

A grower-oriented online system for site-specific Pesticide Use Risk Evaluation (PURE)

Yu Zhan and Minghua Zhang

Graduate Group in Ecology, University of California, Davis, 95616

Department of Land, Air, and Water Resources, University of California, Davis, 95616

Introduction

Over the years, government and research community have cumulated rich information on pesticide risk assessment to alleviate pesticide impact on environmental quality. However, the information sources are disparate and growers may have difficulties in obtaining the appropriate information for pesticide management. Therefore, the Pesticide Use Risk Evaluation (PURE) online system has been developed to assist growers in quantitatively assessing site-specific environmental risk of their Pest Management Practices for both past performance and future plans.

Materials & Methods

The PURE model evaluates pesticide risks to four environmental compartments: surface water, groundwater, soil, and air (Fig. 1). The risks to surface water, groundwater, and soil are estimated as the ratio of predicted environmental concentrations to acute/chronic toxicity of chosen non-targeted organism(s) (Fig. 2), while the risk to air is determined by application rates and the emission potential (EP) of pesticides.

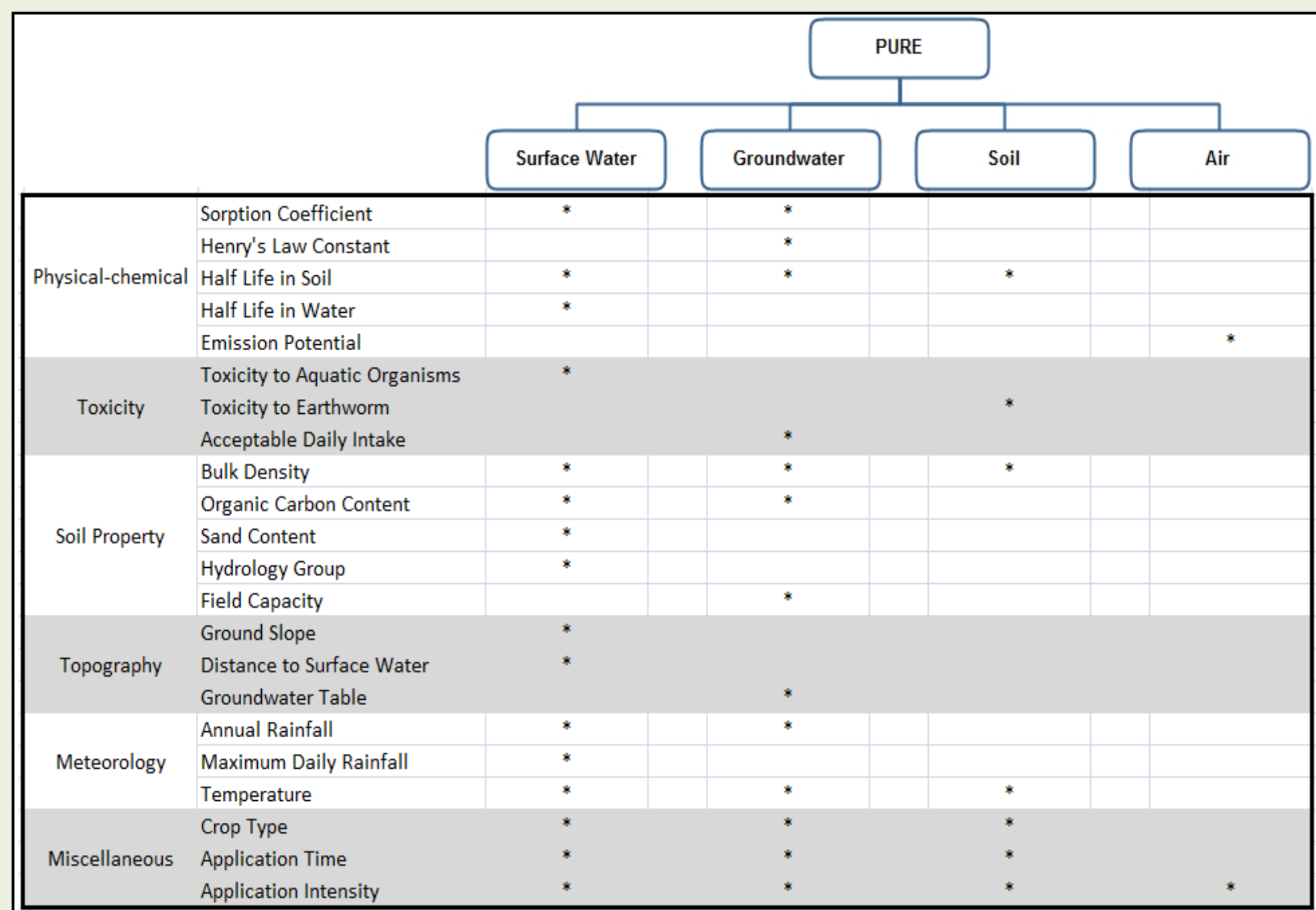


Fig. 1 Structure and data input of the Pesticide Use Risk Evaluation (PURE) model

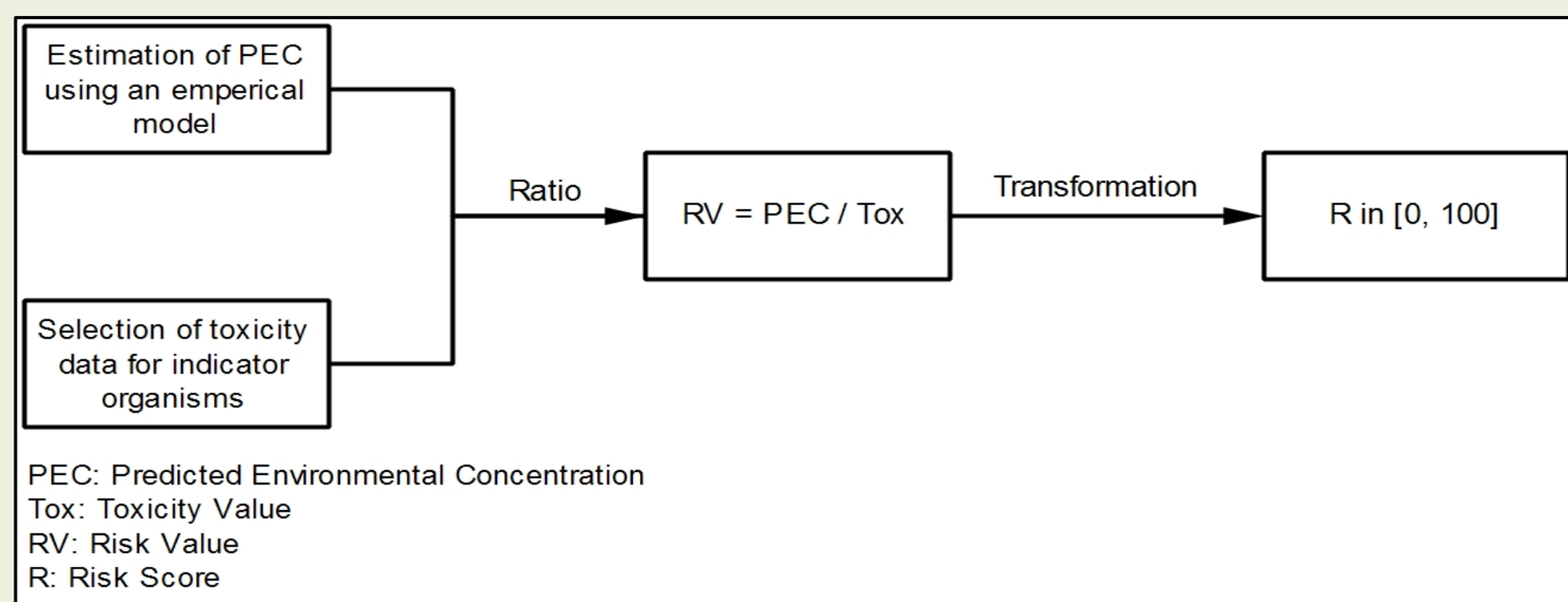


Fig. 2 Flow chart of risk score calculation in the PURE model

User Interface

After receiving users' input on county, commodity, year, field identification, and analysis type, the PURE online system calculates product- and field-level risk scores, and draws multi-year-risk charts and risk maps (Fig. 3 - 8).

the last 7 digits of "Grower ID" in the Pesticide Use Reporting (PUR) database maintained by the California Department of Pesticide Regulation (CDPR)

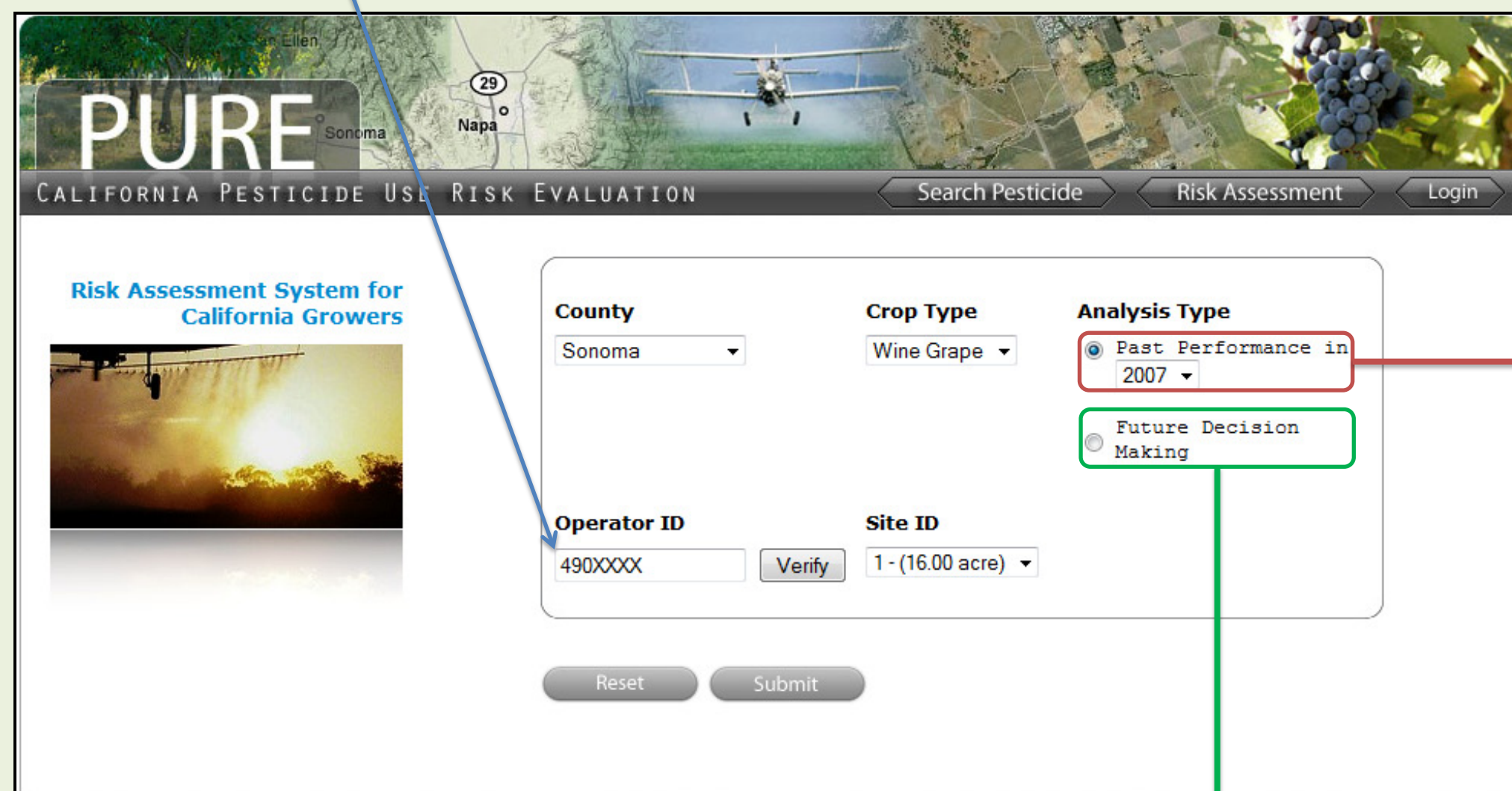


Fig. 3 Configuration page for pesticide risk evaluation

#	Pesticide Product	Application Rate (lbs/acre)	Application Method	Application Date	Remove All
1	Champ Formula 2 Flowable	2.25	Ground	Dormant Season	Remove
2	Pristine Fungicide	0.66	Ground	In Season	Remove
3	Scala Brand Sc Fungicide	0.53	Ground	In Season	Remove
4	Sylgard 309	0.07	Ground	In Season	Remove
5	Goal 2Xl	0.50	Ground	Dormant Season	Remove
6	Roundup Original Max Herbicide	1.61	Ground	Dormant Season	Remove
	Site Program	-			Add

#	Pesticide Product	Application Rate (lbs/acre)	Application Date	Aggregate	Surface Water	Groundwater	Soil	Air
1	Champ Formula 2 Flowable	2.25	Dormant Season	40	38	0	38	51
2	Pristine Fungicide	0.66	In Season	19	3	0	25	22
3	Scala Brand Sc Fungicide	0.53	In Season	27	0	6	28	38
4	Sylgard 309	0.07	In Season	0	0	0	0	0
5	Goal 2Xl	0.50	Dormant Season	40	0	0	12	64
6	Roundup Original Max Herbicide	1.61	Dormant Season	34	0	0	36	48
	Site Program	-		30	14	0	24	44

Fig. 4 Configuration and result tables for future decision-making

Date	Product	Application Rate (lbs/acre)	Aggregate	Surface Water	Groundwater	Soil	Air
04-02	Champ Formula 2 Flowable	2.25	39	38	0	37	51
04-02	Dithane Df	2.00	38	44	0	46	34
04-02	Sulfur Df	5.00	24	0	0	0	38
04-02	Wilbur-Ellis R-56 Spreader Sticker	0.39	22	0	0	0	35
04-16	Champ Formula 2 Flowable	2.25	39	38	0	37	51
04-16	Dithane Df	2.00	38	44	0	46	34
04-16	Sulfur Df	5.00	24	0	0	0	38
04-16	Wilbur-Ellis R-56 Spreader Sticker	0.39	22	0	0	0	35
05-28	Elevate 50 Wdg Fungicide	1.00	26	0	0	11	40
05-28	Pristine Fungicide	0.66	18	2	0	24	22
05-28	Sulfur Df	3.00	21	0	0	0	33
05-28	Sylgard 309	0.07	10	0	0	0	16
06-14	Quintec	0.32	22	0	0	9	35
06-14	Scala Brand Sc Fungicide	0.53	27	0	5	27	39
06-14	Sylgard 309	0.07	11	0	0	0	17
06-15	Quintec	0.16	17	0	0	1	27
06-15	Scala Brand Sc Fungicide	0.26	22	0	0	20	32
06-15	Sylgard 309	0.04	6	0	0	0	9
12-12	Goal 2Xl	3.92	55	0	0	33	86
12-12	Princep 4L	1.79	56	11	79	20	56
12-12	Roundup Original Max Herbicide	1.61	34	0	0	35	48
12-12	Weather Gard	0.41	24	0	0	0	38
2007 Site Program	-	-	50	32	54	37	64
2007 Operator	-	-	41	32	27	36	56
2007 Sonoma County Wine Grape	-	-	29	17	8	20	43
2007 Statewide Wine Grape	-	-	29	11	3	19	45

Fig. 5 Result table of past performance report for a wine grape filed in Sonoma County in 2007

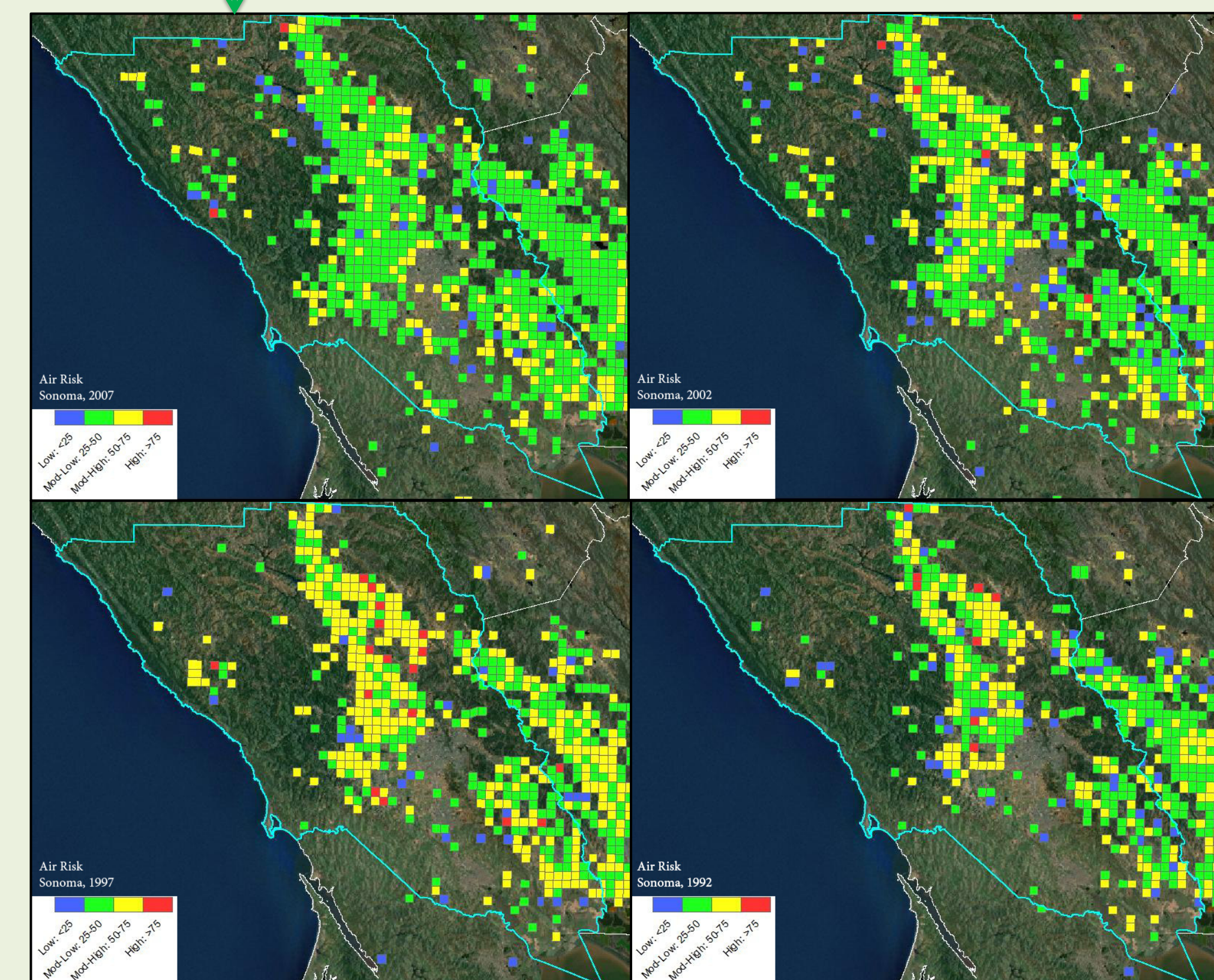


Fig. 6 Air risk maps for wine grape in Sonoma County in year 1992, 1997, 2002, and 2007

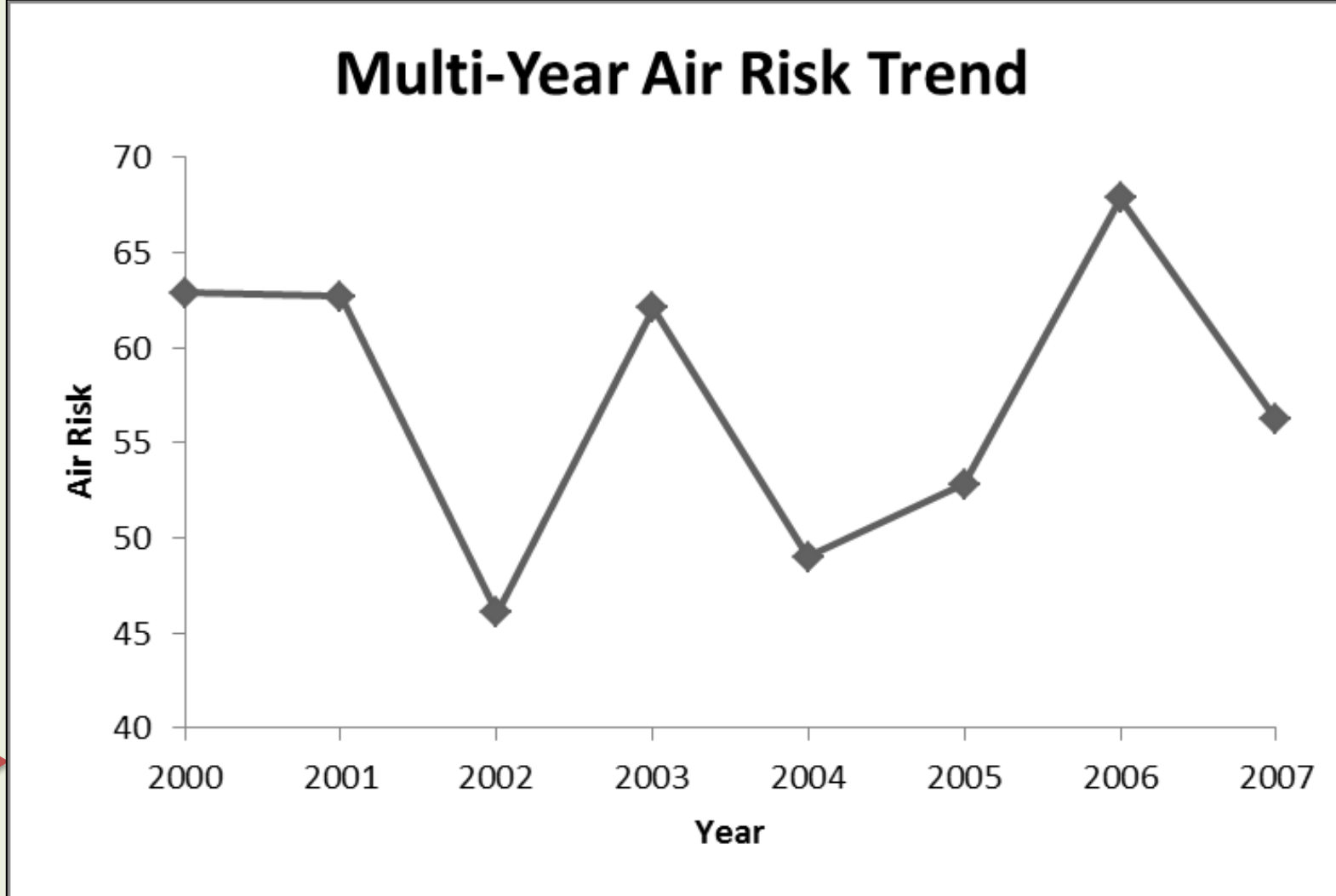


Fig. 7 Multi-year air risk trend for a wine grape grower in Sonoma County

Query result for pesticide product

Product #	Product Name	EP (%)	Active Ingredient(s)
46733	Princep 4L	9.03	Simazine [41.9%];

Fig. 8 Emission potential (EP) and active ingredient for pesticide "Princep 4L"

Summary

The Pesticide Use Risk Evaluation (PURE) online system developed for California's growers is currently under beta testing. The system currently can be used to assess pesticide risks for 6 crops: alfalfa, almond, apple, peach, walnut, and wine grape. We will continue to improve the system and will add the capability to assess the risks for more other major crops in California.

Comparing with other pesticide risk assessment models/systems, the PURE system has the following main features:

- **User-friendly:** minimum user input, and free access to users
- **Transparent:** all equations and data available on request
- **Flexible:** both separate and aggregated risk scores provided
- **Modularized:** easy to maintain existing modules and to add new models

The potential applications of the PURE system are as follows:

- An **educational tool** for guiding growers to screen pesticides with lower environmental risks
- A **decision-making support system** for government regulatory agencies
- A tool for helping develop **eco-friendly (or green) tags** for agriculture products

Acknowledgements

The work has been funded by U.S. EPA Region 9 (award #X8-96982801 and #PE96958301).

Contact Information

Yu Zhan, yuzhan@ucdavis.edu, +1 530 754 9292
Minghua Zhang, mhzhang@ucdavis.edu, +1 530 752 4953