

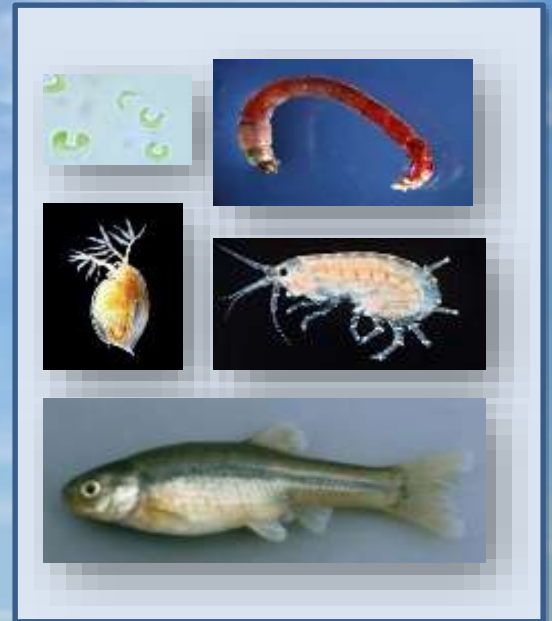
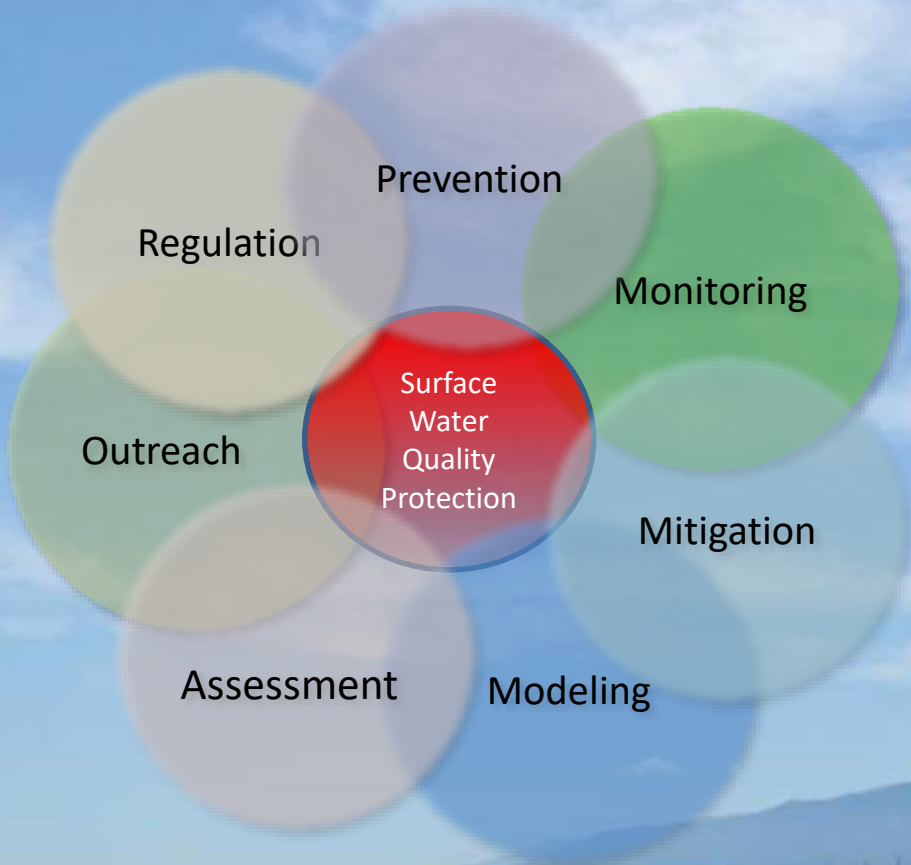
# Protecting Surface Water from Pesticide Contamination



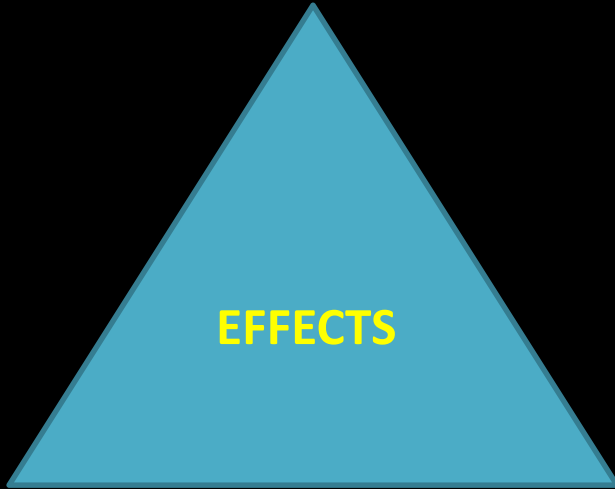
**Kean S Goh, PhD**  
**Environmental Program Manager I**  
**Surface Water Protection Program**  
**California Department of Pesticide Regulation**

2017 CAL-IPC Symposium,  
Palm Springs, CA  
24 October 2017

# CDPR Surface Water Protection Program

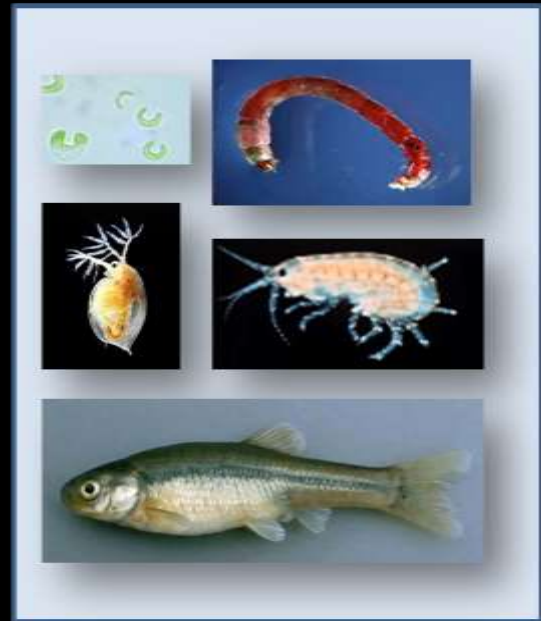


PEST



PESTICIDE

ENVIRONMENT



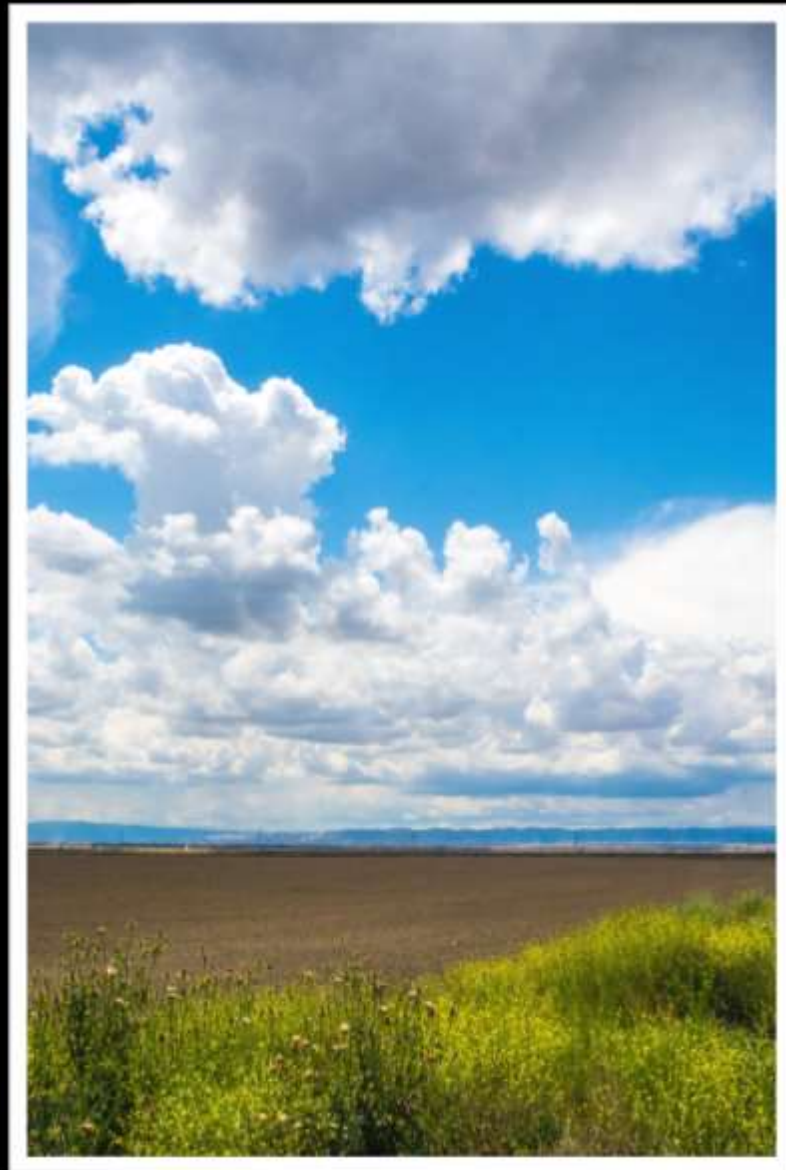
# PESTICIDE

- Chemical Classification
- Mode of Action
- Physico-chemical Properties
- Fate & Transport
- Application
  - Method
  - Timing
  - Rate & Frequency
- Formulation
  - Other Ingredients
- Mixtures



# ENVIRONMENT

- AIR
  - Spray Drift
- LAND
  - Erosion
- WATER
  - Rainfall
  - Irrigation
  - Runoff: sediment & water
- BIOTA
  - Algae
  - Aquatic plants
  - Macro-invertebrates
  - Fish



# PREVENTION

## Registration Evaluation

Agriculture

Urban

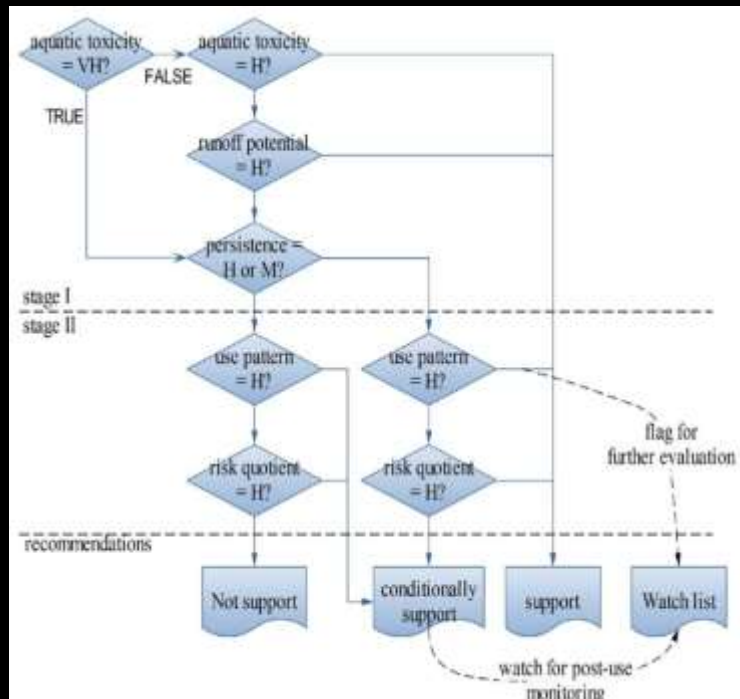
Active ingredient

Degradation products

## Decision

Deny, Accept

Conditional (watch list)



Pesticide Registration Evaluation Model (PREM) Yuzhou Luo 2016

## MONITORING

- Urban & Agricultural
- Monitoring Priority List
- Pesticide Watch List
- Monitoring Network
- Special studies
- Analytical Method
- Aquatic toxicity

## OBJECTIVES

- Determine pesticide presence
- Determine aquatic toxicity
- Detect trends
- Assess effectiveness of mitigation

Pesticide	Use (lbs)	Use score	US EPA Benchmark (ppb)	Tox score	Final score
Permethrin	27,665	5	0.01	7	35
Bifenthrin	27,842	5	0.075	6	30
Cyfluthrin	8,667	4	0.0125	6	24
Diuron	21,010	5	2.4	4	20
Fipronil	8,095	4	0.11	5	20
Pendimethalin	19,251	4	5.2	4	16
Bromacil	12,643	4	6.8	4	16
Prodiamine	6,631	4	3	4	16
Cypermethrin	4,296	3	0.195	5	15
Sulfometuron	2,282	3	0.48	5	15
Carbaryl	2,081	3	0.85	5	15
Oxyfluorfen	1,665	3	0.29	5	15
Malathion	1,363	3	0.3	5	15
$\lambda$ -Cyhalothrin	827	2	0.0035	7	14
Triclopyr	16,939	4	70	3	12
Oryzalin	12,271	4	15.4	3	12
Imidacloprid	7,720	4	35	3	12
Chlorfenapyr	1,556	3	2.915	4	12

# Pesticides Monitored by DPR

## Insecticides

- **Organophosphate:**  
Chlorpyrifos, Diazinon, Dimethoate, Malathion, Methidathion
- **Carbamate:** Methomyl , Carbaryl
- **Phenylpyrazole:** Fipronil (urban)
- **Neonicotinoid:** Imidacloprid
- **Pyrethroids:**  
Bifenthrin,  $\lambda$ -cyhalothrin, Cyfluthrin, Cypermethrin, Permethrin Fenvalerate/Esfenvalerate
- **Diacylhydrazine:**  
Methoxyfenozide, Tebufenozide
- **Anthranilic diamide:** Chlorantraniliprole





# Pesticides Monitored by DPR

## Herbicides:

Bensulide, Benfluralin, Ethalfluralin,  
Oryzalin, Pendimethalin, Prodiamine,  
Trifluralin, Oxyfluorfen, Bromacil,  
Diuron, Prometon, Simazine,  
Tebuthiuron, 2,4-D, Dicamba, MCPA,  
Triclopyr

## Fungicides (Ag):

Chlorothalonil, Azoxystrobin,  
Kresoxim-methyl, Pyraclostrobin,  
Trifloxystrobin

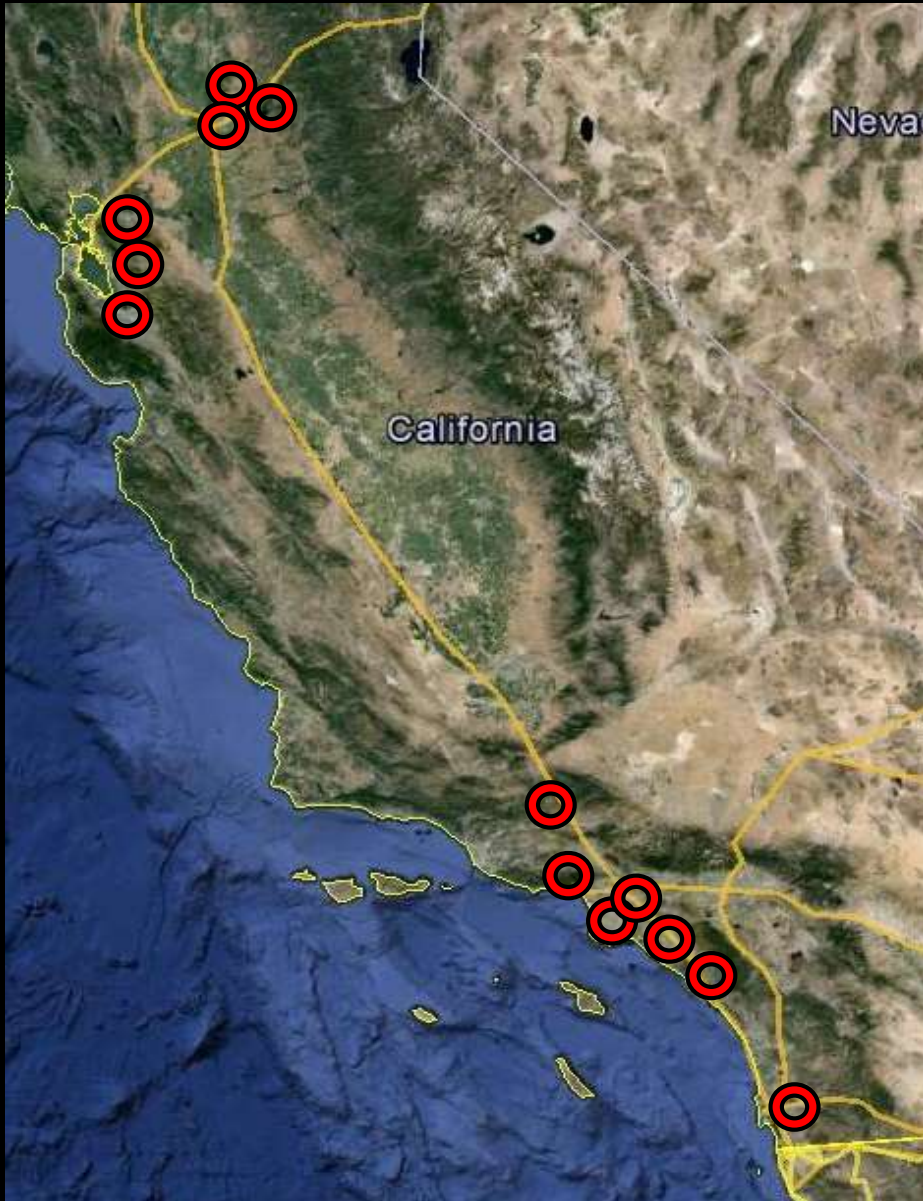


# Ag Monitoring Sites



Ag Drain – 12 sites  
Receiving waters – 10 sites

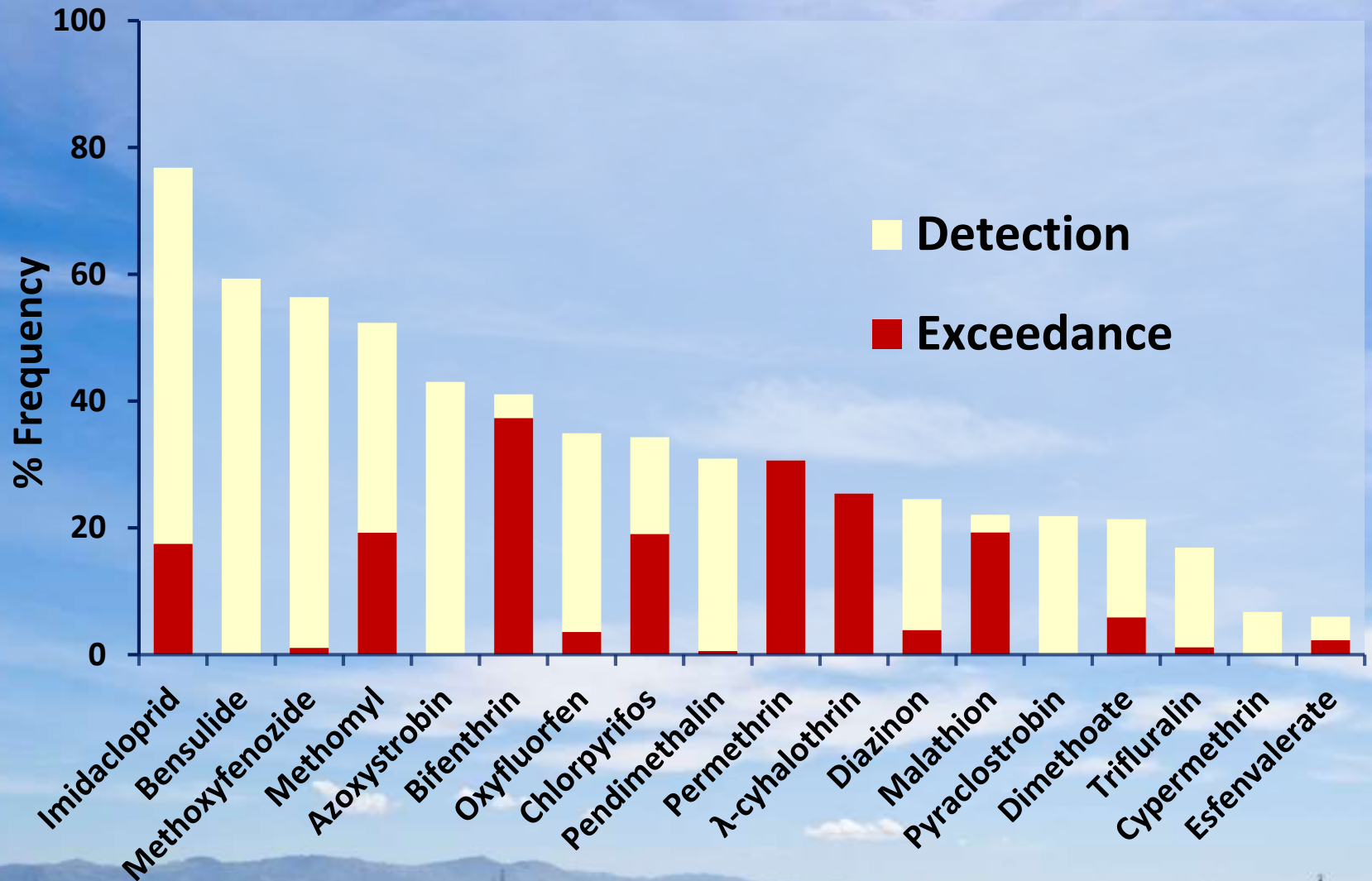
# DPR Urban Monitoring Sites



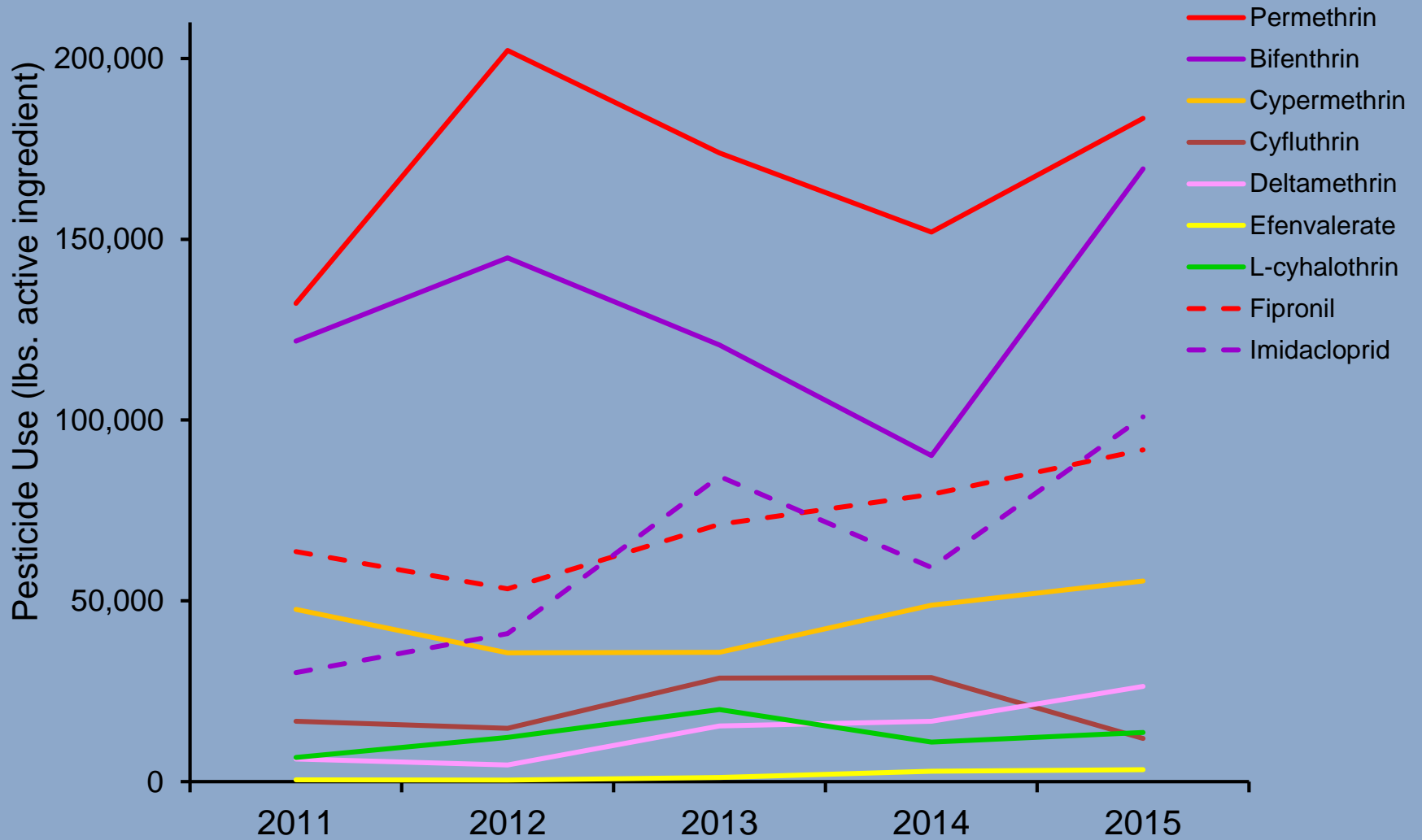
Storm drains – 10 sites  
Receiving waters – 7 sites



# Statewide Benchmark Exceedances Agricultural Watersheds 2011–2015



# URBAN PESTICIDE USE IN CALIFORNIA



# Examples of Pesticide Monitored (no endorsement implied)

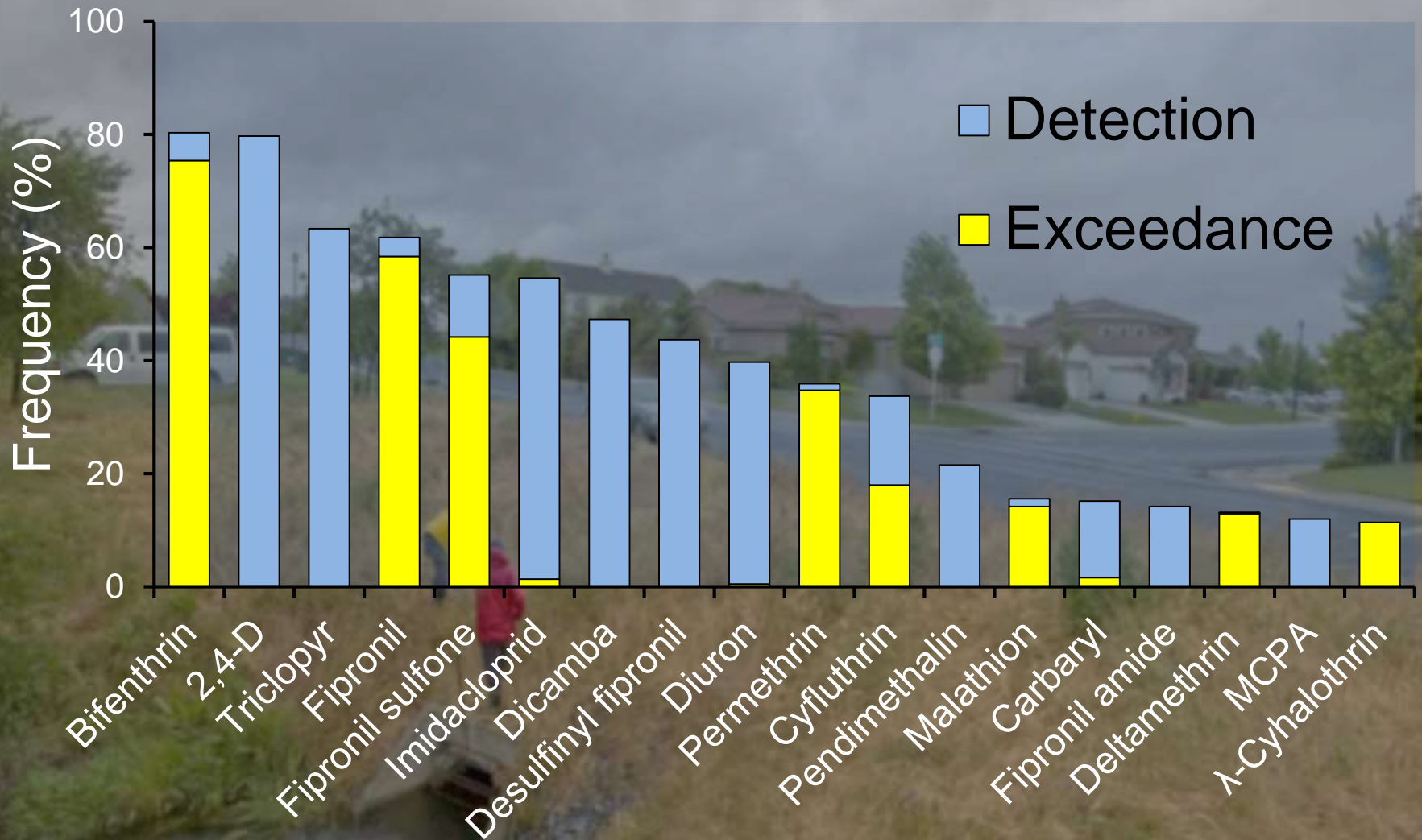
Active ingredient	Some Product Name
Bifenthrin	TALSTAR <sup>®</sup> , MASTERLINE <sup>®</sup> , BIFEN <sup>®</sup>
Permethrin	DRAGNET <sup>®</sup> , TENGARD <sup>®</sup>
Cypermethrin	HOLSTER <sup>®</sup> , DEMON <sup>®</sup> , AMMO <sup>®</sup>
Cyfluthrin	TOMBSTONE <sup>®</sup> , DISCUS <sup>®</sup> , DECATHLON <sup>®</sup> , Cy-Kick <sup>®</sup>
Fipronil	FRONTLINE <sup>®</sup> , TERMIDOR <sup>®</sup> , TAURUS <sup>®</sup>
Imidacloprid	MERIT <sup>®</sup> , TEMPRID <sup>®</sup>
Azoxystrobin	ABOUND <sup>®</sup> , QUADRIS <sup>®</sup> , HERITAGE <sup>®</sup> , STADIUM <sup>®</sup>
Bensulide	BENSUMEC <sup>®</sup> , BETASAN <sup>®</sup> , PRE-FAR <sup>®</sup>

# Aquatic Life Benchmarks for Insecticides (chronic invertebrate toxicity)

Insecticide	Benchmark (ppb)
Chlorpyrifos	0.04
Diazinon	0.105
Dimethoate	0.5
Malathion	0.035
Methomyl	0.7
Imidacloprid	1.05
Bifenthrin	0.0013
$\lambda$ -cyhalothrin	0.002
Permethrin	0.0014



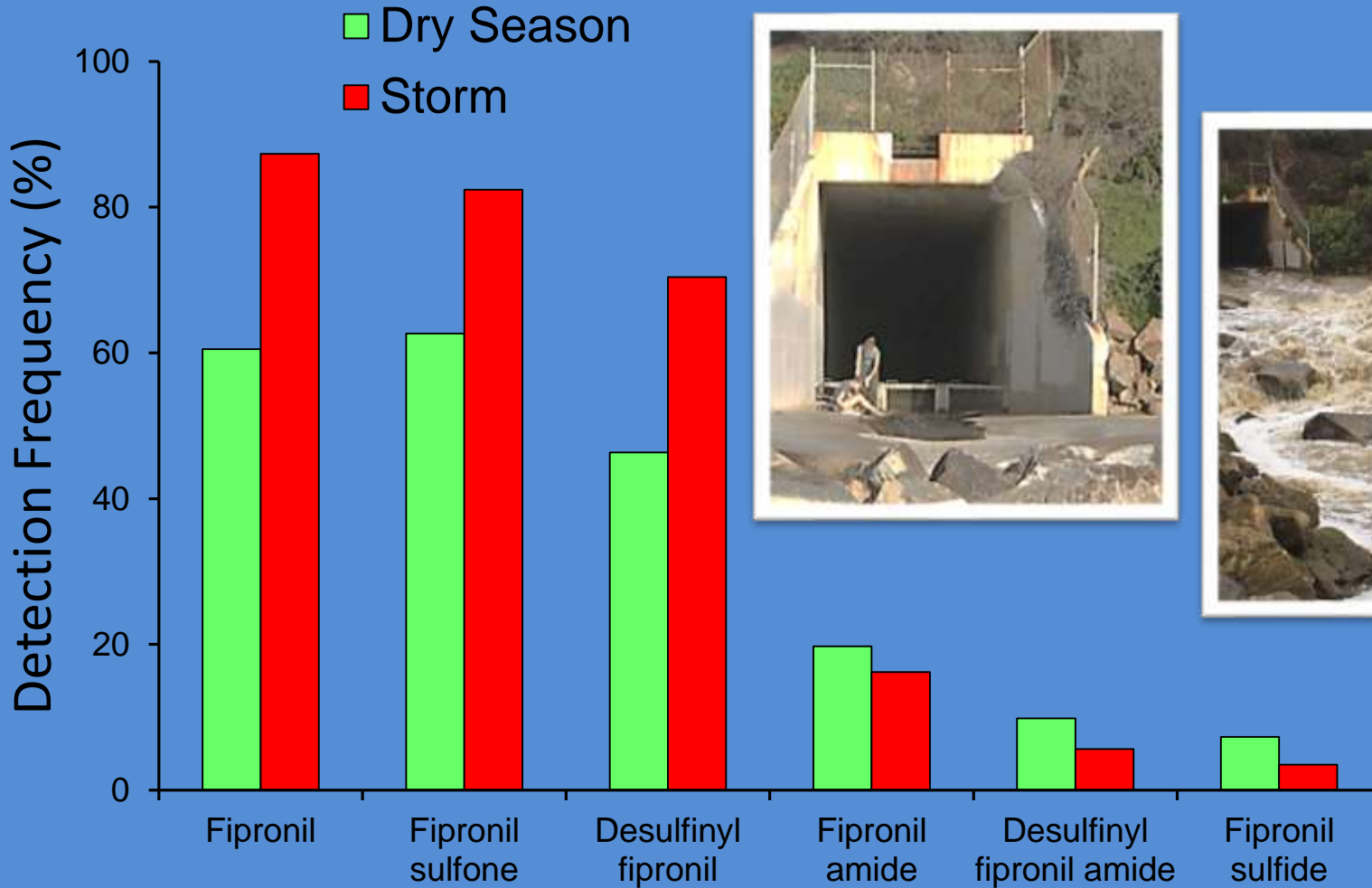
# Statewide Benchmark Exceedances Urban Watersheds 2009-2016





# Fipronils in Southern California Surface Waters

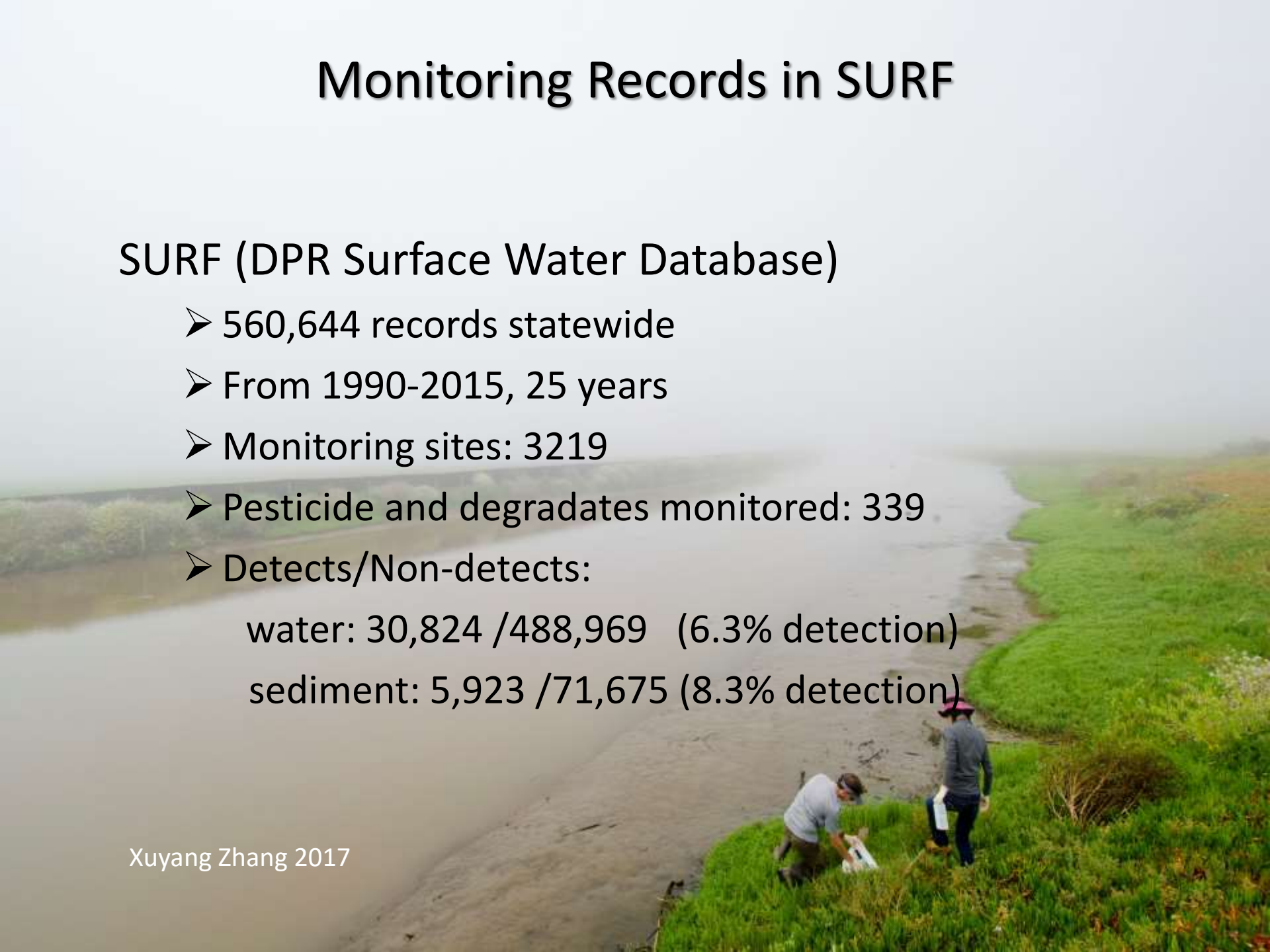
(Termidor®, Taurus®)



# Monitoring Records in SURF

## SURF (DPR Surface Water Database)

- 560,644 records statewide
- From 1990-2015, 25 years
- Monitoring sites: 3219
- Pesticide and degradates monitored: 339
- Detects/Non-detects:
  - water: 30,824 /488,969 (6.3% detection)
  - sediment: 5,923 /71,675 (8.3% detection)





## REGULATION

Reevaluations  
Use restrictions  
Label changes

### Regulations

Urban Pyrethroids  
Dormant Spray  
Chlorpyrifos permit conditions

## FOOD AND AGRICULTURAL CODE

### SECTION 11501

(b) To protect the environment from environmentally harmful pesticides by prohibiting, regulating, or ensuring proper stewardship of those pesticides.

### SECTION 14102-14103

**14102.** The director shall prohibit or regulate the use of environmentally harmful materials, ... In so doing, he shall consider the effect of all such materials upon the environment, and shall take whatever steps he deems necessary to protect the environment. He shall also continue to initiate, cooperate, and collaborate with the University of California and with other state agencies in research designed to reduce and eliminate the use of environmentally harmful materials.

**14103.** In establishing criteria and regulations relating to environmental injury and protection, ... the director shall consult with representatives of the Water Resources Control Board, the Departments of Public Health, Fish and Game and Conservation, and four outside experts of his selection from the fields of agricultural, biological, ecological, and medical sciences.



MITIGATION

**PEST**

IPM Technique

**PESTICIDE**

Pesticide selection

Label directions

Equipment calibration

Application technology

**ENVIRONMENT**

Winds

Water bodies

**BEST MANAGEMENT PRACTICES**

Irrigation Management

Recirculating system

Buffer zone

Water quality treatment pond

Constructed wetland

Vegetated buffer strip

Grassed waterway

Cover crops

Woodchip/charcoal filters

Bioreactors

PAM-Ca

Degradation Enzymes



DPR Sedimentation Pond with CURES

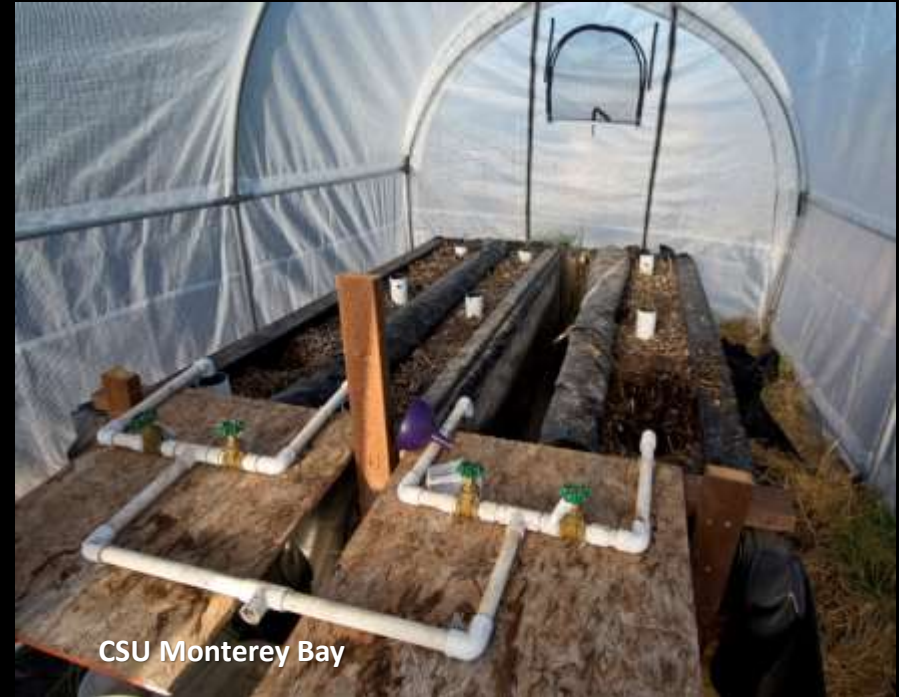
# WOODCHIP BIOREACTORS



Moss Landing Marine Lab, NOAA, DPR

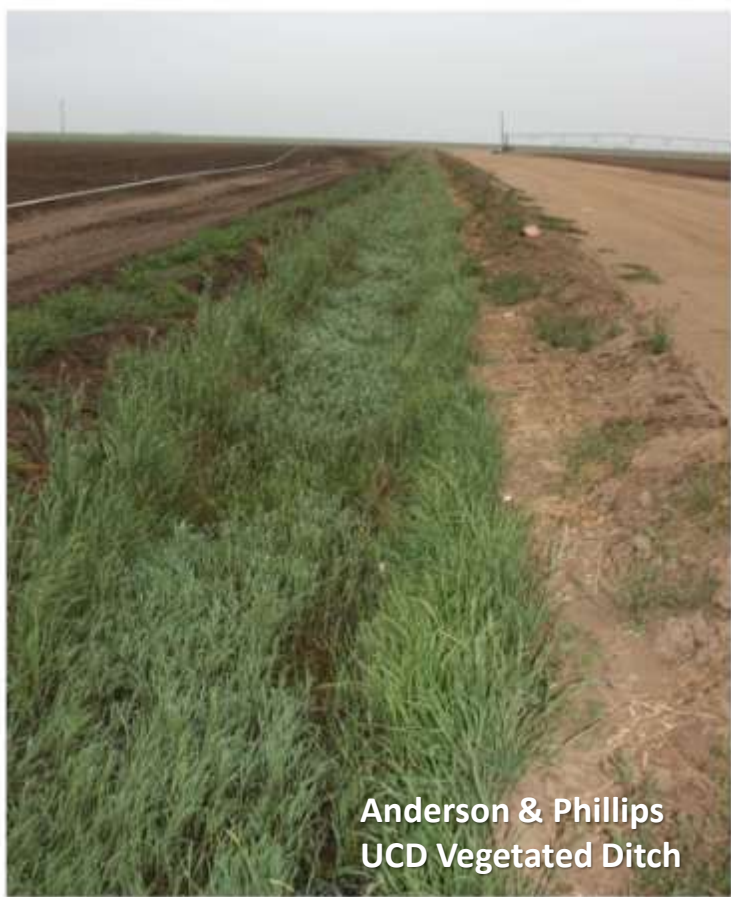


USDA & DPR



CSU Monterey Bay

## VEGETATED DITCHES



Anderson & Phillips  
UCD Vegetated Ditch



DPR Alfalfa



## **Integrated System: Carbon socks at the end of a Vegetated Ditch**

**Brian Anderson & Bryn Phillips  
UC Davis, Granite Canyon Lab, Monterey  
Michael Cahn, UCCE**





**Brian Anderson & Bryn Phillips**  
**Granite Canyon Lab, UC Davis, Monterey**



Vegetated Treatment Pond



Languard<sup>®</sup> pesticide degrading enzyme

[Kean.Goh@cdpr.ca.gov](mailto:Kean.Goh@cdpr.ca.gov)

