

PESTICIDE DRIFT IN CALIFORNIA'S YOLO COUNTY

INTRODUCTION

Drift refers to the off-site movement of a pesticide through the air away from the intended target, in the form of mist, particles, or vapor. While pesticide drift depends on factors like weather, the application site, method of application, and the pesticide used, some drift into surrounding air is expected with all pesticide applications. Fumigants (pesticides in the form of gas) and pesticides applied by air are more likely to drift than other pesticides, making them a major focus of drift reduction efforts. Even the most careful, responsible pesticide sprayer cannot control what happens to pesticide droplets once they are released from a plane or tractor. These droplets may settle in someone's yard, on another farmer's crops, or coat the skin of agricultural workers or others exposed. Proximity to pesticide applications as reported in the California Pesticide Use Reporting (CPUR) database has been used as a surrogate for exposure in recent studies of reproductive outcomes and cancer (Ward et al. 2006). This project aims to investigate the potential for ramifications of pesticide drift on residents and organic crops in one of California's agriculture-dependent counties. Yolo County is known for its production of tomatoes, as well as almonds, grapes (wine and table), rice, and organic products. This project intends to highlight both organic croplands and vulnerable residents, as measured by the presence of schools, that may be at risk for pesticide drift exposure as well as use cropland and pesticide use reporting data to explore the following research questions:

Where are the areas in Yolo County that are most at risk for potential exposure to pesticide drift? Is there clustering of pesticide application in the county? Are there trends in pesticide use in certain commodities which can help predict locations of potential drift? Which cropland should be watched for increased use of pesticides or increased high-risk application methods (by air or fumigation)? Where are residential areas that are most at risk?



YOLO COUNTY 2016 CROP REPORT

Rank	Commodity	Acres	Value
1	Tomatoes	33,800	\$121,513,000
2	Almonds	33,555	\$99,234,000
3	Grapes	58,100	\$81,264,000
4	Organic Products (All)	45,504	\$58,863,000
5	Rice	35,800	\$43,016,000

CA DEPARTMENT OF PESTICIDE REGULATION

Rank	Commodity	Acres	Pounds Pesticides Applied
1	Tomatoes	33,800	772,928
2	Almonds	33,555	396,2934
3	Grapes	58,100	1,987,600
5	Rice	335,800	373,366

SOURCES

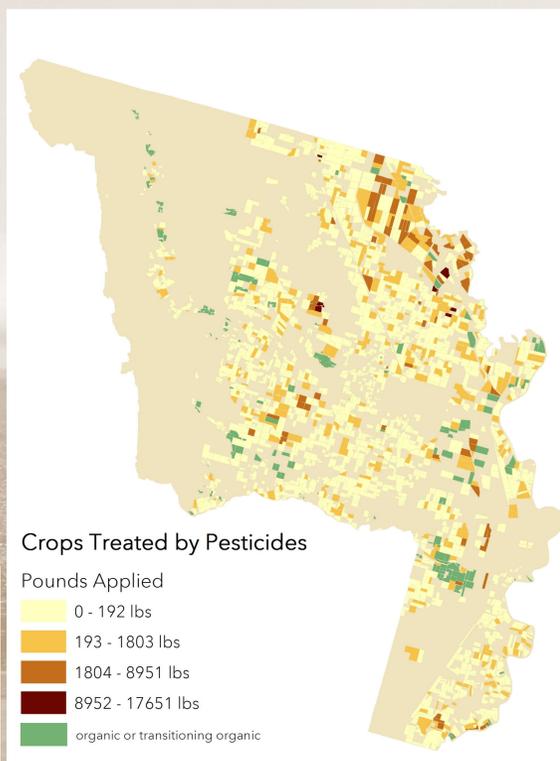
Yolo County GIS Database
 Yolo County 2016 Crop Report
 California Department of Pesticide Regulation 2016 Pesticide Use Report Data
 Ward et al. (2006). Proximity to Crops and Residential Exposure to Agricultural Herbicides in Iowa. *Environmental Health Perspectives*, 114(6).
 California School Campus Database
 CA Farmland Mapping and Monitoring Program
 US Census American Community Survey

PROJECTION

USA Contiguous Albers Equal Area Conic USGS WGS 1984

Land Use, Yolo County

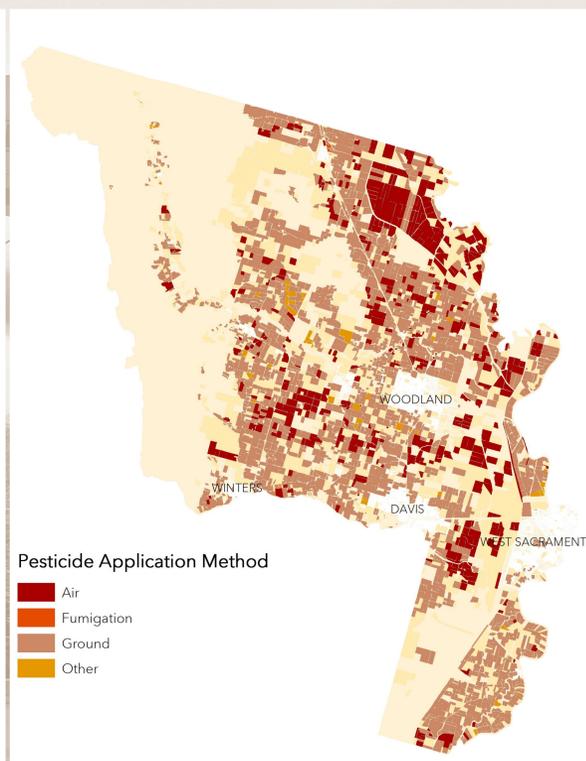
- Agricultural
- Cities, Downtown Mixed Use
- Industrial
- Commercial
- Residential
- Residential Rural
- Parks and Recreation
- Other



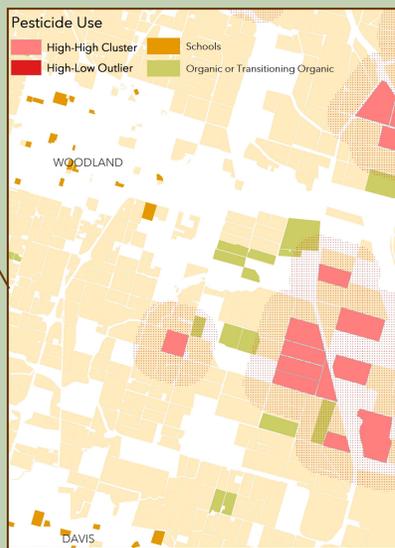
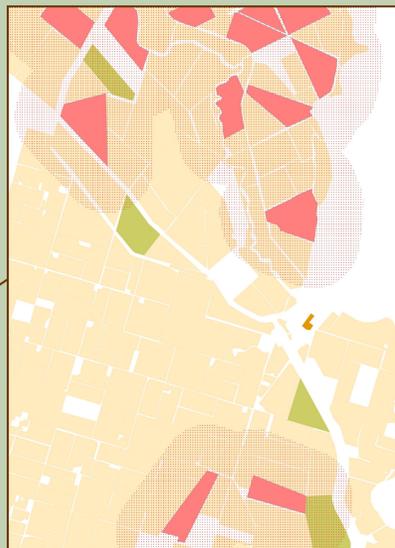
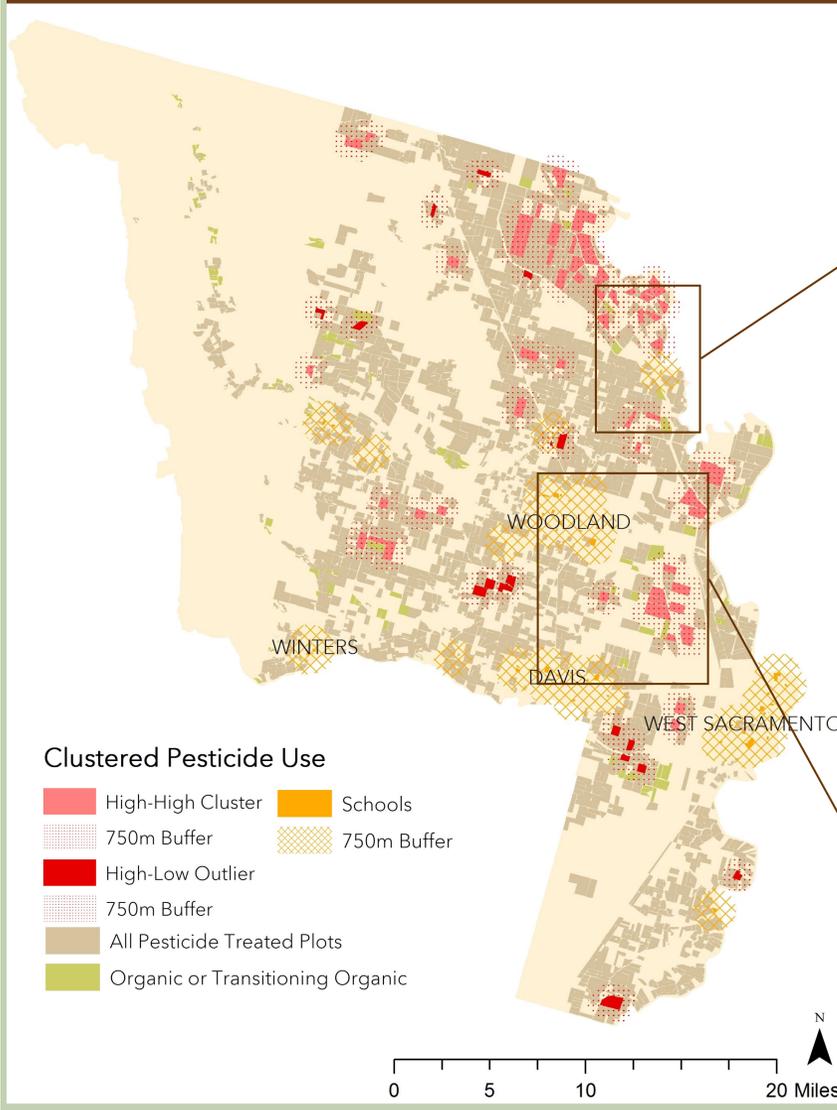
Crops Treated by Pesticides

Pounds Applied

- 0 - 192 lbs
- 193 - 1803 lbs
- 1804 - 8951 lbs
- 8952 - 17651 lbs
- organic or transitioning organic



WHERE IS HARMFUL PESTICIDE DRIFT LIKELY?



METHODS

Using a measure of Local Moran's I, I high-high clusters and high-low outliers of pesticide use by crop parcel, based on the reported gallons applied (California Department of Pesticide Regulation Pesticide Use Report Data 2016). Using ArcGIS, I created a 1,000m buffer surrounding high-high clusters and high-low outliers. This parameter is based on Ward et al.'s 2006 study of pesticide drift in Iowa, which found that primary pesticide drift from the ground and aerial spraying occurs within this distance. I created another 1,000m buffer surrounding schools in the county, using the presence of schoolchildren as a measure for a residential population that is particularly vulnerable to the negative health ramifications of chemical pesticide drift. I also located organic or transitioning-organic plots in order to show their proximity to the high-high clusters and other parcels with high pesticide usage. I selected for locations in which there was significant overlap between the pesticide-use-cluster buffers and the school buffers and/or organic or transitioning-organic plots, which are shown in the inset maps. Additionally, I selected for commodities with the highest usage of pesticides and the highest usage of aerial and fumigation application methods, which resulted in the map indicating the field locations of "Crops to Watch". These also happen to be the top agricultural commodities in Yolo County in terms of acreage and gross value, excluding the category of "organic products, all".

LIMITATIONS

Limitations of this data center around several factors, including the self-reported nature of the pesticide application and crop-layer data, the un-fixed nature of agriculture. Yolo County's GIS Database has highly detailed data about what crops are being grown where, however this neglects the fact that many farmers practice crop rotation and do have the same crop in each plot during each month of the year, or one year after the other. The spatial analysis could be improved by including health-related data, such as cancer incidences, as well as residential population statistics in order to assess the number of residents who may be at risk in the locations selected by my analysis. This analysis is predicated on the assumption that all pesticide usage, especially that applied by air or fumigation, results in pesticide drift, which neglects the fact that drift varies intensely based on weather, crop type, and application. The analysis could be focusing in on the locations of use for a specific group of chemical pesticides that is known to be most harmful to human health and/or most contaminating of organic land. There are also contamination-report incidences from the USDA that could be included for a deeper analysis of the risk facing the growing organic agriculture sector in Yolo County.

DISCUSSION

Pesticide drift is a common health hazard and legal issue in places like Yolo County, where residential and agricultural land use share boundaries and oftentimes overlap. This research may be of use to Yolo County officials in determining locations that are at higher-than-usual risk for pesticide drift. Residents, particularly vulnerable populations like children and agricultural workers and their families, are at risk for negative health hazards, particularly when residential areas are near cropland where large amounts of pesticides are being applied by air or fumigation. Yolo County continues to be a leader in organic agriculture in California, ranking sixth in the state for number of organic acres (twenty-first in the state for conventional acres). Organic farmers are at risk when their fields share borders with cropland where large amounts of pesticides are being applied by air or fumigation. My analysis shows locations at risk, allowing for interventions such as better pesticide-use training and stricter laws regarding buffer zones. Additionally, it reveals the locations of commodities-to-watch for increased pesticide use in the coming years, especially as drought conditions may worsen. Yolo County Data and my analysis show both large amount of pesticide use and high prevalence of air application (such as crop-dusting) for tomato, rice, almonds, and grapes (wine and table). The California Department of Pesticide Regulation's 2016 Summary Report found an increase in state pesticide usage for these same four commodities, among nine others, partially due to drought-related complications. This analysis contributes to the national conversation surrounding the ramifications of widespread pesticide use in U.S. agriculture, presenting a county-scale method for locating sites of greater-than-normal risk of pesticide drift.

