

A Novel Spatial Model of Insecticide Exposure in the Yakima Valley

PIs: Allison Sherris and Catherine Karr

Co-Is: Elaine Faustman, Eddie Kasner, Tomomi Workman, Adam Szpiro

Consultant: Cynthia Curl

Pesticides in the Yakima Valley



RM

Pesticides in the Yakima Valley

Prior UW research documented pesticides in indoor dust and biospecimens

Research

A Section 508–conformant HTML version of this article is available at <https://doi.org/10.1289/EHP3644>.

Longitudinal, Seasonal, and Occupational Trends of Multiple Pesticides in House Dust

Breana Bennett,^{1,2} Tomomi Workman,^{1,2} Marissa N. Smith,^{1,2} William C. Griffith,^{1,2} Beti Thompson,³ and Elaine M. Faustman^{1,2}

¹Department of Environmental and Occupational Health Sciences, School of Public Health, University of Washington, Seattle, Washington, USA

²Institute for Risk Analysis and Risk Communication, University of Washington, Seattle, Washington, USA

³Public Health Sciences Division, Fred Hutchinson Cancer Research Center, Seattle, Washington, USA

A need for scalable exposure assessment

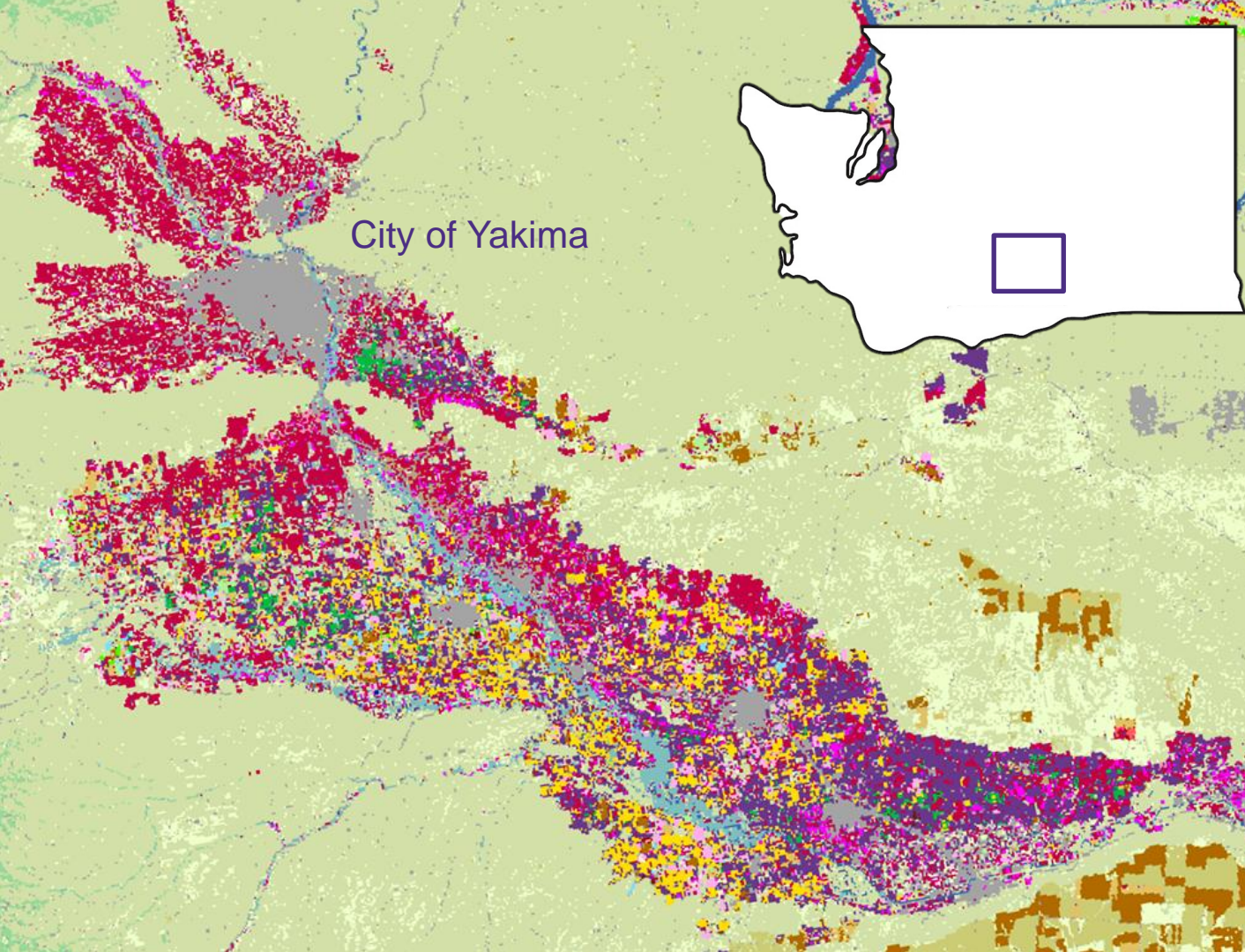


Research Aim

The background of the slide is an aerial photograph of a large agricultural field, likely a vineyard or orchard, with neat rows of green plants stretching across a valley. The sky is a clear, bright blue with some wispy white clouds. The overall scene is bright and open.

Develop a novel spatial model of exposure to agricultural insecticides in the Yakima Valley, trained on existing measures in household dust.

In the bottom right corner of the slide, there are handwritten initials 'RM' in a white, cursive script.



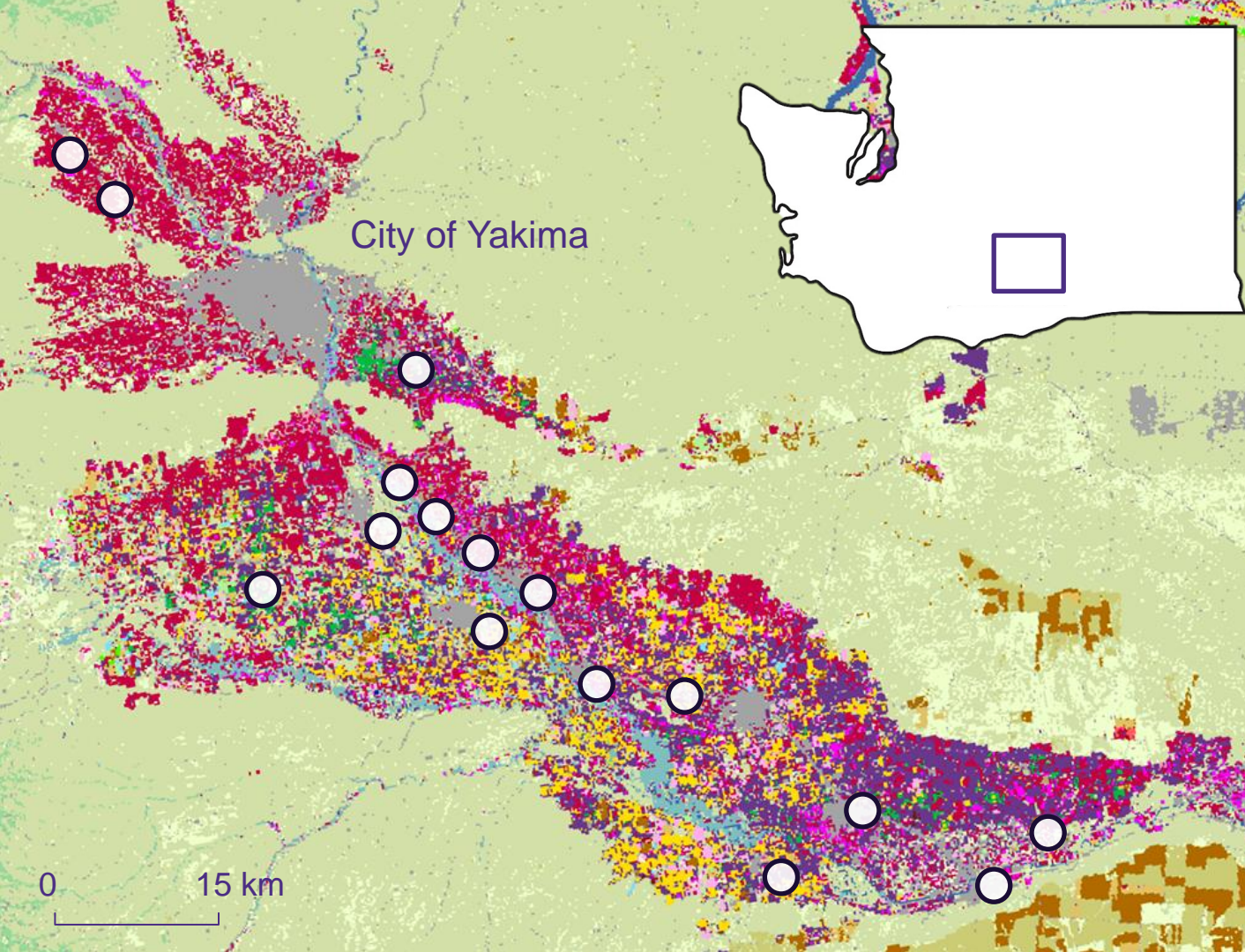
City of Yakima

Most prevalent crop types

- Apples
- Grapes
- Corn
- Alfalfa
- Wheat
- Cherries
- Other hay

Yakima Valley Agriculture

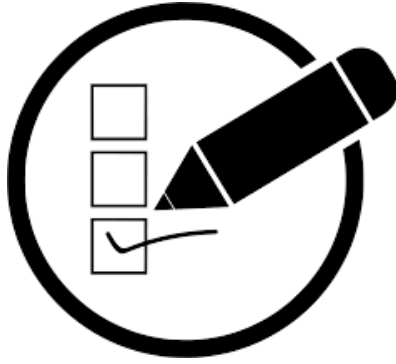
Most prevalent crop types



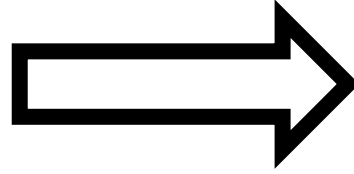
Methods



Spatial data

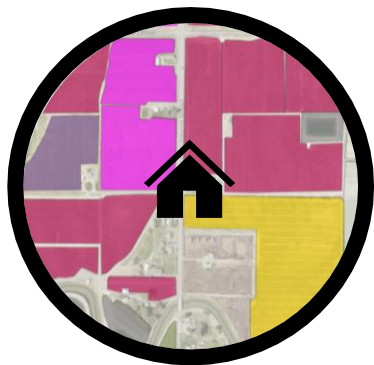


Survey data



**Pesticides in
indoor dust**

Methods



Spatial data

Survey data

Pesticides in indoor dust

- Farmed area within buffers (125 -2000 m)

	Apples		Corn		Hops		Wheat
	Grapes		Pear		Alfalfa		
	Cherries		Mint		Grass/Hay		

Methods



Spatial data

- Farmed area within buffers (WSDA)
- Estimated pesticide application within buffers (USGS, WSDA)
- Weather (NOAA)



Survey data



Pesticides in indoor dust

$$Pest_b = \sum [(a_{c,b})(APR_c)(f_c)]$$

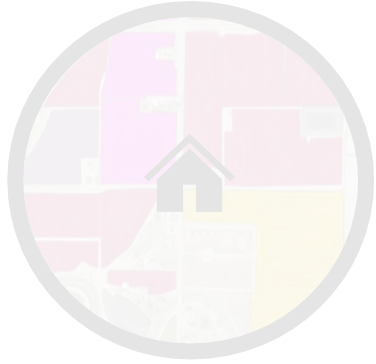
$Pest_b$ = Total applied amount of pesticide in buffer b (kg/yr)

$a_{c,b}$ = Area of crop c in buffer b (hectare)

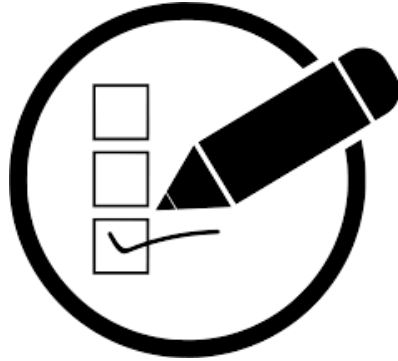
APR_c = Application rate for pesticide on crop c (kg/ha-yr)

f_c = Fraction of planted area which pesticide is applied

Methods



Spatial data



Survey data

- Farmworker status
- Residential pesticide use
- Air conditioning
- Floor type
- Month and year



Random Forest



Pesticides in indoor dust

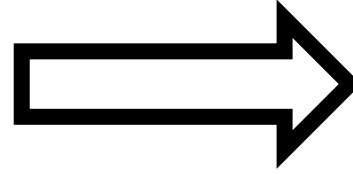
Methods



Spatial data



Survey data



Pesticides in indoor dust

Random Forest

- Machine learning model
- Select important predictors
- Evaluate model performance

Methods



Spatial data



Survey data



Random
Forest



**Pesticides in
indoor dust**

- Chlorpyrifos and permethrin
- 93 households
- 3 seasons (2011)
- >400 samples

Findings

- Models could **classify** households into high vs. low insecticide levels (AUC = 0.80-0.87), but did not accurately **predict** concentrations ($R^2 = 0.25-0.43$).
- After meteorologic variables, **total crop area** was the most important predictor of dust concentrations, followed by **estimated pesticide application**.
 - Most important buffer size varied by pesticide.

Next Steps

Gateway Exposome Coordinating Center (GECC)

- Drs. Karr and Sherris attended GECC working group on pesticide exposure assessment in April 2026.
- Recently awarded GECC Pilot Project to expand model (PI: Sherris).
- Long-term goal: conduct epidemiologic research in ECHO Yakima Valley and other agricultural cohorts.

Thank you!

asherris@uw.edu

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