

Air Monitoring Network Site Selection

California Department of Pesticide Regulation

Air Program

December 9, 2020

Introduction

The California Department of Pesticide Regulation (CDPR) created the Air Monitoring Network (AMN) in 2011 to collect ambient air samples in the communities of Ripon, Salinas and Shafter for analysis of 32 pesticides and five break down products. In 2017, additional funding from a budget change proposal allowed the AMN to temporarily expand from 3 to 8 sampling sites for a 2-year monitoring period. The eight selected sites maintained monitoring in Shafter (Kern County) and added Chualar (Monterey County), Cuyama (Santa Barbara County), Lindsay (Tulare County), Oxnard (Rio Mesa-Ventura County), San Joaquin (Fresno County), Santa Maria (Santa Barbara County), and Watsonville (Ohlone elementary-Monterey County). The additional funding expired in 2020. Given the loss of allocated funds for this project, CDPR was unable to continue operation of eight monitoring sites; therefore, CDPR has re-evaluated reported California pesticide use data to identify four monitoring sites to continue with AMN monitoring operation in 2021 and beyond.

Objectives

This report details the process taken by CDPR to analyze and rank communities in California based on proximity to reported pesticide use for fumigants and organophosphates during the years 2014 to 2018. The four communities were selected based on the results from this analysis, the Department's priorities, environmental justice factors, and historical pesticide detections at current monitoring locations.

Methods

Pesticide Data

County reported pesticide use data was retrieved from CDPR's Pesticide Use Report database (PUR) on February 2 and February 11, 2020, using two statewide queries. Pesticides were grouped into two categories, fumigants and organophosphates (OP), for years between 2014 and 2018. Pesticide use records include the following information: date of application, product name, product percent, amount of pounds of active ingredient (AI) used, acres treated, crop name, county name, township, and section. Structural pesticide use reported at the county level could not be accounted for in this analysis; therefore only pesticide applications used for agriculture are considered. As a result, CDPR excluded the four urban counties of Los Angeles, Orange, San Diego and San Francisco in this analysis. The two categories of pesticide use were aggregated by the smallest reported geospatial area known as a section (a 1x1 square mile [sq mi] area, representing the identifier Meridian Township Range and Section-MTRS) and by the year it was applied. In each category, the pounds of AI were equally weighted. A 5-year average (years with no data were replaced with zeros) was calculated for each section and used for this analysis.

The four fumigants included in this analysis are, 1,3-dichloropropene (1,3-D), chloropicrin, methyl bromide, and MITC generators (Dazomet, metam -sodium, metam-potassium, sodium tetrathiocarbamate). The query produced 51,533 records over the 5-year period.

The 11 OPs selected in this analysis are: acephate, bensulide, DDVP, diazinon, dimethoate, malathion, methidathion, naled, oxydemeton-methyl, phosmet, and S-S-S -tributyl phosphorotrithioate. CDPR excluded chlorpyrifos reported use since it will be phased out for agricultural use at the end of 2020

("Chlorpyrifos Cancellation"). The query for organophosphates from 2014 to 2018 yielded 227,756 records. The results were transferred into an ArcGIS readable file for further analysis.

Geospatial Data and Analysis

The geographic boundaries of California communities which include cities and census designated places (CDP) were downloaded from the U.S Census Bureau's Place 2015 Tiger/Shape line shapefile. This boundary dataset is based on the legal boundaries collected during the 2010 U.S census. CDPR used ArcGIS to calculate the area of the communities in sq mi.

A statewide section boundary shapefile was overlaid and spatially joined to the community boundary dataset.

Template shapefiles of all California communities of three boundary zones similar to "rings" were created using an ArcGIS spatial analysis tool (Buffer Analysis). Distances began at the edge of each community's boundary and were analyzed at a radius of 1 and 5 miles. The three zones are: within community boundary (community zone), community boundary and 1 mile beyond community boundary (local zone), and between 1 mile and 5 miles outside the community boundary (regional zone). This template is used with the PUR data to calculate the use density (lbs/sq mi). Figure 1 shows an example of a community and the three zones.

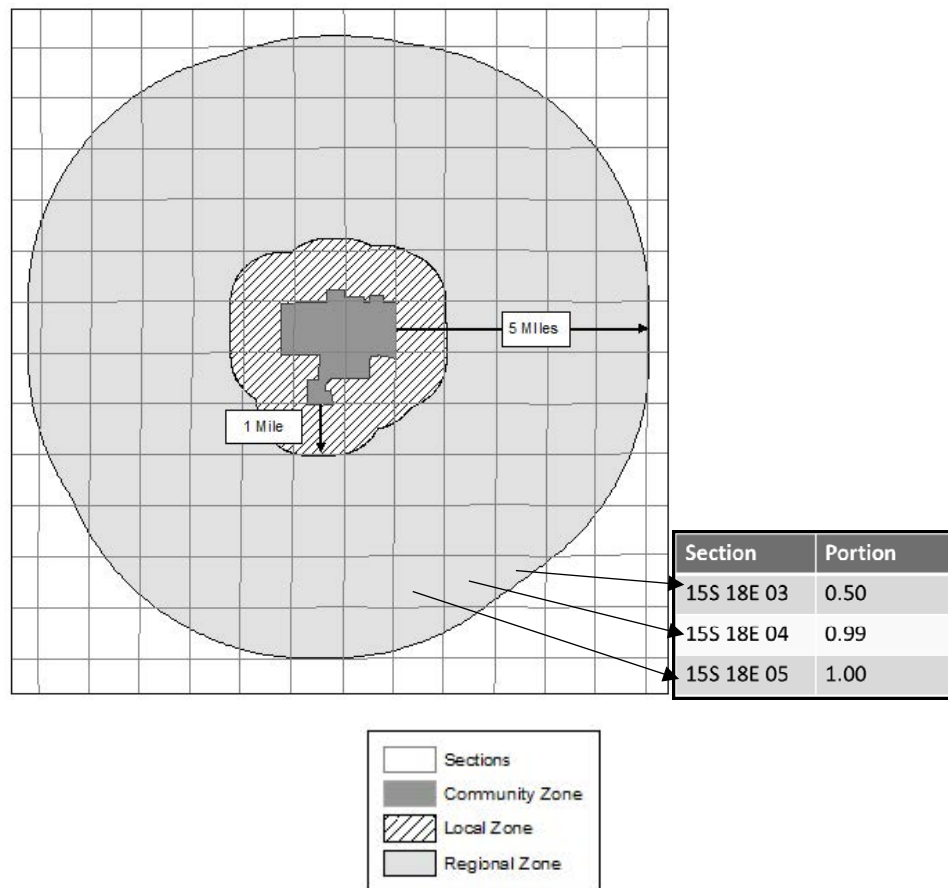


Figure 1: Community, local and regional zones from a community

For cases where sections are partially included within a zone (Figure 1), the amount of pesticide use reported for that section could be over-estimated. To adjust for this, CDPR used a scaling method where the proportion of each section within a zone was calculated and the amount of pesticide used was proportionally scaled to the area of the section within the zone. As a result, a multiplication factor was generated for partial sections. CDPR considered this as the best representative approach, based on limitations in PUR's reporting requirements. Once the three zones were determined for each community, the total area (sq mi) of each community's zone was tabulated in Excel. The readable ArcGIS files with average pesticide use data for fumigants and OPs were processed and spatially joined. Pesticide use data and section boundaries were matched by linking the MTRS field. A similar process was performed for each of the three zones. This exercise determined the geospatial distribution of OP and fumigant use relative to locations of California communities. Six datasets were exported to Excel detailing pesticide use around the communities.

Next, CDPR determined use density (lbs/sq mi). The amount of pesticide applied within each of these three zones was divided by the area of each zone (in square miles). The use density was calculated for OPs and fumigants in all three zones for each community.

Meteorological Data

Local environmental conditions such as weather (wind speed and direction) during and after a pesticide application can impact dispersion of any emissions from the field. CDPR used meteorological data from the California Irrigation Management Information System (CIMIS), a network of 145 automated stations located throughout the state. This network is managed by the California Department of Water Resources and stations collect data at a 2-m height. Annual weather data collected from 2014 to 2018 was downloaded through CIMIS FTP site and processed in the statistical program, R. An R code was written to calculate the average wind speeds over the 5-year period for each active station. Stations with less than three years of data were excluded from this analysis. Coordinate information was extracted and formatted into a readable ArcGIS file. Geospatial analysis determined the closest station to each community. A weighting factor for each community was calculated by dividing the use density by the average wind speed from the corresponding weather station. Using this method, for a given use density the community with a lower average wind speed would rank higher because a higher average wind speed would allow for more mixing (dilution) of air and potentially reduce the risk of higher pesticide concentrations.

Ranking Communities

Each community was ranked based on the weighting factor from highest to lowest (1 to 1,228) for each zone and assigned a final ranking based on the average rank of the three zones. Communities with no reported pesticide use within a mile 5 radius were not considered in initial community rankings. To reduce the large list of ranked communities, CDPR limited the list to the highest 30 ranked California communities for fumigants and OPs. Two lists were produced to use in the site selection process.

Results

Initial Ranking

Out of the 1,228 possible communities included in this analysis, CDPR identified 748 communities which had OP use reported within 5 miles of a community boundary. Results from the fumigants ranking

yielded 499 communities with reported fumigant use within 5 miles of the community. CDPR identified the 30 highest ranked communities for both OP and fumigant use (Table 1).

For OPs: Guadalupe City in Santa Barbara County ranked the highest on the OP list based on CDPR's initial input criteria. CDPR found that 13 counties were represented in the top 30 ranked California communities for OPs. Monterey County was represented by 10 communities. It was followed by Imperial and Santa Cruz counties, each represented by three communities. The OP list includes five of the eight communities where AMN sites were monitored in 2017 to 2020.

For fumigants: The highest ranking community on the fumigant list was Edmundson Acres in Kern County. The results for the fumigant-ranked communities included 12 counties. Santa Cruz and Kern counties were each represented by five communities. Kern and Monterey counties each had a total of four communities in the top 30 list. Similarly, the fumigant list contained four AMN sites and one site from CDPR's targeted 1,3-D study¹.

¹ The CDPR 1,3-D study (Brown) is a long term study targeting 1,3-D in high use areas of California. The two communities of Delhi (Merced County) and Parlier (Fresno County) are monitored once a week similar to the AMN study.

Table 1: Summary of the initial top 30 ranked communities for organophosphates and fumigants.

OP Rank	Community	County	Fumigant Rank	Community	County
1	Guadalupe City*	Santa Barbara	1	Edmundson Acres CDP	Kern
2	Chualar CDP*	Monterey	2	Mettler CDP	Kern
3	Gonzales City	Monterey	3	Macdoel CDP	Siskiyou
4	Castroville CDP	Monterey	4	Pajaro CDP*	Monterey
5	Boronda CDP	Monterey	5	La Vina CDP	Madera
6	San Joaquin City*	Fresno	6	Delft Colony CDP	Tulare
7	Pajaro CDP*	Monterey	7	El Rio CDP*	Ventura
8	San Juan Bautista City	San Benito	8	Mount Hebron CDP	Siskiyou
9	Callender CDP	San Luis Obispo	9	Las Lomas CDP	Monterey
10	Holtville City	Imperial	10	Pajaro Dunes CDP	Santa Cruz
11	Monterey Park Tract CDP	Stanislaus	11	Guadalupe City*	Santa Barbara
12	Greenfield City	Monterey	12	Boronda CDP	Monterey
13	El Rio CDP*	Ventura	13	Bowles CDP	Fresno
14	Isleton City	Sacramento	14	Rodriguez Camp CDP	Tulare
15	Garey CDP	Santa Barbara	15	Castroville CDP	Monterey
16	Seeley CDP	Imperial	16	Cowan CDP	Stanislaus
17	Pajaro Dunes CDP	Santa Cruz	17	Freedom CDP	Santa Cruz
18	King City	Monterey	18	Amesti CDP	Santa Cruz
19	Ripley CDP	Riverside	19	Callender CDP	San Luis Obispo
20	Delft Colony CDP	Tulare	20	Monmouth CDP	Fresno
20	Amesti CDP	Santa Cruz	20	Biola CDP	Fresno
22	Moss Landing CDP	Monterey	22	Cuyama CDP*	Santa Barbara
22	London CDP	Tulare	23	Cherokee Strip CDP	Kern
24	Mettler CDP	Kern	24	Del Rey CDP	Fresno
25	Palo Verde CDP	Imperial	25	Arvin City	Kern
26	Freedom CDP	Santa Cruz	26	Richgrove CDP	Tulare
27	Soledad City	Monterey	27	Interlaken CDP	Santa Cruz
27	San Ardo CDP	Monterey	28	Delhi CDP**	Merced
29	Oceano CDP	San Luis Obispo	29	Mexican Colony CDP	Kern
29	Huron City	Fresno	30	La Selva Beach CDP	Santa Cruz

*AMN site, ** 1,3-D study monitoring site

Final Rankings

Results from 30 ranked communities were re-ranked to account for environmental justice (EJ) factors. The Office of Environmental and Human Health Assessment (OEHHA) provides a screening tool, CalEnviroScreen (CES), which is designed to identify California communities more susceptible to a pollution burden. CES version 3.0 was utilized in this analysis to provide CDPR with the most up to date screening tool to assist in prioritizing CDPR's selection. CDPR used the Population Characteristics (PC) percentile field which rates sensitive population indicators as well as socio-economic factors. The CES 3.0 PC percentile for any California census tract is based on the following parameters: asthma rates, percent of low birth-weight births, cardiovascular disease, educational attainment, linguistic isolation, poverty, unemployment, and housing burden (OEHHA, 2017). The higher the PC percentile score, the higher rate in which a population of a community is burdened by these factors. To account for the difference in the CES spatial scale among census tracts and community boundaries, CDPR used GIS software to process these indicators. CDPR overlaid the community boundaries and PC census tract data to create an average PC for each community in cases where multiple census tracts bisected a community boundary.

The communities were then re-ranked from 1 to 30 based on the highest average PC and then grouped by county. Of the 30 OP-ranked communities, a rank of 1 was assigned to Seeley in Imperial County based on the highest average PC score of 85. Richgrove in Tulare County was the top-ranked fumigant community after adjusting for EJ factors. Tables 2 and 3 summarize the results for final rank, and average PC.

Table 2: Ranked communities for organophosphates adjusted for environmental justice factors

County	Community Name	Final Rank	Average PC
Monterey	Boronda CDP, Greenfield City, King City, Pajaro CDP, Castroville CDP, Moss Landing CDP, Soledad City, Gonzales City, Chualar City, San Ardo CDP	7, 11, 12, 14, 15, 16, 18, 19, 21, 27	70, 63, 59, 56, 53, 52, 49, 48, 43, 28
Imperial	Seeley CDP, Holtville City, Palo Verde CDP	1, 6, 9	85, 72, 69
Santa Cruz	Pajaro Dunes CDP, Amesti CDP	13, 24, 26	58, 40, 34
Riverside	Ripley CDP	2	83
Fresno	San Joaquin City, Huron City	3, 5	82, 75
Stanislaus	Monterey Park Tract CDP	4	77
Santa Barbara	Guadalupe City, Garey CDP	8, 29	69, 16
Tulare	London CDP, Delft Colony CDP	10, 20	64, 47
Sacramento	Isleton City	17	50
San Benito	San Juan Bautista City	22	41
Ventura	El Rio CDP	23	40
Kern	Mettler CDP	25	38
San Luis Obispo	Oceano CDP, Callender CDP	28, 30	20, 9

Table 3: Ranked Communities for fumigants adjusted for environmental justice factors

County	Community Name	Final Rank	Average PC
Santa Cruz	Pajaro Dunes CDP, Interlaken CDP, Amesti CDP, Freedom CDP, La Selva Beach CDP	14, 19, 21, 25, 29	58, 41, 40, 34, 16
Kern	Mexican Colony CDP, Edmundson Acres CDP, Arvin City, Mettler CDP, Cherokee Strip CDP	7, 10, 12, 22, 24	70, 67, 66, 38, 35
Monterey	Boronda CDP, Parajo CDP, Castroville CDP, Las Lomas CDP	6, 15, 17, 23	70, 56, 53, 38
Fresno	Bowles CDP, Del Rey CDP, Monmouth CDP, Biola CDP	3, 4, 9, 13	87, 85, 68, 61
Tulare	Richgrove CDP, Rodriguez Camp CDP, Delft Colony CDP	1, 2, 18	89, 88, 47
Santa Barbara	Guadalupe City, Cuyama CDP	8, 28	69, 30
Siskiyou	Macdoel CDP, Mount Hebron CDP	26, 27	32, 32
Stanislaus	Cowan CDP	5	74

County	Community Name	Final Rank	Average PC
Merced	Delhi CDP	11	67
Madera	La Vina CDP	16	54
Ventura	El Rio CDP	20	40
San Luis Obispo	Callender CDP	30	9

Selected Communities

Given current funding and resources available to CDPR, a total of four AMN monitoring locations were selected. Additionally, locations where CDPR has current air monitors in place were prioritized due to having current site permissions, equipment in place, and established travel logistics. CDPR staff are primarily based in Sacramento and counties with greater travel needs were not feasible at this time due to the COVID-19 public health emergency. Although high- ranked counties, such as Imperial for OP's and Tulare for fumigants were of great interest, CDPR targeted communities that ranked on both OP and fumigant lists. CDPR is also actively monitoring communities of Delhi (ranked 11 on fumigant list) and Parlier through the targeted 1,3-D air monitoring study. The community of Del Rey (ranked 4 on fumigant list) is located within 7 miles of Parlier. The sites selected are Oxnard (Ventura County), Santa Maria (Guadalupe- Santa Barbara County), Shafter (Kern County), and Watsonville (Monterey County). Tables 4 and 5 summarize average pounds of fumigants and OPs applied within community, local, and regional zones.

- **Oxnard (El Rio):** The community of El Rio, was a recent AMN site and previously a Toxic Air Contaminant (TAC) site from 2011-2018. Results from this analysis, showed El Rio was the only community in Ventura County to rank on both the fumigant (ranked 20) and OP lists (ranked 23). CDPR prioritized this location due to the existing CDPR AMN station (Rio-Mesa High School), historical detections, and rankings from this analysis.
- **Santa Maria (Guadalupe):** The community of Guadalupe ranked as the 8th highest community on both OP and fumigant lists. Additionally, this community was prioritized due to the available and existing air monitoring station at this location (Bonita Elementary School), historical detections and a higher average PC score (69) compared to the community of Cuyama (30).
- **Shafter:** The community of Shafter was selected by CDPR to remain as an AMN sampling site. Shafter, an original AMN monitoring site location, has been monitored by CDPR since 2011. While the community of Mexican Colony, which is located 3 miles from Shafter, ranks 7 and has a higher average PC, due to its size and lack of a suitable monitoring site location, this community was not a viable monitoring option. Therefore, CDPR prioritized this region to include a full AMN site and will continue to monitor at the Shafter site due to proximity to high pesticide use regions, proximity to high PC characteristics and for data monitoring consistency.
- **Watsonville (Pajaro):** This site also has a long monitoring history: having been originally a TAC site from 2010 to 2016 and then converted to a full AMN site in 2017. This location was kept primarily based on the proximity of eight similarly ranked communities from Monterey (Boronda CDP, Castroville CDP, Las Lomas CDP, Moss Landing CDP), Santa Cruz (Interlaken CDP, Amesti CDP, Freedom CDP, La Selva Beach CDP) and San Benito (San Juan Bautista City) counties found

on both fumigant and OP lists. Existing AMN equipment at Ohlone Elementary School was a major factor as well.

Table 4: Summary of average pounds of fumigants applied within the three zones, the final rank, and average PC for AMN sites.

Fumigant Community Name	Community Zone	Local Zone	Regional Zone	Final Rank	Average PC
El Rio CDP	101,380	221,842	1,554,829	20	40
Guadalupe City	5,348	109,519	1,192,887	8	69
Pajaro CDP	24,193	187,167	1,721,563	15	56
Shafter City	23,577	112,960	372,483	--	46

Table 5: Summary of average pounds of OPs applied within the three zones, the final rank and average PC for AMN sites.

OP Community Name	Community Zone	Local Zone	Regional Zone	Final Rank	Average PC
El Rio CDP	744	1,462	23,252	23	40
Guadalupe City	1,043	10,136	43,324	8	69
Pajaro CDP	147	2,821	25,766	14	56
Shafter City	110	434	1,965	--	46



Figure 2: Map representing the four planned Air Monitoring Network stations

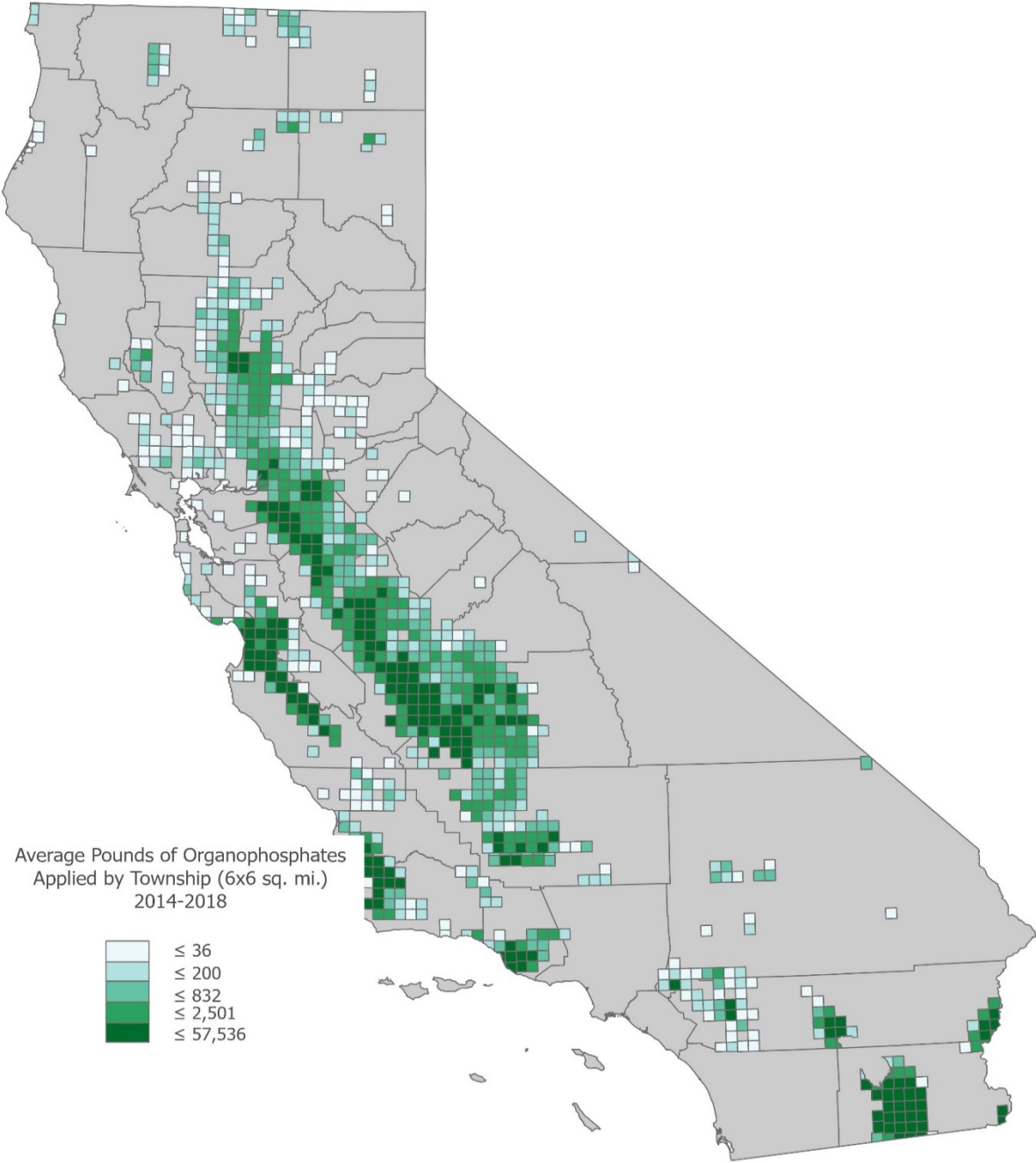
Conclusion

CDPR independently evaluated over 1,200 communities for the use of OPs and fumigants, wind speed and environmental justice factors for the selection of future AMN sites. Based on this evaluation, the communities of Shafter, Watsonville (Pajaro), Oxnard (El Rio) and Santa Maria (Guadalupe) were selected as sites for the AMN for 2021 and potentially beyond.

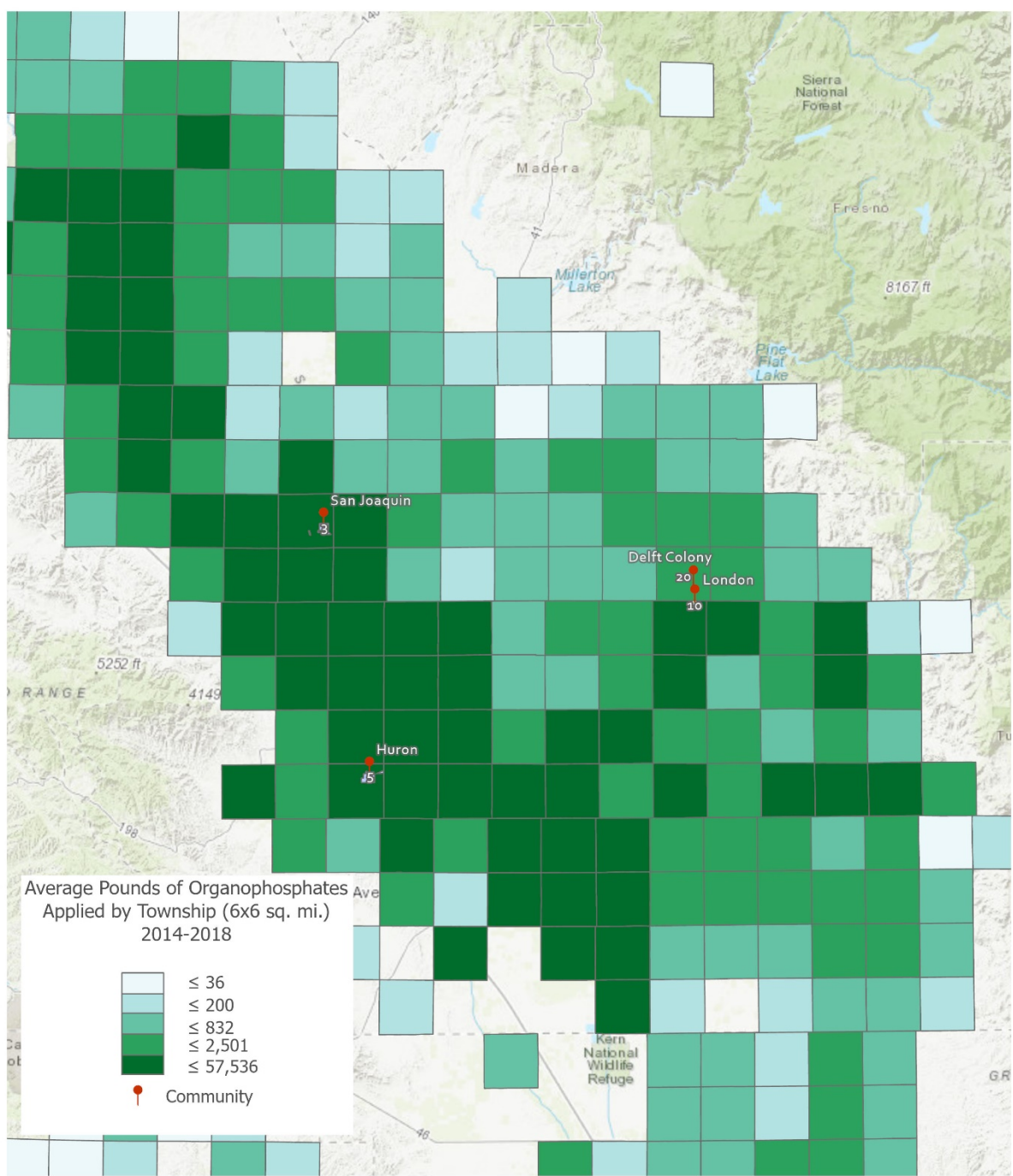
References

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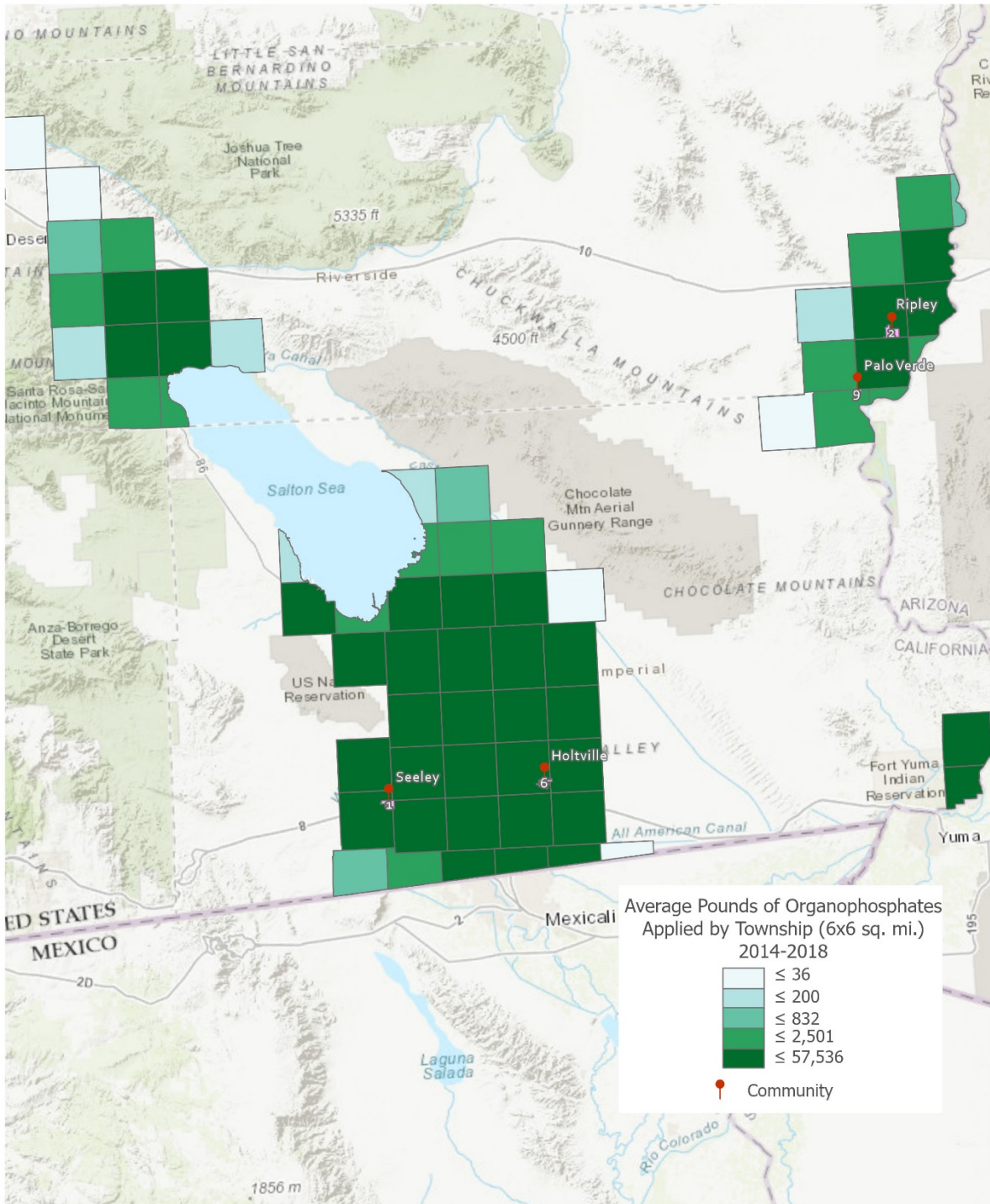
Appendix A: Organophosphate Use maps



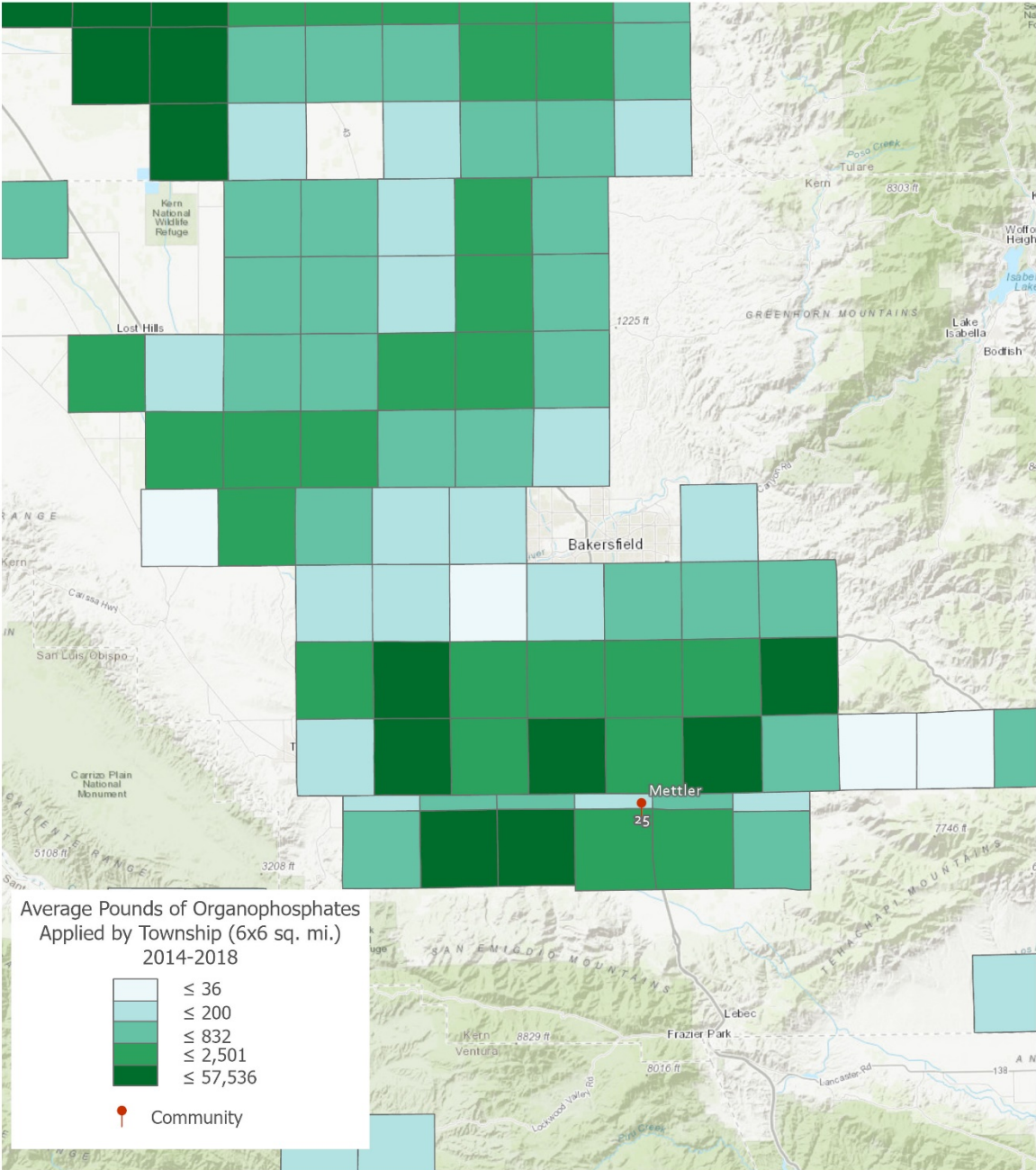
Top Ranking Communities in Fresno, San Joaquin and Tulare Counties



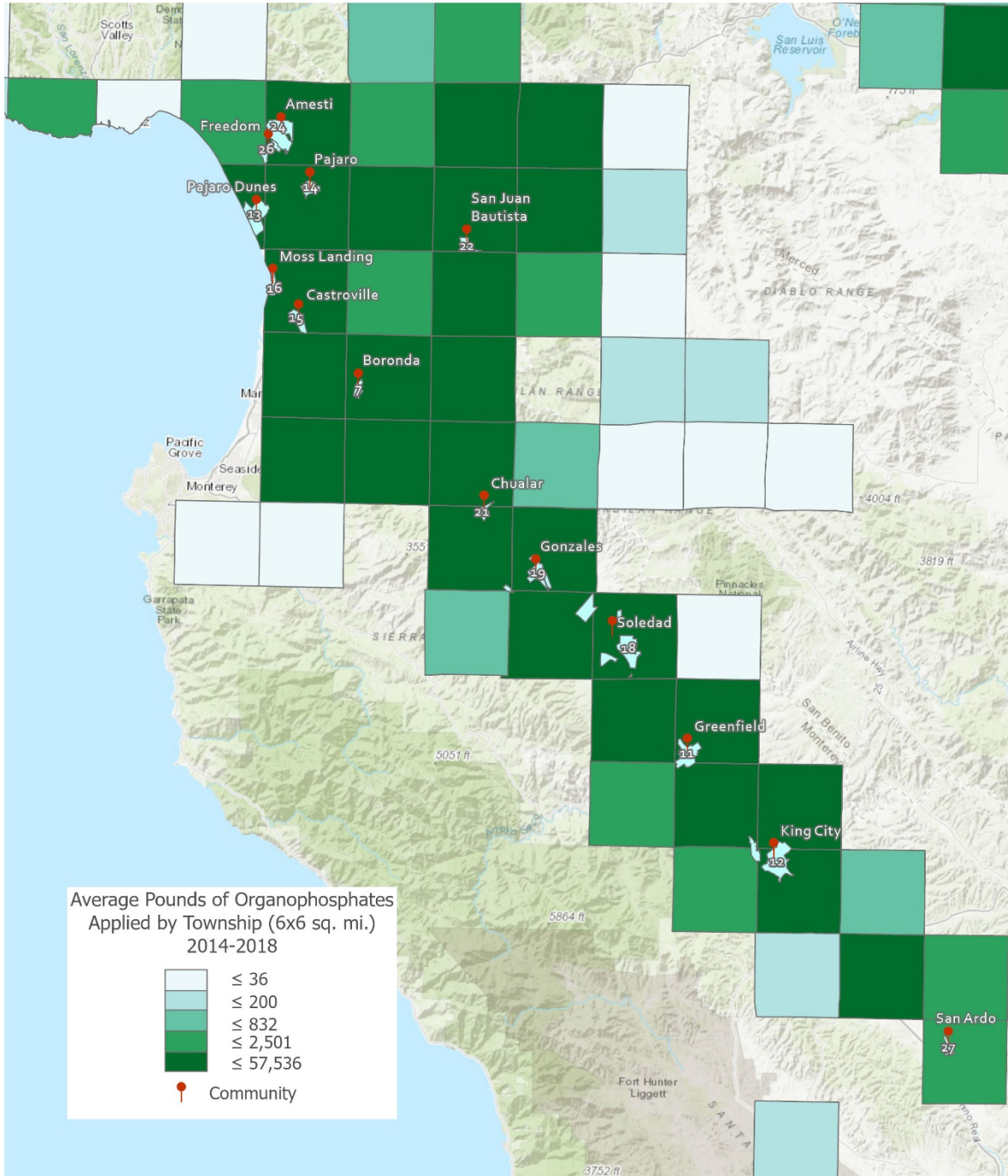
Top Ranking Communities in Imperial and Riverside Counties



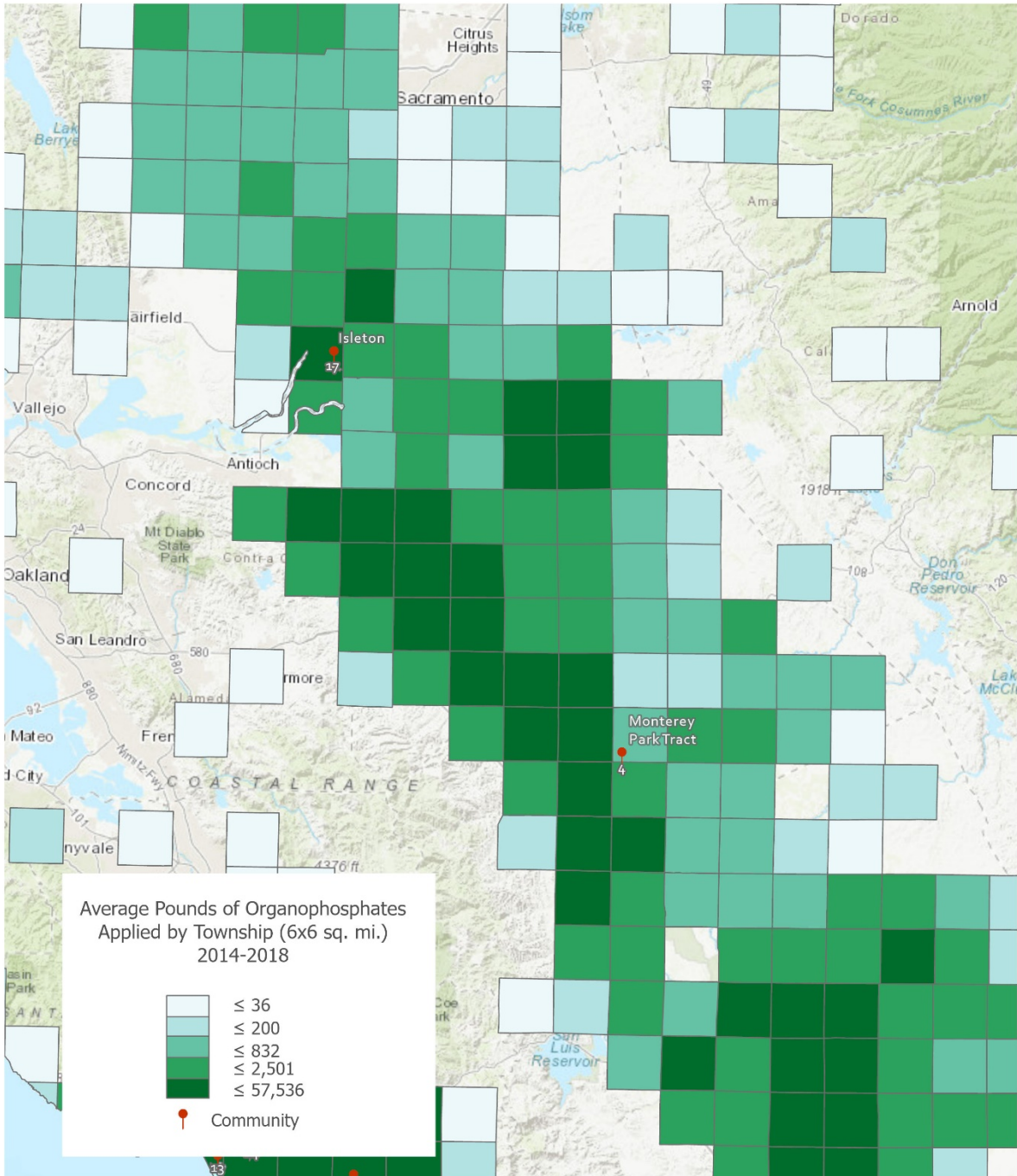
Top Ranking Community in Kern County



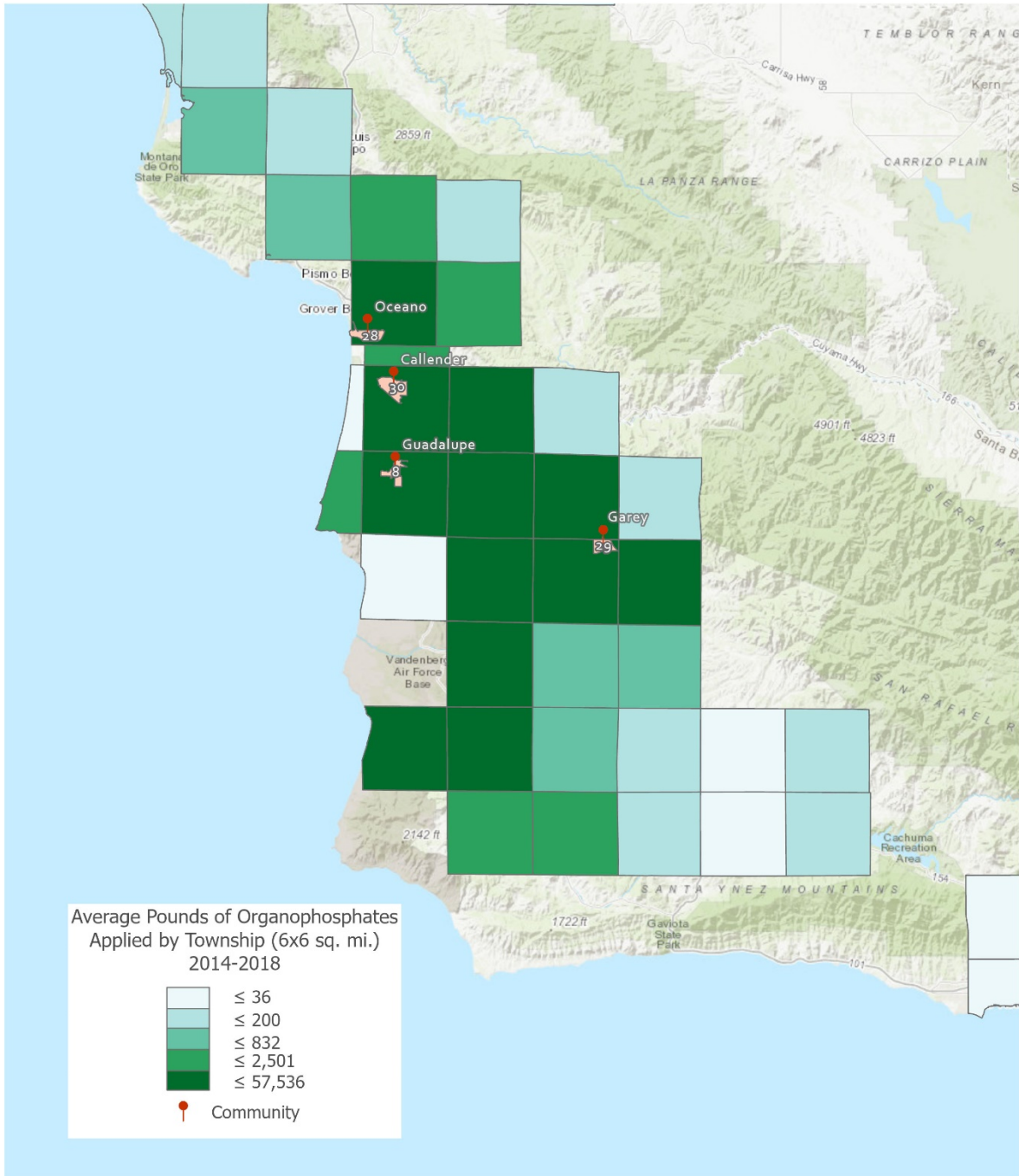
Top Ranking Communities in Monterey, Santa Cruz and San Benito Counties



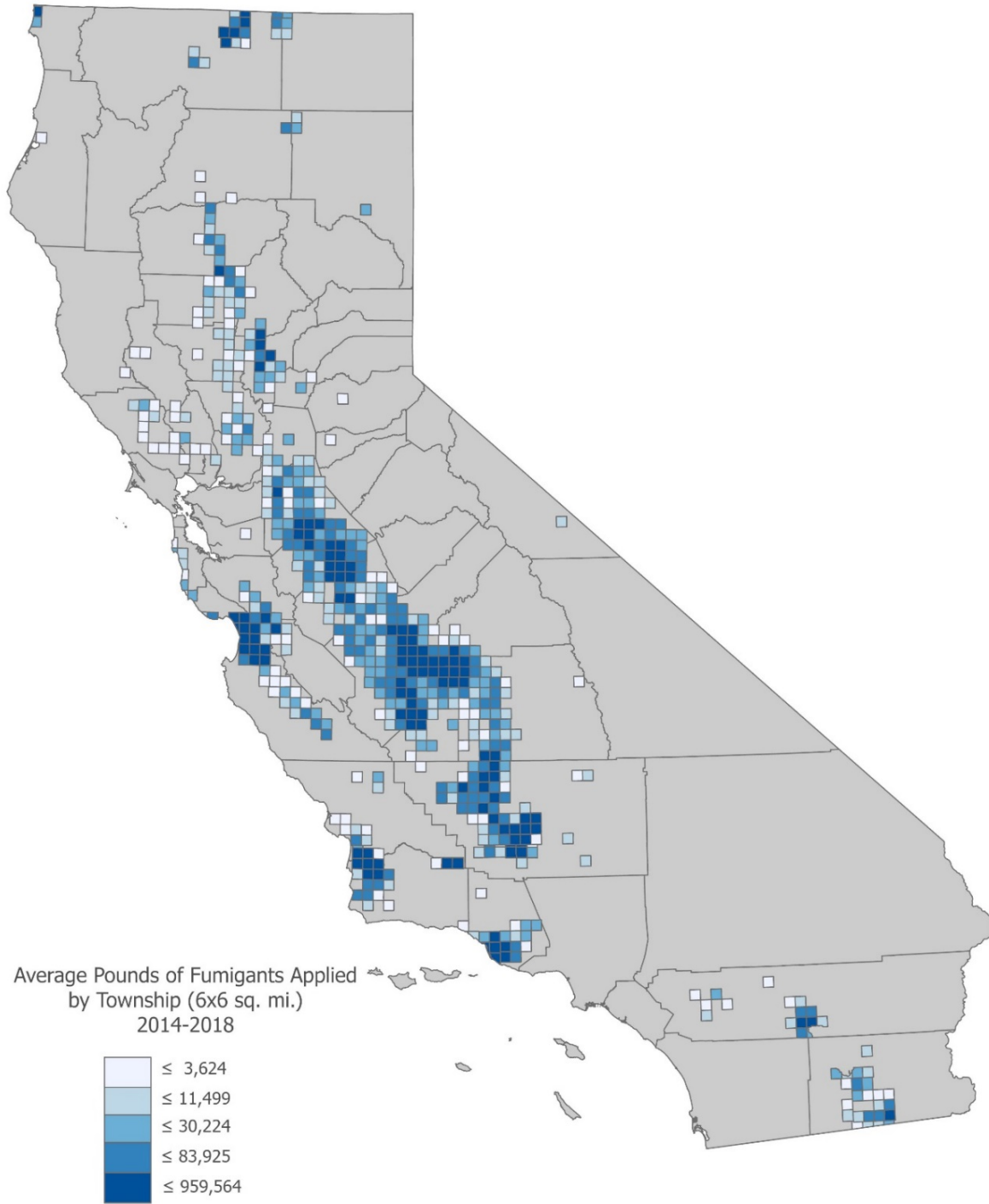
Top Ranking Communities in Sacramento and Stanislaus Counties



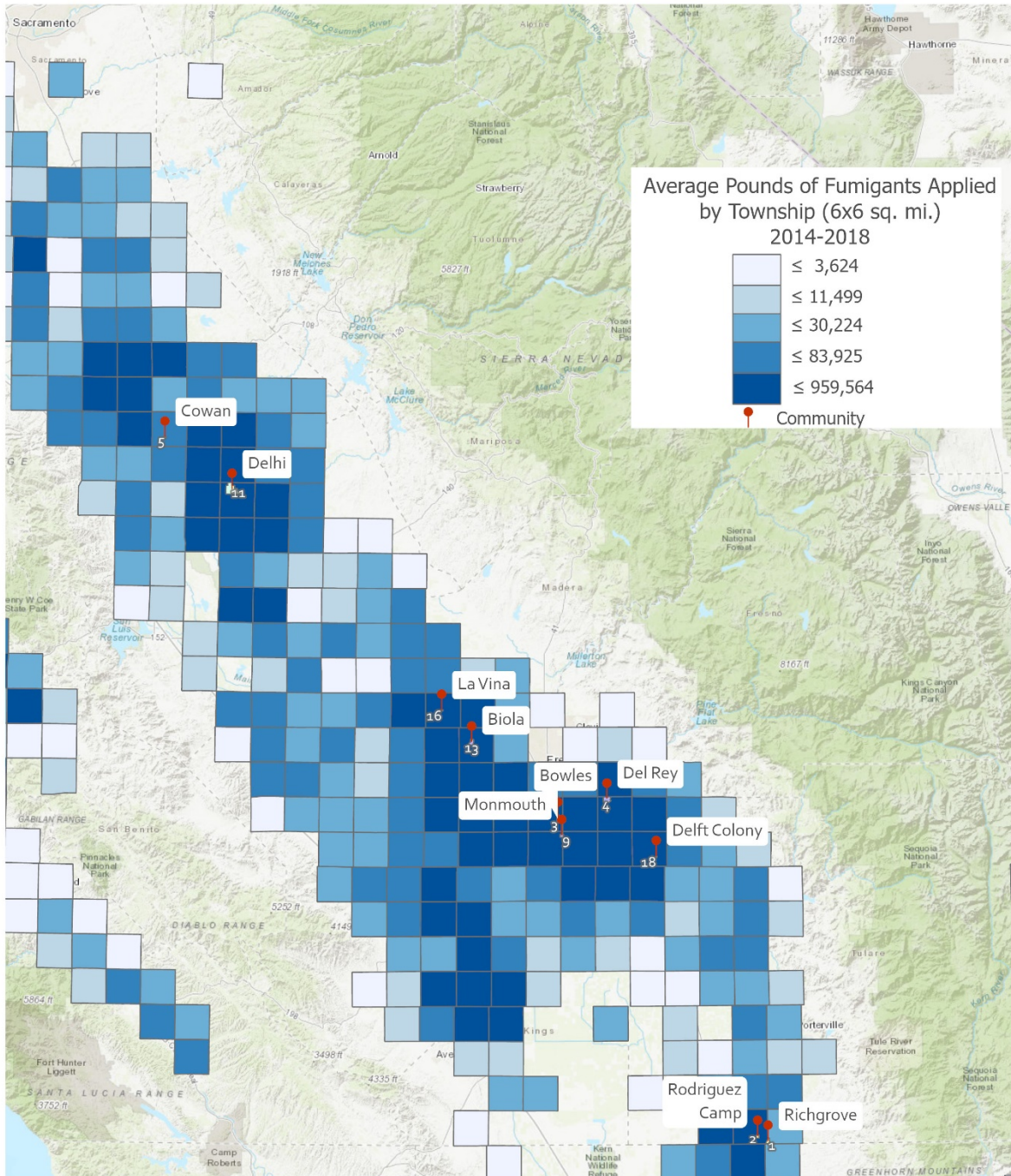
Top Ranking Communities in San Luis Obispo and Santa Barbara Counties



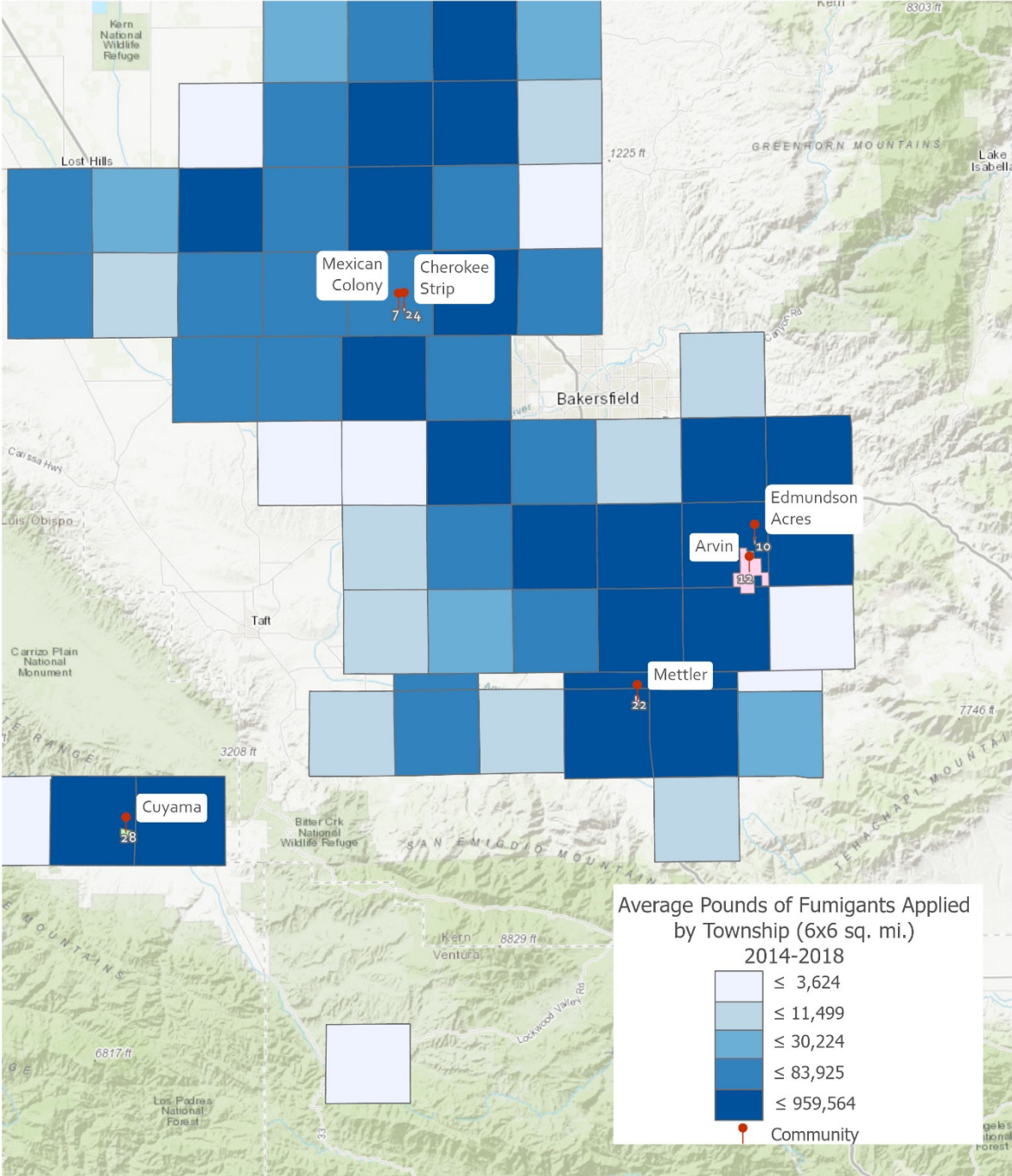
Appendix B: Fumigant Use Maps



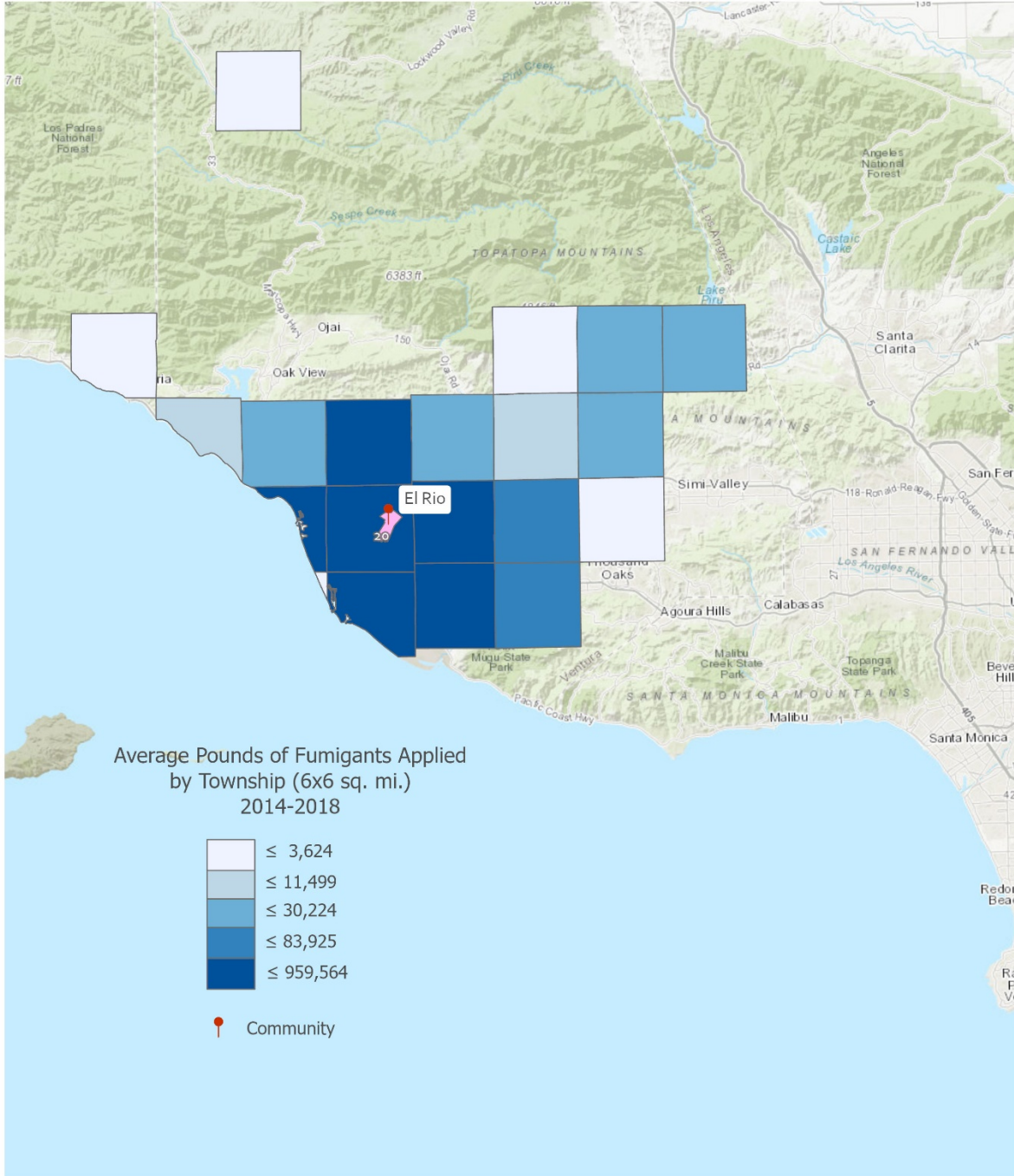
Top Ranking Communities Stanislaus, Merced, Madera, Fresno and Tulare Counties



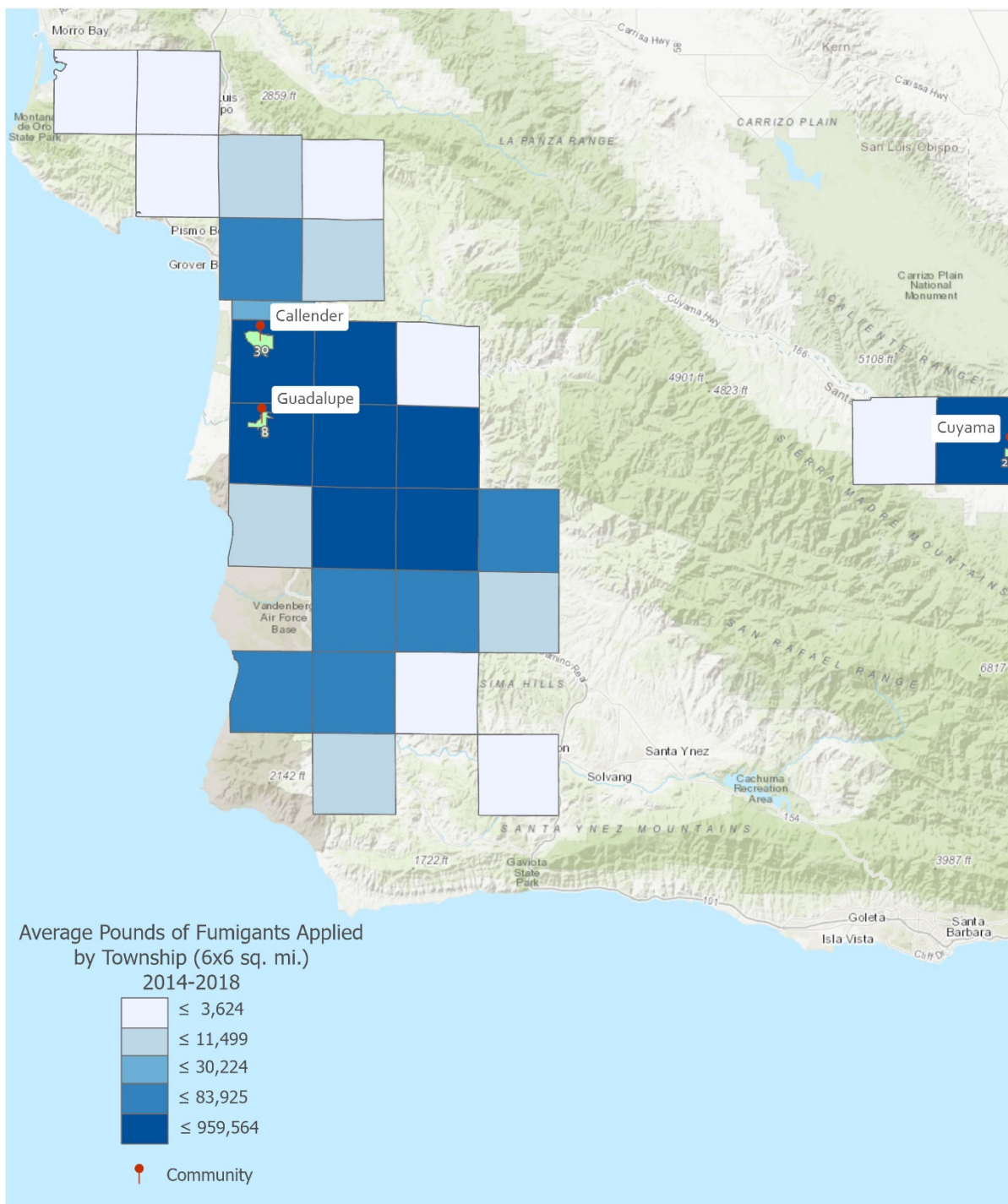
Top Ranking Communities in Kern County



Top Ranking Community in Ventura County



Top Ranking Communities in Santa Barbara County



Top Ranking Communities in Monterey and Santa Cruz Counties

