35
Dichloropropene	Fum	6	27-32	4	30-35	7	20-24	8	20-25
2,4-D	H	7	25-29	7	24-28	4	30-35	5	28-33
Methyl bromide	Fum	8	11-15	8	12-16	8	13-17	7	20-25
Chloropicrin	Fum	9	9-11	10	9-12	9	9-12	18	5-9
Pendimethalin	H	10	7-9	9	9-12	10	9-12	11	15-19

***H = herbicide; Fum = fumigant; I = insecticide.**

**** Million Pounds - Range is the estimate taken from several data sources.**

Pesticides in Oregon

Multiple Products

Over 900 registered <u>active ingredients</u>

insecticides, fungicides, herbicides, antimicrobials……

↓

Over 12,000 registered <u>pesticide products</u>

agricultural pesticides, home products, pet products, mosquito repellents, cleaners, pool/spa chemicals, etc.…

a.i. Bifenthrin in > 150 products

a.i. Fipronil in > 160 products

NPDES Stormwater Permit

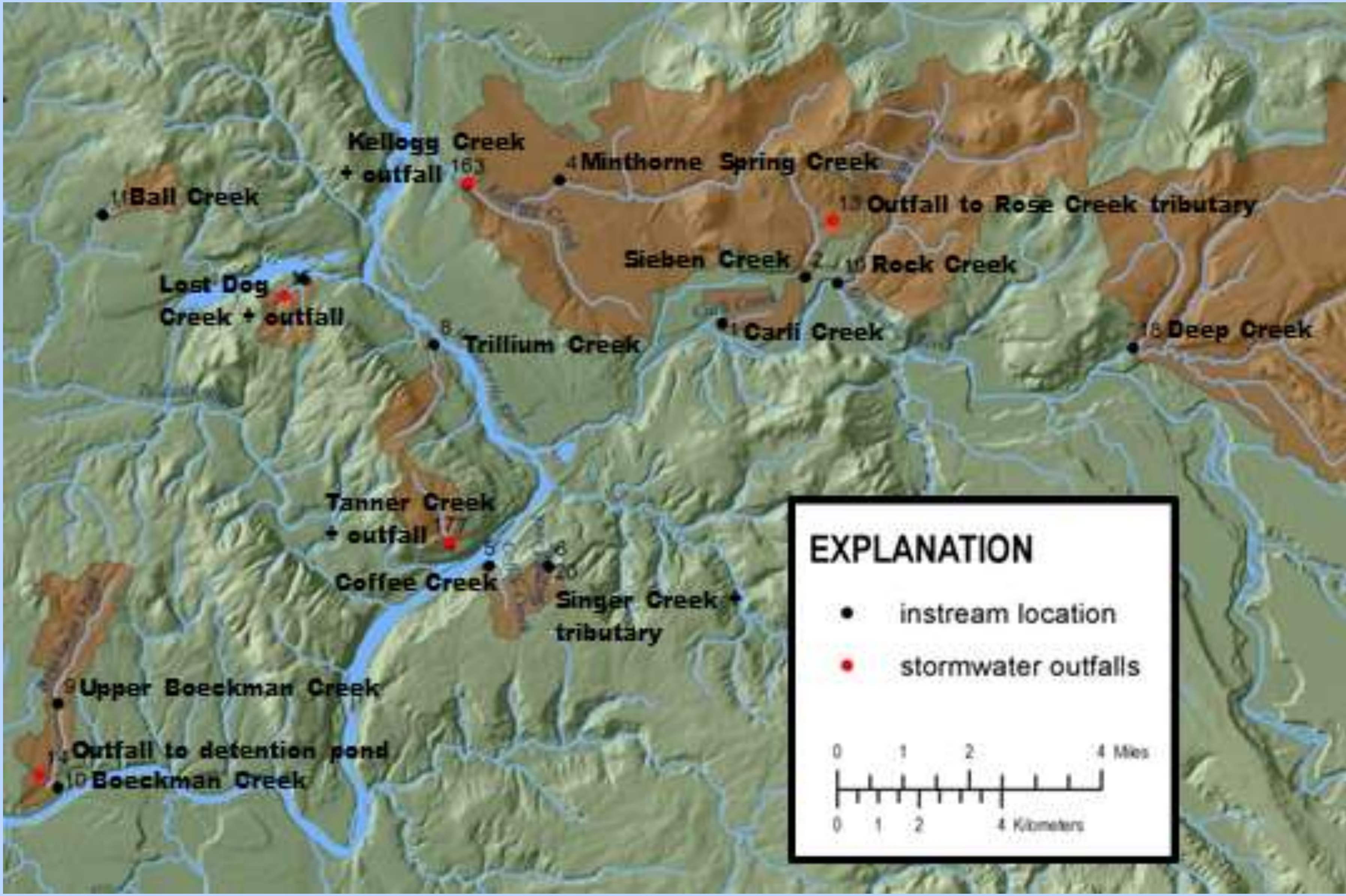
- The latest Phase 1 permit included a pesticide monitoring requirement
- Targeted the most commonly used urban pesticides in Oregon
- Needed to be incorporated into the permittees environmental monitoring program

NPDES Stormwater Permit

- NPDES permit required 15 common compounds and any pesticides currently used by the permittee
- Included 7 insecticides, 5 herbicides, and 3 fungicides
- Permittee could conduct or contribute to a pesticide stormwater characterization or instream pesticide monitoring

Study

- Streams and stormwater outfalls in Clackamas County
- Bed-sediment samples collected from 15 streams during low flow (August – Sept. 2013)
- Stormwater runoff sampled from 15 streams and 5 outfalls (Sept. 2013)
- Sediment collection devices at three sites (August – Oct. 2013)
- Samples were tested for 91 pesticide compounds in water and 118 pesticide compounds in sediment



Kellogg Creek + outfall
16
3
4 Minthorne Spring Creek
11 Ball Creek
13 Outfall to Rose Creek tributary
Sieben Creek
2
10 Rock Creek
Lost Dog Creek + outfall
1 Carli Creek
8 Trillium Creek
18 Deep Creek
Tanner Creek + outfall
17
7
5
6
20
Coffee Creek
Singer Creek + tributary
9 Upper Boeckman Creek
Outfall to detention pond
10 Boeckman Creek
EXPLANATION
instream location
stormwater outfalls
0 1 2 4 Miles
0 1 2 4 Kilometers

City of
Wilsonville
in Oregon

Pesticides Detected

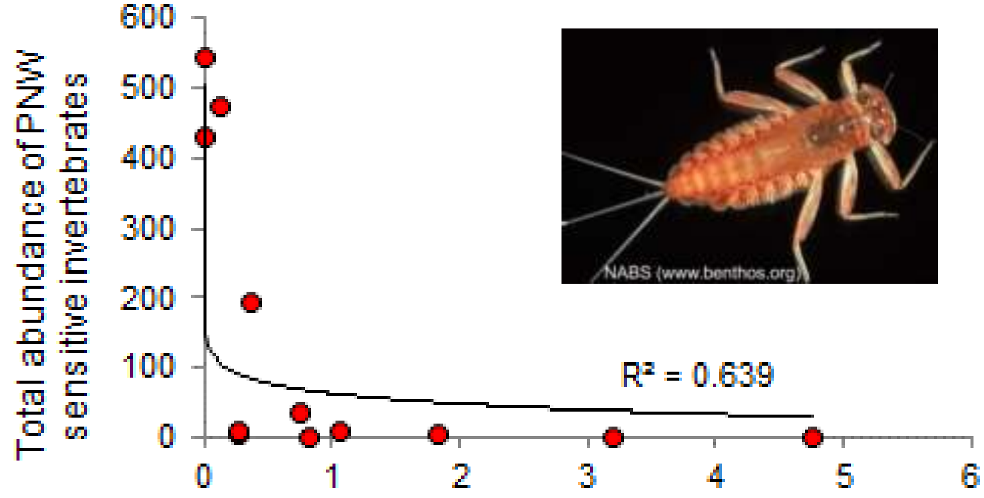
Pesticide (type)	Total Number of Detections	Stormwater runoff			Stream-bed sedi-ment (n=15)
		Storm-water-dissolved (n=20)	Stormwater-suspended sediment (n=20)	SIFT sedi-ment (n=5)	
Bifenthrin (I)	33	15%	75%	100%	71%
Fipronil (I)	13	65%	--	--	--
Fipronil desulfinyl (D)	1	5%	--	--	--
Fipronil sulfide (D)	2	10%	--	--	--
Metolachlor (H)	13	65%	--	--	--
p,p'-DDE (D)	13	--	15%	20%	64%
p,p'-DDD (D)	2	--	5%	--	7%
Pendimethalin (H)	9	--	15%	100%	7%
Trifluralin (H)	8	--	--	80%	29%
Dithiopyr (H)	7	--	--	60%	29%
Carbaryl (I)	6	30%	--	--	--
Iprodione (F)	4	10%	10%	--	--
Zoxamide (F)	4	5%	15%	--	--
Kresoxim-methyl (F)	3	--	15%	--	--
Metalaxyl (F)	3	--	--	--	21%
Pentachloroanisole (D)	3	--	--	20%	14%
Prodiamine (H)	3		--	40%	7%
Propiconazole (F)	3	15%	--	--	--
Cypermethrin (I)	2	--	--	--	14%
Oxyfluorfen (H)	2	--	--	20%	7%

Aquatic-Life Benchmarks

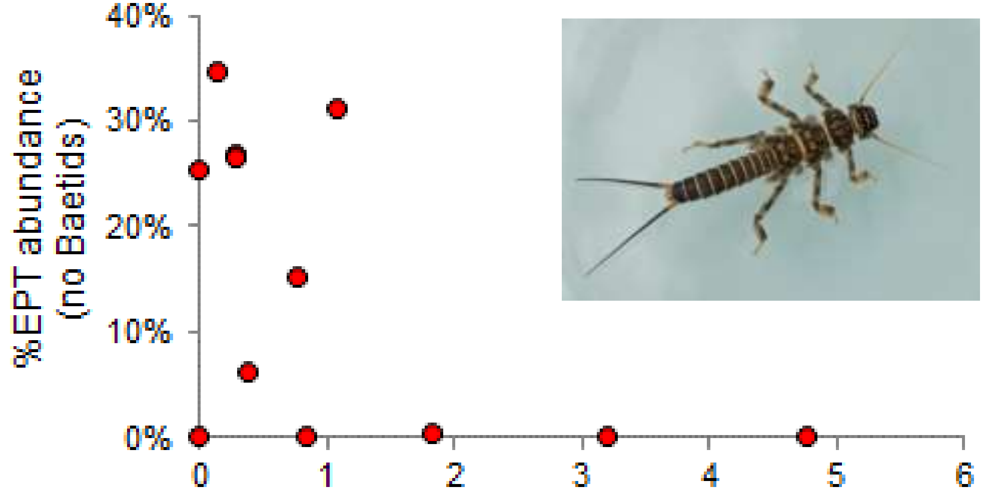
Stream	Stormwater Runoff Concentrations in ng/L				Invertebrate Assemblage Disturbance Class
	Bifenthrin	Fipronil	Malathion	DDE+DDD	
Lost Dog Creek	24*	16*	<	1.1***	Severe
Tanner Creek	97*	127**	<	<	Severe
Sieben Creek	39*	10	<	9.2***	Moderate
Ball Creek	21*	19*	<	<	Severe
Deep Creek	22*	<	<	2.7***	--
Trilium Creek	24*	12*	<	<	Moderate-severe
Kellogg Creek	21*	10.5	<	<	Moderate
Boeckman Creek (upper)	31*	<	<	<	--
Carli Creek	23*	<	<	<	Severe
Coffee Creek	23*	6.7	<	<	Slight
Minthorn Spring Creek	24*	6.4	<	<	Severe
Rock Creek	<	12*	<	<	Moderate-severe
Singer Creek	<	<	457**	<	slight-moderate
Singer Creek tributary	<	20*	<	<	--
Boeckman Creek (lower)	<	<	<	<	Severe

Exceeds: *Chronic invertebrate benchmark, **Acute invertebrate benchmark, ***WQ criterion (CWA)

Declines in sensitive insect species



Declines in %EPT (mayflies, stoneflies and caddisflies)



Study Conclusions

- Pesticides in stormwater runoff are likely harming aquatic insect populations in streams with relatively low bifenthrin concentrations
- While flashy hydrology and degraded habitat, and other pollutants may also contribute, bifenthrin appears to have a substantial impact
- Unclear what mechanism/pathway is most harmful:
  - Short-duration, acute exposures following storms
  - Long-term exposure to streambed sediments
  - Dietary, through consumption of algae and fine organic matter
- Bioswales and other sediment retention features could intercept pyrethroids, DDT metabolites, and other hydrophobic contaminants in urban runoff

DEQ Toxic Reduction Strategy

The strategy identified 25 actions to reduce and assess toxics in Oregon, and DEQ prioritized five of those for short-term action:

- ***Develop and implement low toxicity state purchasing and procurement guidelines***
- **Pesticide collection events** - Since 2014, over **265,000** pounds of pesticide wastes have been collected from **415** growers and other pesticide users removing significant threats to groundwater and surface water throughout the state
- **The Pesticide Stewardship Partnership program** - This program involves monitoring streams to identify waters with pesticides of concern to aquatic life and human health. This data is used to inform and focus voluntary strategies for improving practices that reduce pesticides entering waterways.
- **Collaborate to reduce toxics in consumer products**
- **Integrating technical assistance across programs to advance green chemistry in two industry sectors**

Pesticide Stewardship Partnership Program

- During the 2013-15 biennium, more than 1100 water samples were collected across 12 watersheds
- The considerations for prioritization include concentrations observed over established benchmarks, high frequency of detection in water, or occurring in combinations with many other pesticides:
  - **Herbicides:** atrazine, simazine (and their degradates), glyphosate (and a degradate), diuron, linuron, metolachlor and sulfometuron methyl, dichlobenil (and degradate)
  - **Insecticides:** chlorpyrifos, malathion, carbaryl, imidacloprid and bifenthrin
  - **Fungicides:** propiconazole and pyraclostrobin
- Declines in pesticide concentrations and occurrence were observed in some watersheds, due in part to evolving pesticide use and application practices as a result of applicator awareness of off-target movement

Clackamas Basin Pesticide Stewardship Partnership

Voluntary Steps in a PSP:

- Monitor water quality to identify pesticides of concern (approaching or above unsafe levels or found at high frequencies)
- Share and explain water quality monitoring results with those who are interested in protecting the quality of local streams and rivers
- Engage pesticide users and technical assistance providers to identify and implement voluntary solutions to reduce pesticide drift, runoff and waste
- Use long-term water quality monitoring to measure success in reducing pesticides of concern and evaluate the effectiveness of strategies

Questions