

Pesticide application, California, 2011-2019

Libenson, A., Pace, C., Cushing, L., Morello-Frosch, R. (2023). Pesticide application in California, 2011-2019. Drinking Water Tool metadata, prepared by the Water Equity Science Shop, UC Berkeley.

Contact: cpace@berkeley.edu

File name: Pesticides_plss_final_013023.shp

Spatial Reference

Geographic Coordinate System	NAD 1983	Projected Coordinate System	NAD 1983 (Teale) Albers (Meters)
WKID	4269	Projection	3310
Authority	EPSG	Authority	EPSG
Angular Unit	Degree (0.0174532925199433)	Linear Unit	Meters (1.0)
Prime Meridian	Greenwich (0.0)	False Easting	0.00
Datum	D North American 1983	False Northing	-4000000.0
Spheroid	GRS 1980	Central Meridian	-120.0
Semimajor Axis	6378137.0	Standard Parallel 1	34.0
Semiminor Axis	6356752.314140356	Standard Parallel 2	40.5
Inverse Flattening	298.257222101	Latitude of Origin	0.0

Description

This shapefile contains estimates for annual and total pesticide application between 2011-2019 for 166 selected pesticides that pose a threat to groundwater. We report the application density, in total pounds of active ingredient per square kilometer, for 29,345 polygons that represent public land survey system (PLSS) sections in California.

Methods

PLSS section dataset (**Plsnet.shp**) was downloaded from [The US Bureau of Land Management](#).¹ The dataset contains 164,642 polygons uniquely identified by county, meridian, township, range, section (CO-MTRS) field in the attribute table. We dissolved by meridian, township, range, section (MTRS) field in ArcGIS, resulting in 158,680 polygons that are approximately 1x1 mile grid squares, i.e. PLSS sections.

Pesticide application data were downloaded on May 3, 2022 for 2011 through 2018 and on August 29, 2022 for 2019 from the California Department of Pesticide Regulation's Pesticide Use Reporting (PUR) Program database.² The PUR program collects monthly data on pesticide application at the scale of PLSS sections and releases aggregated annual data by pounds of active ingredient applied to each PLSS section. We selected 166 pesticide active ingredients that met at least ONE of the following criteria as a groundwater threat: 1) Included on the Department of Pesticide Regulation's list 6800: Pesticides with the Potential to Contaminate Groundwater;³ 2) Pesticides with a "high" or "very high" soil mobility rating, corresponding to McCall's soil mobility adsorption coefficient (Koc) of 150 or below and indicating a high likelihood of movement through soil to contaminate groundwater;⁴ 3) Pesticides found in groundwater by nationwide USGS studies;⁵ or 4) Pesticides found in California groundwater by multiple agencies (test results included in the DPR's Well Inventory Database).⁶ See [Appendix A](#) for a full list of the pesticide active ingredients. Each active ingredient was assigned a chemical code according to the Department of Pesticide Regulation database, accessed online at

(<https://apps.cdpr.ca.gov/docs/chemical/master2.cfm>) 166 of these pesticides were applied in California between 2011-2019 and are represented in the field “total_lbs.”

Groundwater threat active ingredients were summed by the PLSS section, by year, and across the 9-year study period. Each PLSS section received a value representing the total pounds of applied pesticides by year (one value for each year, 2011-2019) and a value representing cumulative sum across all years. We also calculated the average pounds of pesticide applied to each section across the 9-year study period and the pounds of active ingredient per square km. Data were processed in R. Processed pesticide data were joined to PLSS sections in ArcGIS pro based on matching MTRS fields in pesticide dataset and Plsnet shapefile.

Attribute Table

Field Heading	Field Description
FID	ESRI generated field
Shape	Polygon – ESRI generated field
MTRS	Meridian, Township, Range, Section (MTRS); PLSS identifier
REGION ⁷	1 2 3 4 5 6 7 8
REGIONNAME	Bay Area Central Coast Eastern Sierra Imperial/Mojave Desert Northern CA Northern Sierra San Joaquin Valley Southern CA
lbs_ai_11	Pounds of pesticide active ingredient (ai) applied in 2011
lbs_ai_12	Pounds of pesticide active ingredient applied in 2012
lbs_ai_13	Pounds of pesticide active ingredient applied in 2013
lbs_ai_14	Pounds of pesticide active ingredient applied in 2014
lbs_ai_15	Pounds of pesticide active ingredient applied in 2015
lbs_ai_16	Pounds of pesticide active ingredient applied in 2016
lbs_ai_17	Pounds of pesticide active ingredient applied in 2017
lbs_ai_18	Pounds of pesticide active ingredient applied in 2018
lbs_ai_19	Pounds of pesticide active ingredient applied in 2019
total_lbs	Sum of pounds active ingredient applied 2011-2019
avg_lbs	Annual average pounds active ingredient applied 2011-2019
area_km2	Total area of PLSS section
t_lbs_km2	Total lbs pesticide / area_km2

Shape_Length	Shape length in meters
Shape_Area	Shape area in square meters

References

1. Public Land Survey System (PLSS): Sections - California Open Data. Accessed September 20, 2022. <https://data.ca.gov/dataset/public-land-survey-system-plss-sections>.
2. Pesticide Use Reporting. Accessed September 10, 2022. <https://www.cdpr.ca.gov/docs/pur/purmain.htm>.
3. Section 6800 - 6808. Accessed September 20, 2022. <https://www.cdpr.ca.gov/docs/legbills/calcode/040101.htm>.
4. Gustafson DI. Groundwater ubiquity score: A simple method for assessing pesticide leachability. Environ Toxicol Chem. 1989;8(4):339-357. doi:10.1002/etc.5620080411
5. Bexfield LM, Belitz K, Lindsey BD, Toccalino PL, Nowell LH. Pesticides and Pesticide Degradates In Groundwater Used for Public Supply across the United States: Occurrence and Human-Health Context. Environ Sci Technol. 2021;55(1):362-372. doi:10.1021/acs.est.0c05793
6. Well Inventory Database. Accessed September 10, 2022. https://www.cdpr.ca.gov/docs/emon/grndwtr/well_inventory_database/index.htm.