Surface Water Monitoring Prioritization Model

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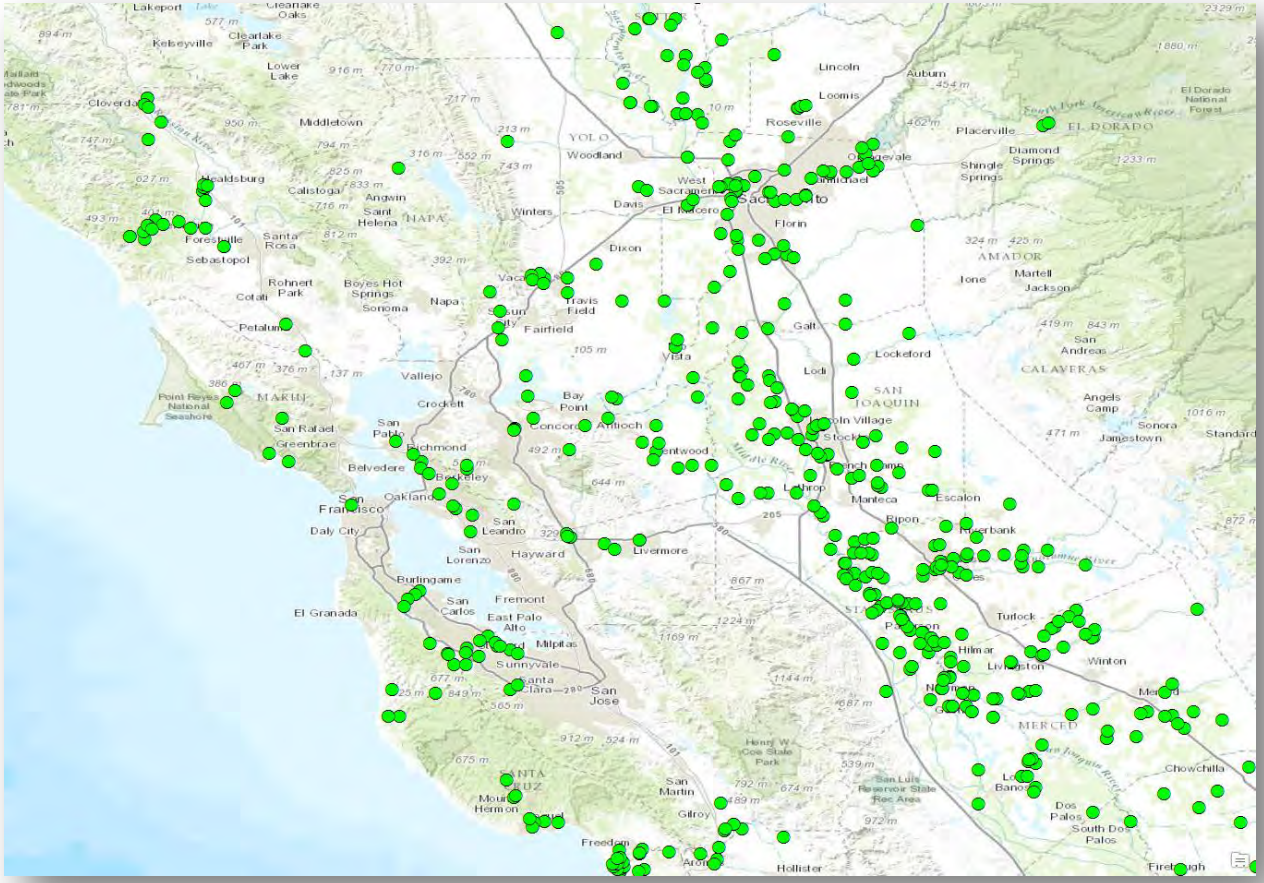
Pesticide monitoring in SW

- Where, when, and what to sample?



Historical and active monitoring sites (by DPR and other agencies) reporting pesticide concentrations (based on DPR Surface Water Database)

Pesticide monitoring in SW

- Where, when, and what to sample?

Table 6. Final Monitoring Lists for Analytes or Analyte Groups in Imperial, Monterey, Santa Barbara and San Luis Obispo Counties from March to October, 2015.

Screen Group*	March	April-September	May, July, September	October
	Imperial PVOD**	Monterey	Santa Barbara San Luis Obispo	Imperial
AZ	X			
2,4-D	X			
DA				X
DN/OX	X	X	X	X
DZ		X		
IMD/BEN		X	X	X
ME	X	X		X
OP	X	X	X	X
Oxydemeton -methyl		Pending		
Paraquat dichloride		Pending		
PY		X		X
STR			X	

When

Where

What

* AZ = Atrizine + Degradates; DA = Diacylhydrazines; DN/OX = Dinitroanilines & Oxyfluorfen; DZ = Diazinon; IMD/BEN = Imidacloprid & Bensulide; ME = Methomyl; OP = Organophosphates; PY = Pyrethroids; STR = Strobilurin

**Palo Verde Outfall Drain

Monitoring study protocol, DPR study 297 (Deng, 2015)
http://cdpr.ca.gov/docs/emon/pubs/protocol.htm

Prioritization for Monitoring

- Where, when, and what to sample?

- Prioritization workgroup
  - "*Establish computer programs to integrate and facilitate the automation of updating the agricultural and urban monitoring priority lists*" (workgroup charter, 2012)

- Output: a prioritization model which generates a priority list of pesticides for surface water monitoring

Project homepage

http://www.cdpr.ca.gov/docs/emon/surfwtr/monitoring_methods.htm

MONITORING

- Fumigant Regulatory Issues
- VOC Emissions
- Surface Water
- Ground Water
- Air
- Publications
- Air Monitoring Network

Surface Water Models

Back to Surface Water Protection Program Publications

Scientists in the Surface Water Protection Program (SWPP), California Department of Pesticide Regulation (CDPR) frequently use simulation models for pesticide risk assessments in product registration evaluation, post-use monitoring, and data analysis. Listed below are selected SWPP models with technical reports and user's manual.

SWMP (Surface Water Monitoring Prioritization Model)

SWMP model is developed to prioritize pesticides for surface water monitoring in agricultural and urban areas of California. For the generation of monitoring priority lists of pesticide ingredients and their degradates, the model incorporates pesticide use and toxicity data, as well as chemical properties, monitoring results, and application information. Advanced options are also provided in the model for monitoring prioritization at various spatial and temporal scales, with user-defined months, years, counties, and watersheds.

- SWMP Quick Start Guide, PDF (124 kb), Video
- Executable and supporting database (.zip compressed file), version 3.0 (8.9 mb)
- User's manual, PDF (1.2 mb)
- Technical Reports
  - Analysis Report, PDF (1.1 mb). Yuzhou Luo, Xin Deng, Robert Budd, Keith Starner, Michael Ensminger. 2013. May 28, 2013.
  - Analysis Memo, PDF (536 kb). Yuzhou Luo, Michael Ensminger, Robert Budd, Xin Deng, and April DaSilva, 2014. II: Refined Priority List.
  - Analysis Report, PDF (763 kb). Yuzhou Luo and Xin Deng, 2015. III: Watershed - Based Prioritization.

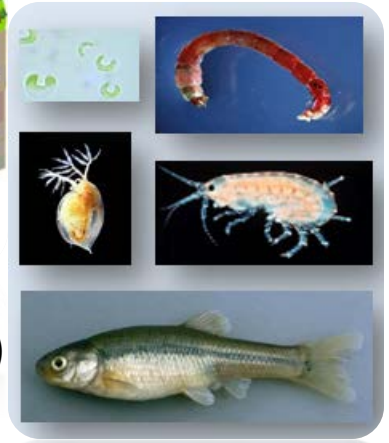
Conceptual Model

(from source to receptor)

Pesticide application

Off-site movement to water

Fate and transport within stream network (watershed)



Impacts on ecosystem

Required data:

Pesticide use data

Landscape characteristics

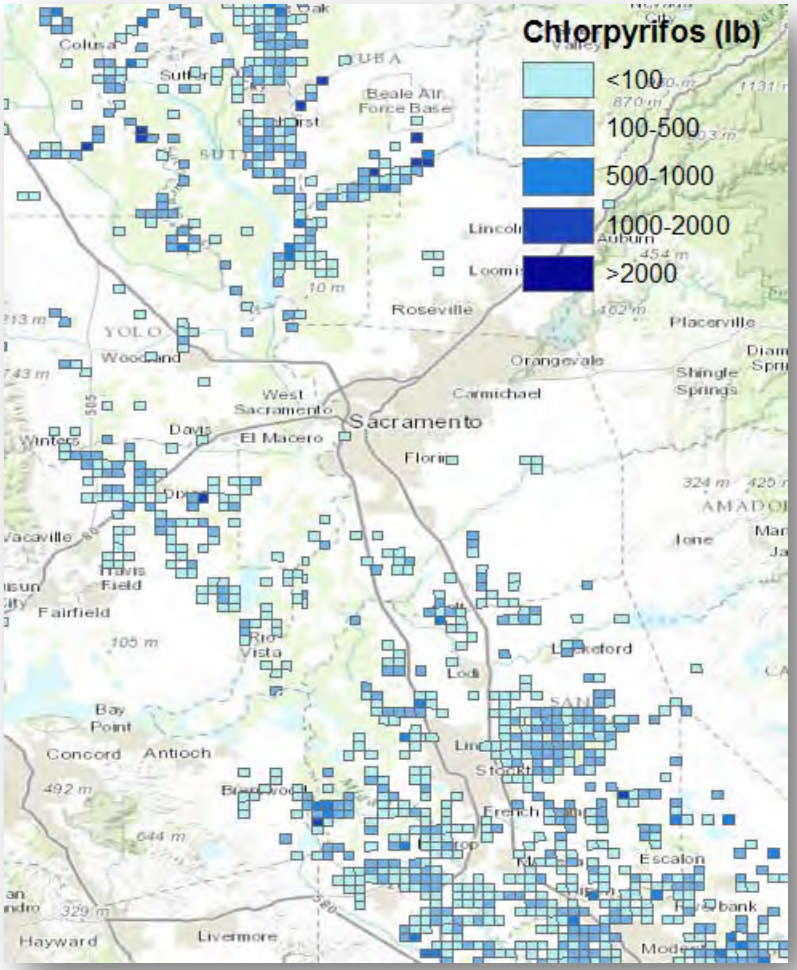
Hydrology data

Ecotoxicology data

Chemical properties

Input data

- DPR's Pesticide Use Reporting (PUR) database
  - Released annually, 1989-2013
  - Agricultural uses: daily data, for each section (1x1mi^2)
  - Non-agricultural uses: monthly data, for each county
  - http://www.cdpr.ca.gov/docs/pur/purmain.htm



Chlorpyrifos use data in 2013 (lb/section) →

Input data

- Pesticide Use Reporting (PUR), DPR
- National Hydrography Dataset (NHD), USGS (U.S. Geological Survey)
- Pesticide Property Database, IUPAC (International Union of Pure and Applied Chemistry)
- Aquatic Life Benchmarks, USEPA (U.S. Environmental Protection Agency)

Modeling Processes

Prepare pesticide use data by watershed

- Agricultural uses: aggregation from section (1x1mi^2) to watershed
- Non-agricultural uses: downscaling from county to watershed

Classify pesticides for potential aquatic risks by use pattern, application method, &chemical properties

Route pesticides through stream network for their "effective uses" for a given sampling location, by considering pesticide accumulation and dissipation

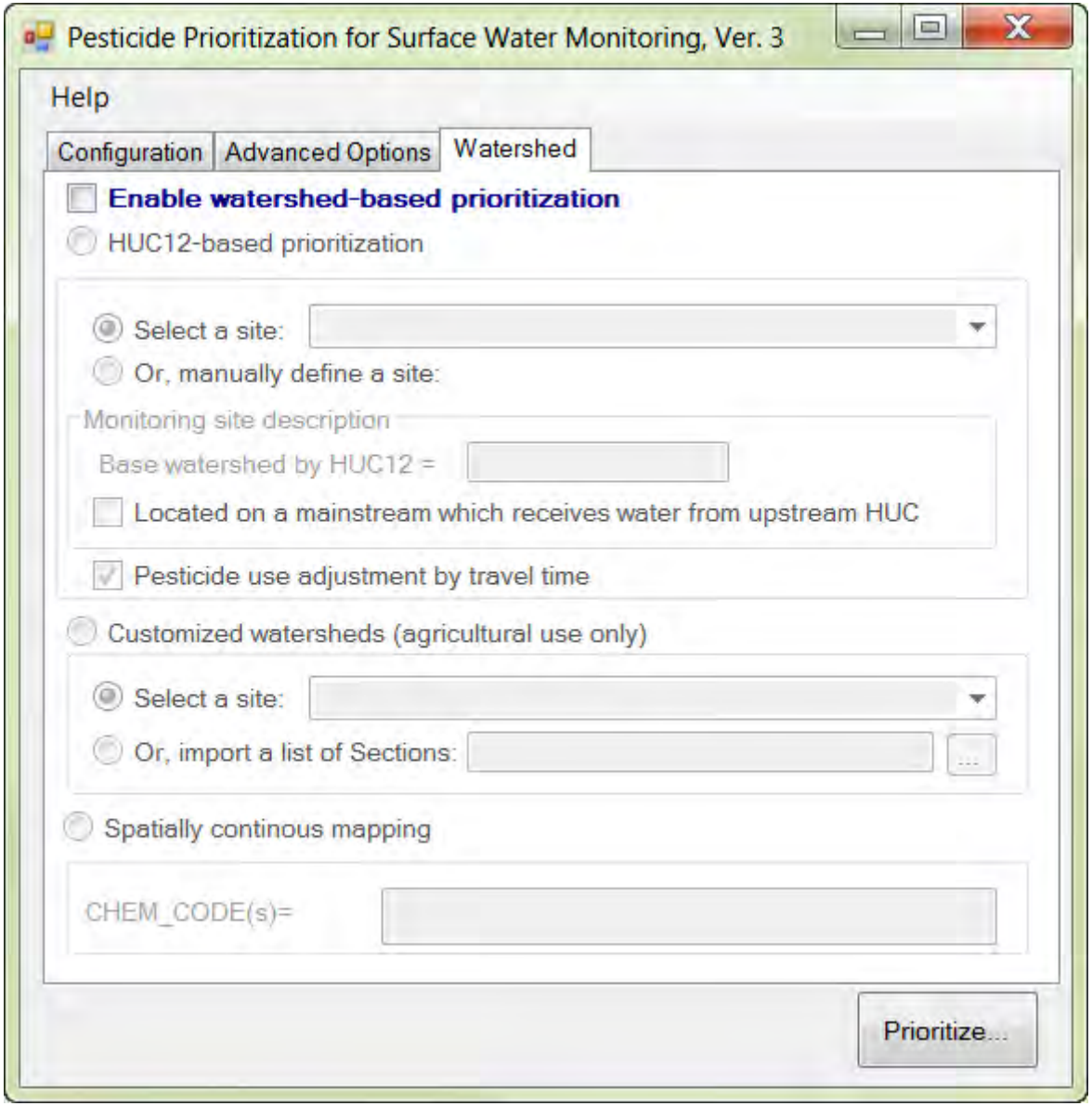
Rank pesticides by effective uses and toxicity data, and make recommendations for monitoring

Pesticide rankings

- [1] Priority scores
  - [**use score**] (1~5) and [**toxicity score**] (1~8)
  - [**final score**]= [toxicity score]*[use score]

- [2] Indicators for pesticide fate and transport
  - Pesticide use patterns, application methods, volatility (soil, water), soil-runoff potential, aquatic persistence, bio-accumulation, bio-availability, …

Graphic User Interface



Model application, example 1

- Salinas River @ Del Monte Rd, agricultural uses, April to September

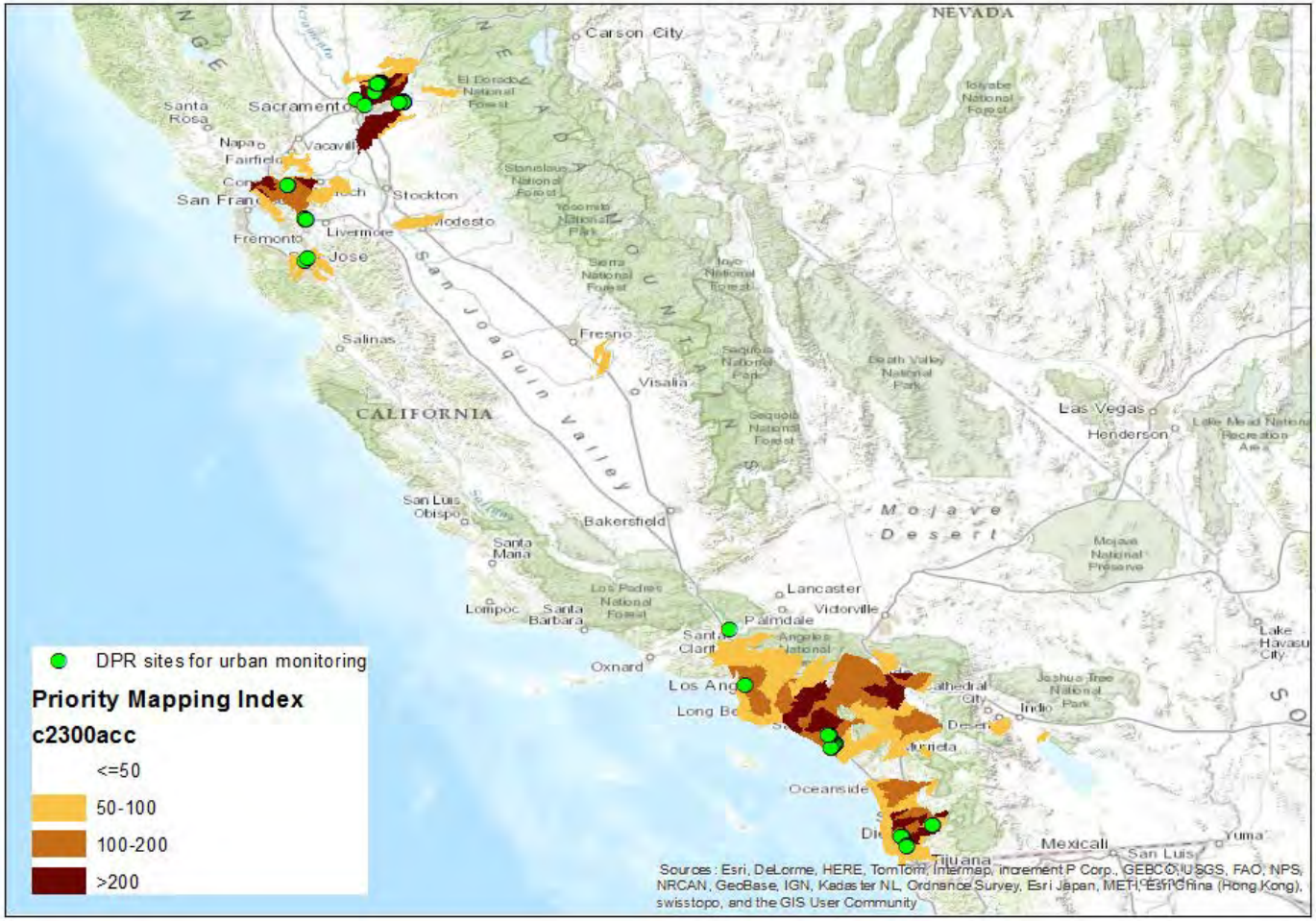
Salinas River, Drainage Area = 11082 km^2

Pesticide	Use score	Tox score	Final score	Monitoring inclusion
Malathion	4	5	20	Yes
Permethrin	3	6	18	Yes
Chlorpyrifos	3	6	18	Yes
Methomyl	4	4	16	Yes
Diazinon	3	5	15	Yes
Paraquat dichloride	3	5	15	Pending[5]
Mancozeb	5	3	15	No[2]
λ-cyhalothrin	2	7	14	Yes
Naled	2	6	12	No[3]
Maneb	3	4	12	No[2]
Oxyfluorfen	2	5	10	Yes
Bensulide	5	2	10	Yes
Captan	3	3	9	No[2]
Cyprodinil	3	3	9	No[4]
Imidacloprid	3	3	9	Yes
Oxydemeton-methyl	3	3	9	Pending[5]

DPR Study #279 Protocol (Deng, 2015)
http://cdpr.ca.gov/docs/emon/pubs/protocol.htm

Model application, example 2

- Spatially continuous mapping for *bifenthrin* (non-agricultural use)



Thank you!

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