DPR Urban Water Monitoring
AND
Pyrethroid Regulations

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Environmental Monitoring Branch
Department of Pesticide Regulation
PAPA Seminar December 4, 2014

- PART I
  - DPR Urban Monitoring Studies
- PART II
  - Pyrethroid Regulations

- PART I
  - DPR Urban Monitoring Studies

Objective 1: What Pesticides are in Surface Water?

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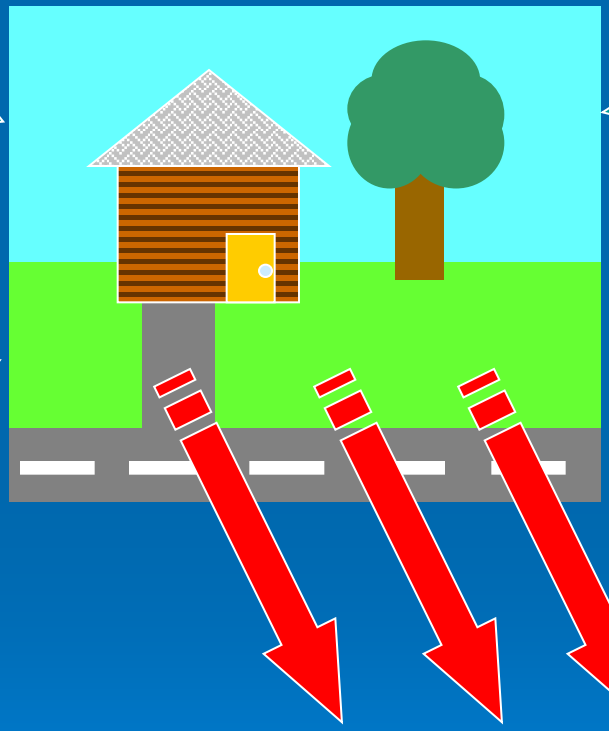

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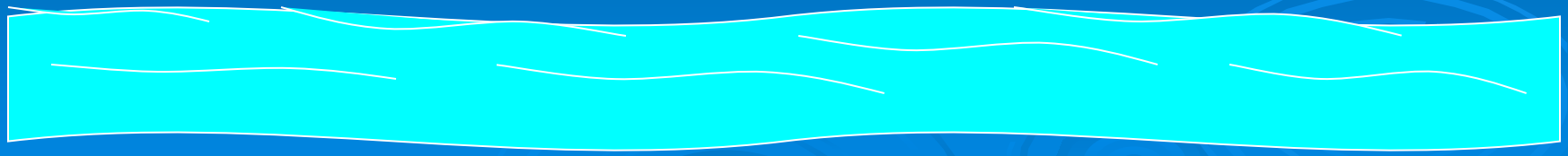
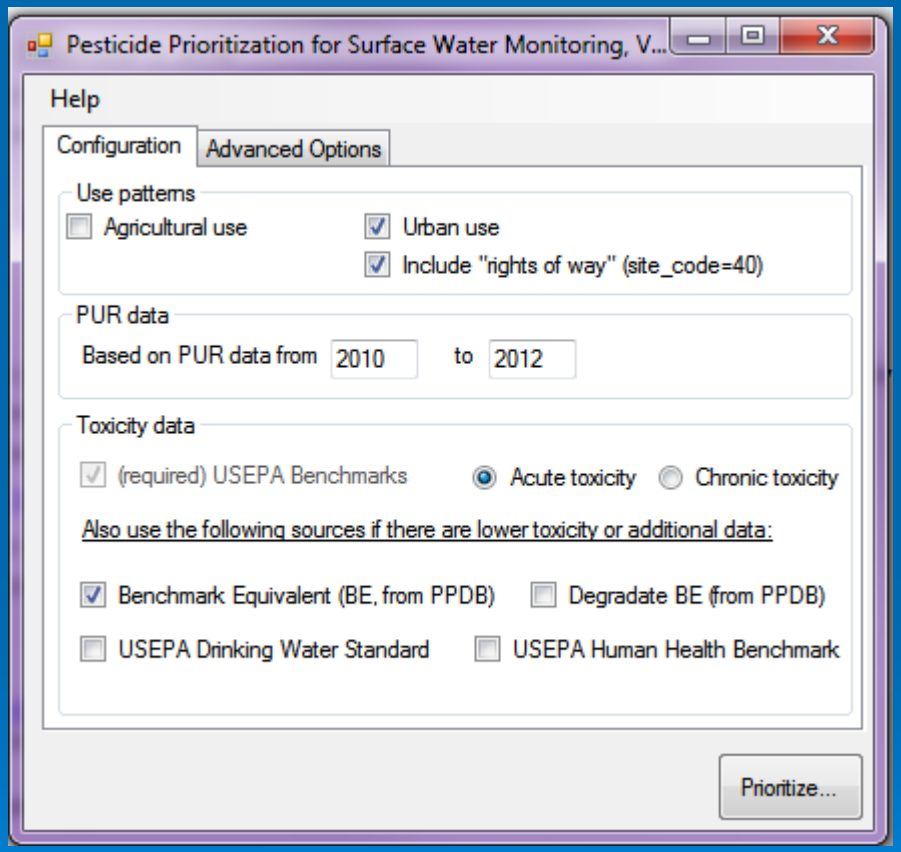
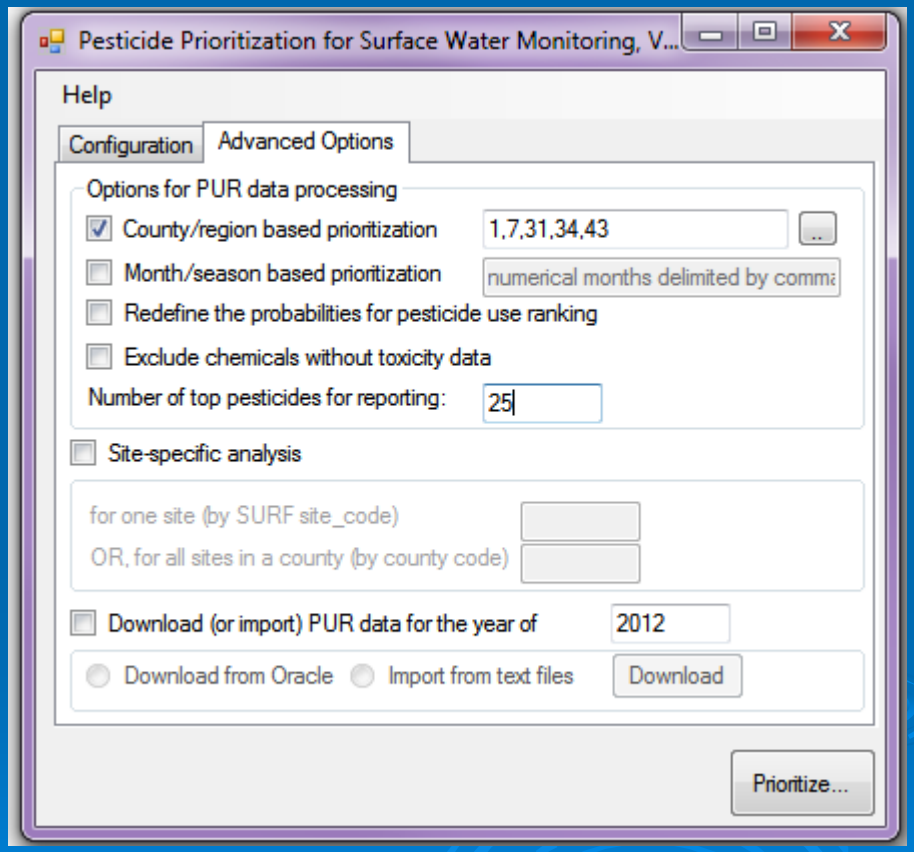


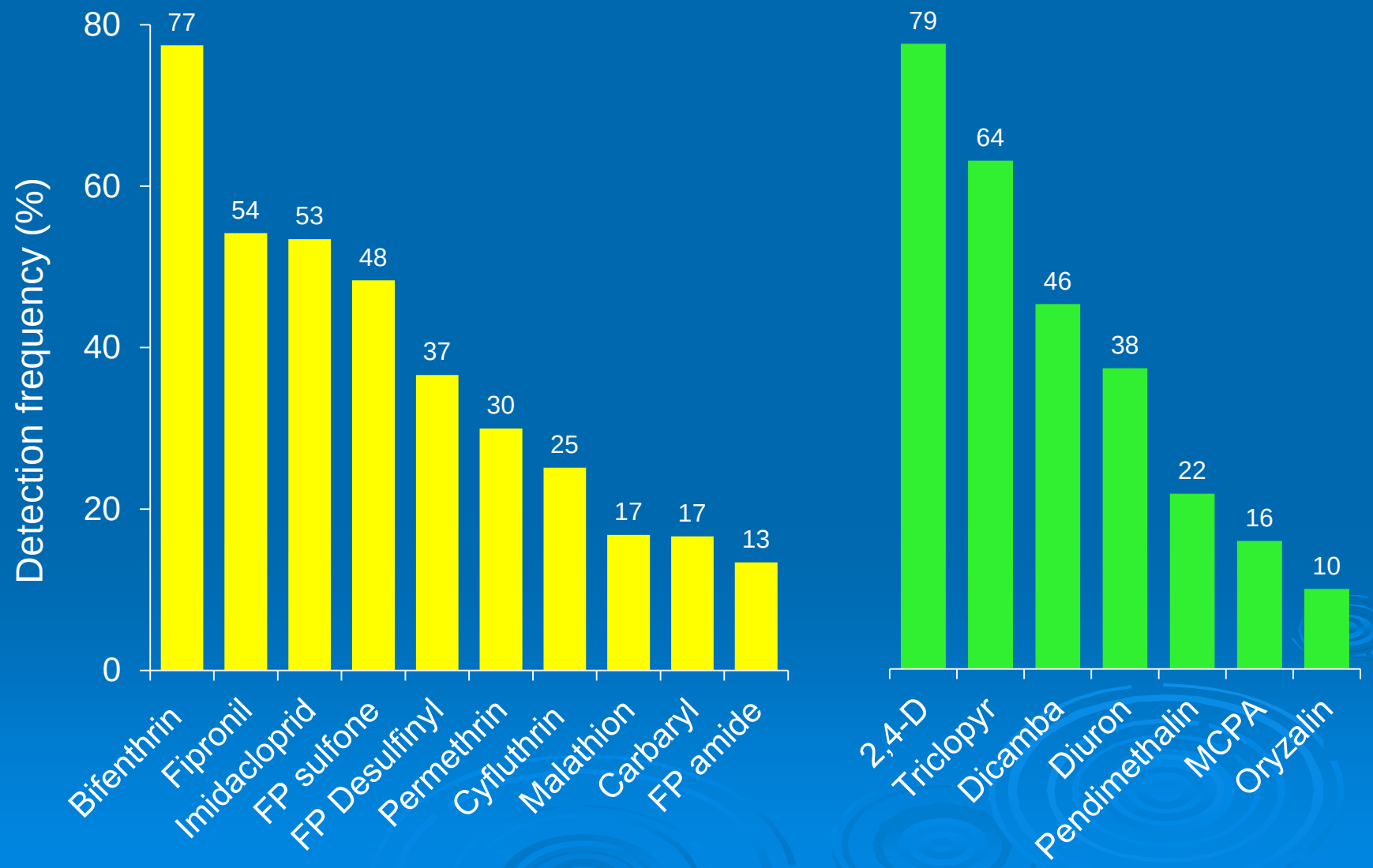
Objective 1 – What Pesticides? Prioritization Model



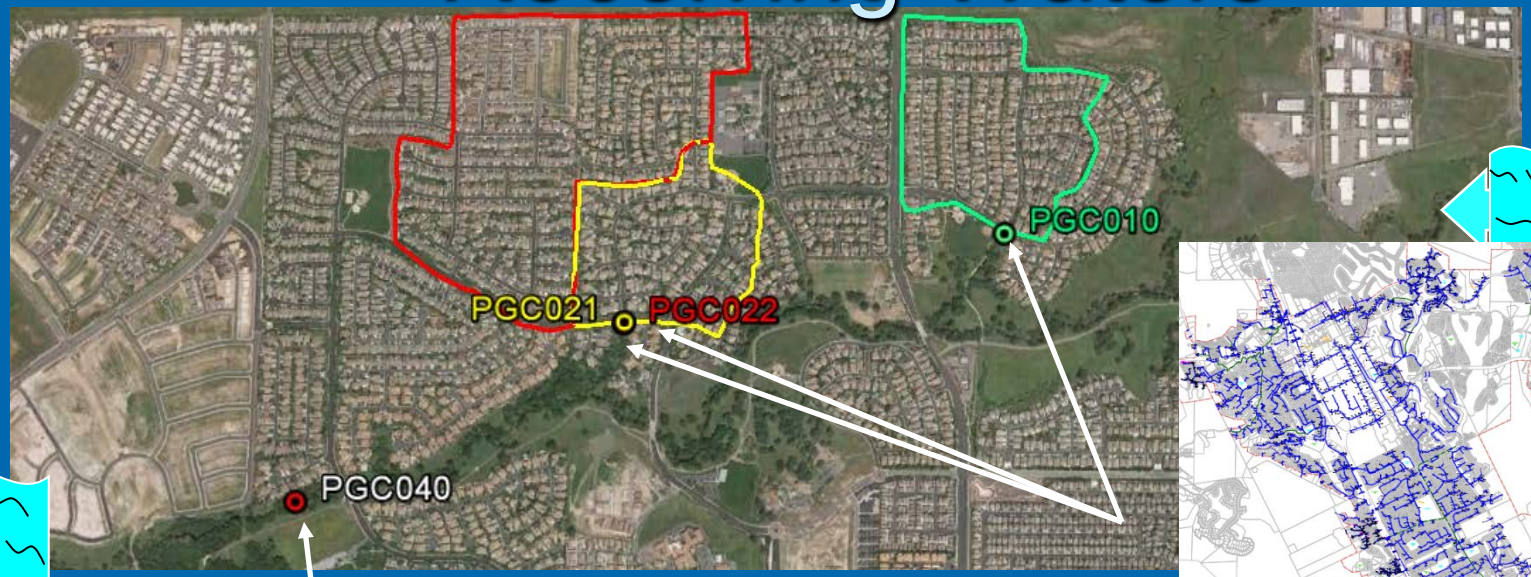


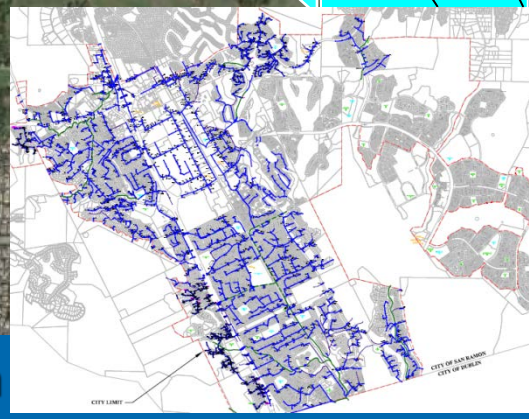
CHEMNAME	use	Use score	BM	Tox score	Final score	Recom
Permethrin	27,665	5	0.01	7	35	TRUE
Bifenthrin	27,842	5	0.075	6	30	TRUE
Cyfluthrin	8,667	4	0.0125	6	24	TRUE
Diuron	21,010	5	2.4	4	20	TRUE
Fipronil	8,095	4	0.11	5	20	TRUE
Diquat	6,823	4	0.75	5	20	FALSE
Pendimethalin	19,251	4	5.2	4	16	TRUE
Chlorothalonil	13,859	4	1.8	4	16	FALSE
Bromacil	12,643	4	6.8	4	16	TRUE
Prodiamine	6,631	4	3	4	16	TRUE
Cypermethrin	4,296	3	0.195	5	15	TRUE
Sulfometuron	2,282	3	0.48	5	15	TRUE
Carbaryl	2,081	3	0.85	5	15	TRUE
Flumioxazin	1,895	3	0.852	5	15	FALSE
Oxyfluorfen	1,665	3	0.29	5	15	TRUE
Malathion	1,363	3	0.3	5	15	TRUE
Lambda-cyhalothrin	827	2	0.0035	7	14	TRUE
Triclopyr	16,939	4	70	3	12	TRUE
Oryzalin	12,271	4	15.4	3	12	TRUE
Imidacloprid	7,720	4	35	3	12	TRUE
Acrolein	4,174	3	7	4	12	FALSE
Halosulfuron-methyl	2,370	3	5.3	4	12	FALSE
Chlorfenapyr	1,556	3	2.915	4	12	TRUE
Oxadiazon	1,419	3	5.2	4	12	TRUE
Deltamethrin	674	2	0.055	6	12	TRUE

Most Prevalent Pesticides in California Urban Surface Waters (2008-2014)



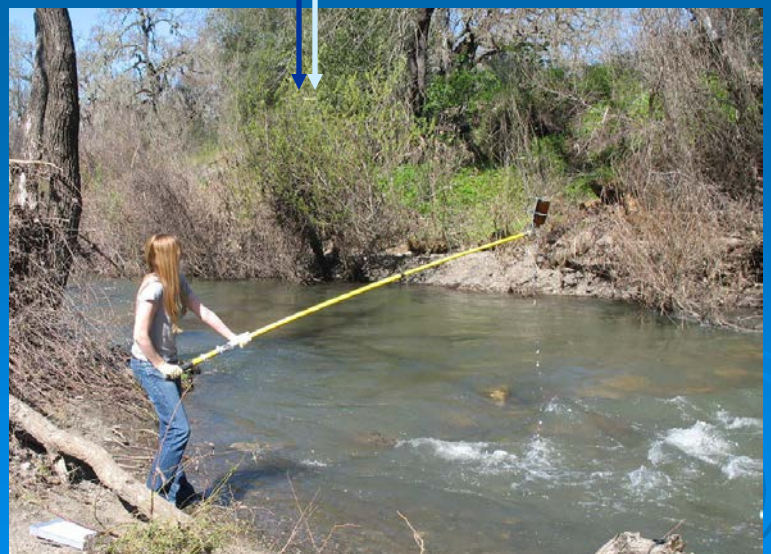
Objective 2: Stormdrain Outfalls and Receiving Waters



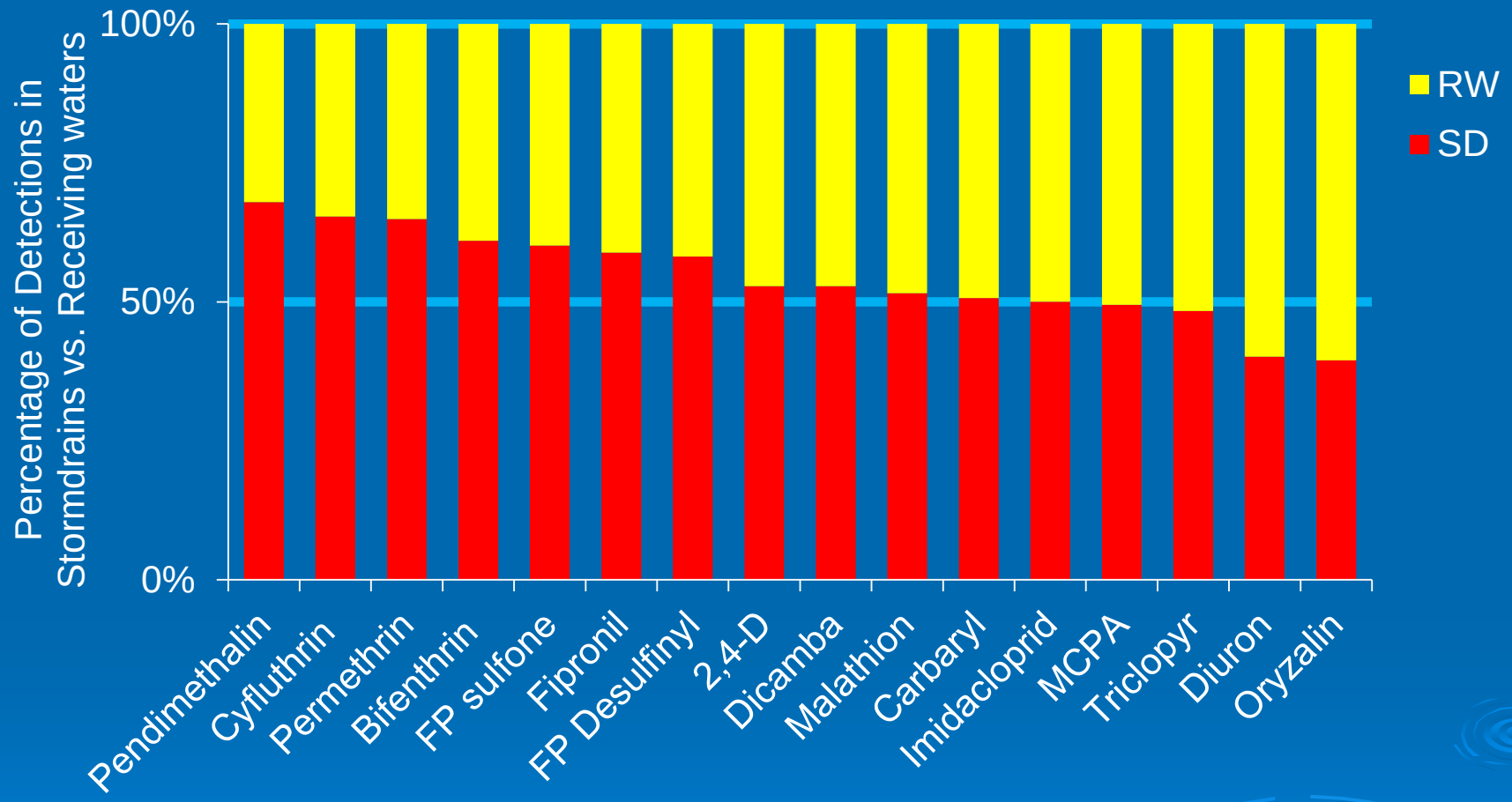


Receiving Water

Stormdrain



Stormdrain Outfalls vs. Receiving Waters



Generally, DF highest in Stormdrains, but not always.
But it does indicate that the most potentially toxic runoff is from urban homes and neighborhoods

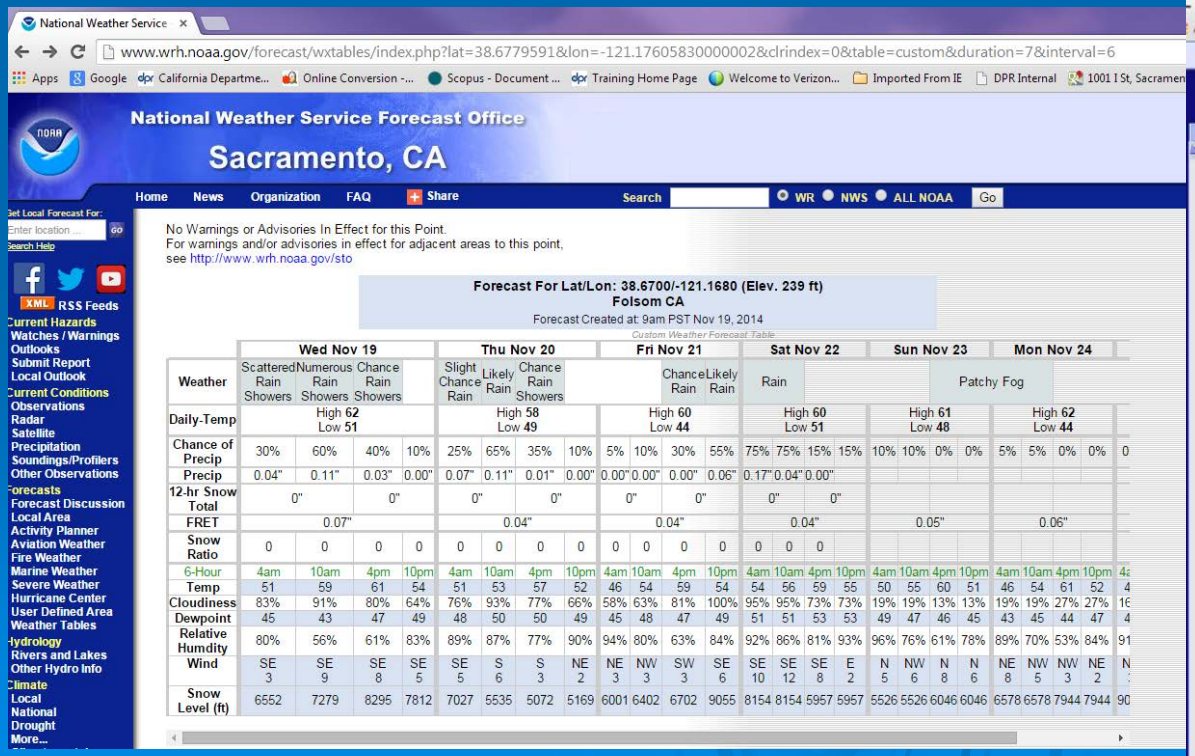
Objective 3: Seasonal Differences

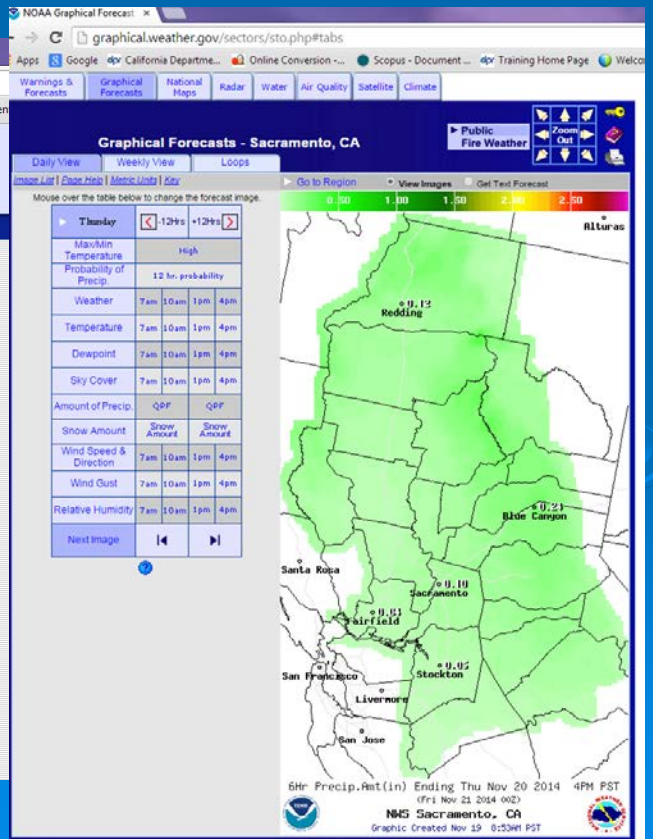
Dry Season

Rain Event

Objective 3 - Seasonal Differences

- Dry – base on use patterns
  - June/August
- Rain – First flush of WY*, Winter Rain

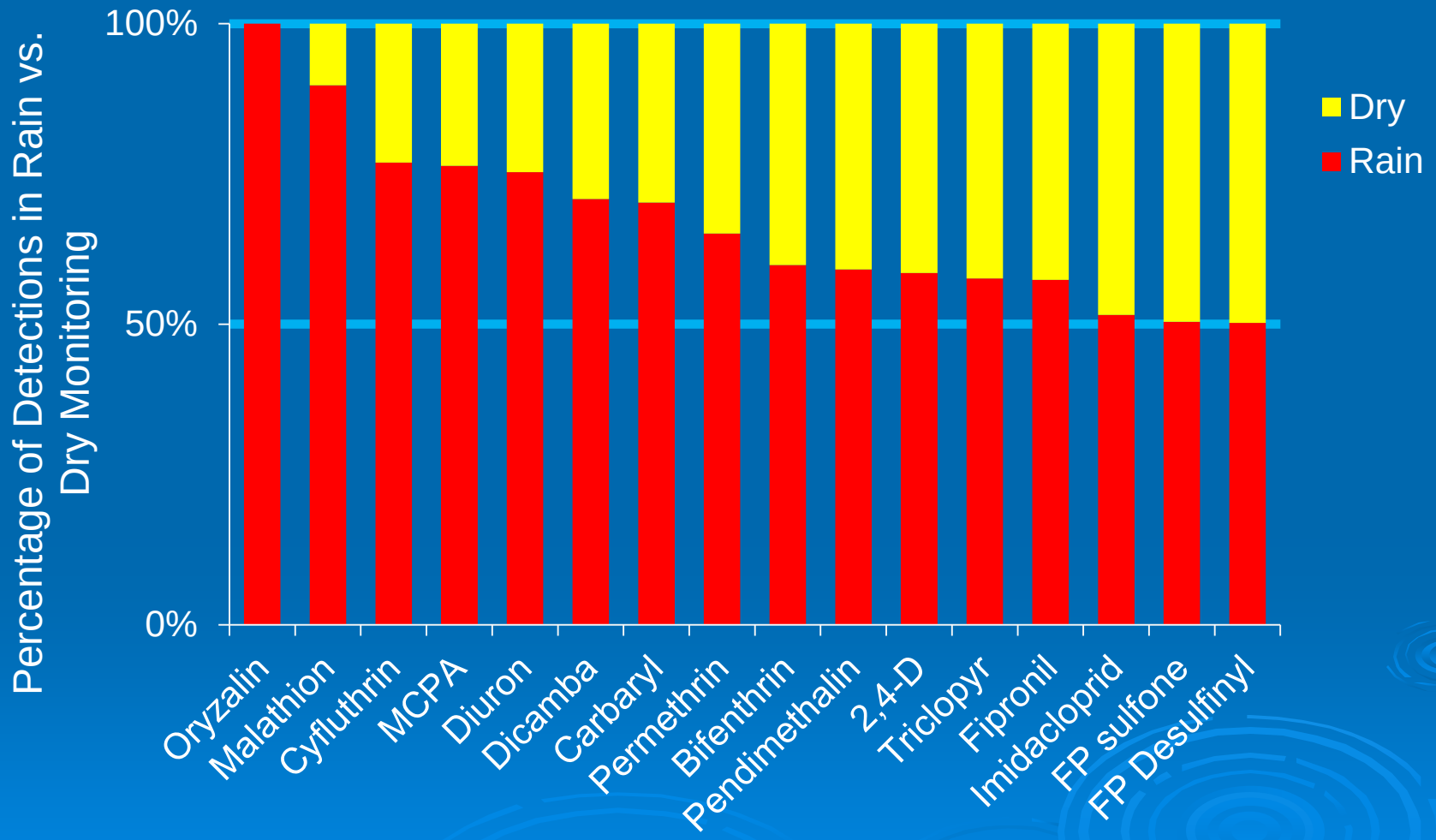




*Water year, Oct 1 – Sept 30

Dry Season Monitoring vs. Rainfall Monitoring

> Detects in RAIN



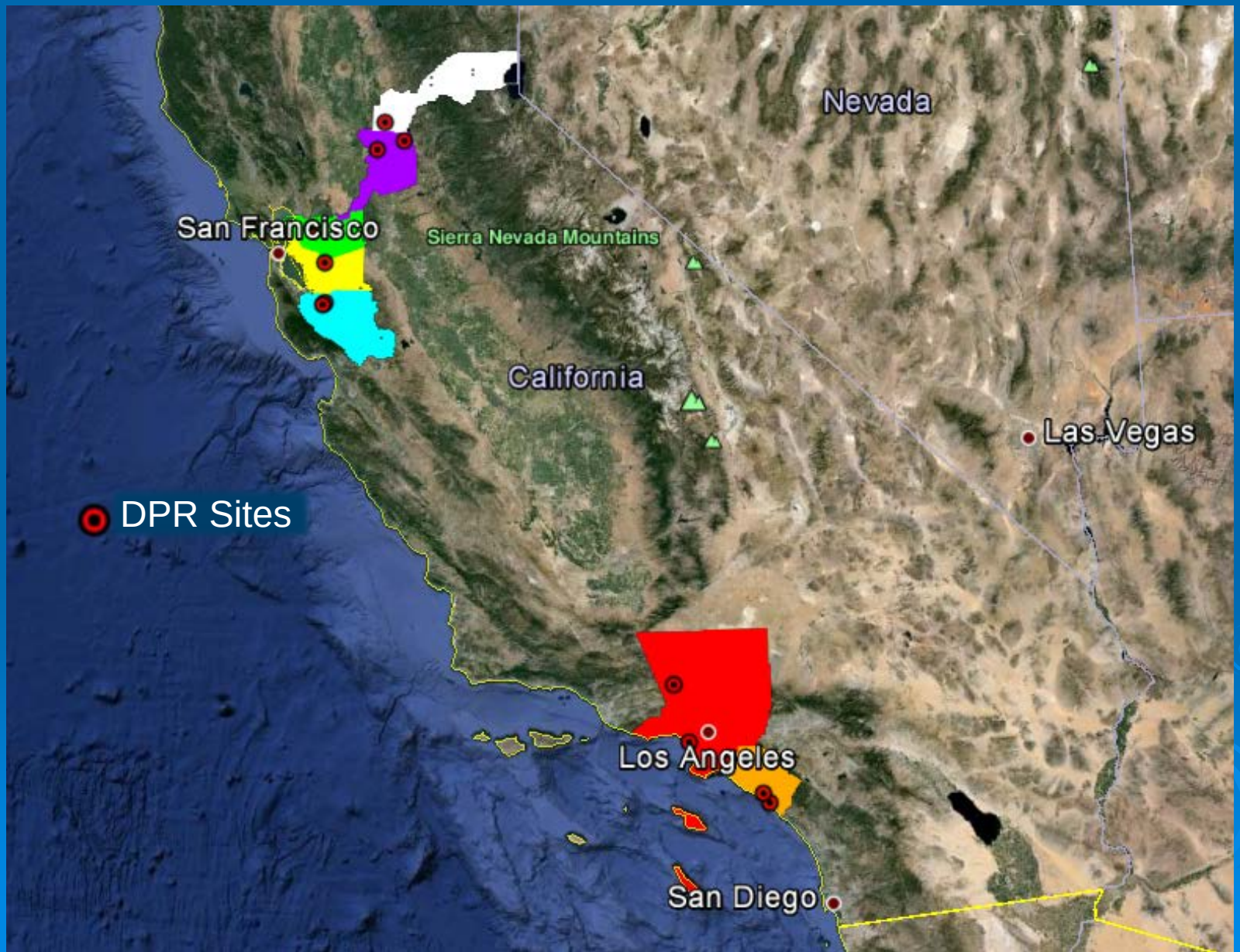
Use caution when spraying when rain is predicted

Objective 4: Regional Differences

Northern California

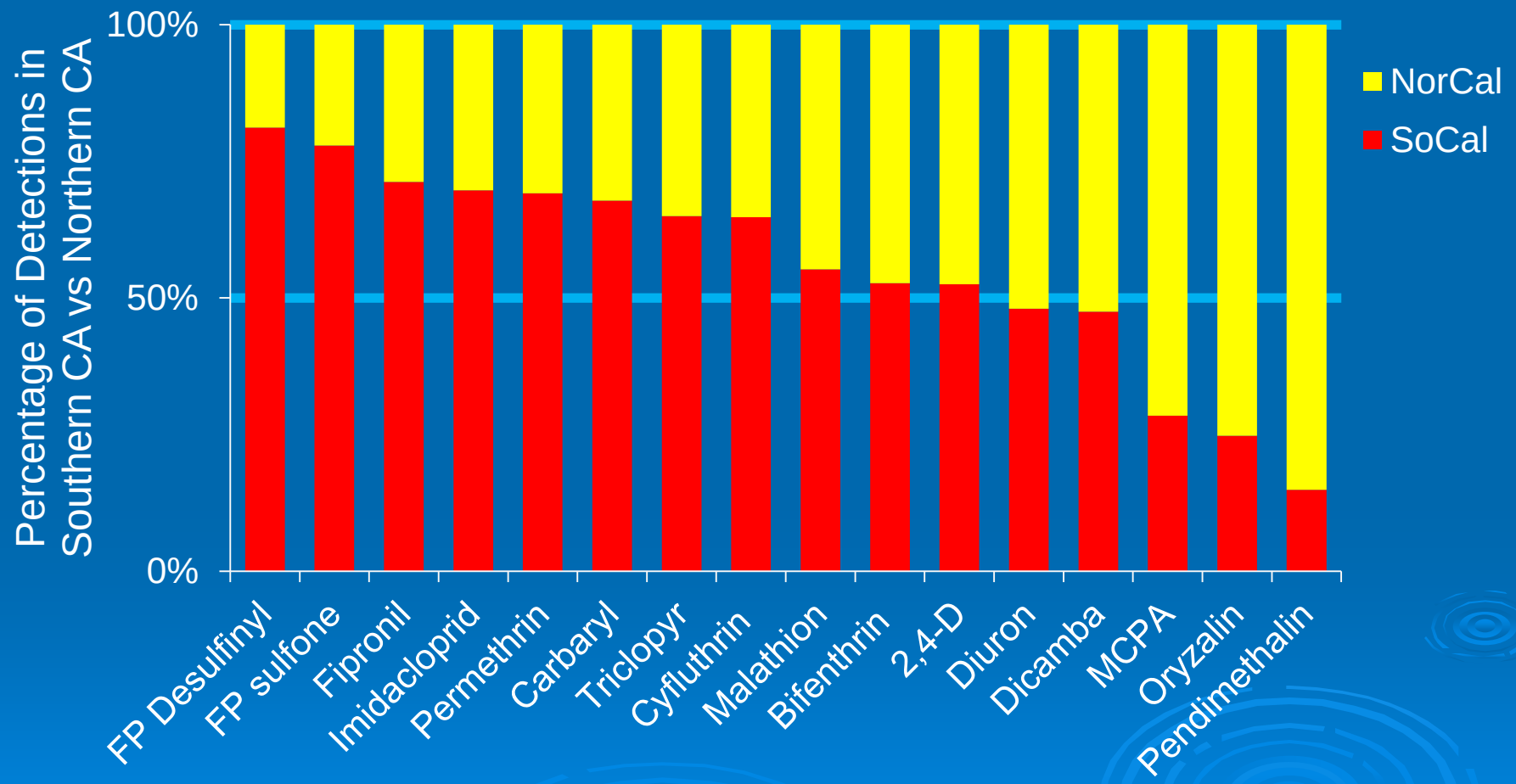
Southern California

Objective 4 – Regional Differences



Regional Differences

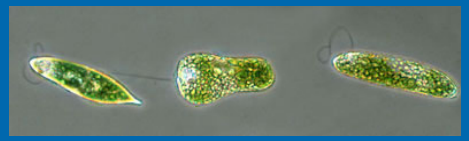
> Insecticide Detects in Southern California



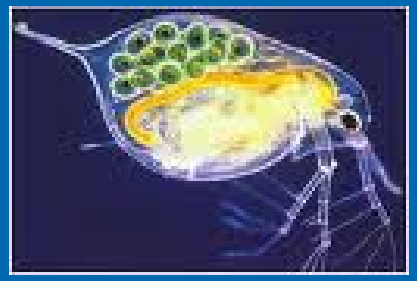
More insecticide runoff (use?) in SoCal

Objective 5: Toxic to Aquatic Species?

Dinoflagellates



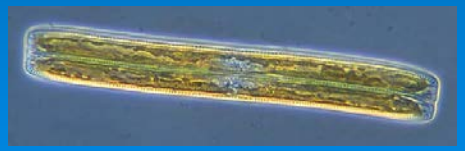
Euglenozoans



Ceriodaphnia dubia

Rainbow Trout

Green algae



Diatoms

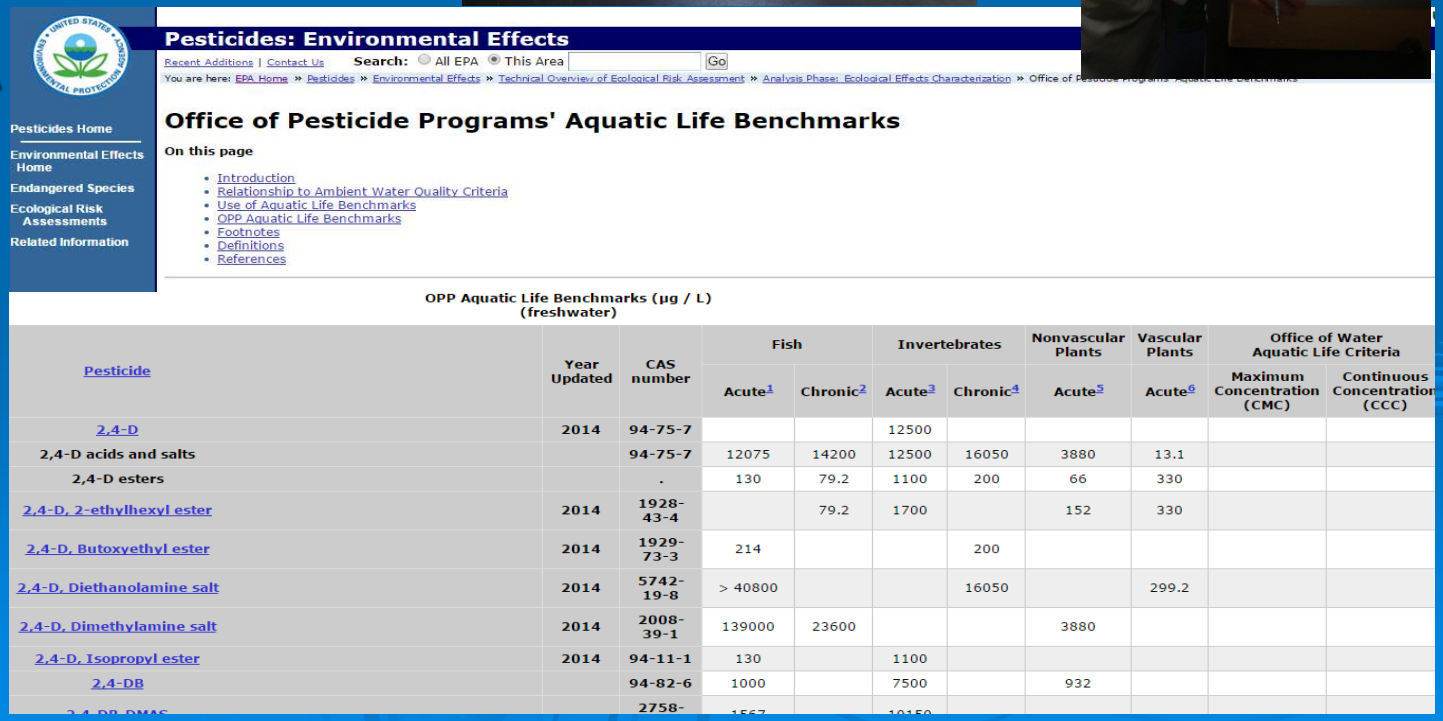
Copepods

Hyalella azteca

Objective 5 - Toxicity

- UCD Aquatic Health Program - *Hyalella azteca*

- USEPA



Pesticides: Environmental Effects

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Pesticides Home
Environmental Effects Home
Endangered Species
Ecological Risk Assessments
Related Information

Office of Pesticide Programs' Aquatic Life Benchmarks

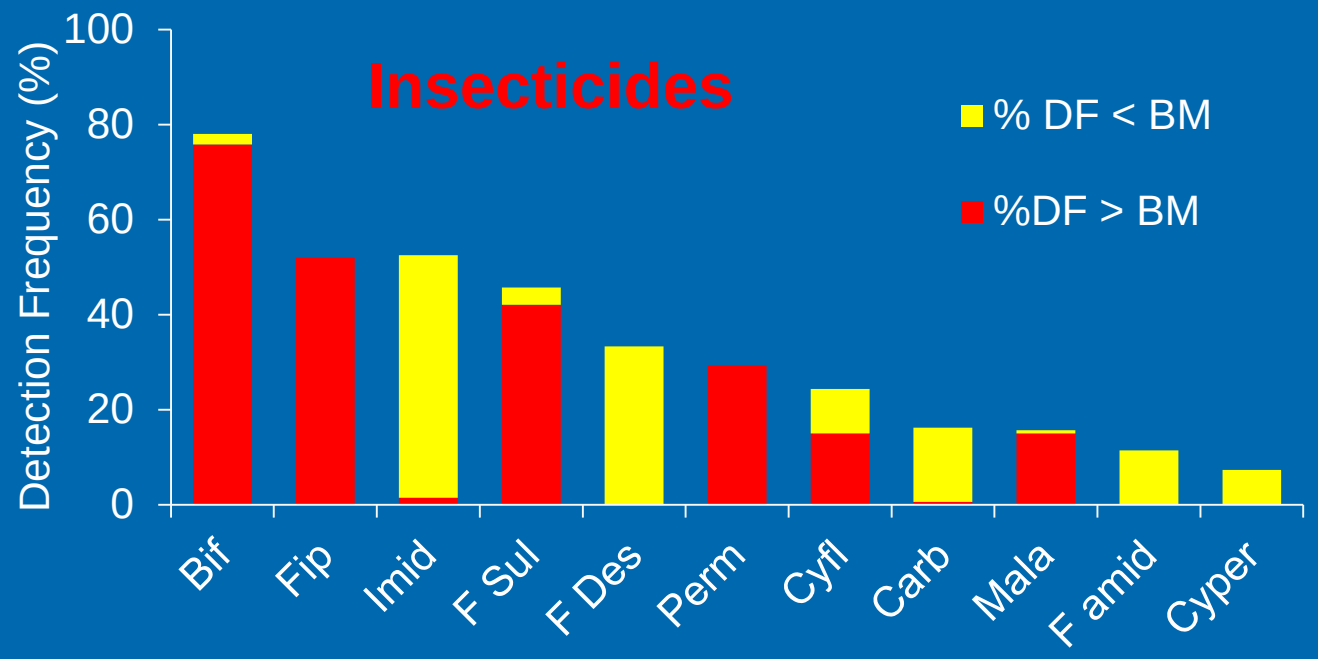
On this page

- Introduction
- Relationship to Ambient Water Quality Criteria
- Use of Aquatic Life Benchmarks
- OPP Aquatic Life Benchmarks
- Footnotes
- Definitions
- References

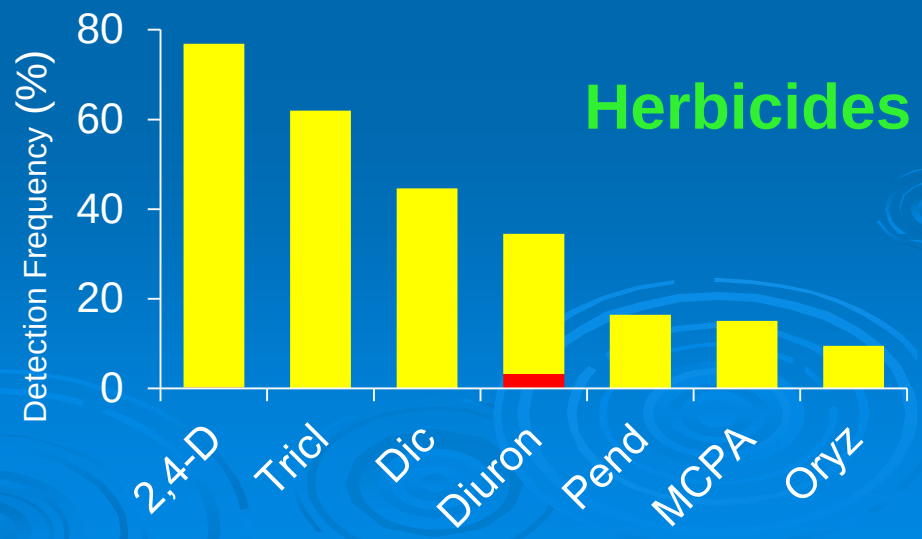
OPP Aquatic Life Benchmarks (µg / L)
(freshwater)

Pesticide	Year Updated	CAS number	Fish		Invertebrates		Nonvascular Plants	Vascular Plants	Office of Water Aquatic Life Criteria	
			Acute[1]	Chronic[2]	Acute[3]	Chronic[4]	Acute[5]	Acute[6]	Maximum Concentration (CMC)	Continuous Concentration (CCC)
2,4-D	2014	94-75-7			12500					
2,4-D acids and salts		94-75-7	12075	14200	12500	16050	3880	13.1		
2,4-D esters		.	130	79.2	1100	200	66	330		
2,4-D, 2-ethylhexyl ester	2014	1928-43-4		79.2	1700		152	330		
2,4-D, Butoxyethyl ester	2014	1929-73-3	214			200				
2,4-D, Diethanolamine salt	2014	5742-19-8	> 40800			16050		299.2		
2,4-D, Dimethylamine salt	2014	2008-39-1	139000	23600			3880			
2,4-D, Isopropyl ester	2014	94-11-1	130		1100					
2,4-DB		94-82-6	1000		7500		932			
2,4-DB, DMAS		2758-	1567		10150					

Potential Toxicity - Comparison to Benchmarks

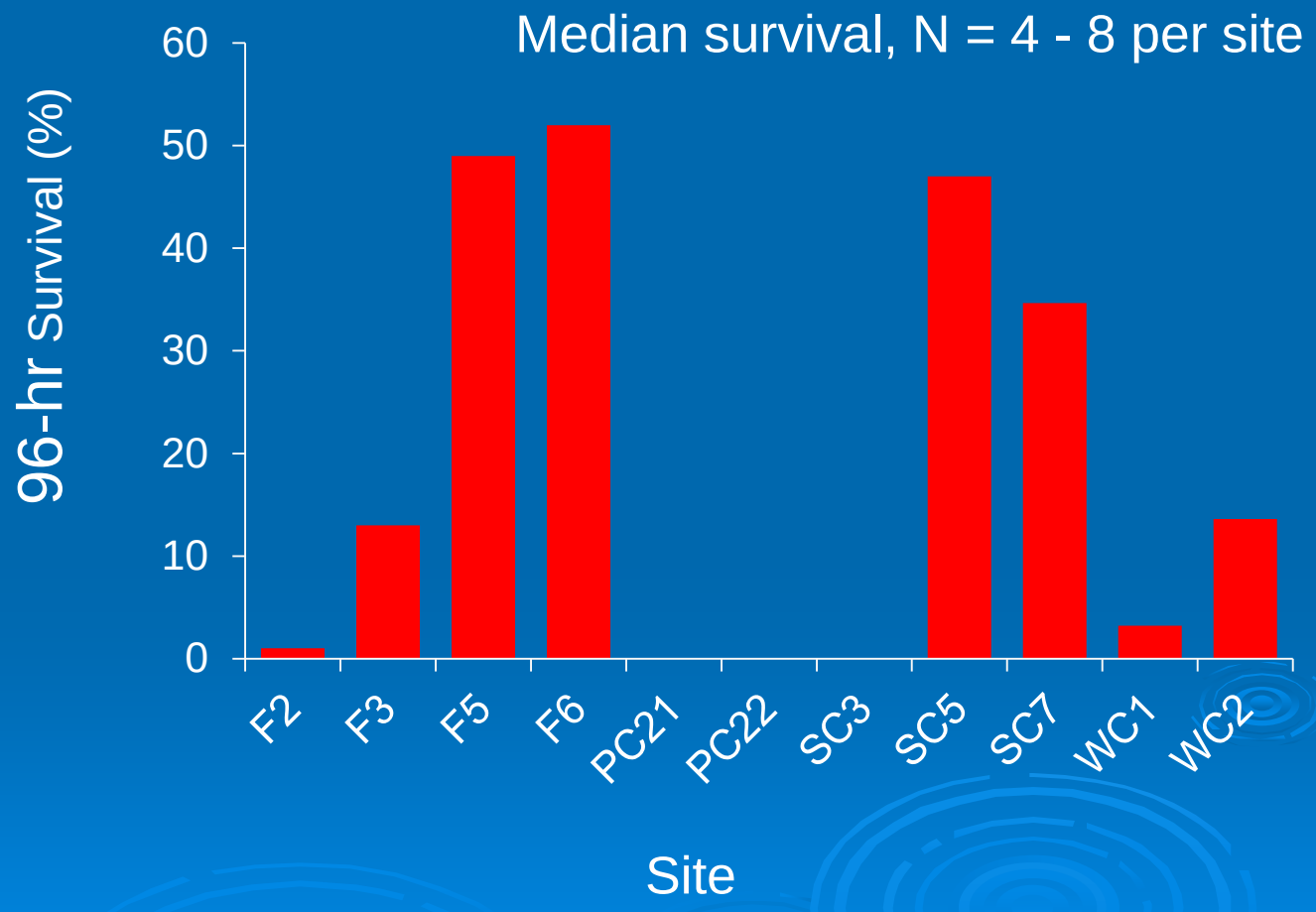


Pyrethroids, fipronil, malathion most concern for potential toxicity to fish, aquatic organisms



Aquatic Toxicity

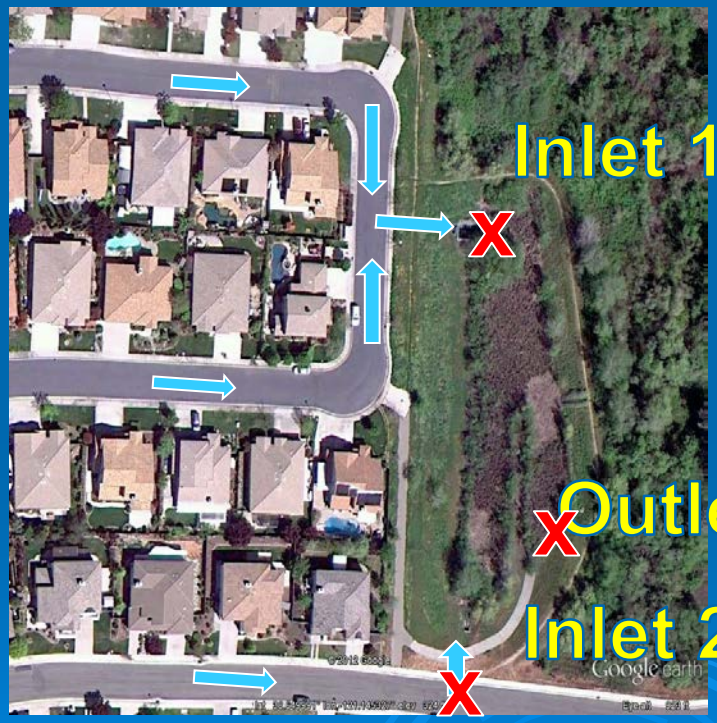
H. azteca



Objective 6- Mitigation Measures

- Urban constructed water quality ponds to reduce pesticide concentrations, pesticide loads, and reduce toxicity

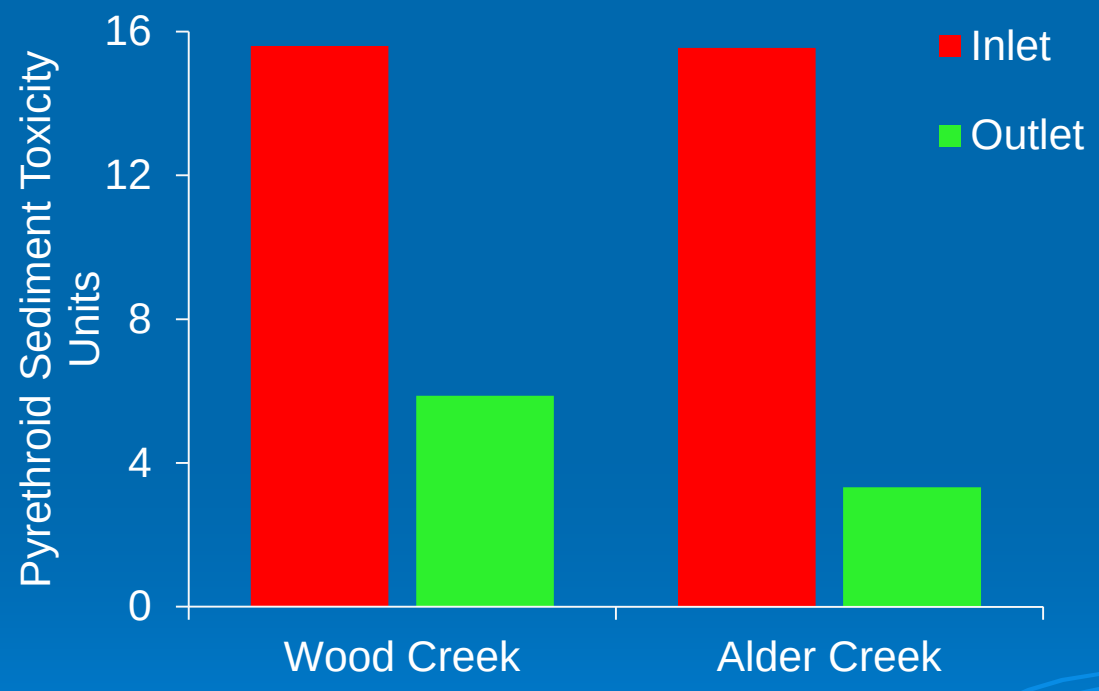
Wood Creek CWQTP



Alder Creek CWQTP

Constructed Water Quality Ponds

How effective are they?



62% reduction

79% reduction

PART II
Pyrethroid Regulations

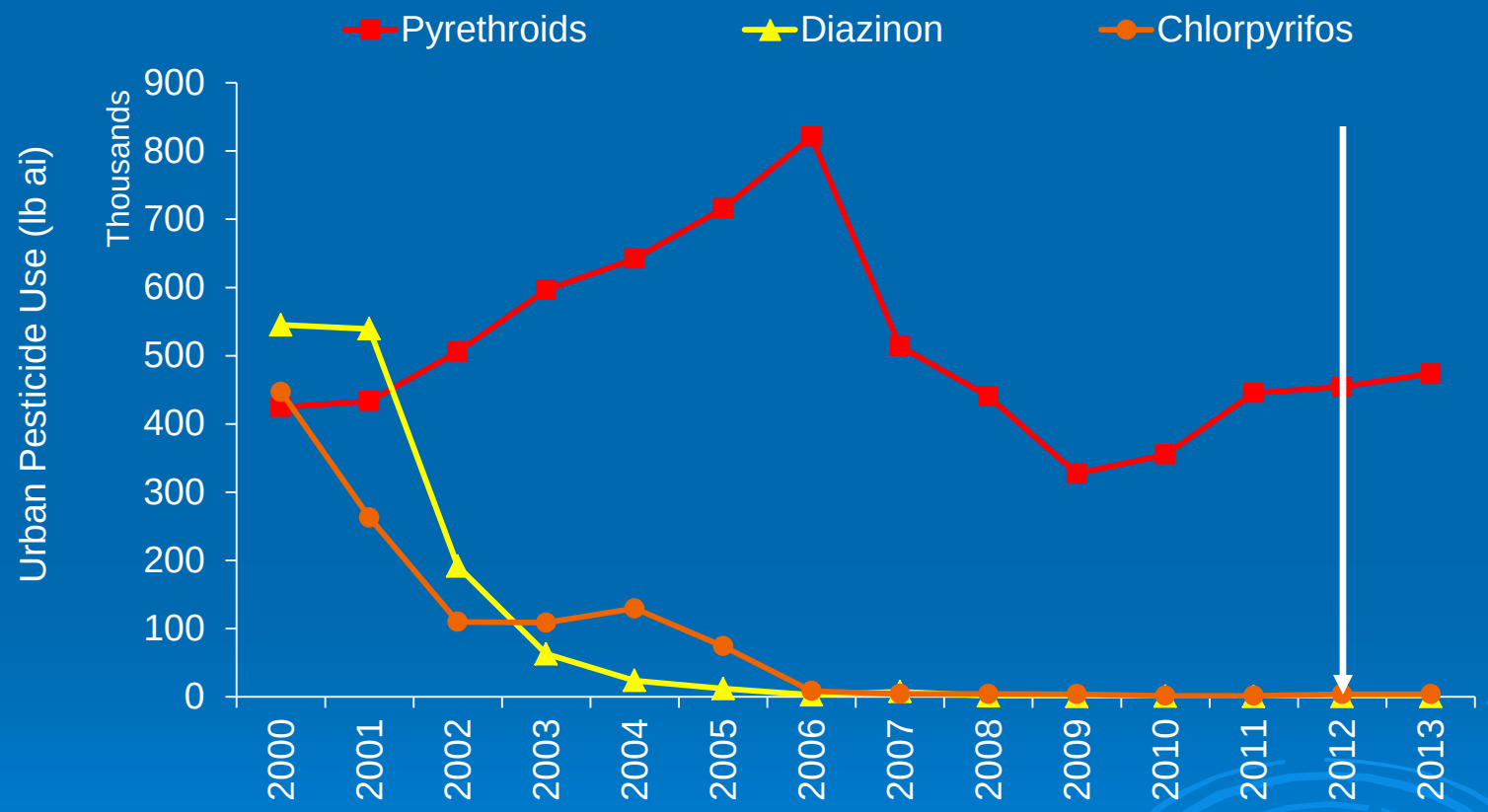
A. Why are Pyrethroids a concern in urban surface waters?

B. Generalities of Surface Water Regulations

C. DPR monitoring and long term trends

A. Pyrethroids are an urban concern

1. Pyrethroids have high use in urban areas

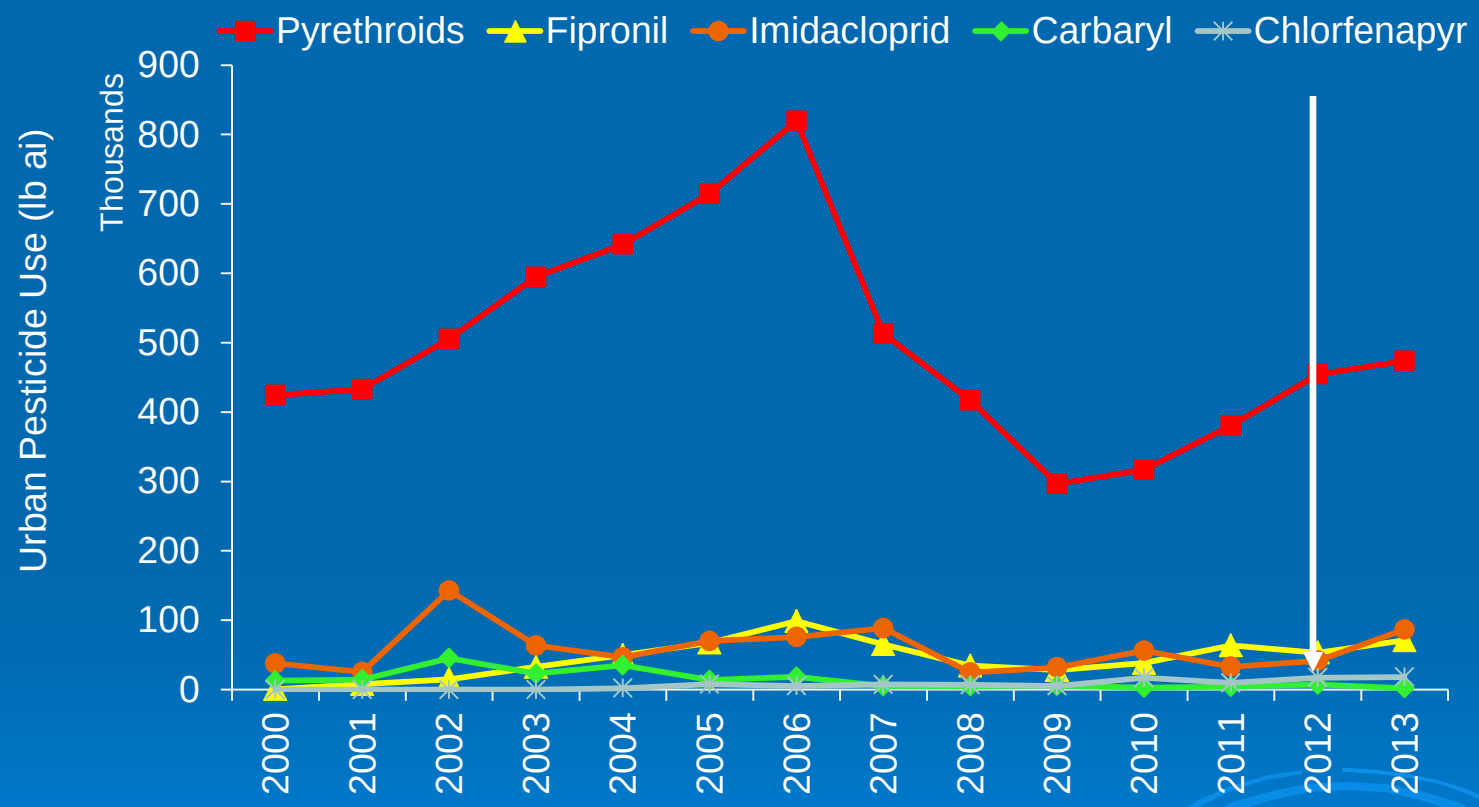


Pyrethroids: high, increasing use, replace OPs

CDPR PUR
Homeowner use not reported

A. Pyrethroids are an urban concern

1. Pyrethroids have high use in urban areas



CDPR PUR
Homeowner use
not reported

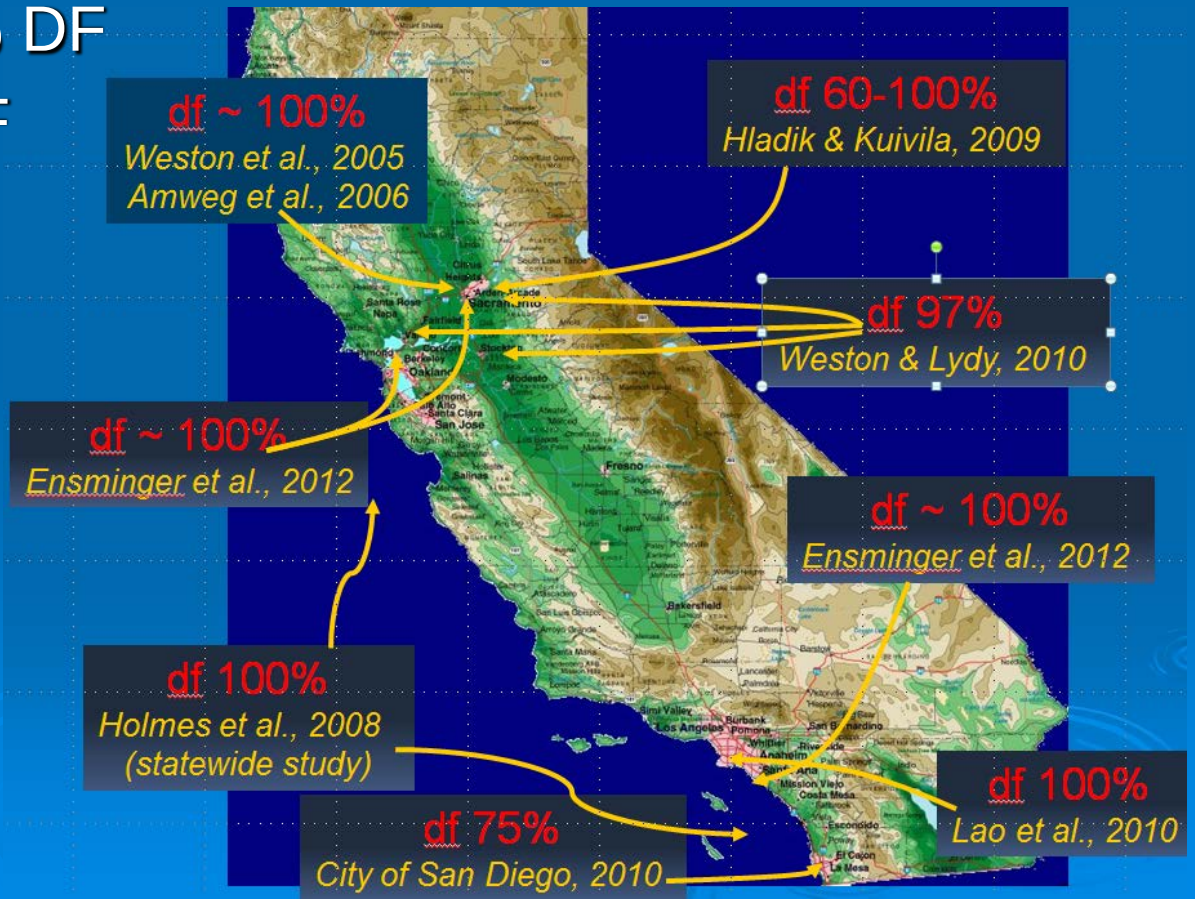
Other urban insecticides (carbaryl, chlorfenapyr, fipronil, imidacloprid) not replace OPs

A. Pyrethroids are an urban concern

2. Pyrethroids have high runoff potential from urban areas, more so than Ag
   - Urban hardscapes
     - Impervious surfaces
   - Storm drain systems
   - Lack of consumer awareness

A. Pyrethroids are an urban concern

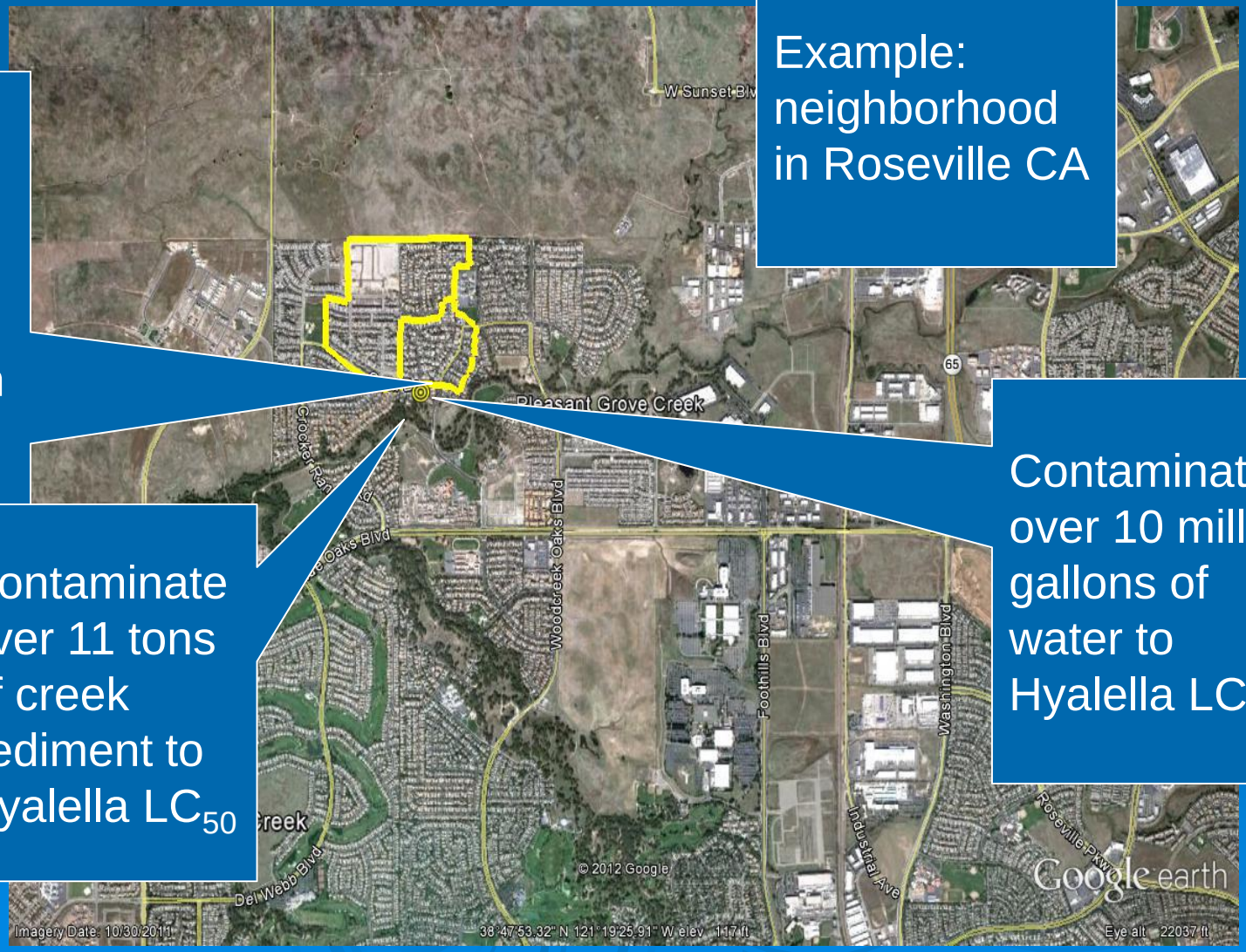
3. Pyrethroids: frequent detections in urban water and sediments
   - Urban detection frequency >> Ag
     - Urban: > 80% DF
     - Ag: ~ 10% DF



A. Pyrethroids are an Urban Concern

400 homes: Over course of one rain storm, released 120 mg of bifenthrin in 24 hrs

Example: neighborhood in Roseville CA



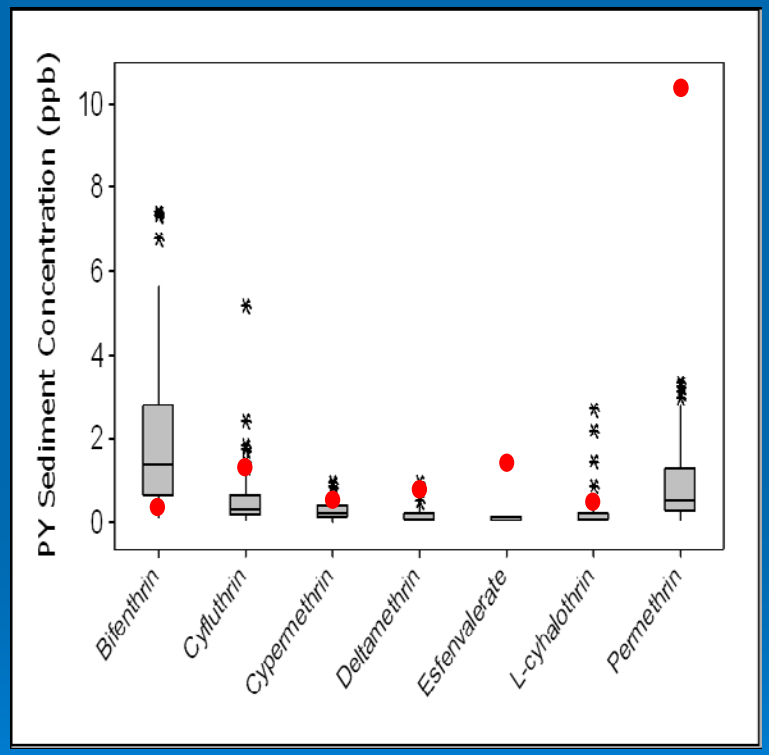
Contaminate over 11 tons of creek sediment to Hyalella LC_{50}

Contaminate over 10 million gallons of water to Hyalella LC_{50}

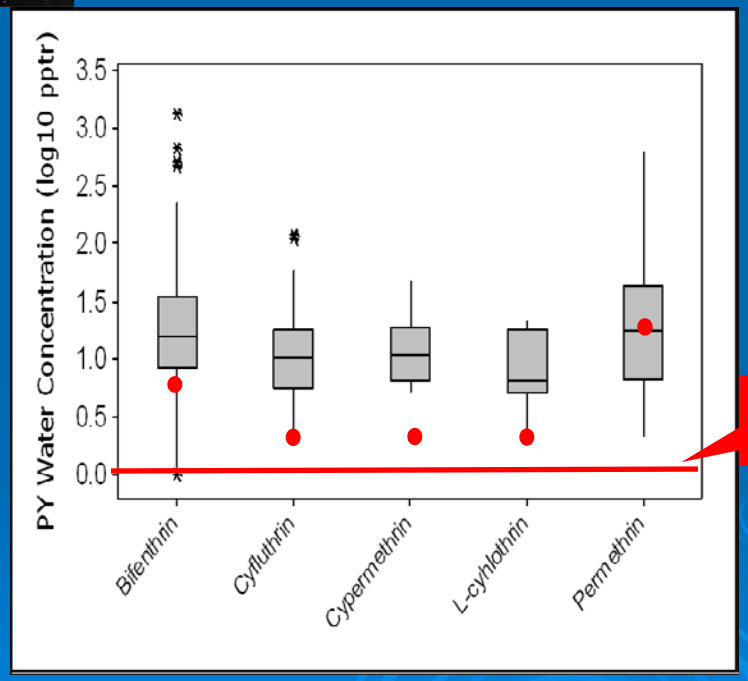
Weston & Lydy http://www.water.ca.gov/iep/docs/052510UrbanRunoff.pdf

A. Pyrethroids are an urban concern

4. Pyrethroids in sediment and surface waters are highly toxic



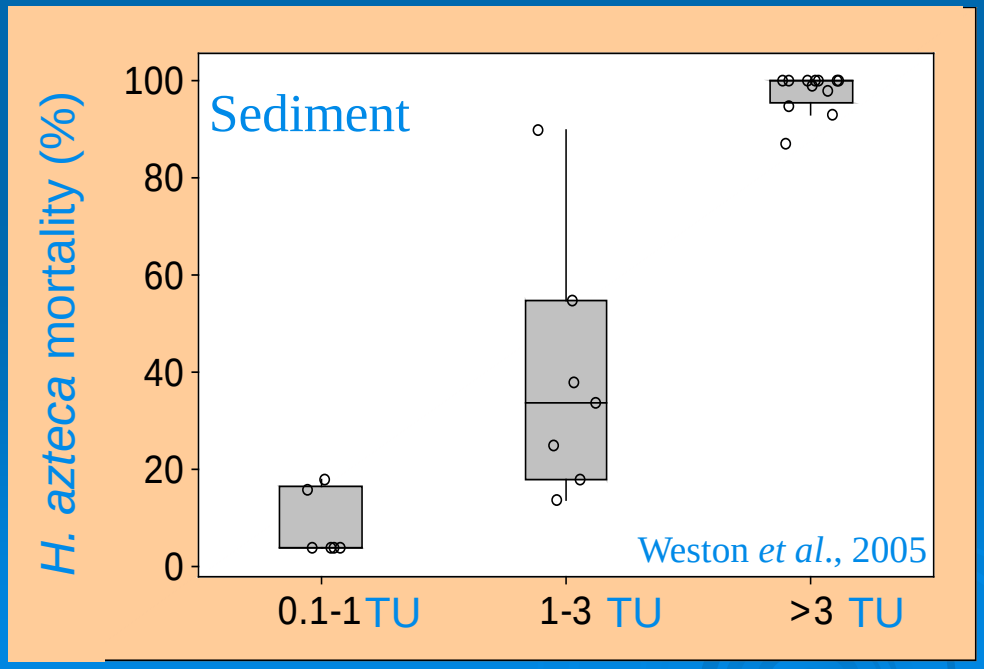
- *Hyallela azteca* sediment LC_{50}

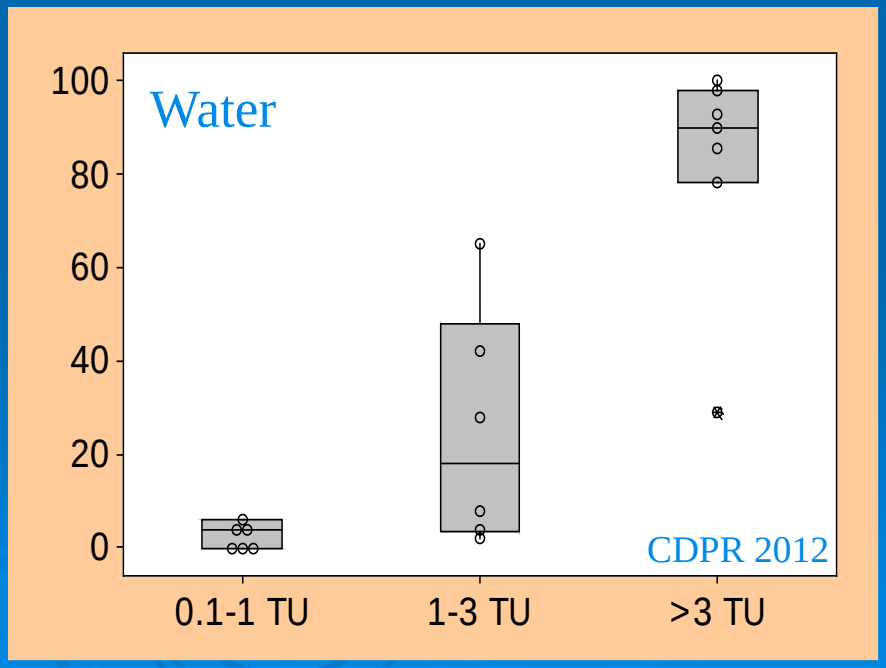


- *Hyalella azteca* water LC_{50}

A. Pyrethroids are an urban concern

5. Toxicity due to pyrethroids
   - Total pyrethroid concentration (toxic equivalents) correlated with observed bioassay mortality





A. Pyrethroids are an urban concern

1. Pyrethroids high use in urban areas
2. Urban areas engineered for high water (pesticide) runoff
3. Frequent pyrethroid detections
4. Pyrethroids are highly toxicity
5. Toxicity correlates to pyrethroid chemistry

↓

Surface Water Regulations for Pyrethroid Use in Urban Areas

B. Surface Water Regulations

Purpose: Protect Urban Surface Waters

- Reduce urban runoff of 17 pyrethroids
- Reduce the amount of pyrethroids applied in <u>outdoor urban</u> (non-ag) areas
  - Professional applicators, “including landscape maintenance gardeners”
    - Categories: structural pest control, landscape maintenance
    - Homeowner use not regulated

Disclaimer:

Not an Enforcement Talk

dpr Section 6960 - 6972

cdpr.ca.gov/docs/legbills/calcode/040501.htm#a690

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CA.GOV California Department of Pesticide Regulation

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California Code of Regulations (Title 3. Food and Agriculture)
Division 6. Pesticides and Pest Control Operations

Division 6. Pesticides and Pest Control Operations
Chapter 4. Environmental Protection
Subchapter 5. Surface Water
Article 1. Pesticide Contamination Prevention

6970. Surface Water Protection in Outdoor Nonagricultural Settings.

The provisions of this section apply to any person performing pest control for hire, including landscape maintenance gardeners, when any of the following pesticides is applied outdoors to structural, residential, industrial, and institutional sites:

bifenthrin
bioallethrin
S-bioallethrin
cyfluthrin
beta-cyfluthrin
gamma-cyhalothrin
lambda-cyhalothrin
cypermethrin
deltamethrin
esfenvalerate
fenpropathrin
tau-fluvalinate
permethrin
phenothrin
prallethrin
resmethrin
tetramethrin

A general review of the pyrethroid surface water regulations, effective July 19, 2012

(a) Except when prohibited in (e), applications to the soil surface, mulch, gravel, lawn, turf, or groundcover must be made using only the methods described below:

Regulations: Applications to limit amount of pyrethroids applied

Limit area on **pervious** surfaces*:

- Spot
- Pin stream of 1 inch or less
- Perimeter band, 3 feet out
- Not w/in 2 feet and sweep

< 2 ft^2

*soil, mulch, gravel, lawn, turf, groundcover

Regulations: Applications to limit amount of pyrethroids applied

Limit area on **<u>impervious</u>** surfaces*:

- Spot
- Crack and crevice
- Pin stream of 1 inch or less
- Perimeter band, 2 feet up

Pin stream - 1 inch out

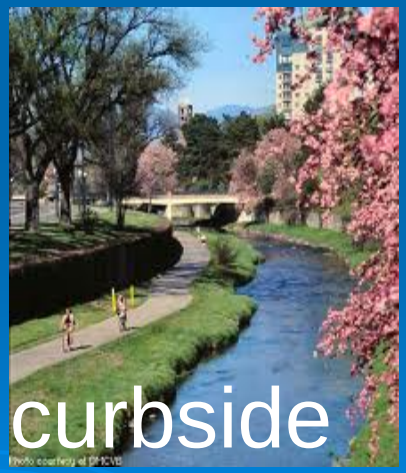
2 feet up

*windows and doors, horizontal surfaces, vertical structural surfaces as walls, foundations, and fencing

Prohibited applications with rain or around water or where water can go

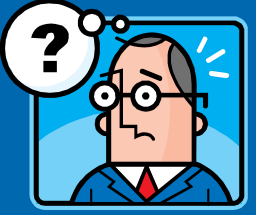
Rainfall

Standing water



Stormdrains, curbside gutters, sewers, aquatic habitat

Unprotected termiticide



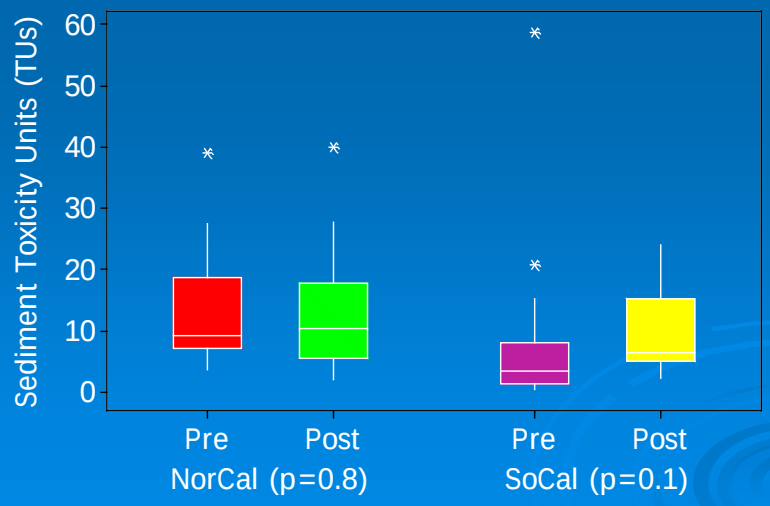
What does DPR Monitoring have to do with Pyrethroid Regulations?

- DPR monitoring confirms pyrethroids are a concern in urban surface waters
- DPR monitoring data is used to determine trends in pyrethroid detections at long-term monitoring sites

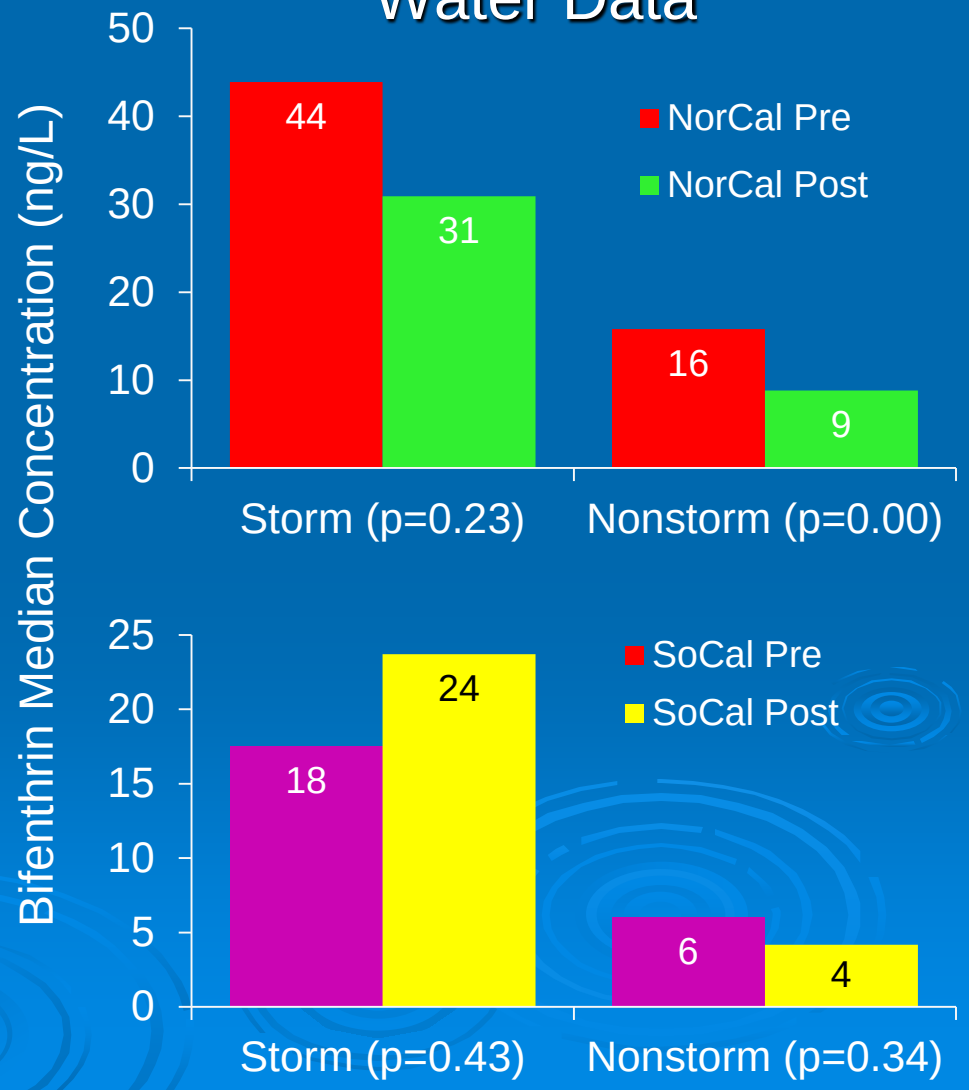
Pyrethroid Trends in Urban Surface Water

Most trend indicators = no decreased bifenthrin detections since regulations in 2012

Sediment Data



Water Data



Take home message

- Pesticide runoff from urban homes and neighborhoods is common
- More insecticides runoff into surface water in SoCal than in NorCal
- Use caution when spraying when rain is predicted due to increased pesticide runoff
- Pyrethroids, fipronil, malathion most concern for potential toxicity to fish, aquatic organisms
- No current decreasing trend in pyrethroid (bifenthrin) runoff
- Know and follow pyrethroid regulations!

Questions?

For further information presented, see:
Pyrethroid monitoring:
http://www.cdpr.ca.gov/docs/emon/surfwtr/presentations/2013_Ensminger.pdf

Sufrace water pyrethroid regulations,
http://www.cdpr.ca.gov/docs/emon/surfwtr/presentations/pepple_swregs_upc_2_1011.pdf

Internet sites and references to slides:

Slide 2 – all pictures taken by DPR (Mike Ensminger, Robert Budd, Kean Goh), permission given for use

Slide 3 – Objectives from Surplus Sales Line (http://www.surplussalesline.com/detail.asp?ProdID=8336); arrow and results chart were taken from powerpoint clip art when searched in powerpoint (insert Clip art); 6x, original site from http://www.beerbarrels2u.co.uk/

Slide 4 – sites are listed on slide; unlabeled pictures, courtesy of R. Budd, DPR

Slide 6, 7 – DPR modeling prioritization program and printout (Yuzhou Lou, DPR)

Slide 8 – pictures by M. Ensminger; map from Google earth; storm drain map from the city of San Ramon, CA

Slide 10 – pictures courtesy of R. Budd (DPR)

Slide 11- from NWS (http://www.wrh.noaa.gov/forecast/wxtables/?wfo=sto) and NOAA (http://graphical.weather.gov/sectors/pacsouthwest.php?element=MaxT)

Slide 13 – courtesy of M. Ensminger, R. Budd (DPR)

Slide 14 – image from Google maps

Slide 16 – Hyalella from ipm.ucdavis.edu; diatoms from pixgood.com; C. dubia from http://www.aquaria.com.ua/; copepods from http://www.warrenphotographic.co.uk; rainbow trout, mountainanglers.com; Euglenozonas, from http://www.fcps.edu/; copepods from http://www.warrenphotographic.co.uk/; green algae, site unknown

Slide 17 – pictures from Linda Deanovic, UC Davis Aquatic Health program, used with permission. Aquatic Life Benchmarks, from US EPA website (http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm)

Slide 19, H. Azteca from http://www.ars.usda.gov/

Slide 20, from Google earth

Slide 25, picture by M. Ensminger, DPR; Storm drain maps, city of San Ramon, CA; “polluted earth”, site unknown

Slide 26, image from Spurlock Efate class presentation, part 2 (DPR training class; http://cdpr.ca.gov/docs/emon/surfwtr/presentations/spurlock_efate_part2.pdf)

Slide 27, images from Google earth

Slide 28, Hyalella image from ipm.ucdavis.edu

Slide 29, Sediment data from Spurlock Efate class presentation, part 2 (DPR training class; http://cdpr.ca.gov/docs/emon/surfwtr/presentations/spurlock_efate_part2.pdf)

Slides 31, 33, 34, and 35 , borrowed from M. Pepple (DPR, retired) in presentation http://cdpr.ca.gov/docs/emon/surfwtr/presentations/pepple_swregs_upc_2_1011.pdf

Slide 33, pin stream application from http://ucanr.org/sites/UrbanAnts/files/77807.pdf

Slide 34,crack and crevice applicator from http://www.americanpestsupplies.com/

Slide 34, application by http://www.ces.ncsu.edu/

Slide 35, Rainfall photograph by M. Ensminger (DPR); applicator in orange coveralls, from R. Budd (DPR)

Slide 36, image from powerpoint clip art

Slide 39, photographs from M. Ensminger and R. Budd, DPR