Co-Occurrence Pesticide Species Tool (CoPST)

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US EPA Region 9





Cramer Fish Sciences

Original Objectives

- Identify the potential spatial and temporal cooccurrence of 40 pesticides with 12 threatened and endangered species
 - Provide further knowledge of the fate and transport of pesticides
 - Provide further knowledge of species presence and life cycle in the study area
 - Identify and rank areas of highest potential risk to prioritize future actions

Current Analysis Objectives

- To better understand the spatial and temporal distribution of 40 pesticides and their <u>potential</u> to cause toxicity (No co-occurrence species model runs)
- Enable state and federal agencies to identify and prioritize areas for refined assessments, monitoring, or mitigation.
- M⁵ = monitoring, modeling, movement, management, and money

Study Area

Sacramento River 27,000 sq mi (69,930 km²)

Bay-Delta Estuary 4,500 sq mi (11,691 km²)

San Joaquin River 32,000 sq mi (83,000 km²)





Pesticide List

- (s)-Metolachlor
- Abamectin •
- **Bifenthrin** ۰
- **Bromacil** ٠
- Captan •
- Carbaryl
- Chlomazone ۲
- Chlorothalonil ٠
- Chlorpyrifos ٠
- **Copper Sulphate**
- **Copper Hydroxide**
- Cyfluthrin
- Cyhalofop-butyl •
- Cypermethrin •
- Deltamethrin •
- Diazinon ۰
- **Dimethoate** •
- Diuron ٠
- **Esfenvalerate** ۰
- Hexazinone •

Herbicide Insecticide Insecticide Herbicide Fungicide Insecticide Herbicide **Fungicide** Insecticide Fungicide **Fungicide** Insecticide Herbicide Insecticide Insecticide Insecticide Insecticide Herbicide Insecticide Herbicide

•	Imidacloprid	Insecticide
•	Indoxacarb	Insecticide
•	Lamda cyhalothrin	Insecticide
•	Malathion	Insecticide
•	Mancozeb	Fungicide
•	Maneb	Fungicide
•	Methomyl	Insecticide
•	Naled	Insecticide
•	Oxyflurofen	Herbicide
•	Paraquat dichloride	Herbicide
•	Pendimethalin	Herbicide
•	Permethrin	Insecticide
•	Propanil	Herbicide
•	Propargite	Insecticide
•	Pyraclostrobin	Fungicide
•	Simazine	Herbicide
•	Trifluralin	Herbicide
•	Ziram	Fungicide
•	Thiobencarb	Herbicide
•	Tralomethrin	Insecticide

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Pesticide Applications

California Department of Pesticide Regulation's California Pesticide

Use Reporting (PUR) database

- 2000-2009
- PLSS section level data for agricultural applications
- County level data for urban applications
 - Home owner use is not included



Current Model Run



Visualizations

- 1. Heat Map of Relative
- 2. Indicator Days by Month
- 3. Aggregated Water **Quality Monitoring Data** by Station

Challenge--Where was it applied?



What is an Indicator Day?

- A Toxicity Threshold Was Produced for each Pesticide.
 - Used USEPA Office of Pesticide Programs acute benchmark for the most sensitive aquatic non-plant species This benchmark incorporates a Safety Factor of 2.
 - Since dealing with T&E this project divided the benchmark value by 10 (OPP benchmark / 10)
- Indicator Days a Day That One or More Pesticides Exceed the Toxicity Threshold
 - On a monthly basis computed the number of indicator days within a Section (1 square mile)

Uncertainty

- PUR precision / accuracy
- Pesticide properties
- Field-specific characteristics
- Hydrology / hydraulics
- Dissipation processes not represented
- Standardized assumptions (example ditch volume)

Edge of field predictions do <u>not</u> indicate adverse effects 🕞 🥝 http://dts.waterborne-env.com/sjsurf/maps/agheat.html

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Water Quality Monitoring Results





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CoPST Explorer

Home	Background		Total H	eat	Ag Heat	OP Heat		Pyrethroids		ids Chlorpyrifos	i Diazinon	
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CALWATER	(2,2,1 Bas	8	3/10/2004	1:00:00 PM	Sample Water	Permethrin		ug/L	ND	× 1	0 110	
		9	0/7/2004	11:40:00 AM	Sample Water	Chlorpyrifos	0.04	ug/L	=		1.1.1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		8	3/10/2004	1:00:00 PM	Sample Water	Esfenvalerate		ug/L	ND			
	éné.	7	7/27/2004	2:20:00 PM	Sample Water	Cypermethrin		ug/L	ND			1
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High		8	3/10/2004	1:00:00 PM	Sample Water	Cypermethrin		ug/L	ND			
Very High		9	9/7/2004	11:40:00 AM	Sample Water	Carbaryl		ug/L	ND	200		AND PORT
🗹 🖻 Water Mon	itoring Sta	8	3/24/2004	11:20:00 AM	Sample Water	Malathion	0.04	ug/L	DNQ	E mark B	the second second	
• 1 - 162		7	7/13/2004	11:20:00 AM	Sample Water	Chlorpyrifos	0.042	ug/L	-			Vilean and
• 163 - 393		9	0/7/2004	11:40:00 AM	Sample Water	Methomyl		ug/L	ND	$\rightarrow \mathbb{Z}$		
9 394 - 715		8	3/10/2004	1:00:00 PM	Sample Water	Captan		ug/L	ND		Stall	
716 - 1189		g	9/7/2004	11:40:00 AM	Sample Water	Diazinon	0.005	ug/L	=	and the	- VINC	
🗏 🔺 Partial Bar	riers	9	9/7/2004	11:40:00 AM	Sample Water	Thiobencarb		ug/L	ND	Water Quality (1	1 of 2)	×
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	r	9	0/7/2004	11:40:00 AM	Sample Water	Esfenvalerate		ug/L	ND	Road Sample Period St	art: 2004-07-13	
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I F January		8	3/24/2004	11:20:00 AM	Sample Water	Cypermethrin		ug/L	ND	Detections (fracti	ion): 0.00386	
E February		g	3/7/2004	11:40:00 AM	Sample Water	Cyfluthrin		ug/L	ND	Zoom to		
T March		8	3/10/2004	1:00:00 PM	Sample Water	Thiobencarb	0.035	ug/L	DNQ	100111/0	The second se	
April		7	7/13/2004	11:20:00 AM	Sample Water	Diazinon		ug/L	ND			
I - May		7	7/27/2004	2:20:00 PM	Sample Water	Bifenthrin		ug/L	ND			
Very Low		7	7/13/2004	11:20:00 AM	Sample Water	Lambda cyhalothrin		ug/L	ND		SUTTER	
Low		7	//27/2004	2:20:00 PM	Sample Water	Diuron	0.04	ug/L	=	13.1 State	PLACER	
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🗖 🗈 October	-	8	3/24/2004	11:20:00 AM	Sample Water	Dimethoate		ug/L	ND	- 0	m	esri
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Reasons why Monitoring and the Model may not Match

- Monitoring data for May was not in historical record
- Parameters monitored may not match the 40 pesticides modeled (i.e. fungicides)
- Analytical method resolution may not be at the environmentally relevant concentration
- Edge-of-field pesticide concentration may be present but may not get to receiving water
 - BMP's in place
 - Natural barriers
 - Chemical or physical degradation occurring

July Modeling Data





Water Quality Monitoring Results



Water Quality Monitoring Results

July Modeled Data



July Monitoring Results

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CoPST Explorer

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🗹 🖂 Water Monitoring Sta						8		535MIDL	S 1	0/6/2008	9:05:00 AM	Sample Water	Diuron		ug/L	ND		
• 1 - 162						6		535MIDL	S 3/	/2/2006	1:29:00 PM	Sample Water	Diuron	3.1	ug/L	=		T
• 163 - 393	ten Pe					000		535MIDL	S 7/	/9/2007	6:48:00 AM	Sample Water	Diuron		ug/L	ND	H	
9 394 - 715							Golf	535MIDL	S 1	0/9/2006	9:19:00 AM	Sample Water	Diuron	-0.21	ug/L	ND		
• 716 - 1189							Course	535MIDLE	is 1/	/8/2005	10:48:00 AM	Sample Water	Diuron		ug/L	ND		
🔲 🔺 Partial Barriers	E			17 m.				535MIDL	S 1/	/5/2008	11:16:00 AM	Sample Water	Diuron	31	ug/L	=		
🖾 🕂 Total Barriers				n		1	1	535MIDL6	S 1/	/7/2008	10:36:00 AM	Sample Water	Diuron	15	ug/L	=		Park
🗹 🖃 ESRI Detailed Rivers	Jencu	a Rd				1		535MIDL	S 7/	/18/2005	7:24:00 AM	Sample Water	Diuron	-88	ug/L	ND		Pinone Rd
				2				535MIDL6	S 1/	/23/2009	10:55:00 AM	Sample Water	Diuron		ug/L	ND		
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🖾 🗄 February			G	2				535MIDL6	6S 7/	/6/2004	9:42:00 AM	Sample Water	Diuron	-88	ug/L	ND		ALDS AN
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Uses of the Tool (Model plus Map layers)

- Identify temporarily and spatially, priority sections, areas and watersheds for further investigation
- Examine current water quality monitoring sites, frequency, and parameters for relevancy
- Identify areas as priority for BMP development and funding
- Aid in developing plans to improve ecosystem quality and water quality

Publications

Hoogeweg, C.G., W.M. Williams, R. Breuer, D. Denton, B. Rook and C. Watry. 2011. <u>Spatial and Temporal Quantification of Pesticide</u> <u>Loadings to the Sacramento River, San Joaquin River, and Bay-</u> <u>Delta to Guide Risk Assessment for Sensitive Species.</u> CALFED Science Grant #1055. Nov, 2 2011. 293 pp http://www.waterborne-env.com/projects_featured.asp

Hoogeweg CG, Denton DL, Breuer R, Williams WM, TenBrook P. 2012. <u>Development of a spatial-temporal cooccurrence index to</u> <u>evaluate relative pesticide risks to threatened and endangered</u> <u>species</u>. In: Pesticide registration and the endangered species <u>act</u>. Eds: Racke KD, McGaughey BD, Cowles JL, Hall TA, Jackson SH, Jenkins JJ, Johnston JJ. ACS Symposium series 1111.