



An Evaluation of the Department of Pesticide Regulation's Surface Water Regulations for Pyrethroids: Are They Working?



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INTRODUCTION

Pyrethroids are a popular class of insecticides in structural and landscape pest management products. The active ingredients bifenthrin and permethrin have the highest reported use by pest control operators (PCO) in California (Figure 1). The Department of Pesticide Regulation's (CDPR) Environmental Monitoring Branch regularly detects pyrethroids in California's surface waters at concentrations that exceed aquatic toxicity benchmarks set by the US EPA (Figure 2) (Budd, 2016; Ensminger, 2016). To address water quality concerns, CDPR adopted surface water regulations in July, 2012 (CDPR, 2012). The regulations limit the application of products containing seventeen pyrethroids (Figure 3). In addition, a source identification study was conducted in collaboration with two large pest control operators in which the companies incorporated esfenvalerate containing products as part of their business routes located in neighborhoods adjacent to Salt Creek watershed in Orange County, Calif. (Figure 4). Esfenvalerate was chosen as a marker to ascertain runoff concentrations made by commercial applications, as it has relatively low reported urban use and had been detected infrequently in California surface waters. To evaluate the effectiveness of the surface water regulations since their adoption, a trend analysis of concentrations at long-term monitoring stations was conducted for each pyrethroid. Information gained by this analysis will assist CDPR to determine if the regulations are effective in reducing pyrethroid concentrations to acceptable levels.

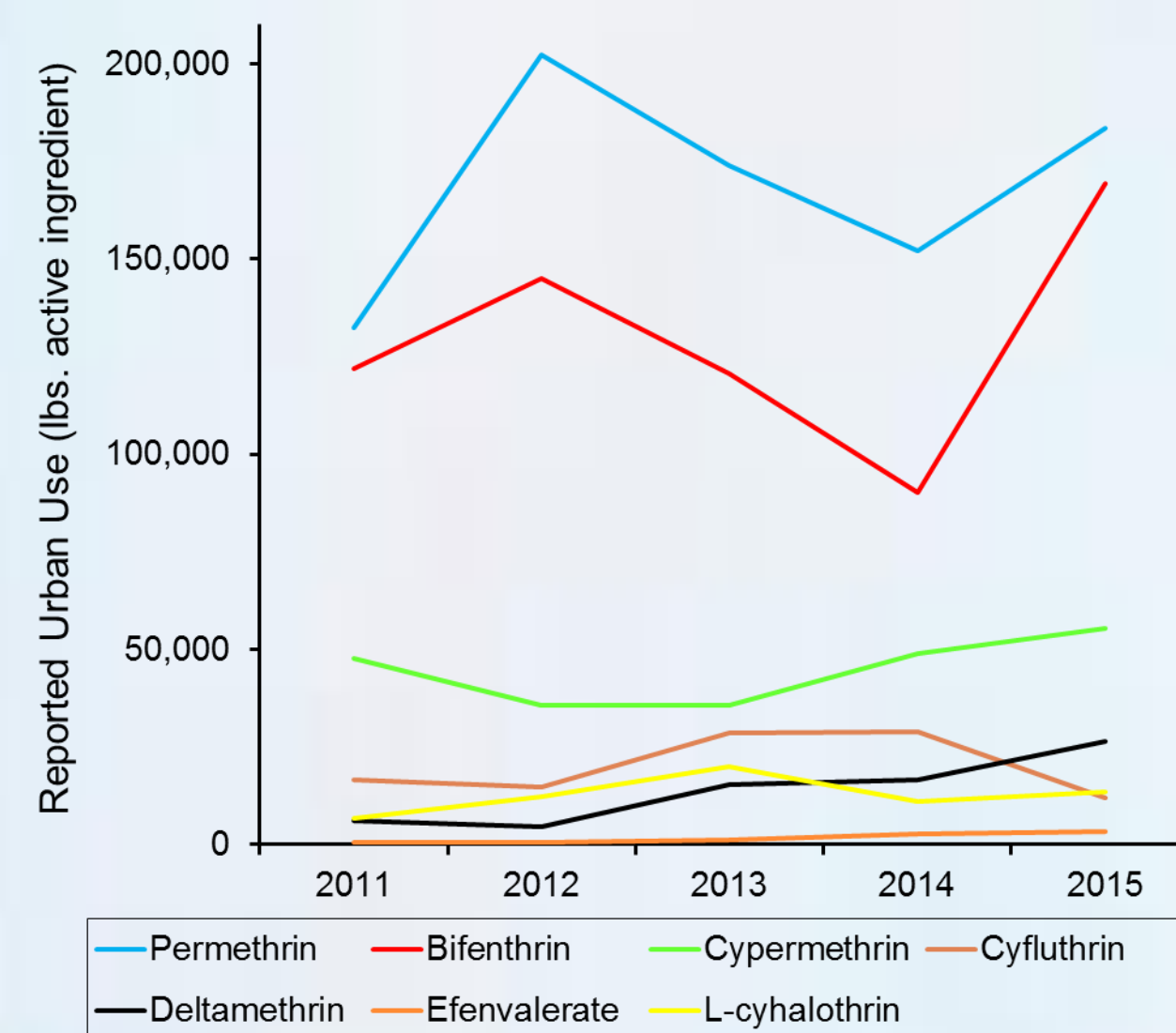


Figure 1. Reported use (lbs. active ingredients) of pyrethroids in California for structural and landscape pest management.

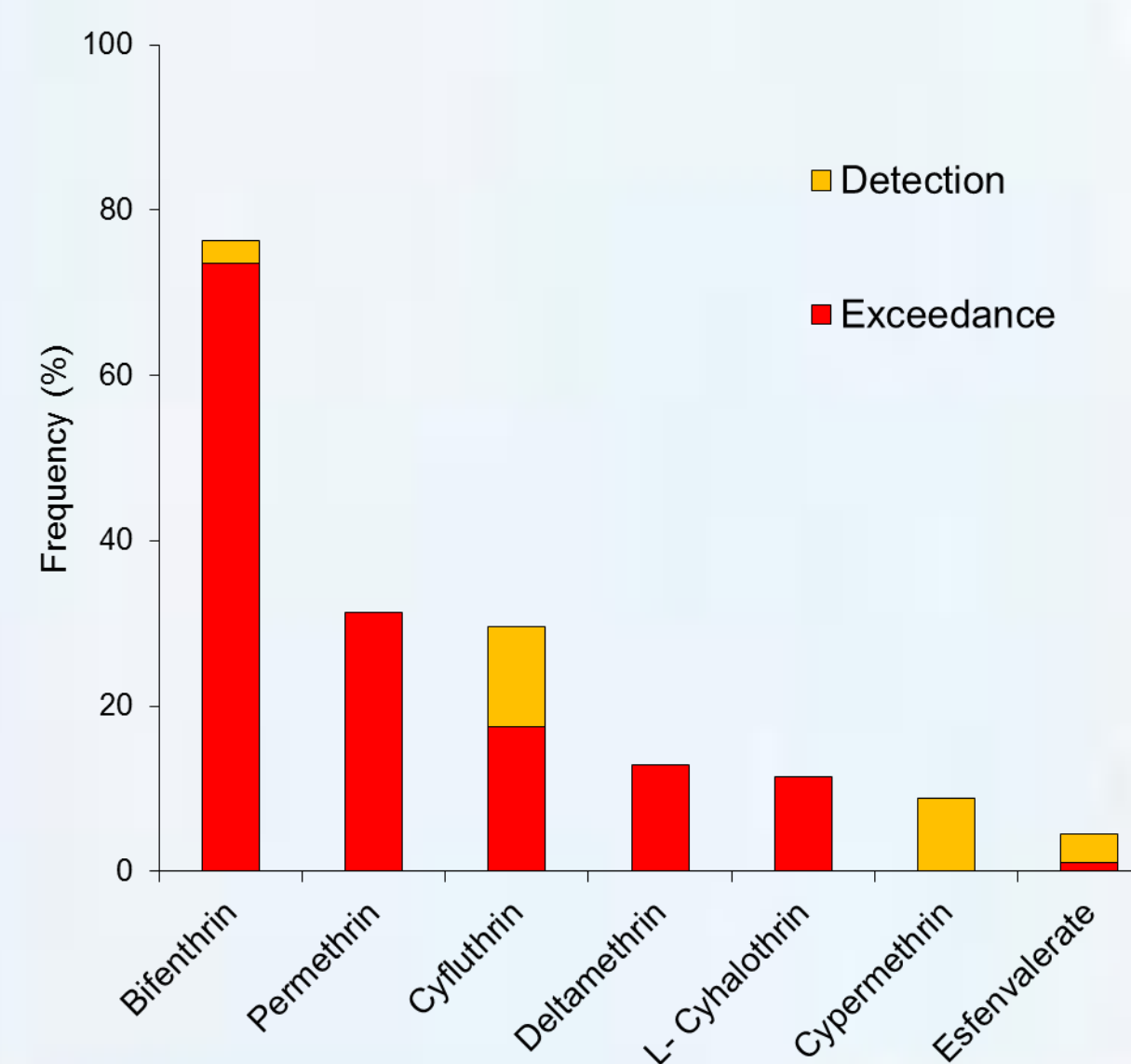


Figure 2. Statewide detection and aquatic benchmark exceedance rate for pyrethroids 2008-2016.

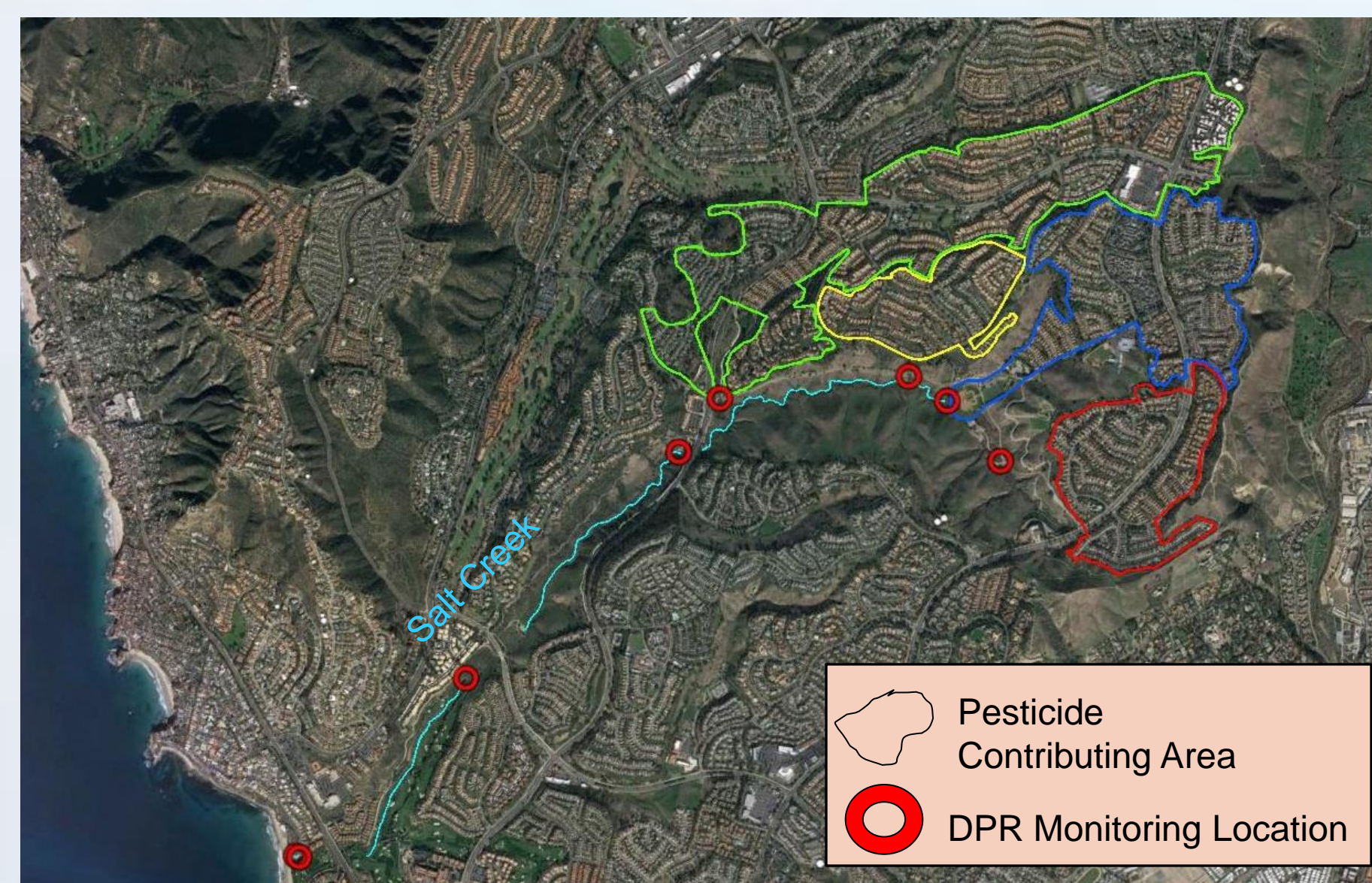


Figure 4. CDPR monitoring locations and contributing areas located in Salt Creek watershed, Orange County, Calif.

METHODS

- All pyrethroid data associated with long-term monitoring stations used. Statistical analysis conducted on all data, by site type (storm drains vs receiving waters) and by event type (storms vs dry season).
- Nonparametric Mann-Whitney test conducted to test data populations (before and after regulations) (Helsel, 2012).
- Nonparametric Kendall's tau calculated to test significance of trends in concentrations over time (Helsel, 2012).
- Starting June 2014, participating PCOs began using esfenvalerate containing products as part of business practices in routes surrounding DPR monitoring locations in Orange County, Calif. Esfenvalerate chosen as a marker of professional applications due to low detections and urban use.

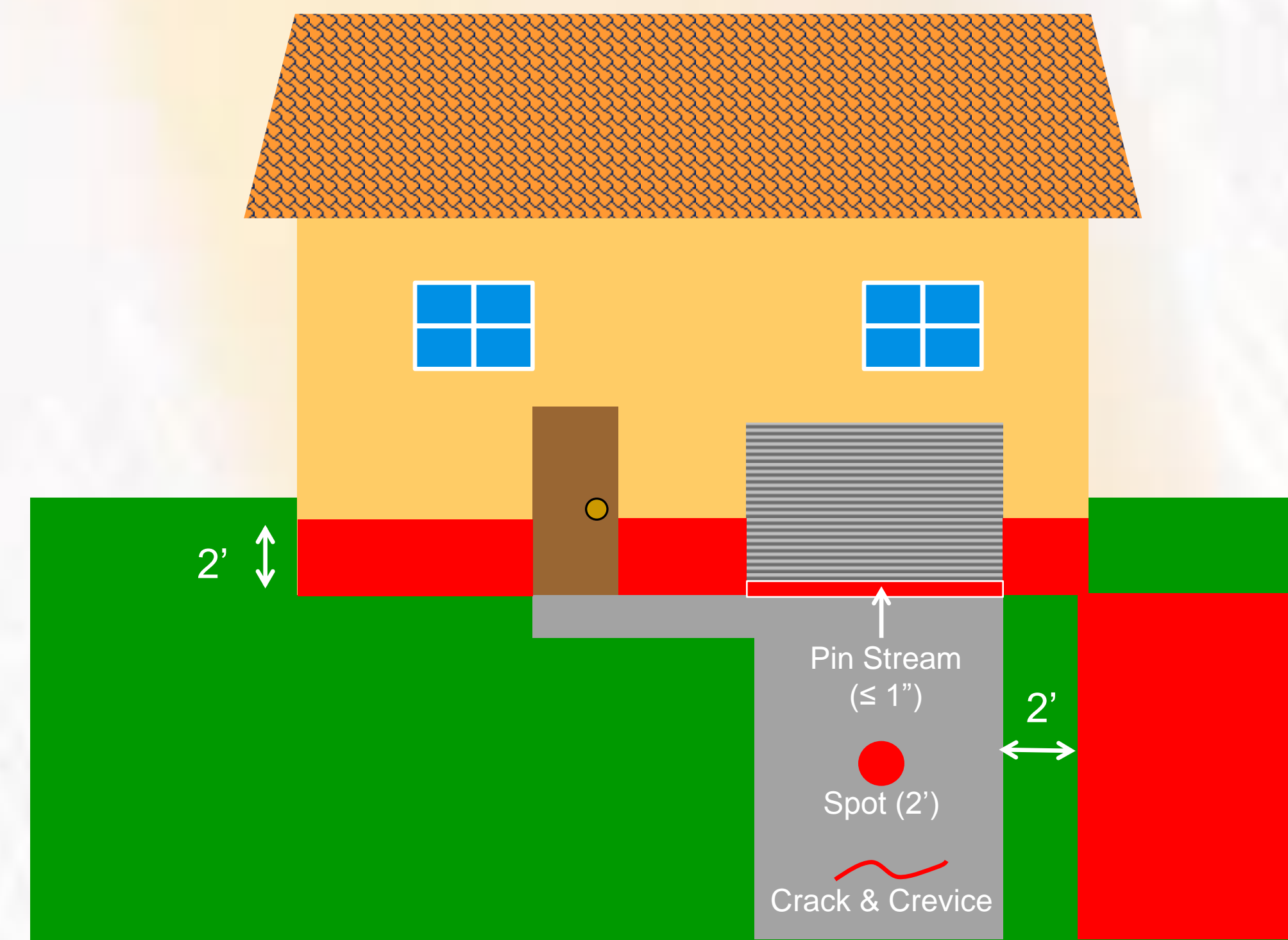


Figure 3. Schematic of pyrethroid application restrictions

CDPR Surface Water Regulations

Restrictions:

- Structural perimeter band spray not to exceed 2 feet up from foundation
- 1-inch pin stream bandwidth up and out from structure above driveway
- Pin stream, spot, and crack and crevice only allowable applications to horizontal impervious surface
- All applications made to horizontal pervious surfaces must maintain a 2 foot buffer to horizontal impervious surfaces

Region	Test	BF	CY	CP	DM	ES	LC	PM
State	All							
Northern California	Storm Drains							
	Receiving Waters							
	Storms							
	Dry Events							
Southern California	All							
	Storm Drains							
	Receiving Waters							
	Storms							
Dry Events								

Table 1. Significance nonparametric Mann-Whitney and Kendall's tau tests at long-term monitoring stations. Yellow highlights indicate significant decreasing trend, red indicates significant increasing trend. An alpha of 0.05 chosen as level of significance. BF=bifenthrin, CY=cyfluthrin, CP=cypermethrin, DM=deltamethrin, ES=esfenvalerate, LC=lambda-cyhalothrin, PM=permethrin

RESULTS and DISCUSSION

- Regional differences in trends observed. Slight decrease in bifenthrin and cypermethrin concentrations for samples collected during storm events and at storm drains located in Northern California. Significant increase in concentrations for several pyrethroid trends in Southern California (Table 1).
- Increased detection frequency of cyfluthrin, cypermethrin, esfenvalerate, and lambda-cyhalothrin at all Southern California monitoring stations. At Northern California stations, an increase in deltamethrin detections balanced by a decrease in cypermethrin (Figure 5).
- A significant increase in esfenvalerate detections observed at Salt Creek storm drains (data not shown), corresponding to period PCOs incorporated esfenvalerate products into their business practices.
- Multiple lines of evaluation, including statistical analysis of pyrethroid data in conjunction with the observed increase in esfenvalerate detections in an area where a known amount of product was applied according to specifics of regulations indicate that more thought needs to be given to the surface water regulations to lower pyrethroid concentrations in Southern California.
- Significant decreases in concentrations at Northern California storm drains potentially indicate a higher adherence to the regulations by local PCOs. However, the monitoring data correlate to a period of drought conditions in which irrigation restrictions were implemented. The climate effects on runoff concentrations are unknown at this time.

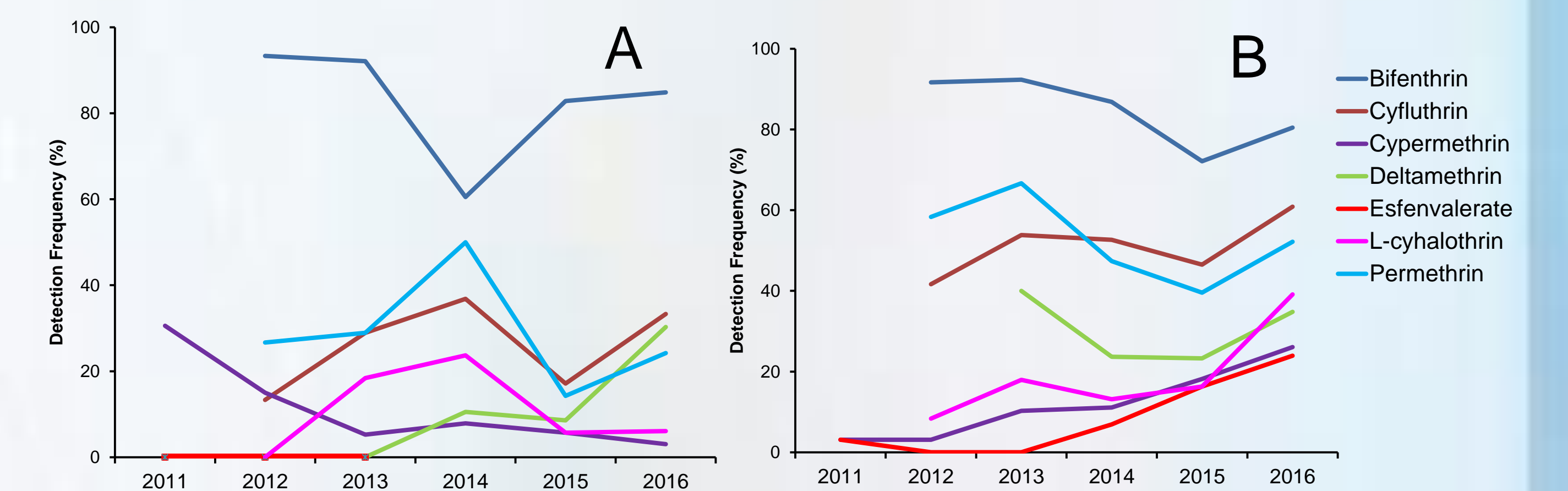


Figure 5. Detection frequency (%) of pyrethroids 2011-2016 at Northern (A) and Southern (B) California monitoring stations. Annual data have same reporting limits for each pyrethroid.

FUTURE EFFORTS

- Assess statewide pyrethroid sediment data provided by the Stream Pollution Trends (SPoT) program to evaluate depositional trends.
- Evaluate effects of climate variability and flow conditions on observed concentrations.
- Use reported use of esfenvalerate to model offsite transport within the Salt Creek watershed.

REFERENCES

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