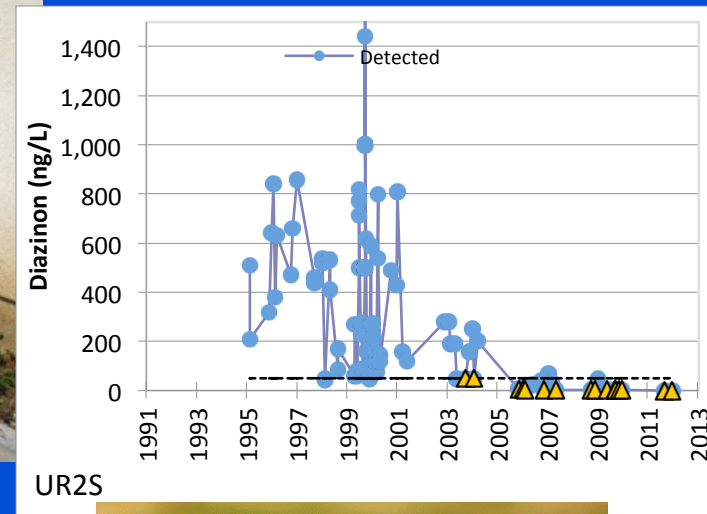


# Insecticide Impairment of Urban Waters:

## Recent successes and upcoming challenges



**Dave Tamayo**  
Environmental Specialist  
Sacramento County Stormwater Program  
CASQA Pesticides Committee Co-chair

CASQA Conference  
San Diego CA  
November 7, 2012



# Acknowledgements

- Kelly Moran, TDC Environmental
- Jamison Crosby, CASQA Pesticides Co-Chair
- Armand Ruby, ARC Consulting
- Tom Mumley, SF RWQCB
- Patti TenBrook, US EPA Region 9
- Darren van Steenwyk, PCOC
- CASQA
- BASMAA
- Riverside FCD, City of San Diego, Contra Costa Co, Alameda Co, County of Sacramento
- NACWA, TriTac

# Pyrethroids: widespread toxicity in California urban waters

- Majority of tested creeks
- Multiple pyrethroids
- Mostly sediment, some water column
- Direct connection to urban runoff
- Urban >> Agricultural areas

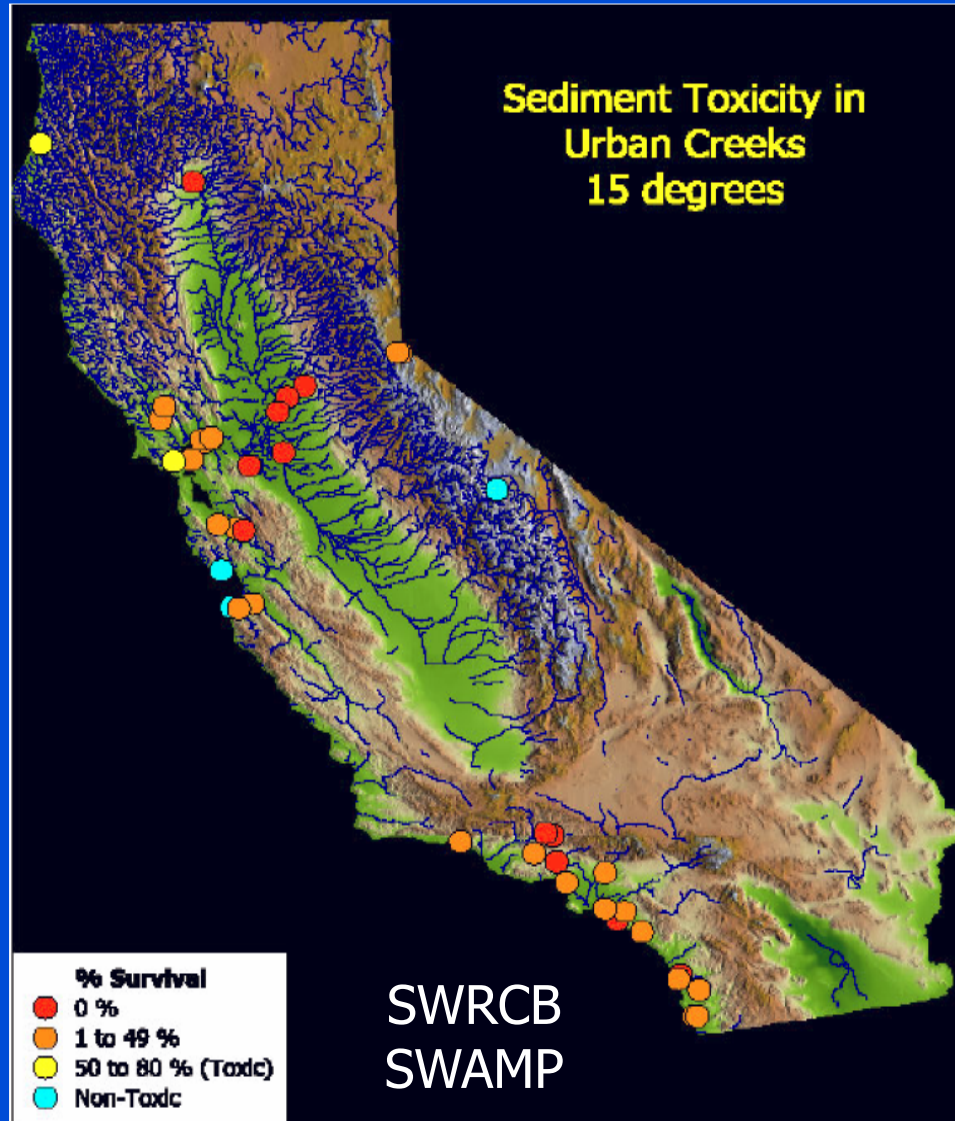
Photo courtesy Don Weston



*Hyalella azteca* (amphipod)

Source: Weston et al., urban runoff program data and California Water Board data.

# Current challenge: Widespread pyrethroid toxicity





# Biggest Source: Argentine ant control conducted legally by licensed professionals



Photo:  
J. Klotz, UCR



Photo:  
Alex Wild

Due to widespread insecticide toxicity,  
Clean Water Act compliance  
probably not attainable without FIFRA help



# Up against a common belief:

- If EPA “approved” (registered) a pesticide, it must be OK for the environment, if used according to the label.



# But....registered pesticides common in water bodies

## Pesticides in the Nation's Streams and Ground Water, 1992–2001

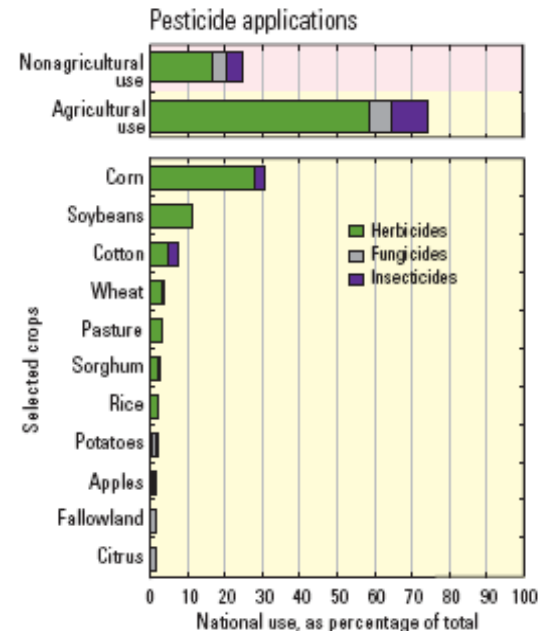
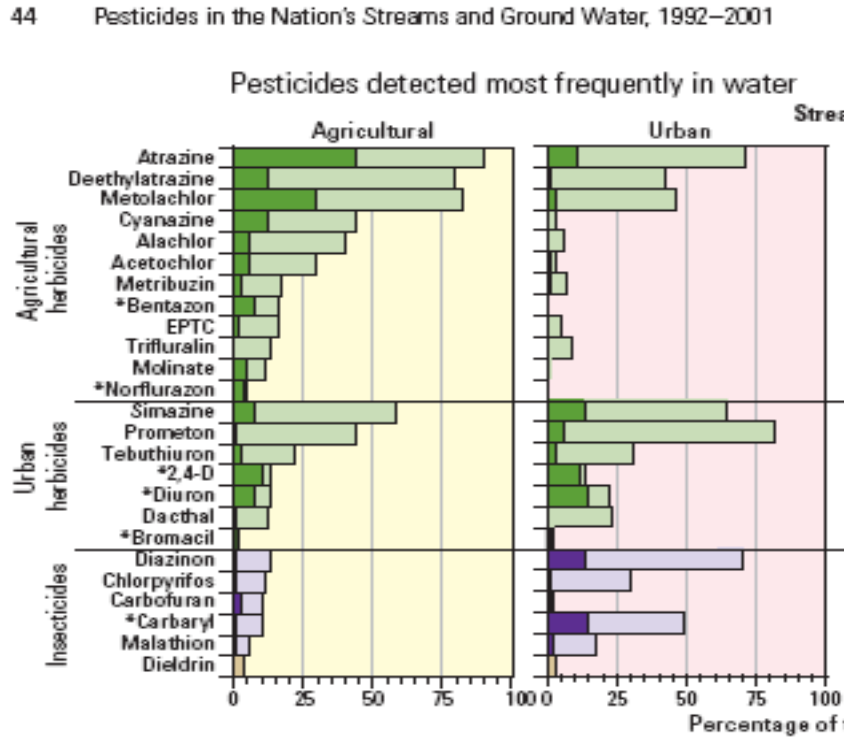


Figure 2-2. Agricultural use of pesticides in 2001 was about three times greater than nonagricultural use. However, nonagricultural uses, such as applications to control weeds and insects in urban and suburban areas, were second only to corn when compared with individual crops. (Pesticide use estimates for individual crops are for 1997 and are from Gianessi and Marcelli, 2000; use estimates for total agricultural and nonagricultural uses are for 2001 and are from Kiely and others, 2004.)



# Not just California: Central Texas urban pyrethroids 2008

From Hintzen, et al 2008



Contents lists available at ScienceDirect

Environmental Pollution

journal homepage: [www.elsevier.com/locate/envpol](http://www.elsevier.com/locate/envpol)



Occurrence and potential toxicity of pyrethroids and other insecticides in bed sediments of urban streams in central Texas

Emily P. Hintzen<sup>a</sup>, Michael J. Lydy<sup>b</sup>, Jason B. Belden<sup>c,\*</sup>

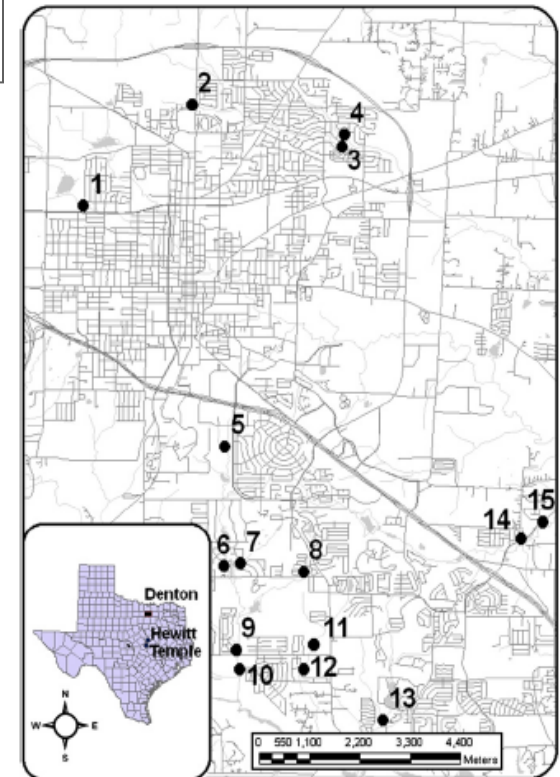
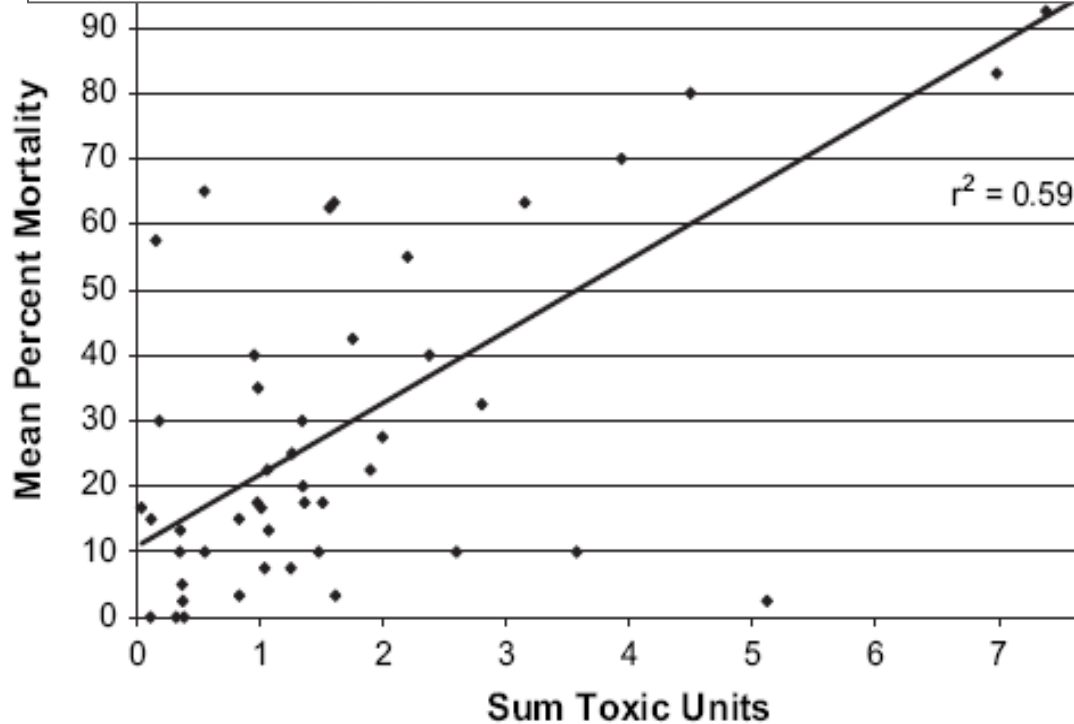


Fig. 1. Map of streams and sample sites in Denton, TX USA. Sites are identified by numbers on Table 3. Stream flow is from West to East. Hewitt and Temple are shown in the inset.

# Pesticide Registration: A Reality Check

- “Gaps in pesticide regulatory programs...result in discharges that adversely affect urban creek water quality”

**San Francisco Bay OP Pesticide TMDL**

Photo courtesy NOAA



# California local agencies cannot regulate pesticide use.

“...no local government “may prohibit or in any way attempt to regulate any matter relating to the registration, sale, transportation, or use of pesticides...”

California Food and Agriculture Code Section 11501.1

**So what's our strategy?...**





So what's our strategy?...



# Regulatory Initiatives

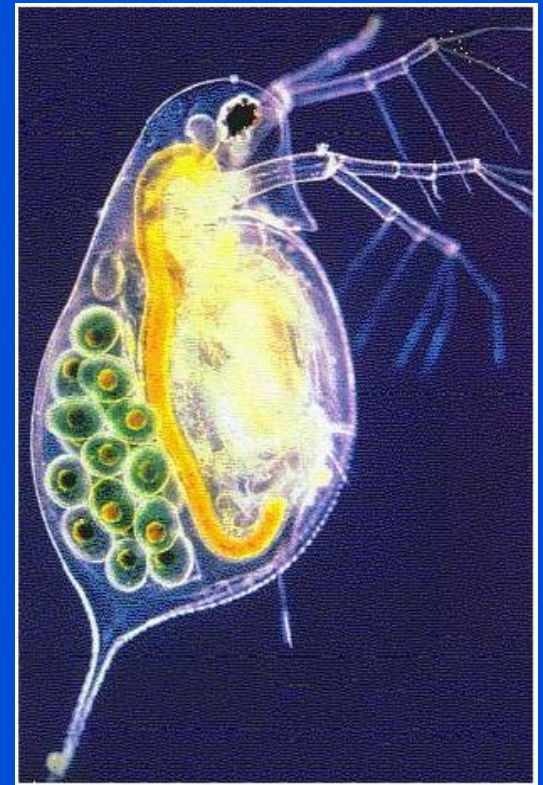
## A key strategy to address pesticide toxicity

- Sufficient authority to regulate pesticide use resides with:
  - U.S. Environmental Protection Agency
  - California Environmental Protection Agency

# Past experience – Proof of Concept

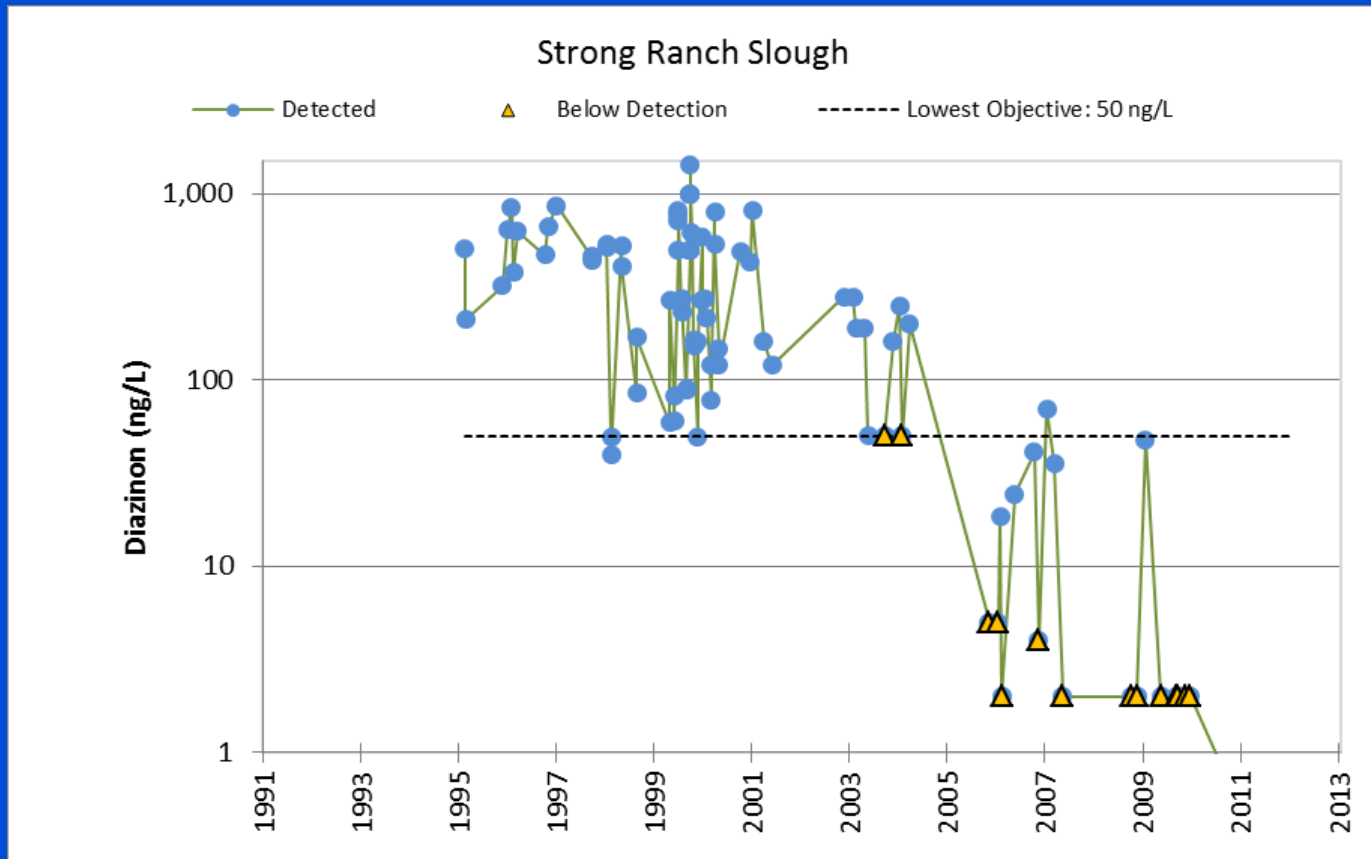
**Diazinon and Chlorpyrifos toxicity in most urban areas of California, 1990s.**

- San Diego
- Sacramento
- San Joaquin
- Orange
- Ventura
- San Francisco Bay Area (9 Counties)



# Diazinon concentrations

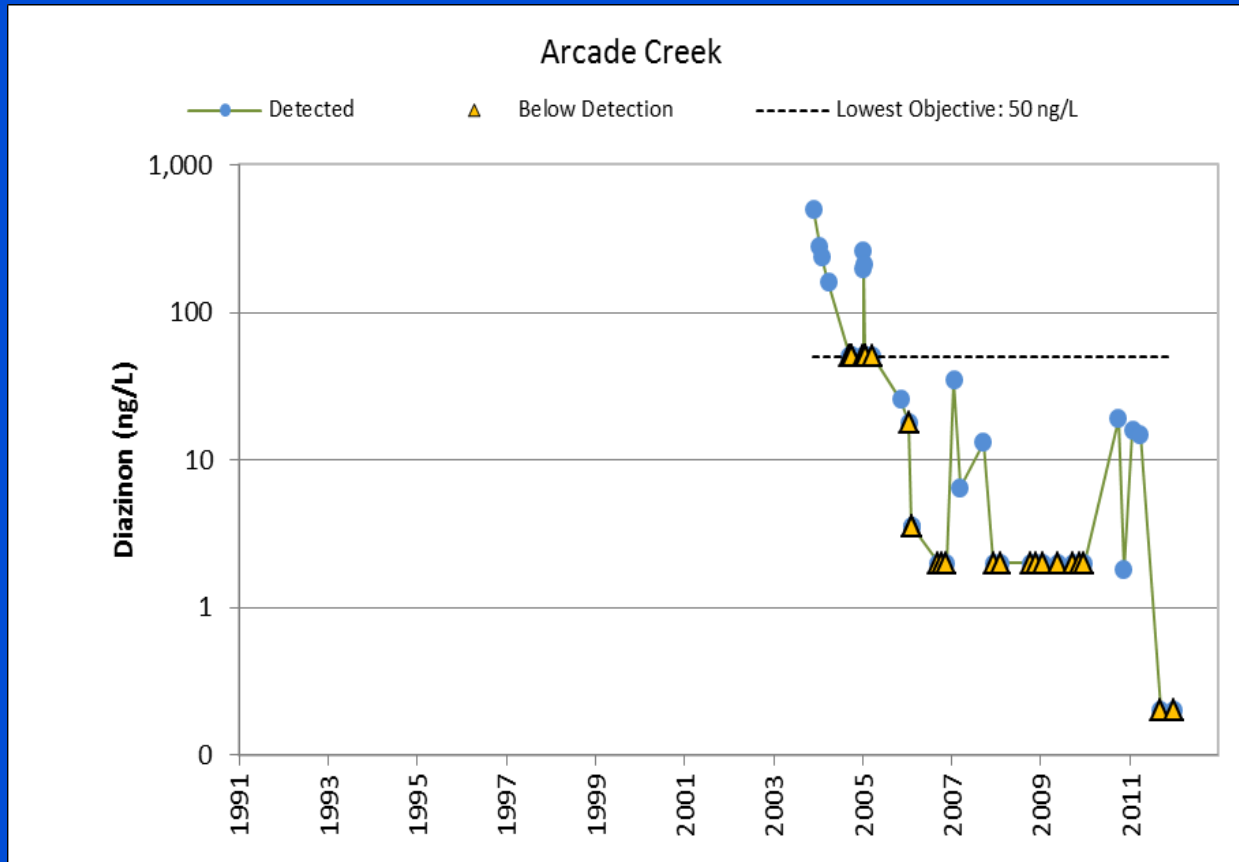
Strong Ranch Slough, Sacramento, 1995-2011





# Diazinon concentrations

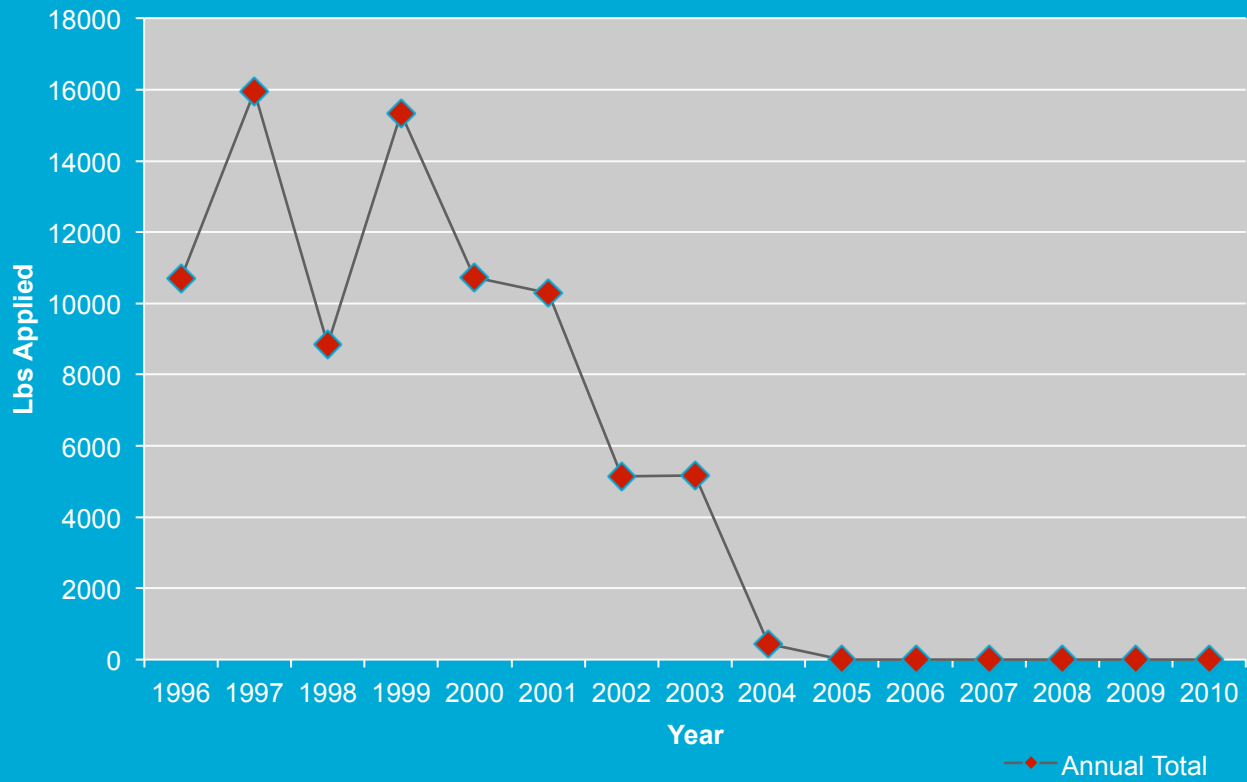
Arcade Creek, Sacramento, 2003-2011



# Diazinon Reported Urban Use

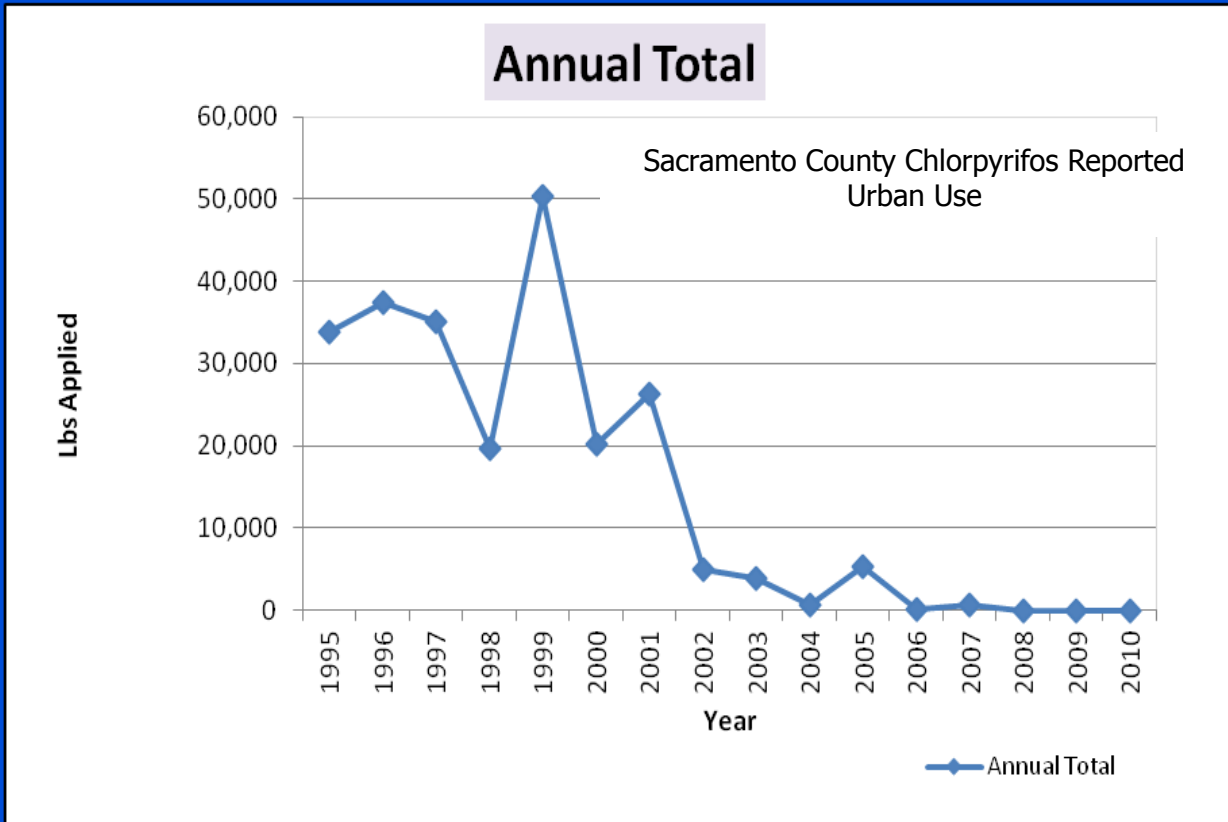
## Sacramento County

1996-2010 (from DPR Pesticide Use Report Database)



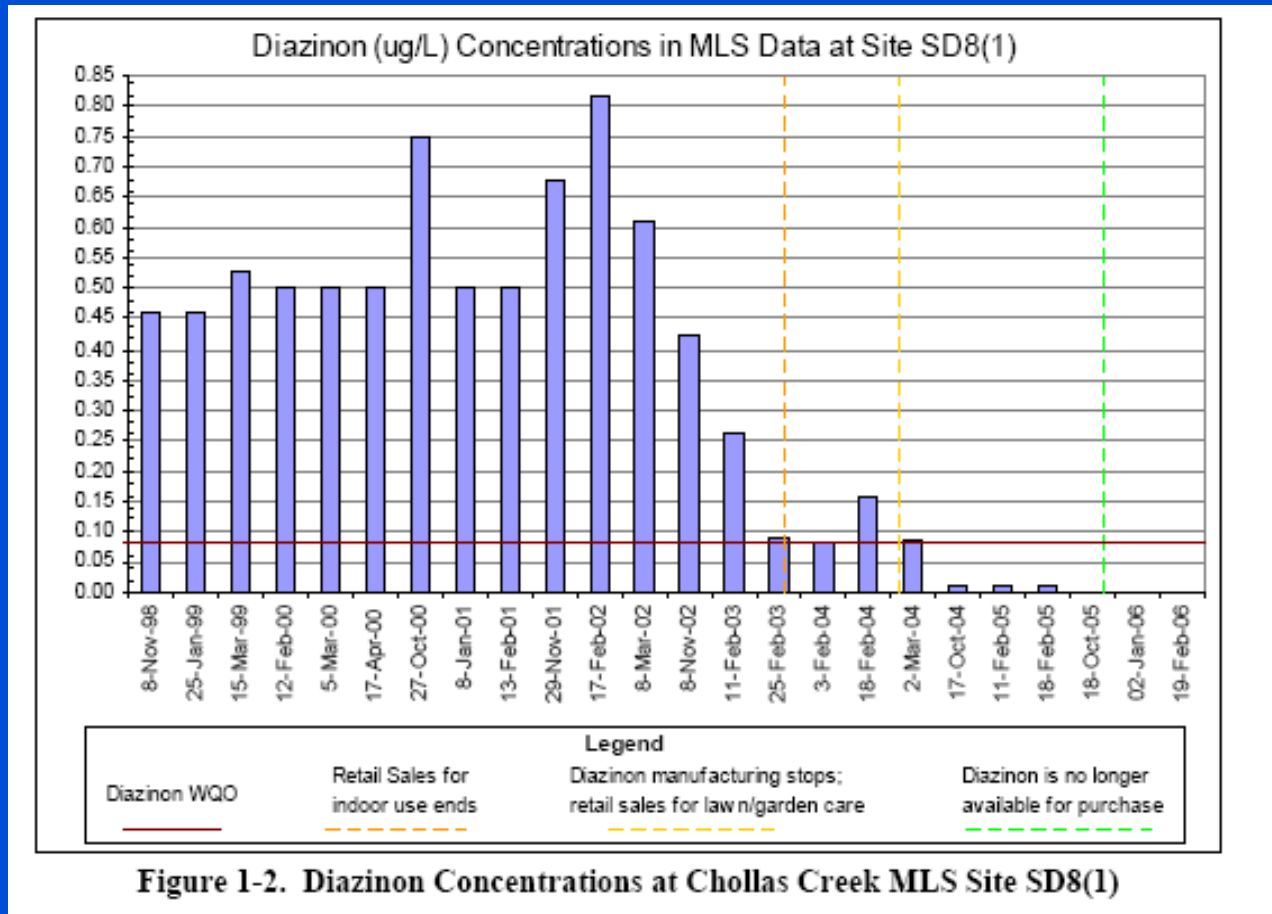


# Chlorpyrifos use

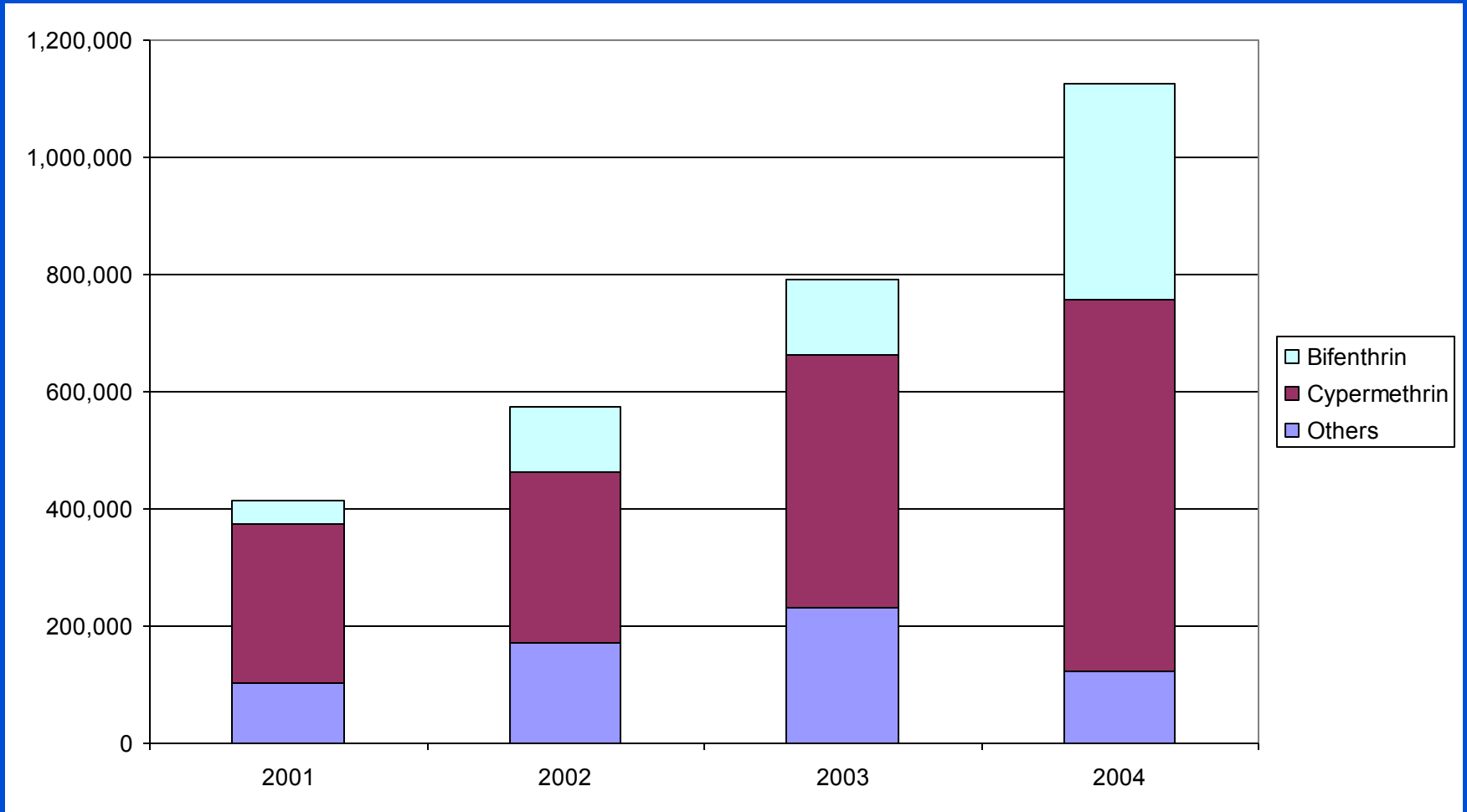




# Right here in San Diego



# Uh oh...switch to pyrethroids

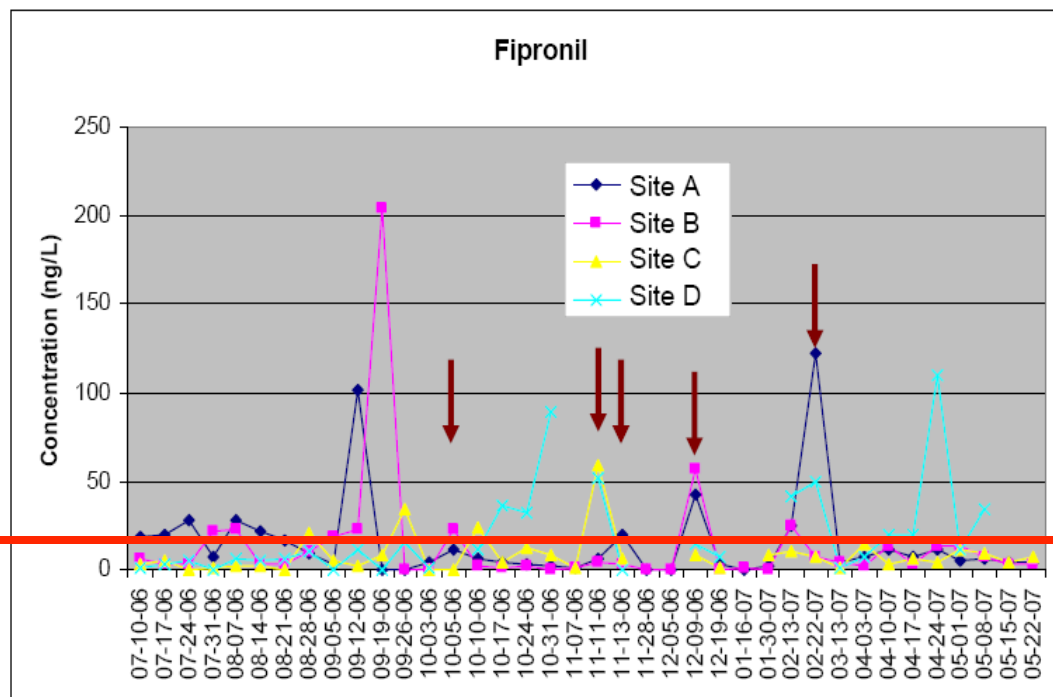


Estimated use of study list pyrethroids in the San Francisco Bay Area 2001-2004 (permethrin equivalents)



# Fipronil on the horizon

## Fipronil in North CA Runoff



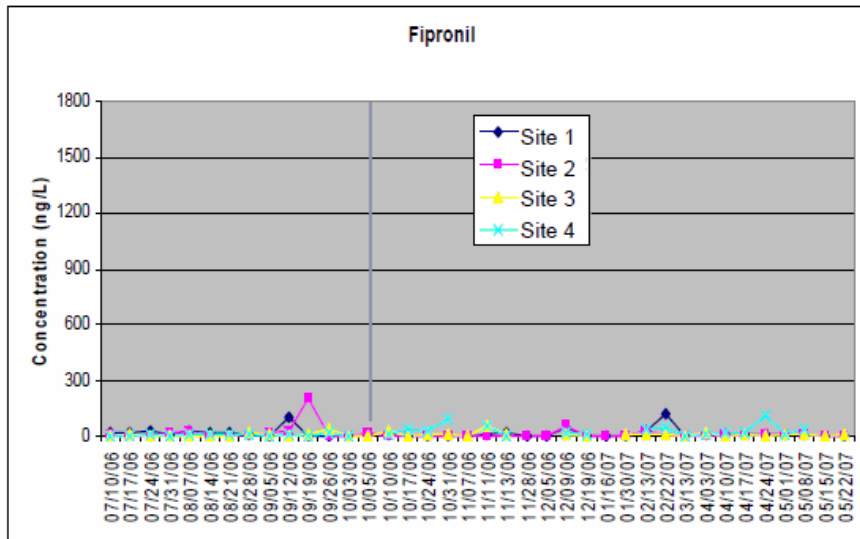
*C. dubia* LC<sub>50</sub> = 18 ppb

Data and graphic by J. Gan

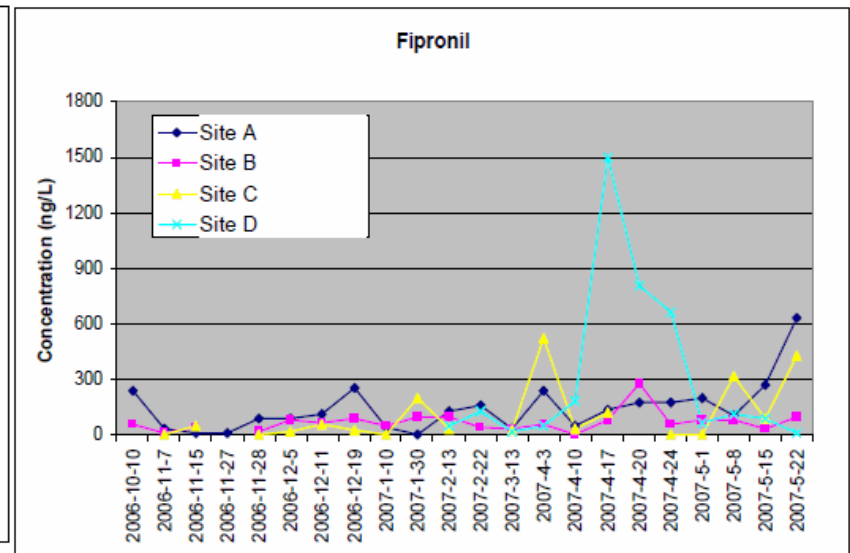
**LC 50 18  
ppb**

# Silver lining (if you're in northern California)

## NORTH



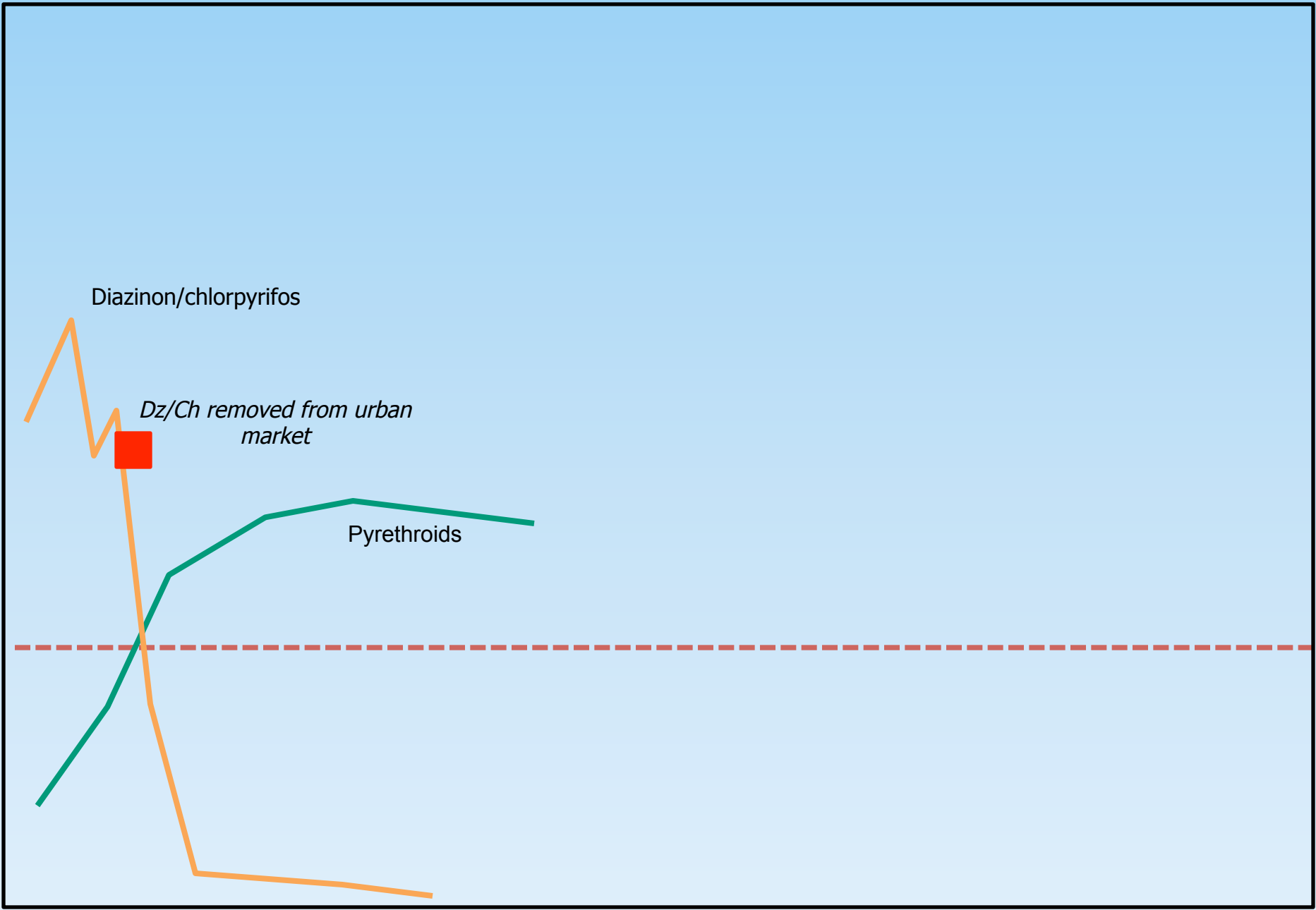
## SOUTH



LC 50 18 ppb

# A Pictorial History and Futurecast of Pesticides in Urban Runoff



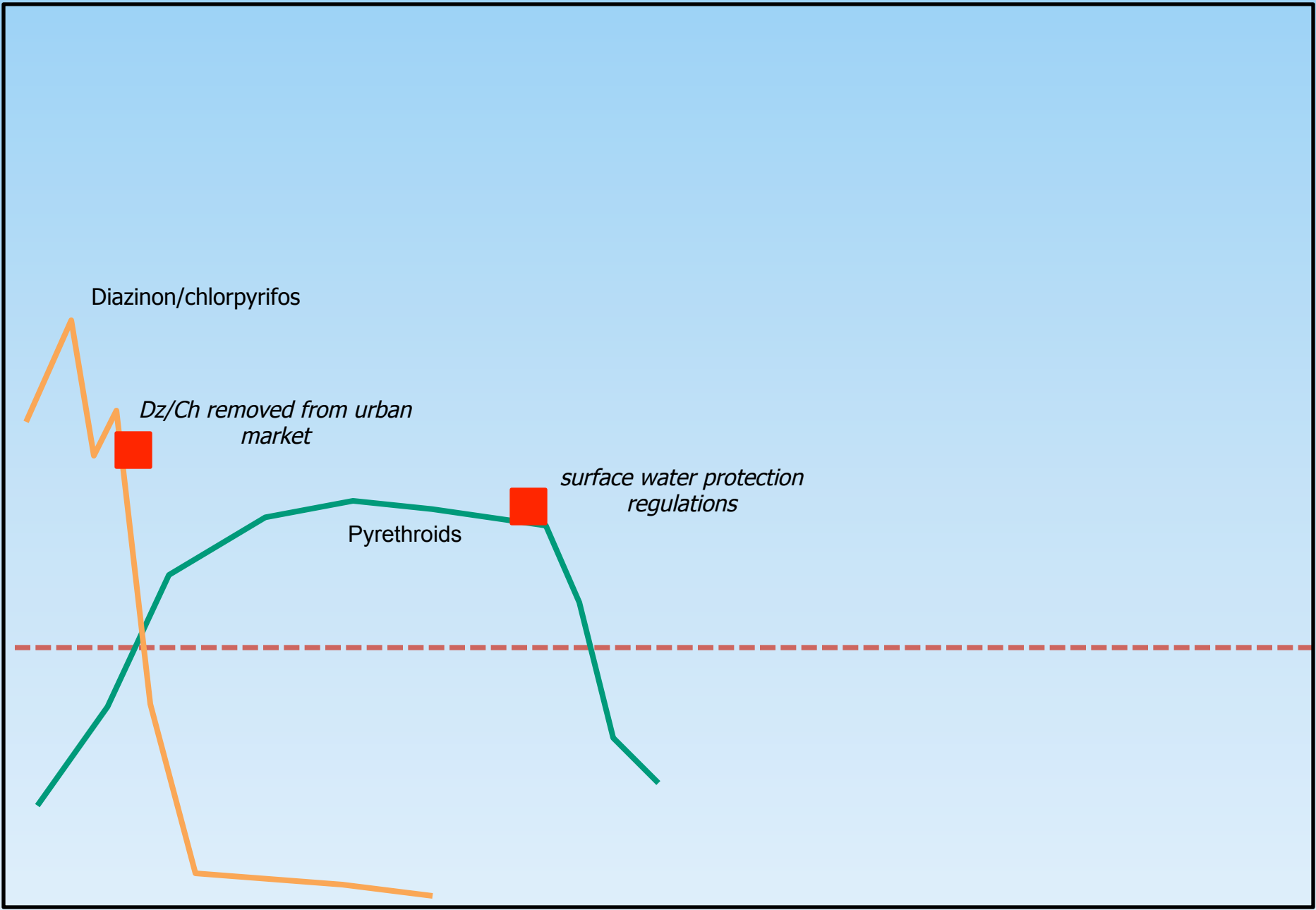


Diazinon/chlorpyrifos

*Dz/Ch removed from urban market*

Pyrethroids



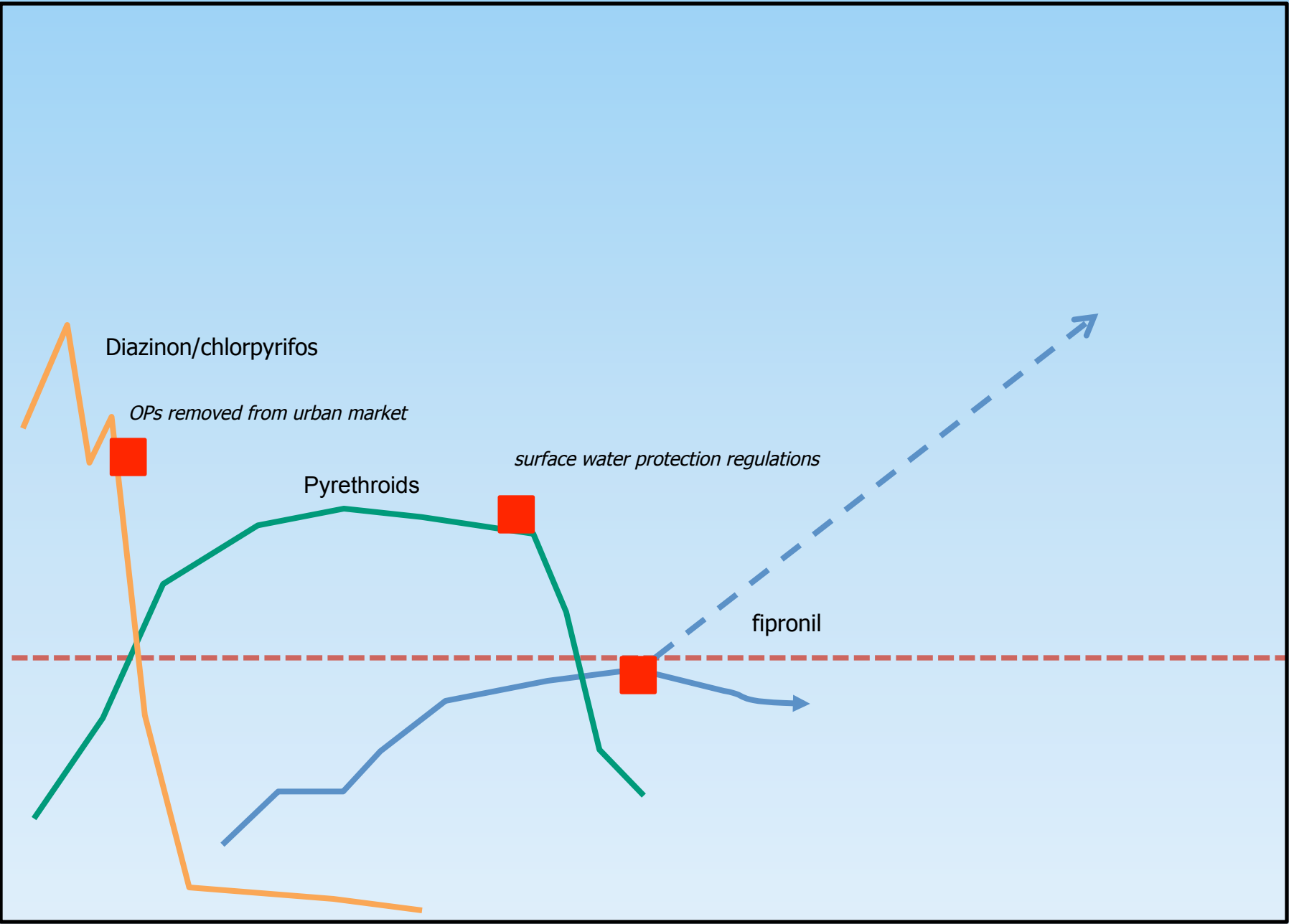


Diazinon/chlorpyrifos

*Dz/Ch removed from urban market*

*surface water protection regulations*

Pyrethroids



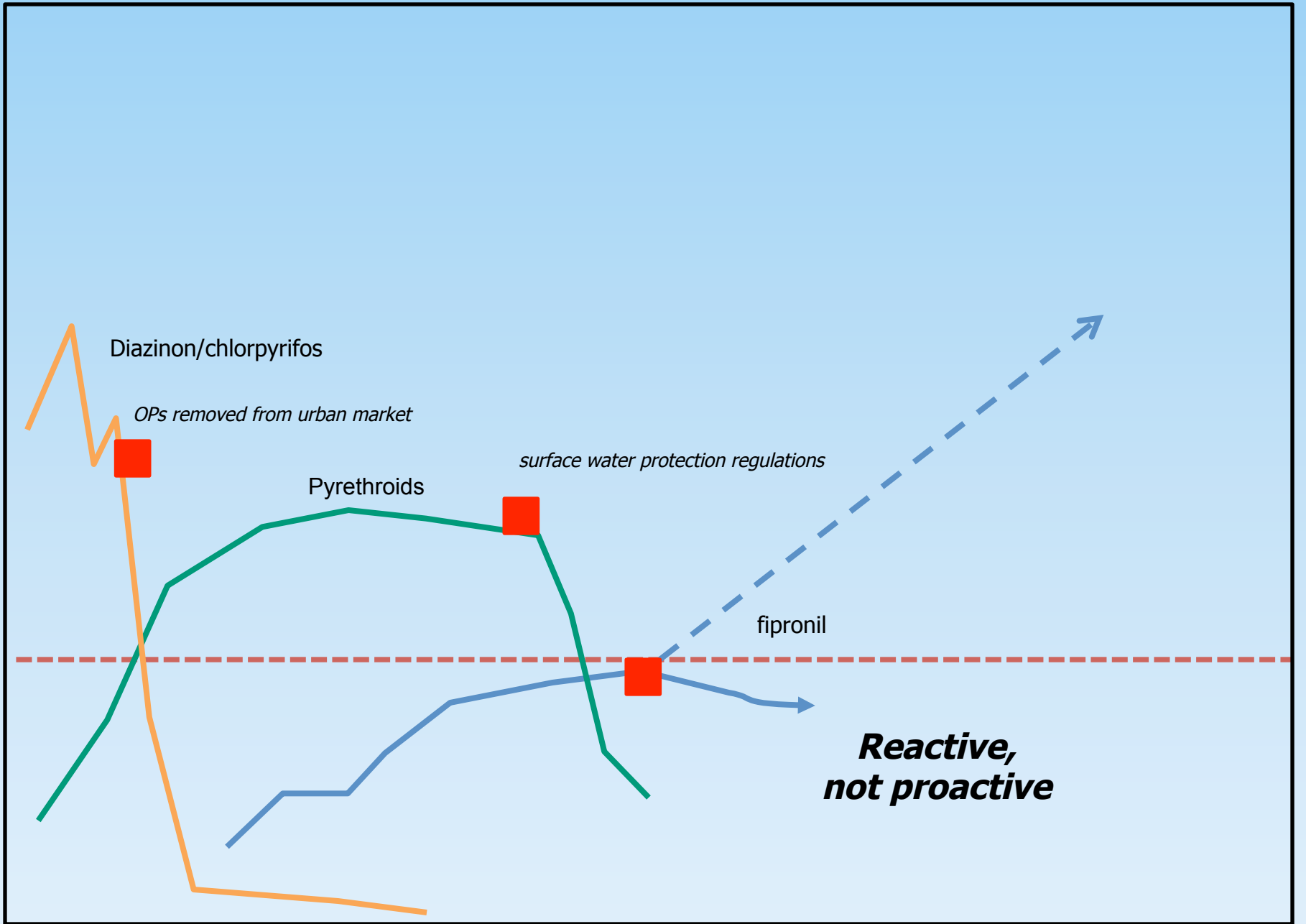
Diazinon/chlorpyrifos

*OPs removed from urban market*

Pyrethroids

*surface water protection regulations*

fipronil



Diazinon/chlorpyrifos

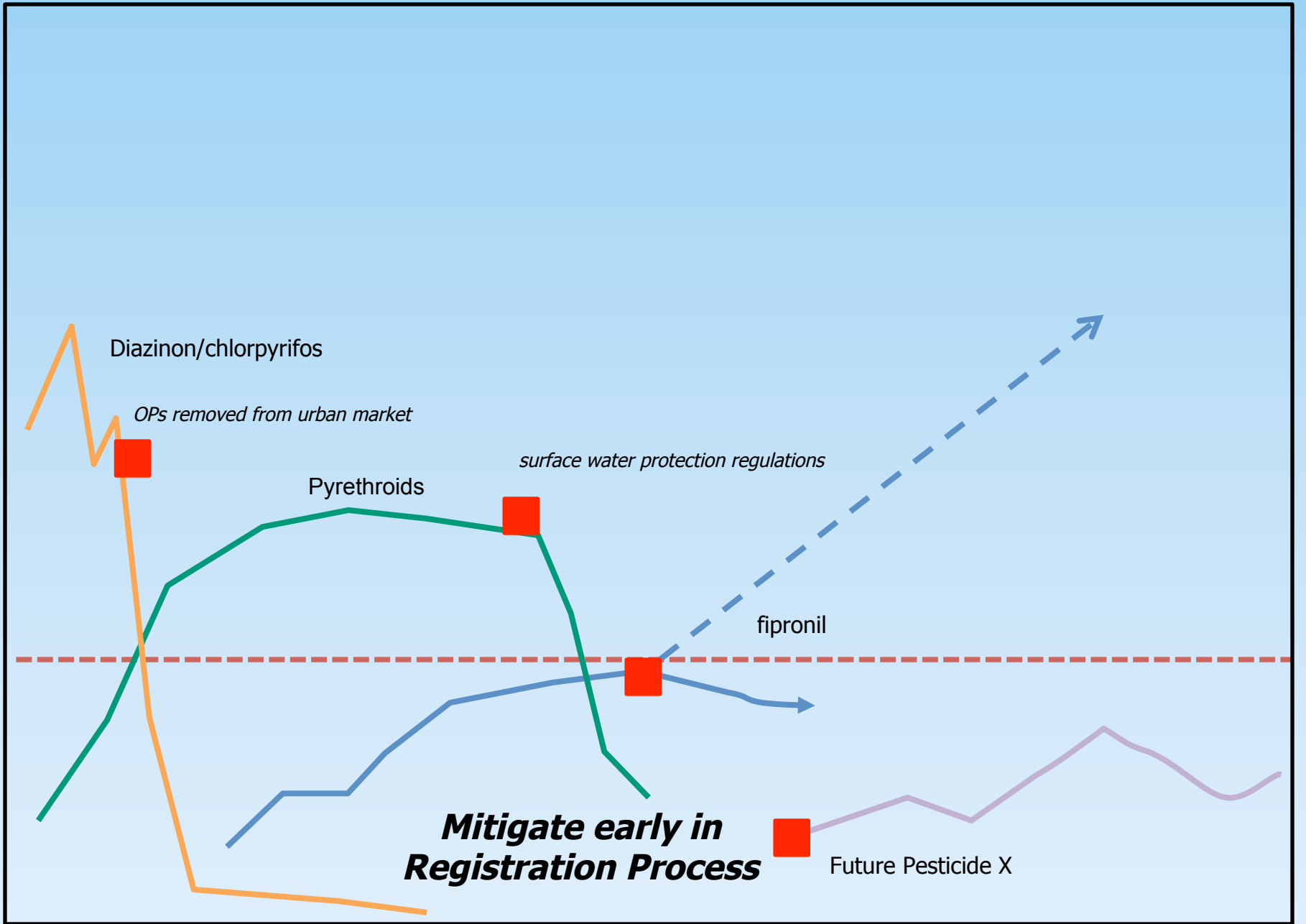
*OPs removed from urban market*

Pyrethroids

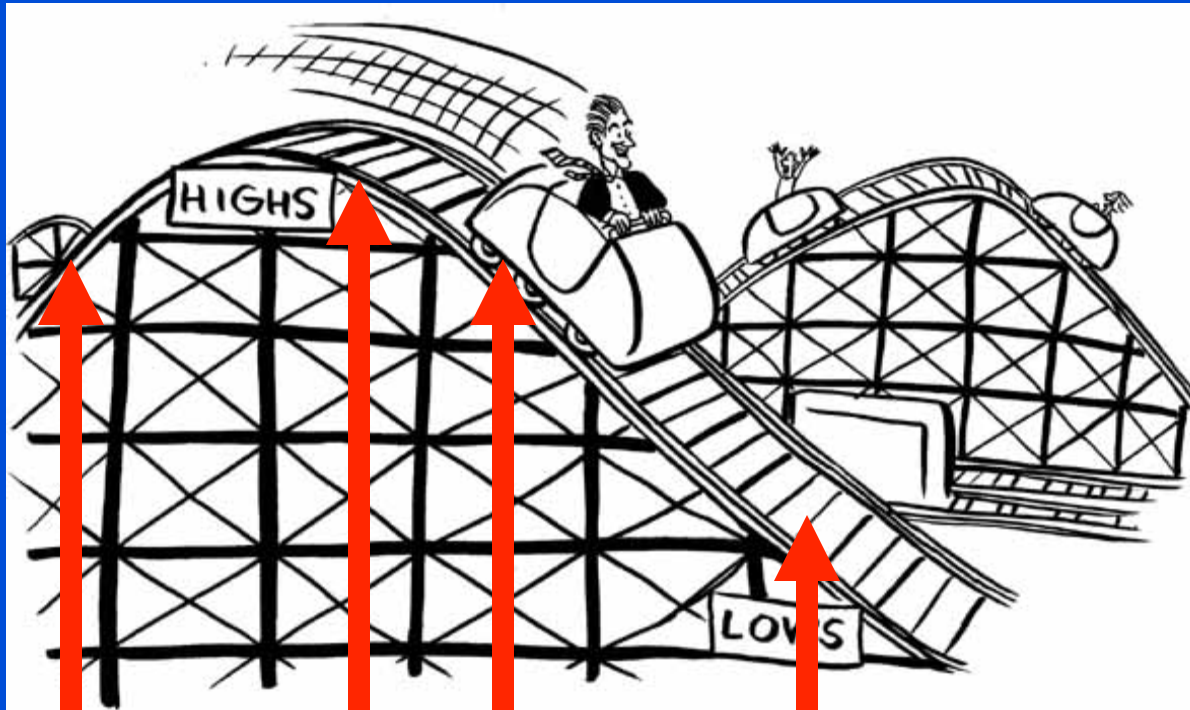
*surface water protection regulations*

fipronil

***Reactive,  
not proactive***



# Where do we go from here?



This is where  
we want to be.

Fipronil  
2010s

Pyrethroids  
2000s

Diazinon  
1990s

DDT  
1960s

**Recent successes point the way:**

## **DPR Surface Water Protection Regulations**

- July 19, 2012
- Restricts pyrethroid applications
- Only applies to licensees
- Works in concert with EPA bifenthrin labels
- UC Davis study predicts 85% reduction in stormwater (Jorgenson et al)



# Recent Success: EPA Bifenthrin Label changes

- No application to horizontal impervious surfaces (unless protected from runoff)
- Restricts applications to vertical surfaces



# Pyrethroid Label Language Changes

## EPA PR Notice 2008-1

U.S. ENVIRONMENTAL PROTECTION AGENCY

### Pesticides: Regulating Pesticides



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You are here: [EPA Home](#) » [Pesticides](#) » [Regulating Pesticides](#) » [Reevaluation: Review of Registered Pesticides](#) » [Pyrethroids and Pyrethrins](#) » Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products

## Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products

Current as of November 2011

### Overview of Initiative

To reduce ecological exposure from residential uses of pyrethroids, EPA has revised the "Environmental Hazard Statements" and general "Directions for Use" for pyrethroid pesticide products used in non-agricultural outdoor settings. These label statements will lead to reduced potential for runoff and drift that can result from applications of pyrethroid end-use products by both professional pesticide control operators and residential consumers in residential, commercial, institutional, and industrial areas. The label statements spell out good stewardship and best-management practices and clarify how these types of products are intended to be used.

While much of the information on this page is designed to help pesticide manufacturers understand the labeling changes, consumers can also use the practices, described in the box to the right, to help protect valuable water resources.

#### Actions for Consumers to Reduce Spray Drift and Runoff from Pyrethroid Pesticide Product Applications

When applying pyrethroid pesticides around your home, follow these good stewardship practices to protect water resources by reducing runoff and spray drift.

- Only apply the pesticide directly to the treatment area.
- Be mindful of the location of storm drains, drainage ditches, gutters, or surface waters during a pesticide application. Apply the pesticide in a manner that does not allow the product to enter these areas.
- Applying pesticides during calm weather conditions, when rain is not predicted for the next 24 hours, will help to ensure that wind or rain does not blow or wash pesticide off the treatment area.
- Rinsing application equipment, such as watering cans, low pressure hand wands, backpack sprayers, etc. over the treated area will help avoid runoff to water bodies or drainage systems.
- When applying granular products, sweeping any product that lands on a driveway, sidewalk, street, or other hard impervious surface, back onto the treated area of the lawn or garden will help to prevent runoff to water bodies or drainage systems.
- When watering treated areas, refer to the watering-in instructions on the label, and ensure you do not water the treated area to the point of runoff.

# Label Language Changes

## ENVIRONMENTAL HAZARDS

This product is extremely toxic to fish and aquatic invertebrates. Remove from premises or tightly cover fish tanks and disconnect aerators when applying indoors where such containers are present. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hr will help to ensure that wind or rain does not blow or wash pesticide off the treatment area. Rinsing application equipment over the treated area will help avoid run-off to water bodies or drainage systems.

# Label Language Changes

## DIRECTIONS FOR USE

IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING.

### USE RESTRICTIONS

- Do not apply this product through any type of irrigation system.
- Do not make applications during rain.
- Do not apply water-based sprays of this product to conduits, motor housing, junction and switch boxes or other electrical equipment because of possible shock hazard. Do not spray where electrical short circuits might result, such as wall outlets, conduits, etc.
- Do not apply in aircraft cabins.
- Do not use in outdoor residential misting systems.
- Do not apply to humans, their clothing or bedding. Do not allow children or pets to contact treated surfaces until spray has dried. Do not contaminate food or use on household pets. Cover fish tanks prior to application. Do not apply this product in patient rooms while occupied or in any rooms while occupied by the elderly or infirm. Do not apply to classrooms when in use.
- Do not contaminate food, feedstuffs, or water supply. Do not contaminate food preparation surfaces, kitchen utensils, dishes, or feed storage containers. Cover any food/feed contact surfaces and cooking utensils in the treatment area during treatment or thoroughly clean before using.
- Do not water the treated area to the point of run-off.

- All outdoor applications must be limited to spot or Crack & Crevice<sup>®</sup> treatments only, except for the following permitted uses.
  1. Treatment to soil or vegetation around structures;
  2. Applications to lawns, turf and other vegetation;
  3. Applications to building foundations, up to a maximum height of 3 ft.Other than applications to building foundations, all outdoor applications to impervious surfaces such as sidewalks, driveways, patios, porches and structural surfaces (such as windows, doors and eaves) are limited to spot and Crack & Crevice applications only.
- Do not apply directly to sewers or drains, or to any area like a gutter where drainage to sewers, storm drains, water bodies or aquatic habitat can occur, except as directed by this label.



# Industry reaction: Compliance Assistance videos



Regulatory Information   Consumer Information   Benefits   Company Sponsors   Resources & News

**PWG2PMP**

## Essential Pyrethroids Information for Pest Control Professionals

**New Label Requirements!**

Professional pest control operators will soon be required to make changes in how they apply pyrethroid pesticides. The changes are the result of new label requirements at the federal level and new regulations being developed in California.

[LEARN MORE](#)



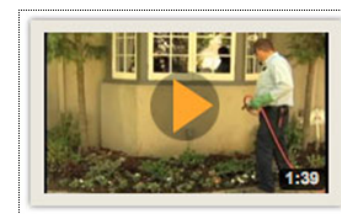
**Pyrethroid Working Group**  
presents

A Video Series:  
**“Understanding California’s  
New Pyrethroid Regulations”**

SEPTEMBER 2012

### How do we create a website?

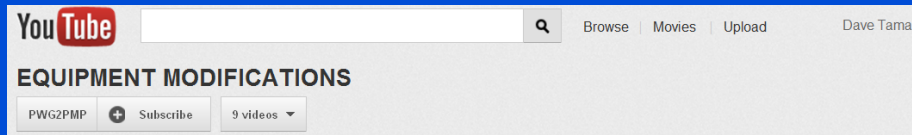
The Pyrethroid Working Group is dedicated to providing the most accurate, relevant and up-to-date information about pyrethroids. This site is especially for Pest Control Professionals as a way to keep up-to-date on the latest research and regulatory changes for pyrethroid insecticides.



Visit our YouTube channel for helpful instructional videos!

[pwg2pmp.com](http://pwg2pmp.com)

# PWG compliance assistance YouTube videos

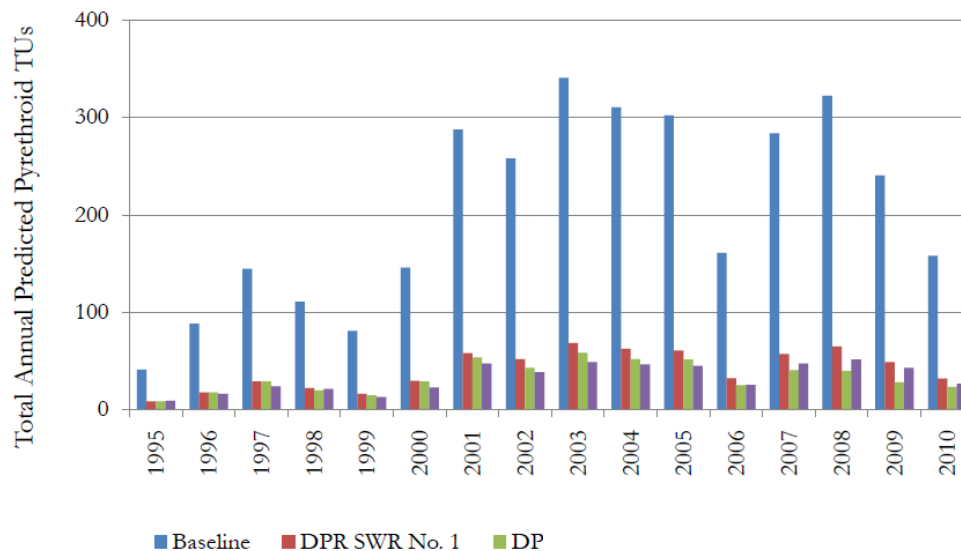


[pwg2pmp.com](http://pwg2pmp.com)



# UC Davis findings (Jorgenson et al.)

## Model Predicted Effectiveness of Proposed DPR Surface Water Protection Rules



## Conclusions

- With respect to pyrethroids, model predicts dramatic improvement in lower American River water quality with Cal DPR surface water protection rules (80-85% reduction in TUs)

# A proactive approach



\*

2005 letter to US EPA:

**“...a key goal of the registration review process should be to protect water quality** and minimize the need to mitigate pesticide impacts through Clean Water Act mechanisms.”

\* *California Stormwater Quality Association*

# Solution:

- Effective, *proactive* pesticide regulation based on *existing statutory authority*.
  - FIFRA (US EPA Office of Pesticide Programs)
  - Calif Food and Ag Code (Calif Dept of Pesticide Regulation)

# CASQA / Stormwater pesticide efforts

- Pesticides Subcommittee
- EPA OPP advisory committee
  - Pesticide Programs Dialogue Committee
- DPR Advisory committees
  - Pest Management Advisory Committee
- Structural Pest Control Board
  - Appointed Board member
  - IPM licensing and continuing education
  - IPM marketing
- Funding for technical support



# Regulatory Initiatives

**SWQTF** *California Stormwater  
Quality Task Force*

## Work Products



Letter to USEPA, 10/26/99  
Subject: Call to action - Pesticide-related toxicity in urban surface waters

October 26, 1999

Ms. Carol Browner  
Administrator  
USEPA  
401 M Street, SW  
Washington, DC 20460

Ms. Susan Wayland  
Assistant Administrator - Office of Prevention, Pesticides, and Toxic Substances (OPPTS)  
USEPA  
401 M Street, SW  
Washington, DC 20460

Mr. J. Charles Fox  
Assistant Administrator - Office of Water (OW)

CASQA comments on Pyrethrins RRA.PDF	11/21/2005 3:53 P
CASQA comments on Risk Assessments and ...	2/27/2006 5:58 PM
CASQA comments on PHMB RED Docket No. ...	10/10/2006 4:53 P
CASQA comments on RED for Copper-Contai...	10/10/2006 4:53 P
CASQA comments on Permethrin RED Docket...	10/11/2006 8:51 A
CASQA comments on RED for Cypermethrin (...)	10/15/2006 8:10 P
CASQA comments on RED for Resmethrin (D...	10/24/2006 8:36 A
CASQA comments on REDs for Pyrethrins_PB...	10/29/2006 11:23
CASQA comments on Tetramethrin Risk Redu...	4/29/2008 2:22 PM
CASQA Comments on d-Phenothrin Risk Red...	5/13/2008 10:28 A
CASQA comments on USEPA proposed _Earl...	10/27/2008 11:49
CASQA comments on Esfenvalerate Registra...	2/16/2010 4:57 PM
Casqa comments on Pesticide Inert Ingredie...	2/22/2010 10:09 A
CASQA Comment Letter - USEPA Registratio...	6/16/2010 9:04 AM
CASQA Comments on Bifenthrin Registration ...	8/24/2010 8:47 AM
CASQA Copper RED Comment Letter 10-10-...	11/19/2010 1:53 P
CASQA comments on Cyfluthrins Registratio...	11/23/2010 8:18 A
CASQA comments on Carbaryl Registration R...	11/23/2010 8:20 A
CASQA comments on Copper Compounds Re...	11/23/2010 8:21 A
CASQA comments on Data Requirements for ...	12/10/2010 5:21 P
CASQA Comments on Preliminary Risk Assess...	12/10/2010 5:36 P
CASQA Comments on IRED for Carbaryl.pdf	12/10/2010 6:05 P
CASQA antimicrobials letter EPA-HQ-OPP-20...	4/15/2011 9:02 AM
CASQA Comments on Nanoscale Material Pes...	8/17/2011 9:37 PM
CASQA Comments on USEPA Permethrin Reg...	8/30/2011 8:20 AM
CASQA comments on Registration Review of ...	11/29/2011 2:39 P
CASQA comments on Registration Review - G...	11/29/2011 5:00 P



# Key Partners

- Calif Department of Pesticide Regulation
- SF RWQCB
- CV RWQCB
- SWRCB
- Region 9 EPA

# Stormwater Regulatory goals:



- US EPA Office of Pesticide Programs
  - **Agency wide** institutionalization of WQ protections
    - Urban pathway analysis
    - Aquatic toxicity data
    - CWA/FIFRA Harmonization
    - Effective label restrictions

# Registration improvements needed

- **Urban pathways**
- **Sediment fate and toxicity**
- **Data for water quality criteria**
  - 8 species, appropriate species
- **Wash-off data for urban surfaces**
- **Commercially viable analytical methods for environmental samples**
- **Clear and rational data exemption criteria**

# CWA vs. FIFRA test species

bifenthrin water exposures LC<sub>50</sub> values (from ECOTOX database)

**FIFRA  
species**



*Daphnia magna* = 1.4 µg/L



*Ceriodaphnia dubia* = 0.107 µg/L



*Hyalella azteca* = 0.0093 µg/L

# CWA vs. FIFRA test species

bifenthrin water exposures LC<sub>50</sub> values (from ECOTOX database)



*Daphnia magna* = 1.4 µg/L



*Ceriodaphnia dubia* = 0.107 µg/L

**CWA  
species**



*Hyalella azteca* = 0.0093 µg/L

# Achievement: Partnership with DPR

- **Surface Water Protection Regulations**
  - pyrethroid applications by licensees
- New screening mechanisms for water body impacts
- IPM research and dissemination
- **Key partner in dealing with US EPA**

# DPR AI screening (draft)

## Indicator #4: use pattern

---

- Pesticide use patterns with high exposure potentials to surface water:
  - *Aquatic* and *rice* pesticides
  - *Urban/residential* uses
  - Crops with *gravity irrigation* (DWR irrigation survey)
  - Crops with *top acreages* in California (PUR database and DWR land use survey)
  - *Winter* rain season application
  - *Pre-emergent* application

# Achievement: Changes at US EPA Office of Pesticide Programs

- **Pyrethroid label changes**
- **Stringent Bifenthrin label changes**
- Pyrethroid registration review frontloaded
- “Harmonize” CWA FIFRA WQ analysis
- Urban pathway analysis
- More appropriate WQ data requirements





# Ongoing challenge: A Moving Target

- 1,012 registered pesticides  
12,890 registered products  
currently
- 900 pesticides and 11,000  
products in late 1990s.
- Environmental monitoring  
changes
  - Fungicides
  - Herbicides
- All regulated and reviewed by  
about 750 employees at OPP...

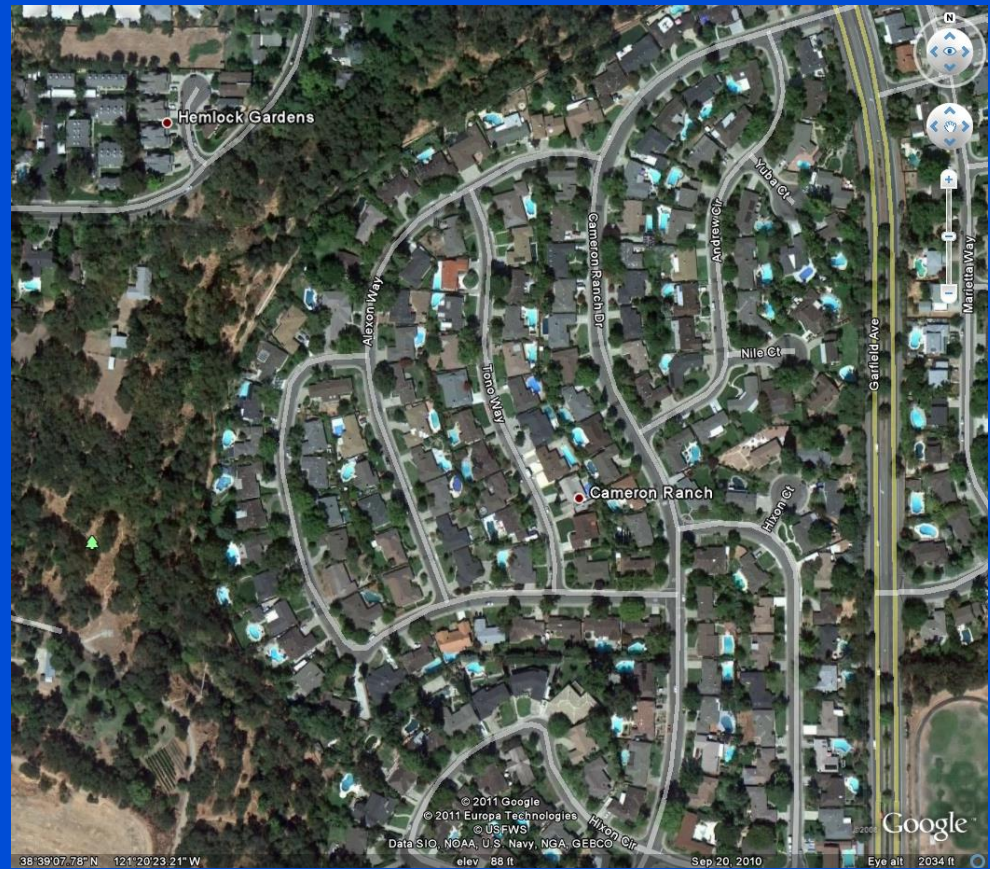


# Result: Whack-a-Mole

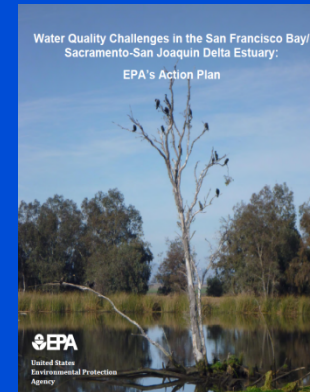




# Ongoing challenges: EPA still needs better understanding of urban pesticide pathways



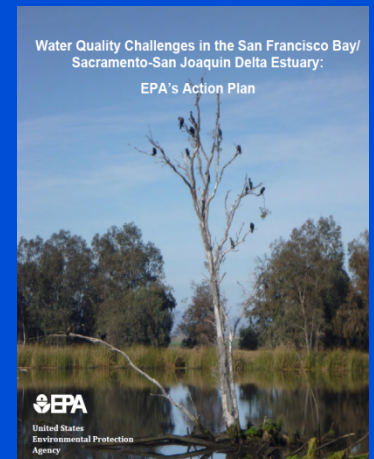
# Ongoing Challenges: ANPR EPA Bay Delta Plan (2011)



- What **new or revised effluent limitations, monitoring requirements or other permit requirements** could be included in NPDES permits for discharges of pesticides from MS4s in the Bay Delta Estuary in order to better meet the regulatory standard of reducing discharges to the maximum extent practicable?
- What information is necessary to determine permit requirements, such as **identifying effluent limits that can effectively reduce ambient contaminant concentrations** and restore designated uses?

# CASQA Response: Meeting with Region 9 EPA

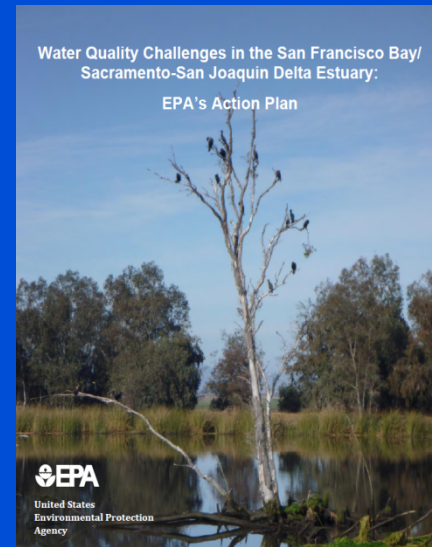
- Organized by CASQA Pesticides Subcommittee
- Educated EPA on California actions for pesticides
  - CASQA
  - Sacramento and Bay Area MS4s
  - Region 2 and Region 5
  - DPR





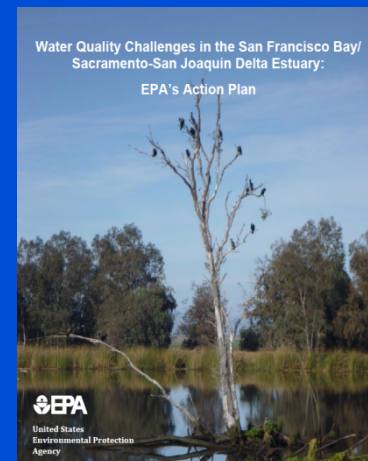
# Result: Bay Delta Action Plan (2012)

- California is a national leader in monitoring and investigating pesticide effects on aquatic species and taking actions to reduce pesticide-caused water quality impairments and aquatic toxicity through pollution prevention programs.
- State agencies are using federal CWA tools and state water and pesticide laws to identify numeric water quality criteria, support monitoring, reporting, and assessment programs, control pesticides at the discharge site, and remove pesticides from runoff before entering the aquatic ecosystem.



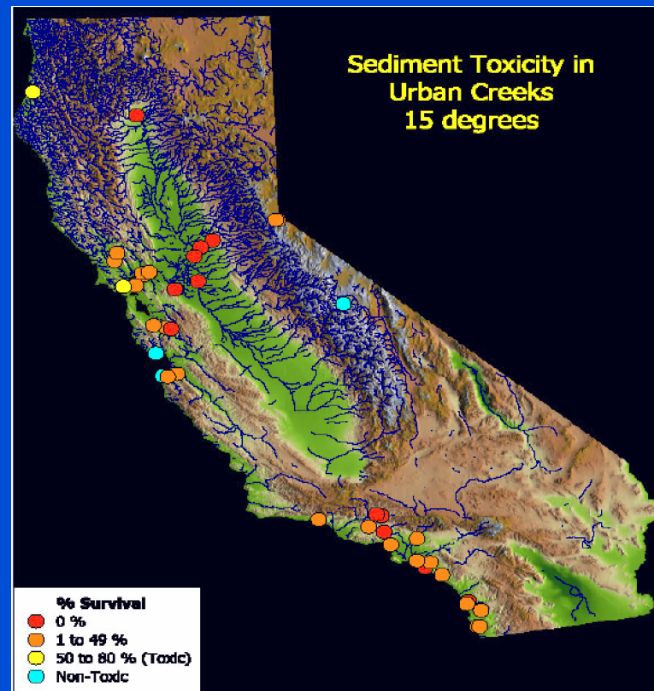
# But...

- d. If aquatic toxicity from urban runoff persists in the Bay Delta Estuary and its tributaries, EPA recommends evaluating the use of residual designation authority to establish a Delta Region Municipal MS4 permit.



# Coming your way? Sacramento MS4 Audit August 2012

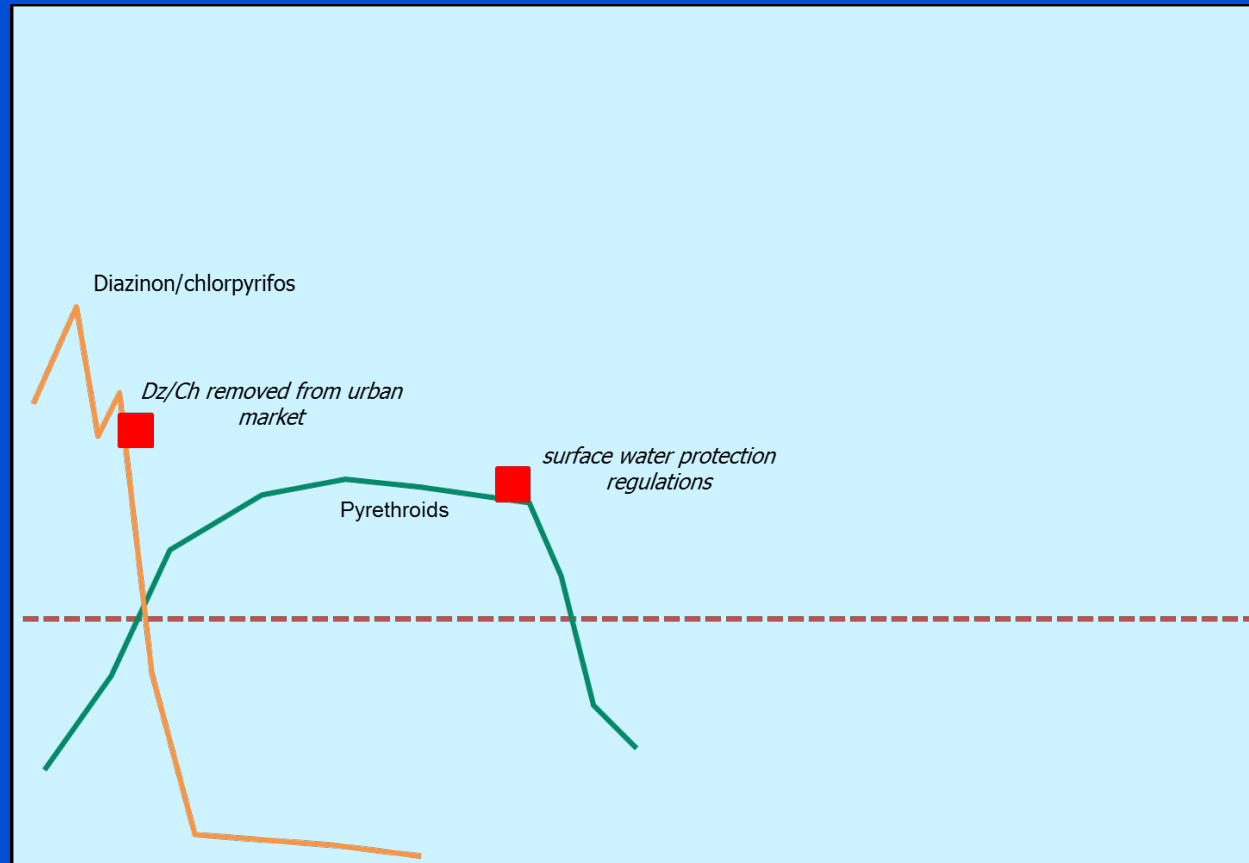
- OP and pyrethroid toxicity was a key topic of interest.



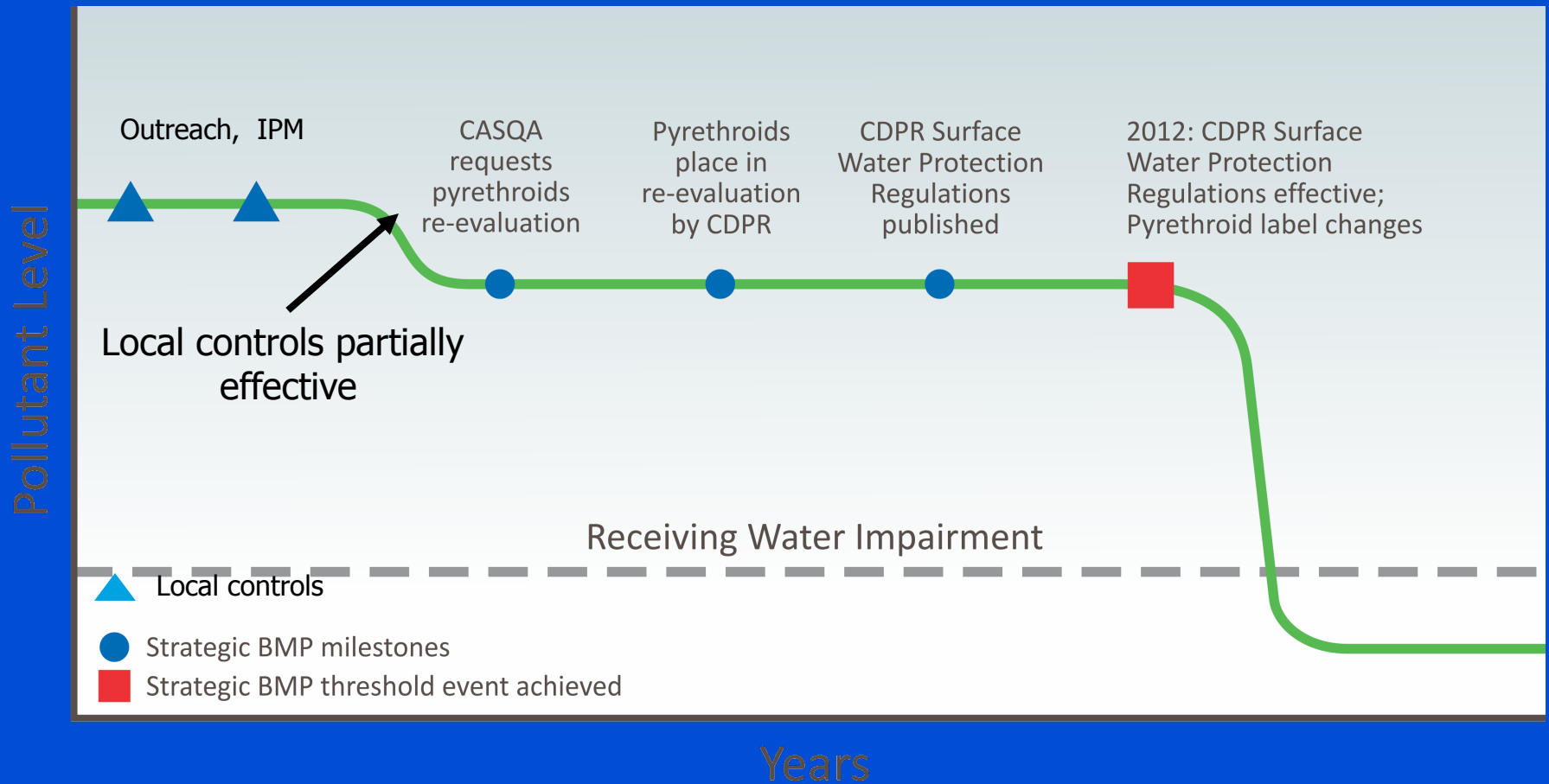


# Sacramento MS4 Audit August 2012

- And this story helped a lot.



# Patience and persistence required: strategic thresholds



# Working together, we can solve sticky problems.



STOP  
WHAC-A-MOLE  
GAMING

Photo courtesy D. Choe

# Questions?

Dave Tamayo

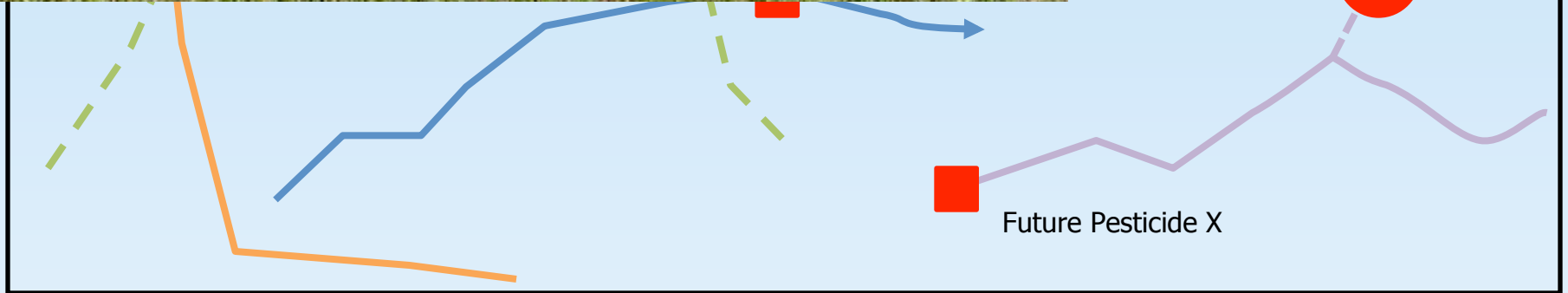
[tamayod@saccounty.net](mailto:tamayod@saccounty.net)

926 874-8024





**Goal: No more  
Whack A Mole!**



Future Pesticide X





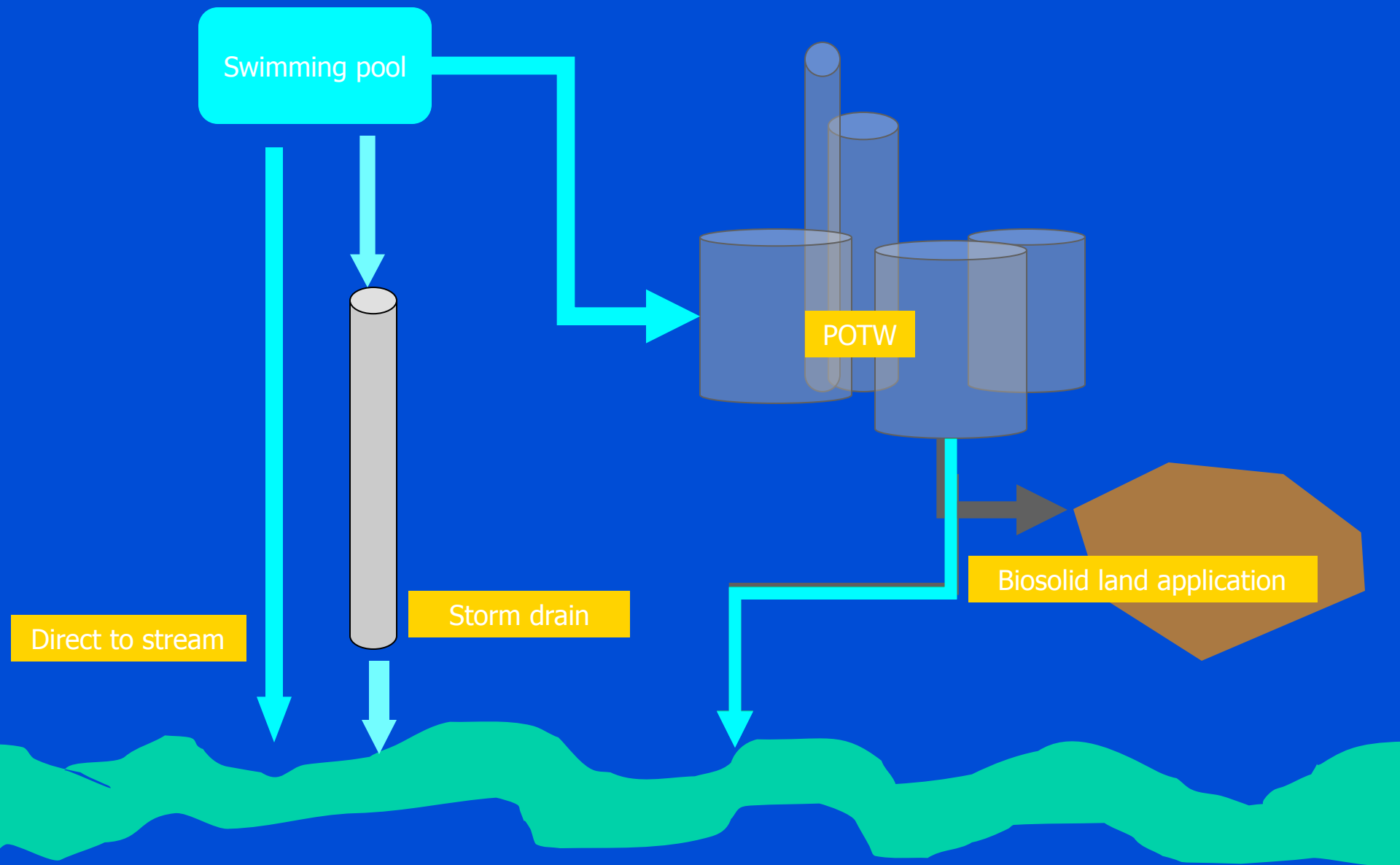
# Which Pesticide Uses Are Most Important for Urban Runoff?

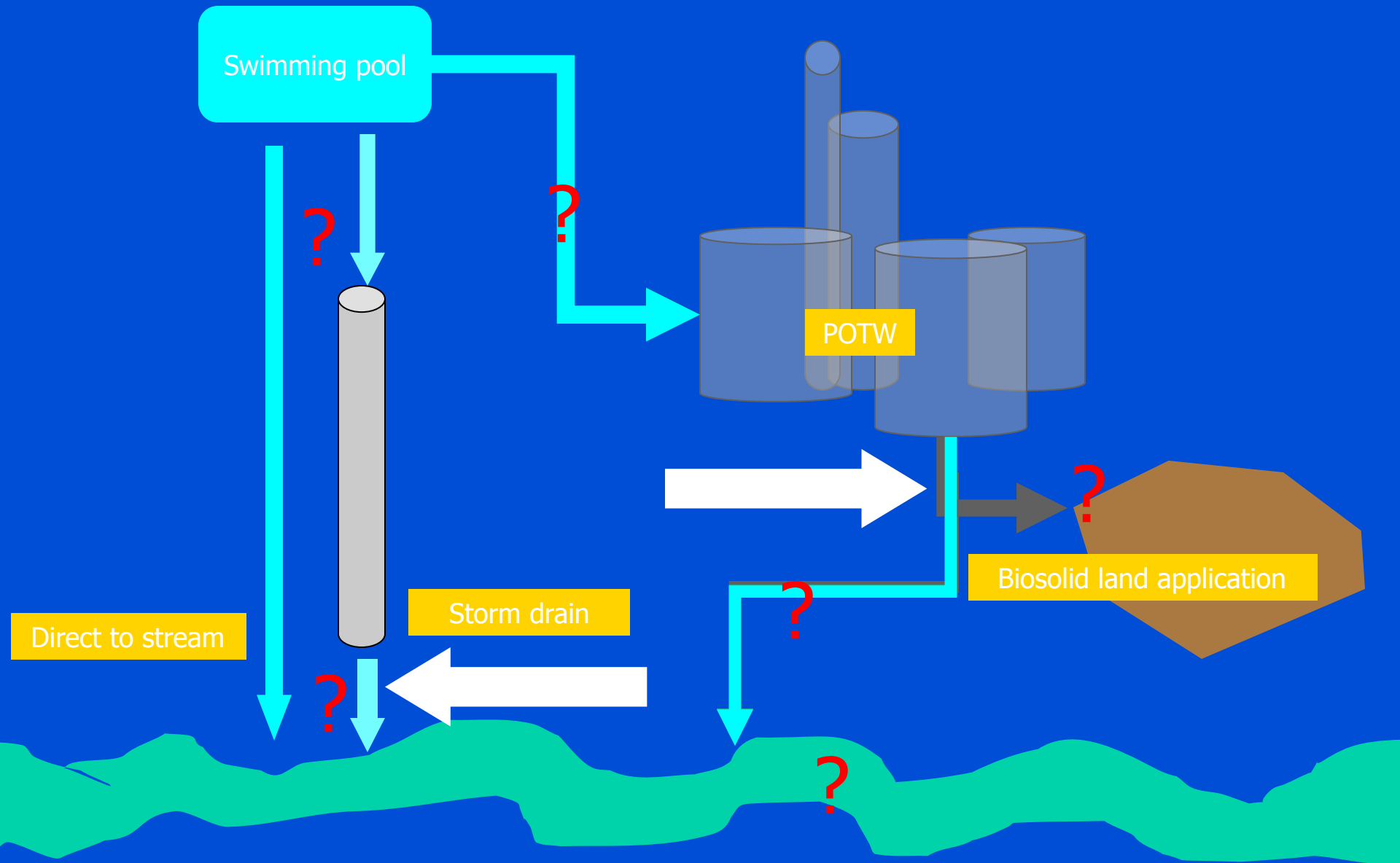






Klotz et al 2008





# Low summer flow



# Achievement: Partnership with DPR

- Pyrethroid re-evaluation
- **Surface Water Protection Regulations**
- Active ingredient screening mechanisms for WQ
- Surface water monitoring program
- Increased urban focus
- IPM research and dissemination
- Negotiation with US EPA



# Surface Water Protection Regulations

- Reduce pyrethroid applications to horizontal impervious surfaces
- Only applies to licensees
- Works in concert with bifenthrin labels
- UC Davis study: 85% reduction in stormwater (Jorgenson et al)
- Effective July 19, 2012
- Surveillance monitoring





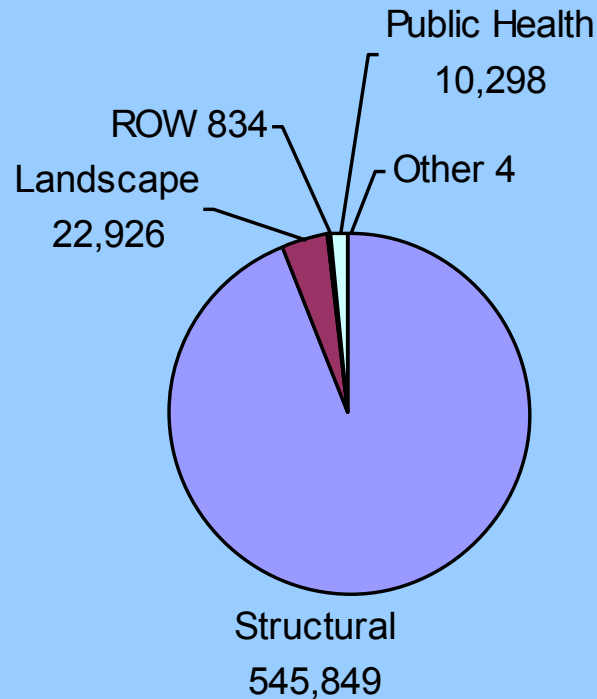
# Achievement: Changes at US EPA Office of Pesticide Programs

- **Pyrethroid label changes**
- **Stringent Bifenthrin label changes**
- Pyrethroid registration review frontloaded
- “Harmonize” CWA FIFRA WQ analysis
- Urban pathway analysis
- More appropriate WQ data requirements





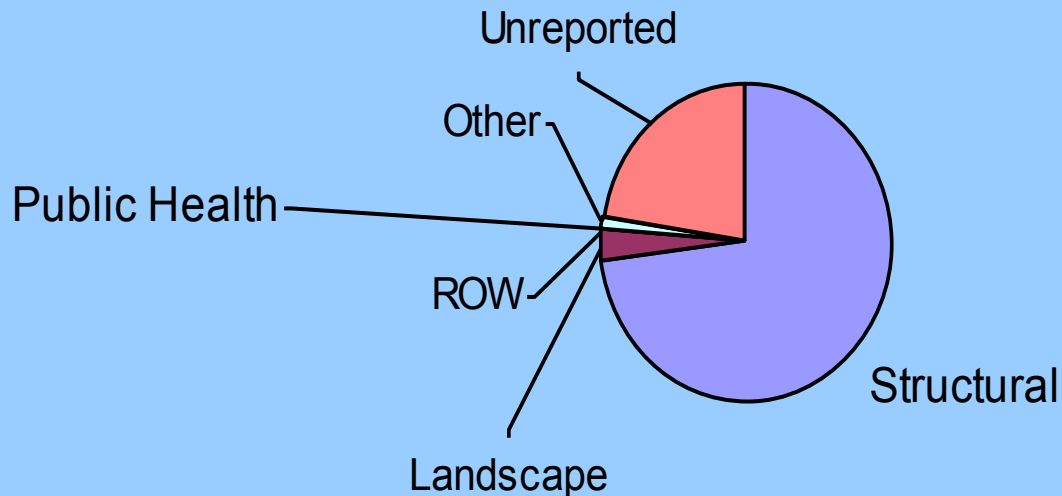
# Where's it coming from?



**Reported Urban Pyrethroid + Pyrethrin Use**  
(California 2007, pounds, active ingredient)

# Unreported uses add to the pie.

**Urban Pyrethroid and Pyrethrins, California 2007**  
reported uses and unreported estimate (sales minus reported)



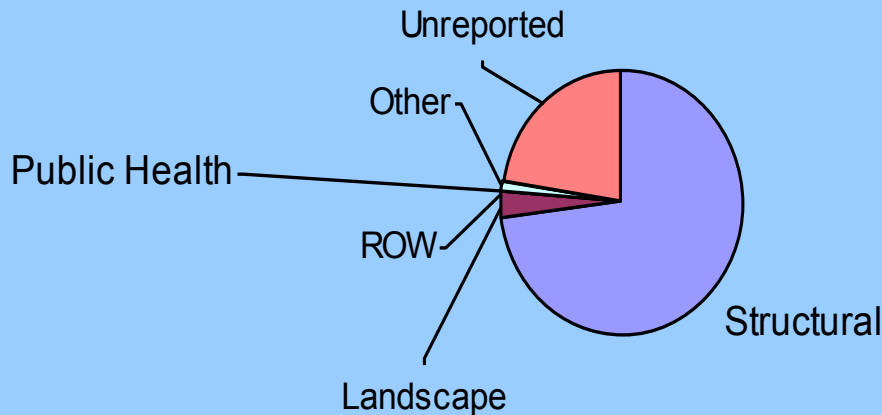
Source: CDPR PUR and sales

# Stormwater Strategy:

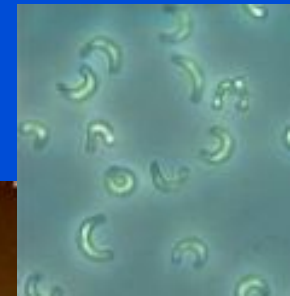
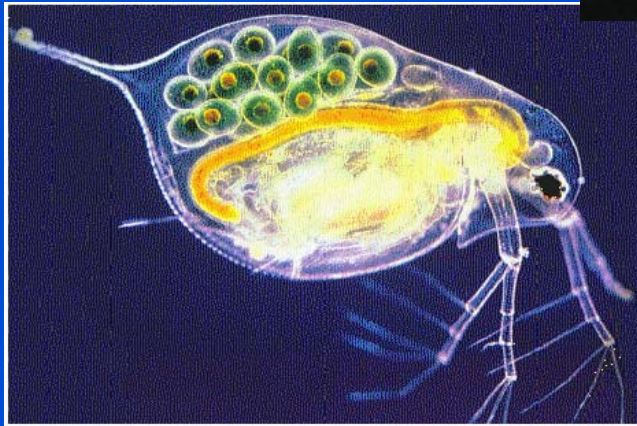
Use FIFRA to address the  
**BIG** part of the pie.

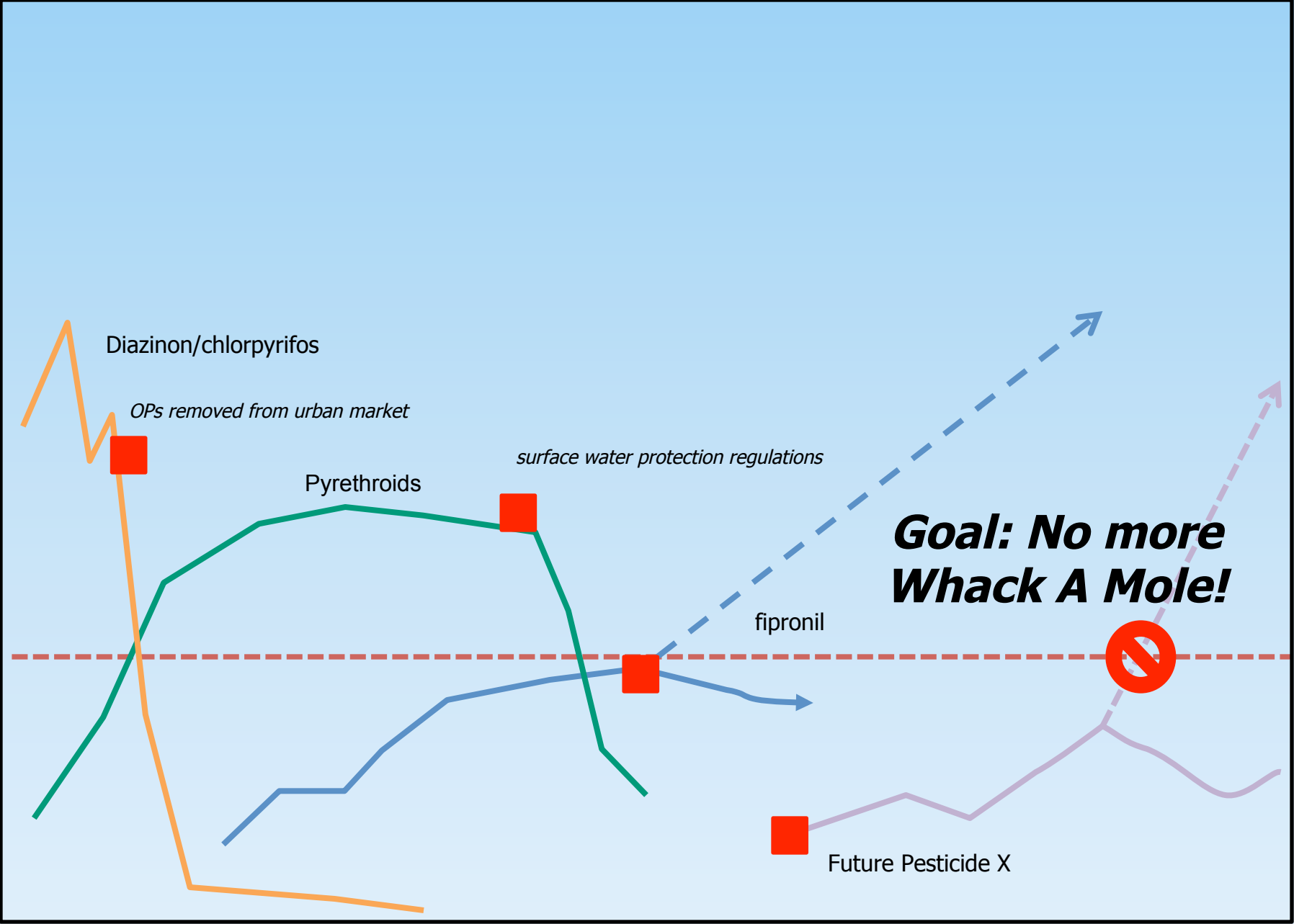


**Urban Pyrethroid and Pyrethrins, California 2007**  
reported uses and unreported estimate (sales minus reported)



# MS4 Permit requires chemical and toxicity testing





Diazinon/chlorpyrifos

*OPs removed from urban market*

Pyrethroids

*surface water protection regulations*

fipronil

**Goal: No more Whack A Mole!**

Future Pesticide X

## OUTDOOR/PERIMETER PESTS (cont.)

	<p>been found, or can find shelter. In ant management programs, apply to flower, shrub or ornamental plant beds where ants may be nesting, find food or forage.</p>
<b>Application Restrictions</b>	<p>Do not water the treated area to the point of run-off Do not make applications during rain. All outdoor applications must be limited to spot or crack-and-crevice treatments only, <u>except</u> for the following permitted uses:</p> <ol style="list-style-type: none"><li>(1) Treatment to soil or vegetation around structures;</li><li>(2) Applications to lawns, turf, and other vegetation;</li><li>(3) Applications to building foundations, up to a maximum height of 3 feet.</li></ol> <p>Other than applications to building foundations, all outdoor applications to impervious surfaces such as sidewalks, driveways, patios, porches and structural surfaces (such as windows, doors, and eaves) are limited to spot and crack-and-crevice applications, only. Application is prohibited directly into sewers or drains, or to any area like a gutter where drainage to sewers, storm drains, water bodies, or aquatic habitat can occur. Do not allow the product to enter any drain during or after application.</p>

# Label Language Changing

- EPA PR Notice 2008-1

Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products		
Description	Amended Labeling Language	Placement on Label
<b>End-Use Products Intended for Occupational Use (WPS and Non-WPS)</b>		
<p><i>Note to Registrant:</i></p> <p>Please note that the following Environmental Hazard Statements (per PR Notice 2008-1) are <b>only</b> intended to replace either of the following statements, whichever one appears on the pesticide label, typically found on products registered for an outdoor use:</p> <ul style="list-style-type: none"> <li>• “Do not apply directly to water. Do not contaminate water when disposing of equipment washwaters or rinsate.”</li> <li>• “For terrestrial uses: Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater or rinsate.”</li> </ul> <p>Other required environmental statements <b>must</b> remain on the label, such as wildlife hazard statements as toxicology data dictate (e.g., specific precautionary statements concerning bees, fish or aquatic organisms).</p>		
Environmental hazard statements on Liquid Concentrate consumer outdoor products (e.g., liquids mixed with water by the user for a tank sprayer or hose-end attachment)	“To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help to ensure that wind or rain does not blow or wash pesticide off the treatment area. Rinsing application equipment over the treated area will help avoid run off to water bodies or drainage systems.”	Environmental Hazard Statement
Environmental hazard statements on Broadcast Granular consumer outdoor products (e.g., ready-to-use granular products which may be combined with fertilizers and broadcast applied with a drop or rotary spreader)	“To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help to ensure that wind or rain does not blow or wash pesticide off the treatment area. Sweeping any product that lands on a driveway, sidewalk, or street, back onto the treated area of the lawn or garden will help to prevent run off to water bodies or drainage systems.”	Environmental Hazard Statement
Environmental hazard statements on Dusts consumer outdoor products (e.g., for garden or ornamental)	“To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help to ensure that wind or rain does not blow or wash pesticide off the treatment area.”	Environmental Hazard Statement





## Formulation Effects and the Off-Target Transport of Pyrethroid Insecticides from Urban Hard Surfaces

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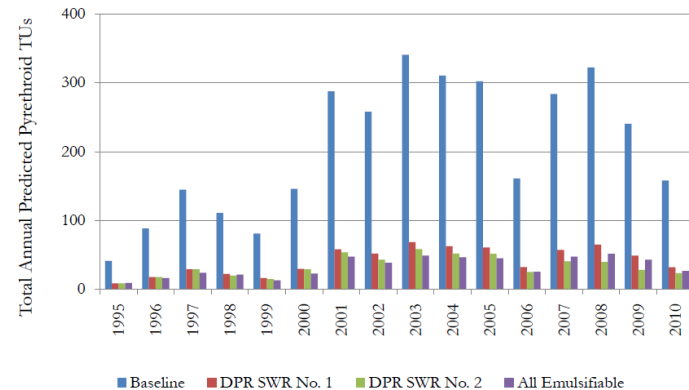
*Received January 21, 2010. Revised manuscript received  
April 5, 2010. Accepted May 18, 2010.*

Controlled rainfall experiments utilizing dr

An improved mechanism by v away from their effectively consi impact on the a fate and transp engineers, scien the physical and It is often the pra of pesticide proc make up that m complex mixture improve active product applica

Numerous sr been conducted factors of activ

## Model Predicted Effectiveness of Proposed DPR Surface Water Protection Rules



## Conclusions

- With respect to pyrethroids, model predicts dramatic improvement in lower American River water quality with Cal DPR surface water protection rules (80-85% reduction in TUs)