Summary of
Pesticide Use Report Data
2015

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April 2017

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For information on obtaining electronic data files, see Page ii.
This report is also available on DPR's Web site <www.cdpr.ca.gov>.
If you have questions concerning this report, contact <PUR.Inquiry@cdpr.ca.gov>.

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How to Access the Summary of Pesticide Use Report Data

The *Summary of Pesticide Use Report Data* issued by the California Department of Pesticide Regulation (DPR) for the years 1989-2015 can be found by selecting the year from the drop-down menu under the Pesticide Use Annual Summary Reports section at <www.cdpr.ca.gov/docs/pur/purmain.htm>. The tables in the Statewide Report and County Summary Reports list the pounds of active ingredient (AI) applied, the number of applications, and the number of acres or other unit treated. The data is available in two formats:

- *Indexed by chemical:* The report indexed by chemical shows all the commodities and sites in which a particular AI was applied.
- *Indexed by commodity:* The report indexed by commodity shows all the AIs that were applied to a particular commodity or site.

The data used in the *Pesticide Use Annual Summary Reports* for 1989 to 2015 are available on CD and on the Department's File Transfer Protocol (FTP) site at <ftp://transfer.cdpr.ca.gov/pub/outgoing/pur_archives/>. The FTP site also includes data for the years 1974 to 1989. The files are in text (comma-delimited) format. Data obtained from the FTP site does not include updates that occur after the Pesticide Use Annual Summary was released. For the most up-to-date data, use the online California Information Portal (CalPIP) at <http://calpip.cdpr.ca.gov/main.cfm> or contact DPR at <PUR.Inquiry@cdpr.ca.gov>

Please direct any questions regarding the *Summary of Pesticide Use Report Data* to the Department of Pesticide Regulation, Pest Management and Licensing Branch, P.O. Box 4015, Sacramento, California 95812-4015, or you may request copies of the data by contacting <PUR.Inquiry@cdpr.ca.gov>.

1 Introduction

California's pesticide use reporting program is the most comprehensive in the world. California has reported pesticide use in some form since 1934. However the detailed reporting that occurs today did not begin until the 1990s. Until 1954, only statistics on aerial pesticide applications were recorded. In 1954, state regulators asked for reports on ground appliction acreage, without any detailed information about the pesticides used or commodities treated. In 1970, farmers were required to report all applications of restricted materials and pest control operators were required to report all pesticides used. The Food Safety Act of 1989 (Chapter 1200, AB 2161) gave DPR statutory authority to require full reporting of agricultural pesticide use. In 1990, California became the first state requiring full reporting of agricultural pesticide use to better inform DPR's pesticide regulatory programs. Prior to full reporting, the regulatory program's estimates of pesticide use frequently relied on maximum rates and applications as listed on the label, overstating many risks. Over the years, these data have been used by a variety of individuals and groups, including government officials, scientists, growers, legislators, and public interest groups. Most pesticide use data required to be reported must be sent to the county agricultural commissioner (CAC), who then reports the data to DPR. In the last few years, DPR has annually collected and processed more than three million records of pesticide applications. (A pesticide application record represents an individual pesticide product, even if it was applied simultaneously with other products in the field or if it contained more than one AI).

California's broad definition of "agricultural use" requires reporting pesticide applications in production agriculture, parks, golf courses, cemeteries, rangeland, pastures, and along roadside and railroad rights-of-way. Each application of pesticide on crops (production agriculture) must include the site name given to a location or field by the CAC as well as the section (square mile) in which the application occurred. Most other uses are aggregated and reported by month with only the county identified. These other uses include rights-of-way applications, all postharvest pesticide treatments of agricultural commodities, structural applications by licensed applicators, all pesticide treatments in poultry and fish production, and some livestock applications. In addition, all applications made by licensed applicators and outdoor applications of pesticides that have the potential to pollute ground water must be reported. The primary exceptions to the reporting requirements are home-and-garden use and most industrial and institutional uses.

In addition to requiring pesticide use reporting, California law (Food and Agricultural Code [FAC] section 12979) directs DPR to use the reports in setting priorities for monitoring food, enforcing pesticide laws, protecting the safety of farm workers, monitoring the environment for unanticipated residues, researching pest management practices, monitoring and researching public health issues, and similar activities. These activities help DPR continuously evaluate currently registered pesticides (FAC section 12824), another mandated activity. Information gathered during continuous evaluation is used to gauge the performance of DPR's regulatory programs and justify additional measures, including development of new regulations or reevaluation or cancellation of pesticide registrations. California Code of Regulations Title 3,

sections 6624 et seq. further describe pesticide use record keeping and reporting requirements.

Continuous Evaluation of Pesticides

The Pesticide Use Report (PUR) greatly increases the accuracy and efficiency of continuous evaluation of pesticides by providing details on each application, including date, location, site (e.g., crop), time, acres or units treated, and the identity and quantity of each pesticide product applied. These data allow scientists and others to identify trends in pesticide use, compare use locations with other geographical information and data, and perform quantitative assessments and evaluations of risks pesticides may pose to human health and the environment.

DPR uses the PUR throughout its pesticide regulatory programs in ways that can be broadly grouped as temporal (time), geospatial (place), and quantitative (amount), often combining elements of each.

Temporal analyses can pinpoint specific applications or span many years. Investigations into suspected worker illnesses, spray drift, fish or wildlife losses, or other enforcement inquiries frequently begin with a review of the PUR to see what applications were made in an area at a particular time. Protection of ground and surface waters, assessments of acute and chronic risks to human health, and allocation of monitoring and enforcement resources often begin with analyses of PUR data spanning many years to evaluate pesticide use trends.

Geospatial analyses may be local or expansive. Local analyses are used to help set priorities for surface and ground water monitoring programs by determining pesticide use and runoff potential in specific watersheds or other defined areas. DPR scientists calculate contributions of smog-forming volatile organic compounds (VOCs) in the atmosphere using reliable pesticide use data and emissions data on products. DPR further refines the analyses to specific air basins that are particularly vulnerable to air pollution to determine whether pesticide-related VOC emissions are below required targets or whether additional restrictions on use may be warranted to protect air quality. More expansive analyses examine the proximity of pesticide use to endangered species habitat, resulting in the development of best use practices to protect these species. These analyses are invaluable when assessing regulatory responses or evaluating the performance of voluntary stewardship efforts.

Quantitative assessments are broadly used to model risks of pesticide use to humans and the environment. The quality and depth of the information provided in the PUR allow researchers to apply realistic assumptions when modeling pesticide exposure. PUR data have been used to model pesticide exposure of people who live near agricultural lands, workers in the field, handlers preparing and applying pesticides, and aquatic organisms inhabiting waterways that receive agricultural runoff. Analysis of the PUR enables well-informed and realistic assessments for risk management decisions.

The passage of the federal Food Quality Protection Act (FQPA) of 1996 launched the PUR into a more integral role as a tool for monitoring and achieving compliance with updated food safety regulations. The FQPA contained a new food safety standard against which all pesticide tolerances–amounts of pesticide residue allowed by federal law to remain on a harvested crop–must be measured. PUR data became increasingly important to commodity groups, University of California (UC) specialists, the United States Environmental Protection Agency (U.S. EPA), and other interested parties as they reassessed tolerances and calculated dietary risks from pesticides based on actual reported uses.

PUR information such as pesticide type, use rates, geographical locations, crops, and timing of applications help researchers understand how various pest management options are implemented in the field. Analyses of these data are the basis for grant projects that DPR funds to promote the development and adoption of integrated pest management practices in both agricultural and urban settings.

The PUR data are used by state, regional, and local agencies, scientists, and public interest groups. The data are an invaluable tool for understanding pesticide use in order to protect human health and the environment while balancing the population's need for quality food, fiber, shelter, and surroundings.

Data Collection

Partial reporting of agricultural pesticide use has been in place in California since at least the 1950s. In the early years, CACs required agricultural pest control operators to submit monthly reports. County requirements varied, but many reports included a statement for each application that showed the grower's name, the location and date of the application, the crop and the size of area treated, the target pest, and the type and amount of pesticide applied. Only statistics on aerial pesticide applications were forwarded to the state for tabulation. In 1955, state regulators asked for reports on ground application acreage but discontinued requirements for detailed reporting of pesticides used and commodities treated. In 1970, DPR required farmers to report all applications of restricted-use pesticides, and pest control operators to report all pesticides used, whether restricted or not. Both kinds of reports had to include the date, location, site (e.g., crop), acres or units treated, and the identity and quantity of each pesticide applied. Production agricultural applications included records for each application and the location to within a square mile area (section, township, and range); all other applications were reported as a monthly summary by county. The reports were filed with the CAC, who forwarded the data to the state, where it was entered into a database and summarized in annual publications.

The Food Safety Act of 1989 (Chapter 12001, Assembly Bill 2161) gave DPR statutory authority to require full reporting of pesticide use. DPR adopted regulations the same year and full-use reporting began in 1990. The first years of full-use reporting nearly overwhelmed DPR's capacity to process data. Use reports were on paper, and required staff to manually enter data from more

than a million records each year. DPR began searching almost immediately for ways to automate reporting from pesticide users to the CAC, and, in turn, from the counties to DPR. However, it was difficult to find an approach that suited the diversity of use reporting and differing budget resources among the counties. Starting in 1991, various automated programs were developed and modified by DPR and CACs. Meanwhile, technological progress and increasing use of online resources by businesses fed expectations for more web-based functionality for pesticide use reporting.

CalAgPermits

In 2011, the counties implemented CalAgPermits, a standardized, web-based system that greatly enhanced the efficiency of data entry and transfer, and thus the accuracy and integrity of the PUR database. In addition to helping CACs issue restricted-materials permits, it allowed individuals and firms the option of reporting pesticide use electronically. CalAgPermits also greatly enhanced data quality assurance by automating data validation and error checking of submitted pesticide use reports before transmission to DPR. The many improvements in the ability to share data electronically between DPR and CACs have greatly improved the efficiency and effectiveness of quality control for the PUR.

Improving Accuracy

DPR checks the accuracy of PUR data many times between the initial data entry and before it is made available to the public. CalAgPermits checks for data entry errors, such as whether the pesticide applicator has the correct permits for any restricted materials reported or whether the pesticide product is allowed on the reported application site. Once the data have been received by DPR they undergo more than 50 different validity checks such as verifying product registration numbers and confirming that products are registered for use on the reported site of application. The PUR database may include products that do not have an active registration since end-users are allowed to continue using stocks purchased prior to a product's registration becoming inactive. Records flagged for suspected errors are returned electronically to the county for resolution. Additional data checks are performed to identify errors and outliers in pesticide use amounts via an extensive statistical method developed by DPR in the late 1990s. If a reported use rate (amount of pesticide per area treated) greatly exceeds maximum label rates, it is flagged as an error and sent back to the CAC to confirm. If the county is unable to identify the correct rate, an estimated rate equal to the median rate of all other applications of the pesticide product on the same crop or site is used instead. Although less than one percent of the reports are flagged with this type of error, some errors are so large that if included, they would significantly affect the total cumulative amount of applied pesticides. For more information on errors and identifying outliers in the PUR, see <www.cdpr.ca.gov/docs/pur/outlier.pdf> and <www.cdpr.ca.gov/docs/pestmgt/pubs/pm9801.pdf>

Improving Access to the Data

There are several ways to access the PUR data. Annual reports serve as an accessible snapshot summary of the much larger PUR database. Before the late 1990s, summaries were only available in hard copy and only by request, indexed by AI and commodity with summaries of pesticide use by county. As use of online resources increased, DPR improved public access to the data and presented it in a more meaningful context, posting the summary annually on its website. In addition, the PUR data used in each annual report from 1974 on can be downloaded from DPR's FTP website <ftp://pestreg.cdpr.ca.gov/pub/outgoing/pur_archives>. This data does not include any updates that may have occurred after the release of the annual report.

In 2003, DPR launched the web-based California Pesticide Information Portal (CalPIP) database to increase public access to the PUR. CalPIP provides pesticide use information including date, site or crop treated, pounds used, acres treated, pesticide product name, AI name, application pattern (ground, air, or other), county, ZIP code, and location where the application was made to within a one-square-mile area. CalPIP annually updates any changes due to errors identified after the annual report has been released, so it is the most up-to-date source of pesticide information available via the website.

Starting in 1996, DPR scientists began analyzing critical crops and their pest problems as well as trends in the pounds of pesticides used, and the number of applications and acres treated. Each year, the annual report charts pesticide use over several years in specific categories:

- Reproductive toxins
- Carcinogens
- Insecticide organophosphate and carbamate chemicals
- Chemicals classified by DPR as ground water contaminants
- Chemicals listed by DPR as toxic air contaminants
- Fumigants
- Oil pesticides derived from petroleum distillation (some may be on the state's Proposition 65 list of chemicals "known to cause cancer," but most serve as alternatives to high-toxicity pesticides)
- Biopesticides (including microorganisms, naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest, such as pheromones)
- Crops (DPR analyzes pesticide use trends for around a dozen crops with the highest amount of pesticide used or acreage treated)

Pesticide use trend analyses can help regulatory agencies understand where efforts to promote reduced-risk pest management strategies are succeeding or failing. Information on long-term trends also helps researchers better identify emerging challenges and direct research to finding solutions.

2 Comments and Clarifications of Data

The following comments and points should be considered when analyzing data contained in this report.

Terminology

- *Product versus active ingredient (AI):* A pesticide product contains both active and inert ingredients. An AI is a component of a pesticide product that controls target pests. There can be more than one AI in a product. Inert ingredients are all the other ingredients of the product which do not target the pest but may enhance product performance and application. Pesticide use is reported to DPR at the product level, where the associated AIs are identified and their use trends are analyzed.
- *Number of agricultural applications:* Number of applications of pesticide products made to production agriculture. More detailed information is given below under "Number of Applications."
- *Pounds applied:* Number of pounds of an AI.
- *Unit type:* The type of area treated with the pesticide:

  A = Acreage
  C = Cubic feet (usually of post-harvest commodity treated)
  K = Thousand cubic feet (usually of post-harvest commodity treated)
  P = Pounds (usually of post-harvest commodity treated)
  S = Square feet
  T = Tons (usually of post-harvest commodity treated)
  U = Miscellaneous units (e.g., number of tractors, trees, tree holes, bins)
- *Acres treated:* Cumulative number of acres treated. More detailed information is given below under "Acres Treated."

Agricultural and Nonagricultural Pesticide Use

Many pesticide licensing, sales, and use requirements are tied to California's definition of agricultural use. Pesticide labels differentiate between agricultural, industrial, or institutional uses. Some pesticide products are labeled for both agricultural and nonagricultural uses.

California law (FAC section 11408) identifies agricultural use as all use except the following categories specifically identified as nonagricultural use:

- *Home:* Use in or around the immediate environment of a household
- *Industrial:* Use in or on property necessary to operate factories, processing plants, packing houses, or similar buildings or use for a manufacturing, mining, or chemical process. In

California, industrial use does not include use on rights-of-way. Postharvest commodity fumigations for buildings or on trucks, vans, or railcars are normally industrial use.

- *Institutional:* Use in or on property necessary to operate buildings such as hospitals, office buildings, libraries, auditoriums, or schools. When a licensed structural pest control operator treats these buildings, it is structural use. Use on landscaping and around walkways, parking lots, and other areas bordering such buildings is institutional use, but use on landscaping not affiliated with such buildings is not.
- *Structural:* Use by licensed structural pest control operators within the scope of their licenses
- *Vector control:* Use by certain vector control (e.g., mosquito abatement) districts
- *Veterinarian:* Use according to a written prescription of a licensed veterinarian

Agricultural use of pesticides includes:

- *Production agricultural use:* Any pesticide used to produce a plant or animal agricultural product (food, feed, fiber, ornamental, or forest) that will be distributed in the channels of trade (Some requirements—most notably those that address worker safety and use reporting—apply only to plant product production.)
- *Nonproduction agricultural use:* Any pesticide used on watersheds, rights-of-way, and landscaped areas (e.g., golf courses, parks, recreation areas, and cemeteries) not covered by the definitions of home and institutional uses

The following specific pesticide uses are required to be reported to the CAC who, in turn, reports the data to DPR:

- Production of any agricultural commodity except livestock (where livestock is defined in FAC section 18663 as "any cattle, sheep, swine, goat, or any horse, mule or other equine, whether live or dead")
- Treatment of postharvest agricultural commodities
- Landscape maintenance in parks, golf courses, cemeteries, and similar sites defined in the FAC as agricultural use
- Roadside and railroad rights-of-way
- Poultry and fish production
- Application of a restricted material
- Application of a pesticide listed in regulation as having the potential to pollute ground water when used outdoors in industrial and institutional settings
- Application by licensed pest control operators, including agricultural and structural applicators and maintenance gardeners

What must be reported. Growers must submit their production agricultural pesticide use reports to the CAC by the tenth day of the month following the month in which the work was performed, and pest control businesses must submit seven days after the application. Not all information submitted to the counties is transferred to DPR.

Production agricultural pesticide use reports include the following:

- Date and time of application
- Geographic location including the county, section, township, range, base, and meridian.
- Operator identification number (An operator identification number, sometimes called a "grower ID," is issued by CAC to property operators. The number is needed to report pesticide use and to purchase restricted-use pesticides. Pest control professionals are not required to obtain an operator ID number.)
- Operator name and address (although this information is not submitted to DPR)
- Site identification number (A site identification code must be assigned to each location or field where pesticides will be used for production of an agricultural commodity. This alphanumeric code is also recorded on any restricted material permit the grower obtains for the location. CalAgPermits has a map server feature that tracks locations of sites for county use.)
- Commodity, crop, or site treated
- Acres or units planted and treated
- Application method (e.g., by air, ground, or other means)
- Fumigation methods. Since 2008, fumigation applications in nonattainment areas that do not meet federal air quality standards for pesticide VOC emissions must be identified along with details on fumigation methods (for example, shallow shank injection with a tarp). This information allows DPR to estimate pesticide VOC emissions, which contribute to the formation of atmospheric ozone, an important air pollutant.
- Product name, U.S. EPA Registration Number (or the California Registration Number if the product is an adjuvant), and the amount of product applied

All other kinds of pesticide use (mostly nonagricultural) are reported by monthly summaries that include the following information:

- Pesticide product name
- Product registration number
- Amount used
- Number of applications
- Application site (e.g., roadside, structure)
- Month of application (rather than date and time)

- County (rather than square mile location)

Commodity Codes

DPR uses its product label database at <www.cdpr.ca.gov/docs/label/labelque.htm>to verify that products listed in pesticide use reports are registered for use on the reported commodity or site. The product label database uses a coding system consistent with U.S. EPA official label information. To minimize errors, a cross-reference table was developed to link different naming systems between the U.S. EPA, the product label database, and the PUR database.

Certain commodities or sites may have more than one site code associated with them if different production methods or uses of the commodity result in different pesticide use. For example, greenhouse and nursery operations are divided into six different site codes: greenhouse-grown cut flowers or greens, outdoor-grown cut flowers or greens, greenhouse-grown plants in containers, outdoor-grown plants in container/field-grown plants, greenhouse-grown transplants/propagative material, and outdoor-grown transplants/propagative material.

Tomatoes and grapes are also separated into further subcategories because of public and processor interest in differentiating pesticide use. Tomatoes are assigned codes to differentiate between fresh market and processing categories. Grapes are assigned separate codes to differentiate table grapes and raisins from wine grapes.

Unregistered Use

The PUR database may contain records of pesticide use on a commodity or site for which the pesticide is not currently registered. Unregistered uses that survive the error-checking process may be due to an error in the DPR product label database, where the product incorrectly lists a commodity or site as being registered. Other unregistered uses may be flagged as errors by the validation procedures, but left unchanged in the database. The error-checking process does not check whether the product was registered at the time of application. It is therefore possible that an application flagged as an error due to a recent change in registration may have been legally applied at the time of application. In addition, the law sometimes allows growers to use existing stocks of a pesticide product following its withdrawal from the market by the manufacturer, or suspension or cancelation by regulatory authorities since the safest way to dispose of small quantities of pesticides is to use them as they were intended. Finally, some pesticide products do not list specific sites or commodities on their labels, as they are designed to target specific pests across all sites, such as some soil fumigants, certain pre-plant herbicides, and rodenticides. In these cases, reporting an application of one of these types of pesticides on a specific commodity or site can result in an error. In 2015, an option was added in CalAgPermits that allows the user to designate any application as “pre-plant” and enter the commodity or site without generating any error messages.

Adjuvants

Use data on spray adjuvants (e.g., emulsifiers, wetting agents, foam suppressants, and other efficacy enhancers) were not reported before full-use reporting was required. Adjuvants are exempt from federal registration requirements but must be registered as pesticides in California. Examples of adjuvants include many alkyl groups and some petroleum distillates.

Cumulative Area Treated

The cumulative area treated is the sum of the area treated with an AI and is expressed in acres (applications reported in square feet are converted to acres). The cumulative area treated for a crop may be greater than the planted area of the crop since this measure accounts for a field being treated with the same AI more than once in a year. For example, if a 20-acre field is treated three times in a calendar year with an AI, the cumulative area treated would be reported as 60 acres.

It is important, however, to be aware of the potential to over-count acreage when summing cumulative area for products that have more than one AI. If a 20-acre field is treated with a product that contains three different pesticide AIs, the PUR record will correctly show that the *product* was applied to 20 acres, but that 20 acre value will also be attributed to each of the three AIs in any chemical summary reports. Adding these values across the AIs results in a total of 60 acres treated instead of the 20 acres actually treated.

Number of Applications

The number of applications is only reported for production agricultural applications. Applicators are required to submit one of two basic types of use reports, a production agricultural report or a monthly summary report. The production agricultural report must include information for each application. The monthly summary report, required for all uses other than production agriculture, includes only monthly totals for all applications of pesticide product, site or commodity, and applicator.

The total number of applications in the monthly summary reports is not consistently reported, so they are no longer included in the annual totals. (In the annual PUR reports before 1997, each monthly summary record was counted as one application) Note that in the annual summary report arranged by commodity, the total number of agricultural applications for the site or commodity may not equal the sum of all applications of the listed AIs. Since the summary report is at the AI level rather than the product level, a single application of a product comprised of two AIs will result in the summary report assigning the single application to both AIs listed under the commodity heading. Summing the agricultural applications for these two AIs would result in an incorrect total of two applications. The total applications value at the bottom of each commodity section removes the possibility of over-counting applications for products with more than one AI, and is therefore a more accurate value.

3 Data Summary

This report is a summary of 2015 data submitted to DPR as of September 27, 2016. PUR data are continually updated and therefore may not match later data from CalPIP or internal queries that contain corrected records identified after September 27, 2016.

Pesticide Use in California

In 2015, 213 million pounds of pesticide AIs were used in California. Since full use reporting was required in 1990, annual pesticide use has been observed to vary by less than 15 percent from the previous year. These fluctuations can be attributed to a variety of factors, including changes in planted acreage, crop plantings, pest pressures, and weather conditions.

The pounds of pesticides used and the number of applications are not necessarily accurate indicators of pesticide risk. There are reduced-risk pesticides that require higher use rates or more applications than many conventional pesticides but have little environmental or human health risk due to their mode of action, toxicity, and selectivity to the targeted pest.

In 2015, as in previous years, the region of greatest pesticide use was California's San Joaquin Valley (Table 1). The four counties in this region with the highest use were Fresno, Kern, Tulare, and San Joaquin. These counties were also among the leading producers of agricultural commodities.

Table 1: *Total pounds of pesticide active ingredients reported in each county and rank during 2014 and 2015*

	2014 Pesticide Use		2015 Pesticide Use	
County	Pounds Applied	Rank	Pounds Applied	Rank
Alameda	306,144	38	356,310	38
Alpine	272	58	193	58
Amador	96,036	44	95,631	45
Butte	2,988,763	17	3,227,227	15
Calaveras	59,965	48	52,806	47
Colusa	2,489,789	18	2,595,649	21
Contra Costa	412,947	36	580,357	35
Del Norte	199,519	41	135,966	43
El Dorado	152,314	42	148,703	42
Fresno	31,969,270	1	37,546,827	1
Glenn	2,091,507	21	2,210,193	22
Humboldt	36,735	51	38,253	50
Imperial	5,030,191	11	4,975,642	11
Inyo	12,151	55	14,009	53

Table 1: (continued) *Total pounds of pesticide active ingredients reported in each county and rank during 2014 and 2015*

	2014 Pesticide Use		2015 Pesticide Use	
County	Pounds Applied	Rank	Pounds Applied	Rank
Kern	27,821,945	2	31,903,060	2
Kings	6,902,956	9	7,016,567	10
Lake	583,418	34	739,467	33
Lassen	116,956	43	56,453	46
Los Angeles	2,088,625	22	2,598,817	20
Madera	9,588,770	5	11,294,779	5
Marin	76,885	47	107,679	44
Mariposa	8,751	57	5,856	56
Mendocino	906,058	31	1,307,324	29
Merced	8,980,921	7	10,115,786	6
Modoc	91,721	45	214,377	41
Mono	9,885	56	12,046	54
Monterey	9,407,636	6	9,181,358	7
Napa	1,365,951	26	1,581,059	25
Nevada	53,769	49	49,497	49
Orange	921,109	30	1,231,732	30
Placer	308,293	37	383,049	37
Plumas	26,863	52	20,971	52
Riverside	2,247,379	19	2,676,499	19
Sacramento	4,061,419	13	4,779,465	13
San Benito	660,443	33	589,271	34
San Bernardino	578,450	35	457,318	36
San Diego	1,620,462	24	1,458,292	26
San Francisco	39,914	50	28,937	51
San Joaquin	12,047,946	4	12,814,552	4
San Luis Obispo	3,041,144	15	3,212,575	16
San Mateo	261,383	39	251,648	40
Santa Barbara	4,785,627	12	4,965,270	12
Santa Clara	1,319,889	27	1,010,331	31
Santa Cruz	1,922,385	23	1,810,519	23
Shasta	247,169	40	291,774	39
Sierra	12,384	54	11,305	55
Siskiyou	1,616,458	25	1,428,155	28
Solano	1,309,612	28	1,451,108	27
Sonoma	2,228,887	20	2,839,007	18
Stanislaus	7,146,785	8	8,083,345	8
Sutter	3,024,005	16	3,136,720	17

Table 1: (continued) *Total pounds of pesticide active ingredients reported in each county and rank during 2014 and 2015*

	2014 Pesticide Use		2015 Pesticide Use	
County	Pounds Applied	Rank	Pounds Applied	Rank
Tehama	863,442	32	969,530	32
Trinity	22,324	53	4,874	57
Tulare	14,924,204	3	17,610,519	3
Tuolumne	83,337	46	50,298	48
Ventura	6,541,333	10	7,345,915	9
Yolo	3,487,379	14	4,168,753	14
Yuba	1,035,852	29	1,602,424	24
Total	190,235,729		212,846,042	

Reported pesticide use in California in 2015 totaled 213 million pounds, an increase of 23 million pounds (12 percent) from 2014. Production agriculture, the major category of use subject to reporting requirements, accounted for most of the increase. Applications increased by 22 million pounds for production agriculture and 511,000 pounds for post-harvest treatments. Use also increased for structural pest control, landscape maintenance, and other reported non-agricultural uses that includes rights-of-way, vector control, research, and fumigation of non-food and non-feed materials such as lumber and furniture. Table 2 breaks down the pounds of pesticide use by general use categories: production agriculture, post-harvest commodity treatment, structural pest control, landscape maintenance, and all others.

Table 2: *Pounds of pesticide active ingredients, 1998 – 2015, by general use categories.*

Year	Production Agriculture	Post-Harvest Treatment	Structural Pest Control	Landscape Maintenance	All Others	Total Pounds
1998	207,992,681	1,760,320	5,931,471	1,407,577	6,874,091	223,966,141
1999	189,345,226	2,059,856	5,673,549	1,412,248	7,906,798	206,397,676
2000	175,767,646	2,167,778	5,187,122	1,414,849	6,854,657	191,392,052
2001	142,963,040	1,462,153	4,922,709	1,290,208	6,324,210	156,962,320
2002	159,214,665	1,852,668	5,469,430	1,449,912	6,834,190	174,820,865
2003	161,052,563	1,785,747	5,177,461	1,975,868	7,526,922	177,518,562
2004	165,915,754	1,874,210	5,120,268	1,612,069	6,996,577	181,518,877
2005	178,369,796	2,260,932	5,625,437	1,775,676	8,517,584	196,549,424
2006	168,668,394	2,216,042	5,273,689	2,286,673	10,269,490	188,714,289
2007	157,482,263	2,279,537	3,967,352	1,672,401	7,337,591	172,739,144
2008	149,462,298	2,540,189	3,202,933	1,589,055	7,236,531	164,031,005
2009	146,533,494	1,479,776	2,911,101	1,344,884	6,016,194	158,285,448
2010	160,439,568	2,164,627	3,699,143	1,734,503	8,025,216	176,063,056
2011	177,360,991	1,546,236	3,149,099	1,723,384	8,732,163	192,511,874
2012	171,840,307	1,238,020	3,465,040	1,555,171	9,084,021	187,182,558
2013	178,927,830	1,526,568	3,804,556	1,465,698	9,746,194	195,470,847
2014	174,736,093	1,318,037	4,030,200	1,622,677	8,528,721	190,235,729
2015	196,252,578	1,829,561	4,299,033	1,727,864	8,737,006	212,846,042

Pesticide Sales in California

The amount of pesticides reported in the PUR database does not reflect the total amount of pesticides sold each year. Typically, only a third of the pesticide AIs sold in a given year are subject to use reporting. Examples of AIs that do not require reports of use are chlorine (used primarily for municipal water treatment) and home-use pesticide products.

There were 687 million pounds of pesticide AIs sold in 2014, an 8 percent increase from the year before. 2015 sales are currently estimated at around 981 million, although that figure may change. Sales data are continuously updated and corrected. Values from earlier years are posted on DPR's website at <www.cdpr.ca.gov>, click "A - Z Index," "Sales of pesticides."

4 Trends in Pesticide Use in Certain Pesticide Categories

This report discusses two different measures of pesticide use: amount of AI applied in pounds and cumulative area treated in acres (for an explanation of cumulative area treated see page 10).

Because different AIs are often used at different rates, the picture of pesticide use may vary between the two measures. Most pesticides are applied at rates of 1-2 pounds per acre, but others at a few ounces or hundreds of pounds per acre. The contrast between measures, pounds and acres, can be seen by looking at the use of different pesticide types (Figures 1 and 2). Figure 1, the amount applied by weight (pounds), shows that pesticides with both fungicide and insecticide properties (fungicide/insecticides) such as sulfur had the highest use, followed by insecticides and fumigants. By cumulative area (acres) treated in Figure 2, insecticides, herbicides, and fungicides were used the most.

When comparing use among different AIs, area treated is often the more useful measure. Pounds of use will emphasize pesticides used at high rates, such as sulfur, horticultural oils, and fumigants. However, the trends in use for any individual AI will be similar regardless of the measure of use.

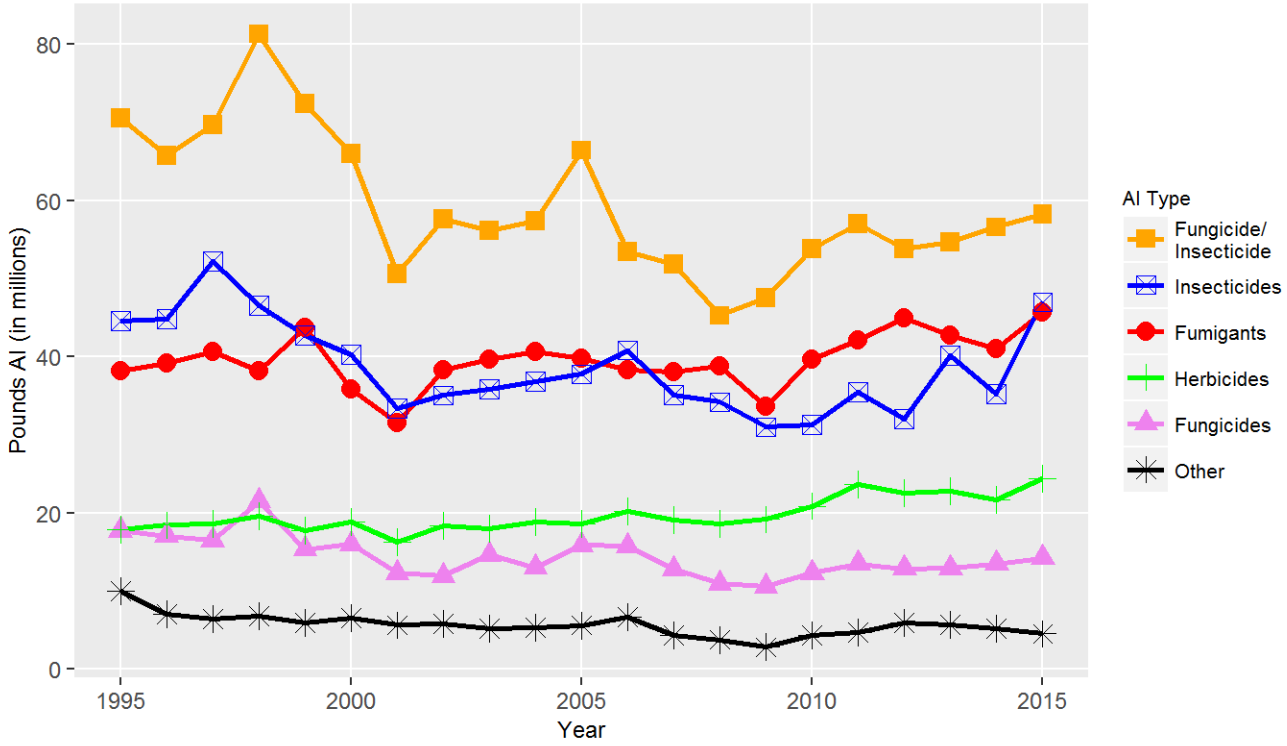

Figure 1: *Pounds of all AIs in the major types of pesticides from 1995 to 2015, where "Other" includes pesticides such as rodenticides, molluscicides, algaecides, repellents, anti-microbials, anti-foulants, disinfectants, and biocides.*

The AIs with the highest total reported pounds were sulfur, petroleum and mineral oils, 1,3-dichloropropene, glyphosate, and metam-potassium (potassium N-methyldithiocarbamate). Sulfur accounted for 24 percent of all reported pesticide use in 2015.

Reported pesticide use by cumulative area treated in 2015 was 96 million acres, an increase of 4.8

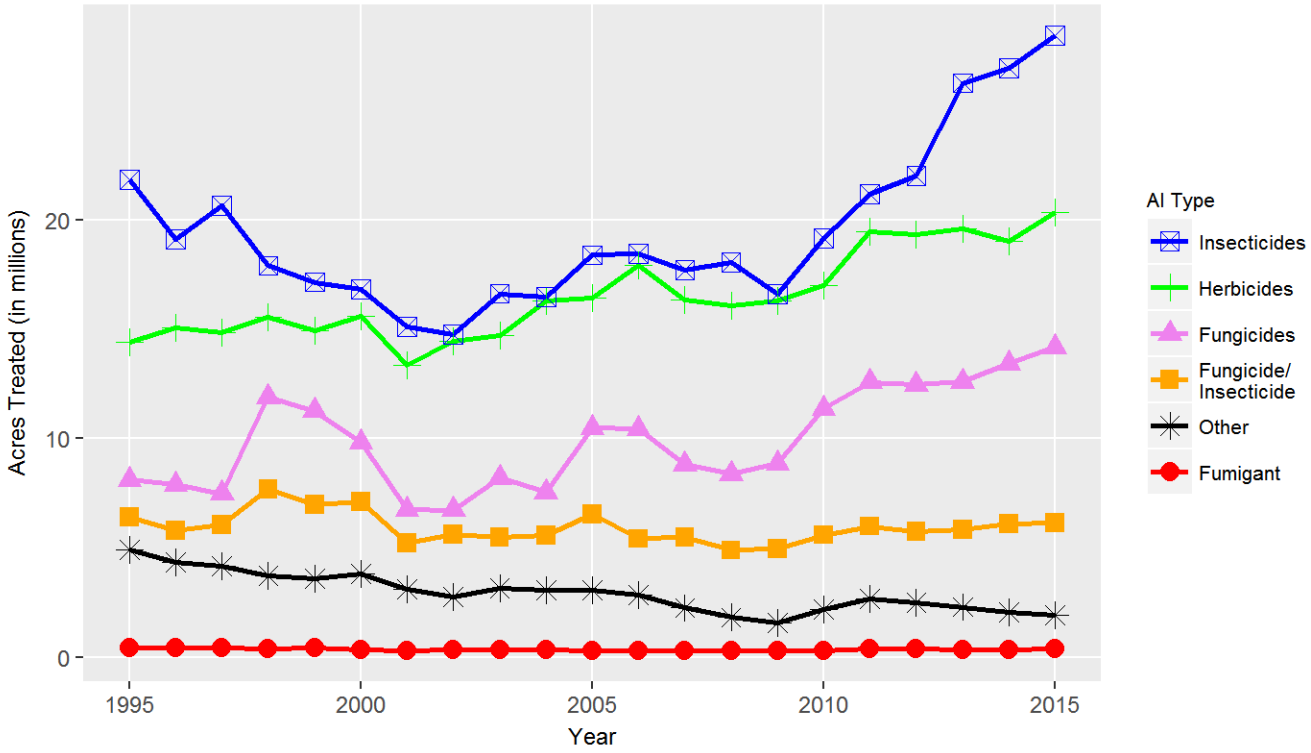

Figure 2: *Acres treated by all AIs in the major types of pesticides from 1995 to 2015, where "Other" includes pesticides such as rodenticides, molluscicides, algaecides, repellents, anti-microbials, anti-foulants, disinfectants, and biocides.*

million acres (5.3 percent) from 2014. The non-adjuvant pesticides applied to the greatest area in 2015 were glyphosate, sulfur, petroleum and mineral oils, abamectin, and oxyfluorfen (Figures 3, 4, and A-1). The top AIs by use types were petroleum and mineral oils for insecticides, copper for fungicides, sulfur for fungicide/insecticides, glyphosate for herbicides, and aluminum phosphide for fumigants.

Pesticide use is summarized for eight different pesticide categories from 2007 to 2015 (Tables 3 – 18) and from 1995 to 2015 (Figures 5 – 12). These categories include reproductive toxicity, carcinogens, cholinesterase inhibitors, ground water contaminants, toxic air contaminants, fumigants, oils, and biopesticides. Changes from 2014 to 2015 are summarized as follows:

- *Reproductive toxins:* Chemicals classified as reproductive toxins increased slightly in amount applied from 2014 to 2015 (31,000-pound increase, 0.4 percent) but decreased in the area treated (2,700-acres treated decrease, 0.1 percent). The increase in amount applied was mainly due to greater use of the fumigant metam-sodium. The decrease in area mostly resulted from less use of the fungicides myclobutanil and thiophanate-methyl and the miticide propargite. Pesticides in this category are listed on the State's Proposition 65 list of chemicals known to cause reproductive toxicity.

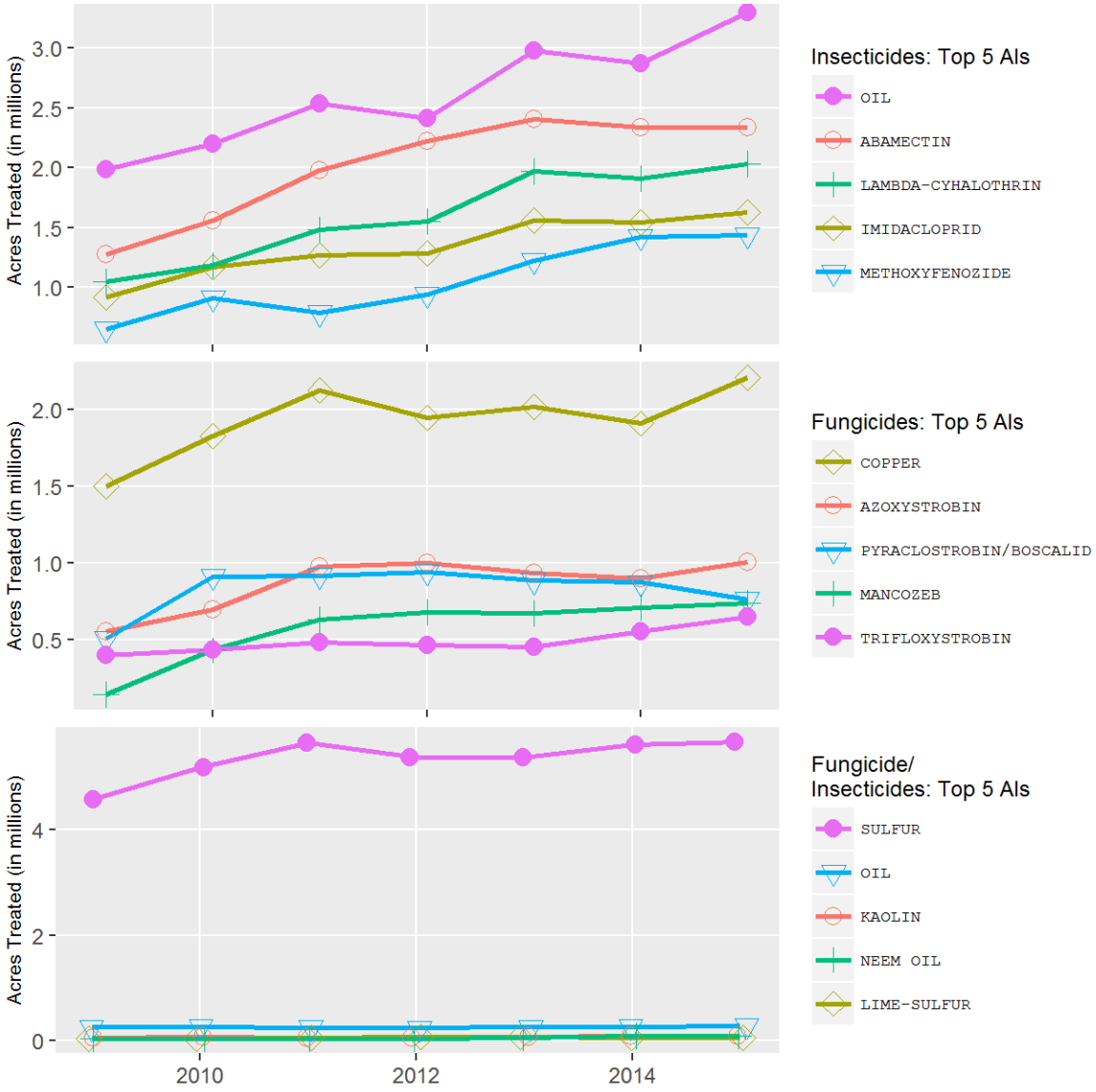

Figure 3: *Acres treated by the top 5 AIs in each of the major types of pesticides from 2008 to 2015.*

- *Carcinogens:* The amount of pesticides classified as carcinogens increased by 5.1 million pounds from 2014 to 2015 (17 percent), but the area treated decreased by 111,000 acres (3.8 percent). The increase in amount applied was mainly due to the greater use of the fumigants metam-potassium and 1,3-dichloropropene. The decrease in area treated was mostly due to less use of the herbicides diuron and oryzalin and the fungicide iprodione. The pesticides in this category are listed by U.S. EPA as A or B carcinogens or on the State's Proposition 65 list of chemicals known to cause cancer.

- *Cholinesterase inhibitors:* Use of cholinesterase-inhibiting pesticides (organophosphate and some carbamate pesticides) decreased from the previous year (178,000-pound decrease, 3.8 percent; 416,000-acre decrease, 11 percent). Most of the decrease in amount applied

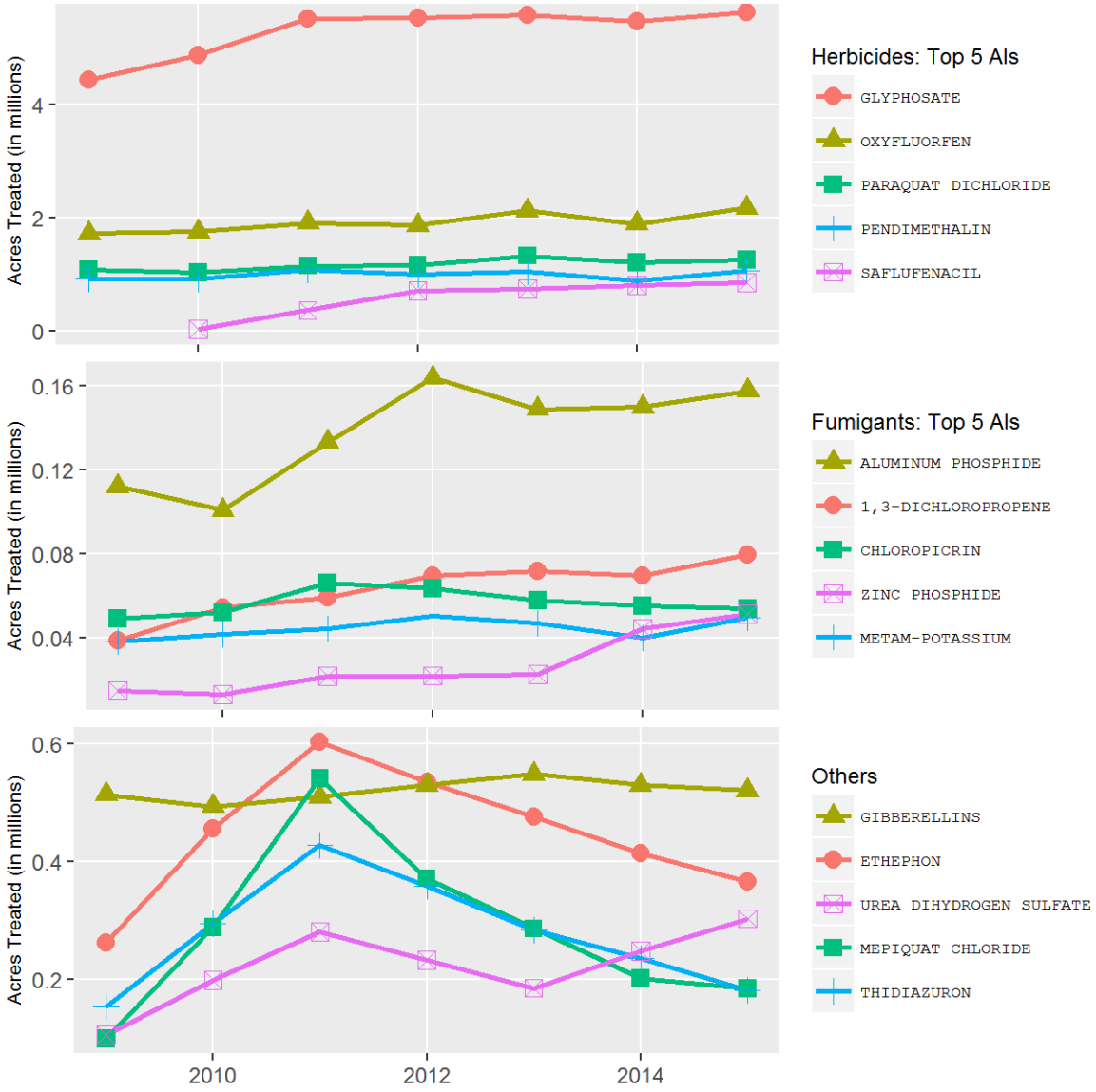

Figure 4: *Acres treated by the top 5 AIs in each of the major types of pesticides from 2008 to 2015.*

and area treated resulted from a decrease in the use of the insecticide chlorpyrifos , which was designated as a restricted-use pesticide for agriculture in 2015. Other AIs with large decreases were the insecticides dimethoate, oxamyl, and malathion.

- *Ground water contaminants:* The use of AIs categorized as ground water contaminants decreased in both amount applied and area treated (107,000-pound decrease, 15 percent; 114,000-acre decrease, 20 percent). The decreases were mostly from less use of the herbicides diuron and simazine.

- *Toxic air contaminants:* The use of AIs categorized as toxic air contaminants increased in both amount applied and area treated (4.5 million-pound increase, 10 percent; 37,000-acre

increase, 1.5 percent). By pounds, most toxic air contaminants are fumigants such as metam-potassium and 1,3-dichloropropene that are used at high rates and whose overall use increased. The increase in area treated was mainly due to increased uses of the fungicide mancozeb and the insecticide carbaryl.

- *Fumigants:* The use of fumigant AIs increased in both amount applied and area treated (4.7 million-pound increase, 11 percent; 41,000-acre increase, 11 percent). Most of the increase was from metam-potassium and 1,3-dichloropropene; however, use of methyl bromide and chloropicrin decreased.

- *Oils:* Use of oil pesticides increased in both amount and area treated (11 million-pound increase, 37 percent; 303,000-acre increase, 6.9 percent). Oils comprise different AIs, but the category used here includes only those derived from petroleum distillation. Some of these oils may be on the State's Proposition 65 list of chemicals known to cause cancer, but most serve as alternatives to highly toxic pesticides. Some highly refined petroleum-based oils are also used by organic growers.

- *Biopesticides:* Use of biopesticides increased in both amount and area treated (770,000-pound increase, 13 percent; 573,000-acre increase, 8.4 percent). The biopesticide with the most use by amount was kaolin, which accounted for most of the increased use in this category. Citric acid, vegetable oil, and s-methoprene accounted for most of the increase by area treated. Kaolin is used both as a fungicide and insecticide, s-methoprene as an insect growth regulator, and citric acid and vegetable oil as adjuvants. In general, biopesticides are derived from or synthetically mimic natural materials such as animals, plants, bacteria, and minerals and fall into three major classes: microbial, plant-incorporated protectant, or naturally occurring substances.

Since 1990, the reported pounds of pesticides applied have fluctuated from year to year. An increase or decrease in use from one year to the next or in the span of a few years does not necessarily indicate a general trend in use, but rather variations related to changes in weather, pricing, supply of raw ingredients, or regulations. Use changes over short periods of time (three to five years) may suggest trends such as the increased pesticide use from 2001 to 2005 or decreased use from 2005 to 2009. However, regression analyses on use from 1996 to 2015 do not indicate a significant trend of either increase or decrease in total pesticide use.

The summaries detailed in the following use categories are not intended to serve as indicators of pesticide risks to the public or the environment. Rather, the data supports DPR regulatory functions to enhance public safety and environmental protection. (See "Continuous Evaluation of Pesticides" on page 2.)

USE TRENDS OF PESTICIDES ON THE STATE'S PROPOSITION 65 LIST OF CHEMICALS THAT ARE "KNOWN TO CAUSE REPRODUCTIVE TOXICITY."

Table 3: *The reported pounds of pesticides used that are on the State's Proposition 65 list of chemicals that are "known to cause reproductive toxicity." Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
1080	<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4-DB ACID	9,185	11,416	13,523	4,570	55	5,826	10,807	10,547	9,104
ABAMECTIN	12,362	12,846	16,624	19,384	26,727	32,958	40,093	37,403	38,263
AMITRAZ	0	0	7	0	0	0	1,486	20	96
ARSENIC PENTOXIDE	7,805	7,433	400	16,144	8,034	9,240	8,480	16,719	22,190
ARSENIC TRIOXIDE	<1	<1	<1	<1	<1	<1	0	<1	<1
BENOMYL	590	100	56	31	28	32	3	10	2
BROMACIL, LITHIUM SALT	1,172	1,851	896	1,835	1,486	1,422	1,145	2,472	2,891
BROMOXYNIL OCTANOATE	41,406	65,375	50,300	43,643	47,817	56,495	49,705	44,088	52,571
CARBARYL	142,010	126,742	135,301	114,077	74,944	113,965	117,367	131,600	155,333
CYANAZINE	0	0	0	0	1	<1	0	1	103
CYCLOATE	31,868	21,242	25,284	27,292	31,037	33,562	30,619	36,566	39,444
DICLOFOP-METHYL	157	0	15	0	7	0	0	0	0
DINOCAP	2	2	2	0	<1	0	0	0	0
DINOSEB	81	166	816	26	75	60	22	374	7
DIOCTYL PHTHALATE	610	340	186	453	248	262	198	73	36
DISODIUM CYANODITHIOIMIDO CARBONATE	0	0	0	0	0	80	<1	0	101
EPTC	152,707	129,470	128,993	118,509	139,605	168,665	187,349	235,271	235,816
ETHYLENE GLYCOL MONOMETHYL ETHER	2,653	1,986	2,257	5,187	4,333	3,782	6,202	5,601	7,601
ETHYLENE OXIDE	2	3	7	0	0	8	0	<1	0
FENOXAPROP-ETHYL	153	219	11	<1	8	0	0	0	0
FLUAZIFOP-BUTYL	5	3	21	11	8	6	17	42	16
HYDRAMETHYLNON	887	825	393	609	1,096	486	444	6,024	398
LINURON	58,592	60,247	51,265	48,424	54,530	57,637	52,529	54,158	50,963
METAM-SODIUM	9,930,337	9,497,562	9,028,103	11,428,913	10,861,317	8,428,425	4,846,428	4,300,079	4,643,122
METHYL BROMIDE	6,448,643	5,693,325	5,615,653	4,809,311	4,057,921	4,003,020	3,535,185	2,964,775	2,666,222
METIRAM	0	0	0	0	15	34	17	13	<1
MOLINATE	75,241	19,653	12,516	24	<1	3	<1	<1	<1
MYCLOBUTANIL	68,403	61,550	59,056	65,604	65,495	64,481	61,155	65,085	60,951
NABAM	9,073	9,635	8,963	10,518	13,358	13,485	22,187	16,535	9,357
NICOTINE	<1	<1	<1	<1	7	<1	0	0	<1
NITRAPYRIN	9	0	84	211	0	<1	2	0	5
OXADIAZON	12,517	9,402	8,741	12,382	7,783	7,272	6,755	4,958	12,110
OXYDEMETON-METHYL	122,723	111,612	68,576	71,290	26,017	17,562	10,656	8,407	6,756

Table 3: (continued) *The reported pounds of pesticides used that are on the State's Proposition 65 list of chemicals that are "known to cause reproductive toxicity."*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
OXYTHIOQUINOX	166	170	45	6	<1	1	<1	1	0
POTASSIUM DIMETHYL DITHIO CARBAMATE	0	0	<1	0	0	0	0	0	0
PROPARGITE	531,832	386,203	378,099	294,853	296,351	252,213	291,007	246,831	213,434
RESMETHRIN	452	269	211	206	122	46	49	233	39
SODIUM DIMETHYL DITHIO CARBAMATE	9,073	9,800	8,963	11,053	13,358	13,485	22,187	16,535	9,357
STREPTOMYCIN SULFATE	5,809	4,394	3,233	4,040	4,651	4,054	4,794	5,148	4,717
TAU-FLUVALINATE	1,028	1,068	1,179	869	834	1,084	1,057	1,261	1,195
THIOPHANATE-METHYL	99,497	74,903	89,882	115,025	87,664	109,800	103,618	112,663	113,106
TRIADIMEFON	873	1,503	1,056	2,153	1,940	2,427	1,620	1,986	1,610
TRIBUTYLTIN METHACRYLATE	0	0	0	0	0	0	1	0	0
TRIFORINE	64	69	4	42	22	2	4	1	<1
VINCLOZOLIN	392	512	476	217	328	470	151	219	149
WARFARIN	1	<1	<1	1	2	2	1	1	<1
TOTAL	17,778,384	16,321,895	15,711,200	17,226,914	15,827,222	13,402,350	9,413,342	8,325,700	8,357,067

Table 4: *The reported cumulative acres treated with pesticides that are on the State's Proposition 65 list of chemicals that are "known to cause reproductive toxicity." Use includes primarily agricultural applications. The grand total for acres treated may be less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
1080	170	<1	67	176	127	<1	111	4	<1
2,4-DB ACID	15,080	19,457	21,629	6,980	121	11,301	13,739	14,719	15,508
ABAMECTIN	1,257,542	1,225,216	1,274,898	1,556,401	1,980,197	2,222,764	2,406,361	2,334,650	2,334,903
AMITRAZ	0	0	74	0	0	0	349	316	86
ARSENIC PENTOXIDE	<1	<1	<1	<1	<1	<1	<1	<1	<1
ARSENIC TRIOXIDE	<1	<1	<1	<1	<1	<1	0	<1	<1
BENOMYL	568	221	162	0	26	19	1	<1	<1
BROMACIL, LITHIUM SALT	<1	<1	<1	<1	<1	<1	<1	<1	<1
BROMOXYNIL OCTANOATE	136,831	186,026	146,301	125,926	139,567	153,503	132,264	118,306	134,156
CARBARYL	97,016	96,136	107,458	81,683	68,272	97,229	96,646	108,750	135,806
CYANAZINE	0	0	0	0	4	<1	0	<1	<1
CYCLOATE	15,601	10,581	12,058	13,799	14,895	17,565	16,045	19,124	20,937
DICLOFOP-METHYL	224	0	30	0	20	0	0	0	0
DINOCAP	8	7	7	0	1	0	0	0	0
DINOSEB	16	453	304	111	427	81	55	450	67
DIOCTYL PHTHALATE	13,258	3,582	4,928	7,921	4,741	5,311	3,188	1,885	626
DISODIUM CYANODITHIOIMIDO CARBONATE	0	0	0	0	0	235	<1	0	300
EPTC	51,706	45,560	49,708	44,289	47,805	56,872	69,989	89,126	90,801
ETHYLENE GLYCOL MONOMETHYL ETHER	26,412	14,857	14,573	35,802	37,642	35,682	34,566	35,902	38,633
ETHYLENE OXIDE	<1	2	60	0	0	<1	0	<1	0
FENOXAPROP-ETHYL	2,552	3,444	142	<1	61	0	0	0	0
FLUAZIFOP-BUTYL	<1	6	2	80	<1	<1	40	3	180
HYDRAMETHYLNON	931	1,138	1,280	4,689	1,514	6,876	1,376	1,653	5,307
LINURON	81,041	81,244	68,604	68,058	77,029	81,958	73,493	76,353	71,331
METAM-SODIUM	78,030	71,815	74,132	72,748	70,874	58,998	28,153	24,422	29,262
METHYL BROMIDE	45,675	35,685	39,587	32,293	47,091	30,237	26,428	16,578	13,443
METIRAM	0	0	0	0	<1	<1	<1	<1	<1
MOLINATE	17,476	4,529	2,942	6	<1	<1	3	<1	1
MYCLOBUTANIL	599,368	545,175	512,906	588,750	569,239	574,657	537,489	564,776	544,380
NABAM	2	1	3	12	<1	<1	<1	<1	<1
NICOTINE	<1	<1	<1	<1	<1	<1	0	0	<1
NITRAPYRIN	35	0	88	111	0	<1	1	0	<1
OXADIAZON	2,991	2,747	1,451	1,712	927	1,148	1,511	1,239	1,777
OXYDEMETON-METHYL	161,835	140,760	82,368	86,131	27,447	18,204	12,163	9,096	7,356
OXYTHIOQUINOX	9	5	4	4	1	1	<1	<1	0
POTASSIUM DIMETHYL DITHIO CARBAMATE	0	0	<1	0	0	0	0	0	0

Table 4: (continued) *The reported cumulative acres treated with pesticides that are on the State's Proposition 65 list of chemicals that are "known to cause reproductive toxicity."*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
PROPARGITE	261,953	186,581	174,063	137,106	142,430	114,213	121,952	104,733	88,018
RESMETHRIN	18	3	11	<1	6	4	436	18	7
SODIUM DIMETHYL DITHIO CARBAMATE	2	1	3	12	<1	<1	<1	<1	<1
STREPTOMYCIN SULFATE	38,468	27,011	24,453	28,966	39,190	34,894	37,999	39,665	40,678
TAU-FLUVALINATE	4,777	5,708	5,015	4,583	5,048	5,001	5,396	5,363	5,184
THIOPHANATE-METHYL	100,011	71,867	92,429	122,563	85,806	124,189	120,649	134,969	119,737
TRIADIMEFON	1,806	2,043	1,007	1,172	2,469	1,341	907	1,282	2,040
TRIBUTYLTIN METHACRYLATE	0	0	0	0	0	0	<1	0	0
TRIFORINE	373	11	10	22	3	<1	<1	3	<1
VINCLOZOLIN	258	212	85	86	100	34	11	5	10
WARFARIN	3,165	1,118	365	290	1,290	3,115	381	435	556
TOTAL	3,015,203	2,783,199	2,713,205	3,022,469	3,364,368	3,655,434	3,741,701	3,703,825	3,701,092

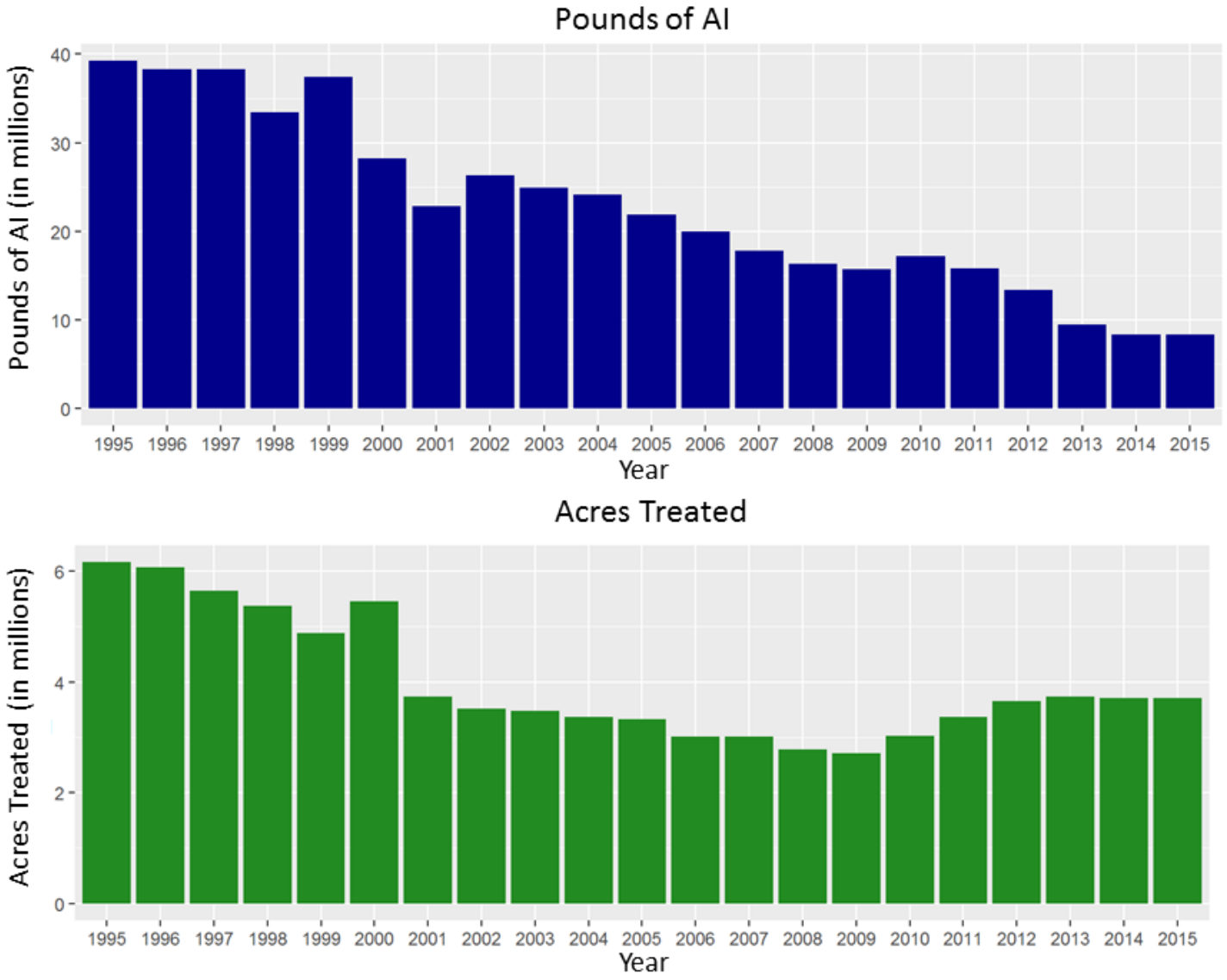

Figure 5: *Use trends of pesticides that are on the State's Proposition 65 list of chemicals that are "known to cause reproductive toxicity." Reported pounds of active ingredient (AI) applied include both agricultural and non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

USE TRENDS OF PESTICIDES LISTED BY U.S. EPA AS A OR B CARCINOGENS OR ON THE STATE'S PROPOSITION 65 LIST OF CHEMICALS THAT ARE "KNOWN TO CAUSE CANCER."

Table 5: *The reported pounds of pesticides used that are listed by U.S. EPA as A or B carcinogens or on the State's Proposition 65 list of chemicals that are "known to cause cancer." Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
1,3-DICHLOROPROPENE	9,596,317	9,708,712	6,399,534	8,797,078	10,924,344	11,952,624	12,941,042	13,584,346	15,757,907
ACIFLUORFEN, SODIUM SALT	0	0	0	<1	0	<1	<1	<1	0
ALACHLOR	3,911	4,343	6,362	9,936	9,294	8,836	6,562	5,118	3,230
ARSENIC ACID	0	0	0	0	17	0	0	0	0
ARSENIC PENTOXIDE	7,805	7,433	400	16,144	8,034	9,240	8,480	16,719	22,190
ARSENIC TRIOXIDE	<1	<1	<1	<1	<1	<1	0	<1	<1
CACODYLIC ACID	41	43	<1	3	<1	<1	0	<1	0
CAPTAN	456,475	362,757	329,747	450,225	376,597	403,834	349,430	370,136	510,832
CARBARYL	142,010	126,742	135,301	114,077	74,944	113,965	117,367	131,600	155,333
CHLOROTHALONIL	736,173	566,773	715,152	961,497	1,148,241	1,183,095	1,114,933	1,215,530	1,065,921
CHROMIC ACID	10,904	10,384	559	22,555	11,224	12,908	11,847	23,358	31,629
CREOSOTE	3	<1	<1	0	0	0	3	0	1
DAMINOZIDE	7,192	7,094	6,570	9,361	8,441	8,252	8,553	8,345	8,921
DDVP	6,376	6,859	4,164	4,169	5,389	4,803	4,619	4,032	4,079
DIOCTYL PHTHALATE	610	340	186	453	248	262	198	73	36
DIPROPYL ISOCINCHOMERONATE	2	<1	<1	1	1	<1	<1	<1	1
DIURON	860,510	734,757	622,598	588,905	674,536	554,604	413,267	324,889	316,596
ETHOPROP	24,241	26,897	20,793	5,645	7,475	2,077	2,502	2,906	1,751
ETHYLENE OXIDE	2	3	7	0	0	8	0	<1	0
FENOXYCARB	4	8	5	3	3	2	1	1	9
FOLPET	0	<1	0	<1	0	<1	<1	<1	<1
FORMALDEHYDE	47,733	24,306	3,972	5,511	4,615	3,847	11,165	52,989	31,956
IMAZALIL	14,421	23,415	13,255	26,181	25,767	26,004	26,013	19,237	21,707
IPRODIONE	255,123	252,212	248,877	349,532	353,698	297,767	260,198	241,049	221,170
LINDANE	2	21	8	18	1	0	2	0	6
MANCOZEB	408,652	330,238	281,639	757,637	1,045,283	1,130,972	1,149,338	1,281,789	1,274,902
MANEB	1,061,028	861,006	656,648	370,333	54,227	6,260	1,383	1,274	667
METAM-SODIUM	9,930,337	9,497,562	9,028,103	11,428,913	10,861,317	8,428,425	4,846,428	4,300,079	4,643,122
METHYL IODIDE	0	0	0	0	1,157	21	0	0	0
METIRAM	0	0	0	0	15	34	17	13	<1
NITRAPYRIN	9	0	84	211	0	<1	2	0	5
ORTHO-PHENYLPHENOL	5,128	4,389	2,133	2,271	2,582	2,964	1,713	1,777	1,313
ORTHO-PHENYLPHENOL, SODIUM SALT	2,266	3,211	2,294	2,129	5,192	3,586	4,375	3,611	4,815
ORYZALIN	664,266	604,932	529,508	602,260	768,867	686,209	584,252	582,385	509,953
OXADIAZON	12,517	9,402	8,741	12,382	7,783	7,272	6,755	4,958	12,110

Table 5: (continued) *The reported pounds of pesticides used that are listed by U.S. EPA as A or B carcinogens or on the State's Proposition 65 list of chemicals that are "known to cause cancer."*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
OXYTHIOQUINOX	166	170	45	6	<1	1	<1	1	0
PARA-DICHLOROBENZENE	15	1	17	0	<1	18	<1	0	0
PENTACHLOROPHENOL	22	4	0	3	18	224	274	11	2
POTASSIUM DICHROMATE	0	0	0	0	0	0	<1	0	<1
POTASSIUM N-METHYLDITHIOCARBAMATE	3,785,436	5,524,647	4,102,412	4,832,615	5,673,371	8,320,255	9,484,467	7,798,703	10,513,789
PROPARGITE	531,832	386,203	378,099	294,853	296,351	252,213	291,007	246,831	213,434
PROPOXUR	191	188	202	298	808	359	373	251	100
PROPYLENE OXIDE	110,068	105,600	111,609	300,008	449,037	389,070	410,360	400,719	392,724
PROPYZAMIDE	114,882	104,077	73,811	51,384	49,678	47,404	42,022	42,662	41,909
SODIUM DICHROMATE	0	0	0	0	0	0	0	2	0
TERRAZOLE	872	1,534	1,140	1,500	638	503	390	437	437
THIODICARB	686	410	511	152	472	145	156	0	0
VINCLOZOLIN	392	512	476	217	328	470	151	219	149
TOTAL	28,798,623	29,297,183	23,684,962	30,018,465	32,849,990	33,858,532	32,099,645	30,666,050	35,762,708

Table 6: *The reported cumulative acres treated with pesticides that are listed by U.S. EPA as A or B carcinogens or on the State's Proposition 65 list of chemicals that are "known to cause cancer." Use includes primarily agricultural applications. The grand total for acres treated may be less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
1,3-DICHLOROPROPENE	53,937	57,922	38,374	54,209	59,065	69,422	71,794	69,558	79,422
ACIFLUORFEN, SODIUM SALT	0	0	0	<1	0	<1	<1	4	0
ALACHLOR	1,500	1,635	2,261	3,276	3,385	3,284	2,670	2,033	1,497
ARSENIC ACID	0	0	0	0	<1	0	0	0	0
ARSENIC PENTOXIDE	<1	<1	<1	<1	<1	<1	<1	<1	<1
ARSENIC TRIOXIDE	<1	<1	<1	<1	<1	<1	0	<1	<1
CACODYLIC ACID	<1	<1	<1	<1	<1	<1	0	<1	0
CAPTAN	215,864	198,262	173,133	245,464	209,979	209,627	187,988	211,312	211,980
CARBARYL	97,016	96,136	107,458	81,683	68,272	97,229	96,646	108,750	135,806
CHLOROTHALONIL	389,497	292,385	377,954	493,216	588,441	571,893	530,305	566,235	540,372
CHROMIC ACID	<1	<1	<1	<1	<1	<1	<1	<1	<1
CREOSOTE	1	1	2	0	0	0	<1	0	<1
DAMINOZIDE	2,291	2,471	2,111	4,357	2,430	2,982	2,529	2,413	2,394
DDVP	2,733	2,231	2,685	1,880	5,184	6,530	5,593	3,307	6,282
DIOCTYL PHTHALATE	13,258	3,582	4,928	7,921	4,741	5,311	3,188	1,885	626
DIPROPYL ISOCINCHOMERONATE	<1	<1	<1	19	<1	<1	<1	<1	1
DIURON	702,939	514,554	405,583	520,587	691,391	555,446	440,197	342,067	284,513
ETHOPROP	4,283	4,159	4,293	1,348	1,892	541	676	802	574
ETHYLENE OXIDE	<1	2	60	0	0	<1	0	<1	0
FENOXYCARB	210	489	353	100	106	110	37	58	15
FOLPET	0	<1	0	<1	0	<1	<1	<1	<1
FORMALDEHYDE	57	67	5	1	6	4	52	2	30
IMAZALIL	<1	668	<1	26	2	<1	<1	32	1
IPRODIONE	412,699	436,226	434,326	578,691	638,622	530,012	479,154	458,958	407,705
LINDANE	0	37	10	31	1	0	<1	0	28
MANCOZEB	212,349	169,422	145,616	433,833	634,215	678,916	675,954	710,867	741,714
MANEB	655,235	558,506	471,395	290,266	40,588	4,559	1,524	1,006	698
METAM-SODIUM	78,030	71,815	74,132	72,748	70,874	58,998	28,153	24,422	29,262
METHYL IODIDE	0	0	0	0	278	37	0	0	0
METIRAM	0	0	0	0	<1	<1	<1	<1	<1
NITRAPYRIN	35	0	88	111	0	<1	1	0	<1
ORTHO-PHENYLPHENOL	149	22	49	58	117	85	130	104	329
ORTHO-PHENYLPHENOL, SODIUM SALT	<1	<1	<1	<1	<1	<1	<1	<1	<1
ORYZALIN	313,343	272,273	236,523	217,193	294,499	263,655	203,900	203,359	162,309
OXADIAZON	2,991	2,747	1,451	1,712	927	1,148	1,511	1,239	1,777
OXYTHIOQUINOX	9	5	4	4	1	1	<1	<1	0
PARA-DICHLOROBENZENE	<1	0	<1	<1	<1	<1	<1	0	0

Table 6: (continued) *The reported cumulative acres treated with pesticides that are listed by U.S. EPA as A or B carcinogens or on the State's Proposition 65 list of chemicals that are "known to cause cancer."*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
PENTACHLOROPHENOL	10	46	0	4	1	15	170	2	5
POTASSIUM DICHROMATE	0	0	0	0	0	0	<1	0	<1
POTASSIUM N-METHYLDITHIOCARBAMATE	42,988	56,009	38,197	41,444	44,078	50,361	46,861	39,708	49,507
PROPARGITE	261,953	186,581	174,063	137,106	142,430	114,213	121,952	104,733	88,018
PROPOXUR	<1	10	356	<1	3	<1	4	178	39
PROPYLENE OXIDE	<1	12	<1	<1	<1	288	9	<1	<1
PROPYZAMIDE	148,399	133,426	102,176	69,328	61,014	57,625	51,921	51,307	49,040
SODIUM DICHROMATE	0	0	0	0	0	0	0	<1	0
TERRAZOLE	879	1,419	711	5,107	443	579	414	660	255
THIODICARB	1,196	673	680	192	656	206	247	0	0
VINCLOZOLIN	258	212	85	86	100	34	11	5	10
TOTAL	3,614,111	3,064,004	2,799,064	3,261,999	3,563,740	3,283,112	2,953,588	2,905,007	2,794,206

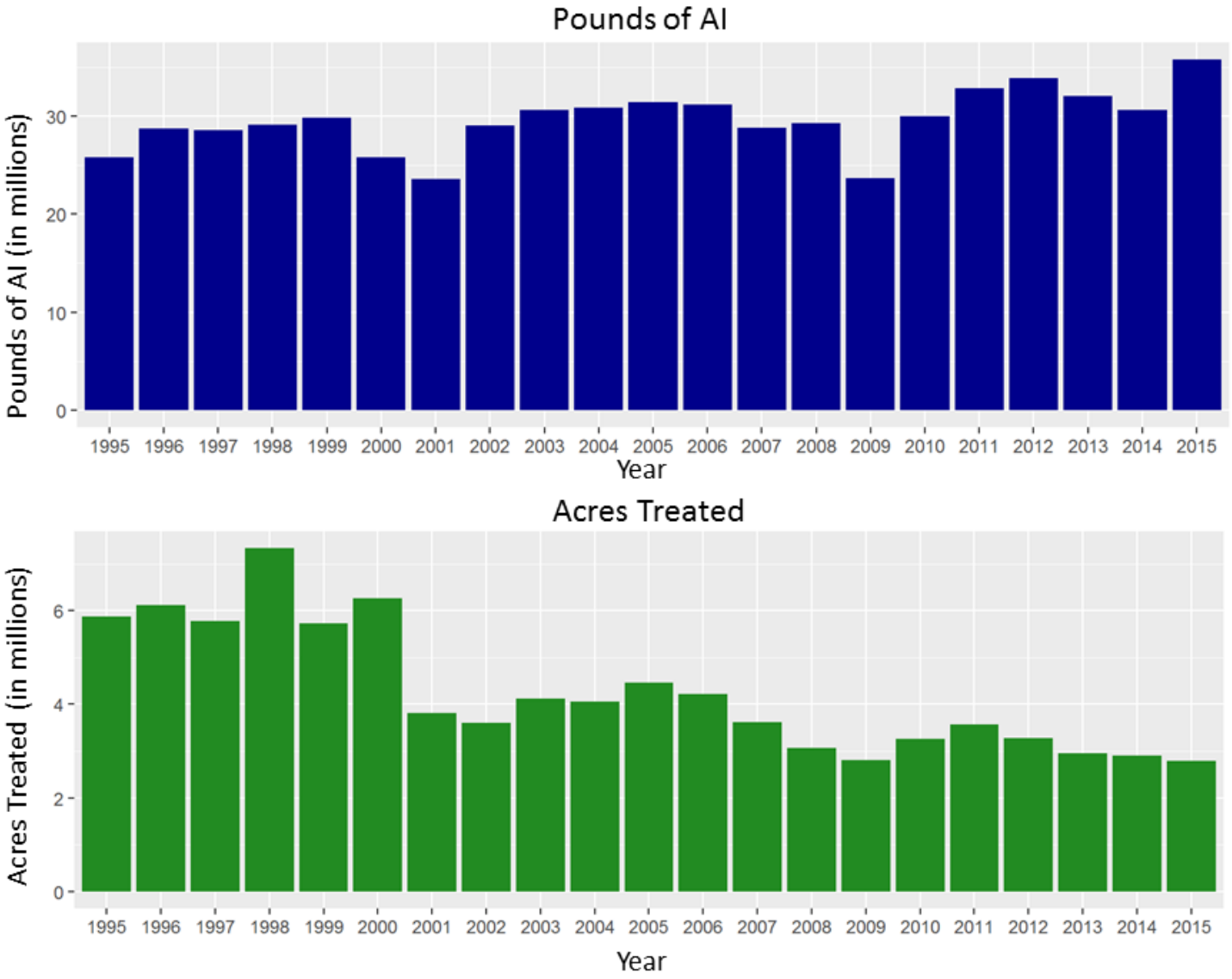

Figure 6: *Use trends of pesticides that are listed by U.S. EPA as A or B carcinogens or on the State's Proposition 65 list of chemicals that are "known to cause cancer." Reported pounds of active ingredient (AI) applied include both agricultural and non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

USE TRENDS OF CHOLINESTERASE-INHIBITING PESTICIDES.

Table 7: *The reported pounds of pesticides used that are cholinesterase-inhibiting pesticides. These pesticides are organophosphate and carbamate active ingredients. Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
3-IODO-2-PROPYNYL BUTYLCARBAMATE	0	0	<1	2,675	102	<1	19	<1	28
ACEPHATE	143,073	152,303	112,562	134,993	152,610	130,461	185,166	144,642	170,378
ALDICARB	115,475	75,767	31,579	64,626	24,167	1,489	1,487	126	0
AZINPHOS-METHYL	25,418	16,269	13,045	1,619	1,582	1,232	32	0	1,638
BENDIOCARB	8	2	<1	1	3	3	2	4	1
BENSULIDE	259,548	244,526	247,733	271,835	288,432	267,050	285,471	319,400	345,261
BUTYLATE	945	27	0	299	0	0	88	53	0
CARBARYL	142,010	126,742	135,301	114,077	74,944	113,965	117,367	131,600	155,333
CARBOFURAN	25,467	16,389	10,117	4	1	0	0	0	0
CHLORPROPHAM	1,532	4,384	4,675	6,990	3,093	2,969	27,481	4,433	3,955
CHLORPYRIFOS	1,442,521	1,368,568	1,246,560	1,290,982	1,300,379	1,106,479	1,469,300	1,308,690	1,108,386
COUMAPHOS	<1	0	0	<1	3	3	14	0	1
CYCLOATE	31,868	21,242	25,284	27,292	31,037	33,562	30,619	36,566	39,444
DDVP	6,376	6,859	4,164	4,169	5,389	4,803	4,619	4,032	4,079
DEMETON	1	0	2	0	0	0	0	0	0
DESMEDIPHAM	1,905	1,598	1,257	1,385	1,345	1,482	1,017	530	112
DIAZINON	353,098	258,544	142,061	126,804	86,647	78,524	61,224	61,126	52,828
DICROTOPHOS	0	0	0	0	0	0	0	5	<1
DIMETHOATE	315,358	292,119	251,726	210,431	226,392	183,207	270,183	335,559	288,510
DISULFOTON	24,558	8,028	10,233	9,085	4,351	5,479	1,924	2,219	415
EPTC	152,707	129,470	128,993	118,509	139,605	168,665	187,349	235,271	235,816
ETHEPHON	430,522	296,421	207,788	375,561	548,700	484,335	397,058	348,470	320,938
ETHION	0	2	28	72	1	44	0	<1	1
ETHOPROP	24,241	26,897	20,793	5,645	7,475	2,077	2,502	2,906	1,751
FENAMIPHOS	39,677	17,482	11,493	8,978	2,964	5,254	2,244	865	97
FENTHION	4	4	9	4	<1	0	0	<1	0
FONOFOS	0	1	0	<1	0	0	0	0	0
FORMETANATE HYDROCHLORIDE	34,127	44,704	32,670	30,313	20,952	20,446	26,912	28,333	31,172
MALATHION	468,614	484,322	531,966	561,398	512,004	405,485	446,879	503,001	442,695
METHAMIDOPHOS	18,867	24,224	17,934	9,664	6,037	<1	55	0	0
METHIDATHION	45,666	47,203	47,319	51,343	29,545	23,396	6,375	3,614	389
METHIOCARB	1,767	2,068	3,093	3,506	2,708	3,786	3,678	3,606	3,362
METHOMYL	307,169	251,382	221,248	231,690	220,085	273,328	260,542	278,793	282,230
METHYL PARATHION	75,385	34,110	25,770	21,427	22,970	25,408	21,520	481	182
MEVINPHOS	30	4	9	24	118	3	<1	8	9
MEVINPHOS, OTHER RELATED	20	3	6	16	79	2	0	5	6
MEXACARBATE	0	0	0	0	0	0	1	0	0

Table 7: (continued) *The reported pounds of pesticides used that are cholinesterase-inhibiting pesticides. These pesticides are organophosphate and carbamate active ingredients.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
MOLINATE	75,241	19,653	12,516	24	<1	3	<1	<1	<1
MONOCROTOPHOS	0	0	0	0	0	0	0	0	0
NALED	132,528	172,632	162,530	175,118	199,189	153,039	218,690	225,285	288,258
O,O-DIMETHYL O-(4-NITRO-M-TOLYL) PHOSPHOROTHIOATE	0	0	0	0	0	0	0	0	0
OXAMYL	45,096	100,000	48,994	121,725	136,967	52,112	73,005	65,766	17,319
OXYDEMETON-METHYL	122,723	111,612	68,576	71,290	26,017	17,562	10,656	8,407	6,756
PARATHION	479	33	118	248	196	25	<1	22	836
PEBULATE	441	68	0	0	0	0	0	0	0
PHENMEDIPHAM	2,841	2,305	2,516	2,448	2,087	2,059	1,195	811	285
PHORATE	33,776	32,408	17,686	14,775	46,430	61,545	30,909	32,343	19,379
PHOSALONE	0	0	0	0	0	0	0	0	0
PHOSMET	424,874	341,422	132,647	115,008	95,781	53,587	60,903	44,342	20,898
POTASSIUM DIMETHYL DITHIO CARBAMATE	0	0	<1	0	0	0	0	0	0
PROFENOFOS	3,638	216	0	1,552	0	58	0	0	0
PROPAMOCARB HYDROCHLORIDE	137,589	116,725	106,078	99,482	92,307	107,144	94,354	99,661	77,980
PROPETAMPHOS	136	116	352	213	139	171	127	3,047	5
PROPOXUR	191	188	202	298	808	359	373	251	100
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	45,757	16,335	8,161	18,427	30,328	21,820	19,077	11,683	6,472
SODIUM DIMETHYL DITHIO CARBAMATE	9,073	9,800	8,963	11,053	13,358	13,485	22,187	16,535	9,357
SULFOTEP	7	4	2	0	1	0	0	0	0
SULPROFOS	0	0	0	0	0	0	0	0	0
TEMEPHOS	1,173	684	83	99	34	17	8	10	5
TETRACHLORVINPHOS	667	1,012	1,306	1,086	912	665	2,660	629	173
THIOBENCARB	289,046	263,499	320,643	258,402	246,927	280,678	289,946	373,930	523,372
THIODICARB	686	410	511	152	472	145	156	0	0
TRIALLATE	0	0	0	879	2,671	3,752	4,530	5,886	4,830
TRICHLORFON	336	961	25	34	40	29	25	11	<1
TOTAL	5,814,258	5,141,747	4,377,326	4,577,730	4,608,384	4,111,192	4,639,930	4,642,955	4,465,046

Table 8: *The reported cumulative acres treated with pesticides that are cholinesterase-inhibiting pesticides. These pesticides are organophosphate and carbamate active ingredients. Use includes primarily agricultural applications. The grand total for acres treated may be less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
3-IODO-2-PROPYNYL BUTYLCARBAMATE	0	0	0	<1	<1	<1	<1	<1	<1
ACEPHATE	148,887	147,910	115,063	144,134	150,268	132,396	183,260	122,681	162,772
ALDICARB	108,892	66,829	31,977	66,192	29,363	1,451	1,882	166	0
AZINPHOS-METHYL	16,636	9,888	7,849	1,724	1,809	1,639	24	0	819
BENDIOCARB	6	<1	<1	<1	<1	<1	<1	<1	<1
BENSULIDE	76,748	75,695	73,306	78,736	84,201	79,195	84,384	85,657	93,957
BUTYLATE	236	6	0	60	0	0	20	12	0
CARBARYL	97,016	96,136	107,458	81,683	68,272	97,229	96,646	108,750	135,806
CARBOFURAN	39,795	24,651	7,331	15	30	0	0	0	0
CHLORPROPHAM	178	147	159	38	82	76	44	117	104
CHLORPYRIFOS	1,154,681	1,162,654	934,562	1,098,958	1,188,283	1,056,026	1,297,160	1,108,238	829,411
COUMAPHOS	<1	0	0	<1	<1	<1	1	0	62
CYCLOATE	15,601	10,581	12,058	13,799	14,895	17,565	16,045	19,124	20,937
DDVP	2,733	2,231	2,685	1,880	5,184	6,530	5,593	3,307	6,282
DEMETON	10	0	10	0	0	0	0	0	0
DESMEDIPHAM	24,780	16,787	16,073	19,264	19,349	17,100	9,307	4,797	887
DIAZINON	422,244	310,125	140,620	104,443	71,156	48,594	35,069	32,862	27,079
DICROTOPHOS	0	0	0	0	0	0	0	23	<1
DIMETHOATE	608,819	576,286	499,889	436,845	532,778	422,179	594,441	725,257	626,602
DISULFOTON	20,315	4,723	7,591	6,167	1,621	2,595	1,042	1,157	204
EPTC	51,706	45,560	49,708	44,289	47,805	56,872	69,989	89,126	90,801
ETHEPHON	490,361	362,926	261,211	455,338	602,803	533,731	475,399	414,018	366,380
ETHION	0	6	15	184	81	332	0	<1	297
ETHOPROP	4,283	4,159	4,293	1,348	1,892	541	676	802	574
FENAMIPHOS	22,618	10,730	7,537	5,873	2,127	2,690	1,437	465	<1
FENTHION	<1	<1	<1	<1	<1	0	0	<1	0
FONOFOS	0	<1	0	3	0	0	0	0	0
FORMETANATE HYDROCHLORIDE	35,383	45,715	32,678	30,898	22,038	21,821	27,894	28,234	31,515
MALATHION	250,823	288,852	277,523	434,717	281,026	271,700	289,861	285,259	267,016
METHAMIDOPHOS	23,022	27,532	20,408	10,731	6,464	<1	69	0	0
METHIDATHION	37,301	43,010	54,227	49,968	34,918	31,741	9,046	3,564	489
METHIOCARB	2,649	2,439	2,131	2,335	2,057	2,801	3,378	2,412	2,439
METHOMYL	502,384	406,030	377,954	410,186	396,429	473,027	439,709	450,050	453,496
METHYL PARATHION	45,173	21,574	15,198	13,046	13,343	15,551	12,486	<1	298
MEVINPHOS	198	34	69	11	108	2	<1	51	51
MEVINPHOS, OTHER RELATED	198	34	69	11	108	2	0	51	51
MEXACARBATE	0	0	0	0	0	0	<1	0	0

Table 8: (continued) *The reported cumulative acres treated with pesticides that are cholinesterase-inhibiting pesticides. These pesticides are organophosphate and carbamate active ingredients.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
MOLINATE	17,476	4,529	2,942	6	<1	<1	3	<1	1
MONOCROTOPHOS	0	0	0	0	0	0	0	0	0
NALED	107,774	105,505	128,415	145,673	163,486	108,978	160,907	139,823	164,391
O,O-DIMETHYL O-(4-NITRO-M-TOLYL) PHOSPHOROTHIOATE	0	0	0	0	0	0	0	0	0
OXAMYL	60,773	116,202	59,118	138,801	150,265	61,967	83,585	75,330	21,149
OXYDEMETON-METHYL	161,835	140,760	82,368	86,131	27,447	18,204	12,163	9,096	7,356
PARATHION	414	101	195	51	68	15	<1	1	207
PEBULATE	163	151	0	0	0	0	0	0	0
PHENMEDIPHAM	26,762	18,198	18,837	21,366	20,767	18,329	9,692	5,425	1,304
PHORATE	23,557	10,933	10,236	8,719	32,863	47,176	22,469	25,658	14,664
PHOSALONE	0	0	0	0	0	0	0	0	0
PHOSMET	142,991	116,516	51,514	40,276	33,692	18,923	23,726	21,120	10,776
POTASSIUM DIMETHYL DITHIO CARBAMATE	0	0	<1	0	0	0	0	0	0
PROFENOFOS	4,509	289	0	1,635	0	155	0	0	0
PROPAMOCARB HYDROCHLORIDE	144,949	123,699	109,027	103,734	95,934	112,188	101,774	106,352	82,107
PROPETAMPHOS	<1	<1	<1	<1	<1	<1	<1	3,621	<1
PROPOXUR	<1	10	356	<1	3	<1	4	178	39
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	31,408	10,850	7,182	15,785	27,139	21,894	22,774	15,139	7,582
SODIUM DIMETHYL DITHIO CARBAMATE	2	1	3	12	<1	<1	<1	<1	<1
SULFOTEP	5	2	3	0	1	0	0	0	0
SULPROFOS	0	0	0	0	0	0	0	0	0
TEMEPHOS	<1	<1	<1	<1	<1	<1	<1	<1	<1
TETRACHLORVINPHOS	200	5	<1	5	5	8	4	3	1,044
THIOBENCARB	74,271	67,483	83,567	75,172	71,824	79,689	84,726	107,636	148,289
THIODICARB	1,196	673	680	192	656	206	247	0	0
TRIALLATE	0	0	0	867	1,854	2,715	2,998	3,918	3,221
TRICHLORFON	<1	<1	<1	<1	<1	<1	<1	<1	<1
TOTAL	4,976,667	4,462,290	3,597,718	4,131,807	4,184,847	3,766,713	4,170,592	3,994,527	3,578,113

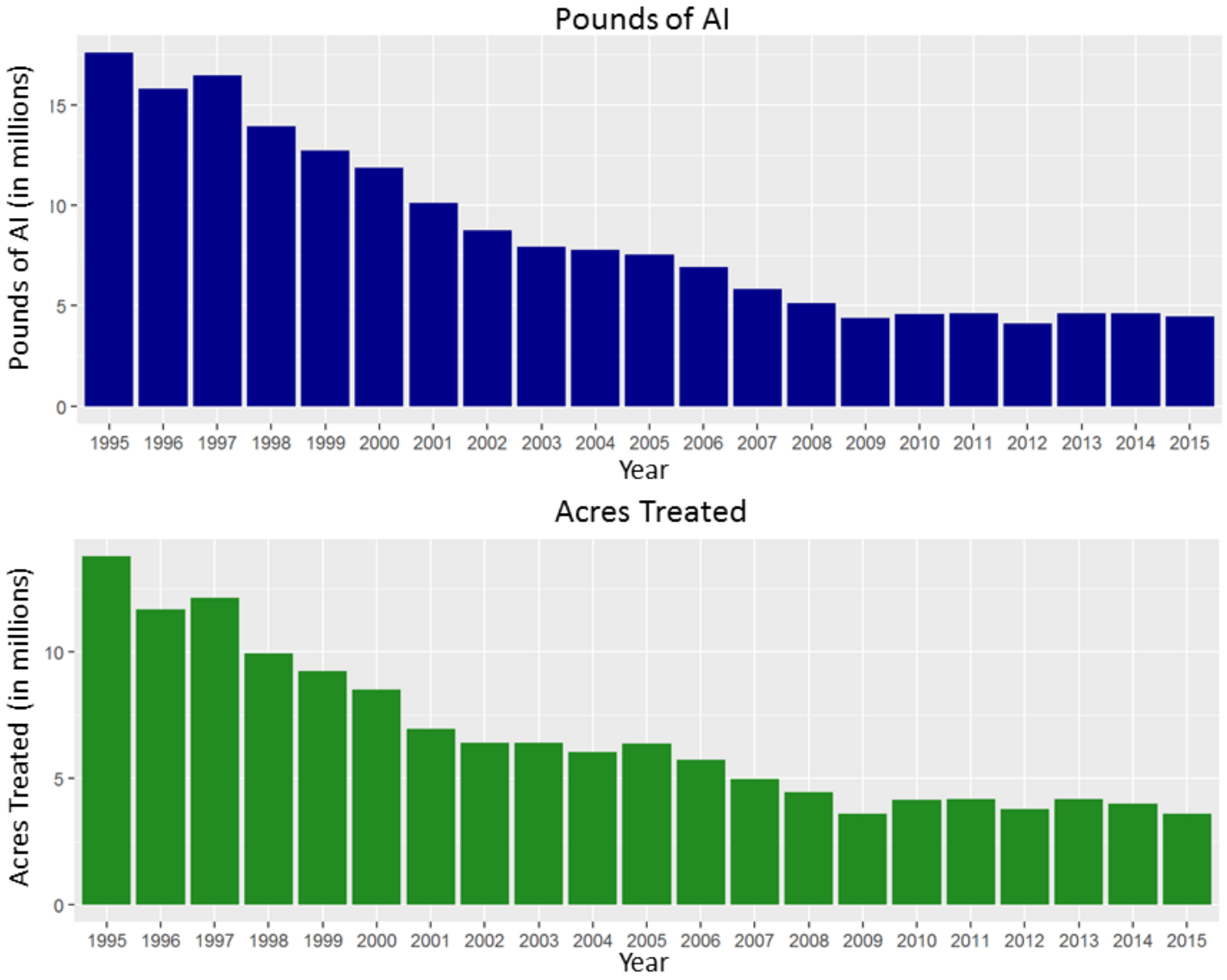

Figure 7: *Use trends of pesticides that are cholinesterase-inhibiting pesticides. These pesticides are organophosphate and carbamate active ingredients. Reported pounds of active ingredient (AI) applied include both agricultural and non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

USE TRENDS OF PESTICIDES ON THE "A" PART OF DPR'S GROUNDWATER PROTECTION LIST.

Table 9: *The reported pounds of pesticides used that are on the "a" part of DPR's groundwater protection list. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6800(a). Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
ATRAZINE	27,546	28,491	23,260	28,937	22,654	32,173	23,763	20,896	17,912
ATRAZINE, OTHER RELATED	571	600	482	607	475	676	488	434	375
BENTAZON, SODIUM SALT	4,858	8,075	9,589	7,447	5,800	7,060	8,250	8,506	8,322
BROMACIL	85,097	68,162	52,049	67,784	92,437	82,485	68,294	61,793	37,472
BROMACIL, LITHIUM SALT	1,172	1,851	896	1,835	1,486	1,422	1,145	2,472	2,891
DIURON	860,510	734,757	622,598	588,905	674,536	554,604	413,267	324,889	316,596
NORFLURAZON	78,150	58,590	44,762	43,686	30,697	42,045	29,946	30,226	22,601
PROMETON	3	3	1	6	3	8	34	1	59
SIMAZINE	541,296	438,952	419,423	378,661	425,621	368,642	300,394	242,880	178,922
TOTAL	1,599,204	1,339,482	1,173,061	1,117,868	1,253,710	1,089,114	845,581	692,098	585,150

Table 10: *The reported cumulative acres treated with pesticides that are on the "a" part of DPR's groundwater protection list. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6800(a). Use includes primarily agricultural applications. The grand total for acres treated may be less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
ATRAZINE	17,382	16,766	15,767	19,990	17,236	23,827	18,305	15,404	14,537
ATRAZINE, OTHER RELATED	17,382	16,766	15,767	19,990	17,236	23,827	18,305	15,404	14,537
BENTAZON, SODIUM SALT	4,215	6,631	6,424	6,258	4,846	6,539	7,466	7,956	6,823
BROMACIL	20,455	21,471	24,420	28,757	32,183	28,746	16,610	12,634	5,997
BROMACIL, LITHIUM SALT	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIURON	702,939	514,554	405,583	520,587	691,391	555,446	440,197	342,067	284,513
NORFLURAZON	74,085	58,866	44,503	45,638	30,601	31,693	23,306	25,112	17,368
PROMETON	4	35	2	20	<1	<1	234	<1	18
SIMAZINE	411,719	320,992	339,117	289,198	324,529	241,365	205,341	165,206	118,650
TOTAL	1,212,529	919,200	812,543	882,518	1,069,235	859,264	695,162	556,111	442,501

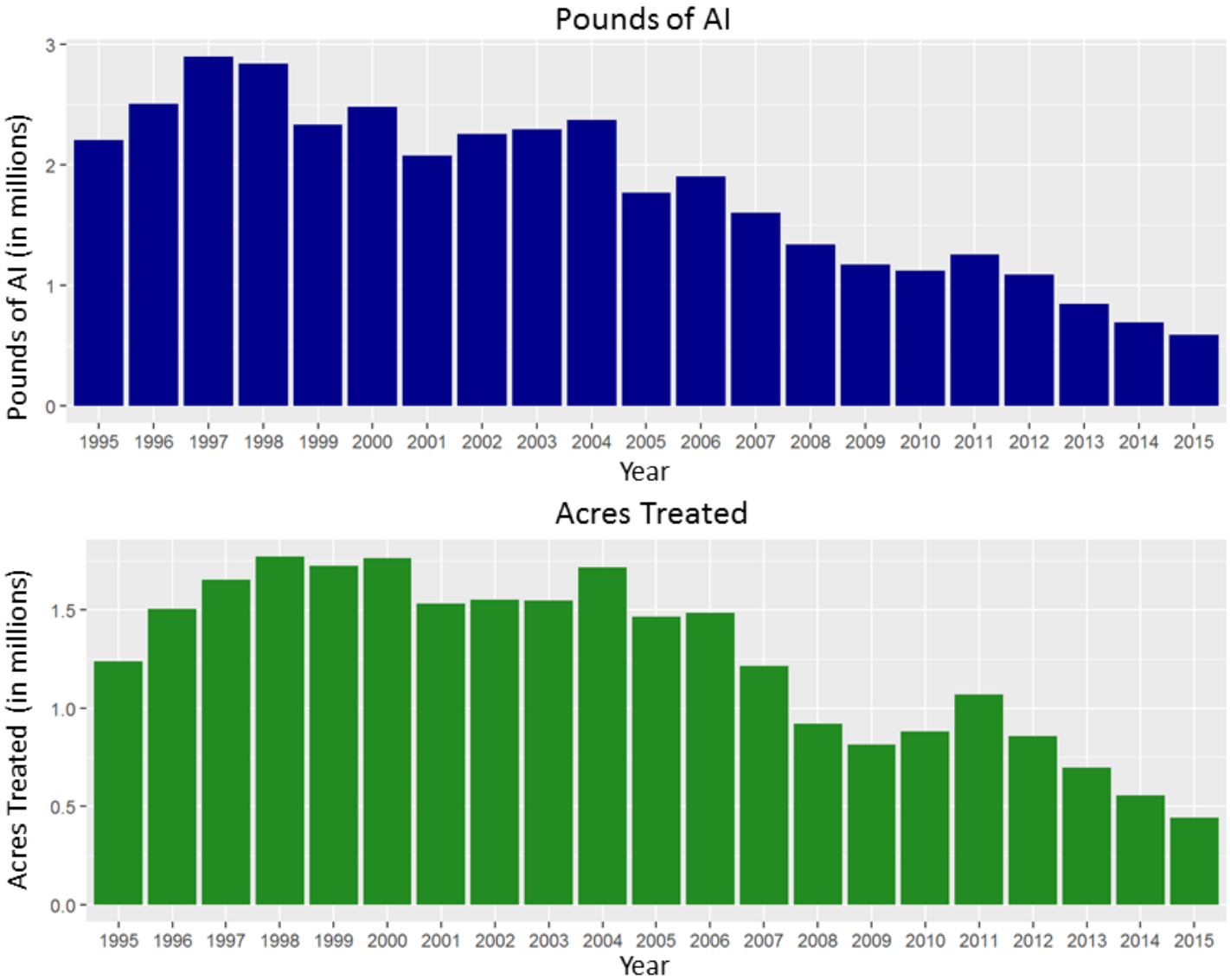

Figure 8: *Use trends of pesticides that are on the "a" part of DPR's groundwater protection list. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6800(a). Reported pounds of active ingredient (AI) applied include both agricultural and non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

USE TRENDS OF PESTICIDES ON DPR'S TOXIC AIR CONTAMINANTS LIST.

Table 11: *The reported pounds of pesticides used that are on DPR's toxic air contaminants list applied in California. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860. Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
1,3-DICHLOROPROPENE	9,596,317	9,708,712	6,399,534	8,797,078	10,924,344	11,952,624	12,941,042	13,584,346	15,757,907
2,4-D	2,755	11,619	10,788	12,526	5,400	4,281	5,965	6,384	7,869
2,4-D, 2-ETHYLHEXYL ESTER	15,029	20,464	15,113	74,398	25,794	27,639	25,620	21,649	26,924
2,4-D, ALKANOLAMINE SALTS (ETHANOL AND ISOPROPANOL AMINES)	29	25	131	516	1	16	18	<1	201
2,4-D, BUTOXYETHANOL ESTER	843	1,775	2,751	1,368	1,757	1,807	3,016	2,318	1,791
2,4-D, BUTOXYPROPYL ESTER	0	13	0	0	0	0	0	0	0
2,4-D, BUTYL ESTER	9	0	2	3	4	7	26	0	129
2,4-D, DIETHANOLAMINE SALT	4,025	5,533	4,913	6,872	3,165	2,649	2,875	4,081	3,627
2,4-D, DIMETHYLAMINE SALT	397,197	466,872	446,575	488,863	408,926	371,705	352,130	329,054	359,904
2,4-D, DODECYLAMINE SALT	0	0	0	0	0	0	0	0	0
2,4-D, HEPTYLAMINE SALT	0	0	0	0	0	0	0	0	0
2,4-D, ISOOCTYL ESTER	11,572	9,603	4,446	4,214	5,361	4,623	2,156	779	994
2,4-D, ISOPROPYL ESTER	10,578	10,671	13,123	11,682	19,073	13,467	11,767	10,439	11,421
2,4-D, N-OLEYL-1,3-PROPYLENEDIAMINE SALT	0	0	0	0	0	0	0	0	0
2,4-D, OCTYL ESTER	0	0	0	0	0	0	0	0	0
2,4-D, PROPYL ESTER	212	141	99	57	0	0	6	0	0
2,4-D, TETRADECYLAMINE SALT	0	0	0	0	0	0	0	0	0
2,4-D, TRIETHYLAMINE SALT	383	332	472	2,829	106	5	<1	23	10
2,4-D, TRIISOPROPANOLAMINE SALT	985	1,140	1,930	2,092	2,741	1,746	1,588	2,439	1,945
2,4-D, TRIISOPROPYLAMINE SALT	636	472	1,941	1,655	1,971	770	1,263	1,871	1,372
ACROLEIN	201,156	215,822	161,637	123,660	101,425	114,130	99,023	84,220	53,679
ALUMINUM PHOSPHIDE	105,169	132,296	108,084	108,406	157,098	148,731	138,617	110,492	85,453
ARSENIC ACID	0	0	0	0	17	0	0	0	0
ARSENIC PENTOXIDE	7,805	7,433	400	16,144	8,034	9,240	8,480	16,719	22,190
ARSENIC TRIOXIDE	<1	<1	<1	<1	<1	<1	0	<1	<1
CAPTAN	456,475	362,757	329,747	450,225	376,597	403,834	349,430	370,136	510,832
CAPTAN, OTHER RELATED	10,131	8,031	7,374	10,002	8,395	8,918	5,967	4,717	4,023
CARBARYL	142,010	126,742	135,301	114,077	74,944	113,965	117,367	131,600	155,333
CHLORINE	857,144	1,278,580	585,673	1,011,383	834,152	1,437,637	1,323,645	800,013	490,089
CHLOROPICRIN	5,505,912	5,590,285	5,687,571	6,398,482	7,310,076	8,931,078	8,220,346	8,992,756	8,488,831
CHROMIC ACID	10,904	10,384	559	22,555	11,224	12,908	11,847	23,358	31,629
DAZOMET	37,537	40,272	65,725	60,539	59,245	39,229	63,920	58,577	83,058

Table 11: (continued) *The reported pounds of pesticides used that are on DPR's toxic air contaminants list applied in California. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
DDVP	6,376	6,859	4,164	4,169	5,389	4,803	4,619	4,032	4,079
ENDOSULFAN	52,403	59,917	41,840	37,799	15,679	11,113	1,833	8,136	6,420
ETHYLENE OXIDE	2	3	7	0	0	8	0	<1	0
FORMALDEHYDE	47,733	24,306	3,972	5,511	4,615	3,847	11,165	52,989	31,956
HYDROGEN CHLORIDE	1,470	4,318	3,976	2,240	504	336	395	412	553
LINDANE	2	21	8	18	1	0	2	0	6
MAGNESIUM PHOSPHIDE	5,132	10,507	8,009	12,233	12,757	11,012	12,291	7,562	13,908
MANCOZEB	408,652	330,238	281,639	757,637	1,045,283	1,130,972	1,149,338	1,281,789	1,274,902
MANEB	1,061,028	861,006	656,648	370,333	54,227	6,260	1,383	1,274	667
META-CRESOL	<1	<1	<1	<1	1	2	7	<1	<1
METAM-SODIUM	9,930,337	9,497,562	9,028,103	11,428,913	10,861,317	8,428,425	4,846,428	4,300,079	4,643,122
METHANOL	0	0	0	0	0	0	0	0	0
METHIDATHION	45,666	47,203	47,319	51,343	29,545	23,396	6,375	3,614	389
METHOXYCHLOR	6	0	8	270	39	0	<1	0	<1
METHOXYCHLOR, OTHER RELATED	0	0	0	0	0	0	0	0	0
METHYL BROMIDE	6,448,643	5,693,325	5,615,653	4,809,311	4,057,921	4,003,020	3,535,185	2,964,775	2,666,222
METHYL ISOTHIOCYANATE	388	0	0	73	476	764	0	92	63
METHYL PARATHION	75,385	34,110	25,770	21,427	22,970	25,408	21,520	481	182
METHYL PARATHION, OTHER RELATED	3,960	1,792	1,355	1,127	1,195	1,334	1,131	<1	5
NAPHTHALENE	0	0	0	1	<1	0	<1	0	0
PARA-DICHLOROBENZENE	15	1	17	0	<1	18	<1	0	0
PARATHION	479	33	118	248	196	25	<1	22	836
PCNB	30,689	29,188	24,637	37,378	11,867	17,418	26,131	23,408	20,304
PCP, OTHER RELATED	2	1	0	<1	3	32	39	2	<1
PCP, SODIUM SALT	<1	0	0	0	<1	0	0	<1	0
PCP, SODIUM SALT, OTHER RELATED	<1	0	0	0	0	0	0	0	0
PENTACHLOROPHENOL	22	4	0	3	18	224	274	11	2
PHENOL	0	0	2	0	0	0	5	3	1
PHENOL, FERROUS SALT	0	0	0	0	0	0	0	<1	0
PHOSPHINE	5,286	48,243	29,527	11,291	125,441	51,143	20,783	11,341	28,015
PHOSPHORUS	<1	<1	<1	1	0	4	3	0	0
POTASSIUM N-METHYLDITHIOCARBAMATE	3,785,436	5,524,647	4,102,412	4,832,615	5,673,371	8,320,255	9,484,467	7,798,703	10,513,789
POTASSIUM PERMANGANATE	0	0	109	0	0	0	0	0	0
PROPOXUR	191	188	202	298	808	359	373	251	100
PROPYLENE OXIDE	110,068	105,600	111,609	300,008	449,037	389,070	410,360	400,719	392,724
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	45,757	16,335	8,161	18,427	30,328	21,820	19,077	11,683	6,472
SODIUM CYANIDE	2,670	3,406	2,579	2,502	1,073	2,588	2,593	2,611	3,108

Table 11: (continued) *The reported pounds of pesticides used that are on DPR's toxic air contaminants list applied in California. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
SODIUM DICHROMATE	0	0	0	0	0	0	0	2	0
SODIUM TETRATHIOCARBONATE	391,303	354,294	249,580	233,949	168,761	49,713	385	120	1,078
SULFURYL FLUORIDE	2,152,451	2,120,860	2,184,823	2,728,977	2,359,006	2,661,786	3,062,343	2,805,856	3,038,910
TRIFLURALIN	908,614	676,386	533,307	473,502	497,887	485,817	504,016	513,702	470,532
XYLENE	1,173	576	517	1,060	282	372	1,181	1,715	668
ZINC PHOSPHIDE	3,215	1,299	20,898	1,745	2,543	2,249	2,287	3,598	3,913
TOTAL	42,899,368	43,462,201	36,970,857	43,864,037	45,772,382	49,254,602	46,812,104	44,754,950	49,222,136

Table 12: *The reported cumulative acres treated with pesticides that are on DPR's toxic air contaminants list applied in California. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860. Use includes primarily agricultural applications. The grand total for acres treated may be less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
1,3-DICHLOROPROPENE	53,937	57,922	38,374	54,209	59,065	69,422	71,794	69,558	79,422
2,4-D	7,405	33,344	25,244	23,856	7,565	7,764	11,441	11,041	13,603
2,4-D, 2-ETHYLHEXYL ESTER	8,362	15,047	9,020	11,797	10,396	7,703	11,634	8,541	11,346
2,4-D, ALKANOLAMINE SALTS (ETHANOL AND ISOPROPANOL AMINES)	23	55	270	172	1	36	26	<1	<1
2,4-D, BUTOXYETHANOL ESTER	1,297	3,648	5,110	2,542	1,206	1,054	1,661	1,775	813
2,4-D, BUTOXYPROPYL ESTER	0	<1	0	0	0	0	0	0	0
2,4-D, BUTYL ESTER	10	0	6	<1	<1	7	<1	0	33
2,4-D, DIETHANOLAMINE SALT	13,339	19,085	18,931	27,009	11,075	7,033	8,859	7,547	6,577
2,4-D, DIMETHYLAMINE SALT	487,361	543,863	527,098	519,534	446,062	378,188	351,911	311,533	328,268
2,4-D, DODECYLAMINE SALT	0	0	0	0	0	0	0	0	0
2,4-D, HEPTYLAMINE SALT	0	0	0	0	0	0	0	0	0
2,4-D, ISOOCTYL ESTER	7,143	4,708	2,673	2,424	2,903	414	1,409	30	97
2,4-D, ISOPROPYL ESTER	137,055	135,797	132,302	138,826	145,544	161,009	149,976	136,530	147,250
2,4-D, N-OLEYL-1,3-PROPYLENEDIAMINE SALT	0	0	0	0	0	0	0	0	0
2,4-D, OCTYL ESTER	0	0	0	0	0	0	0	0	0
2,4-D, PROPYL ESTER	3,348	1,955	1,750	895	0	0	128	0	0
2,4-D, TETRADECYLAMINE SALT	0	0	0	0	0	0	0	0	0
2,4-D, TRIETHYLAMINE SALT	473	679	740	165	117	3	<1	10	45
2,4-D, TRIISOPROPANOLAMINE SALT	108	952	541	720	623	308	524	936	861
2,4-D, TRIISOPROPYLAMINE SALT	204	<1	<1	<1	25	37	653	585	238
ACROLEIN	141	1,027	1,497	12	45	56	68	306	432
ALUMINUM PHOSPHIDE	84,963	80,989	112,063	100,859	133,230	164,082	148,962	150,088	157,647
ARSENIC ACID	0	0	0	0	<1	0	0	0	0
ARSENIC PENTOXIDE	<1	<1	<1	<1	<1	<1	<1	<1	<1
ARSENIC TRIOXIDE	<1	<1	<1	<1	<1	<1	0	<1	<1
CAPTAN	215,864	198,262	173,133	245,464	209,979	209,627	187,988	211,312	211,980
CAPTAN, OTHER RELATED	215,229	198,095	173,083	245,464	209,979	205,623	144,375	119,113	98,351
CARBARYL	97,016	96,136	107,458	81,683	68,272	97,229	96,646	108,750	135,806
CHLORINE	1,201	14,414	24,644	88,144	24,253	24,097	<1	38,381	6,258
CHLOROPICRIN	55,490	53,408	49,089	51,805	65,973	63,433	57,655	55,008	53,853
CHROMIC ACID	<1	<1	<1	<1	<1	<1	<1	<1	<1
DAZOMET	700	183	301	274	243	594	768	152	368
DDVP	2,733	2,231	2,685	1,880	5,184	6,530	5,593	3,307	6,282

Table 12: (continued) *The reported cumulative acres treated with pesticides that are on DPR's toxic air contaminants list applied in California. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
ENDOSULFAN	56,627	64,695	48,639	48,023	19,812	11,134	1,856	8,331	6,561
ETHYLENE OXIDE	<1	2	60	0	0	<1	0	<1	0
FORMALDEHYDE	57	67	5	1	6	4	52	2	30
HYDROGEN CHLORIDE	4	46	49	116	<1	5	0	155	100
LINDANE	0	37	10	31	1	0	<1	0	28
MAGNESIUM PHOSPHIDE	6	143	32	145	80	29	19	14	131
MANCOZEB	212,349	169,422	145,616	433,833	634,215	678,916	675,954	710,867	741,714
MANEB	655,235	558,506	471,395	290,266	40,588	4,559	1,524	1,006	698
META-CRESOL	54	38	108	79	144	857	614	6	128
METAM-SODIUM	78,030	71,815	74,132	72,748	70,874	58,998	28,153	24,422	29,262
METHANOL	0	0	0	0	0	0	0	0	0
METHIDATHION	37,301	43,010	54,227	49,968	34,918	31,741	9,046	3,564	489
METHOXYCHLOR	43	0	75	90	58	0	<1	0	<1
METHOXYCHLOR, OTHER RELATED	0	0	0	0	0	0	0	0	0
METHYL BROMIDE	45,675	35,685	39,587	32,293	47,091	30,237	26,428	16,578	13,443
METHYL ISOTHIOCYANATE	<1	0	0	<1	<1	<1	0	<1	<1
METHYL PARATHION	45,173	21,574	15,198	13,046	13,343	15,551	12,486	<1	298
METHYL PARATHION, OTHER RELATED	45,165	21,331	15,053	13,029	13,326	15,337	12,440	<1	36
NAPHTHALENE	0	0	0	3	<1	0	<1	0	0
PARA-DICHLOROBENZENE	<1	0	<1	<1	<1	<1	<1	0	0
PARATHION	414	101	195	51	68	15	<1	1	207
PCNB	1,764	1,656	1,400	4,429	879	331	605	1,365	811
PCP, OTHER RELATED	10	46	0	4	1	15	170	2	5
PCP, SODIUM SALT	<1	0	0	0	47	0	0	1	0
PCP, SODIUM SALT, OTHER RELATED	<1	0	0	0	0	0	0	0	0
PENTACHLOROPHENOL	10	46	0	4	1	15	170	2	5
PHENOL	0	0	15	0	0	0	114	315	170
PHENOL, FERROUS SALT	0	0	0	0	0	0	0	2	0
PHOSPHINE	3	1,751	50	643	824	687	110	2	25
PHOSPHORUS	10	<1	<1	<1	0	74	108	0	0
POTASSIUM N-METHYLDITHIOCARBAMATE	42,988	56,009	38,197	41,444	44,078	50,361	46,861	39,708	49,507
POTASSIUM PERMANGANATE	0	0	5	0	0	0	0	0	0
PROPOXUR	<1	10	356	<1	3	<1	4	178	39
PROPYLENE OXIDE	<1	12	<1	<1	<1	288	9	<1	<1
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	31,408	10,850	7,182	15,785	27,139	21,894	22,774	15,139	7,582
SODIUM CYANIDE	<1	<1	<1	<1	<1	<1	<1	<1	18
SODIUM DICHROMATE	0	0	0	0	0	0	0	<1	0

Table 12: (continued) *The reported cumulative acres treated with pesticides that are on DPR's toxic air contaminants list applied in California. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
SODIUM TETRATHIOCARBONATE	11,485	10,725	7,180	7,301	4,826	1,672	<1	4	266
SULFURYL FLUORIDE	9	57	361	130	537	532	63	585	153
TRIFLURALIN	772,753	556,306	492,498	438,784	467,206	466,383	478,245	531,595	480,045
XYLENE	2,021	1,418	1,387	584	633	1,010	2,157	1,778	1,225
ZINC PHOSPHIDE	9,301	11,478	14,512	12,751	21,417	21,685	22,425	44,039	51,280
TOTAL	3,116,678	2,807,846	2,578,071	2,740,204	2,551,512	2,536,296	2,381,761	2,470,343	2,507,363

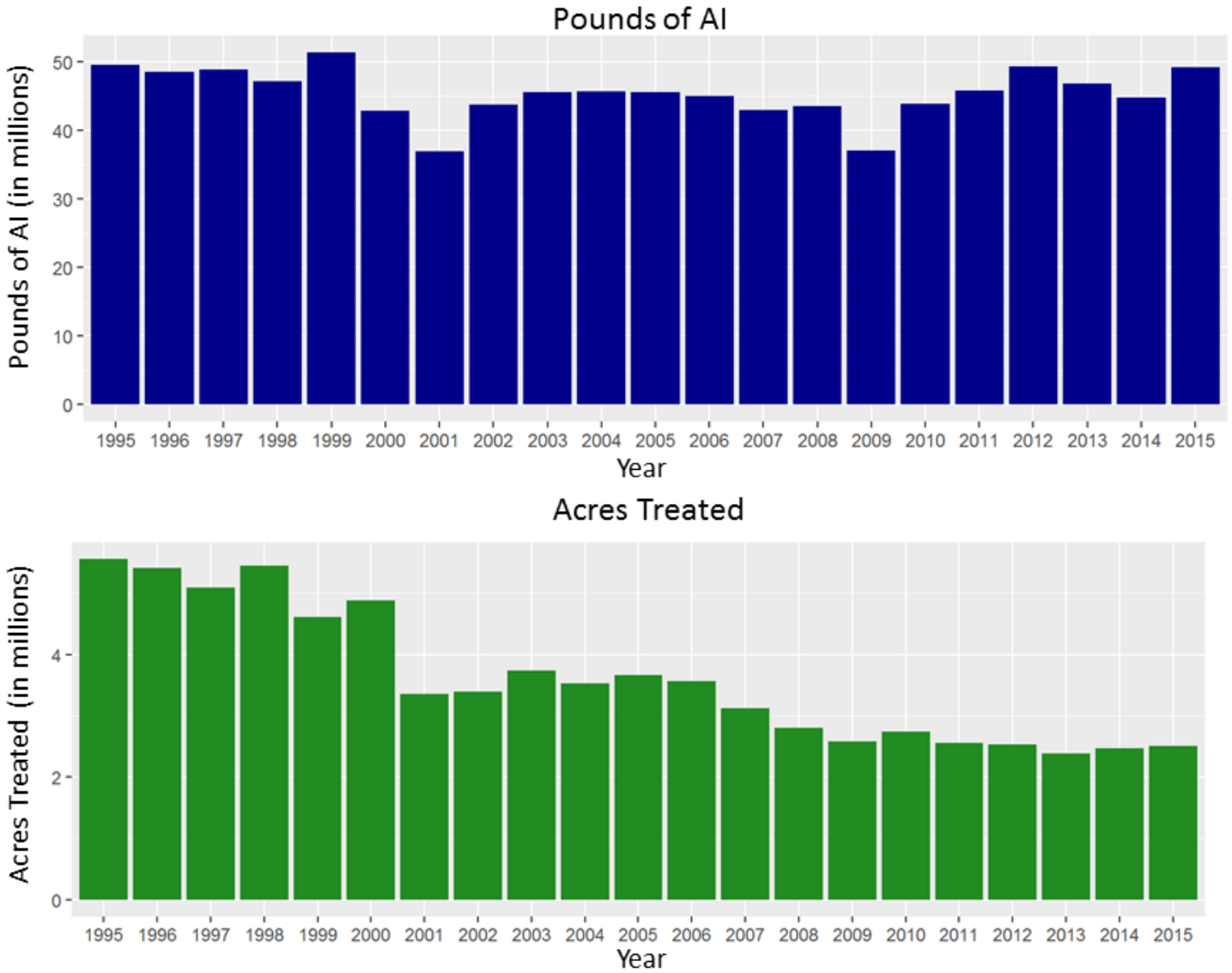

Figure 9: *Use trends of pesticides that are on DPR's toxic air contaminants list applied in California. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860. Reported pounds of active ingredient (AI) applied include both agricultural and non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

USE TRENDS OF PESTICIDES THAT ARE FUMIGANTS.

Table 13: *The reported pounds of pesticides used that are fumigants. Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
1,2-DICHLOROPROPANE, 1,3-DICHLOROPROPENE AND RELATED C3 COMPOUNDS	10,532	0	0	0	0	6	0	1	0
1,3-DICHLOROPROPENE	9,596,317	9,708,712	6,399,534	8,797,078	10,924,344	11,952,624	12,941,042	13,584,346	15,757,907
ALUMINUM PHOSPHIDE	105,169	132,296	108,084	108,406	157,098	148,731	138,617	110,492	85,453
CARBON TETRACHLORIDE	180	1,980	<1	0	6	90	0	7	<1
CHLOROPICRIN	5,505,912	5,590,285	5,687,571	6,398,482	7,310,076	8,931,078	8,220,346	8,992,756	8,488,831
DAZOMET	37,537	40,272	65,725	60,539	59,245	39,229	63,920	58,577	83,058
ETHYLENE DIBROMIDE	3	127	<1	0	0	6	0	0	<1
ETHYLENE DICHLORIDE	0	<1	0	0	0	0	0	0	0
ETHYLENE OXIDE	2	3	7	0	0	8	0	<1	0
MAGNESIUM PHOSPHIDE	5,132	10,507	8,009	12,233	12,757	11,012	12,291	7,562	13,908
METAM-SODIUM	9,930,337	9,497,562	9,028,103	11,428,913	10,861,317	8,428,425	4,846,428	4,300,079	4,643,122
METHYL BROMIDE	6,448,643	5,693,325	5,615,653	4,809,311	4,057,921	4,003,020	3,535,185	2,964,775	2,666,222
METHYL IODIDE	0	0	0	0	1,157	21	0	0	0
PHOSPHINE	5,286	48,243	29,527	11,291	125,441	51,143	20,783	11,341	28,015
POTASSIUM N-METHYLDITHIOCARBAMATE	3,785,436	5,524,647	4,102,412	4,832,615	5,673,371	8,320,255	9,484,467	7,798,703	10,513,789
PROPYLENE OXIDE	110,068	105,600	111,609	300,008	449,037	389,070	410,360	400,719	392,724
SODIUM TETRATHIOCARBONATE	391,303	354,294	249,580	233,949	168,761	49,713	385	120	1,078
SULFURYL FLUORIDE	2,152,451	2,120,860	2,184,823	2,728,977	2,359,006	2,661,786	3,062,343	2,805,856	3,038,910
ZINC PHOSPHIDE	3,215	1,299	20,898	1,745	2,543	2,249	2,287	3,598	3,913
TOTAL	38,087,522	38,830,014	33,611,533	39,723,548	42,162,078	44,988,465	42,738,455	41,038,931	45,716,930

Table 14: *The reported cumulative acres treated with pesticides that are fumigants. Use includes primarily agricultural applications. The grand total for acres treated may be less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
1,2-DICHLOROPROPANE, 1,3-DICHLOROPROPENE AND RELATED C3 COMPOUNDS	108	0	0	0	0	18	0	8	0
1,3-DICHLOROPROPENE	53,937	57,922	38,374	54,209	59,065	69,422	71,794	69,558	79,422
ALUMINUM PHOSPHIDE	84,963	80,989	112,063	100,859	133,230	164,082	148,962	150,088	157,647
CARBON TETRACHLORIDE	<1	161	<1	0	<1	<1	0	<1	<1
CHLOROPICRIN	55,490	53,408	49,089	51,805	65,973	63,433	57,655	55,008	53,853
DAZOMET	700	183	301	274	243	594	768	152	368
ETHYLENE DIBROMIDE	<1	<1	<1	0	0	<1	0	0	<1
ETHYLENE DICHLORIDE	0	160	0	0	0	0	0	0	0
ETHYLENE OXIDE	<1	2	60	0	0	<1	0	<1	0
MAGNESIUM PHOSPHIDE	6	143	32	145	80	29	19	14	131
METAM-SODIUM	78,030	71,815	74,132	72,748	70,874	58,998	28,153	24,422	29,262
METHYL BROMIDE	45,675	35,685	39,587	32,293	47,091	30,237	26,428	16,578	13,443
METHYL IODIDE	0	0	0	0	278	37	0	0	0
PHOSPHINE	3	1,751	50	643	824	687	110	2	25
POTASSIUM N-METHYLDITHIOCARBAMATE	42,988	56,009	38,197	41,444	44,078	50,361	46,861	39,708	49,507
PROPYLENE OXIDE	<1	12	<1	<1	<1	288	9	<1	<1
SODIUM TETRATHIOCARBONATE	11,485	10,725	7,180	7,301	4,826	1,672	<1	4	266
SULFURYL FLUORIDE	9	57	361	130	537	532	63	585	153
ZINC PHOSPHIDE	9,301	11,478	14,512	12,751	21,417	21,685	22,425	44,039	51,280
TOTAL	333,549	333,467	331,252	330,440	391,709	411,040	358,352	364,832	405,420

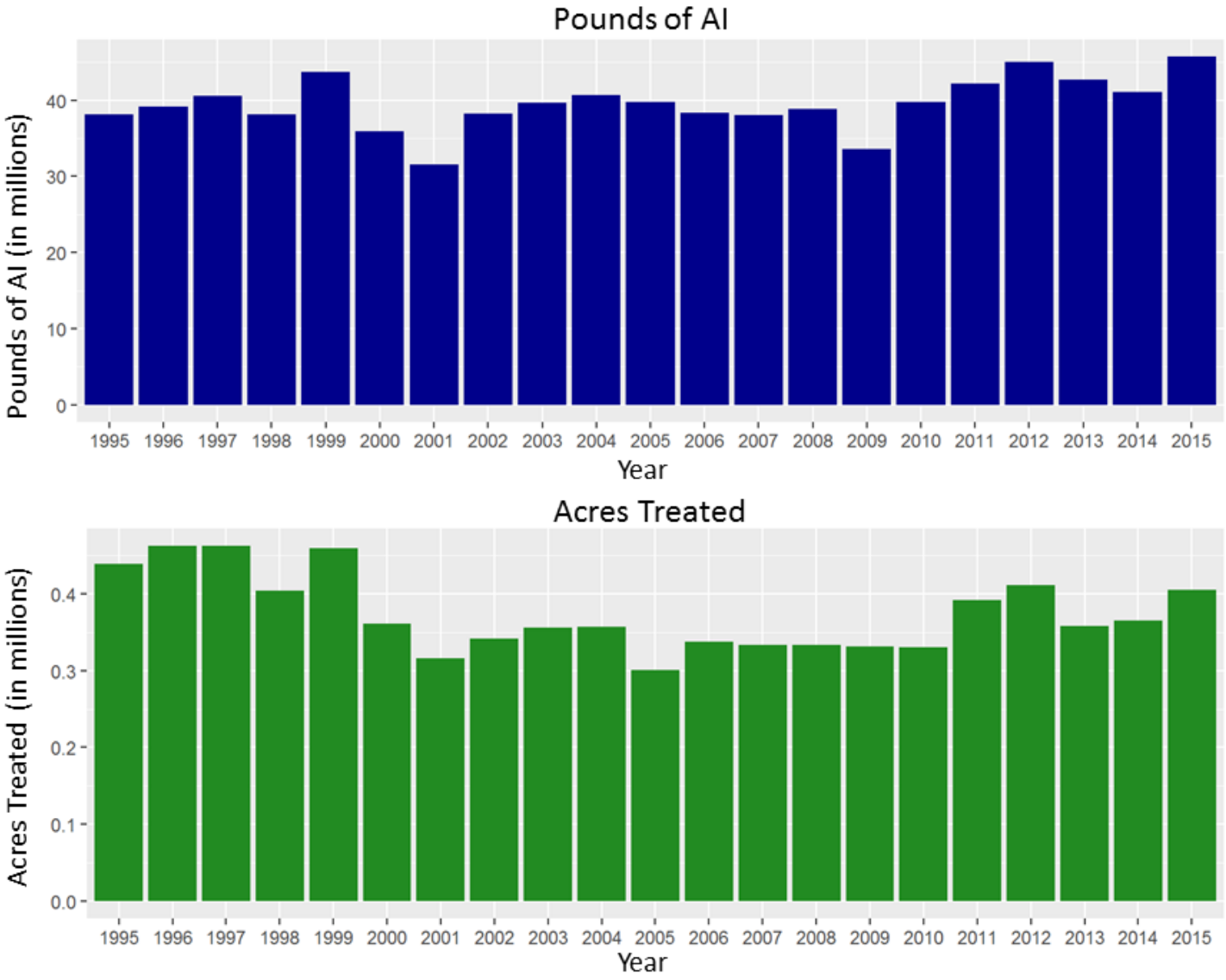

Figure 10: *Use trends of pesticides that are fumigants. Reported pounds of active ingredient (AI) applied include both agricultural and non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

USE TRENDS OF OIL PESTICIDES.

Table 15: *The reported pounds of pesticides used that are oils. As a broad group, oil pesticides and other petroleum distillates are on U.S. EPA's list of A or B carcinogens or the State's Proposition 65 list of chemicals "known to cause cancer." However, these classifications do not distinguish among oil pesticides that may not qualify as carcinogenic due to their degree of refinement. Many such oil pesticides also serve as alternatives to high-toxicity chemicals. For this reason, oil pesticide data was classified separately in this report. Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
COAL TAR HYDROCARBONS	0	0	0	0	0	0	0	0	0
HYDROTREATED PARAFFINIC SOLVENT	300,501	247,676	248,774	224,458	239,204	156,552	169,847	183,198	128,691
ISOPARAFFINIC HYDROCARBONS	16,859	11,250	13,007	6,628	13,823	9,822	7,290	2,191	11,419
KEROSENE	12,431	22,269	148,478	95,973	34,662	20,423	6,938	13,613	4,402
MINERAL OIL	12,861,981	12,341,868	11,656,594	11,437,427	10,319,922	11,562,118	16,153,513	15,798,390	25,168,737
MINERAL OIL, PETROLEUM DISTILLATES, SOLVENT REFINED LIGHT	139	219	124	401	11	0	0	0	0
NAPHTHA, HEAVY AROMATIC	0	0	0	0	0	0	<1	0	31
PETROLEUM DERIVATIVE RESIN	0	0	1	0	<1	0	6	0	0
PETROLEUM DISTILLATES	343,123	504,035	548,178	341,843	280,132	247,408	207,201	158,763	139,413
PETROLEUM DISTILLATES, ALIPHATIC	18,323	16,390	10,493	15,635	8,989	6,638	7,680	15,233	11,031
PETROLEUM DISTILLATES, AROMATIC	1,160	367	103	247	12	100	303	434	128
PETROLEUM DISTILLATES, REFINED	1,237,891	1,487,043	1,222,830	2,005,527	1,986,322	1,909,574	1,905,049	1,736,898	2,021,199
PETROLEUM HYDROCARBONS	1,407	184	138	177	177	27	77	33	692
PETROLEUM NAPHTHENIC OILS	240	248	254	984	1,075	518	349	842	575
PETROLEUM OIL, PARAFFIN BASED	511,255	506,839	1,048,107	618,417	759,923	982,942	1,248,166	1,058,366	1,127,920
PETROLEUM OIL, UNCLASSIFIED	13,419,141	13,583,475	12,246,765	12,528,157	17,840,085	13,418,065	15,891,343	11,085,592	12,779,418
PETROLEUM SULFONATES	<1	<1	0	0	<1	0	0	0	0
TOTAL	28,724,451	28,721,863	27,143,847	27,275,875	31,484,336	28,314,189	35,597,761	30,053,553	41,393,656

Table 16: *The reported cumulative acres treated with pesticides that are oils. As a broad group, oil pesticides and other petroleum distillates are on U.S. EPA's list of A or B carcinogens or the State's Proposition 65 list of chemicals "known to cause cancer." However, these classifications do not distinguish among oil pesticides that may not qualify as carcinogenic due to their degree of refinement. Many such oil pesticides also serve as alternatives to high-toxicity chemicals. For this reason, oil pesticide data was classified separately in this report. Use includes primarily agricultural applications. The grand total for acres treated may be less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
COAL TAR HYDROCARBONS	0	0	0	0	0	0	0	0	0
HYDROTREATED PARAFFINIC SOLVENT	261,415	226,988	232,299	227,415	254,618	183,177	193,661	193,965	175,083
ISOPARAFFINIC HYDROCARBONS	27,903	19,228	22,913	13,709	19,129	15,023	8,637	4,657	23,195
KEROSENE	254,279	284,440	303,497	316,705	319,278	288,599	286,883	267,821	191,021
MINERAL OIL	823,500	875,257	1,009,841	1,193,988	1,272,829	1,386,176	1,820,646	1,927,402	2,360,249
MINERAL OIL, PETROLEUM DISTILLATES, SOLVENT REFINED LIGHT	522	1,010	850	1,255	60	0	0	0	0
NAPHTHA, HEAVY AROMATIC	0	0	0	0	0	0	<1	0	<1
PETROLEUM DERIVATIVE RESIN	0	0	<1	0	<1	0	<1	0	0
PETROLEUM DISTILLATES	280,747	422,253	277,893	238,831	219,254	175,519	175,474	131,339	115,940
PETROLEUM DISTILLATES, ALIPHATIC	31,441	28,159	30,905	58,342	75,134	32,428	36,156	34,338	44,584
PETROLEUM DISTILLATES, AROMATIC	383	107	225	445	12	170	660	408	9
PETROLEUM DISTILLATES, REFINED	231,860	288,363	258,026	273,923	255,913	244,552	258,724	274,250	289,463
PETROLEUM HYDROCARBONS	546	334	309	159	35	5	75	80	173
PETROLEUM NAPHTHENIC OILS	17,950	18,093	22,435	44,879	65,430	27,369	30,539	21,266	35,979
PETROLEUM OIL, PARAFFIN BASED	738,037	658,709	631,120	673,568	712,342	716,396	651,291	727,643	652,826
PETROLEUM OIL, UNCLASSIFIED	674,659	702,988	693,354	766,362	1,042,071	852,993	984,061	809,604	821,993
PETROLEUM SULFONATES	<1	<1	0	0	<1	0	0	0	0
TOTAL	3,323,241	3,505,504	3,458,251	3,764,424	4,170,619	3,894,875	4,416,238	4,371,466	4,674,222

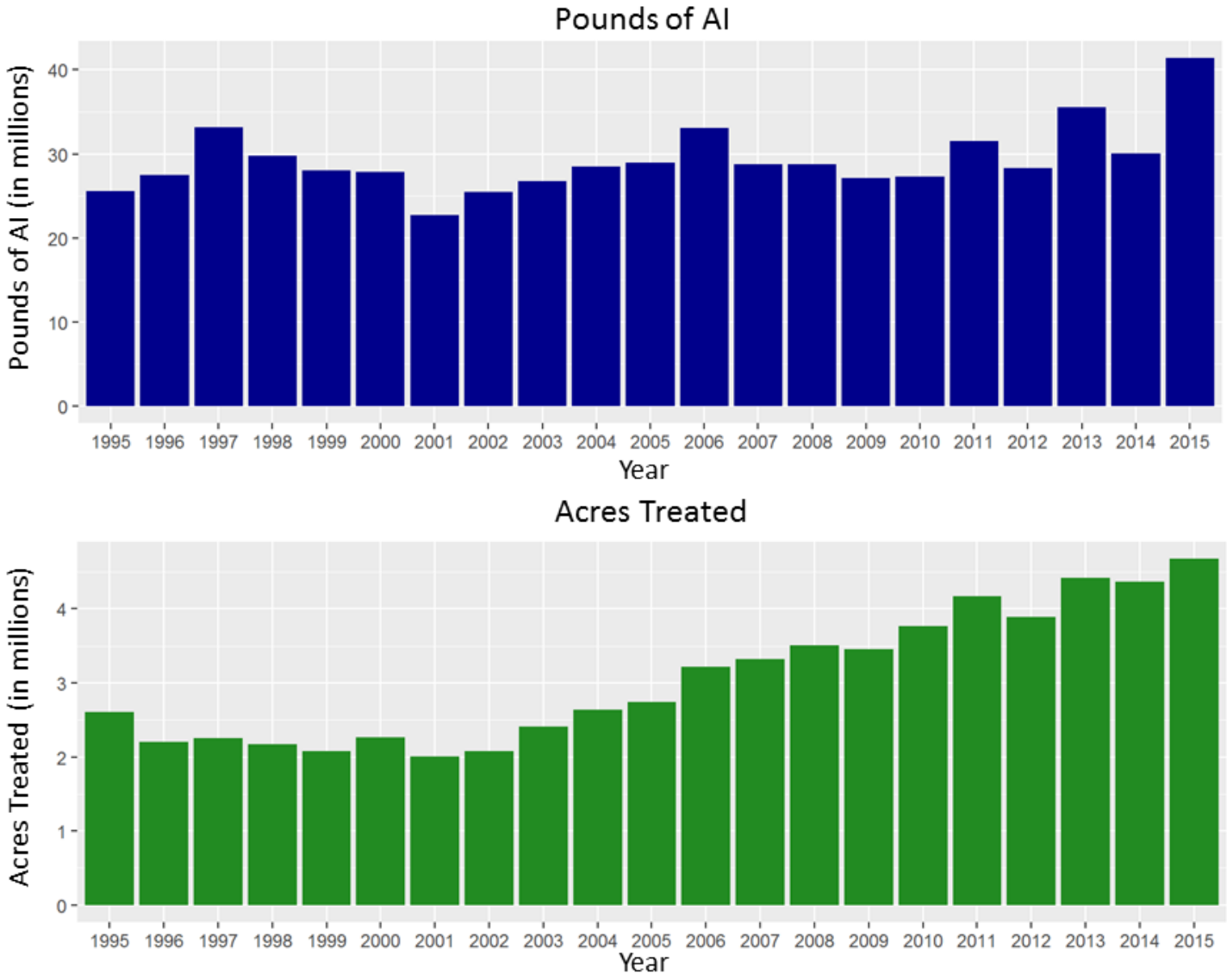

Figure 11: *Use trends of pesticides that are oils. Although oils are on U.S. EPA's list of A or B carcinogens or the State's Proposition 65 list of chemicals "known to cause cancer",these classifications do not distinguish among oil pesticides that may not be carcinogenic due to their degree of refinement. Many such oil pesticides serve as alternatives to high-toxicity chemicals. Reported pounds of active ingredient (AI) applied include both agricultural and non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

USE TRENDS OF BIOPESTICIDES.

Table 17: *The reported pounds of pesticides used that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones). Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
(3S, 6R)-3-METHYL-6-ISOPROPENYL-9-DECEN-1-YL ACETATE	0	0	<1	0	0	<1	0	<1	0
(3S, 6S)-3-METHYL-6-ISOPROPENYL-9-DECEN-1-YL ACETATE	0	0	<1	0	0	<1	0	<1	0
(E)-4-TRIDECEN-1-YL-ACETATE	113	176	80	96	0	0	0	23	1
(E)-5-DECEN-1-OL	0	0	0	0	0	<1	<1	<1	1
(E)-5-DECENOL	2	2	1	1	<1	2	3	1	<1
(E)-5-DECENYL ACETATE	7	8	4	5	2	10	7	4	15
(E,E)-9, 11-TETRADECADIEN-1-YL ACETATE	39	28	11	2	6	3	4	3	2
(E,Z)-7,9-DODECADIEN-1-YL ACETATE	0	0	0	50	249	270	24	24	0
(R,Z)-5-(1-DECENYL) DIHYDRO-2-(3H)-FURANONE	0	0	0	0	0	0	0	0	0
(S)-KINOPRENE	238	252	276	277	191	301	284	311	429
(S)-VERBENONE	0	0	0	0	0	55	0	0	781
(Z)-11-HEXADECEN-1-YL ACETATE	2	0	681	0	1	0	0	0	0
(Z)-11-HEXADECENAL	2	0	0	0	0	0	0	0	<1
(Z)-4-TRIDECEN-1-YL-ACETATE	4	6	3	3	0	0	0	1	<1
(Z)-9-DODECENYL ACETATE	1	<1	<1	<1	<1	<1	<1	<1	<1
(Z,E)-7,11-HEXADECADIEN-1-YL ACETATE	0	<1	3	2	0	0	0	0	0
(Z,Z)-11,13-HEXADECADIENAL	<1	<1	0	<1	571	271	321	619	969
(Z,Z)-7,11-HEXADECADIEN-1-YL ACETATE	0	0	3	3	0	0	0	0	0
1,4-DIMETHYLNAPHTHALENE	18	837	1,544	1,152	544	893	2,225	1,085	891
1,7-DIOXASPIRO-(5,5)-UNDECANE	<1	<1	<1	<1	<1	<1	1	<1	<1
1-DECANOL	0	0	0	0	0	0	0	0	0
1-METHYLCYCLOPROPENE	<1	<1	<1	<1	<1	1	1	<1	1
1-NAPHTHALENEACETAMIDE	49	55	32	25	20	20	19	22	18
1-OCTEN-3-OL	0	0	0	0	0	0	0	<1	<1
2-METHYL-1-BUTANOL	0	0	0	0	0	0	<1	<1	<1
3,13 OCTADECADIEN-1-YL ACETATE	0	44	0	1	12	0	<1	0	<1
3,7-DIMETHYL-6-OCTEN-1-OL	0	1	5	23	12	28	54	42	49
ACETIC ACID	1	21	79	1,732	73	601	43	62	20,806

Table 17: (continued) *The reported pounds of pesticides used that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
AGROBACTERIUM RADIOBACTER	577	32	142	124	95	28	236	149	137
AGROBACTERIUM RADIOBACTER, STRAIN K1026	<1	<1	1	<1	<1	<1	34	<1	<1
ALLYL ISOTHIOCYANATE	0	0	0	0	0	<1	0	0	0
ALMOND, BITTER	<1	<1	<1	<1	<1	<1	<1	<1	<1
AMINO ETHOXY VINYL GLYCINE HYDROCHLORIDE	963	1,073	543	1,024	1,194	1,368	1,444	1,757	1,988
AMMONIUM BICARBONATE	7	2	<1	9	14	7	46	32	38
AMMONIUM NITRATE	35,119	48,460	52,922	55,872	68,980	90,857	124,747	121,649	119,825
AMPELOMYCES QUISQUALIS	<1	0	<1	<1	0	0	0	0	0
ANIMAL GLAND EXTRACTS	0	0	0	0	0	0	0	0	0
ASPERGILLUS FLAVUS STRAIN AF36	0	0	0	0	<1	4	4	8	9
AUREOBASIDIUM PULLULANS STRAIN DSM 14940	0	0	0	0	0	0	81	458	353
AUREOBASIDIUM PULLULANS STRAIN DSM 14941	0	0	0	0	0	0	81	458	353
AZADIRACHTIN	2,235	2,246	2,500	1,885	2,024	2,639	3,161	4,041	5,031
BACILLUS AMYLOLIQUEFACIENS STRAIN D747	0	0	0	0	0	869	84,957	177,585	131,291
BACILLUS FIRMUS (STRAIN I-1582)	0	0	0	0	0	0	0	42	179
BACILLUS POPILLIAE	0	0	0	0	0	0	<1	<1	<1
BACILLUS PUMILUS, STRAIN QST 2808	7,062	8,138	6,987	6,783	7,559	6,752	6,245	7,956	8,109
BACILLUS SPHAERICUS, SEROTYPE H-5A5B, STRAIN 2362	20,192	21,441	18,178	13,013	10,602	9,123	10,500	10,499	12,345
BACILLUS SUBTILIS GB03	6	1	<1	<1	<1	1	1	2	3
BACILLUS SUBTILIS MBI600	0	0	0	0	0	<1	<1	0	0
BACILLUS SUBTILIS VAR. AMYLOLIQUEFACIENS STRAIN FZB24	0	0	0	0	0	2	87	94	102
BACILLUS THURINGIENSIS (BERLINER)	27	16	4	6	26	18	11	4	28
BACILLUS THURINGIENSIS (BERLINER), SUBSP. AIZAWAI, GC-91 PROTEIN	20,474	20,484	27,539	20,397	11,666	17,042	13,265	18,769	16,832
BACILLUS THURINGIENSIS (BERLINER), SUBSP. AIZAWAI, SEROTYPE H-7	2,877	2,373	894	824	819	730	359	333	183
BACILLUS THURINGIENSIS (BERLINER), SUBSP. ISRAELENSIS, SEROTYPE H-14	8,267	9,433	17,202	11,401	22,640	12,616	9,269	11,779	14,892

Table 17: (continued) *The reported pounds of pesticides used that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI STRAIN SA-12	22,702	12,325	12,128	7,424	4,689	10,361	8,246	7,971	8,434
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	987	460	402	150	244	234	53	41	18
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN EG 2348	147	369	118	66	478	44	500	514	344
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN EG2371	0	0	0	<1	<1	0	0	0	0
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN SA-11	63,866	66,612	80,565	75,074	115,679	52,425	77,932	80,401	80,988
BACILLUS THURINGIENSIS (BERLINER), SUBSP. SAN DIEGO	2	0	<1	<1	0	0	0	0	0
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI STRAIN BMP 123	0	764	118	14	0	0	0	0	0
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI, GENETICALLY ENGINEERED STRAIN EG7841 LEPIDOPTERAN ACTIVE TOXIN	632	277	42	1	75	298	5	35	3
BACILLUS THURINGIENSIS VAR. KURSTAKI STRAIN M-200	<1	0	<1	0	0	0	0	0	<1
BACILLUS THURINGIENSIS VAR. KURSTAKI, GENETICALLY ENGINEERED STRAIN EG7826	154	442	95	0	0	528	0	0	0
BACILLUS THURINGIENSIS, SUBSP. AIZAWAI, STRAIN ABTS-1857	32,529	39,464	31,043	26,250	24,282	30,573	29,866	49,186	58,159
BACILLUS THURINGIENSIS, SUBSP. AIZAWAI, STRAIN SD-1372, LEPIDOPTERAN ACTIVE TOXIN(S)	563	256	243	130	88	1	18	6	42
BACILLUS THURINGIENSIS, SUBSP. ISRAELENSIS, STRAIN AM 65-52	40,376	52,969	53,778	71,050	52,787	173,135	49,688	42,762	44,379

Table 17: (continued) *The reported pounds of pesticides used that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
BACILLUS THURINGIENSIS, SUBSP. KURSTAKI, STRAIN ABTS-351, FERMENTATION SOLIDS AND SOLUBLES	71,755	78,527	69,545	96,988	83,027	95,294	83,419	111,383	96,404
BACILLUS THURINGIENSIS, SUBSP. KURSTAKI, STRAIN HD-1	2,262	2,068	3,747	3,589	2,549	3,187	2,323	1,928	1,924
BACILLUS THURINGIENSIS, VAR. KURSTAKI DELTA ENDOTOXINS CRY 1A(C) AND CRY 1C (GENETICALLY ENGINEERED) ENCAPSULATED IN PSEUDOMONAS FLUORESCENS (KILLED)	1	26	28	<1	<1	4	0	<1	0
BACTERIOPHAGE ACTIVE AGAINST XANTHOMONAS CAMPESTRIS PV. VESICATORIA AND PSEUDOMONAS SYRINGAE PV. TOMATO	0	0	0	0	<1	<1	<1	<1	0
BALSAM FIR OIL	0	0	0	<1	0	<1	<1	<1	1
BEAUVERIA BASSIANA STRAIN GHA	711	569	378	357	608	1,053	1,775	2,747	3,474
BUFFALO GOURD ROOT POWDER	137	279	1	11	0	1	25	5	6
BURKHOLDERIA SP STRAIN A396 CELLS AND FERMENTATION MEDIA	0	0	0	0	0	0	0	2,829	58,541
CANDIDA OLEOPHILA ISOLATE I-182	0	0	0	0	0	0	0	0	0
CANOLA OIL	29	25	17	131	26	15	28	34	97
CAPSICUM OLEORESIN	10	5	2	4	4	12	10	27	92
CARBON DIOXIDE	32,010	44,315	7,727	17,550	21,239	30,826	15,739	13,676	14,251
CASTOR OIL	4	4	21	7	<1	2	<1	8	<1
CHENOPODIUM AMBROSIODES NEAR AMBROSIODES	0	0	20,330	10,336	7,897	10,231	20,261	17,504	12,865
CHITOSAN	0	0	0	0	0	0	0	0	0
CHROMOBACTERIUM SUBTSUGAE STRAIN PRAA4-1	0	0	0	0	0	1,169	30,262	46,418	45,880
CINNAMALDEHYDE	3	354	0	0	1	0	0	0	0
CITRIC ACID	41,249	57,279	56,086	74,788	83,373	94,180	127,756	116,452	124,321
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	110,881	104,822	106,271	115,931	71,133	77,257	119,298	197,723	222,741
CODLING MOTH GRANULOSIS VIRUS	<1	<1	<1	<1	<1	<1	<1	<1	<1
CONIOTHYRIUM MINITANS STRAIN CON/M/91-08	6	0	127	80	176	245	611	641	779
CORN GLUTEN MEAL	0	<1	0	0	0	0	0	0	0
CORN SYRUP	81	1,893	2,891	3,026	4,377	4,766	3,216	3,344	4,342

Table 17: (continued) *The reported pounds of pesticides used that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
COYOTE URINE	0	0	0	<1	1	2	3	9	6
CYTOKININ	0	0	0	0	<1	<1	<1	<1	<1
DIHYDRO-5-HEPTYL-2(3H)-FURANONE	<1	<1	<1	<1	0	0	0	0	0
DIHYDRO-5-PENTYL-2(3H)-FURANONE	<1	<1	<1	<1	0	0	0	0	0
E,E-8,10-DODECADIEN-1-OL	2,273	2,037	4,978	1,942	1,376	1,995	2,216	1,401	1,451
E-11-TETRADECEN-1-YL ACETATE	2,399	744	312	100	172	133	142	61	48
E-8-DODECENYL ACETATE	236	265	606	898	192	272	273	224	233
ENCAPSULATED DELTA ENDOTOXIN OF BACILLUS THURINGIENSIS VAR. KURSTAKI IN KILLED PSEUDOMONAS FLUORESCENS	32	18	18	0	1	<1	0	0	0
ENCAPSULATED DELTA ENDOTOXIN OF BACILLUS THURINGIENSIS VAR. SAN DIEGO IN KILLED PSEUDOMONAS FLUORESCENS	0	0	0	0	0	0	0	0	0
ESSENTIAL OILS	<1	0	<1	<1	<1	1	<1	15	12
ETHYLENE	0	0	0	97	1,018	954	1,859	1,282	1,651
EUCALYPTUS OIL	0	0	0	22	<1	0	0	0	0
EUGENOL	0	0	0	0	0	1	<1	1	<1
FARNESOL	2	2	3	10	5	11	21	17	20
FENUGREEK	31	6	17	1	5	8	2	1	7
FERRIC SODIUM EDTA	0	0	0	0	1,979	6,351	5,855	6,790	7,993
FISH OIL	0	0	0	0	1,657	5,466	4,114	0	0
FORMIC ACID	1,509	499	280	223	241	634	77	341	2,590
FOX URINE	0	0	0	<1	<1	2	1	4	3
GAMMA AMINOBUTYRIC ACID	1,936	944	177	118	40	133	28	15	15
GARLIC	142	212	36	423	29	1,905	2,832	1,392	667
GERANIOL	0	1	5	23	12	28	54	42	49
GERMAN COCKROACH PHEROMONE	<1	<1	<1	<1	<1	<1	<1	<1	0
GIBBERELLINS	25,083	23,516	22,916	21,381	21,288	22,682	40,849	27,341	26,894
GIBBERELLINS, POTASSIUM SALT	<1	<1	0	<1	<1	5	0	0	0
GLIOCLADIUM VIRENS GL-21 (SPORES)	152	945	356	945	649	1,957	3,538	2,989	4,387
GLUTAMIC ACID	1,936	944	177	118	40	133	28	15	15
HARPIN PROTEIN	32	16	14	13	11	1	1	<1	0
HEPTYL BUTYRATE	0	0	0	<1	<1	<1	14	6	4
HYDROGEN PEROXIDE	11,860	20,740	21,750	69,179	59,384	36,303	47,214	49,692	75,467
HYDROPRENE	2,282	2,383	1,664	6,382	11,261	3,948	7,351	5,732	6,450
IBA	20	11	6	7	9	12	15	13	13
INDOLE	0	0	0	0	0	0	<1	0	<1

Table 17: (continued) *The reported pounds of pesticides used that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
IRON PHOSPHATE	1,634	1,901	1,435	2,351	2,874	2,327	2,120	2,007	2,084
KAOLIN	1,681,292	1,460,552	2,371,254	3,040,482	1,686,898	2,002,502	2,473,768	2,854,191	3,521,976
LACTIC ACID	0	0	0	0	0	0	0	0	2
LACTOSE	9,019	11,341	9,160	7,984	9,285	6,554	7,143	6,616	7,910
LAGENIDIUM GIGANTEUM (CALIFORNIA STRAIN)	<1	<1	0	0	0	5	0	0	0
LAURYL ALCOHOL	503	830	432	736	497	755	415	293	505
LAVANDULYL SENECIOATE	0	140	462	437	6,120	586	361	386	507
LIMONENE	68,949	45,536	56,495	56,406	62,925	74,369	61,277	346,138	72,642
LINALOOL	113	63	62	1,104	95	137	72	59	92
MARGOSA OIL	0	0	0	579	7,886	9,106	12,189	22,585	25,829
MENTHOL	0	0	0	5	<1	0	20	0	0
METARHIZIUM ANISOPLIAE STRAIN F52	0	0	0	0	0	116	89	121	20
METARHIZIUM ANISOPLIAE, VAR. ANISOPLIAE, STRAIN ESF1	<1	<1	0	<1	<1	0	0	0	0
METHOPRENE	3,357	2,620	1,568	1,492	1,809	1,304	1,350	3,556	1,329
METHYL ANTHRANILATE	152	118	312	343	448	300	1,237	634	1,073
METHYL EUGENOL	0	0	0	0	5	0	9	0	0
METHYL NONYL KETONE	<1	<1	<1	<1	0	0	<1	<1	<1
METHYL SALICYLATE	<1	0	<1	0	0	0	0	0	0
MONTOK PEPPER	0	0	0	0	0	0	0	0	0
MUSCALURE	22	19	20	15	15	16	13	17	23
MYRISTYL ALCOHOL	102	169	88	150	102	155	84	60	102
MYROTHECIUM VERRUCARIA, DRIED FERMENTATION SOLIDS & SOLUBLES, STRAIN AARC-0255	29,990	23,867	23,273	22,813	27,757	25,556	26,005	17,675	30,810
N6-BENZYL ADENINE	198	153	168	217	128	168	182	181	161
NAA	4	31	3	5	4	9	15	12	18
NAA, AMMONIUM SALT	1,253	1,193	1,203	976	839	1,400	1,056	945	995
NAA, ETHYL ESTER	2	8	3	6	23	4	3	5	3
NAA, POTASSIUM SALT	11	0	0	0	0	0	53	15	2
NAA, SODIUM SALT	3	1	2	0	0	0	2	1	<1
NEROLIDOL	2	2	6	24	12	28	54	42	49
NITROGEN, LIQUIFIED	15,741	11,945	2,181	135	216	74	594	6	0
NONANOIC ACID	10,949	11,093	9,063	17,322	17,939	18,200	21,552	17,534	14,703
NONANOIC ACID, OTHER RELATED	576	584	477	912	944	958	1,134	923	773
NOSEMA LOCUSTAE SPORES	<1	<1	<1	<1	<1	1	<1	<1	<1
OIL OF ANISE	<1	<1	0	0	<1	<1	<1	<1	<1
OIL OF BERGAMOT	0	0	0	0	0	0	0	0	0

Table 17: (continued) *The reported pounds of pesticides used that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
OIL OF BLACK PEPPER	<1	<1	1	<1	<1	<1	1	1	<1
OIL OF CEDARWOOD	0	0	0	<1	0	0	0	0	<1
OIL OF CITRONELLA	<1	3	0	5	46	0	0	1	5
OIL OF CITRUS	0	0	0	0	0	0	0	0	0
OIL OF GERANIUM	0	0	0	<1	0	0	0	0	0
OIL OF JOJOBA	7,240	12,070	3,418	4,176	1,232	507	134	376	44
OIL OF LEMON EUCALYPTUS	0	0	0	0	<1	3	0	0	0
OIL OF LEMONGRASS	0	0	0	0	0	0	0	0	0
OIL OF MUSTARD	0	0	0	0	0	0	0	0	0
OIL OF PEPPERMINT	<1	<1	0	<1	0	0	0	0	0
OXYPURINOL	<1	0	0	0	0	0	0	<1	0
PAECILOMYCES FUMOSOROSEUS APOPKA STRAIN 97	0	0	0	0	0	507	3,302	5,950	5,624
PAECILOMYCES LILACINUS STRAIN 251	0	0	0	252	515	840	4,073	5,031	6,408
PANTOEA AGGLOMERANS STRAIN E325, NRRL B-21856	0	0	33	4	1	1	1	0	0
PERFUME	0	0	0	0	0	0	0	0	0
PHENYLETHYL PROPIONATE	326	502	500	822	423	535	701	712	185
POLYHEDRAL OCCLUSION BODIES (OB'S) OF THE NUCLEAR POLYHEDROSIS VIRUS OF HELICOVERPA ZEA (CORN EARWORM)	0	<1	1	1	51	6	1	2	4
POLYOXIN D, ZINC SALT	234	331	397	1,296	3,513	4,738	6,731	7,411	8,602
POTASSIUM BICARBONATE	114,163	109,171	180,858	275,648	358,200	228,917	239,681	223,547	317,642
POTASSIUM PHOSPHITE	189,512	182,376	141,395	287,730	279,896	281,602	390,253	708,831	663,968
POTASSIUM SORBATE	743	0	<1	65	0	0	0	0	0
PROPYLENE GLYCOL	28,505	24,132	25,792	54,233	48,127	58,462	85,788	89,595	85,719
PSEUDOMONAS FLUORESCENS, STRAIN A506	614	390	328	217	274	59	92	270	87
PSEUDOMONAS SYRINGAE STRAIN ESC-11	0	0	0	0	0	0	0	0	0
PSEUDOMONAS SYRINGAE, STRAIN ESC-10	0	0	0	<1	0	0	3	0	0
PUTRESCENT WHOLE EGG SOLIDS	20	1	143	3	1	1	1	1	1
PYTHIUM OLIGANDRUM DV74	0	0	0	0	<1	<1	<1	0	0
QST 713 STRAIN OF DRIED BACILLUS SUBTILIS	17,337	16,703	16,175	21,464	23,962	23,503	24,577	20,952	21,047
QUILLAJA	276	1,183	410	682	1,081	785	1,031	773	829
REYNOUTRIA SACHALINENSIS	0	0	179	8,996	14,843	14,803	15,332	16,099	18,310

Table 17: (continued) *The reported pounds of pesticides used that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
S-ABSCISIC ACID	0	7	66	864	1,852	2,651	2,131	2,345	2,114
S-METHOPRENE	1,726	3,520	3,284	3,921	2,313	2,324	2,331	2,524	2,485
SALICYLIC ACID	0	0	0	0	0	0	0	0	0
SAWDUST	<1	1	<1	1	0	4	4	0	0
SESAME OIL	883	529	851	1,309	1,327	15	<1	0	0
SILVER NITRATE	0	0	0	<1	<1	<1	0	0	0
SODIUM BICARBONATE	0	67	27	3	515	146	44	479	420
SODIUM CHLORIDE	715	4	3	2	169	124	119	211	216
SODIUM LAURYL SULFATE	400	340	146	96	458	884	431	570	1,748
SOYBEAN OIL	14,747	12,005	28,359	24,110	24,109	22,022	45,973	59,297	70,208
STREPTOMYCES GRISEOVIRIDIS STRAIN K61	<1	<1	<1	<1	<1	<1	10	11	18
STREPTOMYCES LYDICUS WYEC 108	<1	<1	1	2	1	2	3	3	3
SUCROSE OCTANOATE	0	1,685	4,003	1,128	230	55	188	98	203
THYME	485	593	775	1,311	665	844	1,135	1,150	257
THYMOL	289	523	1,675	1,539	265	181	398	314	278
TRICHODERMA HARZIANUM RIFAI STRAIN KRL-AG2	38	20	11	504	129	158	184	86	65
TRICHODERMA ICC 012 ASPERELLUM	0	0	0	0	13	19	43	2	2
TRICHODERMA ICC 080 GAMSII	0	0	0	0	13	19	43	2	2
ULOCLADIUM OUDEMANSII (U3 STRAIN)	0	0	0	0	0	0	29	792	516
VANILLIN	5	1	3	<1	1	1	<1	<1	1
VEGETABLE OIL	154,128	270,375	196,078	323,401	514,884	276,278	315,218	267,446	482,137
XANTHINE	<1	0	0	0	0	0	0	<1	0
XANTHOMONAS CAMPESTRIS PV. POANNUA	0	0	0	0	0	0	0	0	0
YEAST	1,030	999	926	470	1,165	818	80	32	86
YUCCA SCHIDIGERA	0	7	169	634	1,649	7,147	11,682	5,651	2,565
Z,E-9,12-TETRADECADIEN-1-YL ACETATE	1	0	6,149	1	7	6	14	122	20
Z-11-TETRADECEN-1-YL ACETATE	228	9	9	9	4	8	8	<1	<1
Z-8-DODECENOL	41	46	106	157	33	46	44	38	40
Z-8-DODECENYL ACETATE	3,647	4,051	9,262	13,964	2,948	3,836	3,467	3,248	3,548
Z-9-TETRADECEN-1-OL	0	0	0	0	0	0	0	0	0
TOTAL	2,930,512	2,846,330	3,727,852	4,903,065	3,811,139	3,890,773	4,711,114	5,848,811	6,618,734

Table 18: *The reported cumulative acres treated with pesticides that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones). Use includes primarily agricultural applications. The grand total for acres treated may be less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
(3S, 6R)-3-METHYL-6-ISOPROPENYL-9-DECEN-1-YL ACETATE	0	0	3	0	0	7	0	24	0
(3S, 6S)-3-METHYL-6-ISOPROPENYL-9-DECEN-1-YL ACETATE	0	0	3	0	0	7	0	24	0
(E)-4-TRIDECEN-1-YL-ACETATE	5,193	7,672	3,942	3,995	0	0	0	1,074	40
(E)-5-DECEN-1-OL	0	0	0	0	0	53	83	20	166
(E)-5-DECENOL	737	262	118	249	166	502	837	639	348
(E)-5-DECENYL ACETATE	737	262	118	249	166	555	920	659	514
(E,E)-9, 11-TETRADECADIEN-1-YL ACETATE	22	956	3	474	759	608	985	466	645
(E,Z)-7,9-DODECADIEN-1-YL ACETATE	0	0	0	5,168	18,104	22,856	2,479	1,623	0
(R,Z)-5-(1-DECENYL) DIHYDRO-2-(3H)-FURANONE	0	0	0	0	0	0	0	0	0
(S)-KINOPRENE	453	575	510	490	346	506	674	750	990
(S)-VERBENONE	0	0	0	0	0	100	0	0	<1
(Z)-11-HEXADECEN-1-YL ACETATE	116	0	1,622	0	49	0	0	0	0
(Z)-11-HEXADECENAL	72	0	0	0	0	0	0	0	74
(Z)-4-TRIDECEN-1-YL-ACETATE	5,193	7,672	3,942	3,995	0	0	0	1,074	40
(Z)-9-DODECENYL ACETATE	5,342	1,304	123	74	1,814	392	555	1,966	950
(Z,E)-7,11-HEXADECADIEN-1-YL ACETATE	0	1	93	1	0	0	0	0	0
(Z,Z)-11,13-HEXADECADIENAL	200	109	0	763	11,336	17,283	20,591	38,681	61,037
(Z,Z)-7,11-HEXADECADIEN-1-YL ACETATE	0	0	93	1	0	0	0	0	0
1,4-DIMETHYLNAPHTHALENE	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,7-DIOXASPIRO-(5,5)-UNDECANE	55	<1	6	<1	<1	30	43	25	32
1-DECANOL	0	0	0	0	0	0	0	0	0
1-METHYLCYCLOPROPENE	6	13	61	3	1	17	21	14	10
1-NAPHTHALENEACETAMIDE	927	870	607	408	315	393	343	394	257
1-OCTEN-3-OL	0	0	0	0	0	0	0	<1	<1
2-METHYL-1-BUTANOL	0	0	0	0	0	0	<1	<1	<1
3,13 OCTADECADIEN-1-YL ACETATE	0	85	0	50	131	0	<1	0	10
3,7-DIMETHYL-6-OCTEN-1-OL	0	67	349	1,531	788	2,220	3,939	3,545	3,094
ACETIC ACID	10	2	226	110	162	3,165	3,114	10,301	15,775
AGROBACTERIUM RADIOBACTER	555	217	215	362	325	852	624	664	806

Table 18: (continued) *The reported cumulative acres treated with pesticides that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
AGROBACTERIUM RADIOBACTER, STRAIN K1026	366	1,935	5,086	81	19	4,947	9,016	754	745
ALLYL ISOTHIOCYANATE	0	0	0	0	0	<1	0	0	0
ALMOND, BITTER	2,068	87	471	74	412	271	88	68	73
AMINO ETHOXY VINYL GLYCINE HYDROCHLORIDE	9,238	10,253	5,611	10,179	11,108	14,991	16,371	17,666	20,039
AMMONIUM BICARBONATE	55	<1	6	<1	<1	30	43	25	32
AMMONIUM NITRATE	503,230	643,869	679,675	726,842	817,273	867,336	1,085,584	953,194	987,517
AMPELOMYCES QUISQUALIS	14	0	22	2	0	0	0	0	0
ANIMAL GLAND EXTRACTS	0	0	0	0	0	0	0	0	0
ASPERGILLUS FLAVUS STRAIN AF36	0	0	0	0	260	48,833	89,337	147,011	159,036
AUREOBASIDIUM PULLULANS STRAIN DSM 14940	0	0	0	0	0	0	254	2,823	1,560
AUREOBASIDIUM PULLULANS STRAIN DSM 14941	0	0	0	0	0	0	254	2,823	1,560
AZADIRACHTIN	91,385	86,813	82,652	71,707	70,228	98,809	113,934	159,345	193,785
BACILLUS AMYLOLIQUEFACIENS STRAIN D747	0	0	0	0	0	2,337	29,684	41,678	38,541
BACILLUS FIRMUS (STRAIN I-1582)	0	0	0	0	0	0	0	12	45
BACILLUS POPILLIAE	0	0	0	0	0	0	<1	<1	<1
BACILLUS PUMILUS, STRAIN QST 2808	79,795	91,795	75,509	72,582	84,276	76,226	68,102	83,386	89,263
BACILLUS SPHAERICUS, SEROTYPE H-5A5B, STRAIN 2362	<1	<1	<1	9	<1	231	38	110	118
BACILLUS SUBTILIS GB03	2	5	2	<1	6	<1	20	302	467
BACILLUS SUBTILIS MBI600	0	0	0	0	0	2	<1	0	0
BACILLUS SUBTILIS VAR. AMYLOLIQUEFACIENS STRAIN FZB24	0	0	0	0	0	406	1,702	3,516	4,328
BACILLUS THURINGIENSIS (BERLINER)	1,129	41	82	127	877	292	258	91	241
BACILLUS THURINGIENSIS (BERLINER), SUBSP. AIZAWAI, GC-91 PROTEIN	53,040	40,440	48,842	40,395	18,657	25,262	22,511	28,611	26,245
BACILLUS THURINGIENSIS (BERLINER), SUBSP. AIZAWAI, SEROTYPE H-7	24,379	20,510	7,888	6,943	7,800	6,221	3,296	2,941	1,348
BACILLUS THURINGIENSIS (BERLINER), SUBSP. ISRAELENSIS, SEROTYPE H-14	833	4,719	501	1,873	337	773	1,110	1,254	1,713

Table 18: (continued) *The reported cumulative acres treated with pesticides that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI STRAIN SA-12	35,513	21,008	19,700	10,721	8,222	15,379	9,855	10,751	10,850
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	16,522	8,671	7,807	2,269	3,063	1,973	818	453	145
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN EG 2348	1,271	2,147	1,302	688	3,428	644	3,580	4,038	2,502
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN EG2371	0	0	0	<1	<1	0	0	0	0
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN SA-11	119,055	100,581	101,522	111,746	84,061	81,637	95,895	111,652	108,542
BACILLUS THURINGIENSIS (BERLINER), SUBSP. SAN DIEGO	<1	0	<1	<1	0	0	0	0	0
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI STRAIN BMP 123	0	1,898	310	73	0	0	0	0	0
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI, GENETICALLY ENGINEERED STRAIN EG7841 LEPIDOPTERAN ACTIVE TOXIN	1,225	451	62	3	200	373	5	99	116
BACILLUS THURINGIENSIS VAR. KURSTAKI STRAIN M-200	<1	0	<1	0	0	0	0	0	<1
BACILLUS THURINGIENSIS VAR. KURSTAKI, GENETICALLY ENGINEERED STRAIN EG7826	479	1,298	250	0	0	1,320	0	0	0
BACILLUS THURINGIENSIS, SUBSP. AIZAWAI, STRAIN ABTS-1857	43,209	49,890	41,724	37,209	35,254	41,581	36,840	68,895	71,250
BACILLUS THURINGIENSIS, SUBSP. AIZAWAI, STRAIN SD-1372, LEPIDOPTERAN ACTIVE TOXIN(S)	4,766	2,343	2,136	1,057	640	4	112	47	301
BACILLUS THURINGIENSIS, SUBSP. ISRAELENSIS, STRAIN AM 65-52	25	2,497	270	758	1,052	1,305	794	2,543	2,009

Table 18: (continued) *The reported cumulative acres treated with pesticides that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
BACILLUS THURINGIENSIS, SUBSP. KURSTAKI, STRAIN ABTS-351, FERMENTATION SOLIDS AND SOLUBLES	133,297	134,290	120,661	162,444	152,463	164,936	147,824	192,441	153,587
BACILLUS THURINGIENSIS, SUBSP. KURSTAKI, STRAIN HD-1	20,045	15,173	20,295	18,465	15,940	15,228	10,138	7,887	11,084
BACILLUS THURINGIENSIS, VAR. KURSTAKI DELTA ENDOTOXINS CRY 1A(C) AND CRY 1C (GENETICALLY ENGINEERED) ENCAPSULATED IN PSEUDOMONAS FLUORESCENS (KILLED)	<1	25	52	2	<1	10	0	<1	0
BACTERIOPHAGE ACTIVE AGAINST XANTHOMONAS CAMPESTRIS PV. VESICATORIA AND PSEUDOMONAS SYRINGAE PV. TOMATO	0	0	0	0	11	25	21	12	0
BALSAM FIR OIL	0	0	0	<1	0	<1	<1	<1	<1
BEAUVERIA BASSIANA STRAIN GHA	2,481	2,091	2,188	1,686	2,706	4,012	6,857	10,900	14,229
BUFFALO GOURD ROOT POWDER	1,694	3,227	8	138	0	25	161	200	224
BURKHOLDERIA SP STRAIN A396 CELLS AND FERMENTATION MEDIA	0	0	0	0	0	0	0	196	5,528
CANDIDA OLEOPHILA ISOLATE I-182	0	0	0	0	0	0	0	0	0
CANOLA OIL	33	1,388	1,541	4,786	3,872	2,329	5,791	4,272	7,455
CAPSICUM OLEORESIN	277	528	325	388	238	576	546	1,576	1,997
CARBON DIOXIDE	<1	<1	<1	<1	26	917	5	20	19
CASTOR OIL	<1	4	12	<1	<1	<1	<1	<1	<1
CHENOPODIUM AMBROSIODES NEAR AMBROSIODES	0	0	6,355	9,265	6,868	13,401	22,552	25,820	19,112
CHITOSAN	0	0	0	0	0	0	0	0	0
CHROMOBACTERIUM SUBTSUGAE STRAIN PRAA4-1	0	0	0	0	0	1,424	38,138	61,191	62,444
CINNAMALDEHYDE	2	556	0	0	<1	0	0	0	0
CITRIC ACID	815,766	919,736	903,198	1,204,981	1,331,913	1,389,851	1,542,332	1,686,289	1,921,431
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	71,278	64,156	47,422	42,281	40,770	42,615	60,211	85,393	88,172
CODLING MOTH GRANULOSIS VIRUS	2,141	1,487	1,139	984	3,468	3,431	4,339	4,510	3,677
CONIOTHYRIUM MINITANS STRAIN CON/M/91-08	120	0	1,204	395	1,107	1,697	4,286	4,886	6,159
CORN GLUTEN MEAL	0	3	0	0	0	0	0	0	0
CORN SYRUP	1,132	7,991	14,316	12,877	27,721	27,760	15,992	14,207	18,817

Table 18: (continued) *The reported cumulative acres treated with pesticides that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
COYOTE URINE	0	0	0	<1	12	<1	<1	<1	<1
CYTOKININ	0	0	0	0	199	2,409	352	3,290	1,966
DIHYDRO-5-HEPTYL-2(3H)-FURANONE	<1	<1	<1	<1	0	0	0	0	0
DIHYDRO-5-PENTYL-2(3H)-FURANONE	<1	<1	<1	<1	0	0	0	0	0
E,E-8,10-DODECADIEN-1-OL	27,784	21,585	15,300	15,283	17,872	15,879	18,241	16,548	10,772
E-11-TETRADECEN-1-YL ACETATE	6,189	5,996	5,592	5,405	1,701	4,485	4,396	489	696
E-8-DODECENYL ACETATE	49,086	54,242	46,757	49,591	45,667	49,300	47,640	41,405	42,595
ENCAPSULATED DELTA ENDOTOXIN OF BACILLUS THURINGIENSIS VAR. KURSTAKI IN KILLED PSEUDOMONAS FLUORESCENS	35	91	37	0	<1	<1	0	0	0
ENCAPSULATED DELTA ENDOTOXIN OF BACILLUS THURINGIENSIS VAR. SAN DIEGO IN KILLED PSEUDOMONAS FLUORESCENS	0	0	0	0	0	0	0	0	0
ESSENTIAL OILS	1	0	<1	4	<1	<1	<1	<1	<1
ETHYLENE	0	0	0	4	70	49	36	21	28
EUCALYPTUS OIL	0	0	0	2	<1	0	0	0	0
EUGENOL	0	0	0	0	0	<1	<1	<1	<1
FARNESOL	652	422	503	1,597	826	2,227	3,940	3,547	3,104
FENUGREEK	2,068	87	471	74	412	271	88	68	73
FERRIC SODIUM EDTA	0	0	0	0	3,049	8,428	8,038	10,540	12,522
FISH OIL	0	0	0	0	<1	382	252	0	0
FORMIC ACID	1	51	10	60	1	368	5	178	1,203
FOX URINE	0	0	0	<1	12	<1	<1	<1	<1
GAMMA AMINOBUTYRIC ACID	24,697	12,905	1,786	835	542	1,811	384	314	287
GARLIC	346	288	374	1,123	1,369	12,410	14,485	8,509	4,767
GERANIOL	0	67	349	1,531	788	2,220	3,939	3,545	3,094
GERMAN COCKROACH PHEROMONE	<1	<1	<1	<1	<1	<1	<1	<1	0
GIBBERELLINS	455,130	490,530	513,398	493,034	509,875	530,010	548,243	529,982	519,871
GIBBERELLINS, POTASSIUM SALT	32	8	0	34	150	795	0	0	0
GLIOCLADIUM VIRENS GL-21 (SPORES)	5	1,090	716	1,401	1,076	3,172	5,444	5,187	7,109
GLUTAMIC ACID	24,697	12,905	1,786	835	542	1,811	384	314	287
HARPIN PROTEIN	3,721	1,998	1,562	1,631	1,582	115	95	0	0
HEPTYL BUTYRATE	0	0	0	<1	<1	<1	<1	<1	<1
HYDROGEN PEROXIDE	7,744	9,361	14,521	23,208	39,189	21,864	22,955	28,034	32,550
HYDROPRENE	2	200	82	<1	<1	2	4	<1	<1
IBA	44,093	3,862	150	227	1,156	1,283	962	940	489
INDOLE	0	0	0	0	0	0	<1	0	<1

Table 18: (continued) *The reported cumulative acres treated with pesticides that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
IRON PHOSPHATE	7,145	6,569	4,561	6,345	5,477	6,519	6,286	8,109	8,698
KAOLIN	56,911	47,438	66,781	82,636	51,100	57,755	80,075	88,044	101,445
LACTIC ACID	0	0	0	0	0	0	0	0	38
LACTOSE	80,366	99,526	77,363	81,164	91,936	68,442	80,242	61,764	86,442
LAGENIDIUM GIGANTEUM (CALIFORNIA STRAIN)	<1	<1	0	0	0	2	0	0	0
LAURYL ALCOHOL	9,358	7,782	4,705	5,495	6,443	6,652	7,807	5,681	5,725
LAVANDULYL SENECIOATE	0	4,316	2,375	7,025	11,754	6,666	5,869	6,294	8,394
LIMONENE	79,012	64,151	55,465	29,621	15,514	73,605	29,552	32,924	45,187
LINALOOL	<1	7	1	<1	<1	<1	<1	2	<1
MARGOSA OIL	0	0	0	40	4,260	7,977	9,546	19,010	19,739
MENTHOL	0	0	0	2	<1	0	20	0	0
METARHIZIUM ANISOPLIAE STRAIN F52	0	0	0	0	0	202	133	634	122
METARHIZIUM ANISOPLIAE, VAR. ANISOPLIAE, STRAIN ESF1	<1	<1	0	<1	<1	0	0	0	0
METHOPRENE	51	42	211	4	896	<1	<1	<1	<1
METHYL ANTHRANILATE	298	219	550	380	2,043	215	1,092	808	6,126
METHYL EUGENOL	0	0	0	0	<1	0	<1	0	0
METHYL NONYL KETONE	<1	<1	1	<1	0	0	<1	<1	<1
METHYL SALICYLATE	1	0	<1	0	0	0	0	0	0
MONTOK PEPPER	0	0	0	0	0	0	0	0	0
MUSCALURE	1,179	<1	739	300	68	40	50	139	41
MYRISTYL ALCOHOL	9,358	7,782	4,705	5,495	6,443	6,652	7,807	5,681	5,725
MYROTHECIUM VERRUCARIA, DRIED FERMENTATION SOLIDS & SOLUBLES, STRAIN AARC-0255	5,097	5,257	5,331	4,840	5,136	4,274	4,456	3,637	8,775
N6-BENZYL ADENINE	2,628	1,775	2,072	3,352	1,691	1,666	2,954	2,630	2,592
NAA	43,507	3,331	47	38	219	655	293	109	209
NAA, AMMONIUM SALT	11,709	10,445	9,024	9,140	9,075	11,922	10,611	9,703	9,966
NAA, ETHYL ESTER	<1	73	1	23	396	384	113	189	37
NAA, POTASSIUM SALT	41	0	0	0	0	0	6	110	35
NAA, SODIUM SALT	340	37	257	0	0	0	153	85	55
NEROLIDOL	652	422	503	1,597	826	2,227	3,940	3,547	3,104
NITROGEN, LIQUIFIED	<1	<1	<1	<1	<1	<1	<1	5	0
NONANOIC ACID	1,275	498	703	412	828	480	2,166	2,074	1,040
NONANOIC ACID, OTHER RELATED	1,275	498	701	412	828	460	2,166	2,074	1,040
NOSEMA LOCUSTAE SPORES	254	30	132	12	12	1,612	1,206	910	750
OIL OF ANISE	<1	<1	0	0	<1	<1	<1	<1	<1
OIL OF BERGAMOT	0	0	0	0	0	0	0	0	0

Table 18: (continued) *The reported cumulative acres treated with pesticides that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
OIL OF BLACK PEPPER	<1	<1	<1	<1	<1	<1	<1	<1	<1
OIL OF CEDARWOOD	0	0	0	15	0	0	0	0	<1
OIL OF CITRONELLA	<1	2	0	34	48	0	0	<1	<1
OIL OF CITRUS	0	0	0	0	0	0	0	0	0
OIL OF GERANIUM	0	0	0	15	0	0	0	0	0
OIL OF JOJOBA	7,846	11,566	7,203	8,255	1,762	1,075	311	323	83
OIL OF LEMON EUCALYPTUS	0	0	0	0	<1	<1	0	0	0
OIL OF LEMONGRASS	0	0	0	0	0	0	0	0	0
OIL OF MUSTARD	0	0	0	0	0	0	0	0	0
OIL OF PEPPERMINT	<1	<1	0	15	0	0	0	0	0
OXYPURINOL	1	0	0	0	0	0	0	6	0
PAECILOMYCES FUMOSOROSEUS APOPKA STRAIN 97	0	0	0	0	0	2,109	12,822	18,483	19,076
PAECILOMYCES LILACINUS STRAIN 251	0	0	0	1,115	2,330	3,531	20,039	25,826	32,090
PANTOEA AGGLOMERANS STRAIN E325, NRRL B-21856	0	0	698	55	25	50	50	0	0
PERFUME	0	0	0	0	0	0	0	0	0
PHENYLETHYL PROPIONATE	<1	<1	94	<1	<1	<1	<1	<1	<1
POLYHEDRAL OCCLUSION BODIES (OB'S) OF THE NUCLEAR POLYHEDROSIS VIRUS OF HELICOVERPA ZEA (CORN EARWORM)	0	98	254	302	14,752	1,297	337	518	1,011
POLYOXIN D, ZINC SALT	3	1,067	1,299	19,082	69,674	95,645	143,483	165,596	191,398
POTASSIUM BICARBONATE	47,299	41,899	69,155	101,283	118,627	75,360	85,862	85,701	111,947
POTASSIUM PHOSPHITE	52,370	49,951	36,665	92,671	82,323	115,741	131,548	214,892	199,092
POTASSIUM SORBATE	230	0	2	105	0	0	0	0	0
PROPYLENE GLYCOL	520,537	420,161	381,957	591,332	662,523	676,406	974,901	1,069,583	1,107,277
PSEUDOMONAS FLUORESCENS, STRAIN A506	4,801	1,943	2,463	1,472	1,281	372	431	1,178	376
PSEUDOMONAS SYRINGAE STRAIN ESC-11	0	0	0	0	0	0	0	0	0
PSEUDOMONAS SYRINGAE, STRAIN ESC-10	0	0	0	3	0	0	<1	0	0
PUTRESCENT WHOLE EGG SOLIDS	<1	<1	33	2	<1	<1	<1	<1	<1
PYTHIUM OLIGANDRUM DV74	0	0	0	0	2	2	63	0	0
QST 713 STRAIN OF DRIED BACILLUS SUBTILIS	67,563	75,619	81,252	100,689	118,051	124,700	141,242	137,958	141,536
QUILLAJA	18,584	27,814	22,595	22,949	30,225	22,907	28,538	30,232	31,106
REYNOUTRIA SACHALINENSIS	0	0	1,297	70,363	90,745	94,112	96,143	95,881	105,283

Table 18: (continued) *The reported cumulative acres treated with pesticides that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones).*

AI	2007	2008	2009	2010	2011	2012	2013	2014	2015
S-ABSCISIC ACID	0	34	502	5,197	9,528	14,974	11,645	12,649	11,202
S-METHOPRENE	30,635	47,284	47,190	65,114	62,628	87,637	49,491	53,441	102,289
SALICYLIC ACID	0	0	0	0	0	0	0	0	0
SAWDUST	10	19	<1	<1	0	74	108	0	0
SESAME OIL	888	846	1,448	1,912	1,938	39	1	0	0
SILVER NITRATE	0	0	0	<1	<1	5	0	0	0
SODIUM BICARBONATE	0	17	57	1	967	1,026	291	544	706
SODIUM CHLORIDE	<1	<1	<1	<1	2	175	207	135	66
SODIUM LAURYL SULFATE	<1	14	<1	<1	<1	<1	<1	<1	<1
SOYBEAN OIL	3,277	2,460	3,792	6,845	3,636	3,302	4,524	6,275	6,681
STREPTOMYCES GRISEOVIRIDIS STRAIN K61	12	<1	<1	<1	1	<1	5	10	18
STREPTOMYCES LYDICUS WYEC 108	96	1,910	4,009	6,998	6,404	10,367	16,071	14,050	16,511
SUCROSE OCTANOATE	0	448	930	1,172	148	1	5	10	2
THYME	<1	<1	68	<1	<1	<1	<1	<1	<1
THYMOL	52	60	50	422	12	18	1	1	1,267
TRICHODERMA HARZIANUM RIFAI STRAIN KRL-AG2	311	201	320	7,253	871	1,088	994	2,516	2,343
TRICHODERMA ICC 012 ASPERELLUM	0	0	0	0	86	704	604	35	251
TRICHODERMA ICC 080 GAMSII	0	0	0	0	86	704	604	35	251
ULOCLADIUM OUDEMANSII (U3 STRAIN)	0	0	0	0	0	0	19	707	406
VANILLIN	2,068	87	471	74	412	271	88	68	73
VEGETABLE OIL	144,591	231,954	211,586	292,501	458,756	266,226	350,771	243,680	309,199
XANTHINE	1	0	0	0	0	0	0	6	0
XANTHOMONAS CAMPESTRIS PV. POANNUA	0	0	0	0	0	0	0	0	0
YEAST	4,694	4,560	3,957	1,306	5,261	3,729	325	142	220
YUCCA SCHIDIGERA	0	18	598	2,316	4,907	16,093	19,524	11,283	7,347
Z,E-9,12-TETRADECADIEN-1-YL ACETATE	44	0	1,622	<1	49	<1	<1	<1	<1
Z-11-TETRADECEN-1-YL ACETATE	6,166	5,040	5,589	4,931	942	3,877	3,411	23	51
Z-8-DODECENOL	49,086	54,242	46,757	49,591	45,667	49,300	47,640	41,405	42,595
Z-8-DODECENYL ACETATE	49,086	54,242	46,757	49,591	45,667	49,300	47,640	41,405	42,595
Z-9-TETRADECEN-1-OL	0	0	0	0	0	0	0	0	0
TOTAL	3,814,782	4,013,525	3,908,033	4,776,837	5,321,237	5,478,530	6,433,154	6,814,186	7,387,355

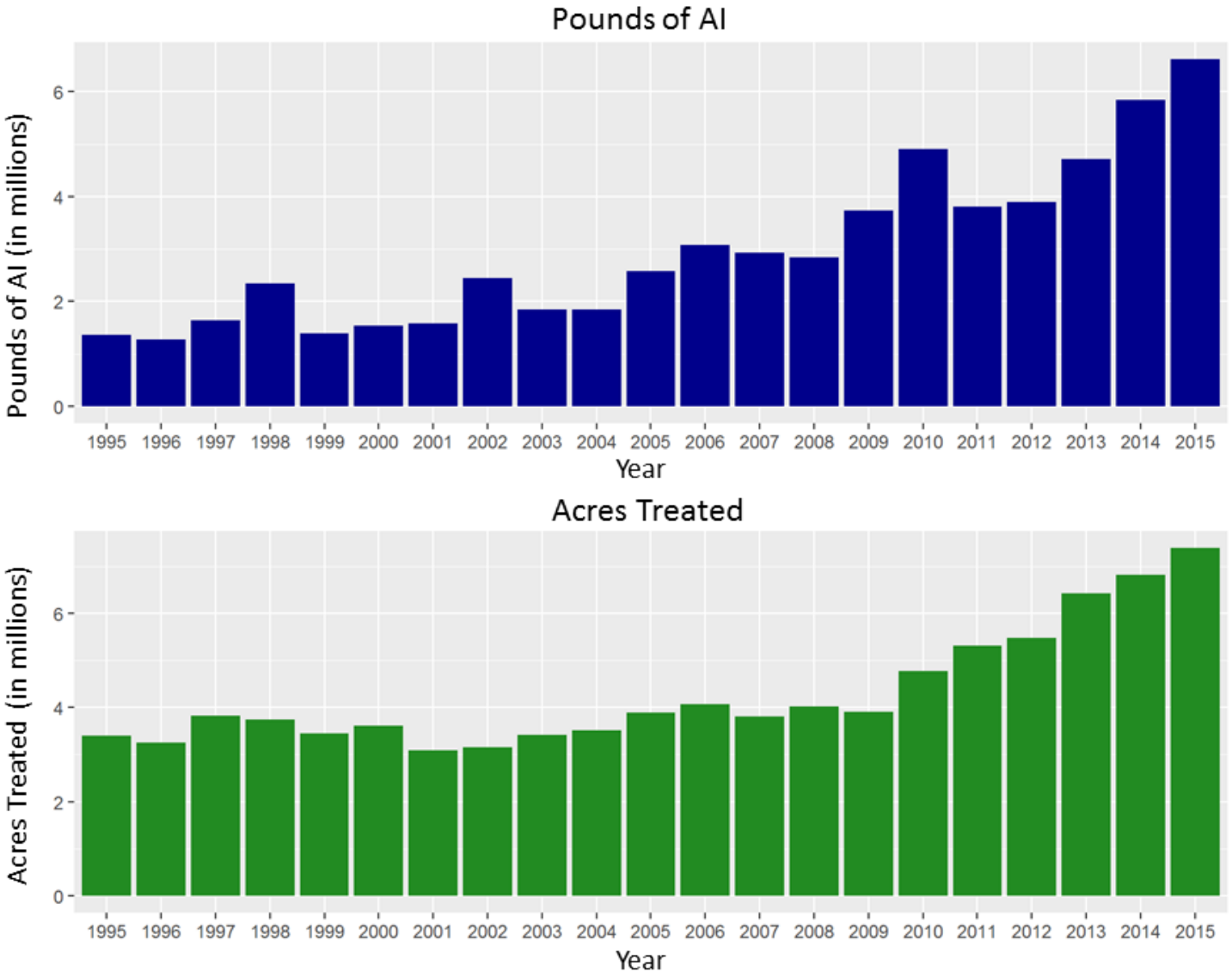

Figure 12: *Use trends of pesticides that are biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones). Reported pounds of active ingredient (AI) applied include both agricultural and non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

5 Trends In Pesticide Use In Certain Commodities

A grower's or applicator's decision to spray depends on many factors, such as the presence of biological control agents (e.g., predatory insects and other natural enemies), current pest levels, cost of pesticides and labor, value of the crop, pesticide resistance and effectiveness, other available management practices, and potential pesticide risk to the environment or farm workers. Pest populations are determined by complex ecological interactions. Sometimes the causes of pest outbreaks are unknown. Weather is a critically important factor and affects different pest species in different ways.

Crops treated with the greatest amounts of pesticides in 2015 were almond, wine grape, processing tomato, table and raisin grape, and strawberry. Crops or sites with the greatest increase in the amount applied from 2014 to 2015 include almond, pistachio, wine grape, orange, walnut, and carrot. Crops or sites with the greatest decrease in the amount applied include water (industrial), rice, strawberry, table and raisin grape, and raspberry (Table 19).

Table 19: *The change in pounds of AI applied and acres planted or harvested and the percent change from 2014 to 2015 for the crops or sites with the greatest increase and decrease in pounds applied. Acre values sourced from CDFA(a, b), USDA(a,b,d)*

	Change in Use 2014–2015		Percent Change 2014–2015	
Crop Treated	Pounds	Acres	Pounds	Acres
ALMOND	9,506,374	60,000	37	6
PISTACHIO	2,971,842	12,000	61	5
GRAPE, WINE	2,610,266	-7,000	10	-1
ORANGE	1,637,980	-3,000	19	-2
WALNUT	1,208,518	10,000	21	3
RASPBERRY	-371,579	1,270	-30	17
GRAPE	-478,544	-3,000	-3	-1
STRAWBERRY	-517,991	-1,000	-4	-2
RICE	-550,192	-11,000	-11	-3
WATER (INDUSTRIAL)	-988,709		-39	

Thirteen commodities were chosen for in-depth analysis of the possible reasons for changes in pesticide use from 2014 to 2015: alfalfa, almond, carrot, cotton, orange, peach and nectarine, pistachio, processing tomato, rice, strawberry, table and raisin grape, walnut, and wine grape. These 13 commodities were chosen because each was treated with more than 4 million pounds of AIs or treated on more than 3 million acres, cumulatively. Collectively, these commodities represent 72 percent of the amount reported in the PUR (78 percent of total used on agricultural fields) and 74 percent of the area treated in 2015.

For these 13 commodities, the non-adjuvant AIs applied to the most area were sulfur and

glyphosate. Sulfur, used on all 13 commodities except rice, was applied mostly on table and raisin grape, wine grape and processing tomato. Sulfur is a natural fungicide favored by both conventional and organic farmers and is used mostly to manage powdery mildew on grape and processing tomato. However, it is used in some crops to suppress mites. Glyphosate is a broad-spectrum herbicide and crop desiccant. Almond acres received nearly 40 percent of the glyphosate use of all 13 commodities, although all 13 commodities reported some use. In addition, the following AIs were used on over one million cumulative acres (although not all of the AIs were used on every one of the 13 commodities): the insecticides (and miticides) abamectin, lambda-cyhalothrin, bifenthrin, methoxyfenozide, and petroleum and mineral oils; the herbicides oxyfluorfen and paraquat dichloride; and the fungicide copper.

Petroleum and mineral oils were second to sulfur in amount of pounds of non-adjuvant pesticides used on all 13 commodities. All 13 crops reported use of oils, but the highest use was on almond, wine grape, orange, and pistachio. Oils are mostly used as insecticides, but can also be used as fungicides and adjuvants. The fumigants 1,3-dichloropropene, chloropicrin, metam-potassium, and metam-sodium also ranked high in pounds of pesticide used on the 13 commodities, with the exception of rice. In production agriculture, these fumigants are usually applied to the soil before planting a crop to control various soil-borne diseases, nematodes, and other problematic pests. In orchards, fumigation may be used to spot-treat a small area following tree removal before a replacement tree is planted.

Information used to develop the trend analyses for each of the thirteen crops in this chapter was drawn from several publications and phone interviews with pest control advisors, growers, University of California Cooperative Extension farm advisors and specialists, researchers, and commodity association representatives. DPR staff analyzed the information, using their knowledge of pesticides, California agriculture, pests, and pest management practices. As a result, the explanations for changes in pesticide use are largely based on the subjective opinions of experts as opposed to rigorous statistical analyses. Additional figures of pesticide distribution maps and graphs associated with each crop can be found in the Appendix of this document (Appendix figures are referenced by an “A” preceding the figure number).

Alfalfa

Alfalfa is grown primarily as a forage crop, providing protein and high energy for dairy cows and other livestock. California is the leading alfalfa hay-producing state in the United States. There are six alfalfa growing regions in California, encompassing a range of climatic conditions: Intermountain, Sacramento Valley, San Joaquin Valley, Coastal, High Desert, and Low Desert (Figure A-3). The price received per ton of hay decreased in 2015 after having reached one of its highest values in 2014 (Table 20). In addition, the number of acres harvested was at its lowest since the 1940s. These two factors account for some of the observed trends in pesticide use in alfalfa in 2015 (Figures 14, A-4, and A-5).

Table 20: *Total reported pounds of all active ingredients (AI), acres treated, acres harvested, and prices for alfalfa each year from 2011 to 2015. Harvested acres from 2011 to 2015 are from USDA(a), 2012-2016; marketing year average prices from 2011 to 2015 are from USDA(c), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	3,526,056	3,541,911	3,740,535	3,732,816	3,509,071
Acres Treated	5,545,181	5,208,146	6,206,811	6,651,029	5,686,110
Acres Harvested	880,000	950,000	900,000	875,000	1,180,000
Price/ton	$ 239	$ 210	$ 206	$ 244	$ 185

Use of all the major insecticides decreased in 2015 (Figure 13). This decrease can be tied to lower prices received for hay as well as reduced number of acres planted. Alternative practices, such as early cutting, may be cheaper than spraying for some pests under these conditions. Less pressure from blue alfalfa aphid–the lowest in two years–likely led to decreased use of insecticides. In addition to the organophosphates chlorpyrifos and dimethoate (Figure 14), malathion, another organophosphate, and methomyl, a carbamate, were used less.

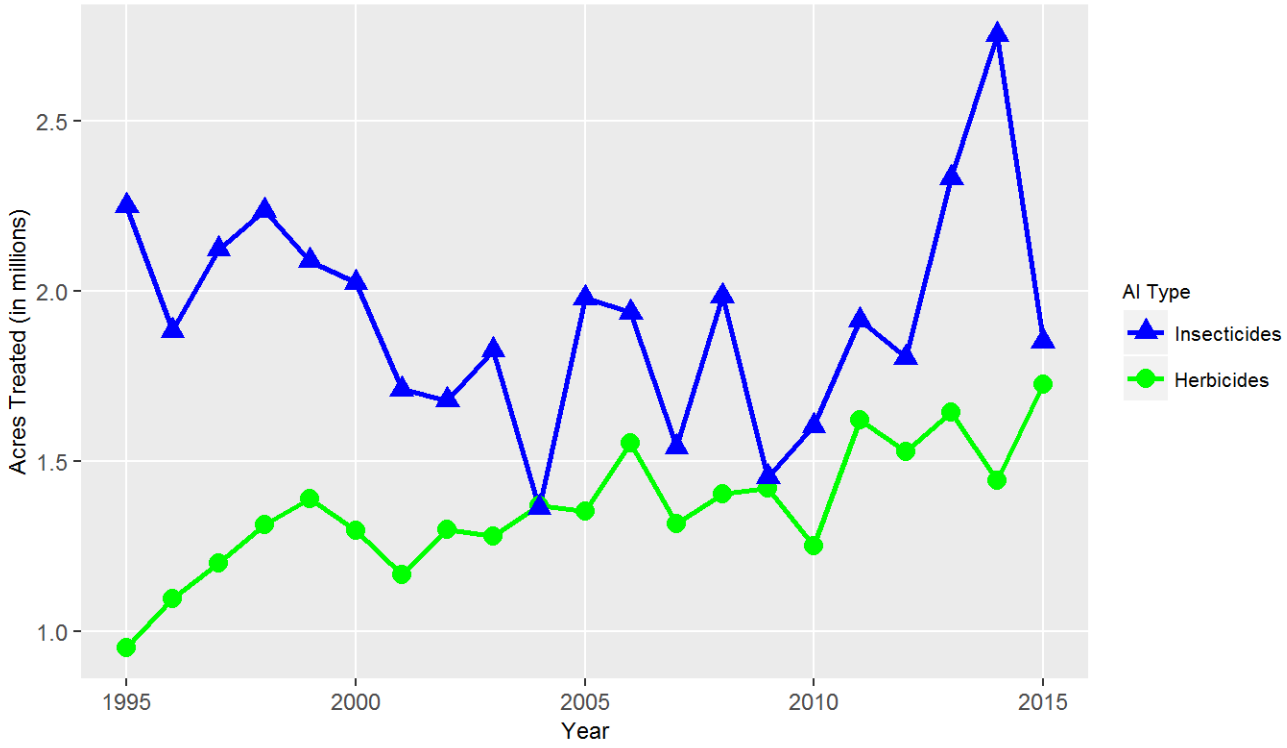

Figure 13: *Acres of alfalfa treated by all AIs in the major types of pesticides from 1995 to 2015.*

There were decreases in the acres treated with all commonly used pyrethroids except cypermethrin. These decreases reverse a trend that had been happening since 2009. Besides cypermethrin, the only other AI to have been applied to a substantially greater number of acres in

2015 was the miticide hexythiazox. Nearly all applications of hexythiazox took place in Imperial County. Increased use of this miticide may have resulted from secondary outbreaks of mites due to pyrethroid applications for blue alfalfa aphid. Flupyradifurone, newly registered in April 2015, was used widely as growers tried this new product to manage the blue alfalfa aphid.

Herbicide use increased (Figure 13). The largest increases were found in paraquat dichloride, glyphosate, hexazinone, flumioxazin, diuron, and carfentrazone-ethyl (Figure 14). Although drought conditions may have inhibited weed growth to some extent, substantial penalties ($100 per ton) levied for reduced quality likely made weed management more important. Weed growth exerts a large effect on the quality of hay.

Use of fungicides in alfalfa is minimal compared to the use of insecticides and herbicides.

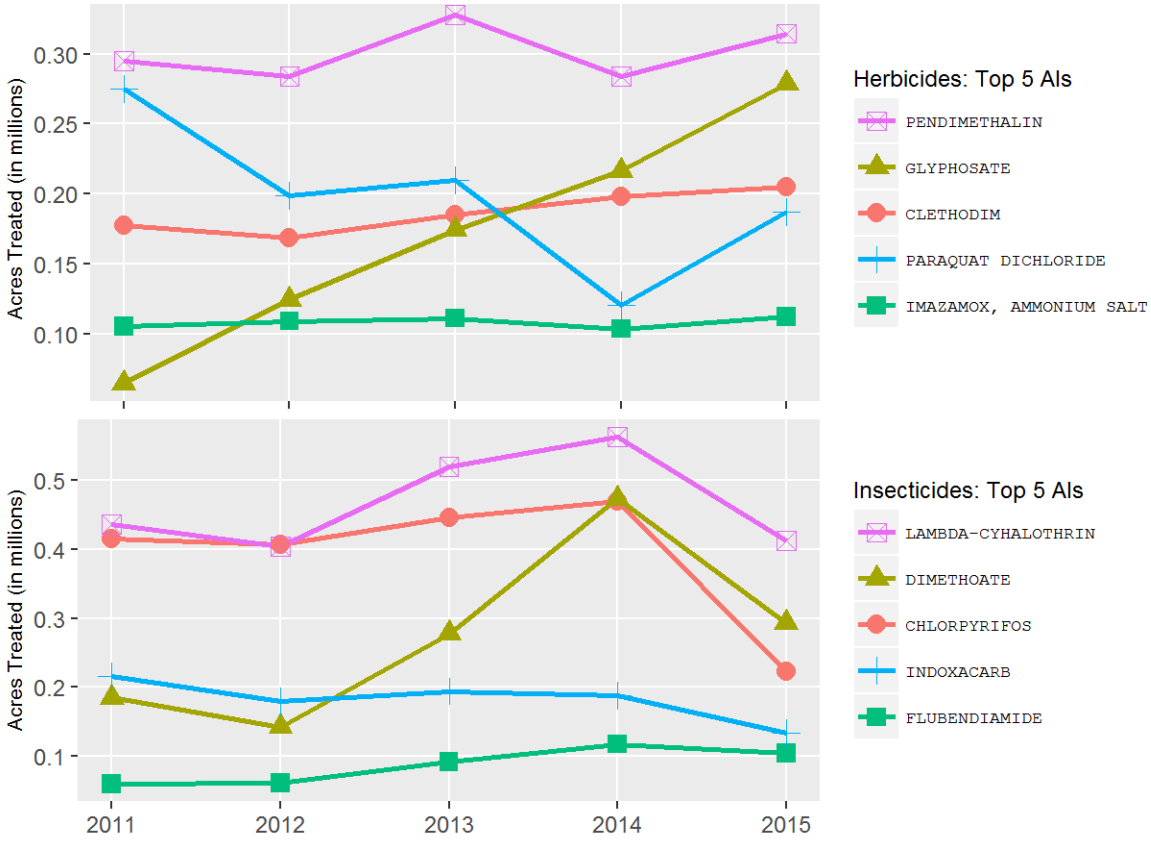

Figure 14: *Acres of alfalfa treated by the top 5 AIs of each AI type from 2011 to 2015.*

Almond

California produces 82 percent of the world's supply of almonds. There are approximately 1.1 million acres of almond, located over a 400-mile stretch from northern Tehama County to

southern Kern County in the Central Valley (Figure A-6). Despite a decreasing price trend, the relatively high prices and low labor requirements of almond production are reflected in a continued annual increase in total acreage (Table 21). Pesticide use increased as well, with a 14 percent increase in treated area and 25 percent increase in the total pounds per acre planted (Table 21).

Table 21: *Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for almond each year from 2011 to 2015. Planted acres from 2011 to 2015 are from CDFA(a), 2011-2015; marketing year average prices from 2011 to 2015 are from USDA(d), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	25,853,549	23,121,348	29,874,358	25,913,046	35,419,420
Acres Treated	13,740,874	14,803,998	16,973,848	18,038,068	20,578,543
Acres Planted	835,000	930,000	970,000	1,050,000	1,110,000
Price/lb	$ 1.99	$ 2.58	$ 3.21	$ 4.00	$ 2.84

The major almond pests include mites, San Jose scale, peach twig borer, navel orangeworm, ants, Alternaria leaf spot, brown rot, band canker, scab, powdery mildew, and many weed species. The use of insecticides increased, as well as herbicides and fungicides. Total pounds of fumigants used increased, although the treated area decreased (Figures 15, 16, A-7, and A-8).

The winter of 2015 had average temperatures but below-average rainfall, resulting in a large overwintering population of navel orangeworm, a major pest of almond. Navel orangeworm feeds directly on the nutmeat. As the larvae feed, they leave behind frass (or excrement), a substrate for the fungi *Aspergillus flavus* and *A. parasiticus*, which contaminate the nut with aflatoxins and impacts food safety. The increasing trend in area treated with insecticides since 2013 likely reflects increasing navel orangeworm pest pressure.

Increased use of methoxyfenozide and chlorantraniliprole and decreased use of pyrethroids show that a variety of chemical modes of action were needed to prevent pest resistance to pyrethroids. However, despite some reports of resistance to bifenthrin, a pyrethroid, its use continued to increase, possibly in an effort to manage leaffooted bugs, which have recently become an important almond pest (Figure 16). Abamectin continued to be widely used, although use leveled off in 2015 (Figure 16). The long-term, widespread use of abamectin resulted in reports of mite resistance. The use of oil in spring and summer increased in 2015, possibly to boost the effectiveness of abamectin, used to manage resistant spider mites. Use of other miticides such as etoxazole and clofentezine also increased.

Herbicides used from 1995 to 2015 steadily increased, reflecting a 36 percent increase in almond acreage, increasing herbicide resistance, and, recently, the drought. Weeds can increase water use by 10 to 30 percent. Thus, during a drought, it can be important to manage weeds to save water, resulting in increased use of herbicides. In addition, resistance to glyphosate, the most commonly

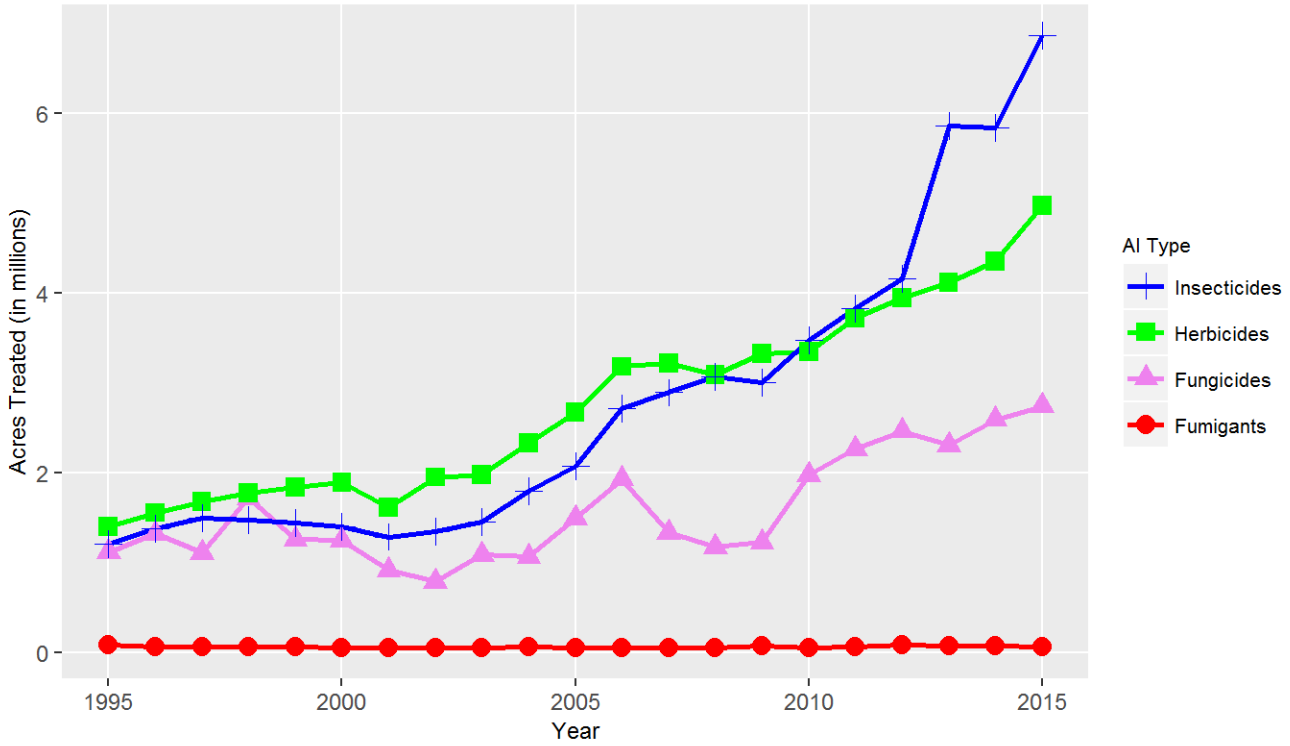

Figure 15: *Acres of almond treated by all AIs in the major types of pesticides from 1995 to 2015.*

used herbicide, has worsened and growers have turned to other herbicides to manage resistant weeds such as rigid ryegrass.

Use of fungicides increased in 2015, likely a reflection of the increased acreage as well as rain during and after bloom. Rainfall is the key predictor of diseases such brown rot, blossom blight, and Alternaria leaf spot.

There were some notable shifts among the top five fungicides used on almond in 2015: fluopyram, metconazole, and copper all increased, while propiconazole and iprodone decreased (Figure 16). Notably, none of the strobilurin fungicides were included among the top five AIs used. The increase in fluopyram and metconazole use was probably due to resistance developing to strobilurin fungicides, as well as their effectiveness against numerous diseases such as brown rot blossom blight, shot hole, scab, anthracnose, Alternaria leaf spot, and other important diseases in almonds. The use of copper increased to combat scab.

Fumigants have multiple functions in almond production: post-harvest insect management during storage, pest management to meet phytosanitary and food safety standards, pre-plant soil fumigation to manage soil-borne diseases and nematodes, and finally, to some extent, rodent management. Use of pre-plant soil fumigants remained relatively low from 2011-2015, with little fluctuation. The use of post-harvest fumigants is dependent on the size of the crop.

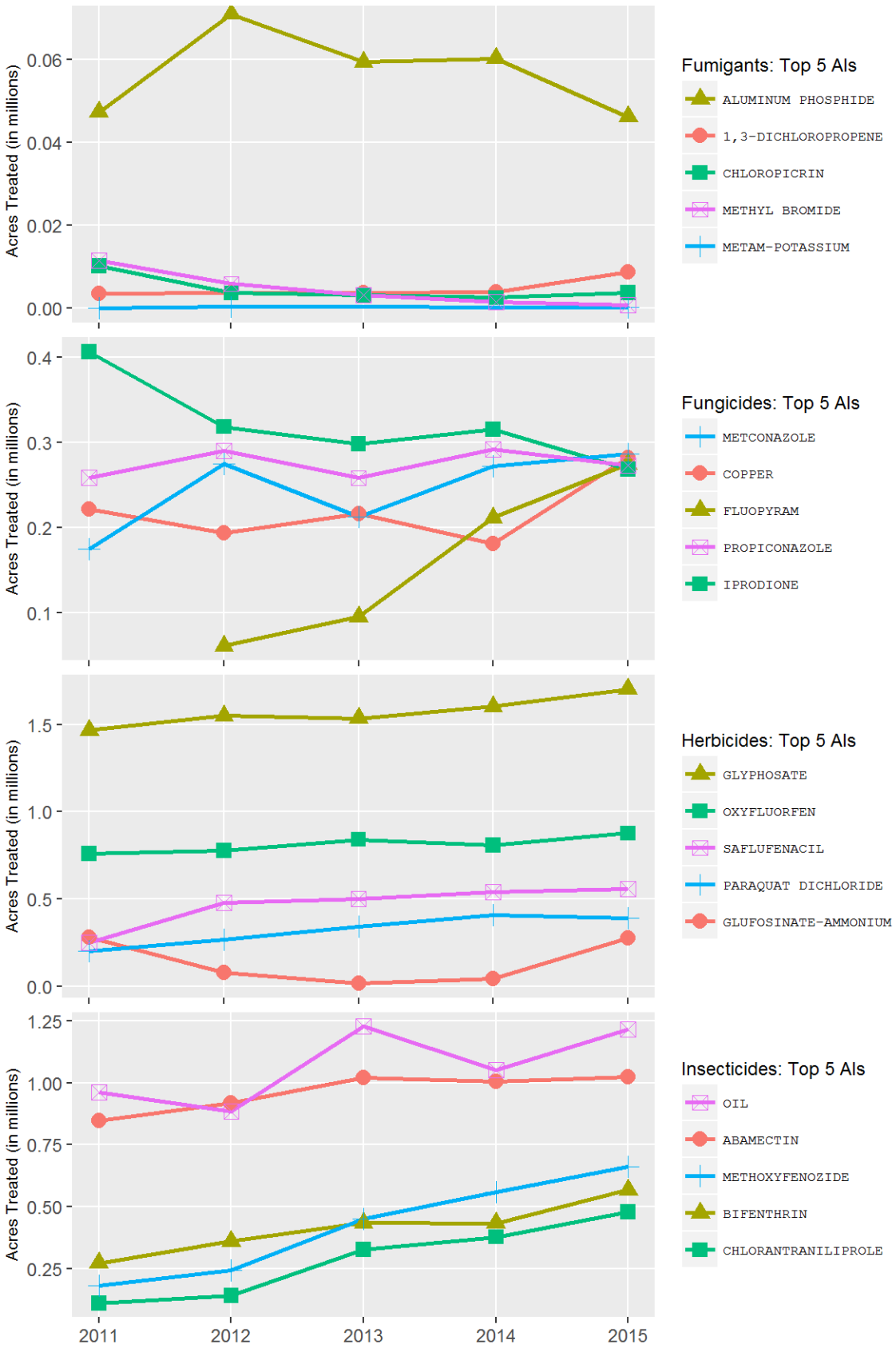

Figure 16: *Acres of almond treated by the top 5 AIs of each AI type from 2011 to 2015.*

Carrot

California is the largest producer of fresh market carrots in the United States, accounting for 81 percent of the U.S. production of 2.4 billion pounds in 2015. California has four main production regions for carrots: the San Joaquin Valley (Kern County), the Central Coast in San Luis Obispo and Santa Barbara counties (Cuyama Valley) and Monterey County, the low desert (Imperial and Riverside counties), and the high desert (Los Angeles County) (Figure A-9). The San Joaquin Valley accounts for more than half the state's acreage.

In 2015, 67,000 acres of carrots were planted in California, an increase of about 1.5 percent from 2014 (Table 22). Despite this increase in acreage, the area treated with fungicides, herbicides, and insecticides decreased. Fumigants were the only pesticide type used on more acres than in 2014 (Figures 17, 18, A-10, and A-11). Nematodes, weeds, cavity spot, and leaf blights remain the major pest concerns.

Table 22: *Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for carrot each year from 2011 to 2015. Planted acres and marketing year average prices from 2011 to 2015 are from USDA(e), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	6,623,626	7,229,837	6,428,037	5,498,445	6,521,610
Acres Treated	457,669	507,562	526,657	605,551	561,571
Acres Planted	65,000	62,000	63,000	66,000	67,000
Price/cwt	$ 34.20	$ 26.90	$ 29.60	$ 28.20	$ 32.70

Fungicides were applied to more acres of carrot production in 2015 than any other pesticide type (Figure 17). The most-applied fungicides by area treated were sulfur, mefenoxam, and copper, followed by pyraclostrobin and azoxystrobin. Both the treated acreage and the applied pounds of sulfur declined, while the use of copper increased. The use of the other three fungicides declined slightly.

Herbicides followed fungicides as the pesticide type with the second largest treated acreage (Figure 17). As was the case in 2014, the most-applied herbicides in carrot production by area were linuron, pendimethalin, fluazifop-p-butyl, and trifluralin (Figure 18). Clethodim replaced EPTC as the fifth most-used herbicide by area. Linuron, which was applied to the largest number of acres, is a postemergence herbicide that manages broadleaf weeds and small grasses.

The most-used insecticides by area remain the same as last year. Use of *Paecilomyces lilacinus* Strain 251, a naturally occurring fungus with nematicidal properties, and imidacloprid, methoxyfenozide, and (S)-cypermethrin remained practically unchanged from 2014. Use of

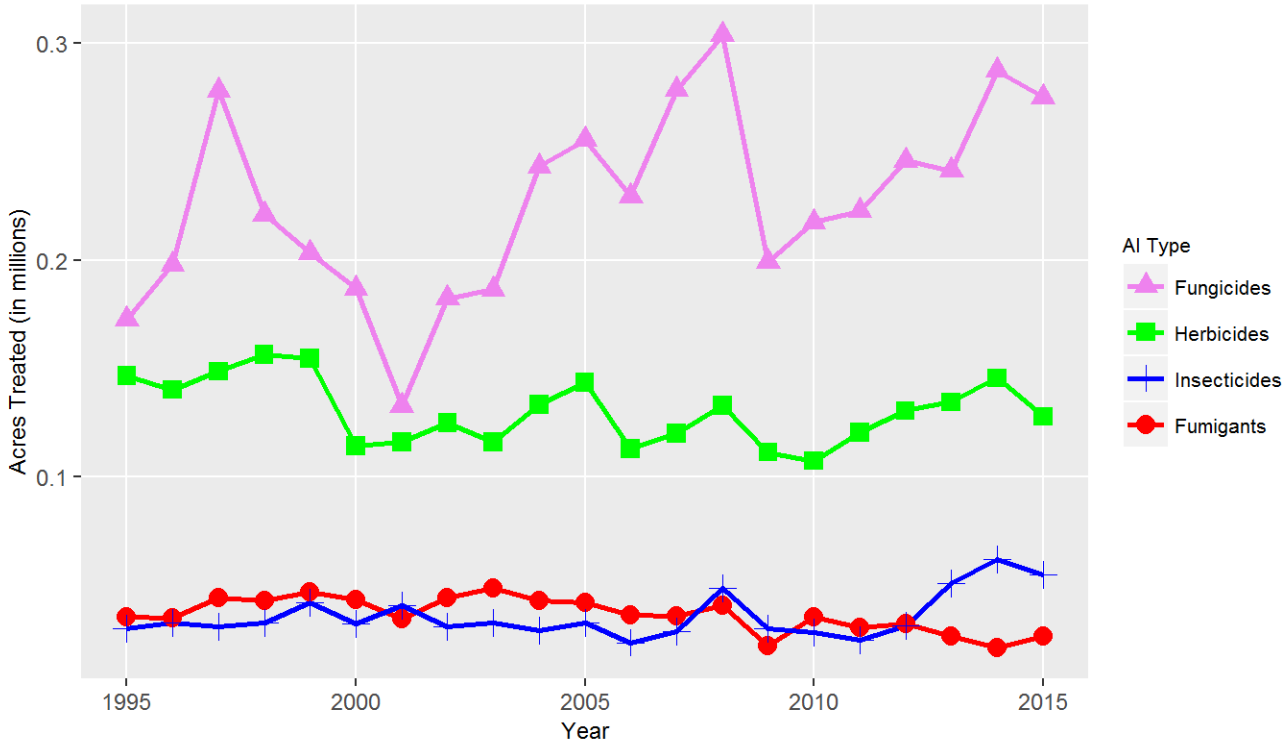

Figure 17: *Acres of carrot treated by all AIs in the major types of pesticides from 1995 to 2015.*

esfenvalerate, which is applied to kill insect pests such as whiteflies, leafhoppers, and cutworms, decreased for both area treated and total pounds applied (Figure 18).

Fumigants in carrot production are primarily used to manage nematodes, weeds, and soil-borne diseases. Metam-potassium, metam-sodium, and 1,3-dichloropropene were the three most-used fumigants for carrots in 2015 (Figure 18). Fumigant use increased both for the area treated and for the total pounds applied. The increase in use of fumigants took place primarily in Kern, Los Angeles, and Imperial counties. The increased use of fumigants was the primary factor that led to the 18 percent increase in total pounds of AIs used in carrot production from 2014 to 2015.

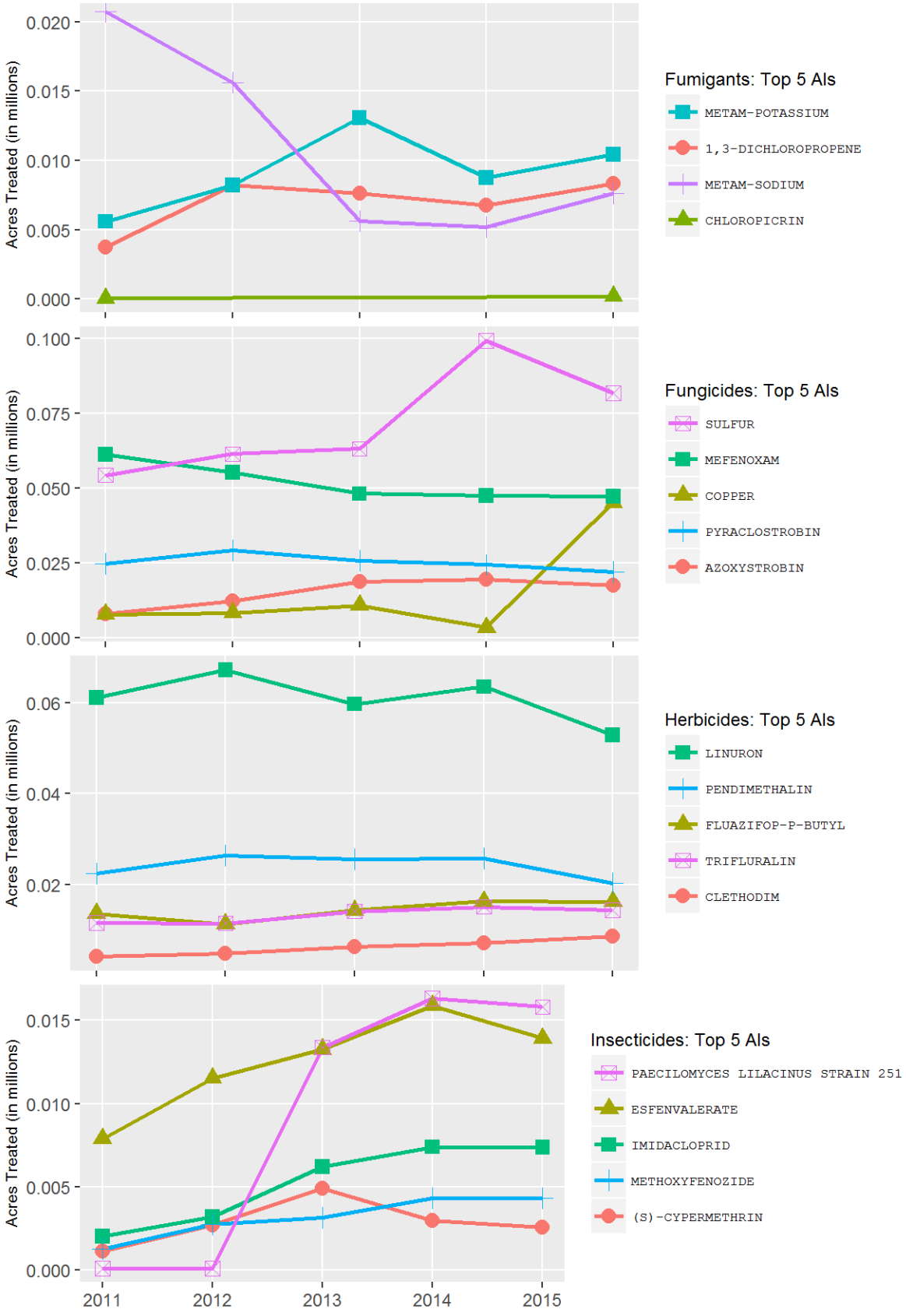

Figure 18: *Acres of carrot treated by the top 5 AIs of each AI type from 2011 to 2015.*

Cotton

Cotton is grown for its fiber, but cottonseed can be used to produce cottonseed oil and cottonseed meal for dairy feed. Total planted cotton acreage decreased in 2015 (Table 23), largely due to competition from China, which drove growers to switch to production of crops that have shown recent increases in profitability, such as almond, tomato, and grape. Most cotton is grown in the southern San Joaquin Valley, with smaller acreages grown in Imperial and Riverside counties and a few counties in the Sacramento Valley (Figure A-12). Nearly all pesticide use decreased from 2014 to 2015 except for insecticides, which increased (Figure 19).

Table 23: *Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for cotton each year from 2011 to 2015. Planted acres from 2011 to 2015 are from USDA(a), 2012-2016; marketing year average prices from 2011 to 2015 are from USDA(c), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	5,062,466	3,522,205	3,003,711	2,433,376	2,155,144
Acres Treated	9,888,810	6,550,710	6,253,788	4,593,251	4,429,184
Acres Planted	456,000	367,000	280,000	212,000	164,000
Price/lb	$ 1.27	$ 1.11	$ 1.45	$ 1.38	$ 0.96

The price per pound in Table 23 is an average of the prices of upland and pima cotton, weighted by their respective acreages. Due to the wide variation in individual prices, it is best to consult USDA and CDFA for specific prices.

Use of most major insecticides increased in 2015 (Figure 19). The use of reduced-risk, selective insecticides increased, which can require more applications to treat a wide variety of pests compared to conventional, broad-spectrum insecticides. The major arthropod pests in cotton in 2015 were lygus bugs, spider mites, cotton aphids, whiteflies, and thrips. However, some locations experienced pest pressure from brown stink bug and grasshoppers as well. Thrips were problematic in areas experiencing cool temperatures and slow cotton development, while lygus bugs were more of a problem mid-season due to large areas of weeds emerging from early rainfall. Lygus bugs, thrips, spider mites, and cotton aphids all required late season management (Figure A-14). Sweet potato whitefly (strain B) developed into a major pest in 2013 and still remains an issue. Late season aphids and whiteflies are a serious concern because they produce sugary excretions, which drop onto the cotton lint creating a condition called sticky cotton. This condition causes problems when the cotton is ginned, lowering the quality of the cotton lint and thus the price growers receive. One factor contributing to larger whitefly populations in recent years is the California drought.

Use of nearly all major herbicides decreased, including glyphosate (Figure 19). As has been the case for the last several years, glyphosate was used much more than any other herbicide due to the

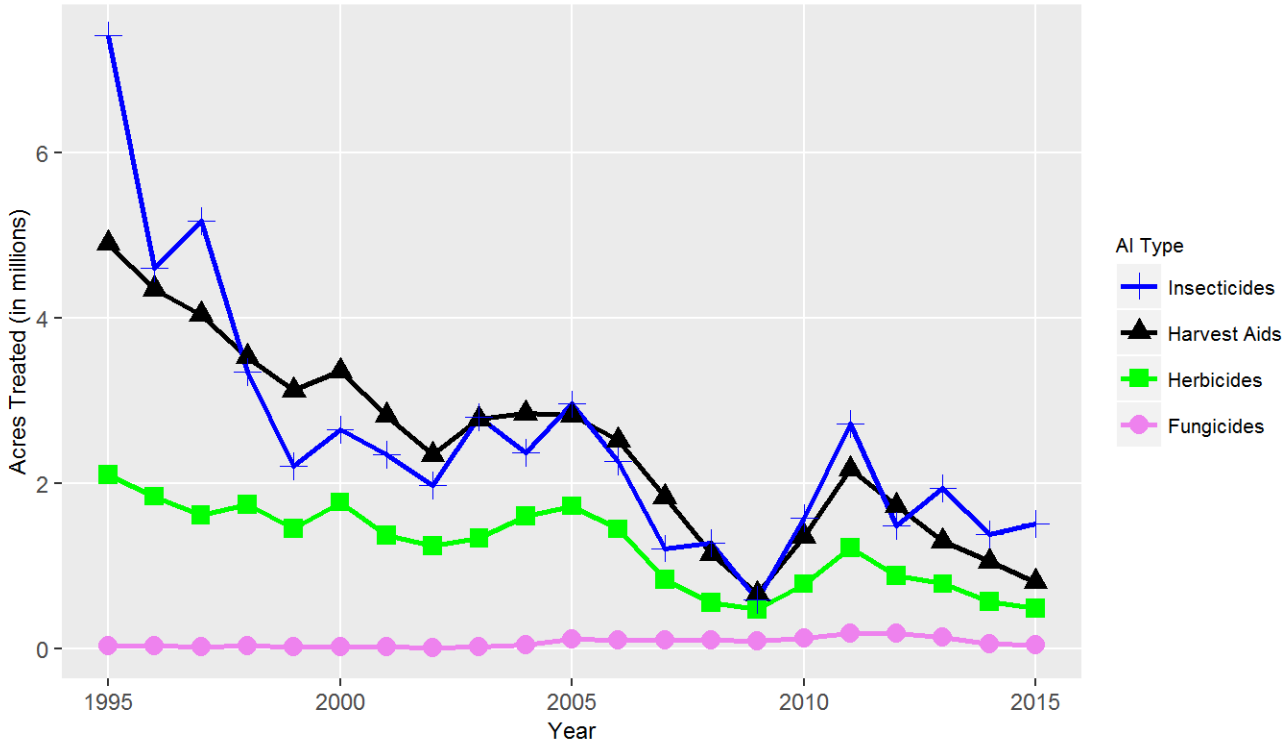

Figure 19: *Acres of cotton treated by all AIs in the major types of pesticides from 1995 to 2015.*

large acreage of Roundup-Ready cotton, a genetically engineered crop designed to be resistant to glyphosate. Some AIs, such as paraquat dichloride, are used both as herbicides and harvest aids, chemicals used to defoliate or desiccate cotton plants before harvest. It is assumed that if an herbicide was applied in August through November, it was used as a harvest aid, not as an herbicide (Figures 20, A-13, and A-14).

Use of nearly all major fungicides decreased in 2015, continuing a decreasing trend from a small fungicide increase in earlier years that was caused by higher-than-normal pest pressure from seedling diseases (e.g. *Rhizoctonia solani*).

Fumigants are also rarely used in cotton fields and their use decreased from 2014 to 2015. Fumigants are used to treat the soil before planting for a range of soil pathogens, nematodes, and weeds, in addition to treating stored products. The higher use in previous years may be due to concern over the soil-inhabiting fungus *Fusarium oxysporum* f. sp. *vasinfectum* race 4, more commonly known as FOV race 4, which is spreading throughout the San Joaquin Valley. Some experts consider this pathogen to be one of the biggest challenges California cotton growers have faced in many years. Once a field is infected, it is impossible to achieve profitable yields of many cotton varieties. Although the pathogen cannot be completely eradicated by pesticides, some research has shown that metam-sodium treatments can knock down inoculum populations.

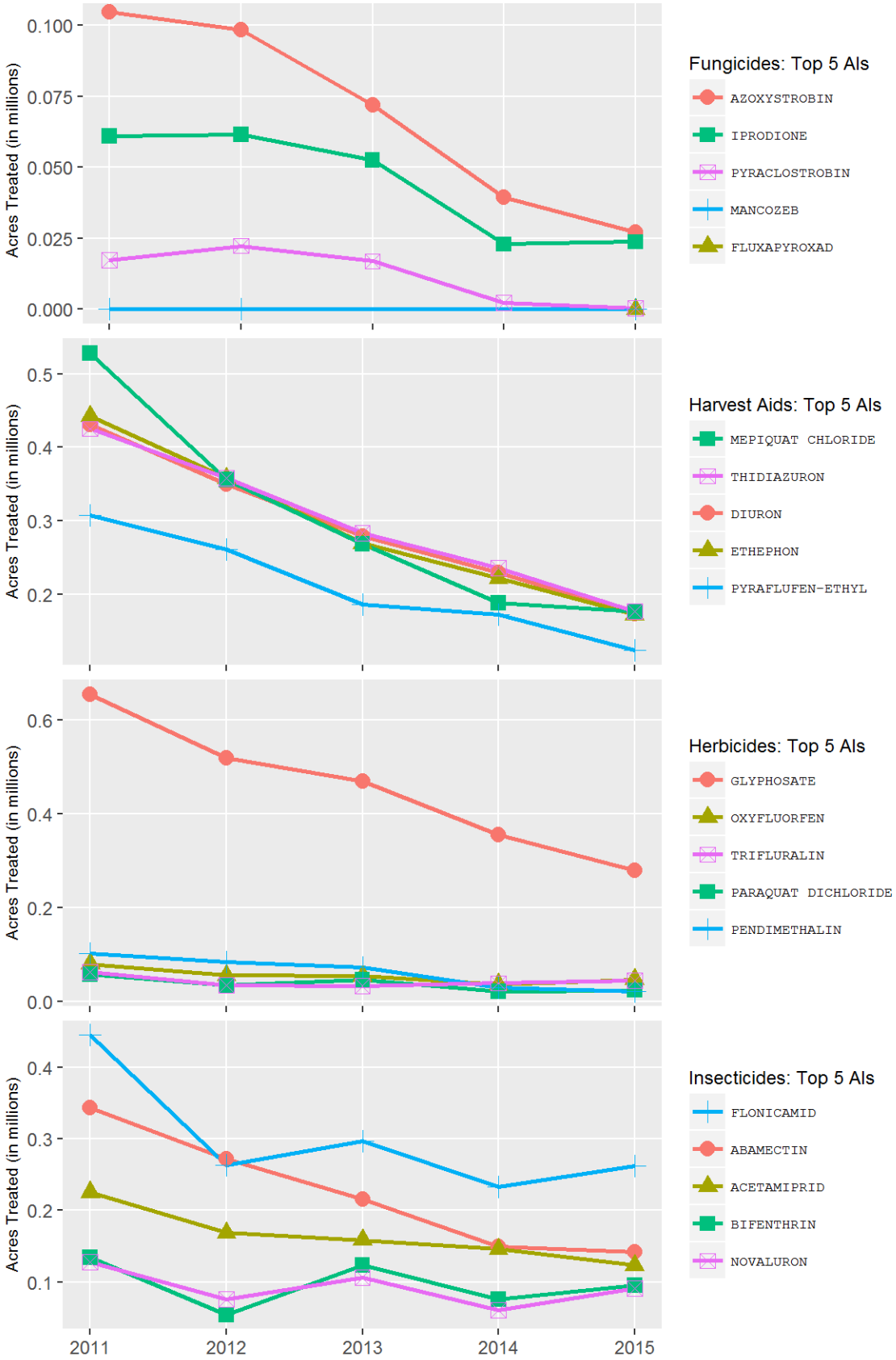

Figure 20: *Acres of cotton treated by the top 5 AIs of each AI type from 2011 to 2015.*

Orange

California has the highest valued citrus industry in the United States. Citrus is grown in four major areas in California. The San Joaquin Valley Region comprises nearly 65 percent of the state's acreage and is characterized by hot, dry summers and cold, wet winters. The Interior Region includes Riverside and San Bernardino counties and inland portions of San Diego, Orange, and Los Angeles counties and is marginally affected by the coastal climate. The Coastal-Intermediate Region extends from Santa Barbara County south to the San Diego County-Mexican border and has a mild climate influenced by marine air. The Desert Region includes the Coachella and Imperial valleys where temperatures fluctuate wildly (Figure A-15).

Table 24: *Total reported pounds of all active ingredients (AI), acres treated, acres bearing, and prices for orange each year from 2011 to 2015. Bearing acres and marketing year average prices from 2011 to 2015 are from USDA(b), 2013-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	10,129,304	8,930,908	8,973,548	8,488,090	10,126,070
Acres Treated	2,447,330	2,344,867	2,371,133	2,385,831	2,535,949
Acres Bearing	180,000	177,000	171,000	166,000	163,000
Price/box	$ 10.50	$ 13.19	$ 13.05	$ 19.03	$ 16.04

Total bearing acres decreased in 2015 by 1.8 percent (Table 24), continuing a four-year decline due in part to a reduction in available irrigation water. The price per box decreased 30 percent in 2015, and was similar to prices from 2012 and 2013.

Insecticide use increased in 2015 (Figure 21). Oils are the most widely used insecticide on oranges (Figure 22). They kill soft-bodied pests such as aphids, immature whiteflies, immature scales, psyllids, immature true bugs, thrips, mites, and some insect eggs. Oils also manage powdery mildew and other fungi.

The Asian citrus psyllid (ACP), which vectors huanglongbing (citrus greening disease), was first detected in Los Angeles in 2008. Since that time, ACP has spread throughout Southern California, up the Central Coast, and into the San Joaquin Valley. Despite eradication efforts, treatments have not prevented the spread of ACP and it remains a major concern.

Aside from its use for the ACP eradication program, chlorpyrifos is a broad-spectrum insecticide used primarily for citricola scale management. However, chlorpyrifos resistance in citricola scale has been documented and imidacloprid is increasingly being used to suppress these resistant populations. Imidacloprid use increased in 2015, continuing a trend since 2005 (Figures A-16 and A-17). Imidacloprid is also used in the required treatment of glassy-winged sharpshooter.

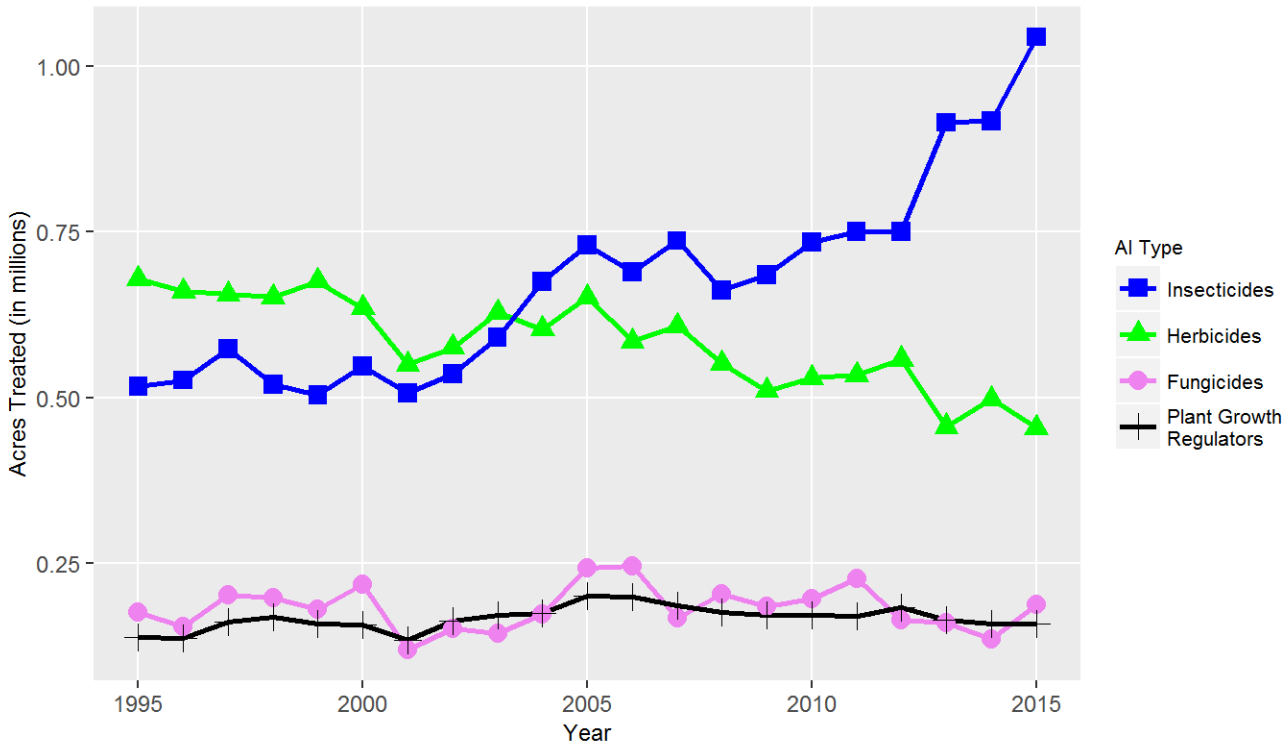

Figure 21: *Acres of orange treated by all AIs in the major types of pesticides from 1995 to 2015.*

Spinosad and spinetoram are relatively new insecticides and are primarily used in citrus to manage citrus thrips (Figure 22). Both are very selective, allowing natural enemies to survive and may eventually take over the market share of older insecticides. Of the two, spinetoram is more effective against citrus thrips populations that have developed resistance to carbamate insecticides, and its persistence and effectiveness has resulted in the reduced use of spinosad.

Fenpropathrin is used to manage red mites, citrus thrips, Asian citrus psyllid, katydids, and other miscellaneous pests. The insecticidal activity of fenpropathrin is largely interchangeable with that of beta-cyfluthrin. Abamectin is used for thrips, mites, and citrus leafminer, and is preferred because it is inexpensive and has broad-spectrum and long residual activity, low worker risk, and a short pre-harvest interval. Dimethoate is used for a variety of pests such as scales and thrips. Its declining use is likely due to the growing popularity of replacement insecticides such as spinetoram and the neonicotinoids imidacloprid and acetamiprid. Pyriproxyfen is used almost exclusively for California red scale. In the San Joaquin Valley, populations of armored scale show resistance to chlorpyrifos, methidathion, and carbaryl, and growers are encouraged to release parasitic wasps and use buprofezin, oil, pyriproxyfen, and spirotetramat.

Fungicides are used to prevent Phytophthora gummosis, Phytophthora root rot, and fruit diseases such as brown rot and Septoria spot. These diseases are exacerbated by wet, cool weather during harvest. There was an increase in fungicide use in 2015, largely due to a substantial increase in

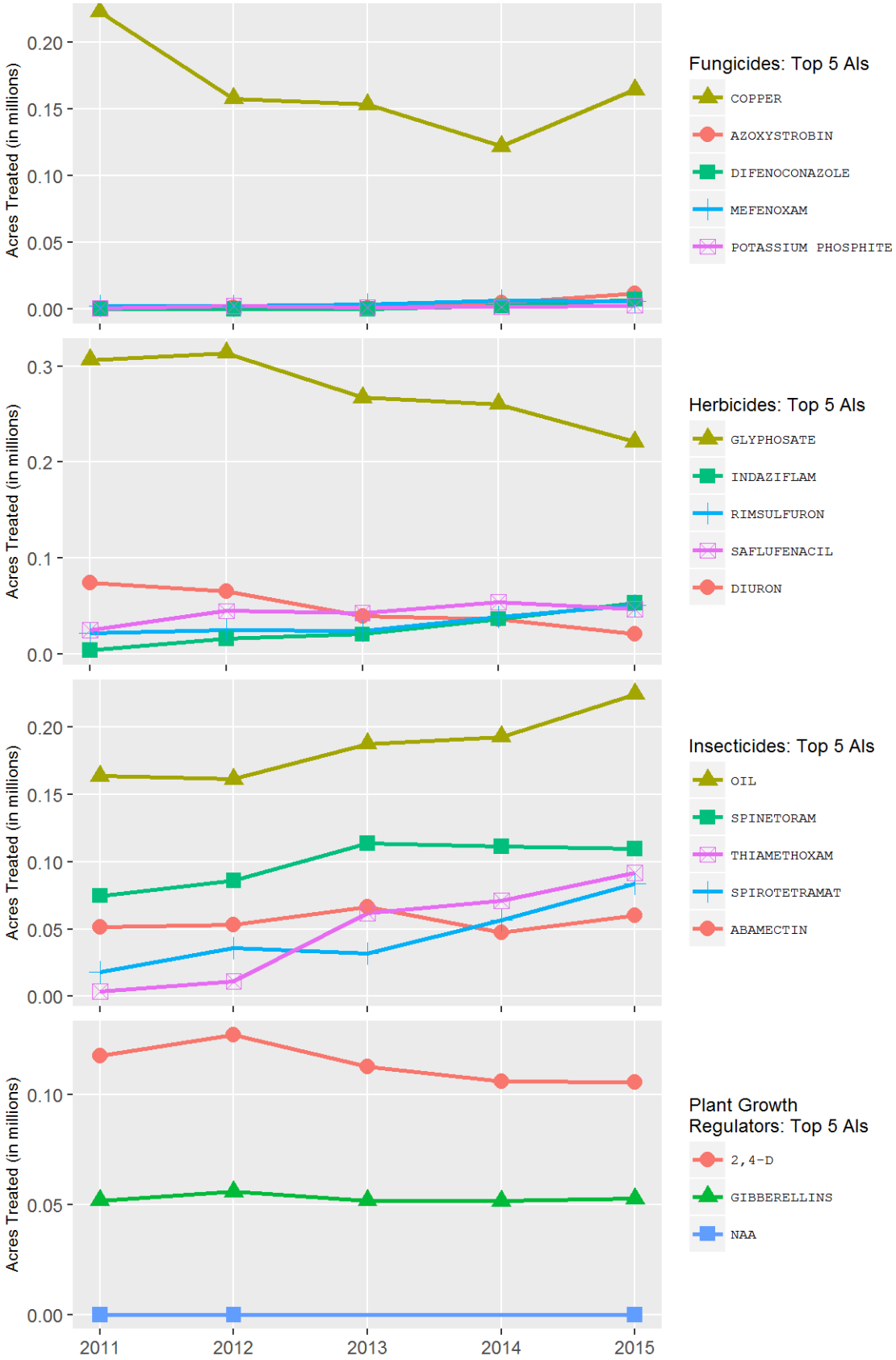

Figure 22: *Acres of orange treated by the top 5 AIs of each AI type from 2011 to 2015.*

the use of copper-based fungicides, the most widely used fungicides in oranges (Figures 21, 22, and A-16).

Weed management is important in citrus groves to prevent competition for nutrients and water, which affects tree growth and reduces yield. Excessive weed growth also impedes production and harvesting operations. Both preemergence and postemergence herbicides are used, as well as mechanical removal. Herbicide use decreased in 2015. Glyphosate, a postemergence herbicide, was the most-used herbicide. Simazine is widely used for pre- and post- emergence weed management. Saflufenacil is a postemergence, burn-down herbicide that was first used in 2010 and now replaces glyphosate for use on horseweed and fleabane due to resistance. Indaziflam is a preemergence herbicide, and its use has increased every year since it was first registered in California in 2011 (Figures 21, 22, and A-16).

Peach and nectarine

California grew 73 percent of all U.S. peaches (including 42 percent of fresh market peaches and 97 percent of processed peaches) and 94 percent of nectarines in 2015. Most freestone peaches and nectarines are grown in Fresno, Tulare, and Kings counties in the central San Joaquin Valley and sold on the fresh market. Clingstone peach, largely grown in the Sacramento Valley, is exclusively canned and processed into products such as baby food, fruit salad, and juice (Figure A-18). Peach and nectarine are discussed together because pest management issues for the two crops are similar.

Table 25: *Total reported pounds of all active ingredients (AI), acres treated, acres bearing, and prices for peach and nectarine each year from 2011 to 2015. Bearing acres and marketing year average prices from 2011 to 2015 are from USDA(d), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	4,569,629	4,018,666	3,735,901	3,615,539	4,388,377
Acres Treated	1,338,479	1,370,963	1,351,003	1,397,501	1,466,231
Acres Bearing	74,000	72,000	64,000	65,000	62,000
Price/ton	$ 451.35	$ 572.68	$ 527.72	$ 670.95	$ 669.56

The price per pound in Table 25 is an average of the prices of peach and nectarine, weighted by their respective acreages. Due to the wide variation in individual prices, it is best to consult USDA and CDFA for specific prices.

Cumulative peach and nectarine acreage treated with insecticides and miticides increased 7 percent in 2015 despite the decrease in bearing acreage (Figure 23). Mites, peach twig borer,

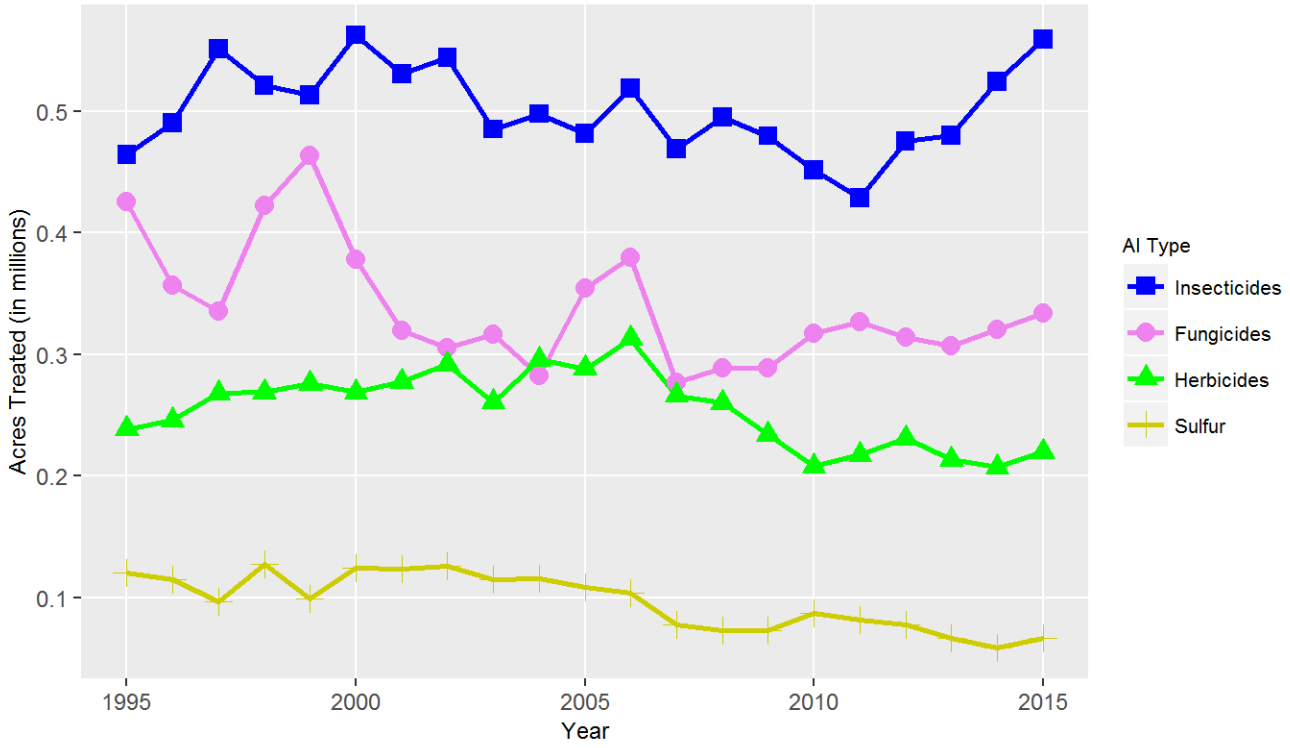

Figure 23: *Acres of peach and nectarine treated by all AIs in the major types of pesticides from 1995 to 2015.*

leafrollers, and ants were all major pests in 2015. Katydids were sporadic pests. Oil was the most-used insecticide in 2015 and its use increased 20 percent. Oils are applied during the dormant and the growing seasons to prevent outbreaks of scales, mites, and moth larvae (Figure A-20). Spinetoram and indoxacarb use increased 28 and 46 percent, respectively. Spinetoram and indoxacarb are applied to manage moths and katydids; spinetoram is also used for thrips.

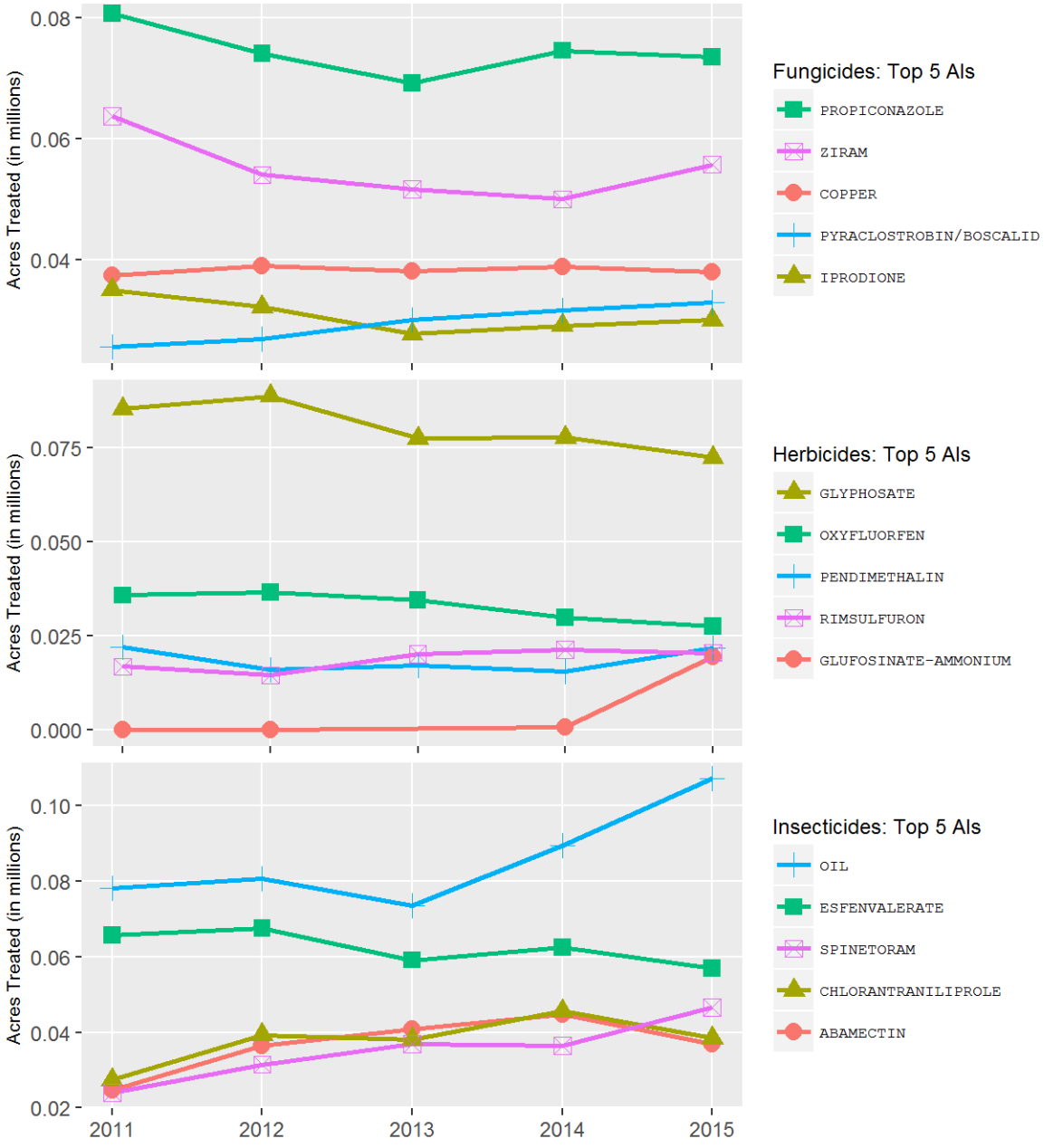

Figure 24: *Acres of peach and nectarine treated by the top 5 AIs of each AI type from 2011 to 2015.*

Although herbicides were applied to 6 percent more cumulative area in peach and nectarine

orchards, the planted acreage declined 4 percent (Figure 23). The area treated with glyphosate declined 7 percent. In contrast, pendimethalin was applied to 41 percent more area (Figures 24 and A-19). Preemergence herbicides such as oxyfluorfen, pendimethalin, rimsulfuron, and indaziflam are applied to soil before the growing season to prevent weed sprouting. Postemergence herbicides such as glyphosate, 2,4-D, pyraflufen-ethyl, and paraquat kill existing weeds on contact. Glufosinate-ammonium was not used much in past years, but its use increased dramatically in 2015. The use of glufosinate-ammonium, a broad-spectrum herbicide, may have increased in 2015 due to more west-coast availability of the AI in recent years and its ability to manage glyphosate-resistant weed species.

Cumulative acres of peach and nectarine orchards treated with fungicides and sulfur during 2015 increased 4 and 14 percent, respectively (Figure 23). Fungicide use increased while bearing acres decreased, suggesting that disease pressure from brown rot, powdery mildew, scab, and rust may have increased. Sulfur is the standard treatment for preventing powdery mildew infection, but it has no curative effect. Metconazole, a fungicide used to manage powdery mildew and brown rot, was used on a much larger scale than it has been in past years, possibly due to resistance of other demethylation inhibitor fungicides. Brown rot is the chief cause of postharvest fruit decay, but gray mold (known as Botrytis bunch rot when it infects grapes), Rhizopus rot (black bread mold), and sour rot can also pose significant problems.

Fumigant use increased 83 percent in 2015 (Figure 23). Fumigants are used in peach and nectarine orchards for rodent management and preplant soil treatments against arthropod pests, nematodes, pathogens, and weeds. Aluminum phosphide use decreased by 40 percent. Aluminum phosphide is used to manage rodents and works best in moist soils. Area treated with 1,3-D, the most widely used preplant soil fumigant, increased 79 percent and chloropicrin application increased as well, indicating an uptick in orchard replanting. Field agricultural use of methyl bromide is being phased out and has not been used since 2013. Changing relationships between nematode infestations, pathogen infections, rootstock choices, and application patterns also affect fumigant selection and use from year to year.

A cumulative total of 1,338 acres of peaches and nectarines were treated with plant growth regulators in 2015. Gibberellins, plant hormones that regulate growth and development, were applied to 3 percent fewer acres. Amino ethoxy vinyl glycine hydrochloride, an ethylene synthesis inhibitor, was applied to 219 acres. Both chemicals can enhance the firmness, size, and storability of fruit. In many cultivars, gibberellins applied from May through July can reduce the percentage of buds that produce flowers the following year. As a result, fruit numbers are reduced, resulting in less or no need for hand thinning and improved fruit quality. Increasing scarcity of field labor may have motivated some growers to experiment with plant growth regulators.

Pistachio

In 2015, California accounted for 233,000 bearing acres of pistachio, or about 98 percent of the U.S. crop (Table 26). The continuing drought, insufficient winter chilling hours, and warm weather during the bloom period combined to reduce the crop in California more than 47 percent–from nearly 513 million pounds in 2014 to 271 million pounds in 2015. Because California produces the majority of pistachios nationally, the U.S. slipped as top producer in 2015 to third place (24 percent) behind Iran (40 percent) and Turkey (28 percent).

Table 26: *Total reported pounds of all active ingredients (AI), acres treated, acres bearing, and prices for pistachio each year from 2011 to 2015. Bearing acres and marketing year average prices from 2011 to 2015 are from USDA(d), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	4,047,461	3,971,860	4,742,470	4,850,489	7,822,331
Acres Treated	2,364,014	2,779,239	3,369,690	3,765,680	4,308,556
Acres Bearing	153,000	182,000	203,000	221,000	233,000
Price/lb	$ 1.98	$ 2.61	$ 3.48	$ 3.57	$ 2.48

Despite the bad year, pistachio acreage will continue to increase during the next few years due to a surge in planting around 2005. (Pistachio trees take 5 to 7 years to begin producing nuts and produce optimally 15 years after planting.) Pistachio is grown in 22 counties, from San Bernardino County in the south to Tehama County in the north, with most grown in the San Joaquin Valley counties of Kern, Madera, Fresno, and Tulare (Figure A-21). Pistachio trees usually alternate between high and low production each year and 2015 was projected to be a lighter harvest.

In 2015, important arthropod pests of pistachio included mites, leaffooted plant bug, false chinch bug, stink bugs, and navel orangeworm, although pest populations were low in many areas.

Insecticide use, as measured by acres, increased 18 percent from 2014 to 2015, primarily due to additional bearing acres, a later harvest, concern about early-season damage from Gill's mealybug, and possible late-season threats by leaffooted plant bug, stink bugs, and navel orangeworm (Figures 25, A-22, and A-23). Feeding by Gill's mealybugs reduces carbohydrates available to pistachio trees, which results in poor development of the kernel. Growers apply buprofezin and imidacloprid early in the season to target immature crawlers moving to the clusters. In 2015, use of imidacloprid rose more than two-fold from April through July in response to Gill's mealybug increasing in area and severity.

Feeding by leaffooted plant bugs can cause epicarp lesion to the nuts shortly after bloom and lead to kernel necrosis after shell hardening in June, darkening and ruining the flavor of the nutmeat.

These bugs usually appear just before harvest in August and September. Stink bugs can also be late-season pests, causing kernel necrosis during July and August. Often growers preemptively apply insecticides, primarily lambda-cyhalothrin and permethrin, before any of the bugs can do much damage.

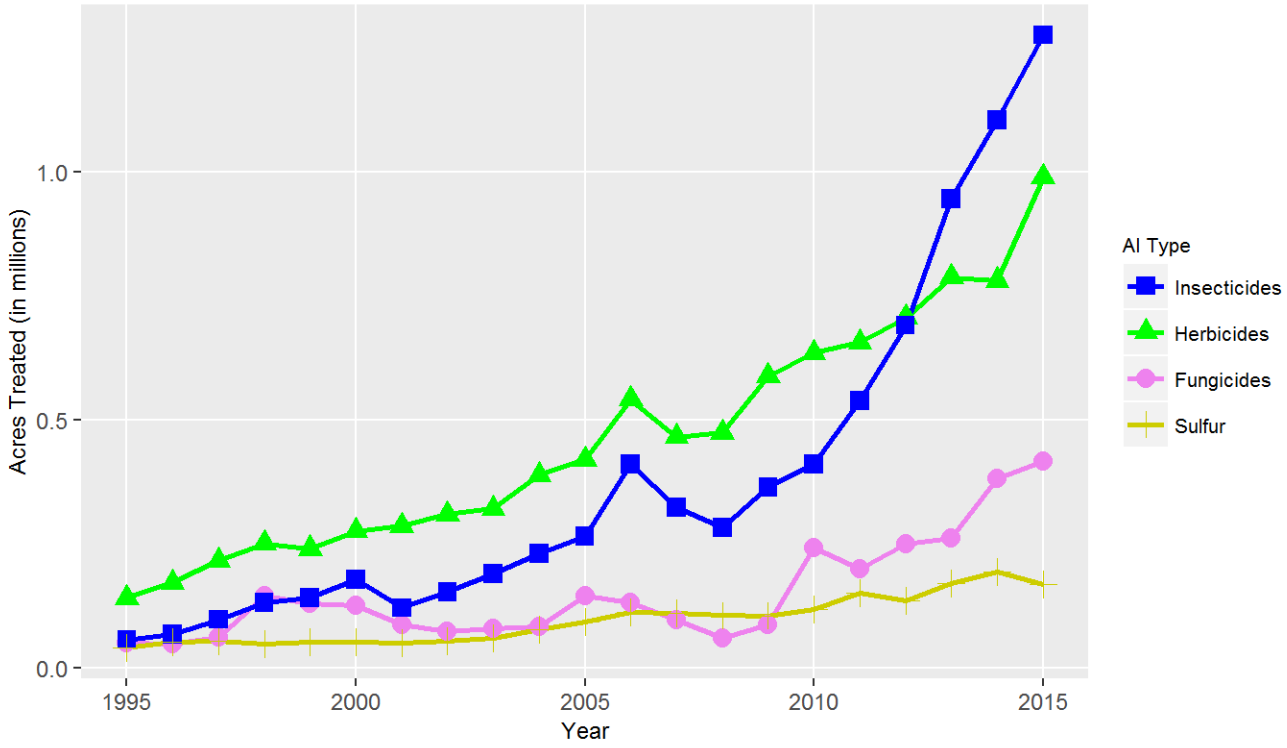

Figure 25: *Acres of pistachio treated by all AIs in the major types of pesticides from 1995 to 2015.*

The navel orangeworm feeds directly on the nutmeat. As the larvae feed, they leave behind frass (or excrement), a substrate for the fungi *Aspergillus flavus* and *A. parasiticus*. Navel orangeworm attacks nuts beginning in July, but insecticide sprays target the third generation that coincides with the beginning of the nut harvest.

Navel orangeworm larvae overwinter in mummy nuts on the ground. During dry winters, they avoid the fungal diseases that would normally kill them under wet conditions. The use of mating-disruption pheromone puffers have increased steadily since 2011. Puffers contain the AI (Z,Z)-11, 13-hexadecadienal and in April 2014 were used in a voluntary area-wide program targeting Kern County's West Side, where the risk of navel orangeworm damage is unusually high. Use of the puffers increased 58 percent in 2015.

Use of fungicides increased (Figure 26). *Aspergillus flavus* strain AF36 is lumped with the fungicides, but is actually an organically acceptable fungal inoculant that acts as a biological control agent and prevents contamination of nuts by aflatoxins. The aflatoxin-producing fungi, a complex of *Aspergillus flavus* and *A. parasiticus*, grow on pest-damaged nuts. Aflatoxins are both

toxic and carcinogenic. About half of the strains of *A. flavus* found in the orchard are atoxigenic–that is, they do not produce aflatoxin. However, almost all *A. parasiticus* strains produce aflatoxins. When applied to orchards, the harmless, atoxigenic strain of *Aspergillus flavus*, AF36, crowds out aflatoxin-producing strains and drastically reduces aflatoxin levels in the nuts. In 2015, AF36 was used on more than 66 percent of all bearing trees. In 2014, *A. flavus* supplies were limited and the material was applied at a lower rate. The supply was restored in 2015 and growers again applied it at the higher labeled rate.

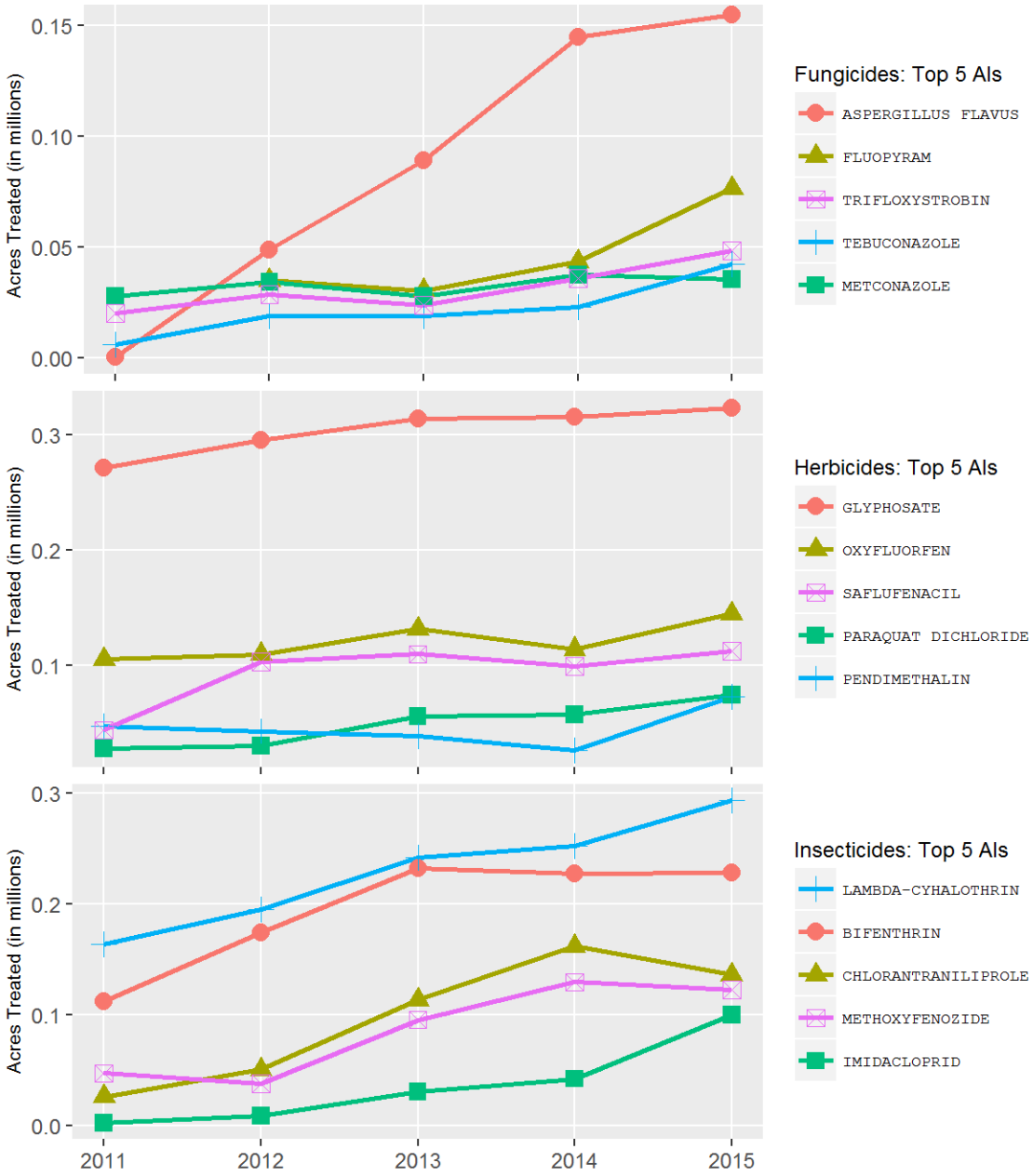

Figure 26: *Acres of pistachio treated by the top 5 AIs of each AI type from 2011 to 2015.*

Sulfur, used as a low-risk miticide, is applied at several pounds per acre, and is used to manage

citrus flat mite. The mites feed on the stems of nut clusters as well as the nut hulls and nuts themselves, which can lead to shell stain. As the weather warms up in June, mite populations thrive and peak in late July and August. In 2015, growers began applying sulfur for mites in April, followed by lower-than-average amounts during June and July, and higher-than-average amounts during September. Overall there was an average reduction from 2014 of 14 percent (Figure A-23).

Despite drought conditions during the growing season, use of all major herbicides increased, most likely in response to increased acreage (Figure 26). Often nonbearing trees, which lack shade to deter weed growth, require more herbicide than bearing trees. The postemergence herbicide glyphosate is applied year-round, but mostly during the summer months to manage weeds such as field bindweed and cheeseweed. Under drought conditions both preemergence and postemergence herbicides are needed to limit weed growth. Reducing competition from weeds extends limited supplies of irrigation water and protects young trees from the false chinch bug, which thrive on weeds next to the orchards.

Processing tomato

In 2015, processing tomato growers planted 299,000 acres, yielding 14.36 million tons, a 3 percent yield increase from 2014. About 95 percent of U.S. processing tomatoes are grown in California. At 34 percent, the U.S. is the world's top producer of processing tomatoes followed by the European Union and China. California processing tomatoes, valued at $1.38 billion in 2015, are primarily grown in the Sacramento and San Joaquin valleys (Figure A-24). Fresno County leads the state in acreage with 31 percent (90,000 acres) of the statewide total, followed by Yolo County (38,000 acres), Kings County (26,000 acres), and San Joaquin County (34,000 acres). Significant production also occurs in Merced, Colusa, Kern, Stanislaus, and Solano counties.

Table 27: *Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for processing tomato each year from 2011 to 2015. Planted acres and marketing year average prices from 2011 to 2015 are from USDA(e), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	14,051,151	13,458,272	13,891,438	15,007,034	15,210,646
Acres Treated	3,118,947	2,991,155	3,432,076	3,701,016	4,042,172
Acres Planted	255,000	260,000	263,000	292,000	299,000
Price/ton	$ 74.30	$ 75.00	$ 88.80	$ 98.60	$ 96.40

Overall, use of all pesticide AIs changed less than 1 percent in 2015 (Table 27). Total cumulative treated acres of processing tomatoes increased 9 percent. Sulfur, metam-sodium, 1,3-dichloropropene, and potassium N-methyldithiocarbamate (metam-potassium) accounted for 87 percent of the total pounds of pesticide AIs applied, while sulfur, chlorothalonil, trifluralin,

azoxystrobin, glyphosate, s-metolachlor, and imidacloprid were applied to the most acreage. The most-used type as measured by area treated was insecticides, which increased 13 percent (Figure 27). The most-used type as measured by amount AI applied was fungicide/insecticide (mostly sulfur and kaolin); use in this category decreased 3 percent.

Overall fungicide use, expressed as cumulative area treated, increased 18 percent and pounds of AI increased 24 percent. Since 2009, use of difenoconazole and azoxystrobin has continuously increased, likely because of increasingly severe powdery mildew outbreaks in the last few years. As a result of these outbreaks, growers must now apply preventive treatments instead of treating powdery mildew as it appears. Pyraclostrobin and fluxapyroxad use in 2015 increased by 4 percent and 36 percent, respectively.

The acreage treated with herbicides increased 1 percent while the amount used was unchanged (Figure 27). Primary weeds of concern for processing tomatoes are nightshades and bindweed. Trifluralin and pendimethalin are used to manage bindweed and are often used in combination with metolachlor. The use of pendimethalin increased 9 percent, while trifluralin use decreased 4 percent (Figures 28 and A-25). Glyphosate is commonly used for preplant treatments in late winter and early spring; its use was unchanged (Figure A-26).

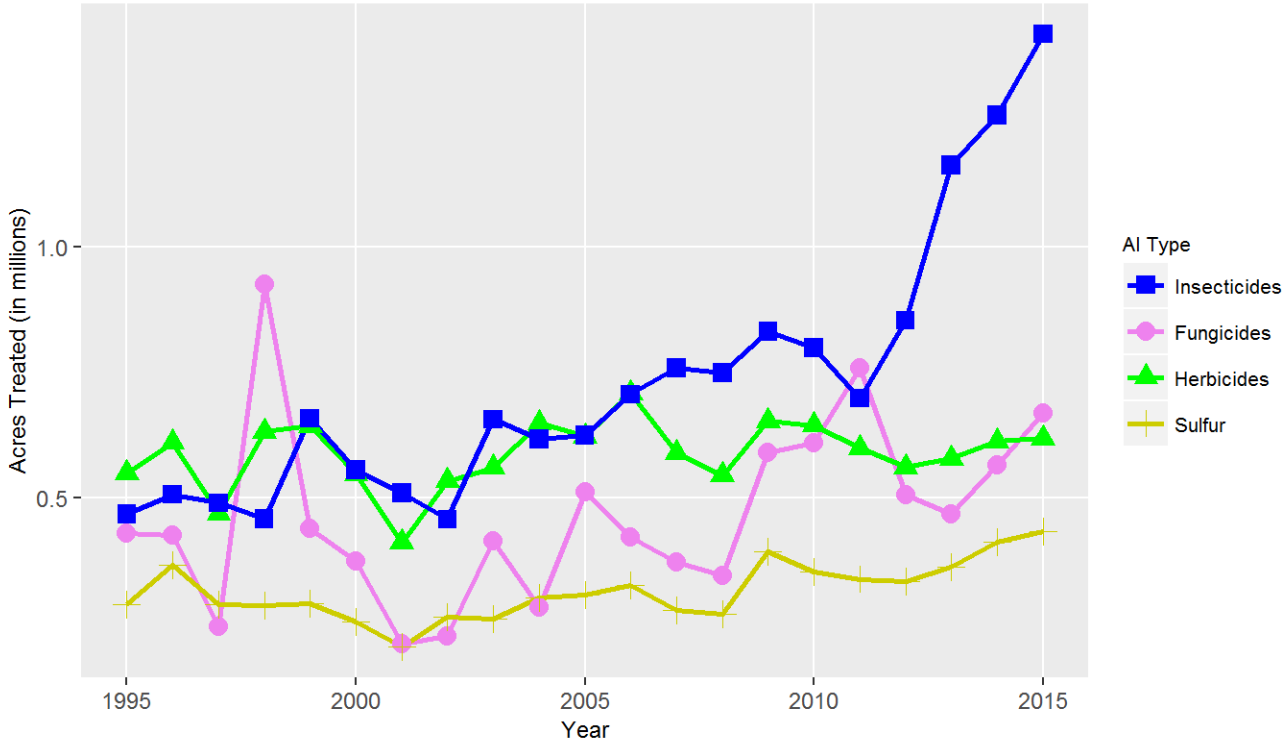

Figure 27: *Acres of processing tomato treated by all AIs in the major types of pesticides from 1995 to 2015.*

Processing tomato growers primarily use three fumigants–metam-potassium, metam-sodium, and

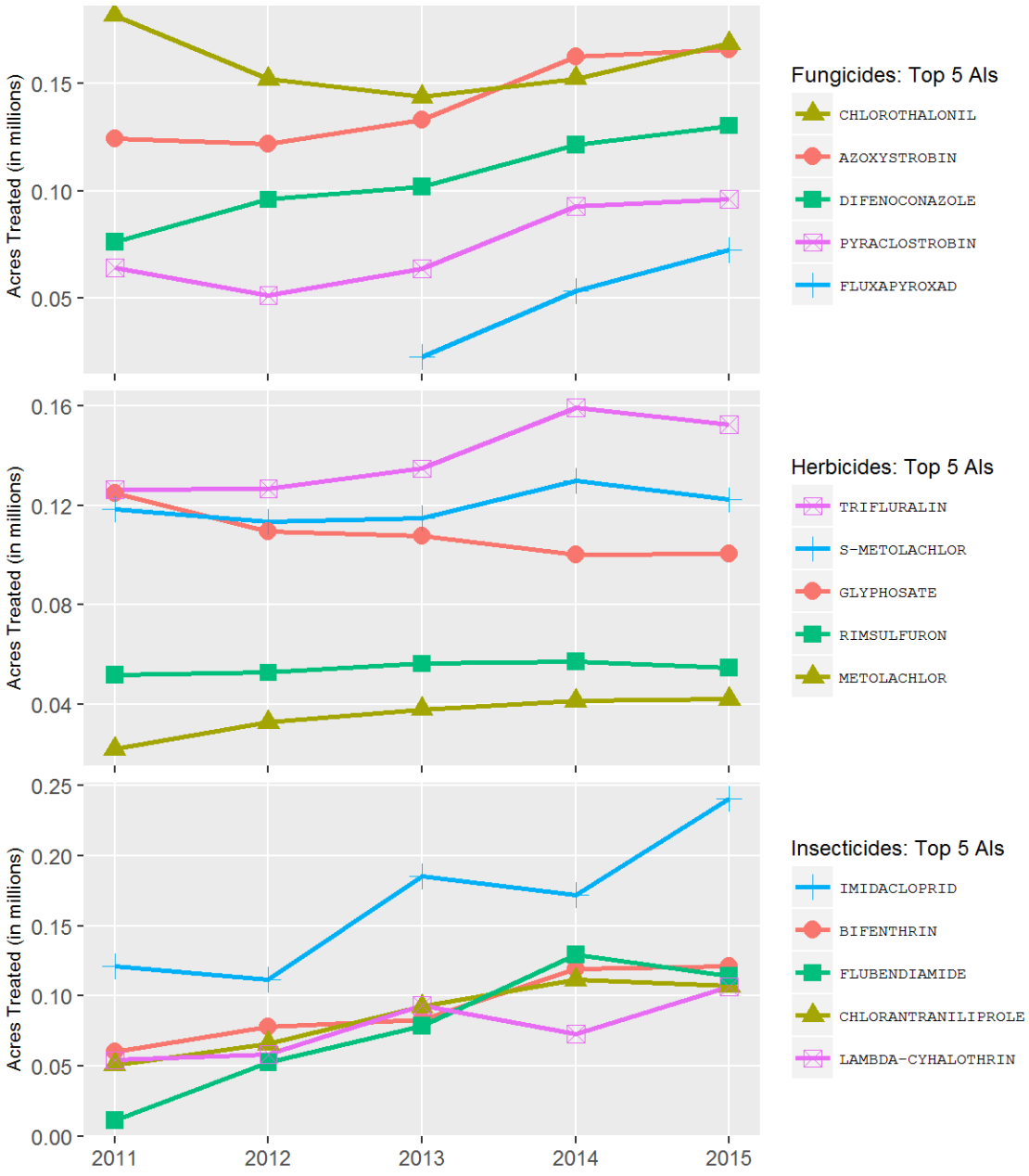

Figure 28: *Acres of processing tomato treated by the top 5 AIs of each AI type from 2011 to 2015.*

1,3-D–to manage root-knot nematodes and weeds, particularly those of the nightshade family. In 2015, fumigant use increased 16 percent and accounted for about 19 percent of the total amount of pesticides applied. In terms of area treated, fumigant use increased 14 percent. The increase in fumigated acres is mostly due to a 50 percent increase in acres treated with metam-potassium.

In 2015, 1,423,350 acres were treated with insecticides, a 13 percent increase from 2014 (Figure 27). This overall increase was likely to manage whiteflies, which vectors tomato yellow leaf curl virus. Imidacloprid, the most-used insecticide, is used to manage whiteflies; its use increased 40 percent from the previous year. Dimethoate, which decreased 11 percent, is a broad-spectrum insecticide used for thrips management. However, its use early in the season can disrupt natural predation and cause population explosions of other insect pests, such as leafminers, later in the season (Figure A-26). Methomyl use decreased 25 percent, as growers have begun switching to pyrethroids such as bifenthrin because of worker safety. Bifenthrin use, which increased 2 percent, is a broad-spectrum pyrethroid often used in rotation with spinosad for thrips management. Bifenthrin is also used to manage mites and stink bugs.

Rice

California is the largest producer of short and medium grain ('Calrose') Japonica rice in the United States and the second largest rice-growing state in the nation. Ninety-five percent of the rice in California is grown in six counties in the Sacramento Valley (Colusa, Sutter, Glenn, Butte, Yuba, and Yolo, Figure A-27). The drought has had marked effects on rice growers, and water cutbacks have caused reduction in rice plantings. In 2015 the acres planted with rice decreased 2.5 percent (Table 28).

Table 28: *Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for rice each year from 2011 to 2015. Planted acres from 2011 to 2015 are from USDA(a), 2012-2016; marketing year average prices from 2011 to 2015 are from USDA(c), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	4,880,885	5,365,318	5,328,668	4,917,398	4,367,250
Acres Treated	2,969,115	2,992,418	3,091,960	2,657,025	2,605,891
Acres Planted	585,000	561,000	566,000	434,000	423,000
Price/cwt	$ 18.60	$ 18.60	$ 20.90	$ 19.30	$ 20.10

Herbicides were the most-used class of pesticides on rice in 2015 (Figure 29). Much of California's rice is grown repeatedly in the same fields and growers are heavily dependent on herbicides for effective weed management. Many of the weed species are difficult to manage and severely compete with the rice crop for resources if allowed to grow unimpeded.

Several species of broadleaf, grass, and sedge weeds that grow along with rice have developed resistance to herbicides. In addition to the well-established resistance to acetolactate synthase (ALS)-inhibiting herbicides, such as bensulfuron methyl, and resistance of certain watergrass types to propanil, new modes of resistance has been observed in bearded sprangletop to clomazone and cyhalofop-butyl, and sedge to propanil. The 40 percent increase in pounds of thiobencarb used in 2015 was probably due to the progressive resistance of sprangletop to clomazone and cyhalofop-butyl. The continuing decrease of bensulfuron methyl may result from 2013 introduction of a product that combines thiobencarb and imazosulfuron for bensulfuron methyl-resistant sedges (Figures 30 and A-28).

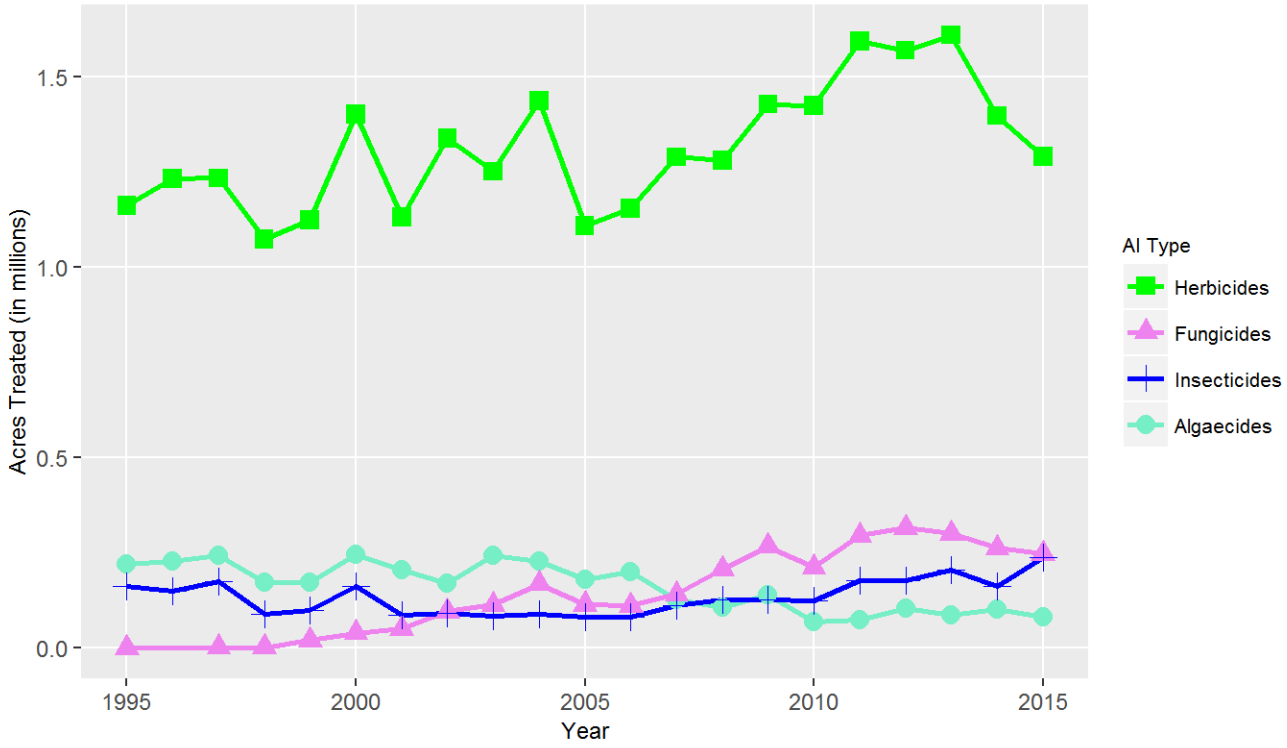

Figure 29: *Acres of rice treated by all AIs in the major types of pesticides from 1995 to 2015.*

The area treated with fungicides decreased 6 percent (Figure 29) and the pounds applied decreased 40 percent in 2015. The decrease in pounds was primarily due to decreased use of sodium carbonate peroxyhydrate, an organic fungicide. Azoxystrobin was the most-used fungicide for rice, accounting for 87 percent of all the cumulative area treated with fungicides. Azoxystrobin, propiconazole, and trifloxystrobin are reduced-risk fungicides often used as preventive treatments.

Copper sulfate is the key algaecide registered for rice in California. Used primarily for algal management in rice fields and also to manage tadpole shrimp in both conventional and organic production. Copper sulfate can bind to organic matter such as straw residue and potentially reduce the algaecide's efficacy. Its decreasing use in the past few years is probably due to

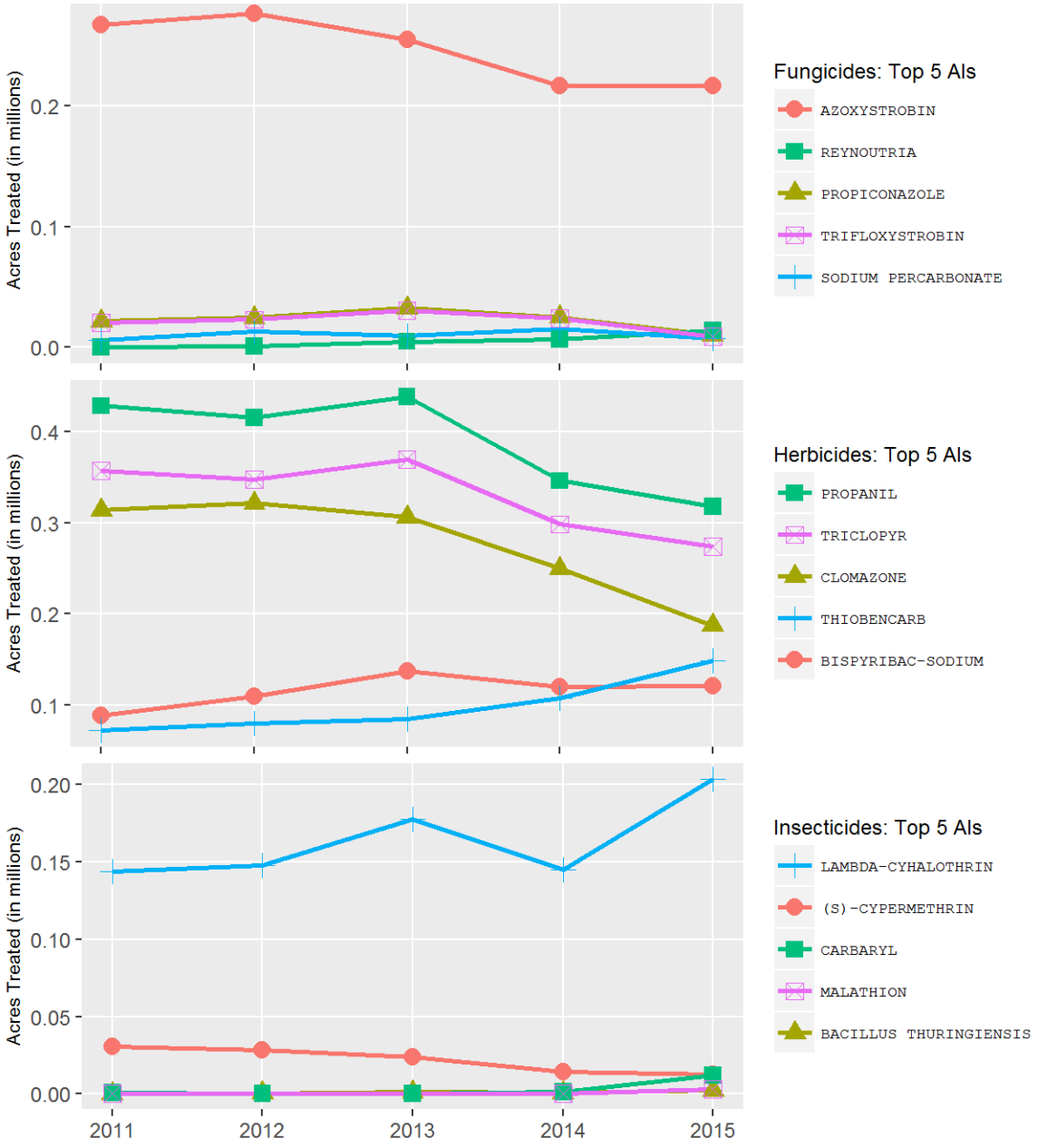

Figure 30: *Acres of rice treated by the top 5 AIs of each AI type from 2011 to 2015.*

increases in price, inconsistency of supply, and variability in efficacy. Sodium carbonate peroxyhydrate was registered as an alternative to copper sulfate to manage algae. However, it has never displaced the use of copper sulfate (Figure A-28).

Usually there is little insect pressure on California rice and insecticides are used on relatively few acres (Figure 29). However, insect problems were high in 2015 and use of insecticides increased in area and pounds applied. Armyworms have a naturally occurring level of tolerance to insecticides. In 2015, no registered insecticide was effective in managing the significant outbreak. Multiple applications of different pesticides, predominantly pyrethroids and carbaryl, had little effect on the pest. An emergency exemption was issued for a methoxyfenozide-containing product. Rice water weevil is the major insect pest on California rice, but tadpole shrimp are becoming more problematic, and in some areas they are the main pest of rice during the seedling stage. Growers often rely on lambda-cyhalothrin, copper sulfate pentahydrate, and carbaryl, applied soon after flooding, to manage tadpole shrimp. Pyrethroids have been used intensively over the last 15 years for rice water weevil and manage this pest less effectively now (Figures 30 and A-29).

Strawberry

In 2015 California produced 2.9 billion pounds of strawberries valued at more than $2.6 billion. Market prices determine how much of the crop goes to fresh market and how much is processed, and in 2015, about 78 percent of the crop went to fresh market. About 40,500 acres of strawberry were planted and harvested in 2015, primarily along the Central and Southern Coast, with smaller but significant production in the Central Valley (Table 29).

Table 29: *Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for strawberry each year from 2011 to 2015. Planted acres and marketing year average prices from 2011 to 2015 are from USDA(d), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	12,099,341	13,845,597	12,038,503	12,283,547	11,765,557
Acres Treated	1,975,589	2,210,233	2,564,533	2,820,704	2,685,413
Acres Planted	38,000	39,000	41,500	41,500	40,500
Price/cwt	$ 75.20	$ 77.10	$ 79.80	$ 88.40	$ 66.50

The major insect pests of strawberry are lygus bugs and larvae of moths and beetles, especially in the Central and South Coast growing areas. Until recently, lygus bugs were not considered a problem in the South Coast, but have become a serious threat probably due to warmer, drier winters and increased diversity in the regional crop complex that supports this pest. Flonicamid

and acetamiprid, insecticides used to manage lygus bugs, ware applied to 36 and 27 percent more acres in 2015, respectively (Figures 32, A-31, and A-32).

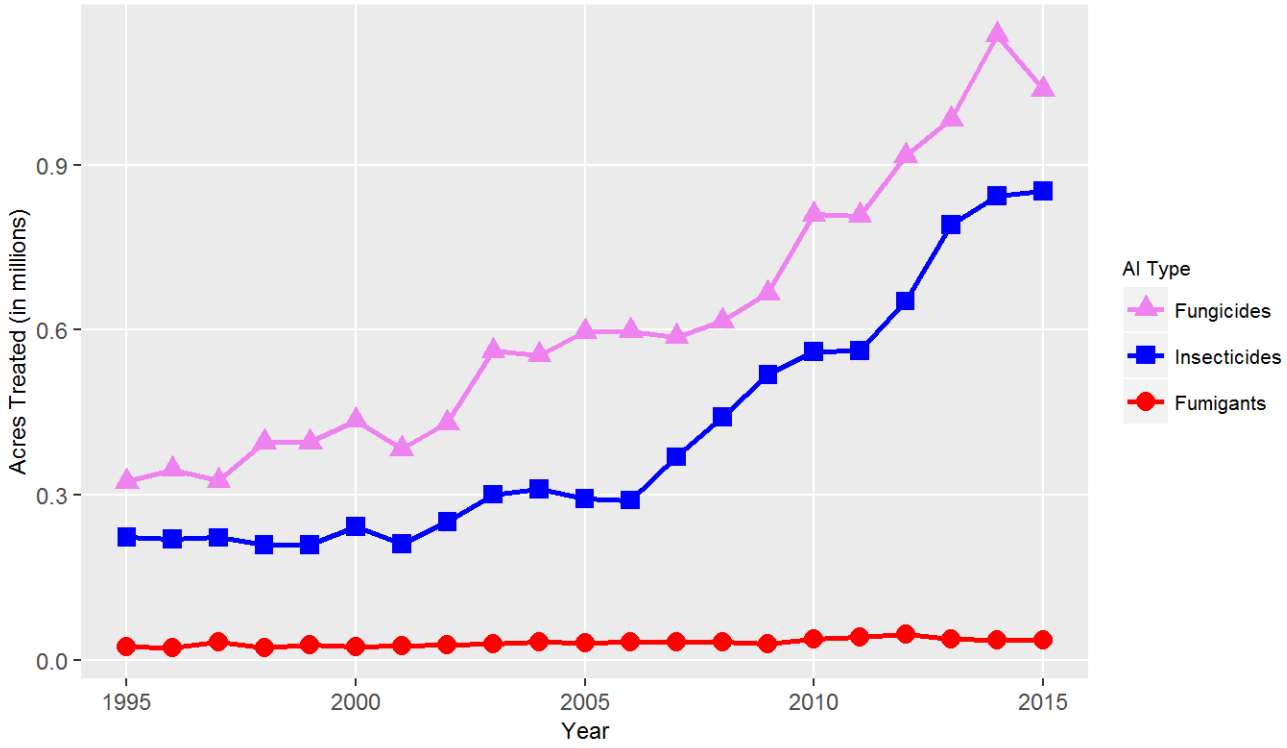

Figure 31: *Acres of strawberry treated by all AIs in the major types of pesticides from 1995 to 2015.*

Herbicide use in 2015 decreased 14 percent. The biggest contributor to this decrease was a 29 percent decrease in oxyfluorfen use.

Fungicides continue to be the most-used pesticides in 2015, as measured by area treated. Overall, fungicide use was relatively unchanged in 2015, with many AIs showing a slight decrease in use (Figure 31).

Strawberry production relies on several fumigants. Fumigants accounted for about 80 percent (as measured by pounds applied) of all pesticide AIs applied to strawberry in 2015, but less than two percent of the planted total cumulative acreage was treated. However, most strawberry fields are fumigated. The area treated with fumigants in 2015 decreased 1 percent (Figures 32 and A-31). Methyl bromide use increased 18 percent; metam-sodium, 149 percent; and 1,3-dichloropropene, 8 percent. Chloropicrin use decreased 5 percent. Methyl bromide is used primarily to manage pathogens and nutsedge. Metam-sodium more effectively manages weeds, but is less effective than 1,3-dichloropropene or 1,3-dichloropropene plus chloropicrin against soil-borne diseases and nematodes. Fumigants are applied at higher rates than other pesticide types, such as fungicides and insecticides, in part because they treat a volume of space rather than a surface, such as leaves

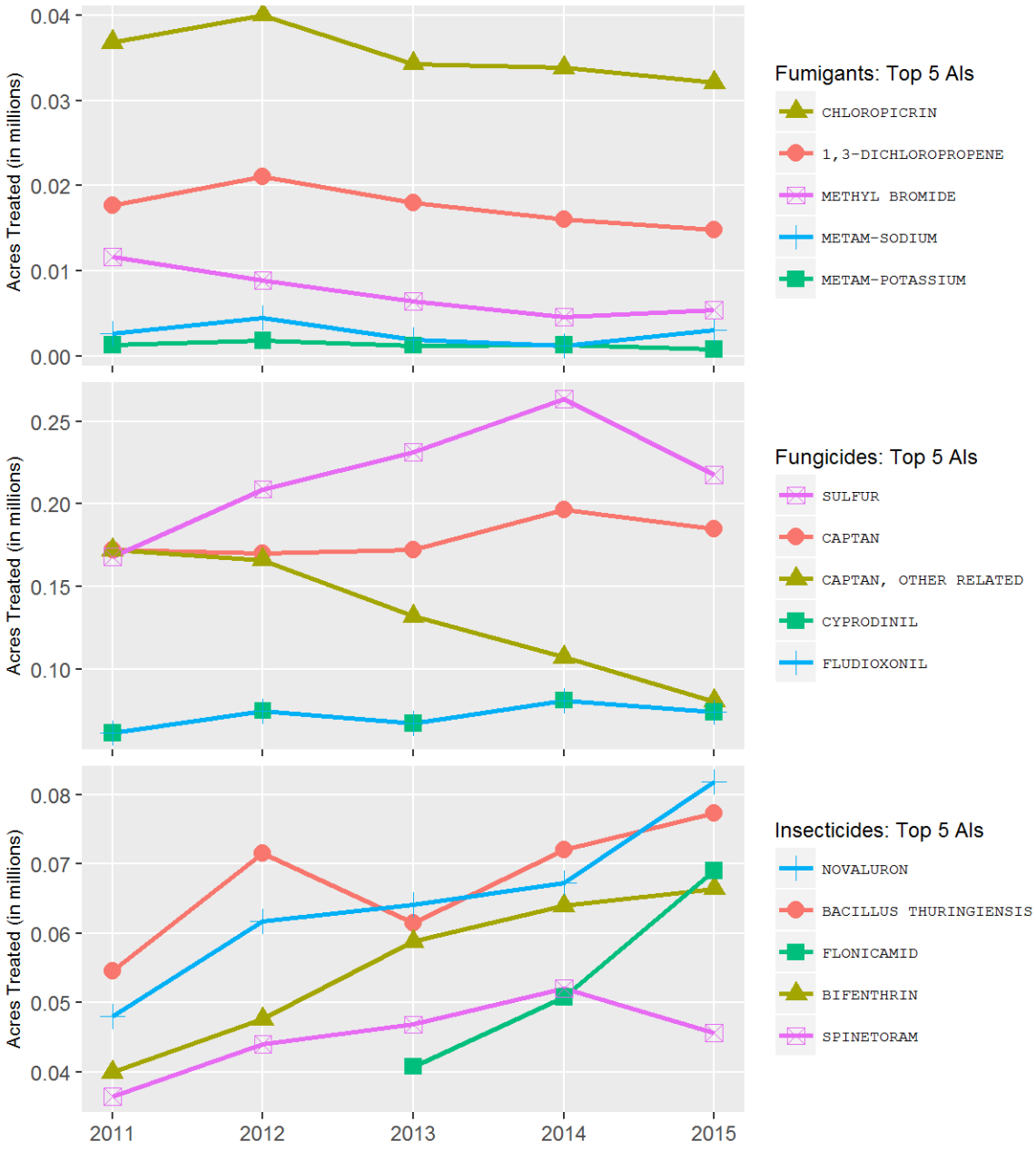

Figure 32: *Acres of strawberry treated by the top 5 AIs of each AI type from 2011 to 2015.*

and stems of plants. Thus, the amounts applied are large relative to other pesticide types even though the number of applications or number of acres treated may be relatively small.

Table and raisin grape

The southern San Joaquin Valley region accounts for more than 90 percent of California's raisin and table grape production (Figure A-33). Total acreage planted to table and raisin grape decreased by an estimated 3,000 acres in 2015, while average prices increased (Table 30). 'Thompson Seedless' was again the leading raisin grape cultivar, while 'Flame Seedless' was again the leading table grape cultivar.

Table 30: *Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for table and raisin grape each year from 2011 to 2015. Planted acres from 2011 to 2015 are from CDFA(b), 2014-2016; marketing year average prices from 2011 to 2015 are from USDA(d), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	16,435,201	14,922,769	14,628,803	15,089,897	14,556,586
Acres Treated	6,782,549	6,834,514	7,146,756	7,109,714	6,854,582
Acres Planted	305,000	321,000	323,000	313,000	310,000
Price/ton	$ 516	$ 737	$ 697	$ 756	$ 820

The price per ton in Table 30 is an average of the prices of table and raisin grapes, weighted by their respective acreages. Due to the wide variation in individual prices depending on type and use of the grape, it is best to consult USDA and CDFA for specific prices.

Changes in pesticide use on table and raisin grape, like those on wine grape, are influenced by a number of factors, including weather, topography, pest pressure, evolution of resistance, competition from newer pesticide products, commodity prices, application restrictions, and efforts by growers to reduce costs.

Area treated with sulfur, fungicides, insecticides, or herbicides decreased in 2015 (Figure 33).

The area treated with the top five insecticides decreased in 2015, though not by large margins (Figure 34). This reduction in use may be attributed to declining grape acreage as vineyards are replaced by almond and pistachio orchards, though reduced pest pressure may have played a role as well. The only insecticides applied to more area in 2015 were chlorpyrifos (used as a delayed-dormant application in response to expected large populations of vine mealybug in spring), beta-cyfluthrin, flubendiamide, and acetamiprid. Indoxacarb use also increased substantially but was applied to a relatively small number of acres. Flubendiamide and

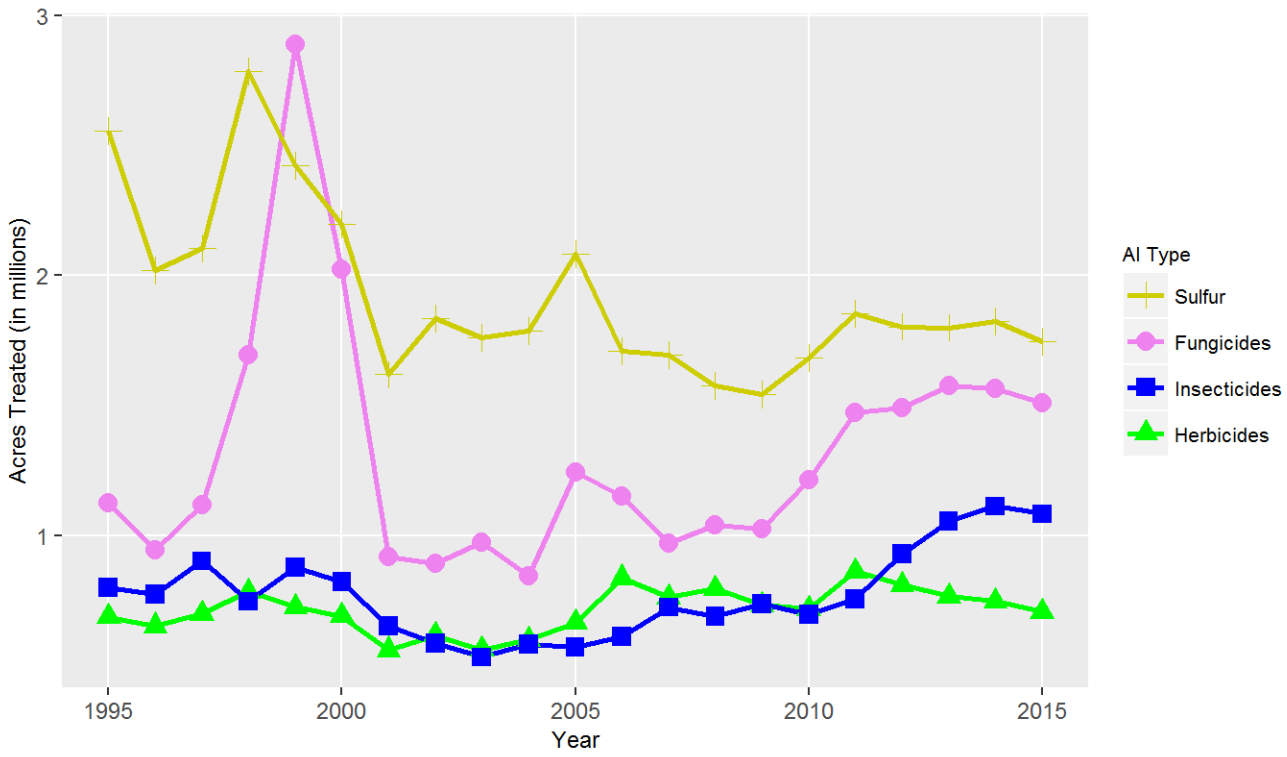

Figure 33: *Acres of table and raisin grape treated by all AIs in the major types of pesticides from 1995 to 2015.*

indoxacarb are used to manage moth larvae, particularly the western grapeleaf skeletonizer and cutworms. Two of these insecticides, chlorpyrifos and flubendiamide, have been under reevaluation by the U.S. EPA, which has proposed to revoke all tolerances for chlorpyrifos, and in 2016 canceled registration of all flubendiamide products.

The areas treated with sulfur and other fungicides decreased marginally (Figure 33). Fungicides with the greatest area treated were the same as in 2014 (Figure 34and A-34). Notable increases in use were observed for fenhexamid and tetraconazole. Most applications were made in spring to early summer, likely for powdery mildew, which posed a moderate problem early in the season in 2015 (Figure A-35). Much of the pattern of fungicide use across years can be explained by rotation of fungicides as part of a resistance management program.

With drought continuing into the fourth year, weed growth may have been inhibited to some extent. The area treated with herbicides decreased again, a trend that has continued since the drought began in 2012 (Figure 33). Glyphosate use decreased again while use of glufosinate-ammonium increased substantially. Glufosinate-ammonium is an attractive alternative to glyphosate, and after a period of unavailability, growers are likely shifting to this AI to reduce selection for glyphosate-resistant weeds. There were reductions in the area treated with all other herbicides, except flazasulfuron, which was applied to a relatively small number of acres (less than 6,000). Flazasulfuron was registered in 2012 so its use might be expected to increase for a period. The area treated with fumigants in 2015 decreased by nearly half. Most of the decrease was accounted for by reduced application of aluminum phosphide, an AI for rodent control. The area treated with 1,3-D increased by 30 percent.

The area treated with plant growth regulators (PGRs) decreased modestly in 2015. Gibberellins were again used far more than other PGRs, followed by ethephon and hydrogen cyanamide, which has been increasingly used since 2009. Hydrogen cyanamide is applied after pruning to promote bud break.

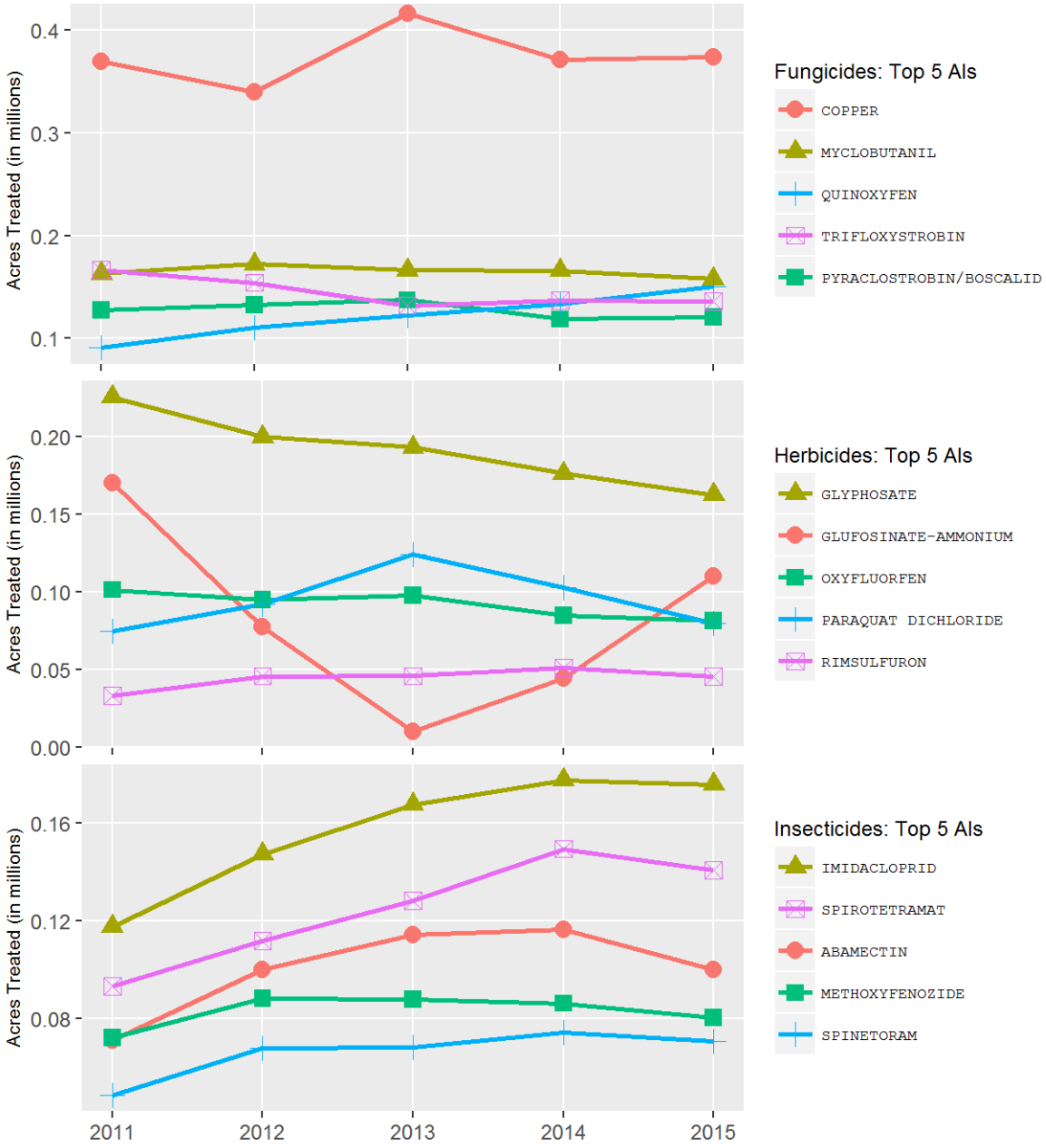

Figure 34: *Acres of table and raisin grape treated by the top 5 AIs of each AI type from 2011 to 2015.*

Walnut

California produces 99 percent of the walnuts grown in the United States. The California walnut industry has more than 4,000 growers who farmed approximately 300,000 bearing acres in 2015 (Table 31 and Figure A-36). Mild temperatures led to faster crop development and an earlier harvest despite a lack of chilling hours and the ongoing drought crisis. Walnut production was estimated at 603,000 tons in 2015, an increase of about 6 percent from the previous year. The price per ton decreased almost 50 percent while bearing acreage increased 3 percent. The dramatic price drop has been attributed to a combination of decreased demand due to stabilizing consumption rates and an increase in foreign walnut supplies. The amount of applied pesticides increased 21 percent and area treated increased 20 percent. In general, pesticide use followed similar patterns seen in 2014, with increases in fungicides, insecticides, and herbicides, though overall fumigant use was nearly unchanged. (Figure 35).

Table 31: *Total reported pounds of all active ingredients (AI), acres treated, acres bearing, and prices for walnut each year from 2011 to 2015. Bearing acres and marketing year average prices from 2011 to 2015 are from USDA(d), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	3,956,526	4,284,105	5,044,526	5,706,158	6,914,676
Acres Treated	2,351,894	2,981,857	3,496,708	4,030,560	4,824,696
Acres Bearing	245,000	270,000	280,000	290,000	300,000
Price/ton	$ 2,900	$ 3,030	$ 3,710	$ 3,340	$ 1,620

The area treated with insecticides, which includes miticides, increased 14 percent (Figure 35). Reasons include increased acreage and relatively warm temperatures throughout the growing season, especially in the spring, which allowed insects to mature faster and shorten the time between generations. Pressure from walnut husk fly and navel orangeworm continued to increase. Abamectin, a miticide, remained the most-used insecticide/miticide because of its low cost and continued efficacy, while another miticide, hexythiazox, saw a large increase in area treated. Drought and hot weather conditions may have contributed to increased mite pressure. Additionally, bifenthrin, acetamiprid, chlorantraniliprole, and imidacloprid use increased (Figures 36 and A-37).

The 22 percent increase in area treated with herbicides reflects the increase in walnut acreage, especially in younger plantings, where weeds thrive until tree canopies are capable of shading orchard floors (Figure 35). In addition, a dry winter adversely impacted or even prevented the use of preemergence herbicide programs and may have contributed to increased postemergence herbicide use. A combination of price and good management of most broadleaf weeds, including glyphosate-resistant hairy fleabane in the San Joaquin Valley, are likely contributors to the

increase in saflufenacil. Use of the relatively new herbicide indaziflam continues to increase because of its long-lasting broad-spectrum management of weeds (Figures 36, A-37 and A-38).

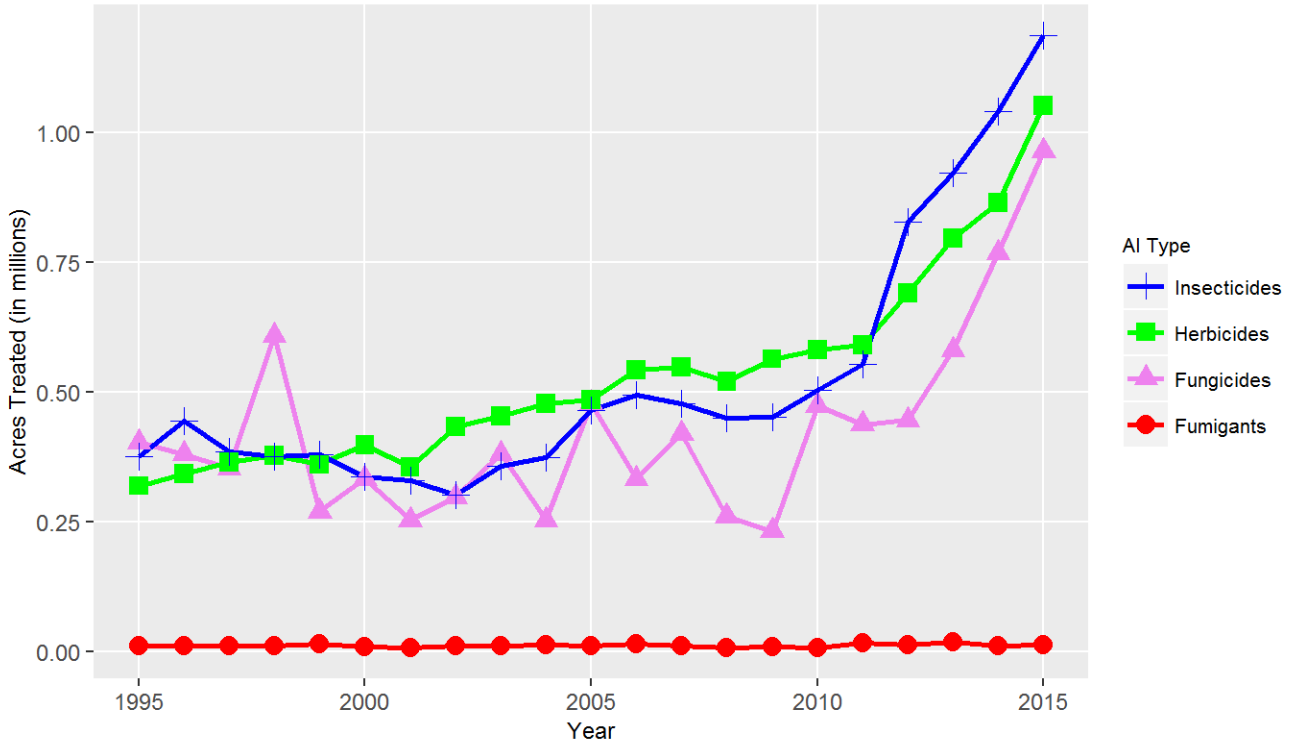

Figure 35: *Acres of walnut treated by all AIs in the major types of pesticides from 1995 to 2015.*

The area treated with fungicides increased 25 percent (Figure 35). Copper and mancozeb, used to manage blight, had the highest use and use was higher than in 2014. Use of other fungicides, such as pyraclostrobin, boscalid (pyraclostrobin and boscalid are used as a mixture), propiconazole, and azoxystrobin, saw large increases (Figures A-37, and A-38). These increases were likely due to the increased occurrence of Botryosphaeria canker (Bot), a fungus that that kills wood within infested walnut orchards and causes severe crop loss.

The area treated with fumigants was mostly unchanged: methyl bromide use continued to decline while chloropicrin and 1,3-dichloropropene increased. Most fumigants are applied to the soil before planting while aluminum phosphide is used to manage vertebrates. Given the cost and tighter regulations, some growers are using alternatives such as fallowing or cover-cropping for a year before replanting orchards.

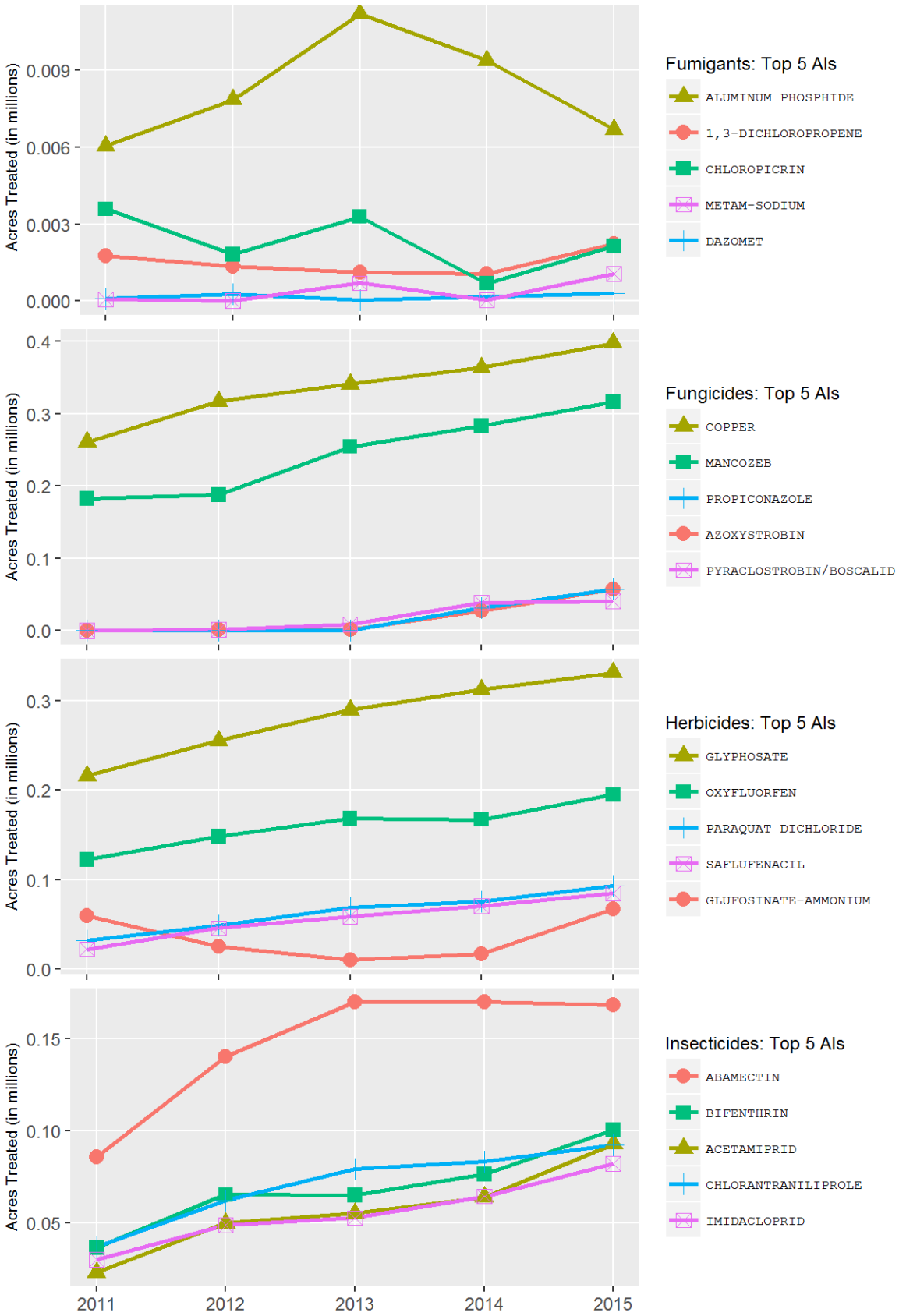

Figure 36: *Acres of walnut treated by the top 5 AIs of each AI type from 2011 to 2015.*

Wine grape

There are four major wine grape production regions: North Coast (Lake, Mendocino, Napa, Sonoma, and Solano counties); Central Coast (Alameda, Monterey, San Luis Obispo, Santa Barbara, San Benito, Santa Cruz, and Santa Clara counties); northern San Joaquin Valley (San Joaquin, Calaveras, Amador, Sacramento, Merced, Stanislaus, and Yolo counties); and southern San Joaquin Valley (Fresno, Kings, Tulare, Kern, and Madera counties). (Figure A-39). Pest and disease pressure may differ among these regions. The pooled figures in this report may not reflect differences in pesticide use patterns between production regions.

Changes in pesticide use on wine grape are influenced by a number of factors, including weather, topography, pest pressure, evolution of resistance, competition from newer pesticide products, commodity prices, application restrictions, efforts by growers to reduce costs, and increased emphasis on sustainable farming.

Table 32: *Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for wine grape each year from 2011 to 2015. Planted acres from 2011 to 2015 are from CDFA(b), 2014-2016; marketing year average prices from 2011 to 2015 are from USDA(d), 2014-2016. Acres treated means cumulative acres treated (see explanation p. 10).*

	2011	2012	2013	2014	2015
Pounds AI	29,522,748	26,867,158	26,749,046	26,800,350	29,465,382
Acres Treated	9,751,786	9,333,489	10,258,480	10,102,683	10,757,619
Acres Planted	543,000	588,000	610,000	615,000	608,000
Price/ton	$ 637	$ 773	$ 753	$ 759	$ 679

The total amount of pesticides applied in 2015 and the cumulative area treated increased from 2014 values (Table 32).All the major types of pesticides–sulfur, fungicides, herbicides, and insecticides–increased in 2015, a recurring trend for all pesticide types except herbicides, which tend to fluctuate more annually (Figure 37).

Vine mealybug continued to be a concern for growers. It has now been found throughout most of the grape-growing regions of California. The warm winters since 2012 have allowed vine mealybug populations to build up early in the season. In the North Coast region, a new pest, the Virginia creeper leafhopper, continued to cause substantial damage in some locations, as did the western grape leafhopper. While there is effective biological control for western grape leafhopper, Virginia creeper leafhopper infestations require insecticide applications. On the positive side, the European grapevine moth was nearing eradication, which was officially declared in August 2016.

Oil, chlorpyrifos, thiamethoxam, clothianidin, chlorantraniliprole, fenpyroximate, and to a lesser extent imidacloprid were applied to more area than in 2014. Three of these insecticides (thiamethoxam, clothianidin, imidacloprid) are neonicotinoids used to manage mealybugs,

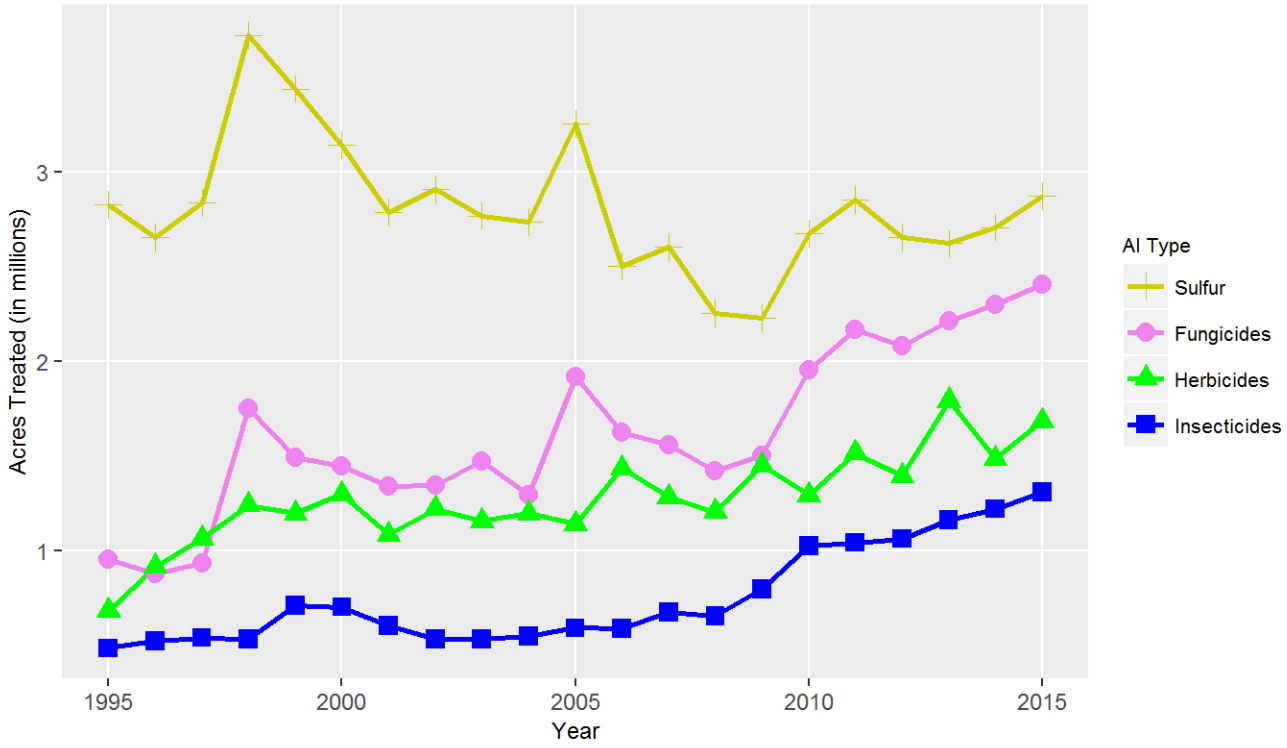

Figure 37: *Acres of wine grape treated by all AIs in the major types of pesticides from 1995 to 2015.*

leafhoppers, and sharpshooters, and one is a miticide (fenproximate). Chlorantraniliprole is used to manage moth larvae. The number of acres treated with spirotetramat, used on similar pests to those treated with the neonicotinoids, differed little from 2014 but the number of pounds applied increased greatly, suggesting that it was being applied at the higher rates (Figures 38,A-40, and A-41).

Large vine mealybug populations in the southern San Joaquin Valley in 2015 sparked an appreciable increase in chlorpyrifos use. Chlorpyrifos is used as postharvest or delayed dormant treatments to prevent spring buildup of vine mealybug populations. This increase comes at a time when the U.S. EPA has proposed a revocation of all tolerances for this insecticide.

Fungicide use increased slightly in 2015 (Figure 37), despite the dry conditions of the drought that generally do not favor fungal reproduction. Difenoconazole, cyflufenamid, potassium bicarbonate, fenhexamid, and fluopyram had the largest increases in area treated. The top five fungicides applied to the largest cumulative treated area changed little from 2014 (Figure 38). It is likely that growers were rotating AIs to slow the evolution of resistance.

Despite the drought's potential inhibitory effect on weed growth, herbicide use increased in 2015 (Figure 37). There was a decrease in use of herbicides in 2014, attributed in part to drought conditions. The largest increases in 2015 were in the use of glufosinate-ammonium and flumioxazin (Figure 38), but notable increases occurred in 2,4-D and indaziflam as well. Indaziflam was registered in 2012. Glufosinate-ammonium, an herbicide that was difficult to acquire in the West a few years ago, is an attractive alternative to glyphosate. The large increase in its use did not come with a corresponding decrease in glyphosate use, however (Figure 38).

Fumigant use continued a decreasing trend that has been observed over the past four years, with the exception of an increase in area treated with 1,3-D and to a lesser extent sodium tetrathiocarbonate, the latter of which had been used on only 4 acres over the past two years. The overall decrease in fumigant use was due to fewer applications of aluminum phosphide for rodent management.

Use of gibberelins decreased in 2015, though they were by far the most commonly applied plant growth regulator (PGR). Use of other PGRs was negligible in 2015.

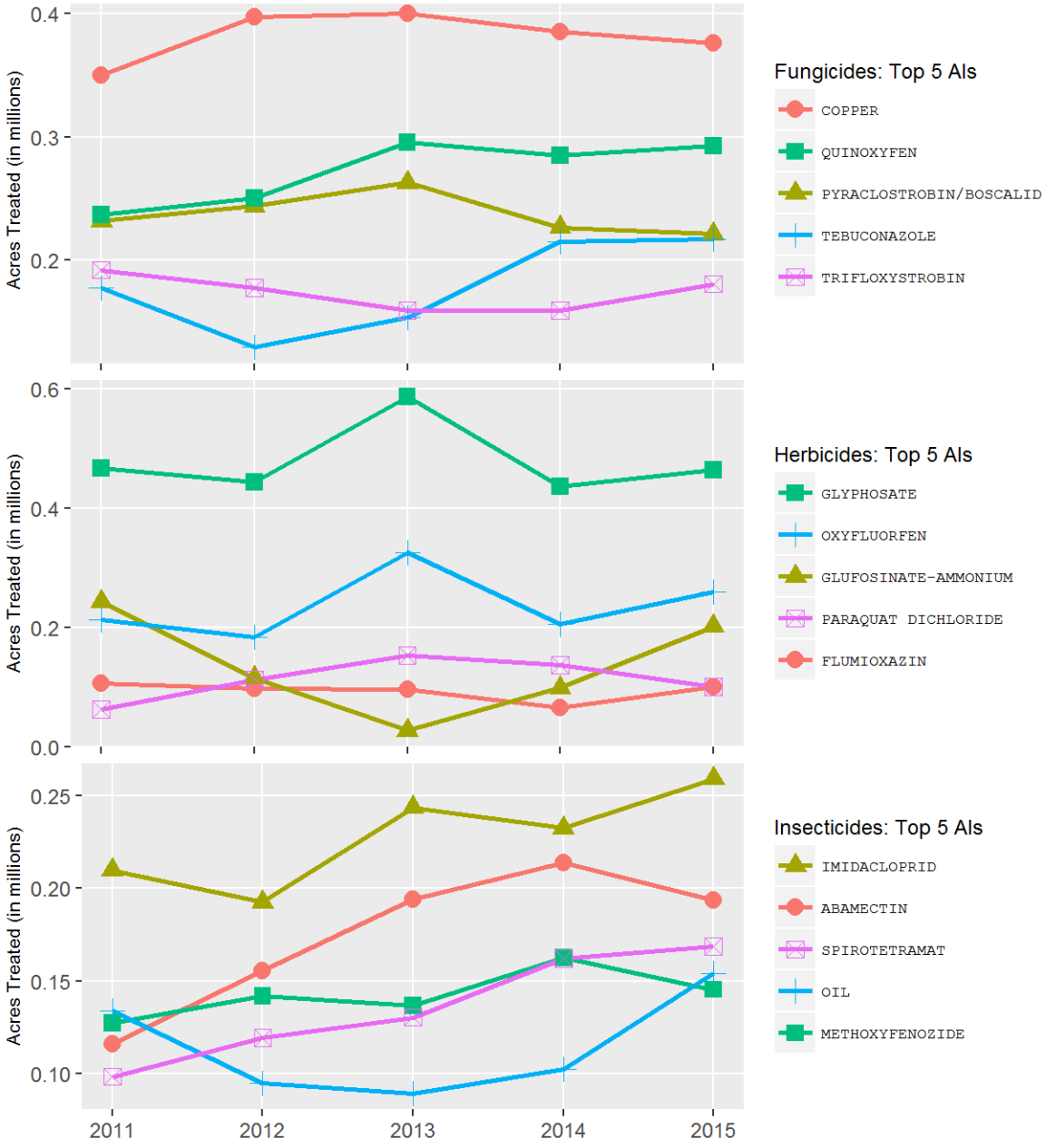

Figure 38: *Acres of wine grape treated by the top 5 AIs of each AI type from 2011 to 2015.*

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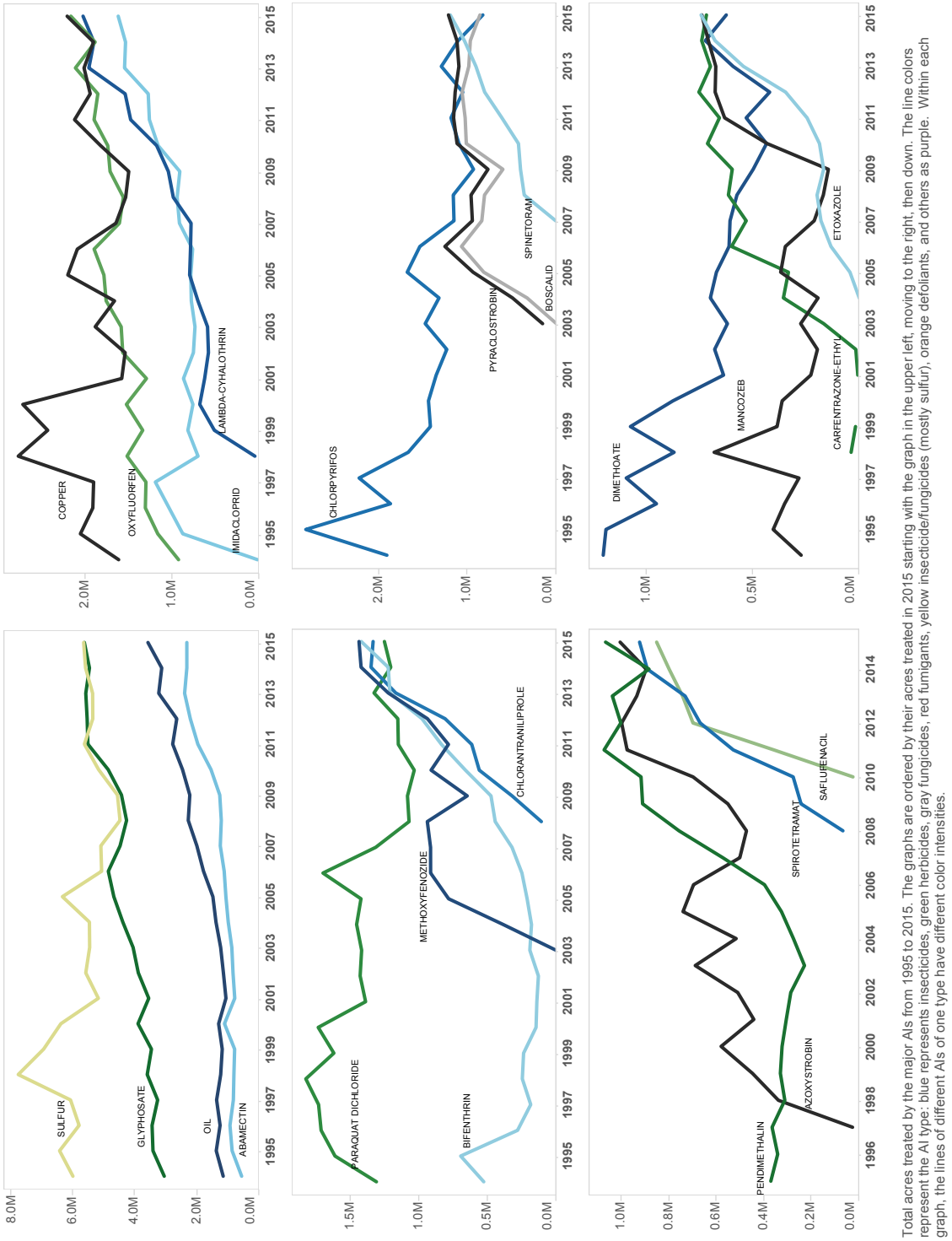
And many thanks to all the contributions and expertise from County Agricultural Commissioners, growers, University of California Cooperative Extension Area Integrated Pest Management Advisors and Farm Advisors, pest control advisors, commodity marketing boards, and University of California researchers.

Appendix



Total acres treated by the major AIs from 1995 to 2015. The graphs are ordered by their acres treated in 2015 starting with the graph in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, yellow insecticide/fungicides (mostly sulfur), orange defoliants, and others as purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-1: *Acres treated by the major AIs from 1994 to 2015.*

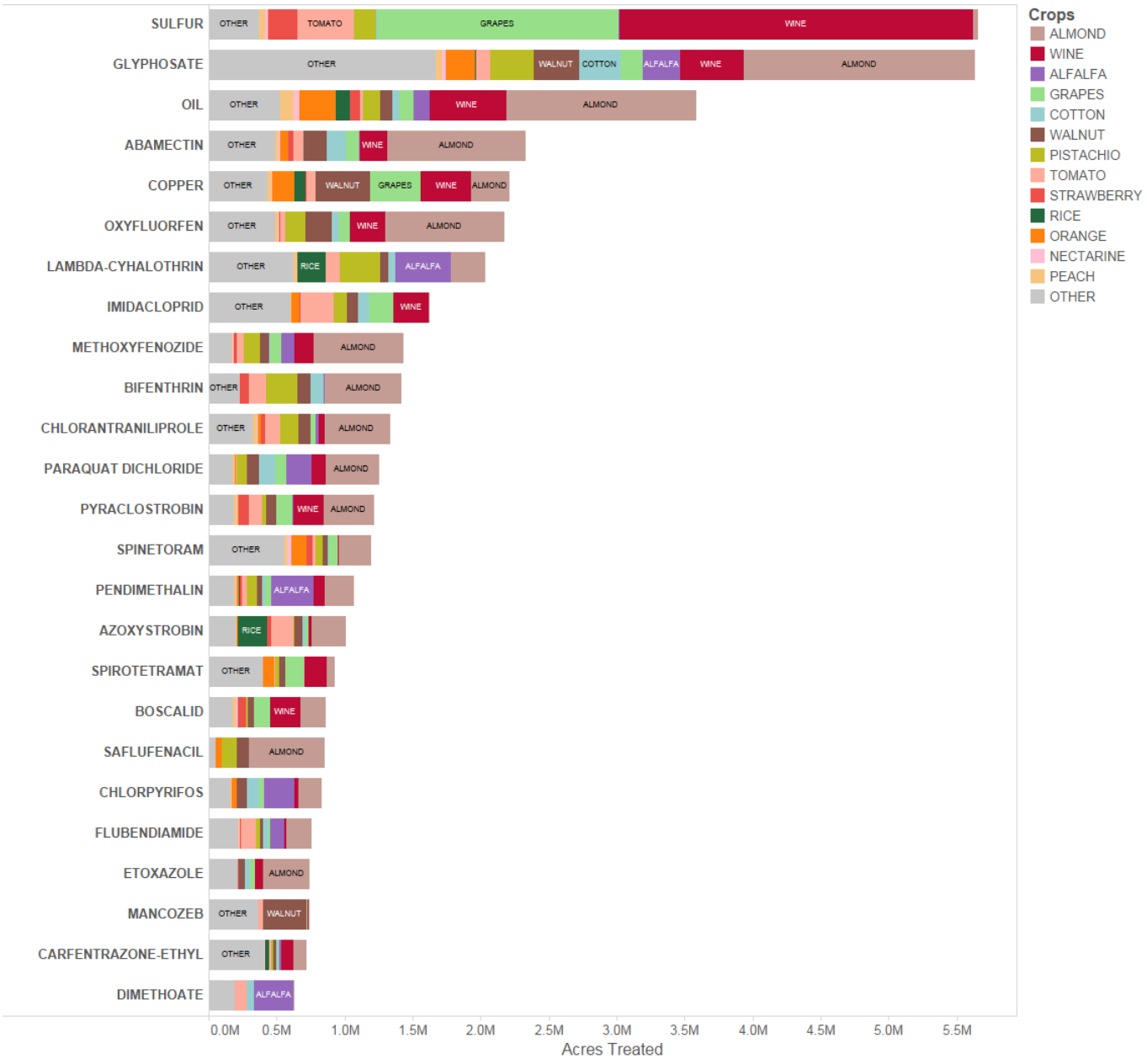


Figure A-2: *Acres treated by the major AIs and crops in 2015.*

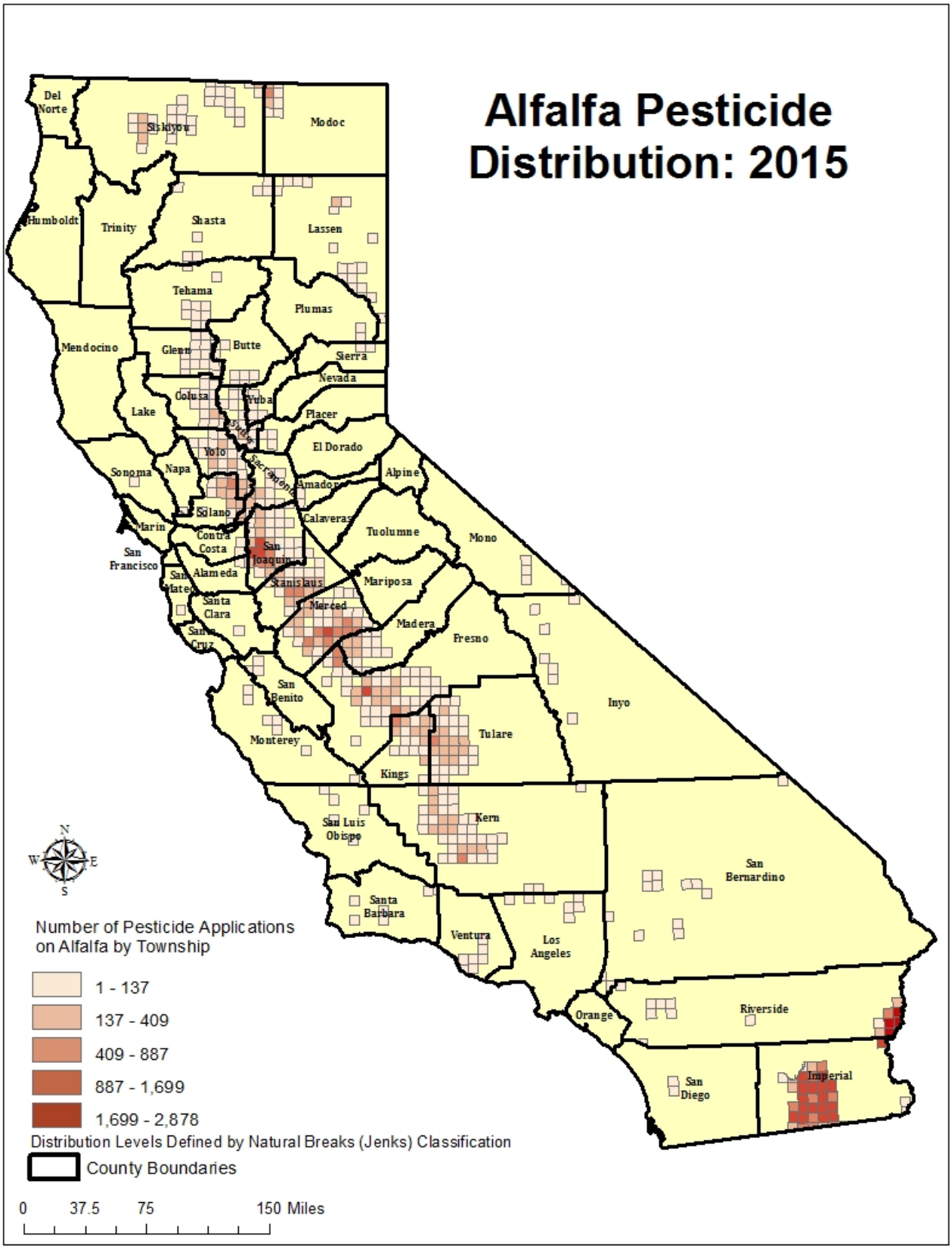
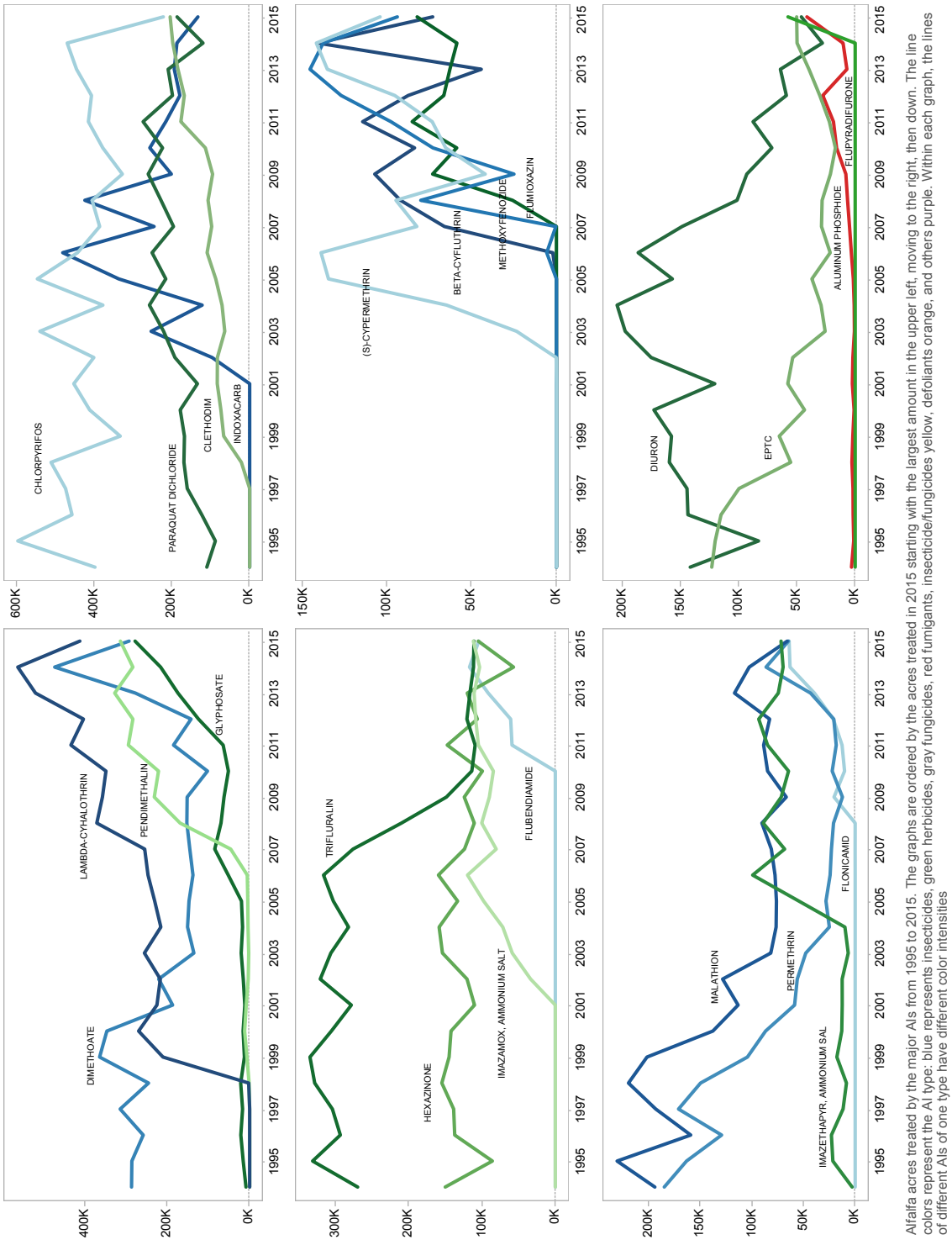


Figure A-3: *Number of pesticide application in alfalfa by township in 2015.*



Alfalfa acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities

Figure A-4: *Acres of alfalfa treated by the major AIs from 1994 to 2015.*

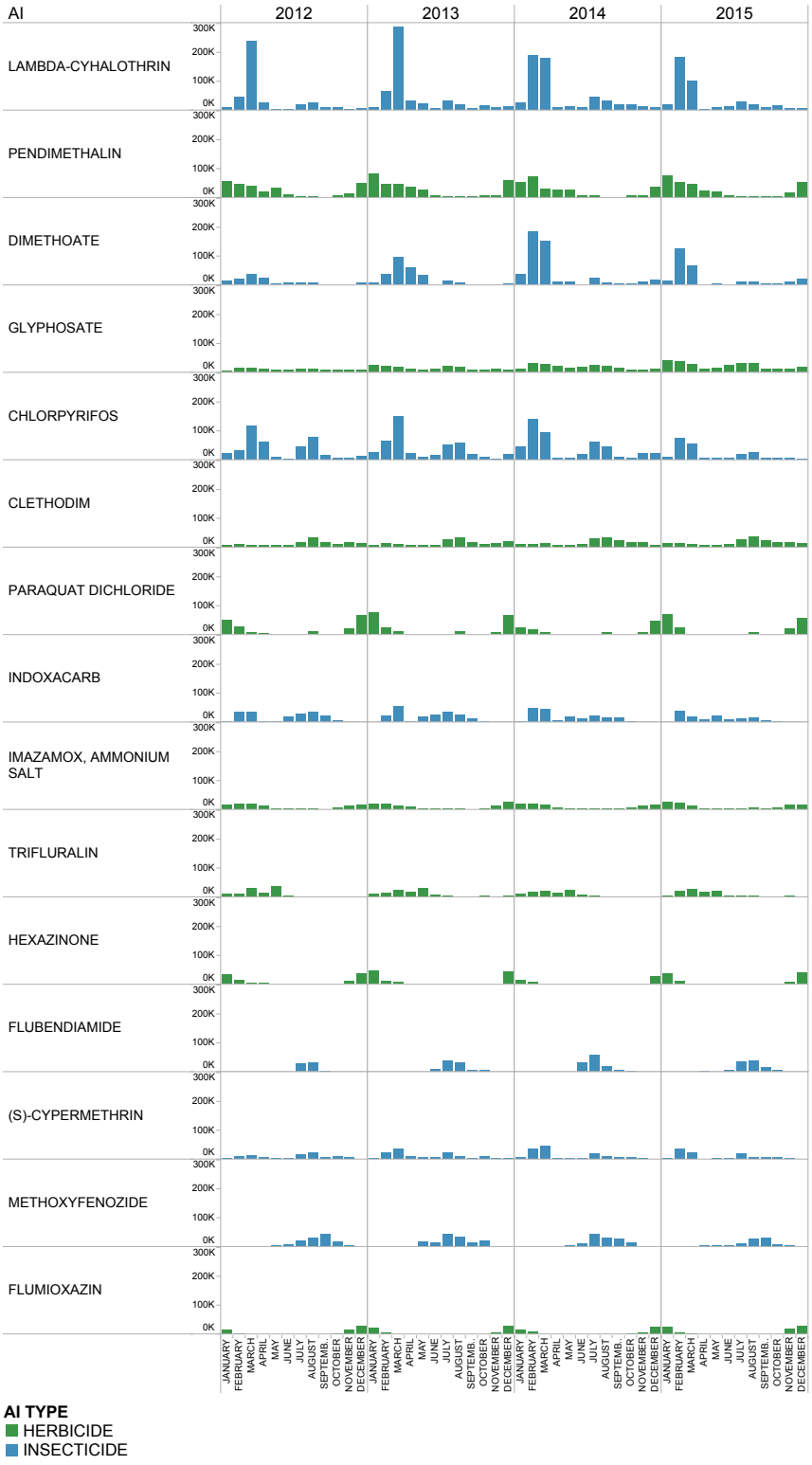


Figure A-5: *Acres of alfalfa treated by the major AIs by month and AI type from 2011 to 2015.*

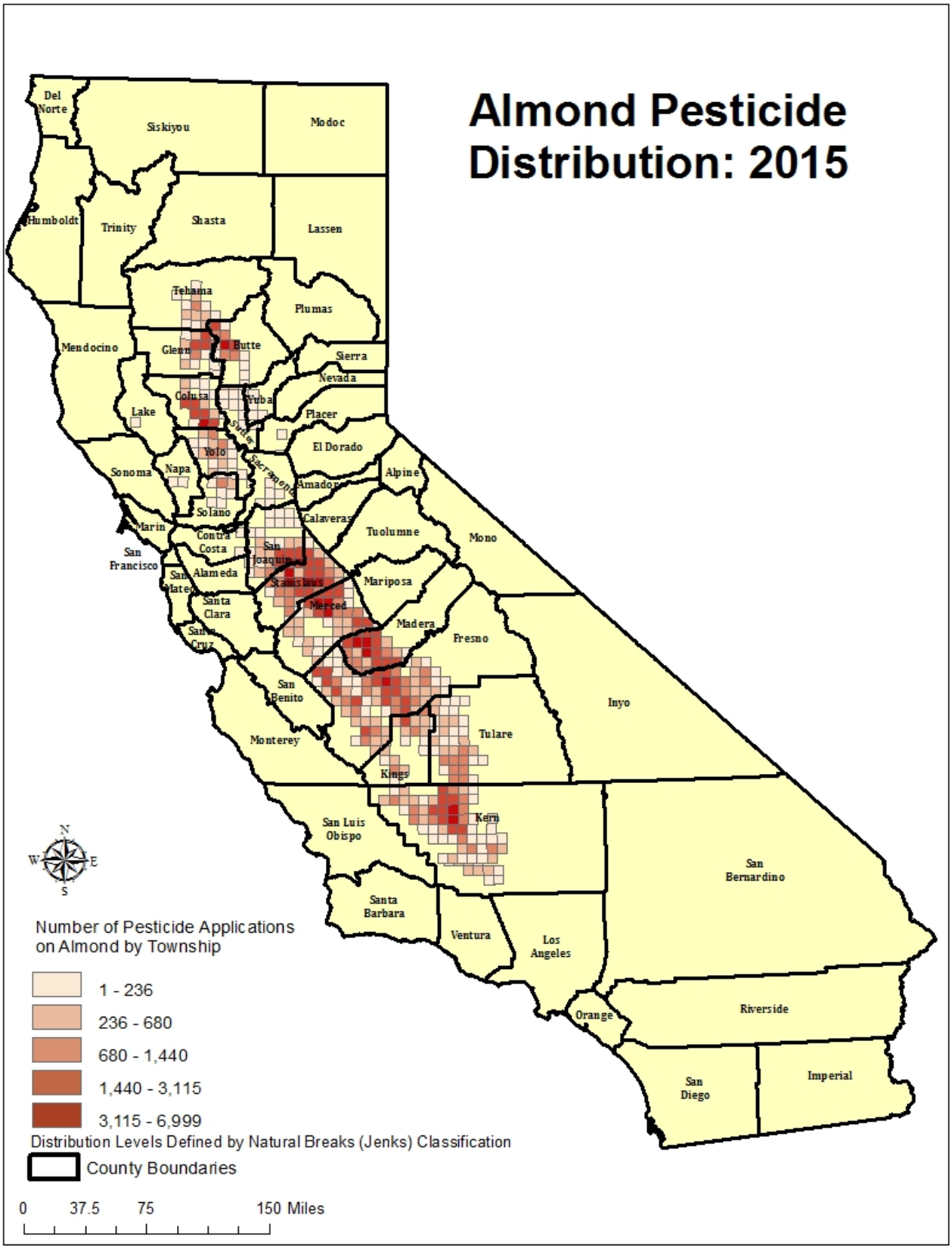
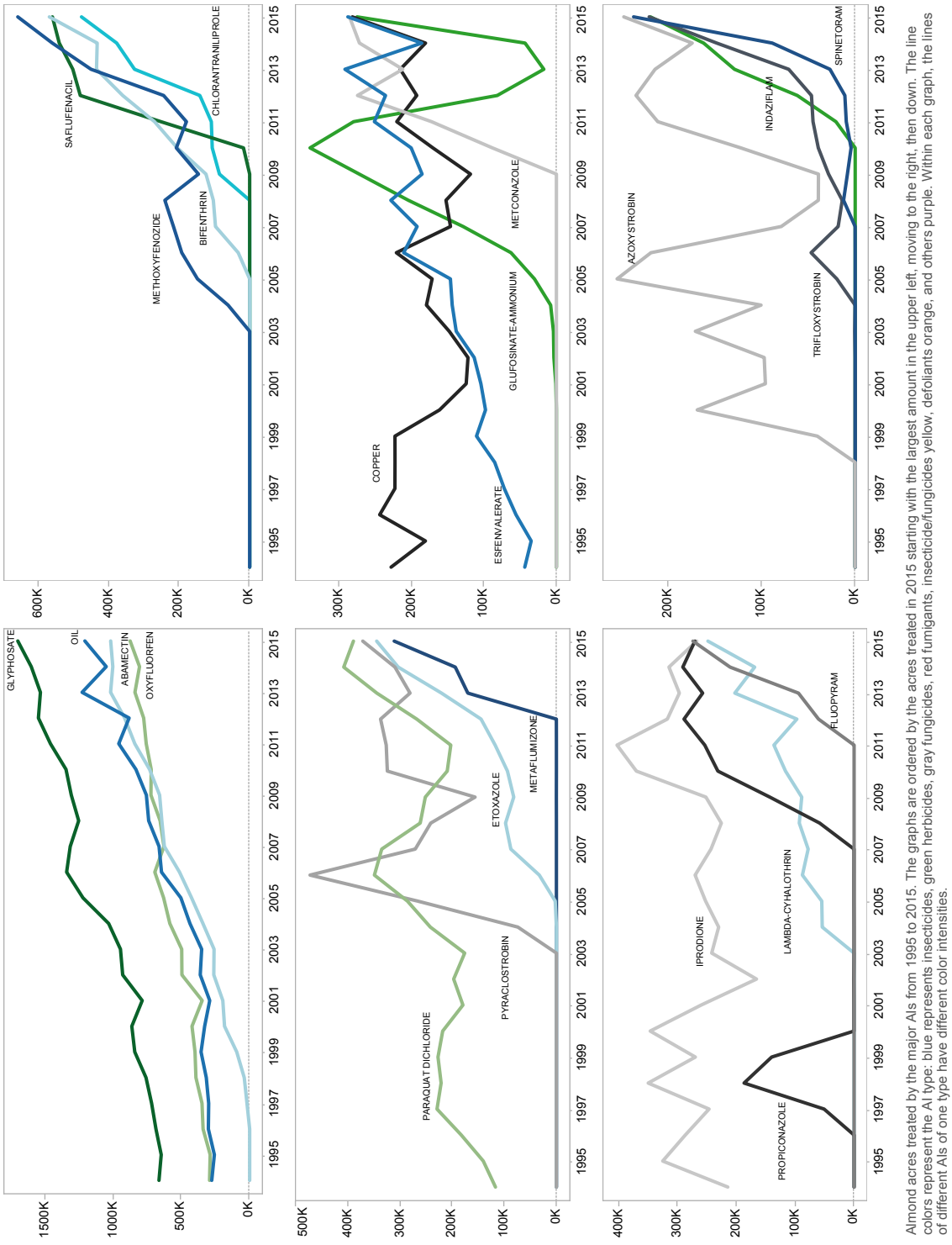


Figure A-6: *Number of pesticide application in almond by township in 2015.*



Almond acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-7: *Acres of almond treated by the major AIs from 1994 to 2015.*

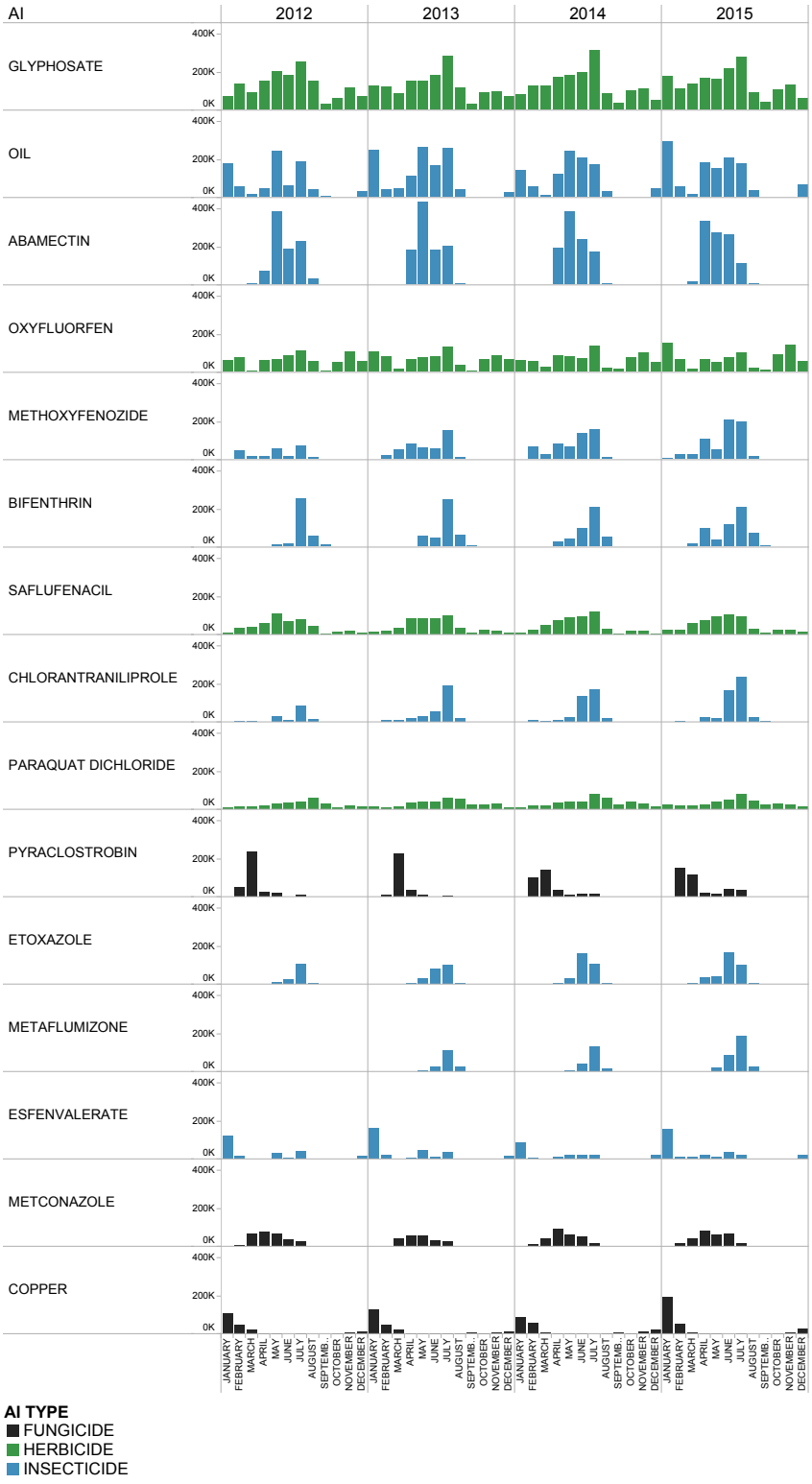


Figure A-8: *Acres of almond treated by the major AIs by month and AI type from 2011 to 2015.*

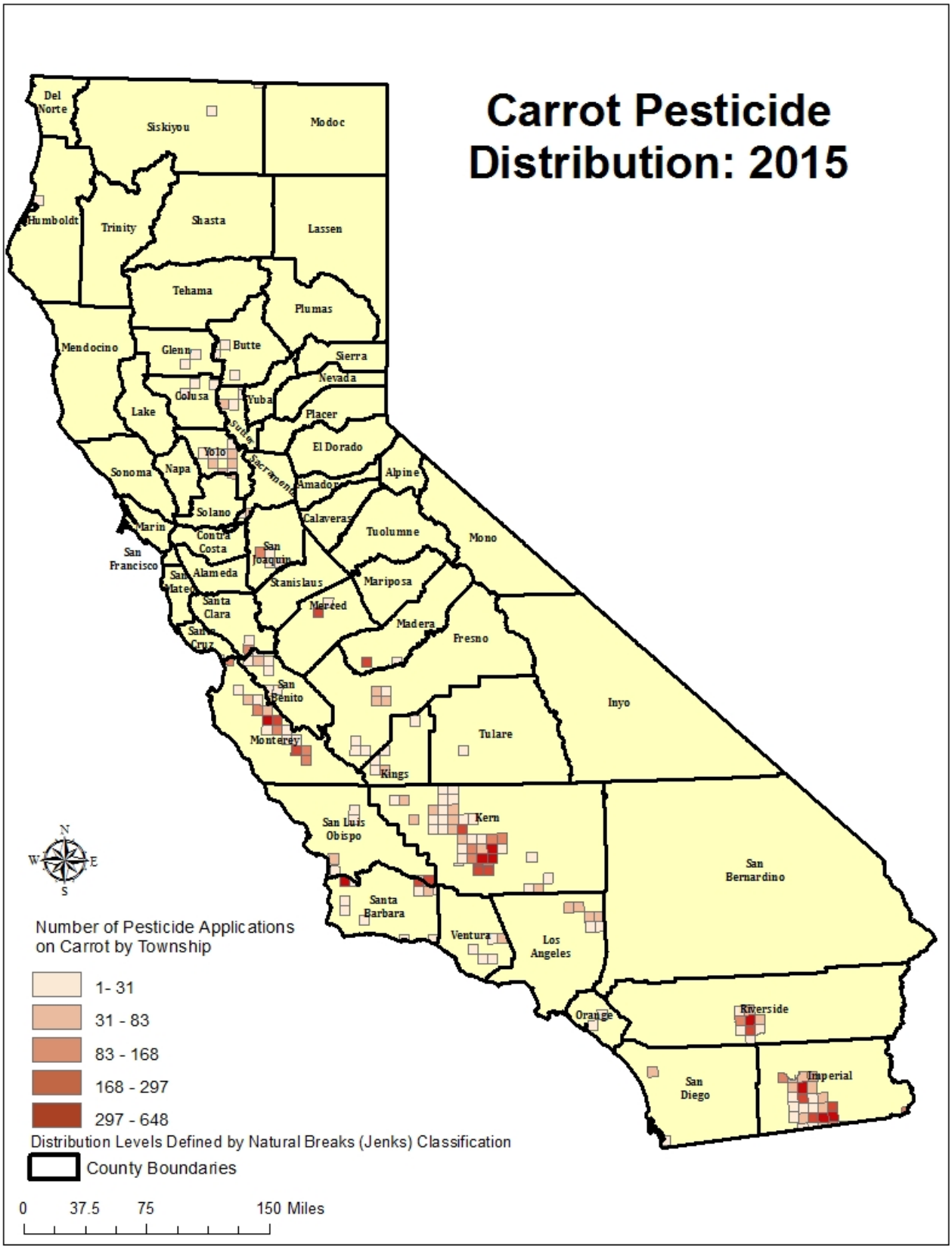
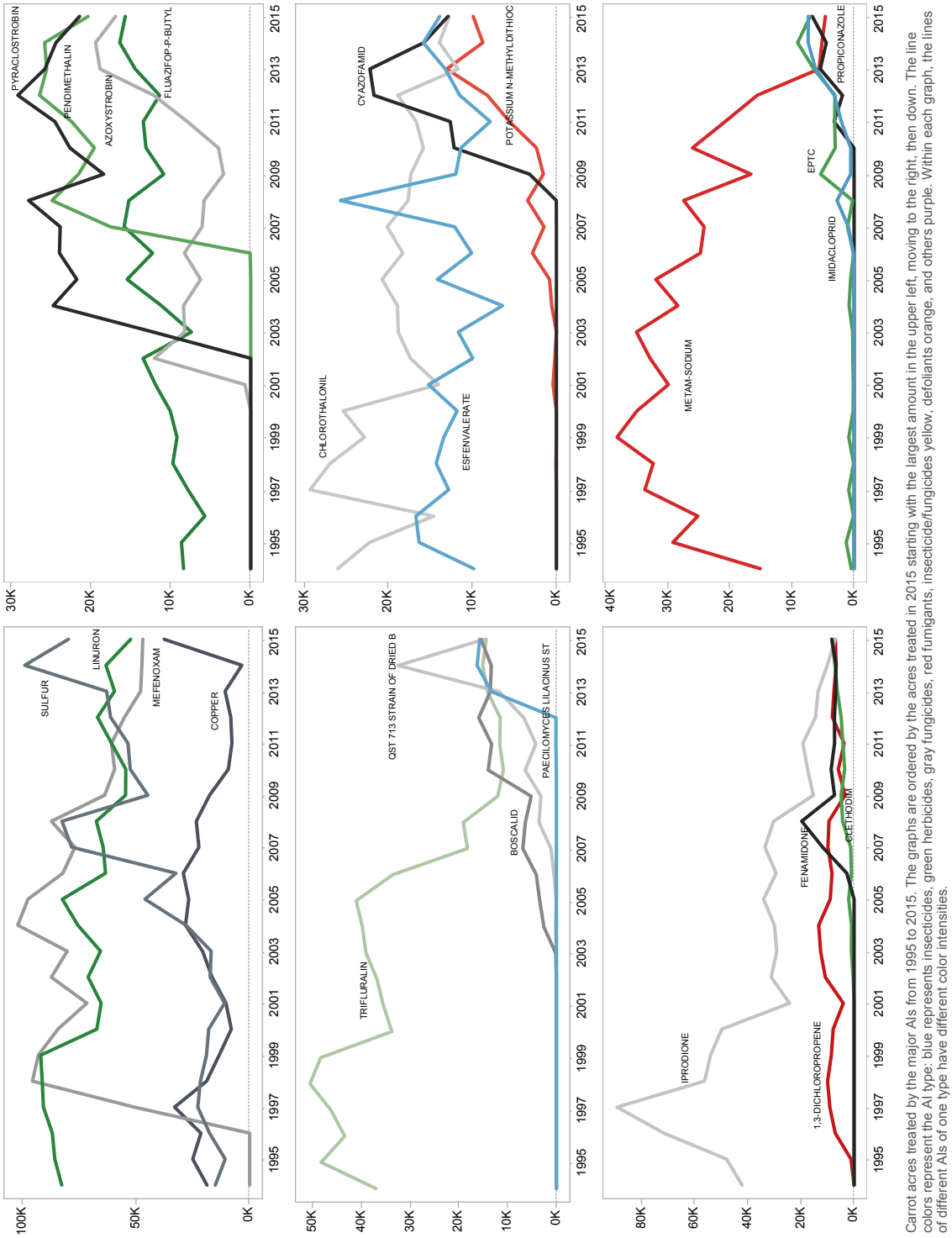


Figure A-9: *Number of pesticide application in carrot by township in 2015.*



Carrot acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-10: *Acres of carrot treated by the major AIs from 1994 to 2015.*

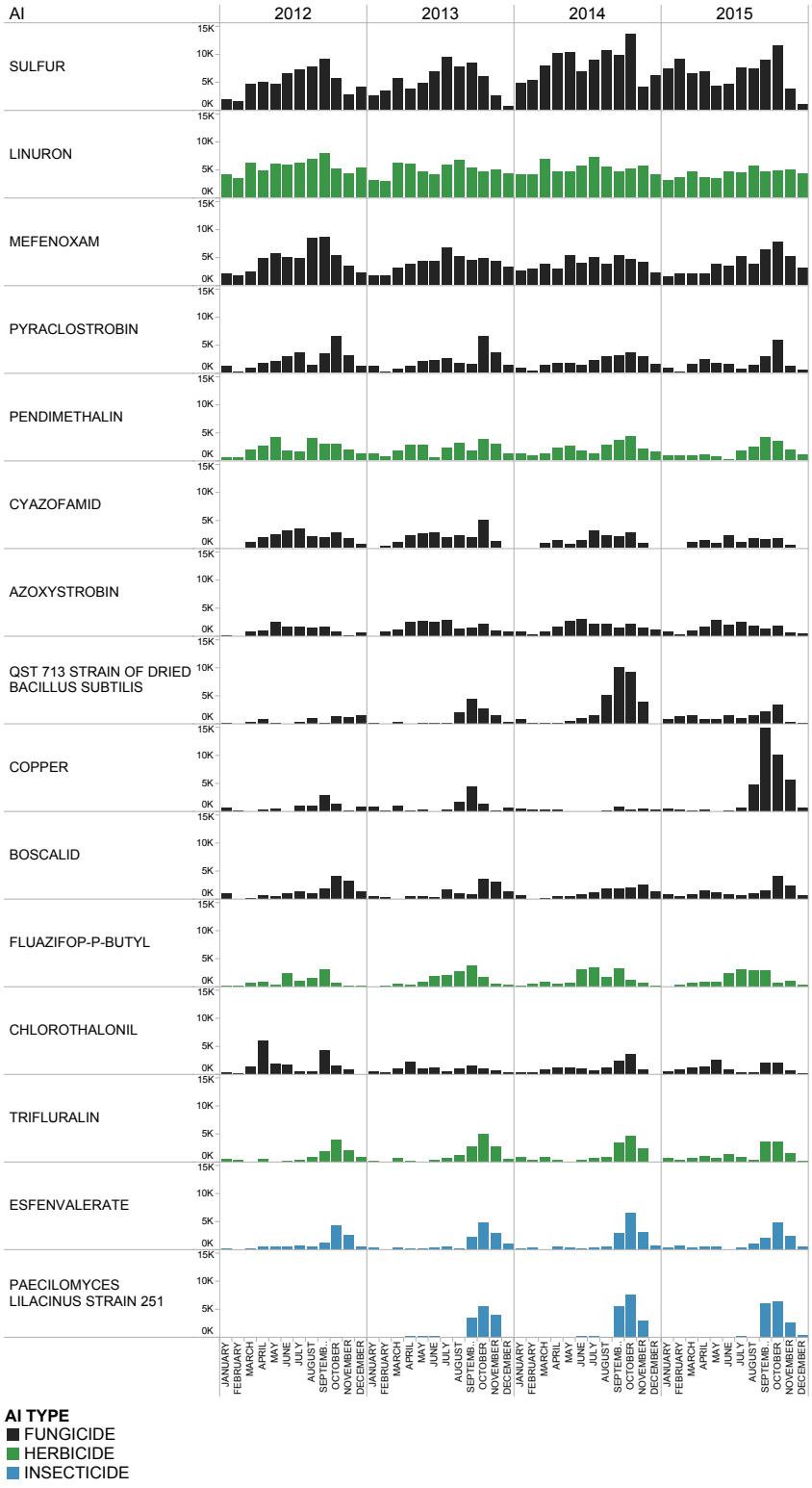


Figure A-11: *Acres of carrot treated by the major AIs by month and AI type from 2011 to 2015.*

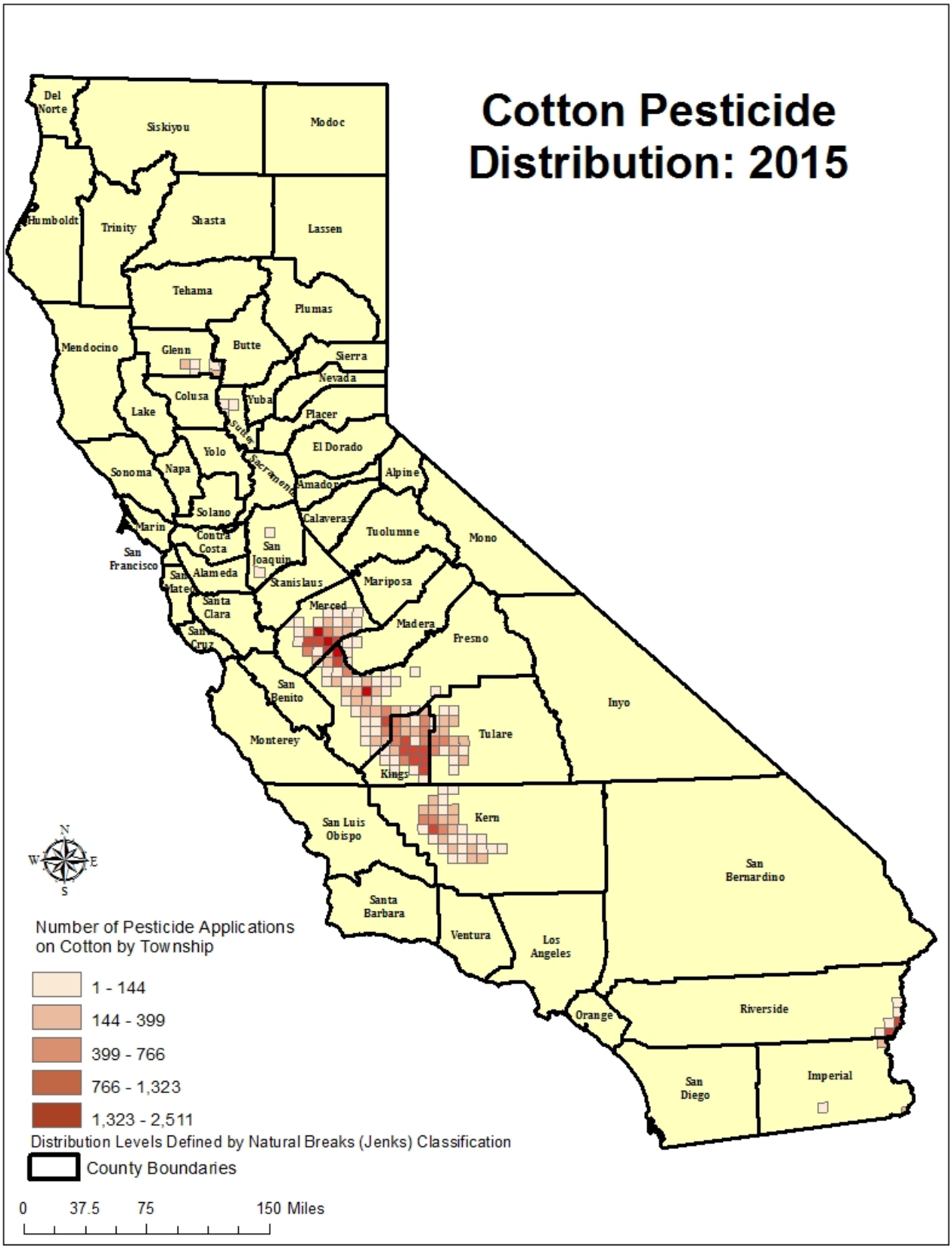
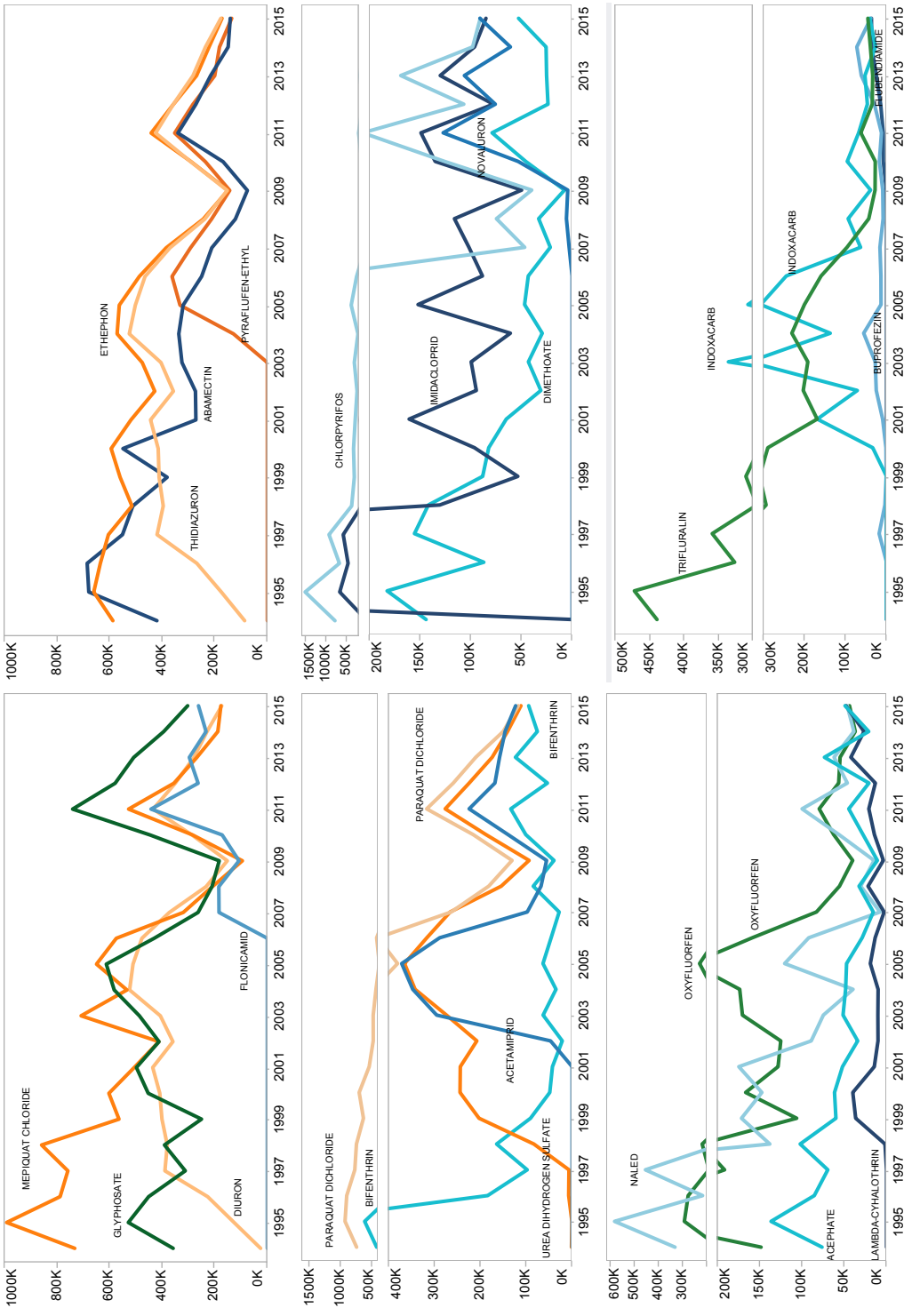


Figure A-12: *Number of pesticide application in cotton by township in 2015.*



Cotton acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-13: *Acres of cotton treated by the major AIs from 1994 to 2015.*

Figure A-14: *Acres of cotton treated by the major AIs by month and AI type from 2011 to 2015.*

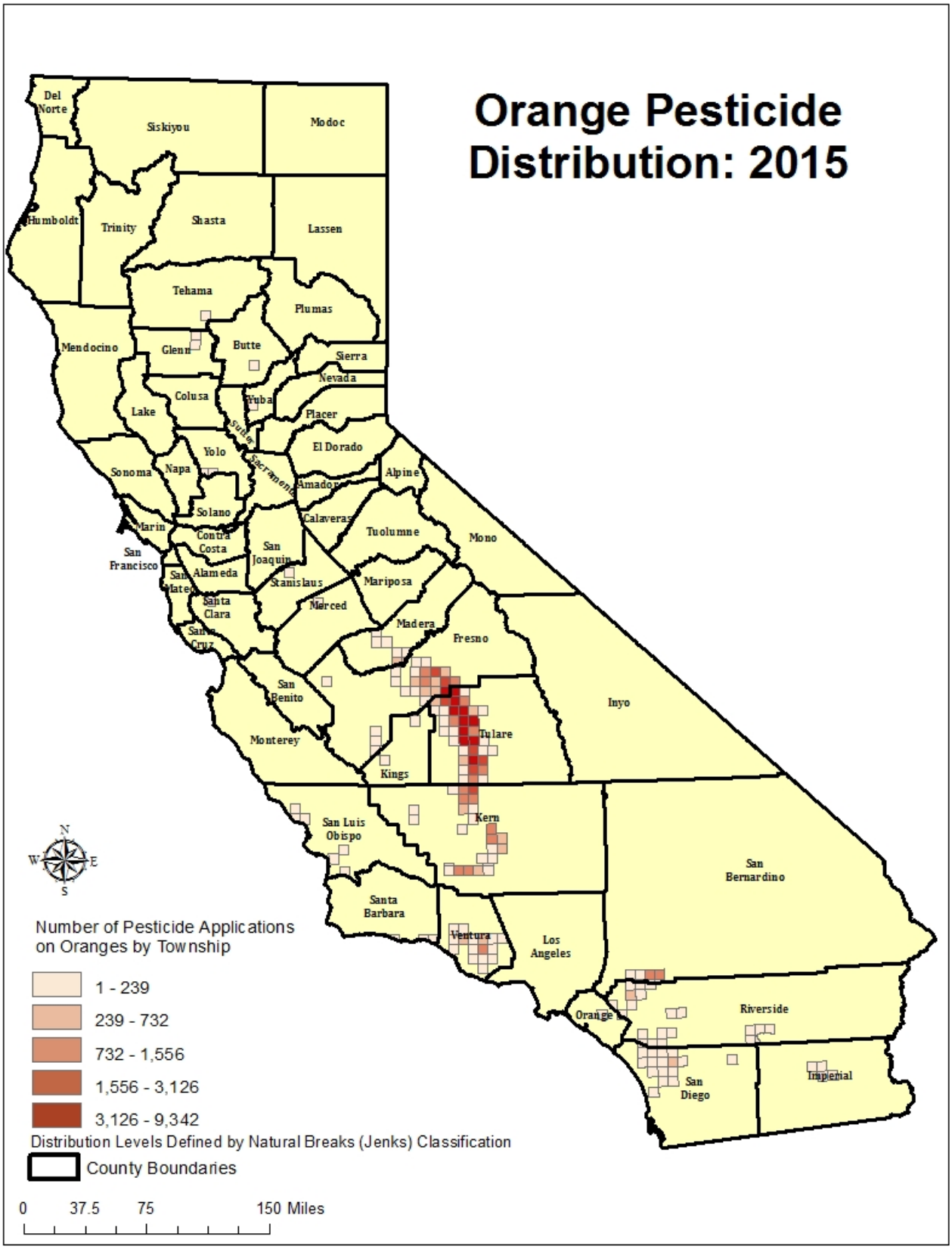
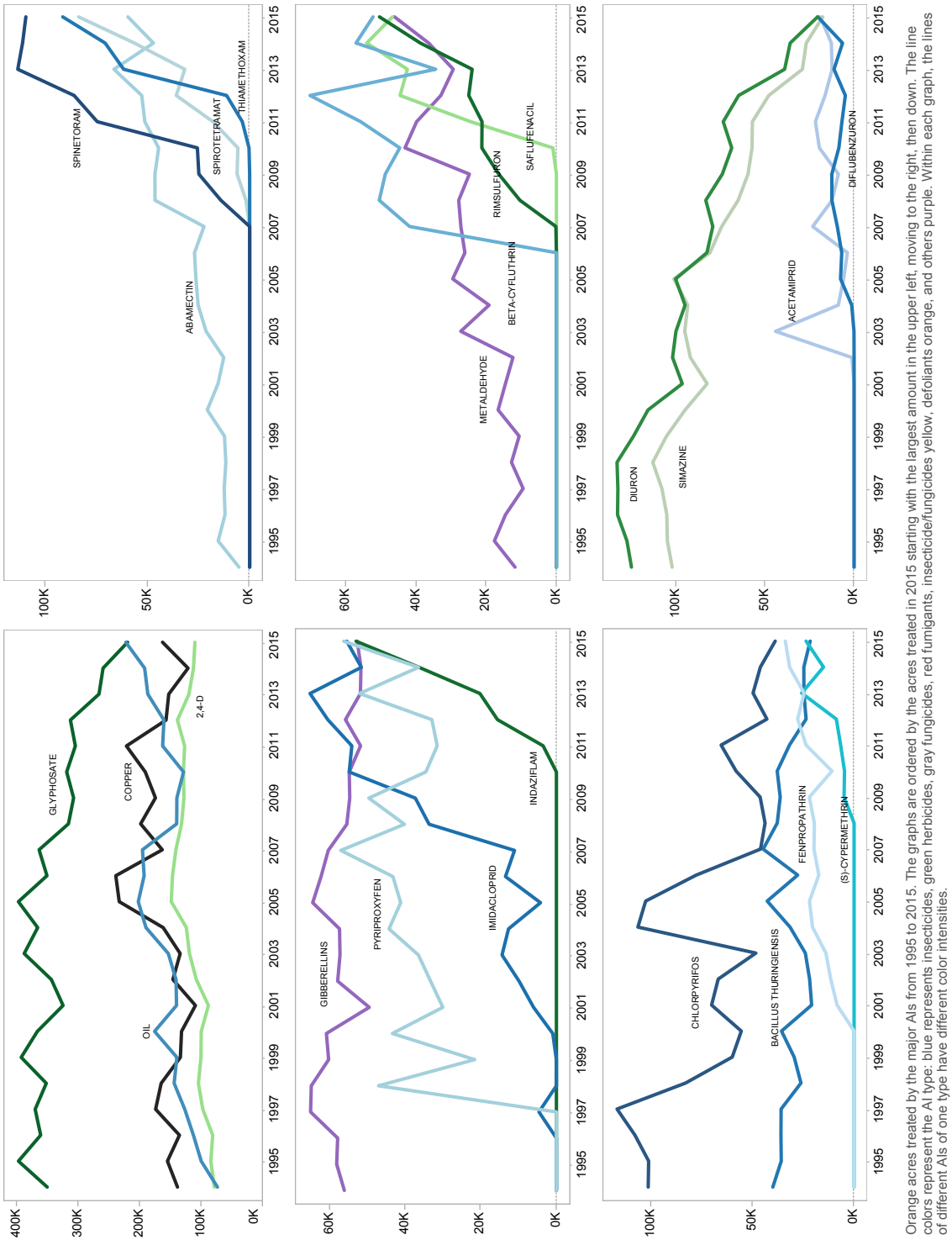


Figure A-15: *Number of pesticide application in orange by township in 2015.*



Orange acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-16: *Acres of orange treated by the major AIs from 1994 to 2015.*

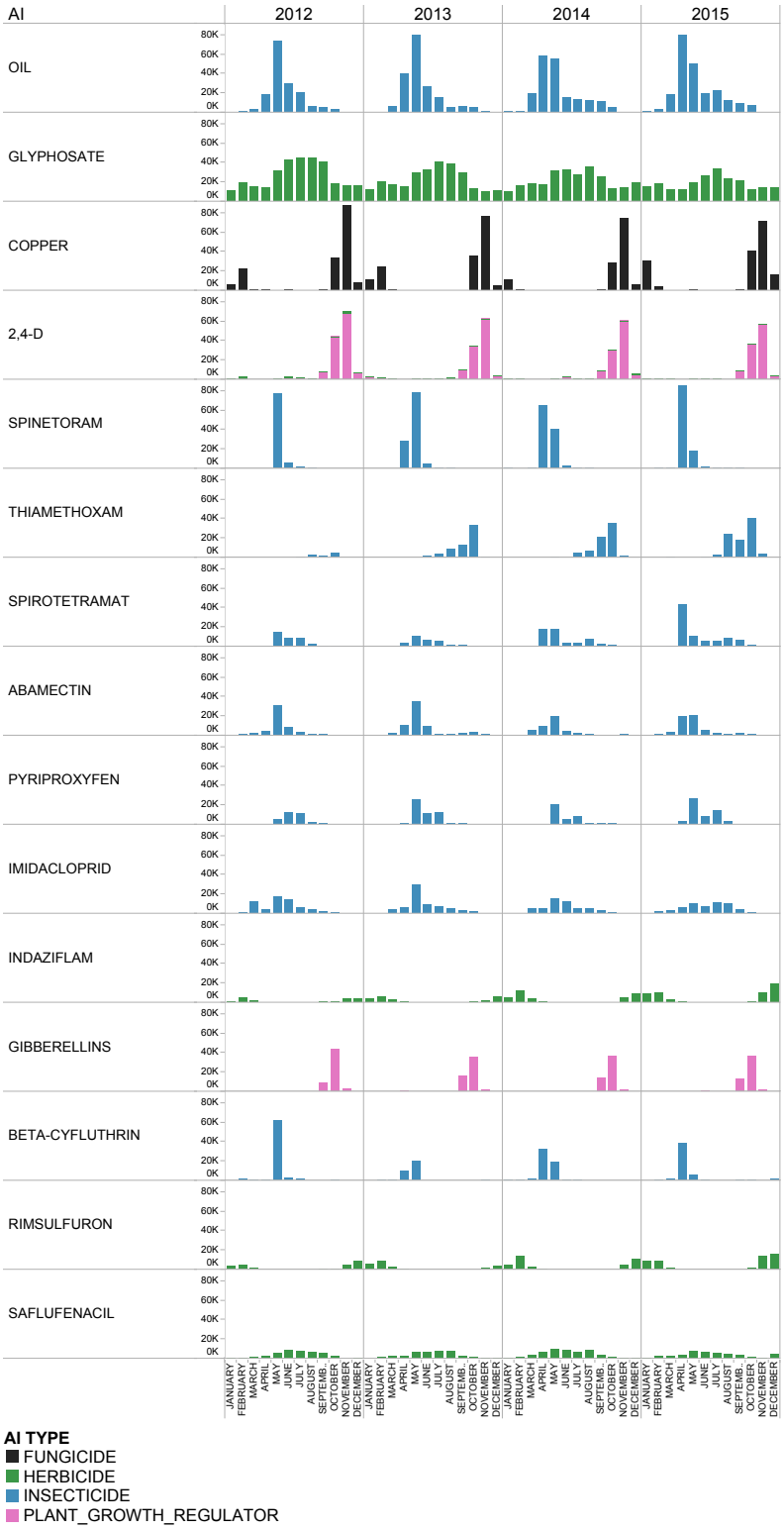


Figure A-17: *Acres of orange treated by the major AIs by month and AI type from 2011 to 2015.*

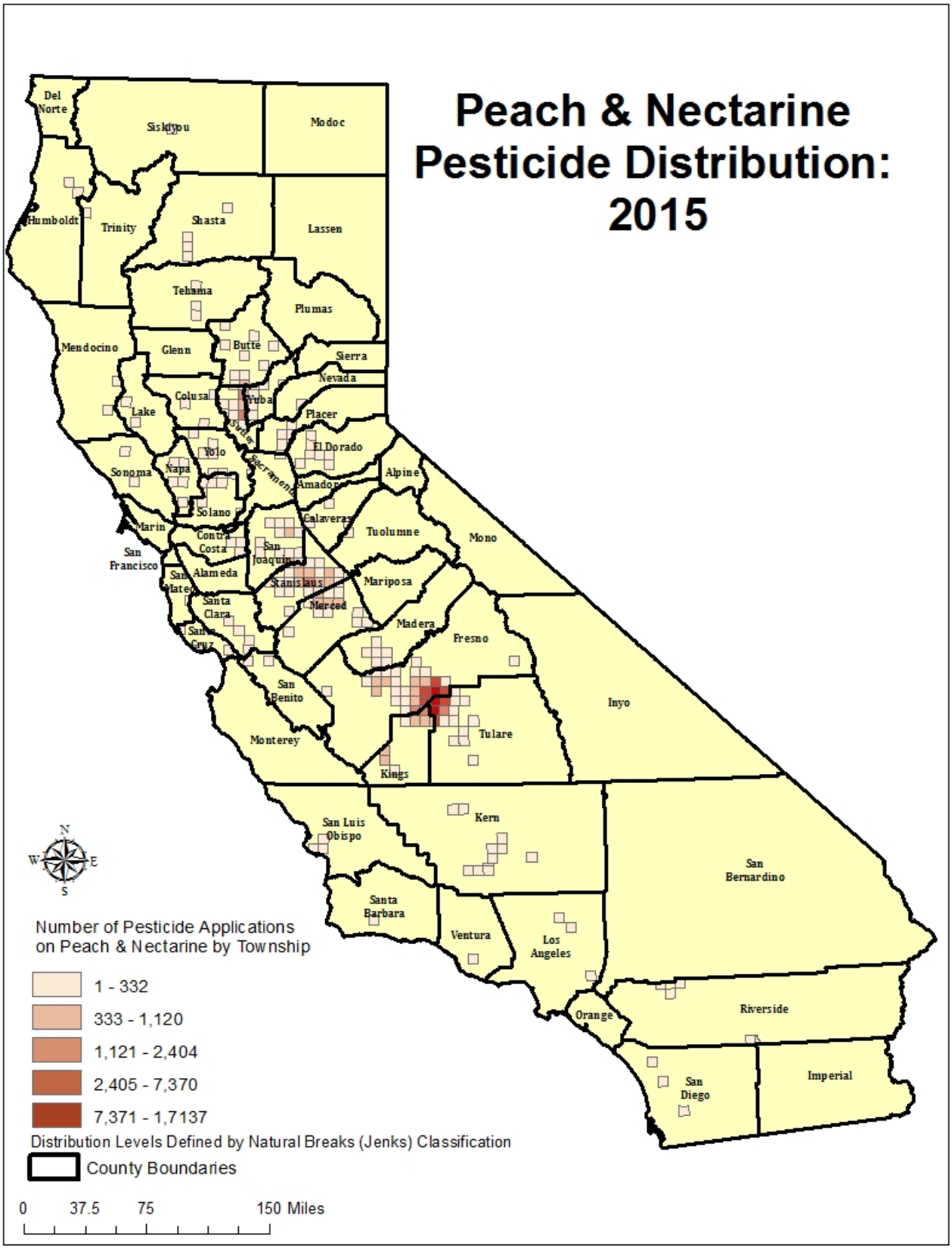


Figure A-18: *Number of pesticide application in peach and nectarine by township in 2015.*

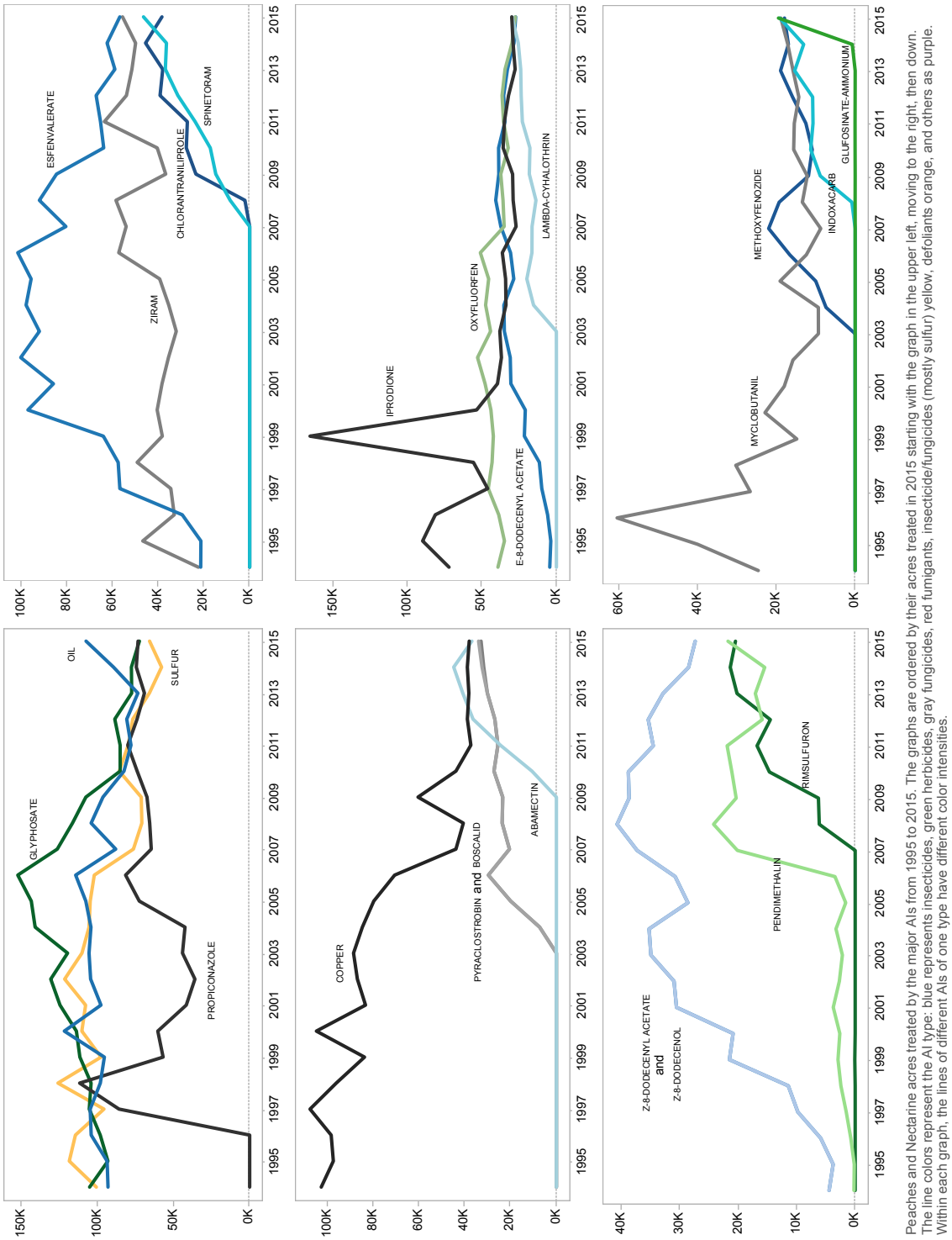


Figure A-19: *Acres of peach and nectarine treated by the major AIs from 1994 to 2015.*

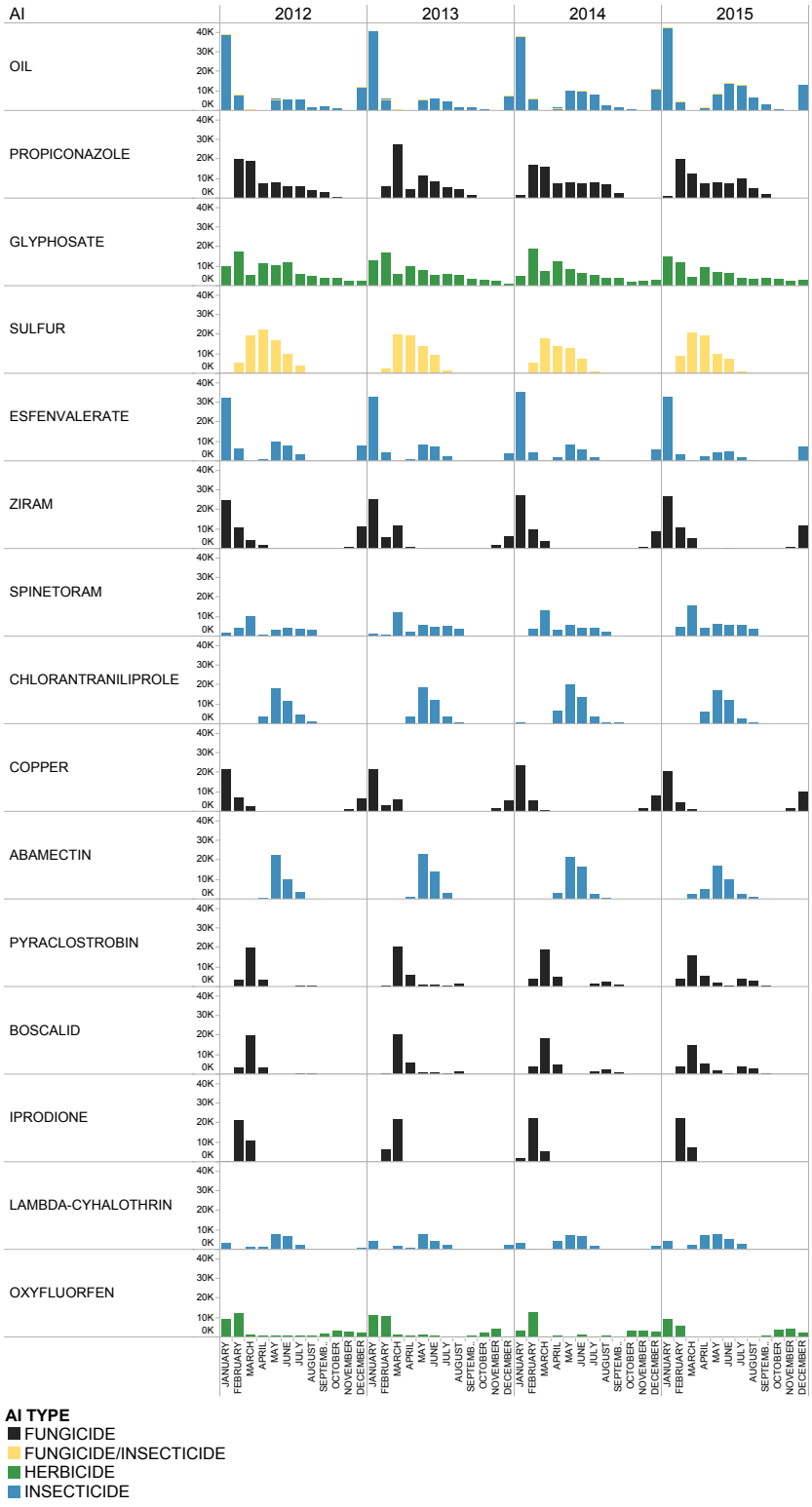


Figure A-20: *Acres of peach and nectarine treated by the major AIs by month and AI type from 2011 to 2015.*

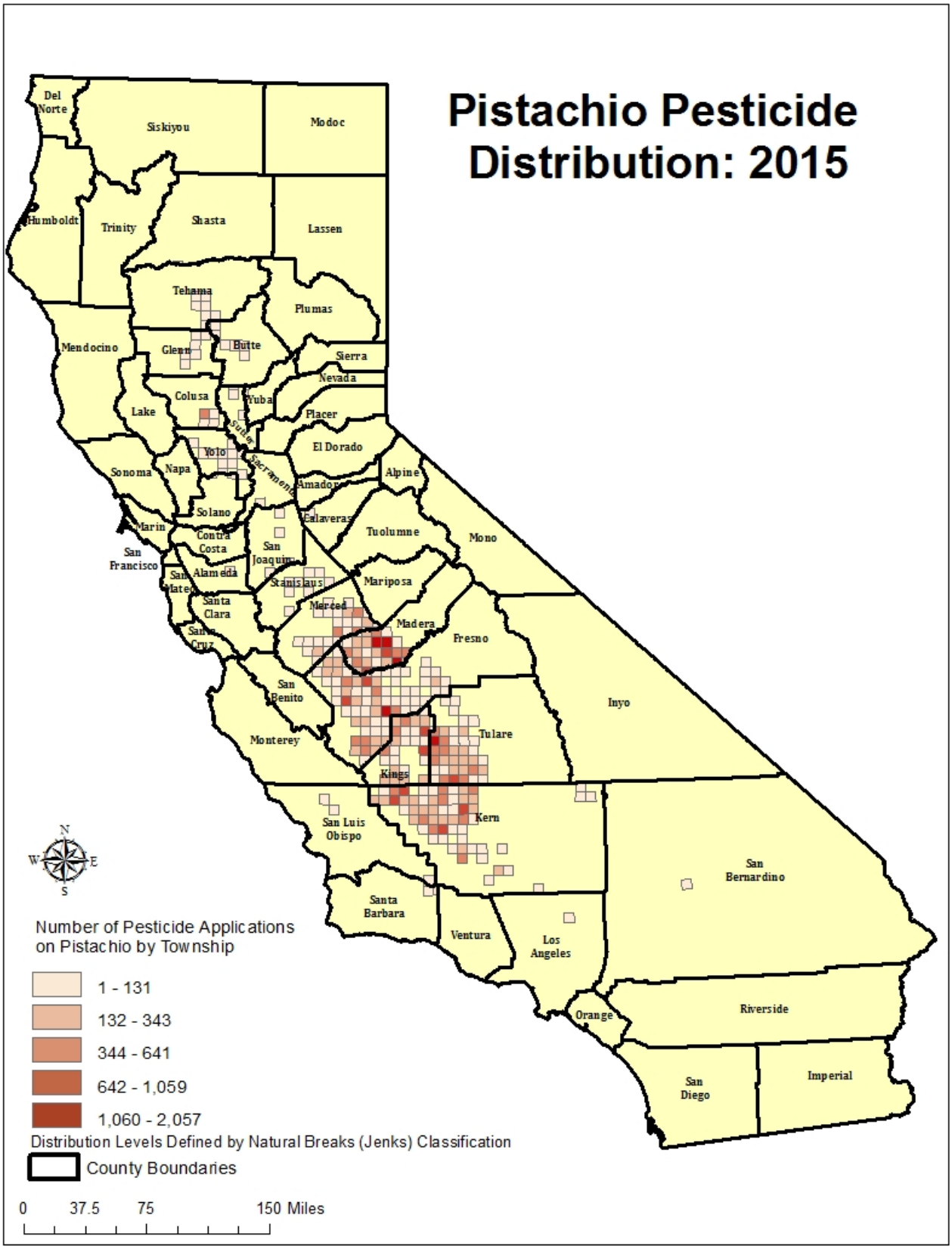
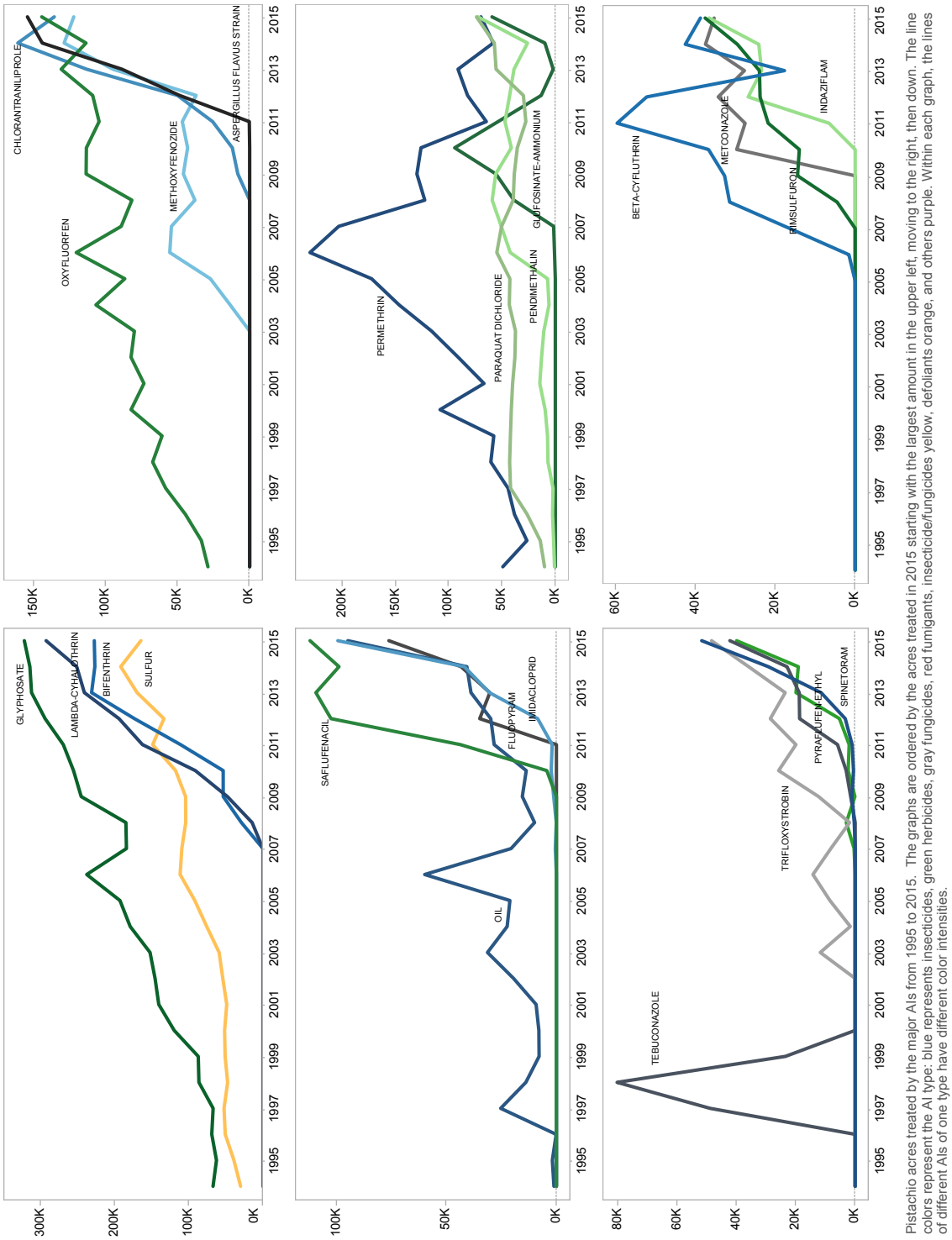


Figure A-21: *Number of pesticide application in pistachio by township in 2015.*



Pistachio acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-22: *Acres of pistachio treated by the major AIs from 1994 to 2015.*

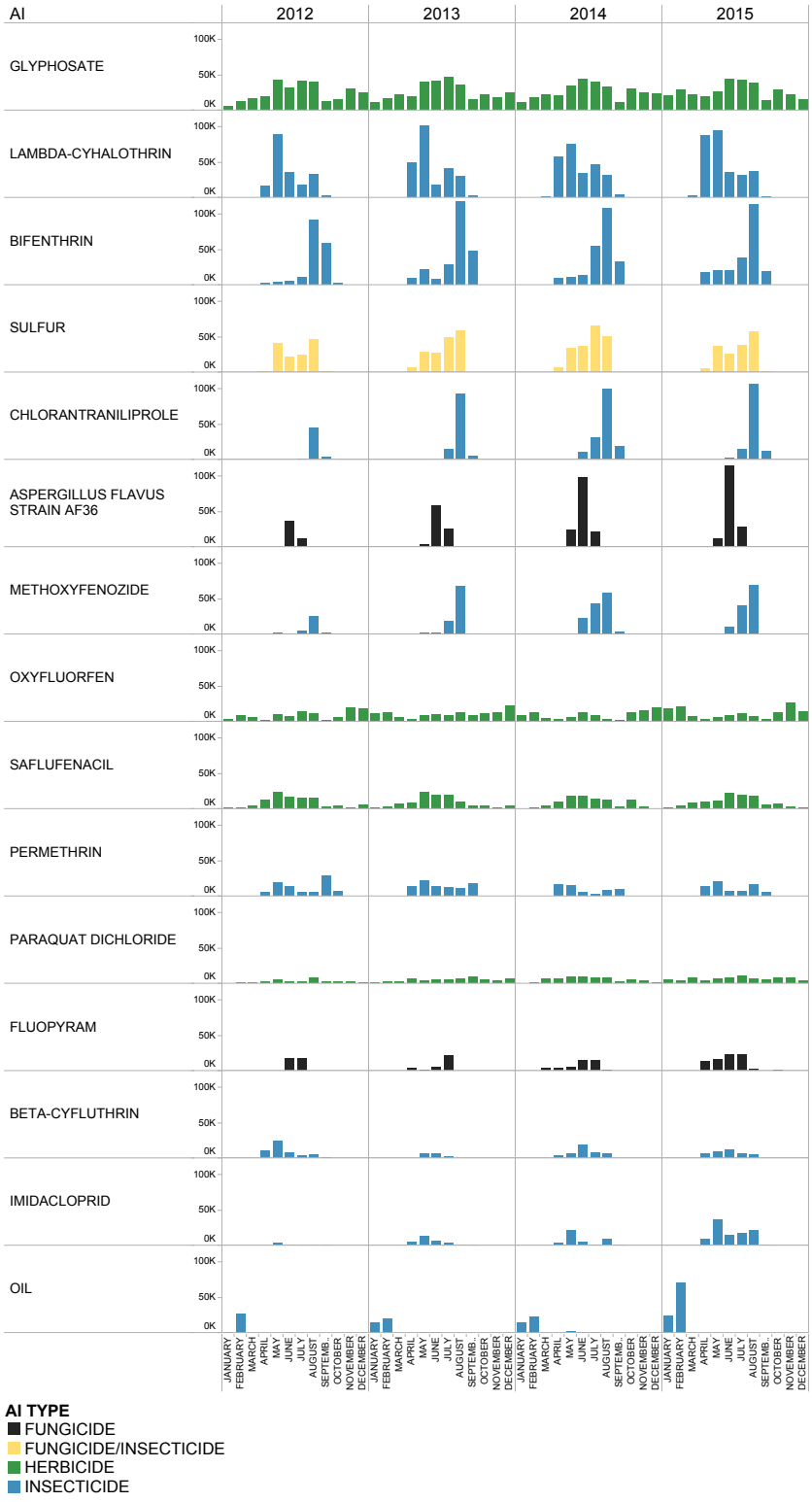


Figure A-23: *Acres of pistachio treated by the major AIs by month and AI type from 2011 to 2015.*

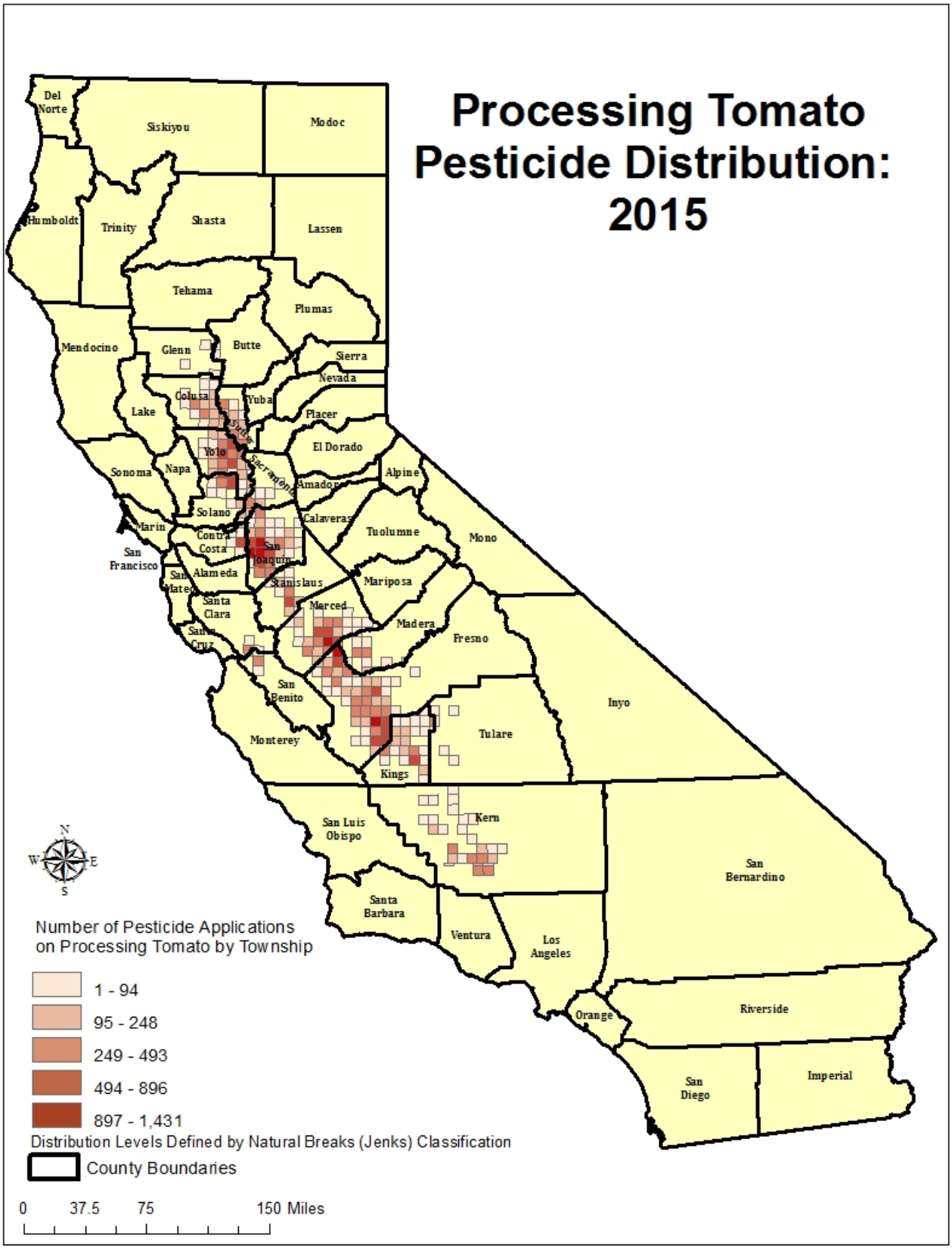
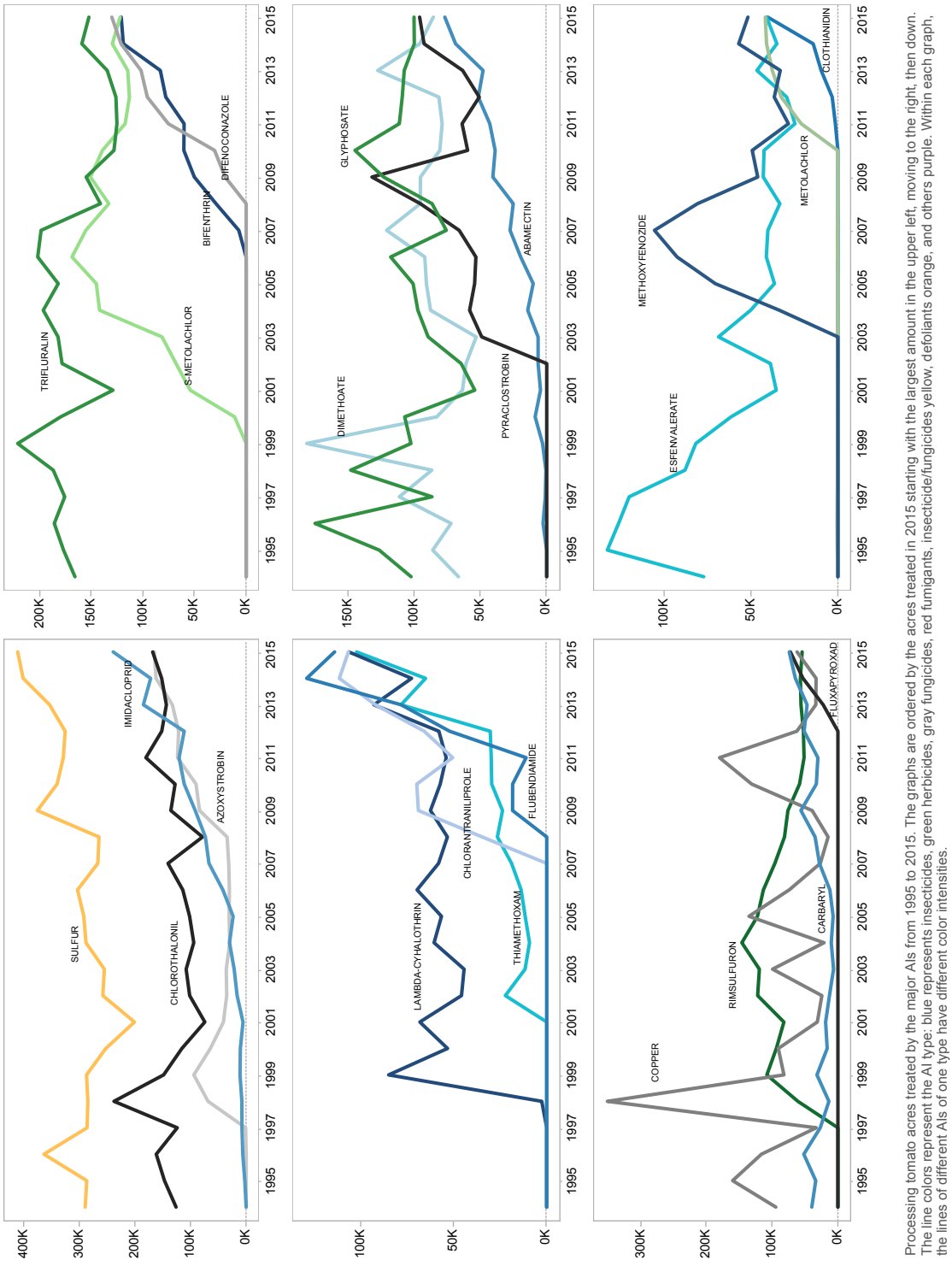


Figure A-24: *Number of pesticide application in processing tomato by township in 2015.*



Processing tomato acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-25: *Acres of processing tomato treated by the major AIs from 1994 to 2015.*

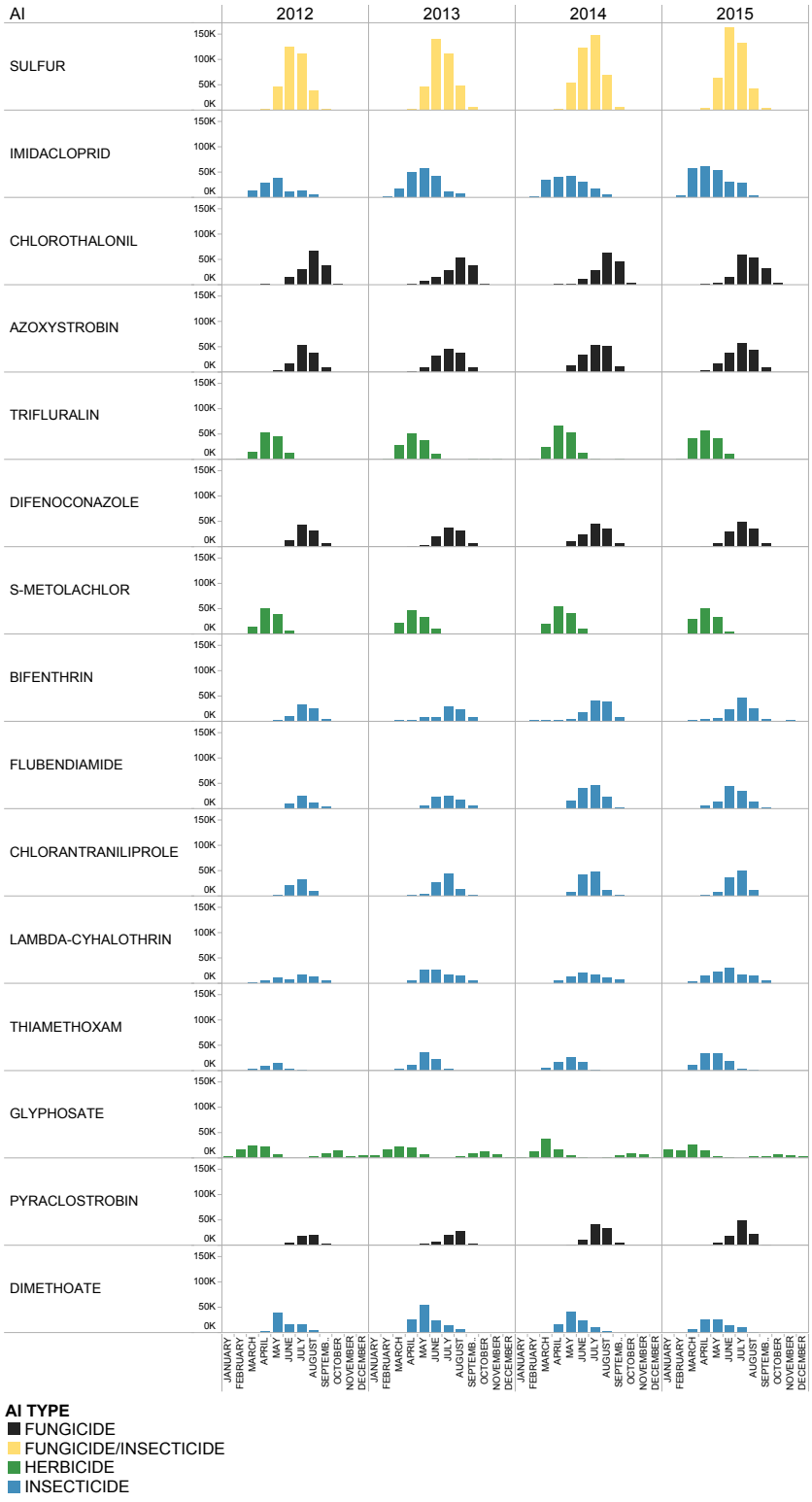


Figure A-26: *Acres of processing tomato treated by the major AIs by month and AI type from 2011 to 2015.*

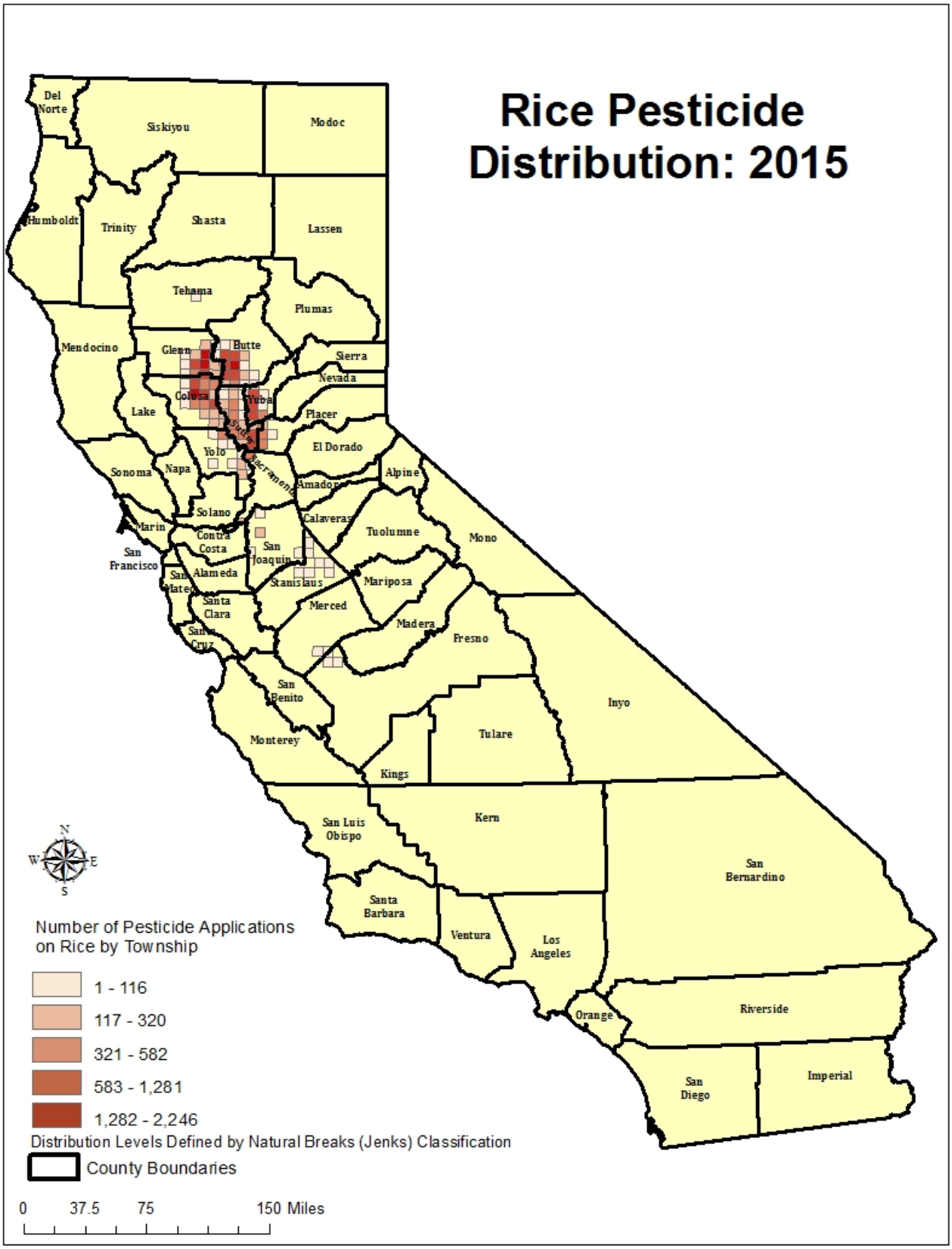
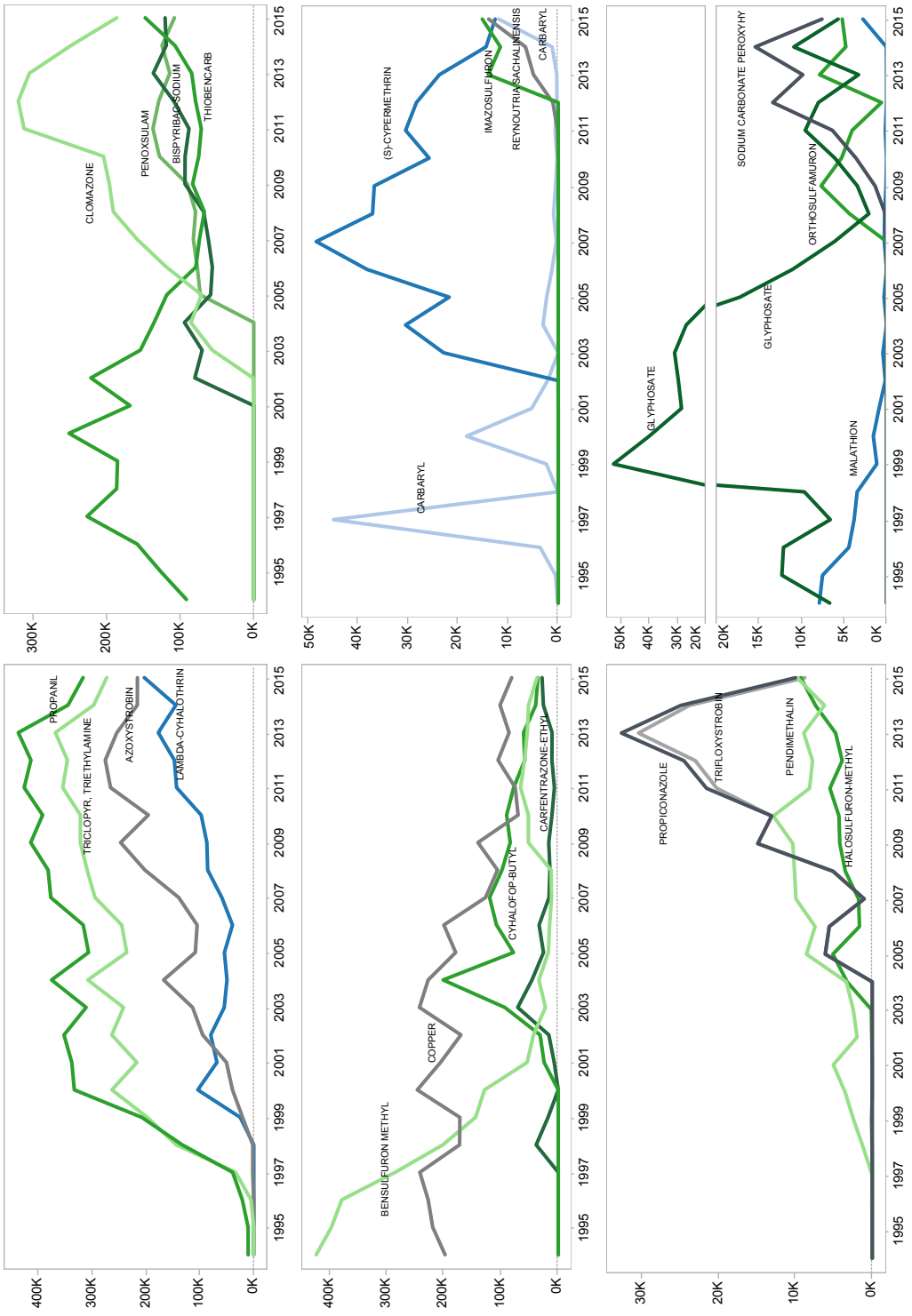


Figure A-27: *Number of pesticide application in rice by township in 2015.*



Rice acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-28: *Acres of rice treated by the major AIs from 1994 to 2015.*

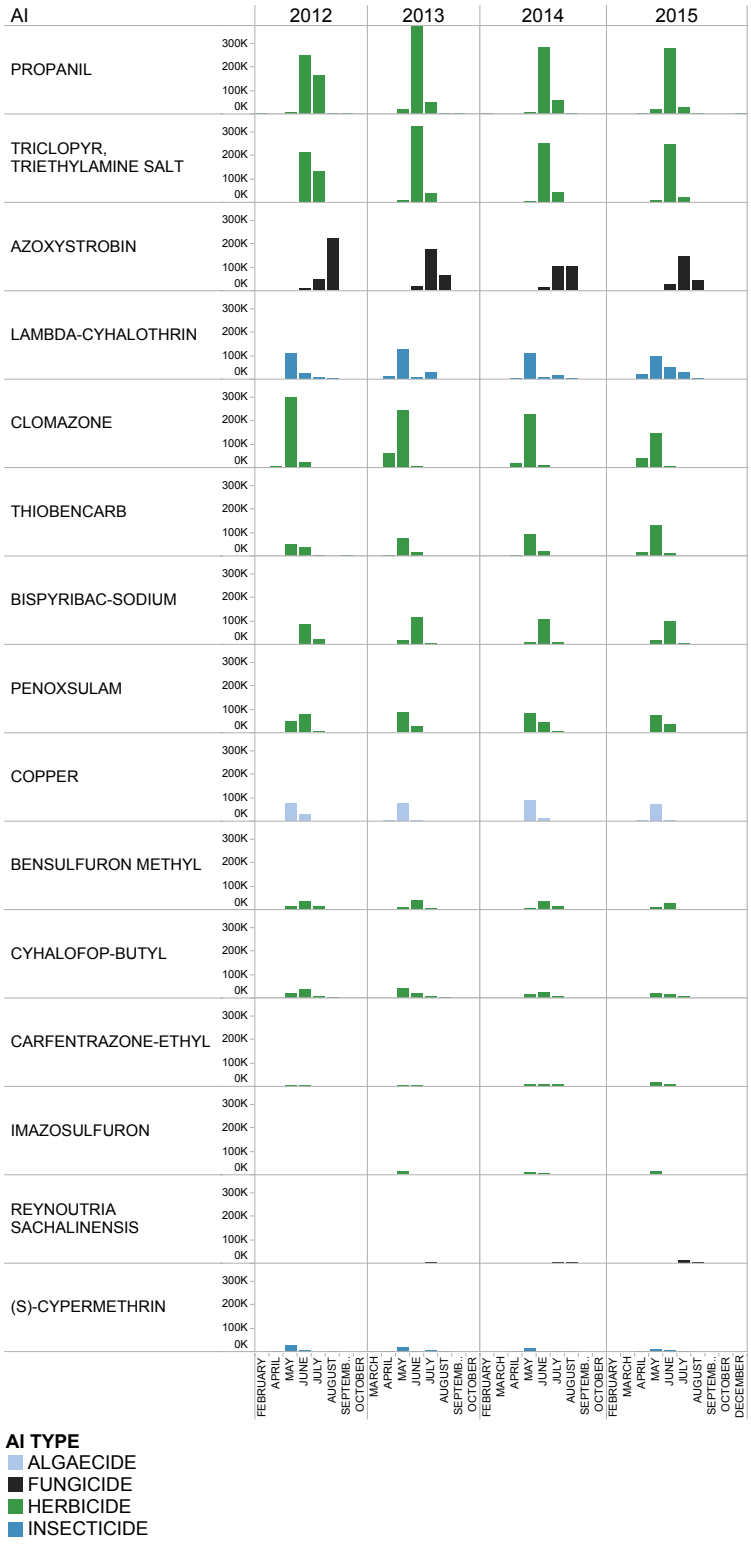


Figure A-29: *Acres of rice treated by the major AIs by month and AI type from 2011 to 2015.*

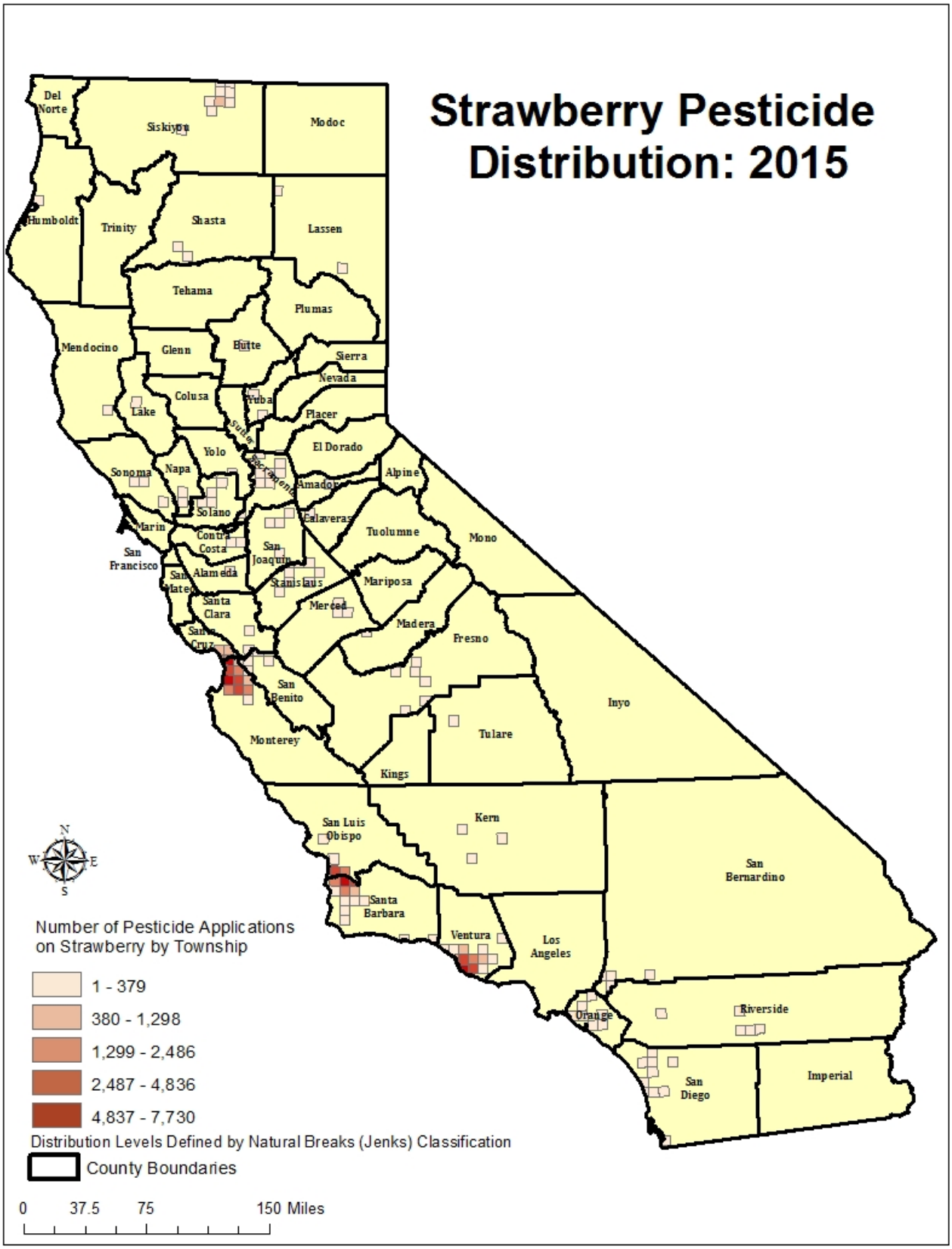
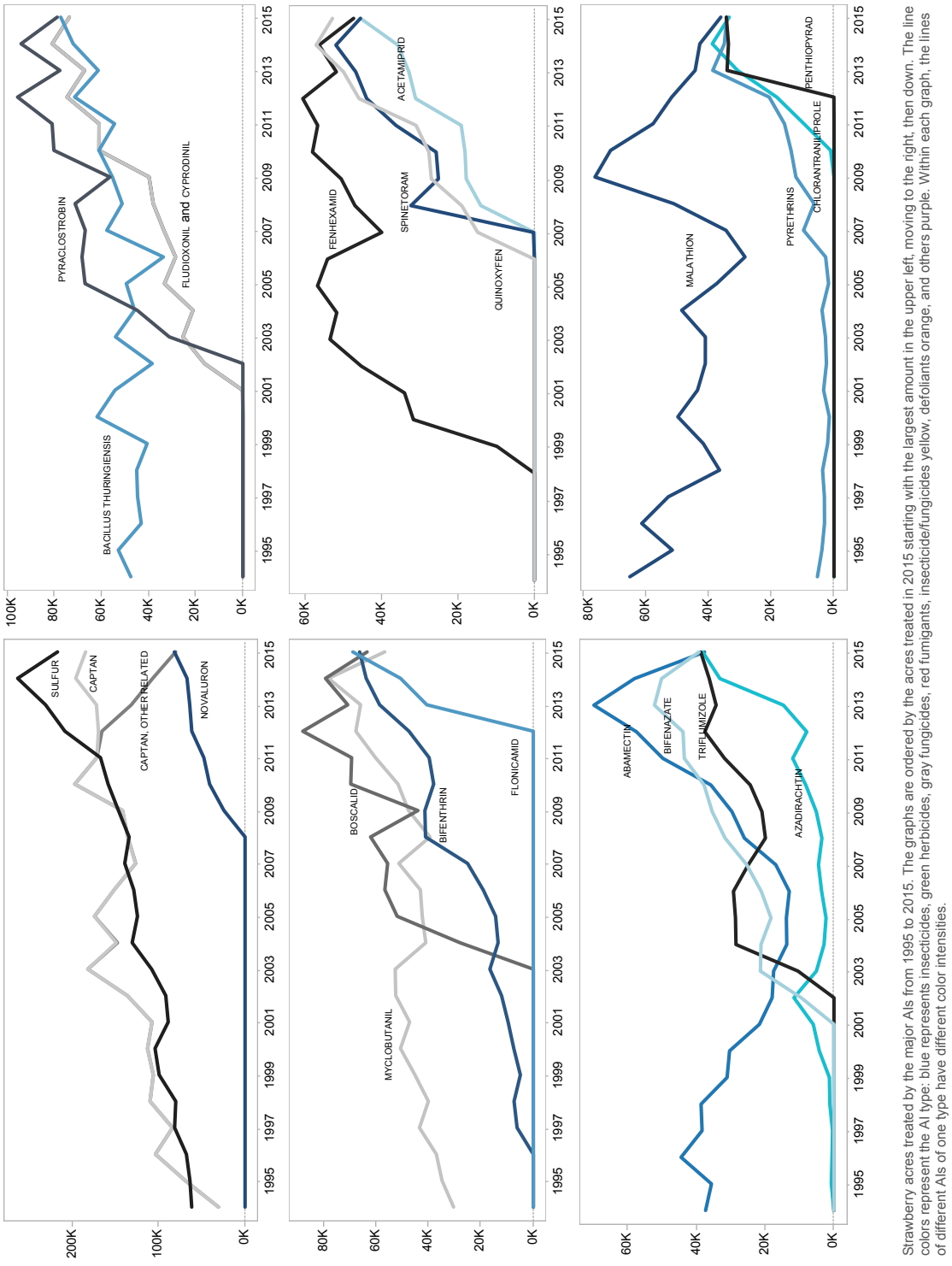


Figure A-30: *Number of pesticide application in strawberry by township in 2015.*



Strawberry acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-31: *Acres of strawberry treated by the major AIs from 1994 to 2015.*

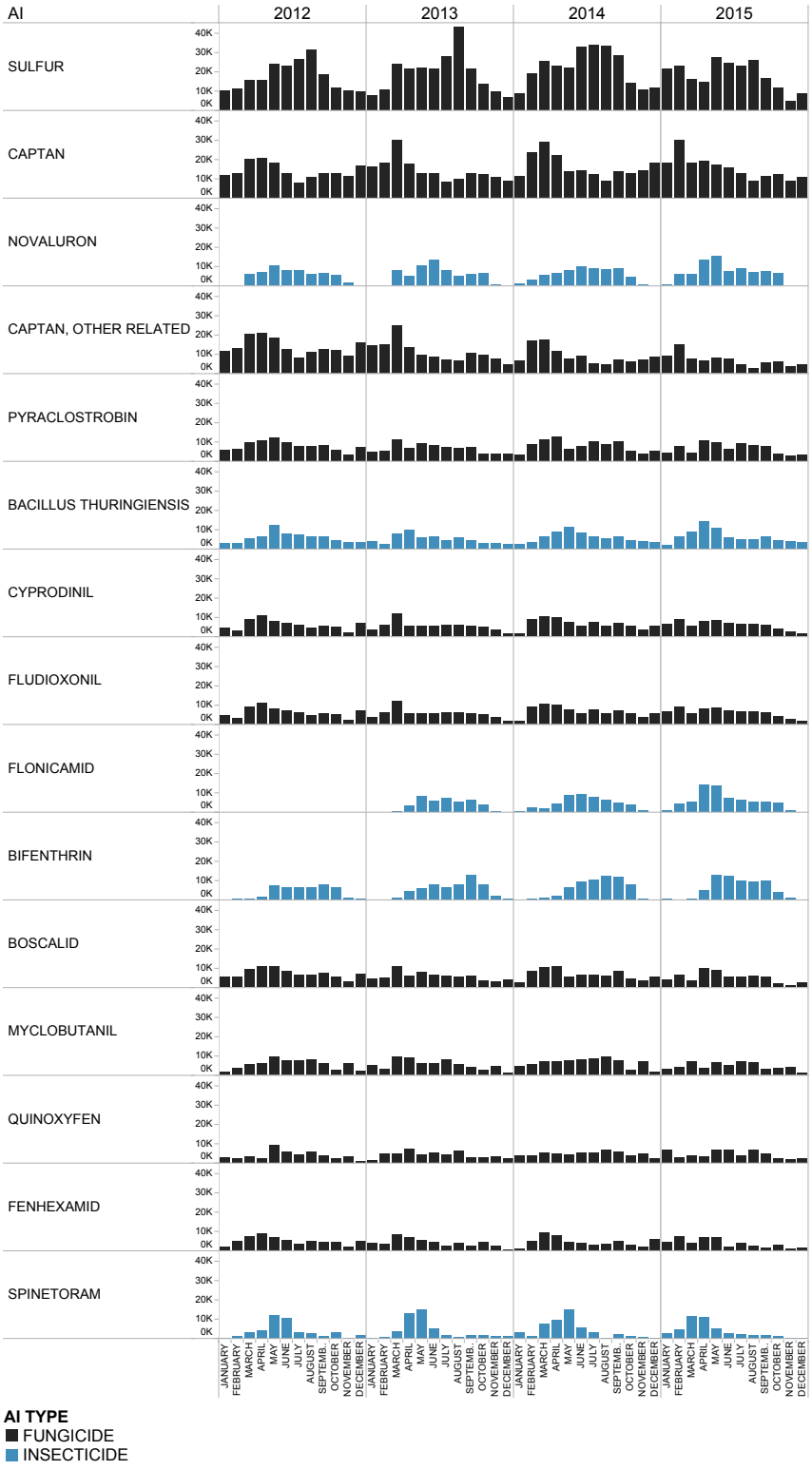


Figure A-32: *Acres of strawberry treated by the major AIs by month and AI type from 2011 to 2015.*

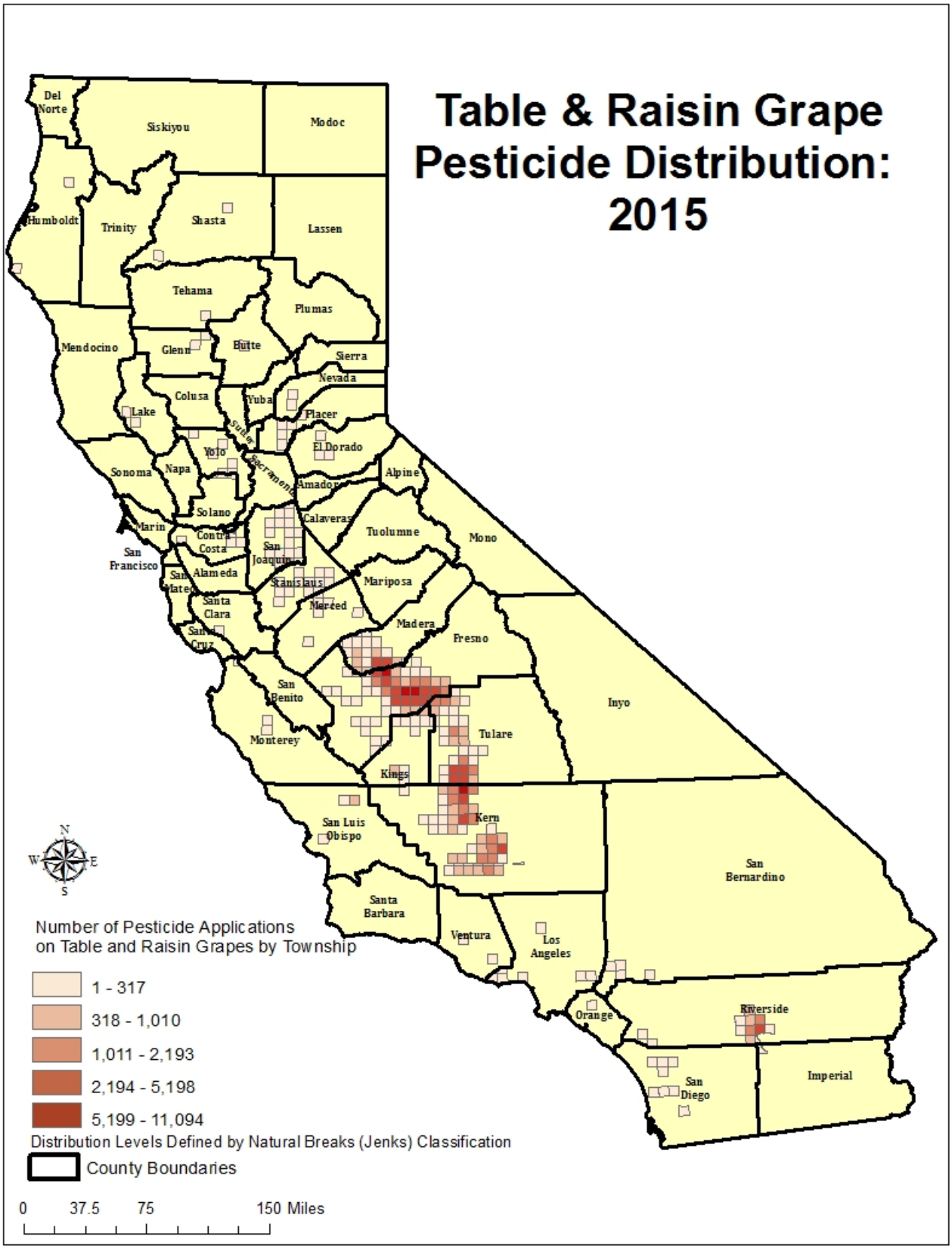


Figure A-33: *Number of pesticide application in table and raisin grape by township in 2015.*

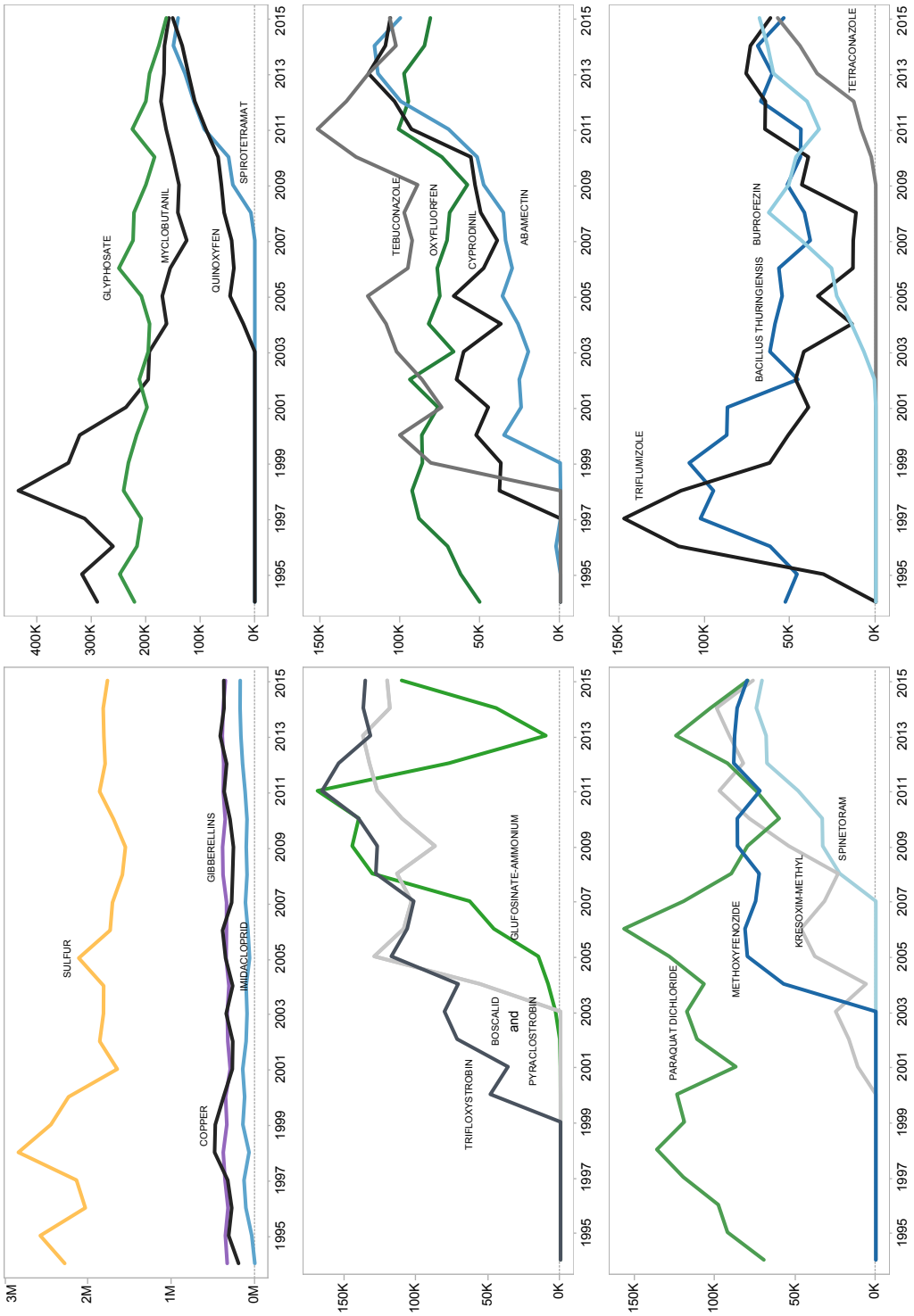


Figure A-34: *Acres of table and raisin grape treated by the major AIs from 1994 to 2015.*

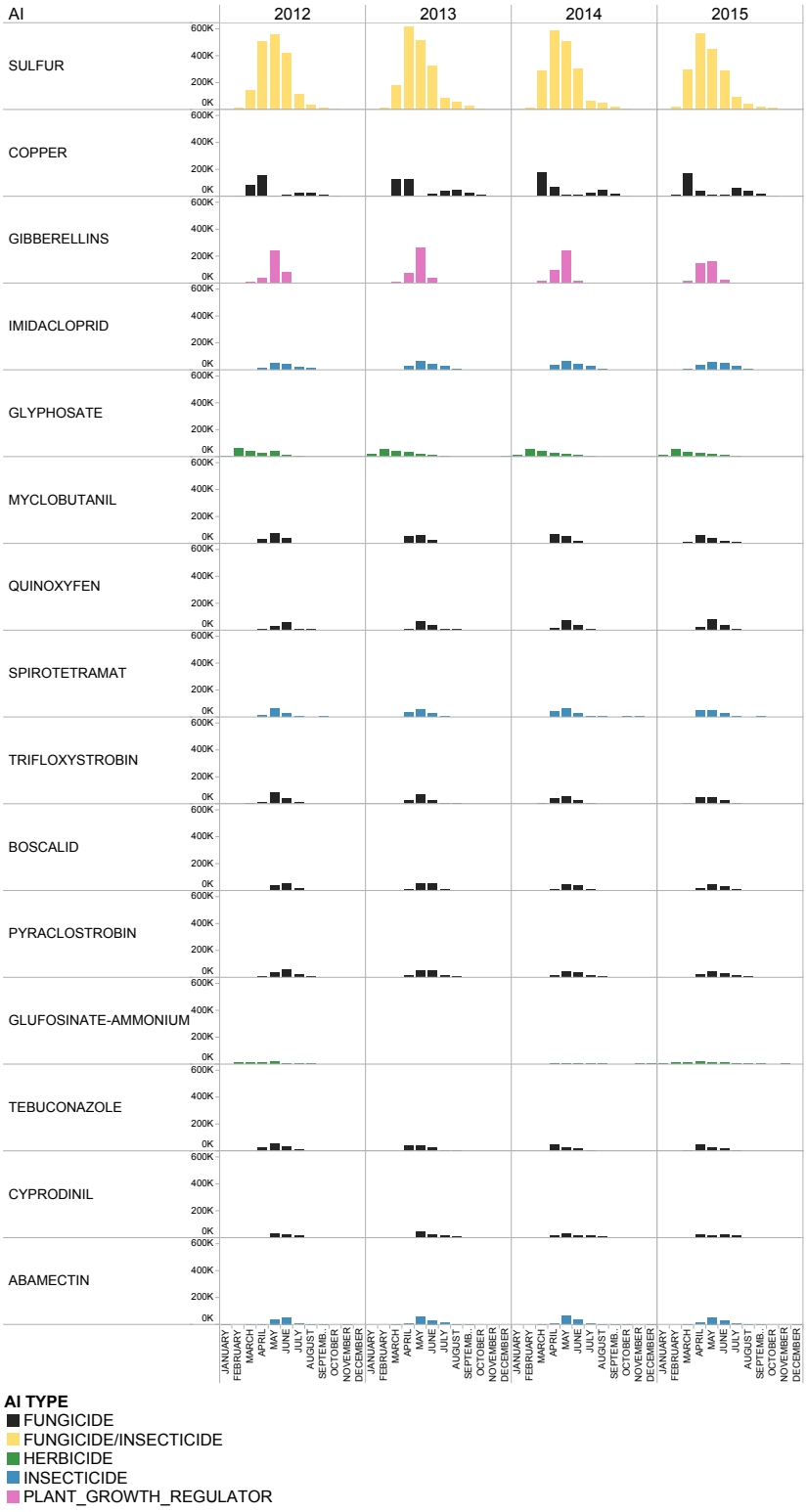


Figure A-35: *Acres of table and raisin grape treated by the major AIs by month and AI type from 2011 to 2015.*

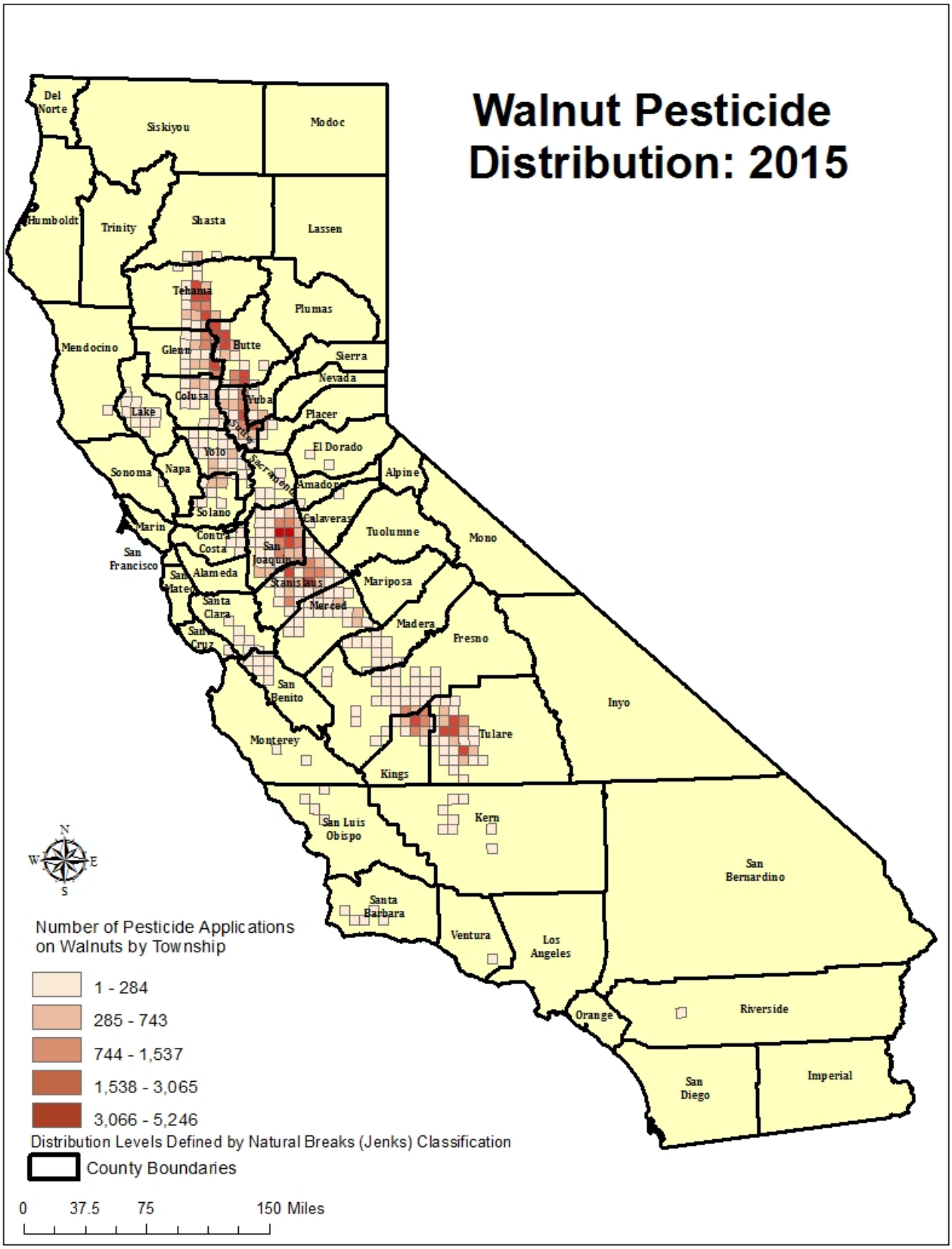
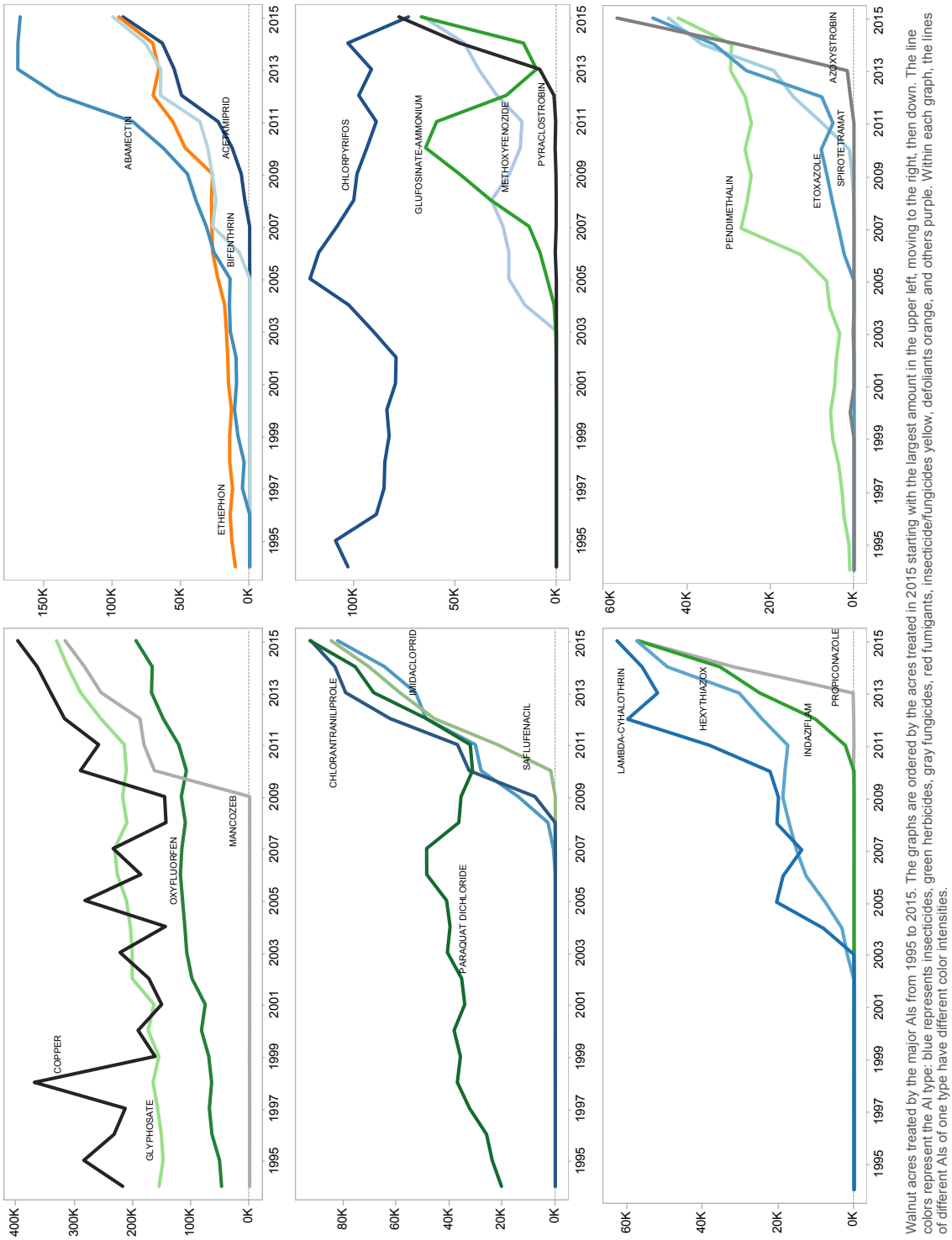


Figure A-36: *Number of pesticide application in walnut by township in 2015.*



Walnut acres treated by the major AIs from 1995 to 2015. The graphs are ordered by the acres treated in 2015 starting with the largest amount in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides yellow, defoliants orange, and others purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-37: *Acres of walnut treated by the major AIs from 1994 to 2015.*

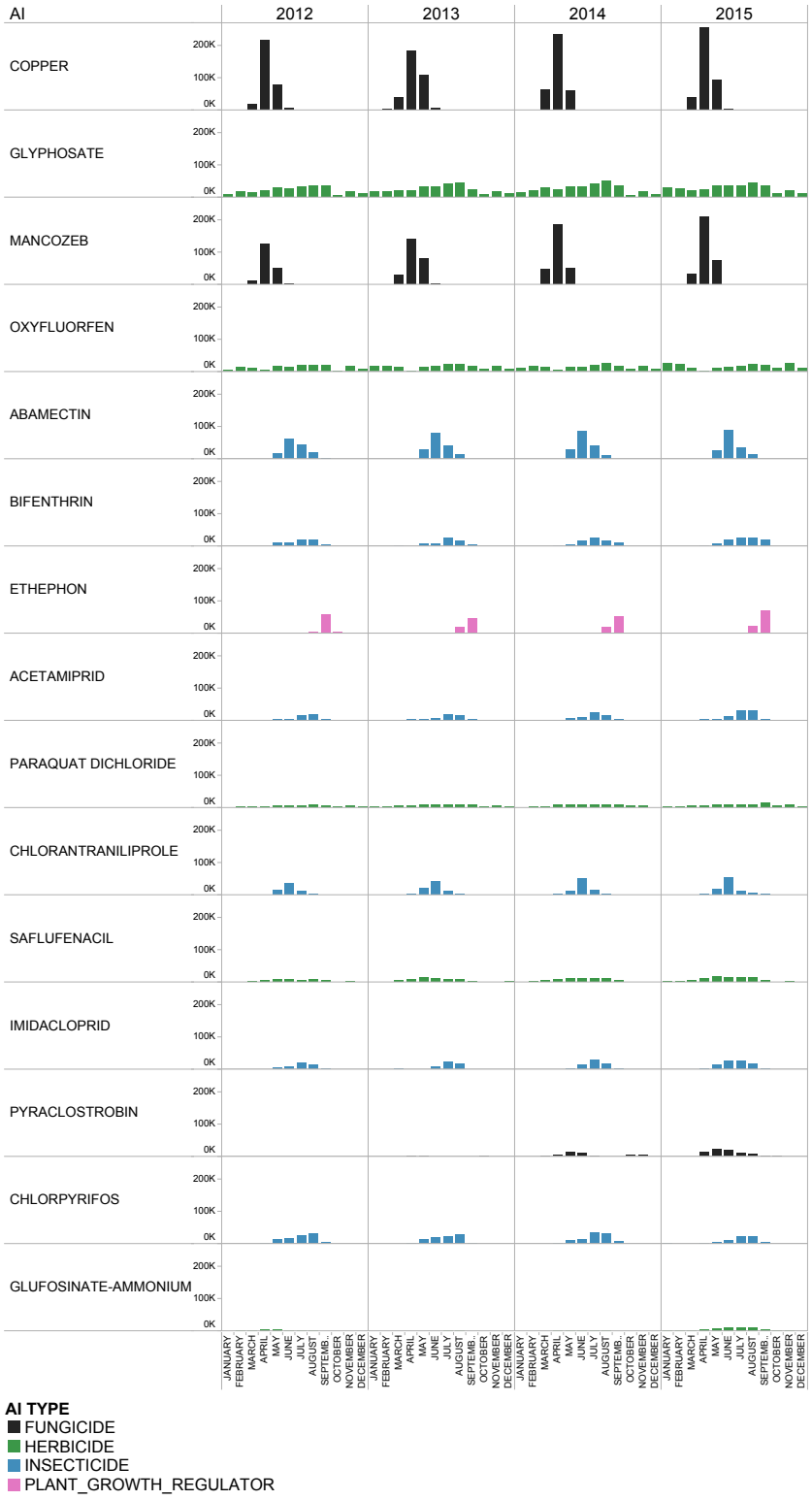


Figure A-38: *Acres of walnut treated by the major AIs by month and AI type from 2011 to 2015.*

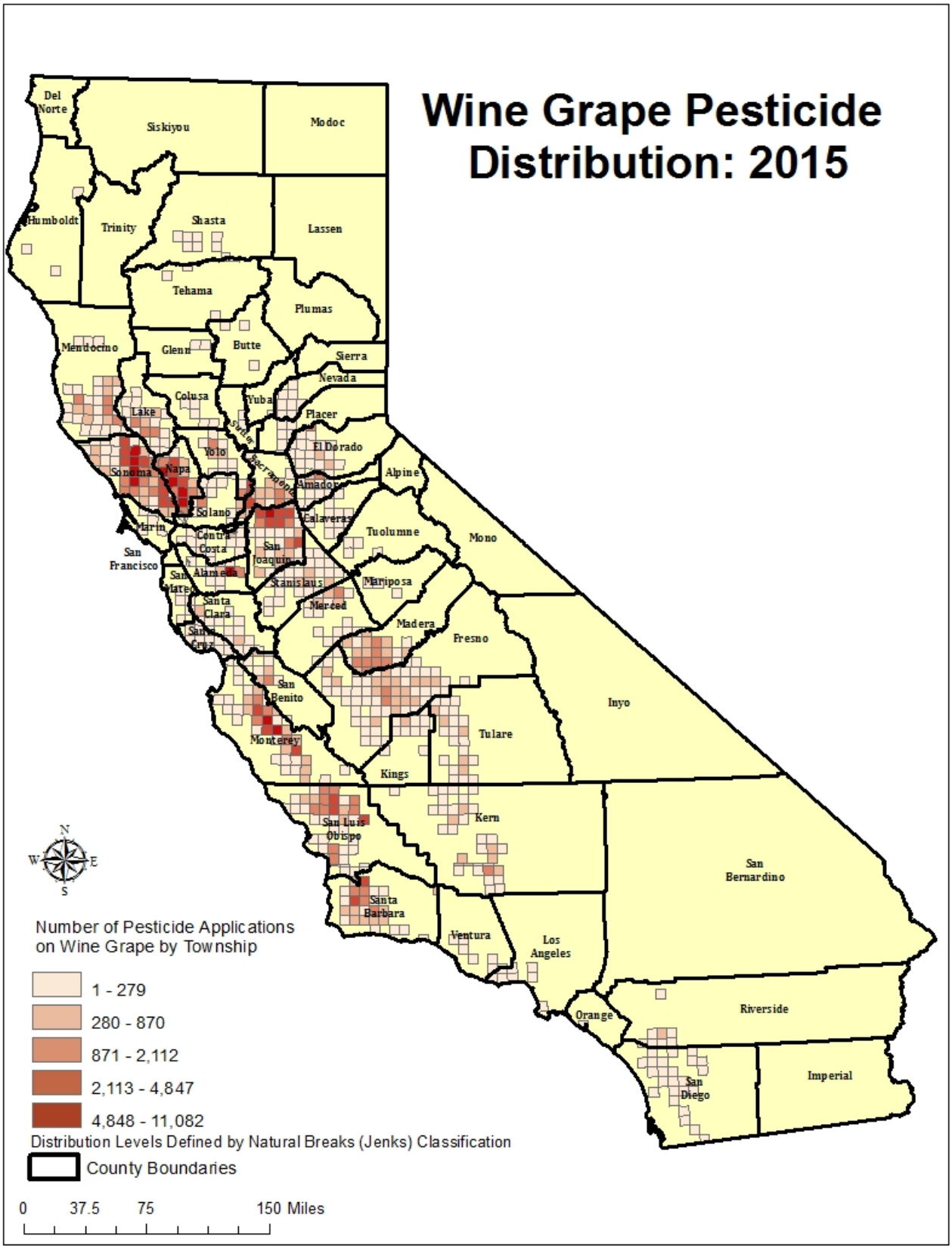
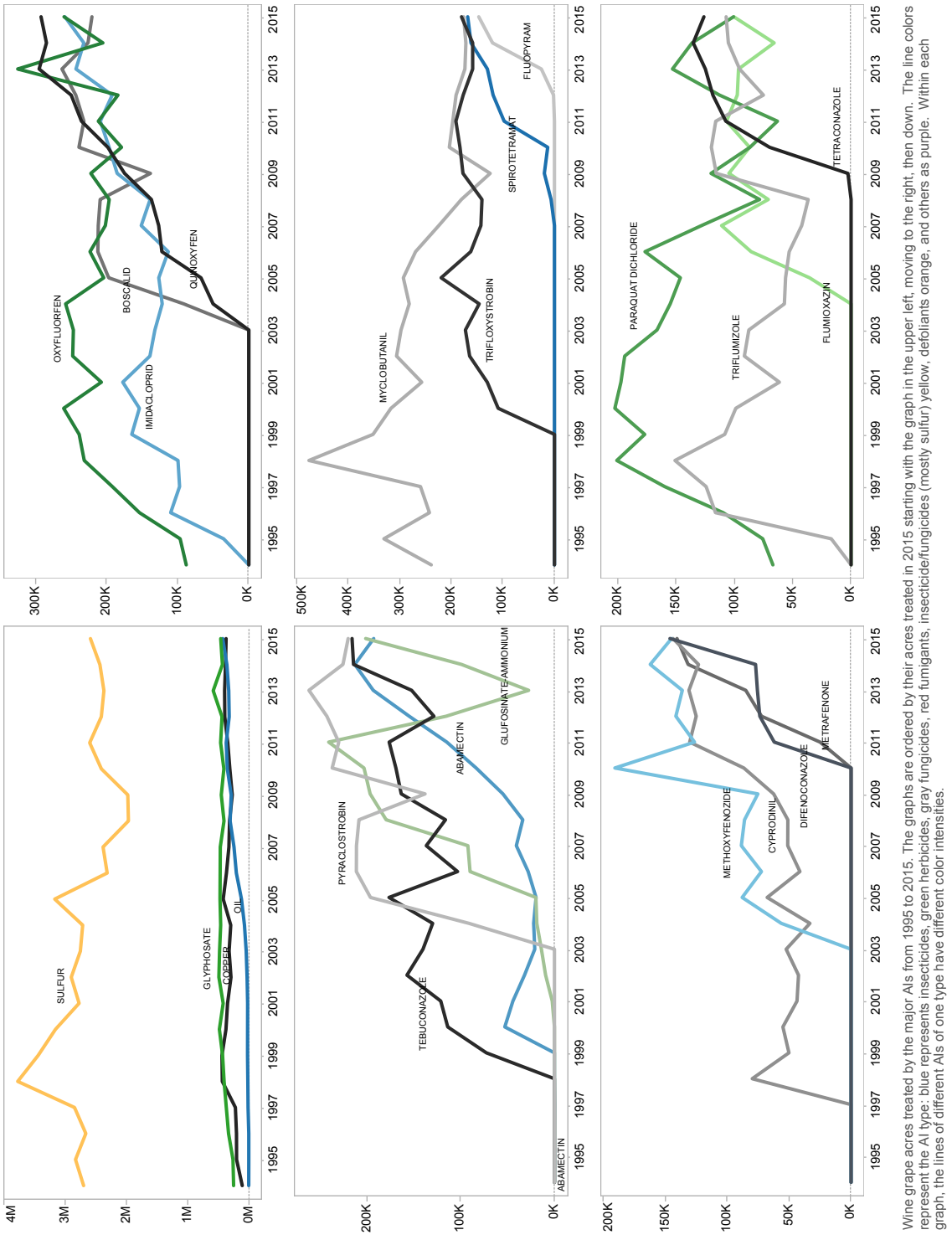


Figure A-39: *Number of pesticide application in wine grape by township in 2015.*



Wine grape acres treated by the major AIs from 1995 to 2015. The graphs are ordered by their acres treated in 2015 starting with the graph in the upper left, moving to the right, then down. The line colors represent the AI type: blue represents insecticides, green herbicides, gray fungicides, red fumigants, insecticide/fungicides (mostly sulfur) yellow, defoliants orange, and others as purple. Within each graph, the lines of different AIs of one type have different color intensities.

Figure A-40: *Acres of wine grape treated by the major AIs from 1994 to 2015.*

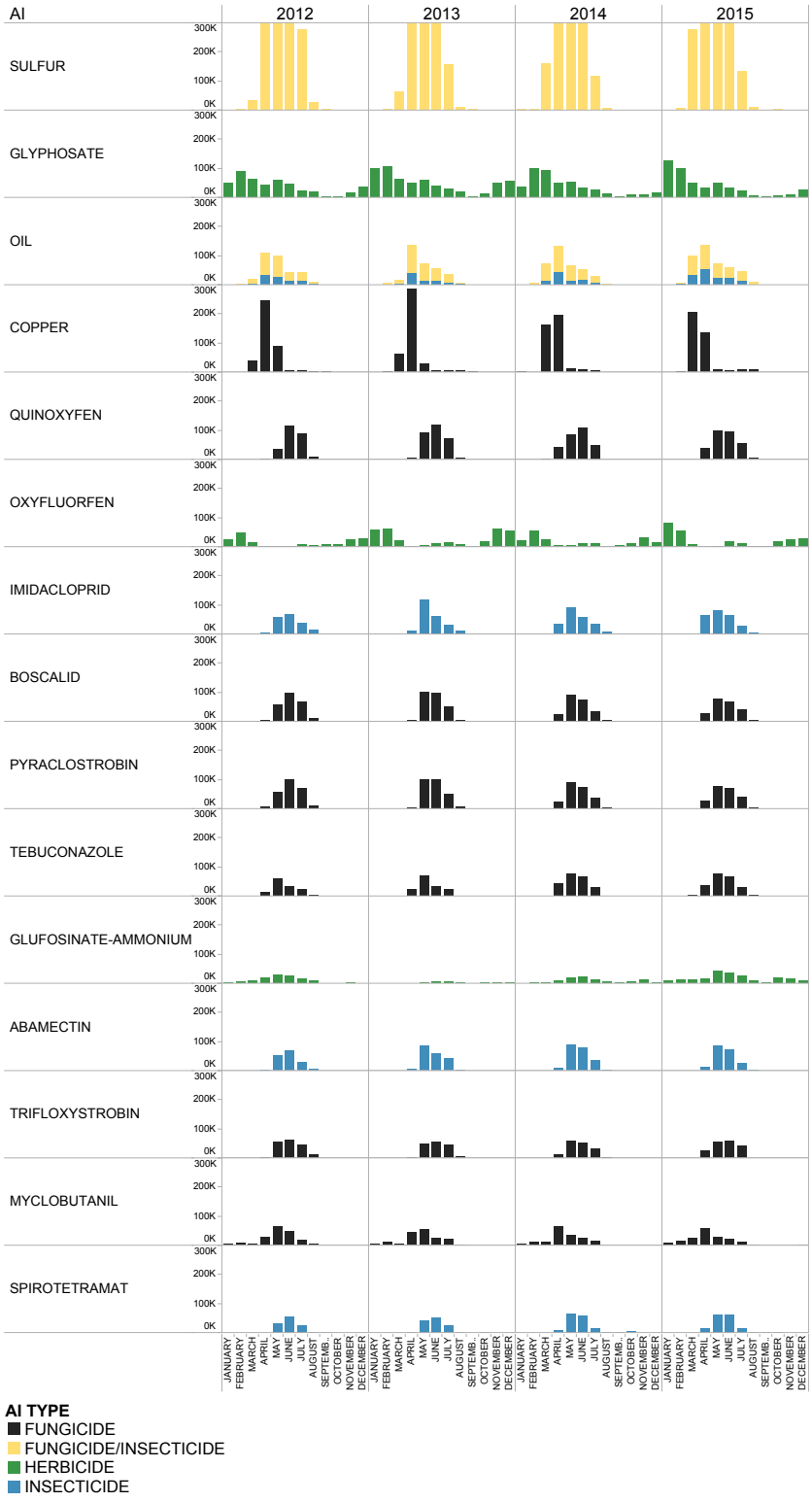


Figure A-41: *Acres of wine grape treated by the major AIs by month and AI type from 2011 to 2015.*