

Tracking Non-residential Pesticide Use in Urban Areas of California



Submitted by
Cheryl A. Wilen, Ph.D., Primary Investigator

Written by
Nila I. Kreidich
Mary Louise Flint, Ph.D.
Cheryl A. Wilen, Ph.D.
Minghua Zhang, Ph.D.

June 10, 2005

Preface

The University of California conducted the research for the project, *Tracking Non-residential Urban Pesticide Use in California*. This project was funded by a contract (02-0198C) with the Department of Pesticide Regulation (DPR) of the California Environmental Protection Agency. The statements and conclusions in this report are those of the authors and not necessarily those of DPR. The mention of commercial products, their source, or their use in connection with materials reported herein is not to be construed as actual or implied endorsement of such products.

DPR Agreement Number 02-0198C

Contact Information

Principal Investigator:
Cheryl A. Wilen, Ph.D.

Area Integrated Pest Management Advisor
University of California Statewide IPM Project
San Diego, Orange, and Los Angeles Counties
Cooperative Extension San Diego County
5555 Overland Ave, Suite 4101 San Diego CA 92123-1219
e-mail: cawilen@ucdavis.edu

Nila I. Kreidich

Graduate Student Researcher, University of California Davis
M.S. Candidate: Integrated Pest Management & International
Agricultural Development
University of California Davis, LAWR- Hydrology Department
One Shields Avenue, Davis CA 95616- 8621
e-mail: nikreidich@ucdavis.edu

Mary Louise Flint, Ph.D.

Director, Integrated Pest Management Education & Publications & CE
Specialist
University of California Statewide IPM Project
University of California Davis, IPM Education & Publications
One Shields Avenue, Davis CA 95616-8621
e-mail: mflint@ucdavis.edu

Minghua Zhang, Ph.D.

Associate Adjunct Professor of Land, Air, and Water Resources,
University of California Davis &
Division of Pest Management, Environmental Monitoring, Enforcement,
and Licensing; California Department of Pesticide Regulation
University of California Davis, LAWR- Hydrology Department
One Shields Avenue, Davis CA 95616- 8621
e-mail: mhzhang@ucdavis.edu & mzhang@cdpr.ca.gov

Acknowledgements

We would like to thank the California Department of Pesticide Regulation for the support of this project and in particular Nan Singhasemanon, Associate Environmental Research Scientist, who provided guidance and input on the projects structure and development as it progressed. We would also like to thank the following contributors for their expertise:

Kathy Aleman, the student translator in Arcade Creek Watershed; Cecilia Osorio, the student translator in Chollas Creek and San Diego Creek Watersheds; Juli Jensen and Karen Vietheer from the Sacramento County Agricultural Commissioner's office; Simone Hardy and Paul Davy from the San Diego County Agricultural Commissioner's office; Steve Hill from the Orange County Agricultural Commissioner's office; Eric R. Paulsen, PCOC; Gene Davis, Central Valley Regional Valley Water Quality Control Board, for the GIS shape files for the Arcade creek watershed; The Santa Ana Regional Water Quality Control Board for the GIS shape files for San Diego Creek and Upper Newport Bay Watersheds; Steven Bourke, Landscape Maintenance Superintendent for the City of Irvine; Darren Haver, UCCE; Michael Rust, UC Riverside; Bart Brandenburg from Brandenburg and Associates; and Karl Krist, UC ANR.

Table of Contents

EXECUTIVE SUMMARY	1
INTRODUCTION	8
1.1 PURPOSE AND SCOPE	8
1.2 BACKGROUND	9
1.3 WATERSHED BACKGROUND	12
1. METHODS.....	20
2. IDENTIFYING URBAN PESTICIDE USER GROUPS.....	23
3.1 MONTHLY PESTICIDE USE REPORTS	23
3.2 GROUPS WHO REPORT PESTICIDE USE	25
3.3 GROUPS WHO DO NOT REPORT PESTICIDE USE.....	30
3. PESTICIDE USE TREND ANALYSIS.....	34
4.1 URBAN PESTICIDE USE IN CALIFORNIA.....	34
4.2 THE BREAKDOWN OF PESTICIDE USE IN SACRAMENTO, SAN DIEGO AND ORANGE COUNTIES	35
4.3 A COMPARISON OF PESTICIDE USE TRENDS AMONG SACRAMENTO, SAN DIEGO, AND ORANGE COUNTIES .	37
5. PESTICIDE USE TRENDS AND INFORMATION SOURCES FOR GROUPS THAT REPORT PESTICIDE USE	39
5.1 STRUCTURAL PEST CONTROL	39
5.2 LANDSCAPE MAINTENANCE	55
5.3 PUBLIC AGENCY PEST CONTROL	65
6. PESTICIDE USE TRENDS AND INFORMATION SOURCES OF GROUPS THAT DO NOT REPORT PESTICIDE USE.....	76
6.1 MAINTENANCE GARDENERS	76
6.2 PRIVATE BUSINESS AND COMMERCIAL PESTICIDE USERS	79
6.4 INSTITUTIONAL PESTICIDE USERS	82
6.5 INDUSTRIAL PESTICIDE USERS	85
6.6 THE DEPARTMENT OF DEFENSE	85
7. RECOMMENDATIONS	87
7.1 OUTREACH APPROACH/ STRATEGIES FOR ALL PESTICIDE USER GROUPS	87
7.2 SPECIFIC SUGGESTIONS FOR PESTICIDE USER GROUPS	92

CONCLUSIONS 94

REFERENCES 95

APPENDICES 98

APPENDIX A: UC COOPERATIVE EXTENSION SURVEY JUNE 2004 98

APPENDIX B: COMMERCIAL PEST CONTROL COMPANY SURVEY QUESTIONS 103

APPENDIX C: BUSINESS SURVEY QUESTIONS 104

APPENDIX D: LANDSCAPE MAINTENANCE SURVEY QUESTIONS..... 105

APPENDIX E: PROFESSIONAL PESTICIDE USERS SURVEY 106

Executive Summary

Urban pesticide use presents numerous concerns related to human and environmental health. Pesticide application in residential, public, commercial, and industrial areas is threatening water quality in California watersheds. Urban pesticide user groups may have little pesticide training or knowledge of pesticides, appropriate disposal practices, safer alternatives and Integrated Pest Management (IPM). Additionally, the amount and type of pesticides used by some of these groups is unreported and unknown. More educational and outreach programs directed at these groups are likely to assist the reduction of pesticide use impact to human health risks and water quality; however, appropriate educational approaches for many of these groups have not been well examined.

To address these issues, we investigated pesticide use trends, behaviors, and educational resources for urban pest managers in the Arcade Creek Watershed (Sacramento County), Chollas Creek Watershed (San Diego County), and Upper Newport Bay/ San Diego Creek Watershed (Orange County). Specific objectives were to:

- 1) Identify non-residential pesticide user groups in urban environments.
- 2) Examine the pesticide acquisition, use, and disposal practices within each user group.
- 3) Investigate the sources of information about pesticides and integrated pest management (IPM) within each user group.
- 4) Identify the educational needs of each user group.
- 5) Develop recommendations on comprehensive and effective outreach approach/strategy for urban insecticide user groups.

We relied on three major resources for this study: the DPR Pesticide Use Report (PUR) database, interviews, and surveys. The PUR database was used to identify the primary urban pesticide user groups and to examine non-agricultural¹ pesticide use trends in the selected study areas. Personal interviews were conducted with pest management professionals, University of California researchers, urban watershed pollution prevention experts, representatives from professional organizations, and representatives from the Agricultural Commissioners' offices in the selected study areas. Three additional surveys were conducted: a survey of maintenance gardeners and pest management professionals, a web-based survey with University of California Cooperative Extension (UCCE) Advisors, and a phone survey with structural pest control companies, apartment managers, pet groomers and kennels, cemeteries, and parks and recreation departments.

Pesticide Use Reporting: We identified that Licensed Structural Pest Control Operators, Licensed Landscape Pest Control Professionals, and Public Agency Pest Control user groups report pesticide use. Pesticide users who are not licensed generally do not report pesticide use. These include:

- Residents who apply pesticides to their own homes or landscapes
- Some maintenance gardeners
- Pet groomers/kennels
- Employees applying incidental treatments at commercial businesses/buildings
- Employees applying incidental treatments at institutional facilities

¹ Non-agricultural pesticide use is defined as a monthly summary record (DPR Record Identification Number 2 or the letter C) in the PUR database.

- Employees applying incidental treatments at industrial (factories and warehouses) facilities
- The Department of Defense

Use Trends and Information Sources for Groups that Report Pesticide Use

1) Structural Pest Control

Use trends: The most recent non-agricultural PUR data, 2003, indicates that structural pest control accounts for over 90% of the total non-fumigant reported insecticide use in Sacramento, San Diego, and Orange Counties. Overall, Sacramento County used more pesticides than San Diego and Orange Counties for structural pest control. The reported use of diazinon and chlorpyrifos has been steadily declining while the reported use of select pyrethroids and fipronil has been increasing in all three counties.

Primary sources of pest management information (based on an interview with 23 structural pest control companies in Sacramento County):

Top Ten Places Where Structural Pest Control Companies get Information about Pesticides and IPM

	Percent who gave this response ^a
1 Representatives from pesticide manufacturers and distributors (e.g. Target Specialty Products, Univar, and Syngenta)	74%
2 Trade Magazines (e.g. Pest Control Technology)	52%
3 Internet Resources (e.g. PestWeb®)	52%
4 Workshops, meetings, and training seminars	17%
5 Continuing education classes	17%
6 The pesticide label	17%
7 Technical handbooks (e.g. Handbook of Mallis)	13%
8 Past experience using pesticides/ trial and error	13%
9 Professional organizations	9%
10 Word-of-mouth	9%

a. The percent of structural pest control companies interviewed in Sacramento County who gave this response; many of those interviewed gave multiple responses.

2) Licensed Landscape Pest Control Professionals

Use trends: Herbicides (particularly glyphosate) are the pesticide group most commonly reported used by landscape professionals. In all three counties, insecticides (other than oils) composed less than 10% of total reported pesticide use in 2003. The reported use of diazinon and chlorpyrifos has been decreasing while the reported use of imidacloprid has been increasing.

Primary sources of pest management information:

- Trade magazines
- Professional organizations

- Continuing education classes
- Commercial contacts/ sales people
- Books and online publications
- Internet
- In-house training
- Pesticide distributors and manufacturers

3) Public Agency Pest Control

Right-of-ways

The majority of reported pesticide use on right-of-ways is herbicides. In 2003, the two most frequently applied herbicides in all three counties were glyphosate and diuron.

Primary sources of pest management information:

- Similar to other licensed landscape pest professionals.

Public Health Pest Control

Since 1993, pesticide use for mosquito and vector control has drastically decreased in Sacramento, San Diego, and Orange County. In 2003, over 50% of the total reported pesticides were oils (petroleum distillates) in all three counties.

Primary sources of pest management information:

- Vector control professional organizations
- The University of California.

Regulatory Pest Control

Of the total non-agricultural pesticide use in California, in 2003 only 1% is reported under the category regulatory pest control.

Primary sources of pest management information:

- United States Department of Agriculture's Animal and Plant Health Inspection Service (USDA APHIS),
- California Department of Food and Agriculture (CDFA)
- The University of California
- County Agricultural Commissioners offices

Use Trends and Information Sources for Groups that Do Not Report Pesticide Use

Groups that do not report pesticide use are unlicensed individuals who apply pesticides generally as a minor part of their jobs. They usually do not belong to professional organizations or attend educational programs related to pest management. They purchase their pesticides at retail outlets and get much of their information from these stores. In many cases, we were not able to get a clear picture of their pesticide use practices. The main findings about pesticide use trends and information sources for these groups include:

1) Maintenance Gardeners

Maintenance gardeners are required to have a pesticide applicators license and report pesticide use, yet only 33 to 41% of those surveyed² were licensed or were supervised by someone with a license³. Pesticide use for these individuals is infrequent and most do not apply pesticides as a major part of their job. More gardeners in Orange and San Diego counties stated that they use herbicides and insecticides than gardeners in Sacramento County. In all areas herbicides were

² A total of 65 groups of maintenance gardeners were surveyed.

³ Because they are not licensed, we assume they do not report pesticide use.

the most commonly applied by this group. Only 7% of the gardeners surveyed in Arcade Creek said that they used insecticides compared with 68% in Chollas Creek and 69% in Upper Newport Bay/ San Diego Creek. Most gardeners surveyed were following acceptable practices for disposal.

Top Ten Places Where Maintenance Gardeners get Information about Pesticides and IPM

	Percent who gave this response ^a
1 Store employees where they purchase pesticides	35%
2 Past experiences working as a gardener ^b	23%
3 Educational materials (e.g. MSDS sheets in Spanish and English) and/or training provided by the landscape company ^c	14%
4 The supervisor or homeowner decides what pesticide to use	14%
5 The pictures on the pesticide container	8%
6 Other maintenance gardeners	6%
7 Horticulture and pest management classes	5%
8 Pesticide product label	5%
9 Books, newspapers, magazines, and newsletters	3%
10 Pesticide vendor (e.g. Target Specialty Products)	3%

a. The percent of maintenance gardeners interviewed in Sacramento, San Diego, and Orange counties who gave this response; a total of 65 groups of maintenance gardeners were interviewed.

b. These gardeners said that they rely on their own knowledge about pests and pesticides to make management decisions.

c. These gardeners said that they received printed information or short training courses from the landscape company they work for. Most of the gardeners who gave this response work for landscape companies with more than 10 employees. The level of training varies greatly depending on the landscape company. Pesticide training is usually coupled with landscape equipment (such as mowers and leaf blowers) training.

2) Private Businesses

We were not able to collect data on pesticides used by private businesses. This group does not report pesticide use. Most large corporations, such as those with many retail outlets, restaurant chains, hotel chains, or chain stores, have developed standards for pest control that usually involve outside contractors. Smaller businesses are more likely to make their own pesticide applications. Apartment managers tend to contract their pest control needs.

3) Pet Groomers and Kennels

The majority of the pet groomers and kennels who were surveyed use botanical based flea and tick shampoos (either pyrethrum, limonene, or neem active ingredients). It is unknown how many pet groomers or kennels seek information about pesticides and IPM from available resources.

4) Institutional and Industrial Pesticide Users

We were unable to get data on pesticide use patterns or educational resources for institutional and industrial pesticide users; however, many of these groups hire professional pest control companies.

5) Department of Defense

Pesticides are applied at military site locations by commercial pest control companies with contracts, a certified pesticide applicator⁴, or a Department of Defense certified pesticide applicator⁵. All pesticide applicators must follow Armed Forces Pest Management Board (AFPMB) guidelines.

Recommendations for Developing a Comprehensive Outreach Strategy

A comprehensive outreach strategy for non-residential urban pesticide user groups should include components directed both at professionals and the general public they serve. Educational needs for urban professional users include information on proper use and disposal of pesticides, alternatives that reduce water quality risks, and information on environmental and economic impacts. The public also needs to know about alternatives and risks so they can demand services that optimally protect their health and the environment. Many outreach mechanisms are available. Suitability depends on the user group. Any outreach program will require substantial additional funding to what is currently available for federal, state, and university resources.

The components for a successful outreach strategy should include the following:

1. Public Education
 - i. Educate private citizens and businesses to demand IPM services
 - ii. Encourage private businesses and public agencies to adopt IPM programs and/or policies that encourage the minimal use of pesticides in and around facilities.
2. Professional Education
 - i. Educate people who are not reporting about the appropriate laws and regulations
 - ii. Develop an educational campaign and more convenient facilities for the disposal of pesticide products and containers
3. Partnerships
 - i. Develop IPM certification programs with incentives for companies to participate
 - ii. Take advantage of current pest control product vendors as an outreach channel
4. Outreach mechanisms
 - i. Deliver IPM information in a clear and simple manner in a way easily accessible to the user group
 - ii. Develop a resource directory for different pesticide user groups to find IPM training materials and supplies
 - iii. Produce informational updates from unbiased sources

⁴ Certified Pesticide Applicator. Any individual who applies pesticides or supervises the use of pesticides, and who has been authorized to do so by successfully completing a training program approved by the EPA followed by formal certification by the Department of Defense or a State or for OCONUS, subsection B.5., of reference (a).

⁵ DoD-Certified Pesticide Applicator. Military or civilian personnel certified in accordance with DoD Instruction 4150.7 (reference (b)) or Non-FIFRA certification, Appendix D of this Manual, and certified in the category in which a pesticide shall be applied.

We prioritized nine specific outreach strategies considering both their importance and potential for rapid implementation. Some strategies that we felt could have lasting benefits, such as certification programs or electronic newsletters, were ranked lower because major resources (e.g. financial resources and human capital) and stakeholder cooperation would be required to implement them. The following is a list of nine outreach strategies for all pesticide user groups, listed in order of importance:

1. Deliver IPM information in a clear, simple manner.

The concepts of IPM are often confusing. To add to this confusion, many different groups have developed their own concept of IPM. Pesticide manufacturers and distributors contradict basic IPM principals by advertising their products nationally as integral components of an effective IPM program.

2. Educate customers to demand IPM services.

Businesses, public agencies, and homeowner associations need additional information about hazardous pesticides and the advantages of IPM services. Educated consumers will create a market for IPM services from structural and landscape pest companies. These pest management companies will then have the incentive to adopt IPM principals and reduce pesticide use.

3. Educate groups who are not reporting about the laws and regulations regarding pesticide use in California.

Currently there are many different groups who apply pesticides in urban areas who do not have a license. Businesses who use pesticides may not realize that they need to have licensed pest control expert on staff.

4. Encourage private businesses and public agencies to adopt IPM programs and/or policies that encourage the minimal use of pesticides in and around their facilities.

Developing an IPM policy would help facilitate private businesses and public agencies to reduce the use of pesticides. This should include training programs for employees who apply pesticides and information about how to establish contracts with pest control and landscape maintenance companies who practice IPM.

5. Develop and educational campaign and more convenient facilities for the disposal of pesticide products and containers.

Develop convenient disposal sites for containers and leftover product. This should include large community containers where commercial pesticide users can dump leftover pesticides.

6. Take advantage of current pest control product vendors as an outreach channel.

Some pesticide vendors, including pesticide distributors, box stores that sell pesticides, pesticide manufactures, and independent pesticide sales people, not only produce and/or sell pesticides but provide outlets where pest control companies can get information about pest identification, pesticide labels, and IPM. These communication outlets are well established but are underutilized by university researchers, UCCE, regulatory agencies, and non-governmental organizations.

7. Develop a resource directory of IPM training materials and supplies for pesticide user groups.

Training materials offered by pesticide distributors often lack information about monitoring pests and pest prevention and instead focus on selecting the appropriate pesticide to use against a specific pest or a combination of pests. As an alternative, information about the impact of pesticide on water quality and proper disposal practices should be essential parts of a training program.

8. Produce e-newsletter updates from unbiased sources (e.g. UCCE).

E-newsletters offer an alternative form of communication that is simple and easily accessible. These newsletters could offer information about how pesticide impact water quality, how to avoid pesticide pollution with IPM practices and pesticide-related toxicity information. These newsletters would be especially helpful for facilities managers who are establishing IPM policies or who are looking for a pest control company to contract with.

9. Develop IPM certification programs with incentives for companies to participate.

There is currently a lack of IPM certification programs for pest control companies in California. Having IPM certifications available would increase the professionalism of the pest control industry. Current or developing certifications need to be reviewed by public agency or reputable professional organizations for potential problems.

Introduction

1.1 Purpose and Scope

Many different groups use pesticides in urban areas. Pesticide application in residential, public, commercial, and industrial areas is impairing water quality in California urban watersheds. Numerous scientific studies have indicated that non-point source pollution degrades biological communities and limits the long-term beneficial uses of urban streams (Domagalski, 2000). Urban pesticide user groups who are contributing to surface water pollution may have little pesticide training or knowledge of pesticides and Integrated Pest Management (IPM).

This report reviews the pesticide use behavior of non-residential pesticide user groups and their access to information about the safe use of pesticides and alternative practices. Non-residential use includes all urban use of pesticides except applications by residents themselves to their own homes and landscapes (applications by professionals, landlords, or apartment employees to residences would be included under our definition of residential use). This report also makes recommendations regarding outreach activities for these groups that might assist the reduction of pesticide use impacts to human health and water quality.

Previously the University of California IPM Program conducted three projects funded by the California Department of Pesticide Regulation (CDPR)⁶ investigating residential pesticide use in California. These projects sponsored telephone and pesticide product shelf surveys to determine information about outdoor pesticide use, pest control practices, and the attitudes of residential pesticide users. This report complements these projects by providing information on professional and other non-residential pesticide users.

Project Objectives

This project investigated pesticide use trends, behaviors, and educational resources for urban pest managers in the Arcade Creek (Sacramento Co.), Chollas Creek (San Diego Co.), and the Upper Newport Bay/ San Diego Creek (Orange Co.) watersheds in California. This information was then used to develop recommendations for outreach pathways for different pesticide user groups. Specifically the objectives of this project were the following:

- 1) Identify non-residential pesticide user groups in urban environments
- 2) Examine the pesticide acquisition, use, and disposal practices within each user group.
- 3) Investigate the sources of information about pesticides and integrated pest management within each user group.
- 4) Identify the educational needs of each user group.
- 5) Develop recommendations on comprehensive and effective outreach approach/strategy for urban insecticide user groups.

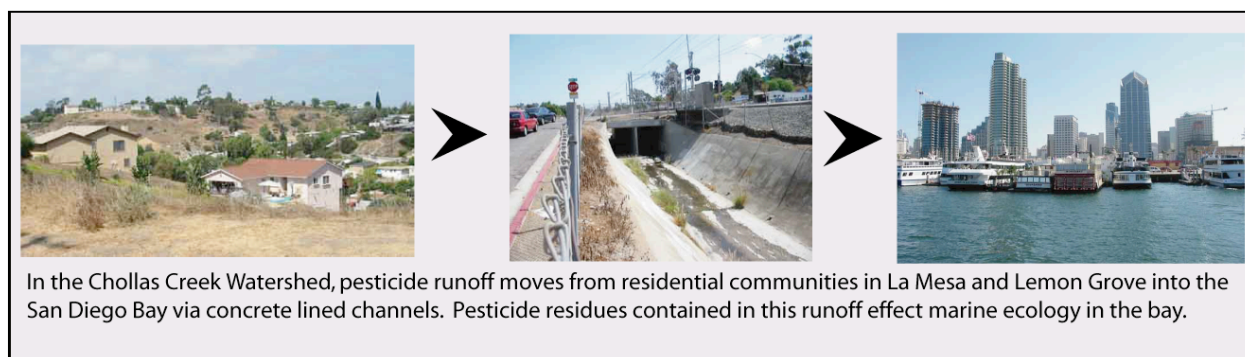
⁶ There were two reports produced by Cheryl A. Wilen: *Survey of Residential Pesticide Use and Sales in the San Diego Creek Watershed of Orange County, California* (2001) and *Survey of Residential Pesticide Use in the Chollas Creek Area of San Diego County and Delhi Channel of Orange County, California* (2002). One report was produced by Mary Louise Flint: *Residential Pesticide Use in California: A Report of Surveys taken in Sacramento (Arcade Creek), Stockton (Five-Mile Slough) and San Francisco Bay Areas with Comparisons in the San Diego Creek Watershed of Orange County California* (2003).

1.2 Background

Why is pesticide use a concern in urban areas?

Urban pesticide use presents numerous concerns related to human and environmental health. In an urban setting, the potential for toxic exposure to pesticides increases due to the high population density. Pesticide exposure may especially impact the health of children, seniors, and those with weak immune systems. Environmental impacts are also a concern. This study had a special focus on pesticide uses and practices that affect aquatic organisms. Run-off of organophosphate insecticides into creeks, rivers, and bays in the three selected watersheds has already been identified as an environmental problem requiring mitigation (Figure 1.1).

Figure 1.1 The Movement of Pesticides Within an Urban Watershed



Urban Pesticide Use in the United States

Pests, including weeds, insects, rodents, and plant diseases cause significant damage to structures and landscapes in urban areas. As a result, billions of dollars are spent annually on pesticides to control pests in the United States. In 2001 (the most recent data available at the time of this report), user expenditures on pesticides in the U.S. by the industrial, commercial, and government sector was over one billion dollars; the home and garden sector spent almost two billion dollars (Table 1.1) (Kiely et al., 2004).

Table 1.1 U.S. Pesticide Expenditures in 2001 (Millions of dollars)⁷

	Herbicides/ Plant Growth Regulators	Insecticides and Miticides	Fungicides
Agriculture	4,987	1,326	615
Industry/ Commercial/ Government	792	510	172
Home and Garden	631	1,288	48

Source: Pesticide Industry Sales and Usage, 2000 and 2001 Market Estimates (Kiely et al., 2004)

Currently in the United States over 150 million pounds of insecticides and herbicides are applied annually in urban areas. In 2001, 32 million lbs of insecticide (active ingredient⁸) and 120 million lbs of herbicide (active ingredient) were applied for urban use in the United States. During this same year the most commonly used insecticide, in the industrial/ commercial/ and

⁷ This information is based on Croplife America annual surveys, USDA/ NASS, and EPA proprietary data.

⁸ Active ingredient (also referred to as a.i.) is defined as the ingredient that actually controls the targeted pests. Pesticides are regulated primarily on the basis of active ingredients.

government sector, was chlorpyrifos, with 2-4 million lbs of active ingredient applied (Table 1.2). The most commonly used herbicide in this sector was 2-4 D, with 16-18 million lbs of active ingredient applied (Table 1.2) (Kiely et al., 2004).

Table 1.2 The Top Ten most Commonly used Pesticides in the Industry/ Commercial/ and Government Sector in 2001, Measured by Pounds of Active Ingredient²

Pesticide	Category	Millions of lbs of a.i. ⁶ used
1) 2-4 D	Herbicide	16-18
2) Glyphosate	Herbicide	13-15
3) Copper Sulfate	Fungicide	4-6
4) Pendimethalin	Herbicide	3-5
5) Chlorothalanil	Fungicide	2-4
6) Chlorpyrifos	Insecticide	2-4
7) Diuron	Herbicide	2-4
8) MSMA	Herbicide	1-4
9) Triclopyr	Herbicide	1-3
10) Malathion	Insecticide	1-3

Source: Pesticide Industry Sales and Usage, 2000 and 2001 Market Estimates (Kiely et al., 2004)

Concerns Associated with Urban Insecticide Use

In 2001, organophosphate insecticides were one of the top pesticide groups reported in the United States (Table 1.2). The two most commonly detected insecticides found in urban streams throughout the United States in 2001 were the organophosphates, diazinon and chlorpyrifos (Domagalski, 2000). The presence of diazinon and chlorpyrifos in urban streams has proven to be of some concern. Diazinon and chlorpyrifos are highly toxic to aquatic invertebrates following acute exposure (USEPA, 2000d)(USEPA, 2000c).

As a result, the United States Environmental Protection Agency (USEPA) has mandated the phase out of diazinon and chlorpyrifos for most residential and urban uses beginning in 2001. In 2001, retailers stopped the sale of most pesticide products containing chlorpyrifos. Retail sales of all indoor uses of diazinon products were banned in December 2002. All outdoor non-agricultural diazinon products were banned from retail stores in December 2004 (USEPA, 2000b).

Chlorpyrifos is being phased out as a result of potential health risks to children and not due to aquatic toxicity. According to the USEPA, the manufacturer of chlorpyrifos has agreed to eliminate the use of chlorpyrifos for nearly all household purposes. Chlorpyrifos use in schools, parks, and other settings where children may be exposed has been cancelled. However, chlorpyrifos may be applied to urban settings where children will not be exposed. These indoor areas include ship-holds, railroad boxcars, industrial plants, manufacturing plants, or food processing plants and outdoor areas include golf courses, road medians, industrial plant sites, and public health uses on fire ant mounds and mosquito control (USEPA, 2000a).

As a result of the phase out of diazinon and chlorpyrifos for urban uses, it is expected that other pesticides will replace the use of these products. A study by Moran (2003) indicated that 10 insecticides (bifenthrin, carbaryl, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, imidacloprid, malathion, permethrin, pyrethrins, and piperonyl butoxide) were the most likely to gain significant market share. Depending on the application location of these pesticides, they may cause significant threat to aquatic organisms in urban streams (Moran, 2003).

Concerns Associated with Urban Herbicide Use

There is a lack of herbicide monitoring data for urban streams; therefore, it is more difficult to demonstrate a direct relationship between what was used and what herbicides have been detected in streams. Soluble or sorbed herbicide can move with soil water to surface or ground-water resources (Carter, 2000). The level of degradation of receiving urban water bodies is controlled by rainfall characteristics (intensity and duration), herbicide properties (solubility, octanol- water partition coefficient), soil conditions (texture, antecedent moisture, ground cover), site topography, herbicide use patterns (application time, mode, and rate), and distance of transport (Carter, 2000; Huang et al., 2004). Compared with agricultural production areas, the level of herbicide runoff in urban areas may be higher due to large areas of impervious surfaces. This is especially true for herbicide applications along roadsides. For example, diuron, an herbicide commonly applied along roadsides, may impact water quality by impairing primary phytoplankton productivity (Kuivila et al., 1997).

1.3 Watershed Background

This project covers three study areas: Arcade Creek Watershed (Sacramento County), Chollas Creek Watershed (San Diego County), and Upper Newport Bay/ San Diego Creek Watershed (Orange County) (Figure 1.2). These three watersheds were chosen for this study because State and Regional Water Boards have classified them as impaired water bodies and are located in urban areas. Many sections of this report will focus on pesticide use trends for an entire county because the California Department of Pesticide Regulation’s PUR data does not identify use at a watershed level. This section describes key features of these three watersheds including land use, water quality problems, and surface water monitoring data.

Table 1.3 shows the land use breakdown for these three watersheds. The San Diego Creek Watershed is the largest watershed (112 square miles) yet has the smallest percentage of residential land use (15%) (Strauss, 2002). Land use in this watershed is more evenly divided between residential, commercial, industrial, open space, roadways, and education, religion or recreation than the Chollas Creek or Arcade Creek Watersheds. Conversely, the Chollas Creek Watershed is the smallest watershed (25 square miles) yet has the largest percentage of residential land use (67%) (Pardy and Smith, 2002). The second most dominant land use in this watershed is open space (16%). Slightly over half of the land use in the Arcade Creek Watershed is residential (38 square miles) (Foothill Associates, 2003). Other land use data for the Arcade Creek Watershed was not available.

Table 1.3 Land Use Comparisons for these three Watersheds

	Arcade Creek Watershed⁹	Chollas Creek Watershed¹⁰	Newport Bay Watershed¹¹	San Diego Creek Watershed¹²
Land area	38 square miles	25 square miles	13 square miles	112 square miles
Residential	56%	67%	20%	15%
Commercial	N/A	5%	10%	8%
Industrial	N/A	7%	0	5%
Open space	N/A	16%	24%	28%
Roadways	N/A	4%	16%	13%
Education, religion, or recreation	N/A	N/A	18%	21%
Transportation	N/A	N/A	1%	2%

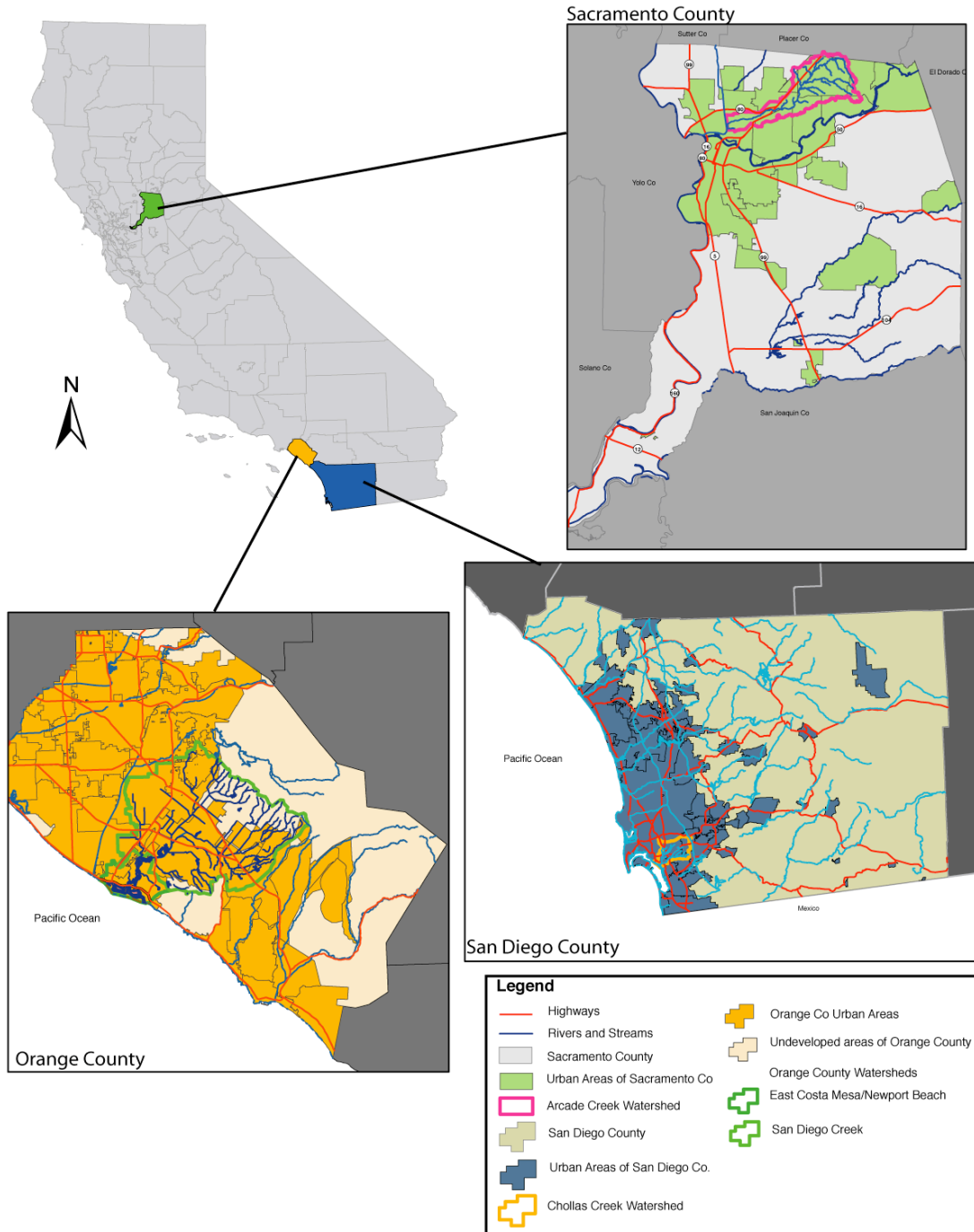
⁹ Source: (Foothill Associates, 2003)

¹⁰ Source: (Pardy et al., 2002)

¹¹ Source (Strauss, 2002)

¹² Source (Strauss, 2002)

Figure 1.2 The Urban Areas of Sacramento, San Diego, and Orange Counties



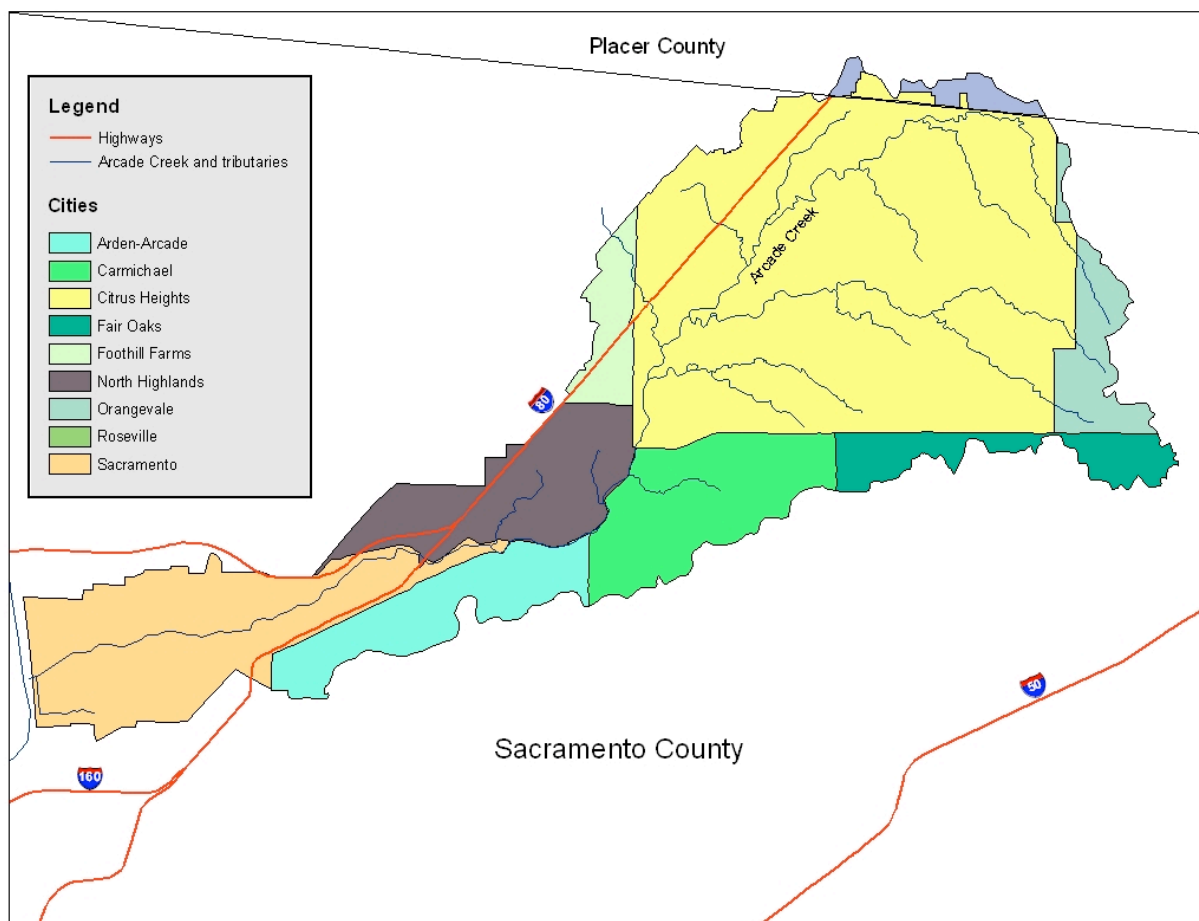
Arcade Creek Watershed

The Arcade Creek Watershed is a 38 square mile urbanized watershed that is located in northeastern Sacramento County with a minor portion in Placer County (Figure 1.3) (Foothill Associates, 2003). The watershed includes portions of the cities of Sacramento, Citrus Heights, and Roseville, with the majority falling within Citrus Heights. Over half (56%) of this watershed is composed of residential neighborhoods, with some commercial, institutional, and recreational areas (Foothill Associates, 2003). Arcade Creek flows through a number of city landmarks including: Haggin Oaks Golf Complex, Sunrise Golf Course, city parks, American River College, East Lawn Sierra Hills Cemetery, and Calvary Cemetery.



Arcade Creek

Figure 1.3 The Arcade Creek Watershed in Sacramento County



Arcade Creek is a perennial natural stream with riparian woodlands along the banks. The creek becomes a concrete-lined channel with a few trees three miles upstream from the Natomas East Main Drainage Canal (NEMDC) (Spector et al., 2004). Only a minor amount of the flow from this creek is attributable to ground water, most of the flow is urban runoff either

from rain or lawn irrigation (Domagalski et al., 2000; Foothill Associates, 2003). Watersheds where more than 25% of the land is covered with impervious surfaces are likely to have water quality problems. Nearly half (45%) of the Arcade Creek Watershed is covered by impervious surfaces, resulting in less infiltration of water and contaminants and more runoff into storm drains (Foothill Associates, 2003). Figure 1.4 shows how stream flow changes with weather events. Sacramento received higher than normal amounts of rainfall during the month of October 2004. As the rate of discharge of Arcade Creek increase more runoff from impervious surfaces flows into the creek.

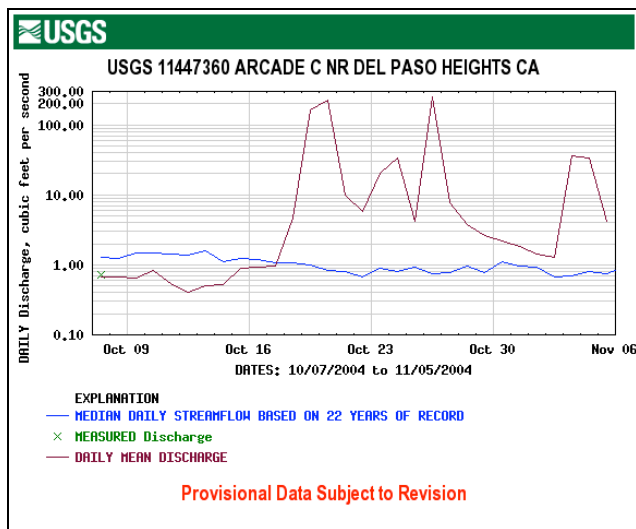


Figure 1.4

Arcade Creek



Arcade Creek

Arcade Creek has some of the highest levels of diazinon of any stream in the United States. This watershed has been designated an impaired waterbody based on the concentrations of chlorpyrifos and diazinon¹³ (Domagalski et al., 2000). The latest published monitoring data from the Sacramento River Watershed Program (SRWP), states that organophosphates were detected at seven of the 14 monitoring sites; of these sites, diazinon was most frequently detected (28 of 33 samples) in Arcade Creek (SRWP, 2004). In these samples collected from Arcade Creek in 2002-2003, diazinon levels were higher than the Department of Fish and Game's recommended Continuous Concentration Criterion (CCC) of 0.05 µg/ L (SRWP, 2004). From 1996 until 2003 the mean amount of diazinon detected in Arcade Creek was 0.35 µg/ L¹⁴ out of 63 total samples (SRWP, 2004). Chlorpyrifos has also been detected in urban runoff but the levels are not as high as diazinon.

¹³ For additional information about the levels of pesticides detected in Arcade Creek refer to the Total Maximum Daily Load (TMDL) for the pesticide diazinon and chlorpyrifos for Arcade Creek available online at: <http://www.swrcb.ca.gov/~rwqcb5/programs/tmdl/urban creeks/urban crksreport.pdf>

¹⁴ During this same time period the minimum level of detection was 0.06 µg/ L and the maximum level of detection was 1.38 0.06 µg/ L (SRWP, 2004).

Other pesticides detected in 2002-2003 in Arcade Creek by the SRWP were prometon, Prowl, simazine, bromacil, carbaryl, diuron, and oryzalin. Diuron was the only herbicide that was detected in Arcade Creek at a greater concentration than the minimum toxicity threshold in USEPA's OPP Ecotoxicity Database (SRWP, 2004).

Chollas Creek Watershed

The Chollas Creek Watershed is located east and southeast of downtown San Diego in San Diego County. This watershed encompasses 16,273 acres and is highly developed (Figure 1.5) (Pardy and Smith, 2002). Chollas Creek is a drainage channel that flows from Mid-City and



Chollas Creek

Lemon Grove to the San Diego Bay. Approximately 84%, 8%, and 8% of the land within the watershed is contained within the cities of San Diego, Lemon Grove, and La Mesa, respectively. This creek has highly variable flows, with the highest flow rates during the rainy season and with storm events and with limited or no surface flows during the dry season. The creek is mostly composed of concrete lined channels with some sections of earthen creek bed. Chollas Creek gets much wider and often contains more water from runoff near the mouth, which empties into the San Diego Bay (Pardy and Smith, 2002).

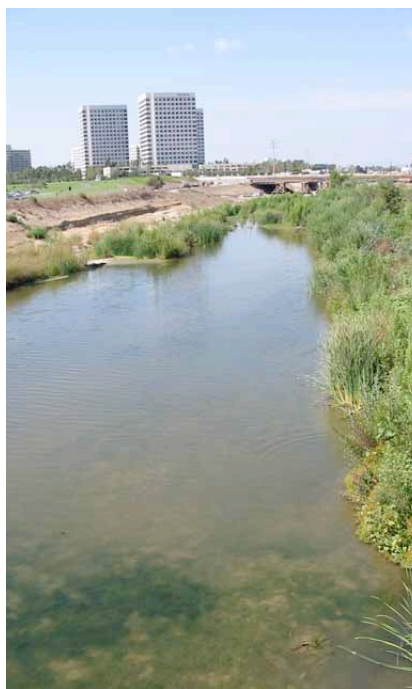
Figure 1.5 The Chollas Creek Watershed



Chollas Creek has been identified as an impaired waterbody for the insecticides chlorpyrifos and diazinon. Preliminary water quality monitoring indicated that there were concentrations of diazinon (0.32 to 0.54 $\mu\text{g/L}$) high enough to cause toxicity to the indicator species, the water flea (*Ceriodaphnia*) (Pardy and Smith, 2002). The Chollas Creek diazinon TMDL has set numeric targets for acute toxicity at 0.08 $\mu\text{g/L}$ and chronic toxicity at 0.05 $\mu\text{g/L}$ (Pardy and Smith, 2002). These values set 'acceptable' limits of diazinon for this creek; the goal of watershed groups and state agencies is to identify prevention measures so that these limits are not exceeded. Currently there is very little information about any other pesticides that are impacting surface water quality in this watershed.

Upper Newport Bay and San Diego Creek Watershed

This watershed includes portions of the cities of Costa Mesa, Irvine, Laguna Woods, Lake Forest, Newport Beach, Orange, Santa Ana, and Tustin (Figure 1.7). Over the last several decades there have been significant land use changes within these two watersheds. As a result of the increased demand for housing in Orange County, land has quickly shifted from agricultural to urban development (U.S. Army Corps of Engineers, 2001).



San Diego Creek

Predominant land uses in these two watersheds includes commercial and residential uses with open space areas such as parks, the San Joaquin Freshwater Marsh, and Newport Bay (Figure 1.6) (U.S. Army Corps of Engineers, 2001). The Upper Newport Bay Watershed contains a 752 acre ecological reserve, a coastal wetland that provides habitat for six endangered bird species and two endangered plant species. The San Diego Creek watershed contains large areas of open space, mainly in the foothills and upper areas where development has not yet occurred (Strauss, 2002).

The creeks in these two watersheds also have very variable flows. During the dry season, base flow is minimal. During the wet season flows are much higher and fluctuate depending on the amount of rainfall during storm events. In many of the main tributary channels of the San Diego Creek there are significant erosion problems (U.S. Army Corps of Engineers, 2001). Sediment from erosion may carry pesticides (especially pyrethroids) to these urban creeks. Furthermore, the channelization of these creek beds has increased the quantity and efficiency of freshwater and sediment transport to the Newport Bay (U.S. Army Corps of Engineers, 2001).

A TMDL was developed for chlorpyrifos and diazinon in this watershed. The TMDL was initiated for these watersheds based on a toxicity identification evaluation (TIE) that indicated diazinon and chlorpyrifos surface water toxicity. All of the 123 water samples taken from the Newport Bay Watershed showed toxicity to the indicator species, *Ceriodaphnia*. Of these samples, 88% caused complete mortality within a few days (Strauss, 2002). As a result of this water quality monitoring, chronic numeric targets have been set for diazinon and chlorpyrifos.

Figure 1.6 The San Diego Creek and Newport Bay Watersheds: Roads and Creeks Map

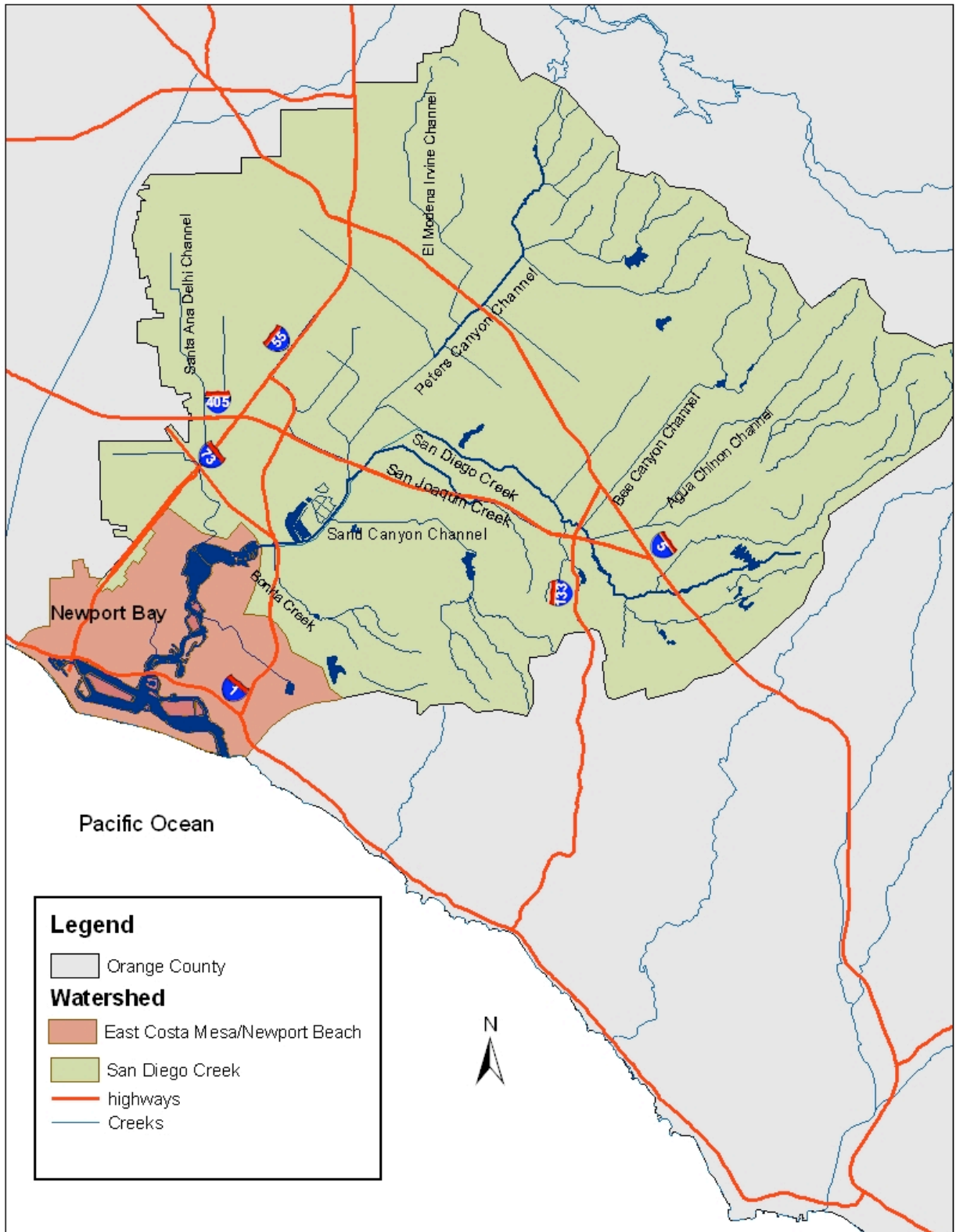
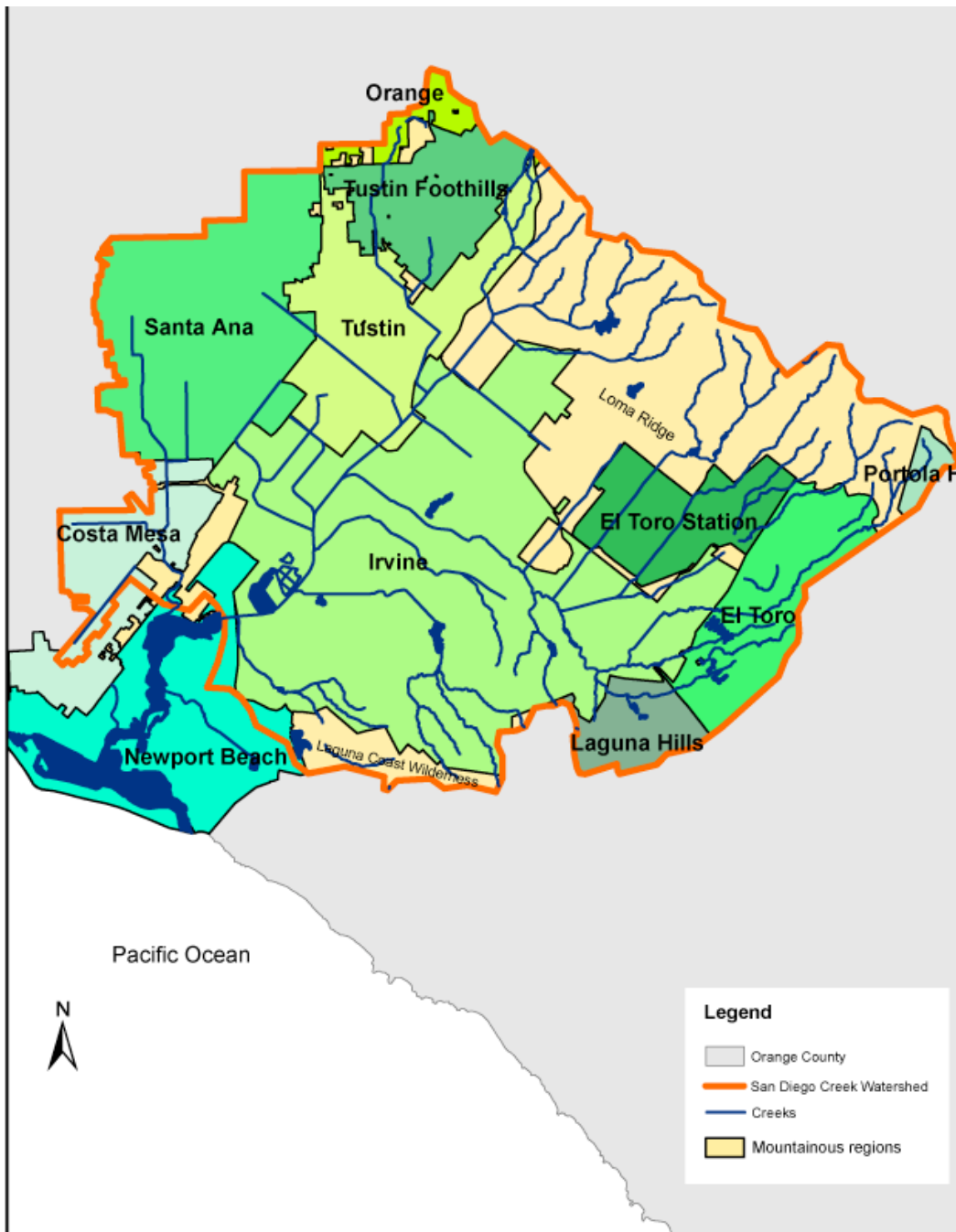


Figure 1.7 San Diego Creek and Newport Bay Watershed: Cities Map



1. Methods

The following resources and methods were used to complete each objective in this report:

- 1) Identify non-residential pesticide user groups in urban environments.
 - PUR database
 - California State laws and regulations regarding who must report pesticide use.
 - Project team meetings
 - Interviews with the Sacramento, Orange, and San Diego Counties Agricultural Commissioner's office.
- 2) Examine the pesticide acquisition, use, and disposal practices within each user group.
 - PUR database
 - Surveys with structural pest control companies, landscape maintenance gardeners, parks and recreation departments, and cemetery managers
 - Literature review
- 3) Investigate the sources of information about pesticides and integrated pest management within each user group.
 - Interviews with pest management experts
 - Surveys with structural pest control companies, landscape maintenance companies, parks and recreation departments, and cemetery managers
 - Literature review
 - Project team meetings
- 4) Identify the educational needs of each user group.
 - Interviews with pest management experts
 - Surveys with structural pest control companies, landscape maintenance companies, parks and recreation departments, and cemetery managers
 - Literature review
- 5) Develop recommendations on comprehensive and effective outreach approach/strategy for urban insecticide user groups.
 - Project team meetings
 - Interviews with pest management experts
 - Surveys with structural pest control companies, landscape maintenance companies, parks and recreation departments, and cemetery managers
 - Literature review

1) The Pesticide Use Report Database

The Pesticide Use Report (PUR) database was used to examine pesticide use trends in California's urban landscape. According to, *Regulating Pesticides: The California Story, A Guide to Pesticide Regulation in California* (Federighi and Brank, 2001), non-agricultural applicators submit monthly reports that include only pesticide product name and manufacturer, the product registration number, amount used, number of applications, the kind of site treated (e.g., roadside, structure), and total number of applications of all pesticides. Reports are submitted to the County Agricultural Commissioner's office, where they are reviewed by staff for accuracy, and entered into the county database. The data is then transferred monthly to CDPR (Federighi and Brank, 2001).

Data were obtained using ArcView¹⁵ GIS and PUR database query tools. Pesticide use trends from 1993-2003 were examined to determine what groups report pesticide use in Sacramento, San Diego, and Orange County. Pesticide use data was also used to develop trends for specific pesticides.

2) Project Team Meetings

The project team (Cheryl Wilen, Nila Kreidich, Mary Louise Flint, Minghua Zhang, and Nan Singhasemanon) held meetings to discuss educational resources and outreach methods for each pesticide user group.

3) Interviews

Personal interviews and phone interviews were conducted with interested parties to help supplement information for this report. Interviews were conducted with representatives from the Agricultural Commissioner's office in Sacramento County, San Diego County, and Orange County. Interviews were conducted to better understand monthly pesticide use report trends. Interviews were also conducted with pest management professionals, University of California researchers, urban watershed pollution prevention experts, and representatives from professional organizations.

4) Surveys

UCCE web-based survey

A web-based survey was designed for UC Cooperative Extension advisors, specialists, and others who work with these groups to help develop recommendations on the most comprehensive and effective outreach approach/ pathway for urban insecticide user groups. This survey was e-mailed out to a number of list-serves to reach the appropriate people. There were 17 responses to this survey. This survey is included in Appendix A.

Phone surveys

Phone surveys were conducted with different pesticide user groups. The Sacramento County phone book was used to contact pest control companies. Each of the companies contacted were asked specific questions about pesticide use, disposal, and where they get information about what pesticide use. Twenty-three pest control companies from Sacramento answered our phone survey. The survey questionnaire is included in Appendix B. Apartment complexes in the Arcade Creek Watershed were also surveyed over the phone. Apartment managers were asked who conducts pest management at their complex including questions about pest control companies, landscape companies, and facility managers (Appendix C). A number of other pesticide user groups were also interviewed over the phone including pet groomers and kennels, cemeteries, and parks and recreation departments.

Landscape maintenance gardener survey

Landscape maintenance gardeners were visited at their work sites and asked a list of questions about their pesticide use practices and knowledge about IPM. Each watershed was surveyed by driving around targeted areas looking for landscape gardeners in residential and non-residential areas. Gardeners were approached and then asked a series of questions. Two student translators were hired to conduct the interviews in Spanish if the subject spoke Spanish primarily. A copy of this survey is included in Appendix D.

¹⁵ ESRI, ArcView 9 GIS Software, 380 New York Street Redland, California 92373

Target Specialty Products' 31st Annual Fall Seminar and Exhibit Survey Sacramento, California

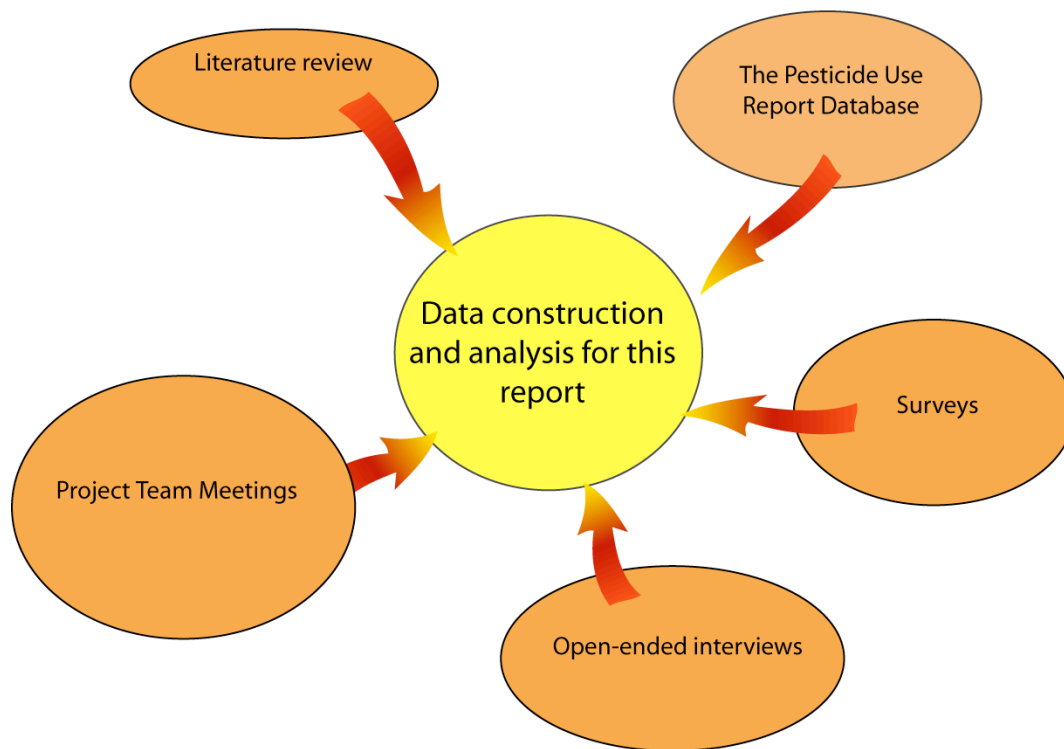
Ten representatives from pest control companies were surveyed on October 2, 2003 at the Target Specialty Products' seminar. This survey is included in Appendix E.

5) Literature Review

A literature review was conducted to determine information about each pesticide user group and to supplement information obtained from the surveys. Information was obtained through trade magazines, websites, peer-reviewed journal articles, books, and reports.

All of following information sources were combined to produce this report (Figure 2.1).

Figure 2.1 A Summary of the Research Methodologies Used to Construct this Report



2. Identifying Urban Pesticide User Groups

3.1 Monthly Pesticide Use Reports

The Development of the Pesticide Use Reporting System

Since at least the 1950s in California, agricultural pesticide use has been partially reported to the State. Beginning in 1970, anyone who used restricted materials was required to file a pesticide use report with the county agricultural commissioner. In addition, California required certified commercial pest control applicators¹⁶ (those engaged in pest control for hire, such as ground and aerial applicators, structural applicators, and landscape pest professionals) to report all pesticides used, restricted or non-restricted. In 1990, full use reporting began (including all agricultural pesticide applications¹⁷) as a result of demands for more realistic and comprehensive pesticide use data to accurately estimate dietary risk as well as exposure and potential risk to workers (DPR, 2000). *The main exceptions to the full use reporting requirements are home and garden use and most industrial and institutional uses* (DPR, 2000).

Since 1990, the following pesticide uses must be reported to the agricultural commissioner (DPR, 2003):

- For the production of any agricultural commodity, except livestock.
- For the treatment of postharvest agricultural commodities.
- For landscape maintenance in parks, golf courses, and cemeteries.
- For roadside and railroad rights-of-way.
- For poultry and fish production.
- Any application of restricted material.
- Any application of a pesticide with the potential to pollute ground water (listed in section 6800 (b) of the California Code of Regulations¹⁸, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1) when used outdoors in industrial and institutional settings.
- Any application by a licensed pest control operator.

As a result of pesticide use reporting requirements defined in the California Food and Agriculture Code the following groups are not legally required to report pesticide use:

- Private applicators¹⁹- residents applying pesticides to their own homes and landscapes.
- Pet groomers and kennels (with exception to employees with a Qualified Applicators Certificate who apply a restricted material)
- Facility managers, janitors, and/or employees at commercial, industrial, and institutional facilities who are not engaged for hire in the business of pest control.
- The Department of Defense

¹⁶ **Certified commercial applicator-** A person holding a valid structural pest control operator or field representative license issued by the Structural Pest Control Board of the Department of Consumer Affairs and a person holding a valid qualified applicator certificate by the director (California Food and Agriculture Code).

¹⁷ Agricultural pesticide use includes pesticide applications to parks, golf courses, cemeteries, and along roadside and railroad right-of-ways.

¹⁸ The California Code of Regulations can be found at: www.cdpr.ca.gov/docs/inhouse/calcode/subchpte.htm

¹⁹ A private applicator is defined in the California Food and Agricultural Code as a householder who uses or supervises the use of a pesticide, outside the confines of a residential dwelling for the purpose of controlling ornamental, plant, and turf pests on residential property owned, leased, or rented by that householder.

Distinguishing Urban Pesticide User Groups using the PUR database

Pesticide user groups within urban areas can be separated according to whether or not they complete a monthly pesticide use report (Figure 3.1). Persons required to maintain pesticide use records (as Defined in the California Food and Agriculture Code) must report a monthly pesticide use summary to the county agricultural commissioner where pesticide applications are performed. According to the California Code of Regulations (Title 3. Food and Agriculture), a monthly pesticide use report contains the following information (Figure 3.1):

1. The name and address of the person who or business/organization which applied pesticide(s).
2. County where the pest control was performed.
3. Month and year of pesticide use.
4. Crop, commodity or site treated, except when using a designated use code, as specified on the Monthly Summary Pesticide Use Report Form.
5. Pesticide and amount used.
6. Number of applications made with each pesticide and the total number of applications made during the month.

Groups that report pesticide use are identified in the PUR database by the site location ID. This code is assigned by the County Agricultural Commissioner on the use permit, which indicates a particular location (field) where pest control work will be performed that is recorded on the restricted material permit or other approved form (DPR, 2000). Site location IDs for urban areas vary depending on the county. Sacramento, San Diego, and Orange Counties all report pesticide use using the following site locations: Structural Pest Control, Landscape Maintenance, Right-of-ways, Public Health Pest Control, and Regulatory Pest Control. Monthly summary record types indicate urban use, noted in the PUR database by the number 2 or the letter C. The CHEM_CODE field identifies specific active ingredients used within each pesticide user group.

Figure 3.1 Monthly Pesticide Use Report Form

STATE OF CALIFORNIA MONTHLY SUMMARY PESTICIDE USE REPORT PR-ENF-000 (REV. 4/92)		DEPARTMENT OF PESTICIDE REGULATION PESTICIDE ENFORCEMENT BRANCH				
INSTRUCTIONS FOR COMPLETING THIS FORM ARE INDICATED BELOW						
OPERATOR (FIRM NAME)		ADDRESS		CITY	ZIP CODE	PHONE NUMBER
OPERATOR ID/PERMIT NUMBER	LICENSE NUMBER	COUNTY WHERE APPLIED	COUNTY NUMBER	MONTH/YEAR OF USE	TOTAL NUMBER OF APPLICATIONS	
<small>1. Complete Columns A, B, C, and D for All Users. 2. Complete Column E by using one of the Following Codes: Code 10 - Structural Pest Control.....includes any pest control work performed within or on buildings and other structures. Code 30 - Landscape Maintenance Pest Control.....includes any pest control work performed on landscape plantings around residences, or other buildings, golf courses, parks, cemeteries, etc. Code 40 - Right-of-Way Pest Control.....includes any pest control work performed along roadides, power lines, median strips, ditch banks and similar sites. Code 50 - Public Health Pest Control.....includes any pest control work performed by or under contract with State or local public health or vector control agencies. Code 80 - Vertebrate Pest Control.....includes any pest vertebrate pest control work performed by public agencies or work under the supervision of the State or county agricultural commissioner. Code 91 - Commodity Fumigation (Nonfood/Nonfeed).....includes fumigation of nonfood/nonfeed commodities such as pallets, dunnage, furniture, burlap bags, etc. Code 100 - Regulatory Pest Control.....includes any pest control work performed by public employees or contractors in the control of regulated pests. 3. Complete Columns F and G, if Use Does not Fit one of the Above Codes.</small>						
A	B	C	D	E	F	G
MANUFACTURER AND NAME OF PRODUCT APPLIED	EPACALIFORNIA REGISTRATION NUMBER FROM LABEL (INCLUDE ALPHA CODE)	TOTAL PRODUCT USED (Check One Unit of Measure)	NUMBER OF APPLICATIONS	CODE	COMMODITY OR SITE TREATED	ACRES/UNITS TREATED
	-- -- --	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA				
	-- -- --	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA				
	-- -- --	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA				
	-- -- --	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA				
	-- -- --	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA				
	-- -- --	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA				
	-- -- --	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA				
	-- -- --	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA				
	-- -- --	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA				
REPORT PREPARED BY _____ DATE _____						
Reports must be submitted to the county agricultural commissioner by the 10th of the month following the month in which the work was performed.						

Table 3.1 Summary of the Pesticide User Groups within an Urban Watershed who Report Pesticide Use

1) Structural Pest Control	
	Branch 1,2, and 3 license
2) Landscape Maintenance	
	Professional Landscape Maintenance Companies
	Golf Course Superintendents
	Parks and Recreation Departments
	Cemetery Landscape Managers
	Sports Turf Managers
	Landscape Pest Specialists
3) Public Agency Pest Control	
	Right-of-ways
	Public Health pest control
	Regulatory pest control

3.2 Groups who Report Pesticide Use

1) Structural Pest Control

Structural pest control is the broadest pesticide user group covered in this report. Structural pest control businesses offer a wide range of pest management services ranging from fumigation of an entire structure to perimeter sprays for the treatment of reoccurring pests such as ants. Most pest control companies in the United States provide general pest control services including insect and rodent control. These pest control companies offer services on all types of structures including²⁰:

- **Residential-** Homes and apartment buildings
- **Food storage, processing and service facilities**
 - Processing plants and warehouses
 - Restaurants, bars, and fast food chains
 - Supermarkets and grocery stores
- **Commercial-** shopping centers, office buildings, and hotels
- **Industrial-** non-food storage buildings and factories
- **Medical-** Hospitals and nursing homes
- **Schools and other educational institutions**

According to the California Structural Pest Control Board, “Structural pest control is the control of household pests (including but not limited to rodents, vermin, and insects) and wood destroying pests and organisms or such other pests which may invade households or structures, including railroad cars, ships, docks, trucks, airplanes, or the contents thereof (SPCB, 2004).”

²⁰ This list is adapted from the services that Western Exterminators (www.west-ext.com), one of the largest pest control companies in California, offers.

Structural pest control can be divided into subcategories according to the license or licenses of pest control operators (PCOs) (Table 3.2). Larger pest control companies such as Terminix, Western Pest Control, Clark Pest Control, and Orkin have employees with Branch 1, 2, and 3 licenses. In general, smaller pest control companies tend to have only one of these licenses.

Table 2.1 Structural Pest Control Licenses

License	Description	Example of Businesses
Branch 1: fumigation license	Companies or individuals with this classification can perform fumigation of structures.	License-to-Kill- San Diego Western Exterminators
Branch 2: General Household Pest License	Individuals or companies that treat household pests such as spiders, rodents, cockroaches, weevils, ants, bees, carpenter ants, and carpenter bees, etc.	Terminix Orkin Western Exterminators Centurion Pest Control
Branch 3: Wood-Destroying Pest Organisms License	Individuals or companies within this category are licensed to perform inspections for wood-destroying pests and organisms, issue the inspection report and completion notices, conduct treatments, and perform any repairs recommended on the inspection report.	Terminix Orkin Western Exterminators Diamond Termite- San Diego Pro-Ex

There are currently 1,200 companies with structural pest control licenses in California; 800 (about 67%) are members of Pest Control Operators of California (PCOC) (Eric Paulsen, personal communication). The Pest Control Operators of California offer programs for insurance, continuing education, credit union, and legislative and regulatory representation (SPCB, 2004). The main pests that Structural Pest Control Operators (SPCOs) manage are: drywood and subterranean termites, ants, cockroaches, rats and mice, fleas, lice, ticks, spiders, carpet beetles, clothes moths, house flies, mosquitoes, pantry pests, wood-boring beetles, wood wasps and hornets, yellowjackets, and other social wasps. Of all these pests, ants are the most difficult pests for SPCOs to control followed by spiders and mosquitoes (Porter, 2004); pesticides are the most common treatment for these pests.

2) Landscape Maintenance

The landscape maintenance category contains many different groups who perform turf and ornamental pest management services. People who use pesticides under landscape maintenance are divided into two general groups:

- 1) *Landscape Pest Professionals (Public Agency Personnel and Private Business)*
- 2) *Maintenance Gardeners²¹ (those that report pesticide use)*

²¹ Although maintenance gardeners are required to have a license and report pesticide use, many do not. More information about maintenance gardeners is available under the section discussing groups who do not report pesticide use.

The first group, Landscape Pest Professionals, can further be split into groups who all report pesticide use under landscape maintenance. These groups include the following:

- Public and private golf course superintendents
- Public and private cemetery grounds managers
- Parks and recreation landscape managers
- Sports turf managers
- Landscape Maintenance companies who report pesticide use

Pesticide use reporting information from each of these sub-groups is consolidated under landscape maintenance in the PUR database. Those who report pesticide use under this category most likely have a Qualified Applicator Certificate (QAC) with the specialty in landscape maintenance Category (B) or the Maintenance Gardener Pest Control Business Category (Q). According to the document, *State of California, Qualified Applicators Certificate Pest Control Categories* revised 10/04, a person with a landscape maintenance QAC license may apply or supervise the use of restricted use pesticides to control pests in natural or planted ornamental, turf, and other outside areas around buildings. Only those with a Category B license can conduct pest control work in areas such as golf courses, parks, cemeteries, or similar areas. Maintenance Gardeners who apply any pesticide incidental to their gardening business must have a Maintenance Gardener Pest Control Business License (PR-PML-004) and a QAC license with a Category B or Q specialty (CDPR, 2004).

Professional landscape companies who report pesticide use are usually companies with more than ten employees. These companies offer landscape installation, maintenance, and pest control services to homeowners, homeowner associations, private businesses, public agencies, and city parks and recreation departments. Some companies only focus on landscape pest control while other companies may only have one landscape pest control professional. In some cities, licensed landscape pest specialists have contracts with public agencies to perform pest control at public cemeteries, golf courses, and parks.

Other groups who report pesticide use under landscape maintenance include landscape maintenance managers at public and private facilities including golf courses, cemeteries, parks, sports fields, and other large expanses of managed landscape. Landscape managers who apply pesticides to these areas are required to have a license and file a monthly pesticide use report. However, there are private facilities that have employees who apply pesticides without a license or monthly reporting. It is often difficult to distinguish between these facilities and those who have licensed employees that report pesticide use. In general, the larger the facility and the more demand for a pesticide regiment on turf and ornamentals, the more likely the facility is to have licensed professionals who report pesticide use.

3) Public Agency Pest Control

There are a number of public agencies who apply pesticides in urban environments including groups described as right-of-ways, public health pest control, and regulatory pest control. Public agency employees also apply pesticides in parks, golf courses, and public buildings. Licensed public agency employees report pesticide use monthly to the Agricultural Commissioner's office.

Right-of-ways

Right-of-ways is defined as pesticide applications made to the following application sites: roadsides, power lines, median strips, ditch bands, airport runways, railroads, canal ditches, parking lots, cell phone towers, bike trails, and flood control sites. Generally, licensed road crews apply herbicides to these locations. State and local agencies apply herbicides to control

vegetation growth along roadsides to improve visibility for drivers, reduce fire risk, and prevent physical damage to the road surface.

Right-of-way pesticide applicators must have Qualified Applicators Certificate (QAC) or they must be supervised by someone who has a QAC. The category right-of-way allows a person to use or supervise the use of restricted use pesticides to control pests in the maintenance of roads, highways, power lines, telephone lines, pipelines, canals, railroads, or other similar sites. It also includes landscaped right-of-way areas (CDPR, 2004).

Pesticides that are reported under right-of-ways are applied by the following groups:

California Department of Transportation (Caltrans) to maintain freeways and State highways
County Public Works Departments
City Public Works Departments
Private pest control companies that are under contract
Utility Companies
Other²²

Public Health Pest Control

According to CDPR, public health pest control can be defined as any work performed by or under contract with state and local public health or vector control agencies. Those who perform work under this category must have a QAC license with a Category K specialization. Category K allows a person to use or supervise the use of restricted use pesticides in official programs for the management and control of pests having medical and public health importance (CDPR, 2004). Although the majority of pesticide applications are conducted by each county's vector control district, private pest control companies who have a QAC license with a Category K specialization also conduct minor pesticide applications.

A variety of pesticides are used within urban areas to manage pests that may be a vector for human diseases. This includes pesticide applications to fire ant mounds, mosquito control, and manhole covers. Each vector control district has developed individual policies regarding public health pest control. The following information highlights some of the key activities of each district located within the study area of this project.

Sacramento County

The majority of pesticide applications made under the category public health pest control are conducted through the Sacramento-Yolo Mosquito and Vector Control District (SYMVCD). The SYMVCD offers the following district services²³:

Integrated Pest Management for mosquitoes, yellowjackets, and feral honeybees.
Vector surveillance for mosquitoes, yellowjackets, ticks, and valley black gnats.
Disease surveillance testing for Western Equine and St. Louis Encephalitis
Identification and advisory for public health vectors
School and public education about mosquitoes and other vectors
Educational information about mosquitoes, Africanized honey bees, ticks, and yellowjackets.

²² This may include railroad applications by railway companies; however, this group was not investigated for this report.

²³ Additional information is available at www.fightthebite.net

San Diego County

The majority of pesticide applications are conducted under the San Diego County Vector Control Program (SDCVCP). This vector control district uses pesticides to mostly control mosquitos, domestic rats, flies, and ticks. Currently one of their most important programs is the West Nile Virus Strategic Response Plan, which is designed to prepare for the inevitable arrival of the West Nile Virus to San Diego County.

Orange County

The majority of pesticide applications for public health pest control are made by the Orange County Vector Control District (OCVD). The OCVD controls rats, flies, mosquitoes, and fire ants using IPM technologies. The OCVD pesticide use policy is the following²⁴:

“The District considers the use of chemicals to control vectors at the least desirable of the available Integrated Vector Management (IVM) options. Instead, programs rely more on prevention, exclusion, and public education. If chemicals become necessary to apply, the products used by the District are recognized by the U.S. Environmental Protection Agency as being environmentally friendly and safe (Class III) to humans (OCVCD, 2004).”

Regulatory Pest Control

Regulatory pest control is defined as any pest control work performed by public employees or contractors in the control of regulated pests, including those that interfere with health, comfort, leisure, aesthetics, recreation, stability of existing biological systems, or agricultural and material production (Baker et al. 1997). Persons applying pesticides for regulatory pest control must have a QAC license with a regulatory examination. The regulatory category for a QAC license allows a person to use or supervise the use of restricted use pesticides in official government programs for the control of regulated pests (CDPR, 2004).

There are a number of official government programs in California that report pesticide use under regulatory pest control. The Integrated Pest Control (IPC) Branch conducts a wide range of pest management and eradication projects as part of the Division of Plant Health and Pest Prevention Services (under the California Department of Food and Agriculture, CDFA). The IPC branch uses pesticides to control a variety of noxious weeds, vertebrates, plant diseases, and insects²⁵. The Interior Pest Exclusion Branch of the California Department of Food and Agriculture work cooperatively with the United States Department of Agriculture (USDA), other state departments of agriculture, and the California County Agricultural Commissioners to enforce plant quarantines and control regulated pests. Some of the most important regulated pests currently in California include fire ants, Mexican and Oriental fruit fly, glassy-winged sharpshooter, and *Phytophthora ramorum* (the pathogen that causes Sudden Oak Disease).

²⁴ Additional information is available at www.ocvcd.org

²⁵ Additional information about IPC is available at www.cdfa.ca.gov/phpps/ipc

3.3 Groups who do not Report Pesticide Use

According to the California Code of Regulations, the following groups are **not** required to report pesticide use:

- Residents applying pesticides to their own homes and landscapes
- Pet Groomers and Kennels (unless they apply a restricted pesticide material)
- Employees applying incidental treatments to commercial businesses/buildings
- Employees applying incidental treatments to institutional facilities
- Employees applying incidental treatments at industrial (factories and warehouses) facilities
- The Department of Defense

As a result, less is known about the pesticide use practices of these groups. However, maintenance gardeners who apply pesticides **are required** under the California Code of Regulations to be licensed and report pesticide use. A preliminary survey conducted for this report indicates that many maintenance gardeners who apply pesticides are not licensed and do not report pesticide use. Maintenance gardeners are discussed in greater detail later in this report.

Table 3.3 Summary of the Pesticide User Groups within an Urban Watershed who *DO NOT* Report Pesticide Use²⁶

1) Residents Applying Pesticides in their Homes and Landscapes
2) Maintenance Gardeners (some)
3) Pet Groomers/ Kennels
4) Commercial Garden Centers/ Retail Nurseries Facility managers, janitors, and/or employees at hotels, office complexes, shopping centers, apartment complexes, etc...
5) Institutional Facility managers/ staff, janitors, and employees at schools, daycare centers, hospitals, etc...
6) Industrial Facility managers, janitors, and/or employees at factories and warehouses
7) The Department of Defense

²⁶ Table 3.3 is not an exhaustive list of the pesticide users in California who do not report pesticide use. This report will only focus on the main pesticide user groups in the Arcade Creek, Chollas Creek, and San Diego Creek/ Upper Newport Bay Watersheds.

1) Residents Applying Pesticides to their Homes or Landscapes

Residents who apply pesticides to their homes or landscapes are a major contributor to pesticide use in urban areas. However, the focus of this report is the use of pesticides by people who apply pesticides as part of their jobs. This report does include information about licensed and non-licensed pesticide use to residential property by for-hire groups. Residents are not required to have a pesticide applicators license or report pesticide use. Other reports have focused specifically on residential pesticide use in California¹.

2) Maintenance Gardeners

The category maintenance gardeners is a large and diverse group composed of small landscape maintenance businesses in California. These businesses often have less than ten employees and manage landscapes on residential, commercial, or public property. Occasionally they may apply pesticides at the customer's request, but landscape pest control is not the focus of these businesses. According to the CDPR, these maintenance gardener businesses must obtain a Maintenance Gardener Pest Control Business License and in order to get this license they must have an employee with a QAC in category B or Q specialization (CDPR, 2004). However, according to our survey, often maintenance gardeners in California do not have these licenses and do not report pesticide use.

3) Pet Groomers and Kennels

Non-veterinary grooming businesses and other such for hire animal maintenance operations who use pesticides to treat animal pests for clients for a direct or indirect fee are considered in this pesticide user group. In California, pesticide users within this group who apply for a QAC license have the opportunity to take an exam under Category I specialization. A Category I QAC license allows a person to use or supervise the use of restricted use pesticides to control pests on animals and in the facilities where animals are confined (CDPR, 2004). It is unknown what percentage of pet groomers and kennels have a person on staff with a QAC license in the three watersheds studied. This group does not report pesticide use.

4) Private Business or Commercial Users

This group includes owners and employees of businesses such as apartment complexes, hotels, restaurants, retail nurseries and garden centers, shopping complexes, and office parks. These businesses have facilities managers, janitors, and general employees who may purchase pesticides at retail outlets and apply them to commercial property. This group is not required to have a pesticide applicators license or report pesticide use. However, if they hire a licensed structural pest control operator or licensed landscape pest control operator, these professionals do report pesticide use on commercial property.

5) Institutional

Institutional pesticide users include employees of various institutions in urban areas including schools, universities, childcare facilities, hospitals, and prisons. Facility managers, janitors, and/or employees at these locations may apply pesticides. Institutional pest control may also be performed by a hired licensed pest control operator. For example, a contract management survey conducted by Hospitals and Health Networks' (HHN) Contract stated that more than 85% percent of respondents hire outside vendors to manage pest problems (Owens, 2003). Many city and individual institutions have developed IPM policies. These institutions may have IPM coordinators that facilitate any pest management practices.

California School IPM Program

Public Schools in California do not have to report pesticide use to the CDPR PUR database if pesticides are applied by school employees. School employees also do not have to be licensed. However, the California Healthy Schools Act of 2000 established a separate on-site pesticide use record-keeping requirement for schools. Among the provisions are the following²⁷:

- Annual written notification of the pesticides that are expected to be applied by district staff or an outside contractor to the parents or guardians of students.
- Staff and parents have the opportunity to register for notifications of future pesticide applications.
- The school district shall post warning signs where pesticides will be applied, 24 hours in advance and 72 hours after application.
- Each school shall maintain records of all pesticide use at the school for four years and make the records available to the public upon request.
- Each school district must designate an IPM coordinator to carry out these requirements.

Teachers, janitors, food service workers, and facility managers are not required to fill out the school site pesticide use reporting form (Figure 3.2). School district IPM coordinators may encourage school staff to keep pesticide use records but they are not required to submit these records to CDPR. However, pest control businesses must report all pesticides used on any school site to CDPR. They must fill out two pesticide use reports for each school applications, the standard structural pest control form and the school site reporting form. Unfortunately, pesticide applications made on school property that are available using the PUR database are commingled with all other structural pest control use. No specific information on where pesticides are applied by PCOs is publicly available under the current record keeping requirements, therefore, it is difficult to know which pesticides PCOs use on school property, indoor or out. Pesticide applications made to landscapes around schools are not always reported either. In 2002, over 75% of California school districts reported hiring outside pest control businesses; only one in three used contractors for outdoor landscape pest control (Geiger and Tootelian, 2002).

²⁷ California school IPM requirements can be found at www.cdpr.ca.gov/cfdocs/apps/schoolipm/overview/main.cfm?crumbs_list=1,3

Figure 3.2 School Pesticide Use Reporting Form

SCHOOL SITE PESTICIDE USE REPORTING							
STATE OF CALIFORNIA PR-ENF-117 (EST. 4/01)			DEPARTMENT OF PESTICIDE REGULATION PEST MANAGEMENT & LICENSING BRANCH				
APPLICATION YEAR	BUSINESS REGISTRATION/LICENSE/CERTIFICATE #	BUSINESS/OPERATOR NAME					
BUSINESS ADDRESS		CITY	STATE	ZIP CODE	BUSINESS PHONE NUMBER		
Code 10 - Structural Pest Control.....includes pest control work performed within or on buildings or other structures Code 30 - Landscape Maintenance Pest Control.....includes pest control work performed on landscape plantings around buildings Code 40 - Right-of-Way Pest Control.....includes pest control work along roadsides, power lines, median strips, etc. Code 50 - Public Health Pest Control.....includes pest control work performed by or under contract with State of local public health or vector agencies Code 80 - Vertebrate Pest Control.....includes pest control work performed by public agencies or work under the supervision of the State of county agricultural commissioner Code 91 - Nonfood/Nonfeed Fumigation.....includes pest control work performed on commodities such as mattresses, furniture, etc. Code 100 - Regulatory Pest Control.....includes pest control work performed by public employees or contractors in the control of regulated pests							
SCHOOL SITE CDC #/DAY CARE FACILITY # QR NAME & ADDRESS	COUNTY	Date & Time Application Completed	LOCATION (# or name from list below)	Manufacturer & Name of Product Applied	EPA/California Registration Number From Label (include alpha code if possible)	Amount Used (and check one unit of measure)	Code (from list above)
					- - -	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA	
					- - -	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA	
					- - -	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA	
					- - -	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA	
					- - -	<input type="checkbox"/> LB <input type="checkbox"/> OZ <input type="checkbox"/> PT <input type="checkbox"/> QT <input type="checkbox"/> GA	

LOCATIONS:
 1 Administration Bldg 5 Cafeteria 9 Landscape (indoor) 12 Locker Room 15 Restroom
 2 Athletic Field 6 Classroom 10 Landscape (outdoor) 13 Multipurpose Room 17 Vehicle
 3 Auditorium 7 Gymnasium 11 Library 14 Playground 18 Multiple Locations
 4 Bldg, exterior 8 Hardscape (parking lot, sidewalk, etc.) 15 Pool 19 Other, please indicate

REPORT PREPARED BY _____ DATE _____

Report must be submitted to the Department of Pesticide Regulation, P.O. Box 4015, Sacramento, CA 95812-4015

6) Industrial

Pesticides at industrial complexes are applied by facility managers, janitors, and employees along with professional pest control companies. Many structural pest control companies offer industrial pest control services. For example, Terminix Commercial has a division that only focuses on pest control for manufacturing, distribution, and warehousing facilities. Pest control operators who apply for QAC licenses have the opportunity to take an exam under the residential, industrial and institutional pest control category. This category allows a person to use or supervise the use of restricted use pesticides to control pests in industrial establishments; including packing plants, food manufacturing, processing plants, warehouses, grain elevators, and factories (CDPR, 2004).

7) Department of Defense (The United States Military)

Any pesticide application made to U.S. Military property is internally regulated by the Department of Defense; specifically pest management activities are coordinated by the Armed Forces Pest Management Board (AFPMB). The AFPMB recommends policy, provides guidance, and coordinates the exchange of information on all matters related to pest management through the Department of Defense (AFPMB, 2005). The AFPMB’s mission is to ensure that environmentally sound and effective programs are present to prevent pests and disease vectors from adversely affecting Department of Defense operations. Both military and civilian pest management professionals must be certified by the state or Department of Defense to make pesticide applications on Military property.

3. Pesticide Use Trend Analysis

4.1 Urban Pesticide Use in California

The PUR database is a useful tool to examine non-agricultural pesticide use trends. However, it only represents a fraction of the total amount of pesticides used in urban areas²⁸. Approximately two-thirds of the pesticide active ingredients sold each year are not reported, including home-use pesticide products (CDPR, 2003). Urban pesticide use also varies from year to year, depending on pest pressure, weather, housing and commercial development, economic conditions, public perceptions of certain pests, and other factors.

Since 1998 (as reported by the CDPR PUR database) over 11 million pounds of pesticide (active ingredient) have been applied each year in California for non-agricultural purposes and pesticide use has remained the same since 1998. In 2003, 12,990,675 lbs of pesticide (active ingredient) were reported for non-agricultural purposes in California. Over 70% of the total non-agricultural pesticide use reported in California in 2003 was under the categories structural pest control and right-of-ways.

Figure 4.1 shows the breakdown of reported non-agricultural pesticide use in California during 2003. The majority of pesticide use falls under structural pest control. Figure 4.2 shows that this trend has remained consistent since 1998. Pesticide use under landscape maintenance and public health has fluctuated since 1998 but has consistently remained lower than right-of-ways. According to PUR data, only 1% of the total non-agricultural pesticide use reported in California falls under regulatory pest control.

Figure 4.1 Total Non-agricultural Pesticide Use in California, 2003

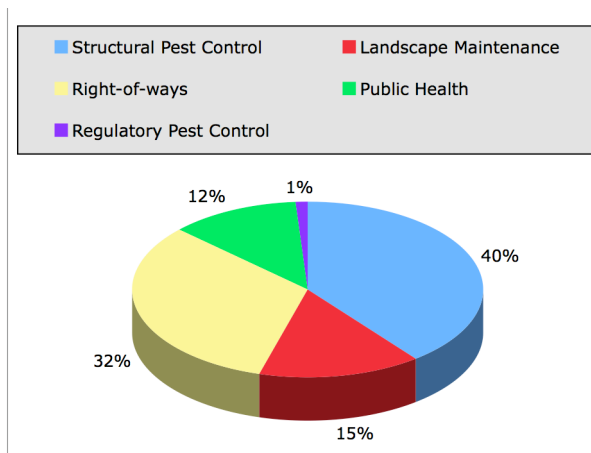
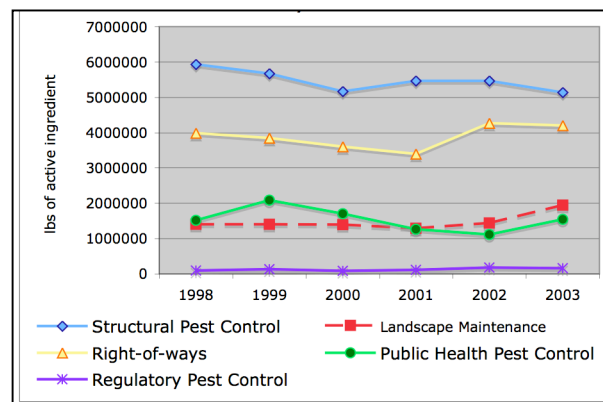


Figure 4.2 Total Non-agricultural Pesticide Use in California, 1998-2003



²⁸ Urban is defined as groups that report pesticide use monthly to the County Agricultural Commissioner’s office. These groups include structural pest control, landscape maintenance, right-of-ways, public health pest control, and regulatory pest control. In general these groups apply pesticides to urban areas but there some non-urban areas that receive pesticide applications from these groups. For example, right-of-ways includes all roads in the county.

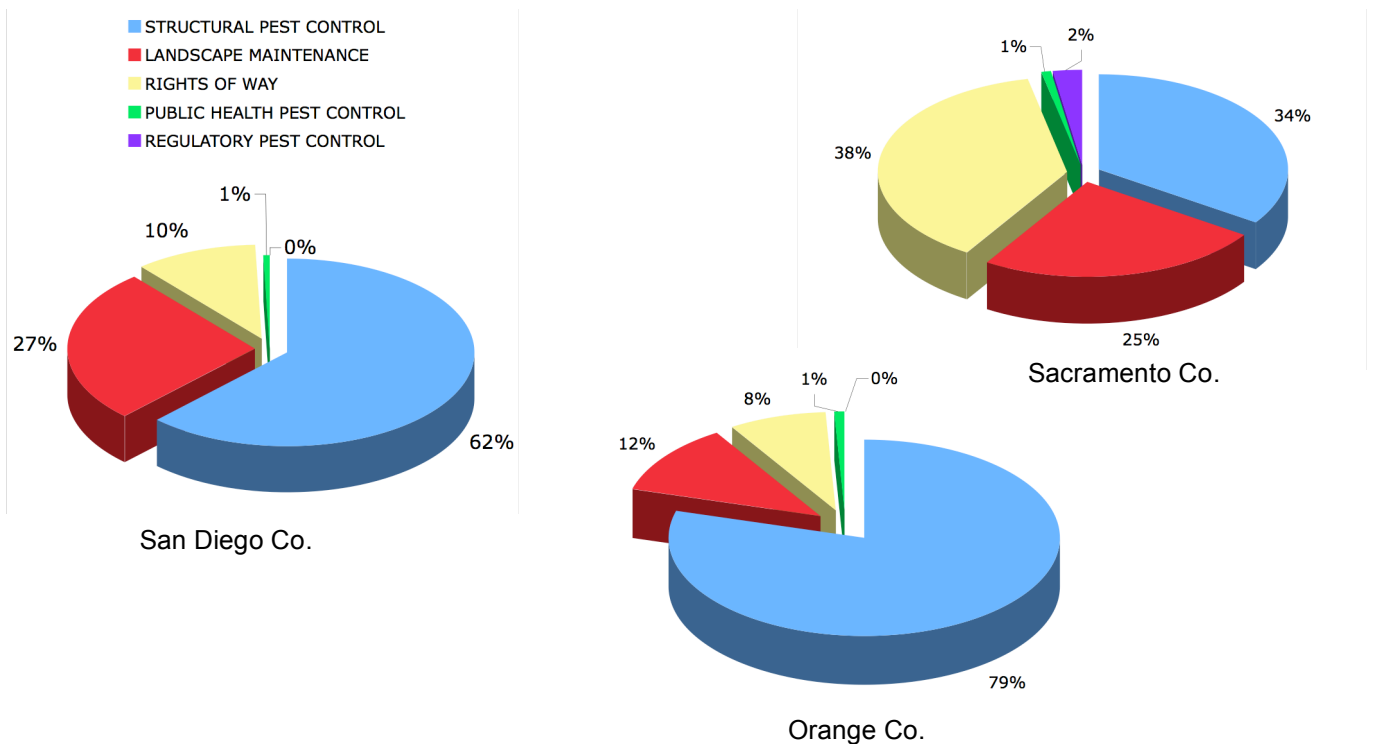
4.2 The Breakdown of Pesticide Use in Sacramento, San Diego and Orange Counties

Table 4.1 and Figure 4.3 show the most recent total reported non-agricultural pesticide²⁹ use among Sacramento, San Diego, and Orange Counties. The majority of pesticides used in San Diego and Orange Counties fall under the category structural pest control. In Sacramento County, there is a more even distribution of pesticide use between the categories structural pest control, landscape maintenance, and right-of-ways. In 2003, San Diego had the highest use of non-agricultural pesticides, with a total of 1,031,533 lbs of active ingredient.

Table 4.1 Total Non-agricultural Pesticide Use, 2003

	Sacramento	Orange	San Diego
STRUCTURAL PEST CONTROL	77268	728907	642797
LANDSCAPE MAINTENANCE	55537	106584	273863
RIGHTS OF WAY	84702	72840	107983
PUBLIC HEALTH PEST CONTROL	2198	8155	6307
REGULATORY PEST CONTROL	5482	406	583
TOTAL	225186	916891	1031533

Figure 4.3 Percentage Breakdown of Total Non-agricultural Pesticide use (2003)



²⁹ Pesticides includes: insecticides, fumigants, herbicides, fungicides, molluscicides, oils, adjuvants, and other chemical products.

Non-fumigant Insecticide Use

The most recent PUR data (for 2003) indicates that structural pest control accounts for over 90% of the total non-fumigant reported insecticide use in Sacramento, San Diego, and Orange Counties. This includes both indoor and outdoor pesticide applications. Landscape maintenance ranks second in total insecticide use; however, it only accounts for less than 10% of the total non-agricultural insecticide use in these three counties. Public agency pest control only represents a fraction of the total insecticide use in these counties (Table 4.2).

Table 4.2 Total Reported Non-fumigant Insecticide Use (2003)

	Sacramento	%	San Diego	%	Orange	%
Structural Pest Control	44,294	93%	206,951	90%	258,306	98%
Landscape Maintenance	1,984	4%	22,737	10%	2,929	1%
Right-of-ways	207	0.4%	137	0.1%	921	0.4%
Public Health Pest Control	988	2%	142	0.1%	562	0.2%
Regulatory Pest Control	4	0.01%	401	0.2%	145	0.1%
TOTAL	47,476		230,369		262,863	

Herbicide Use

The most recent PUR data (2003) indicates that right-of-ways accounts for over 50% of the total non-agricultural herbicides used in Sacramento and San Diego Counties. Landscape maintenance had the highest use in Orange County, accounting for over 50% of the herbicide use. Under most circumstances structural pest control operators and those who work in public health pest control do not use herbicides. Herbicide use under regulatory pest control varies year to year and depends on the pest being regulated (Table 4.3).

Table 4.3 Total Reported Non-fumigant Herbicide Use (2003)

	Sacramento	%	San Diego	%	Orange	%
Structural Pest Control	1,394	1%	3,360	2%	17	0%
Landscape Maintenance	39,533	39%	58,356	38%	65,366	53%
Right-of-ways	56,825	56%	91,943	60%	58,928	47%
Public Health Pest Control	39	0.04%	1	0%	161	0.1%
Regulatory Pest Control	4,037	4%	82	0.1%	17	0.01%
TOTAL	101,828		153,743		124,490	

4.3 A Comparison of Pesticide Use Trends Among Sacramento, San Diego, and Orange Counties

When comparing pesticide use among Sacramento, San Diego, and Orange Counties, it is important to consider pest pressure, climate, population, and building density. Other factors such as the type of landscaping must also be considered when comparing pesticide use trends of a specific pesticide user group. To account for these demographic differences among counties, a ratio was developed: the number of building units divided by the total lbs of active ingredient used each year (Figure 4.4).

Figure 4.4 Formula Used to Account for Demographic Differences Among Counties

$$\text{Adjusted Pesticide Use} = \frac{\text{Total Pounds of Active Ingredient}}{\text{Housing Units} + \text{Private Non-farm Establishments with Paid Employees}}$$

In general, non-agricultural pesticide use is higher in San Diego and Orange Counties (with or without compensating for building unit density). San Diego and Orange Counties have a much higher population and building unit density than Sacramento County (Table 4.4); on the other hand Sacramento County has more land devoted to agriculture. In the past five years, the County of Sacramento has experienced a rapid increase in development. In the future, this may change the amount of non-agricultural pesticides applied in Sacramento County, especially under structural pest control, lessening the differences in pesticide use among these three counties.

Table 4.4 Differences Among the Three Counties Studied; Based on U.S. Census Data

	Sacramento County	San Diego County	Orange County
Population estimate, 2003	1,330,711	2,930,886	2,957,766
Housing units, 2002 ³⁰	492,506	1,072,792	992,921
Private nonfarm establishments with paid employees, 2001 ³¹	25,909	69,059	79,937

(U.S. Census Bureau, 2004a)

³⁰ A housing unit is a house, apartment, mobile home, group of homes, or a single room that is occupied as a separate living quarter

U.S. Census Bureau. 2004b. State and County QuickFacts [Online]
<http://quickfacts.census.gov/qfd/states/06000.html> (posted July 9, 2004).

³¹ A non-farm private establishment is a single physical location at which business is conducted or where services or industrial operations are performed

Climate is another major factor that may influence pesticide use patterns in all three counties. The climate is milder in San Diego and Orange County than in Sacramento County. All three counties have a Mediterranean climate, with warm dry summers and cool rainy winters. According to the National Weather Service, seasonal mean temperatures for Sacramento and San Diego, California are the following:

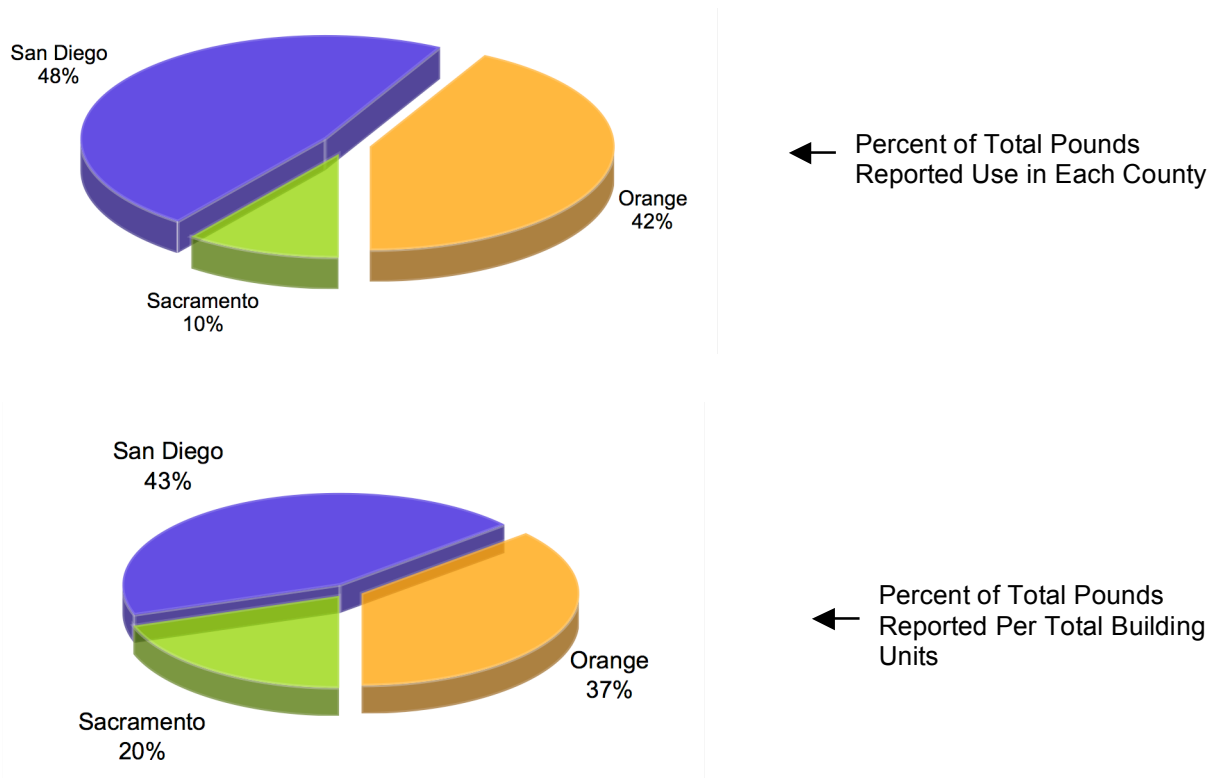
	Sacramento, °F	San Diego, °F
Summer	74	72
Fall	63	67
Winter	47	58
Spring	65	64

<http://www.cpc.ncep.noaa.gov/products/predictions/90day>

This difference in climate impacts the type and density of pests found in the watersheds studied. For example, drywood termites and whiteflies are more prevalent in southern California than in northern California.

Figure 4.5 demonstrates how the relative use of pesticides changes when the ratio [lbs of active ingredient : number of building units, Figure 4.4] is calculated for all three counties. When building unit density is accounted for, the proportional use of pesticides in Sacramento County increases but is still lower than use in San Diego or Orange County. This ratio is used throughout this report to compare pesticide use among counties.

Figure 4.5 Proportion of Total Reported Non-Agricultural Pesticide Use in Three Counties, 2003



5. Pesticide Use Trends and Information Sources for Groups that Report Pesticide Use

5.1 Structural Pest Control

Non-fumigant Pesticide Use Trends³²

Overall, more pesticides are used in San Diego and Orange Counties for structural pest control than in Sacramento County. According to the 2003 PUR data, San Diego and Orange Counties applied a large percentage, 12% and 14% respectively, of the total non-fumigant insecticides applied in California; Sacramento County only represented 2% of the total use in California. Figure 5.1 shows that since 2000, non-fumigant insecticide use in San Diego and Orange Counties has remained above 150,000 lbs of active ingredient (with the exception of San Diego in 2001). Non-fumigant insecticide use in Sacramento County has remained below 60,000 lbs of active ingredient since 2000.

Figure 5.1 Non-fumigant Insecticide use Trends (2000-2003)

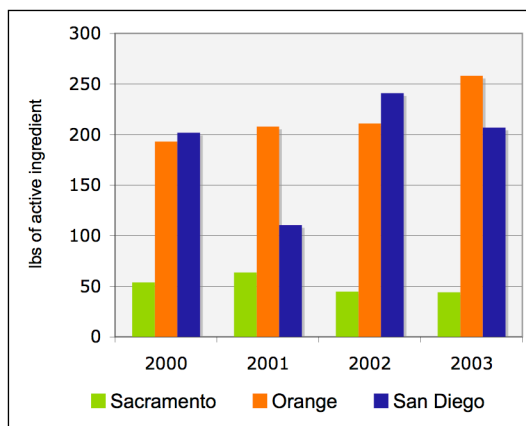
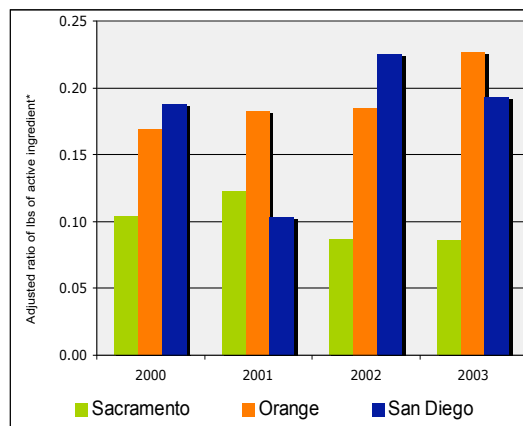


Figure 5.2 Non-fumigant Insecticide use Trends, Adjusted for Building Density



When adjusted for building density³³, non-fumigant insecticide use in Sacramento is closer to the amounts that were applied in San Diego and Orange Counties. Figure 5.2 shows that in 2001, non-fumigant insecticide use in Sacramento County exceeded use in San Diego County. Since 2001, use has decreased slightly in Sacramento County and use in San Diego and Orange Counties has increased.

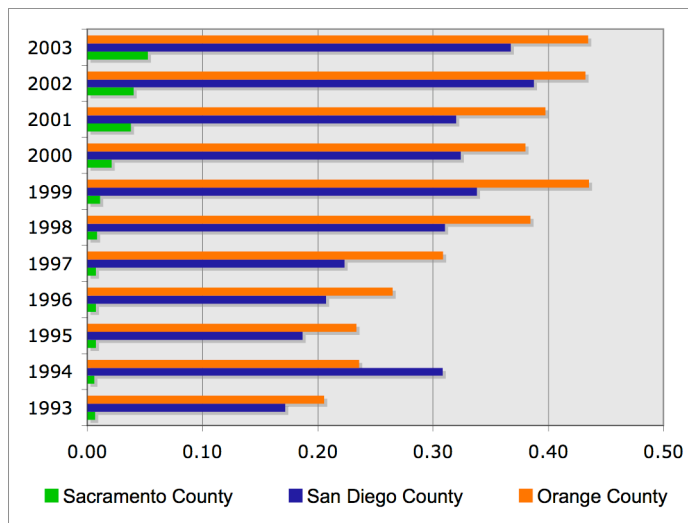
³² Fumigants have been removed from this analysis because they are applied at a much higher rate than liquid or granular insecticides.

³³ Building density adjustment = pounds of active ingredient / (number of housing units + private nonfarm establishments with paid employees).

Fumigant use

Fumigants are applied to control wood destroying insects in structures. Figure 5.3 shows that since 1995, Orange County has consistently used more fumigants than San Diego and Sacramento counties and fumigant use in all three counties has increased since 1993.

Figure 5.3 Fumigant use trends, adjusted for building density

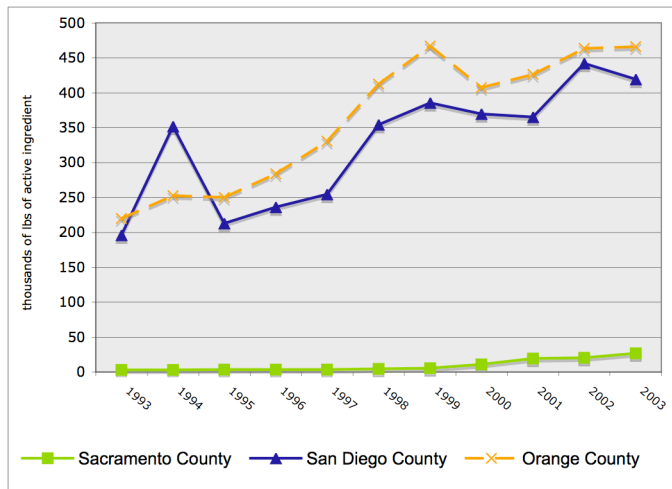


Currently, the most frequently used fumigant in California is sulfuryl fluoride (Vikane®). In the past, methyl bromide was one of the most common fumigants for structural pest control. Methyl bromide is no longer used for structural pest control and is being phased out for all purposes in California. Fumigants are registered for use at the following urban locations: dwellings (including mobile homes), buildings, construction materials, furnishings (household effects), and vehicles including automobiles, buses, surface ships, rail cars, and recreational vehicles (Dow AgroSciences, 2000).

Sulfuryl fluoride is a federally restricted use pesticide that is marketed as a liquefied gas in pressurized steel cylinders (Kollman, 2004). Sulfuryl fluoride is often applied with a warning agent, the fumigant chloropicrin. Chloropicrin causes smarting of the eyes, tears, and discomfort, and has a very disagreeable pungent odor at very low concentrations (Dow AgroSciences, 2000). Sulfuryl fluoride is registered for use to control the following pests: drywood termites, Formosan termites, powder post beetles, death watch beetles, old house borers, bed bugs, cockroaches, clothes moths, rodents (rat and mice), larvae and adult carpet beetles, and oriental, American, and brown-banded cockroaches (Dow AgroSciences, 2000).

Because it is applied at very high rates, sulfuryl fluoride has the highest use of any other pesticide, including agricultural use pesticides in many counties in California. In 2002, 3,044,000 lbs of sulfuryl fluoride were applied for structural pest control in California (Kollman, 2004). Figure 5.4 shows that since 1993, the use of sulfuryl fluoride has been increasing in Sacramento, San Diego, and Orange Counties. Use of this fumigant in California has consistently been higher in San Diego and Orange Counties than in Sacramento County. There are two reasons why the southern counties may use more fumigants: 1) drywood termites are a more severe problem in southern California due to the mild climate, 2) there are more homes and commercial buildings to fumigate in San Diego and Orange Counties than in Sacramento County.

Figure 5.4 Sulfuryl Fluoride Use Trends (1993-2003)



Non-fumigant Insecticide Use

General pest control and termite companies use a wide range of insecticides to control structural pests. Insecticides used for localized treatments include pyrethroids, organophosphates, imidacloprid, fipronil, liquid nitrogen, and borate baits. In the past, the most prevalent insecticides used were the organophosphate insecticides, diazinon and chlorpyrifos. These insecticides are being phased out in California for structural pest control; as a result, their use has rapidly declined in California since 2000. A number of different pyrethroid insecticides are now replacing organophosphates, including permethrin (Dragnet®), lambda-cyhalothrin (Demand®), β -cyfluthrin (Tempo®), bifenthrin (Talstar®), cypermethrin (Demon®), and deltamethrin (Suspend®) (Moran, 2003). Since 2000, two other insecticides have become available to pest control companies for the control of termites and ants, imidacloprid (Premise®) and fipronil (Termidor® and Maxforce®). Borate products are also commonly used under structural pest control. These products (which may be formulated as baits, dusts, or liquids) can highly be highly effective against ants, cockroaches, and wood borers and are considered a “reduced risk” insecticide in urban settings (Rust et al., 2004). The most common borate insecticide products include the following active ingredients: anhydrous borax, boric acid, and disodium octaborate tetrahydrate.

In the summer of 2004, a survey was conducted with structural pest control companies in Sacramento County. Twenty-three SPCOs responded to this survey. The SPCOs surveyed were asked to list the top three insecticides they use for structural pest control (Table 5.1). The following are their responses:

Table 0.1 SPCO Survey Summary

Insecticide	Number of respondents who said they use this product	
Termidor®	Fipronil	12
Suspend®	Deltamethrin	6
Dragnet®	Permethrin	6
Talstar®	Bifenthrin	5
Premise 75®	Imidacloprid	5
Maxforce®	Fipronil	4
Tempo®	Cyfluthrin	3
Demand®	Lambda-cyhalothrin	2
	Malathion	2
Demon®	Cypermethrin	1
Terro®	Sodium tetraborate decahydrate (borax)	1
Contact®	Piperonyl butoxide, pyrethrins, petroleum distillates	1

According to the PUR database, similar pesticides are popular for all SPCOs who report pesticide use in Sacramento, San Diego, and Orange County (Table 5.2).

Table 5.2 The Top Ten Non-fumigant Insecticides Reported Used for Structural Pest Control in 2003

Sacramento County			San Diego County		Orange County	
	<i>Chemical</i>	<i>Lbs of a.i.</i>	<i>Chemical</i>	<i>Lbs of a.i.</i>	<i>Chemical</i>	<i>Lbs of a.i.</i>
1	Cypermethrin	18,924	Disodium Octaborate Tetrahydrate	71,419	Disodium Octaborate Tetrahydrate	83,361
2	Diazinon	5,162	Cypermethrin	33,461	Permethrin	73,145
3	Chlorpyrifos	3,813	Nitrogen, Liquefied	25,380	Nitrogen, Liquefied	49,708
4	Permethrin	3,424	Permethrin	24,636	Boric Acid	10,400
5	Cyfluthrin	2,104	Diazinon	16,362	Fipronil	9,932
6	Disodium Octaborate Tetrahydrate	1,984	Boric Acid	8,398	Imidacloprid	6,478
7	Malathion	1,586	Limonene	6,012	Chlorpyrifos	4,365
8	Boric Acid	1,582	Chlorpyrifos	5,710	Cypermethrin	4,247
9	Fipronil	1,210	Bifenthrin	3,501	Diazinon	3,559
10	Bifenthrin	1,164	Fipronil	3,383	Potash Soap	2,799

A number of the insecticides that are ranked highest in use intensity contain active ingredients that are relatively nontoxic (Table 5.2). For example, in 2003 disodium octaborate tetrahydrate was ranked number one in San Diego and Orange Counties for pounds of active ingredient applied under structural pest control. One respondent from the survey conducted with structural pest control companies in Sacramento County said that they frequently use the borax based bait, Terro® (Table 5.1).

Although the more toxic organophosphates are being phased out, they are still widely used by licensed professionals. In 2003, diazinon had the 2nd highest reported use (lbs of active ingredient) of any other non-fumigant insecticide applied under structural pest control in Sacramento County (Table 5.2). Two respondents from phone survey conducted with structural pest control companies in Sacramento said that they frequently use the organophosphate, malathion (Table 5.1).

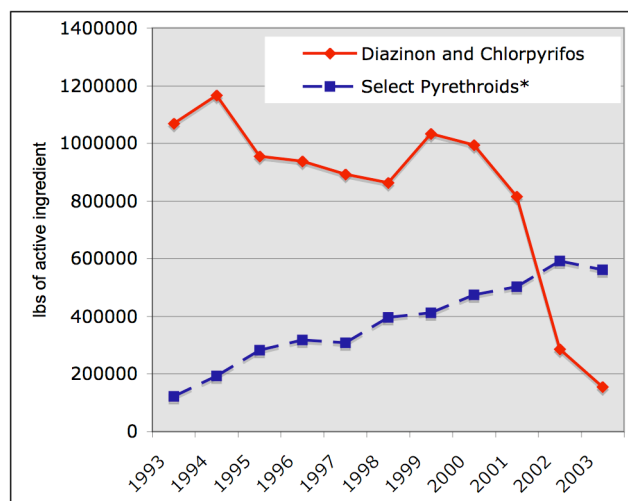
The most recent PUR data (Table 5.2) and survey data (Table 5.1) indicate that pyrethroids are one of the most frequently used insecticides for structural pest control. In 2003, the use of the pyrethroid, cypermethrin, in Sacramento County exceeded all other non-fumigant insecticides used. The use of cypermethrin (19,000 lbs of active ingredient) was over three times as much as diazinon (5,000 lbs of active ingredient) in this county.

Diazinon and Chlorpyrifos versus Select Pyrethroids³⁴: How Pesticide Use for Structural Pest Control is Changing in California

Total Use in California

Figure 5.5 shows that the use of diazinon and chlorpyrifos for structural pest control in California has been rapidly decreasing since 2000, with the largest decrease in use between 2001 and 2002. These pesticide products are very effective against urban pests; however, government regulations and concerns over water quality have caused some PCOs to choose alternative insecticide products.

Figure 5.5 Diazinon, chlorpyrifos and select pyrethroid use trends for structural use in California

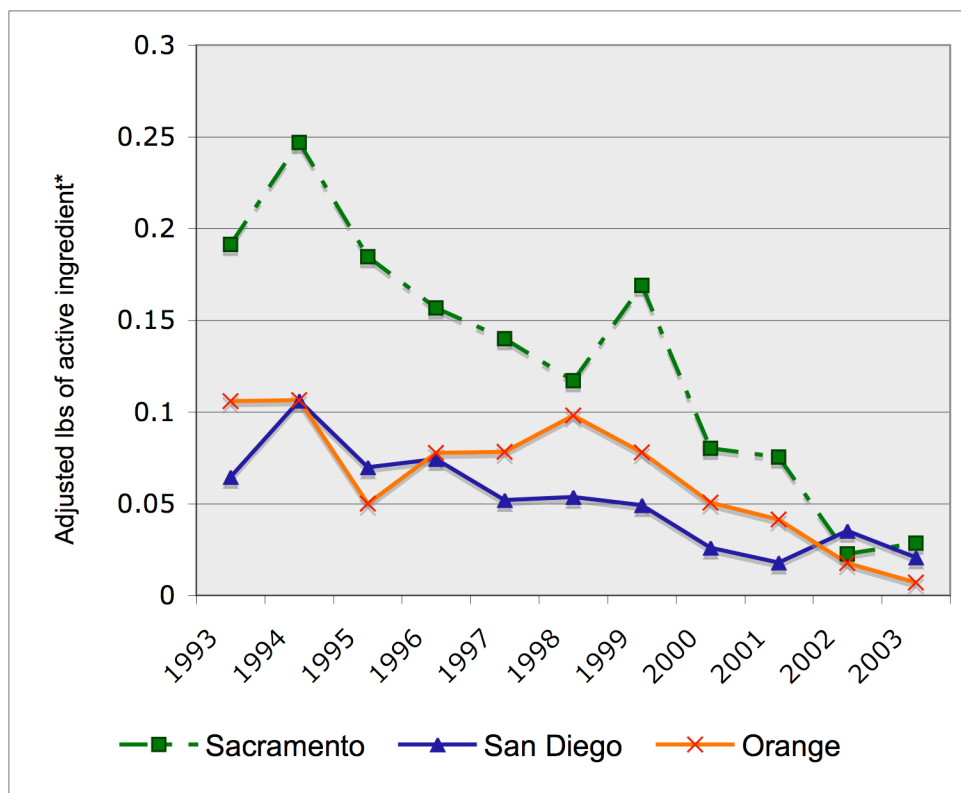


³⁴ Select pyrethroids are used throughout this analysis. They include: permethrin, bifenthrin, lambda- cyhalothrin, cyfluthrin, cypermethrin, and deltamethrin.

As restrictions have been placed on diazinon and chlorpyrifos, pesticide applicators have mainly replaced organophosphates with pyrethroids. Figure 5.5 also shows that the use of pyrethroids has been steadily increasing since 1993. In 2002, the use of pyrethroids exceeded the use of diazinon and chlorpyrifos.

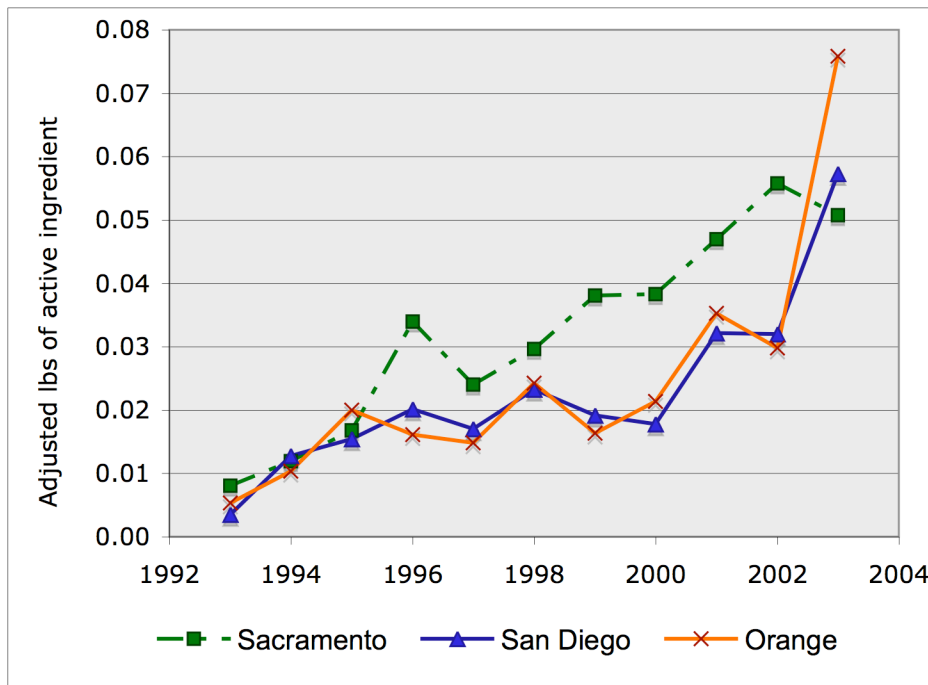
PUR data indicates that this insecticide replacement trend is similar for Sacramento, San Diego, and Orange Counties. Figure 5.6 shows that the use of diazinon and chlorpyrifos has been steadily declining since 1993. Unlike the diazinon and chlorpyrifos use trends for the entire state of California, use of these two insecticides did not sharply decline after 2001. In fact, diazinon and chlorpyrifos use in San Diego County slightly increased between 2001 and 2002. Adjusting for building density, since 1993 Sacramento County has had the highest use of diazinon and chlorpyrifos. In 2002, the use of these insecticides in Sacramento County declined rapidly and the latest PUR data (2003) indicates that use is similar to San Diego and Orange Counties.

Figure 5.6 Diazinon and Chlorpyrifos Use Trends, Adjusted for Building Density



Similar to statewide trends, the use of select pyrethroids in Sacramento, San Diego, and Orange counties has been steadily increasing since 1993 (Figure 5.7). From 1993 to 1995, pyrethroid use among these three counties followed the same trend but from 1995 to 2002, pyrethroid use in Sacramento County was higher than San Diego and Orange Counties. In 2003, the use of pyrethroids in San Diego and Orange counties exceeded the use in Sacramento County.

Figure 5.7 Select Pyrethroid Use Trends, Adjusted for Building Density



Figures 5.8 and 5.9 compare the number of diazinon and chlorpyrifos applications with the number of pyrethroid applications made in San Diego and Orange counties.³⁵ Figure 5.8 shows that in San Diego County, the number of pyrethroid applications exceeded diazinon and chlorpyrifos applications in 1999. Since 1999, pyrethroid applications have greatly increased, while diazinon applications have slowly declined. Figure 5.9 shows that the number of pyrethroid applications exceeded diazinon and chlorpyrifos in Orange County also in 1999. The rate of increase in the number of pyrethroid applications is slightly less than in San Diego County. However, the rate of decrease of diazinon and chlorpyrifos applications was greater in Orange County than in San Diego County.

Figure 5.8 The number of select pyrethroid applications compared with the number of diazinon and chlorpyrifos applications made each year in San Diego County

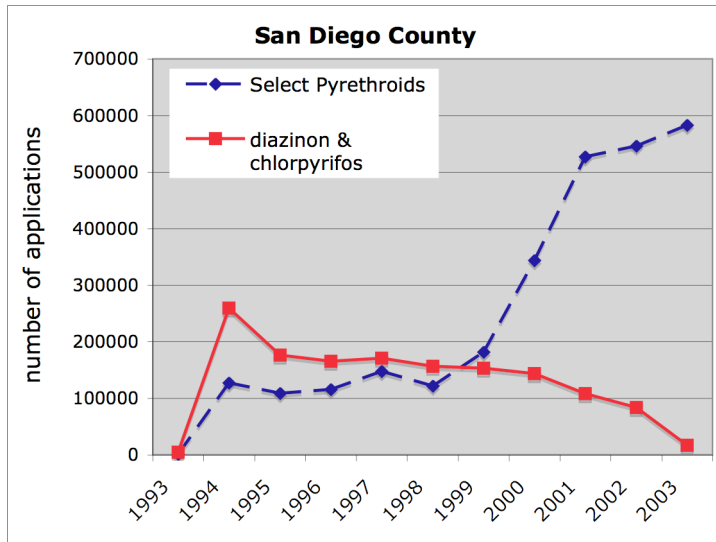
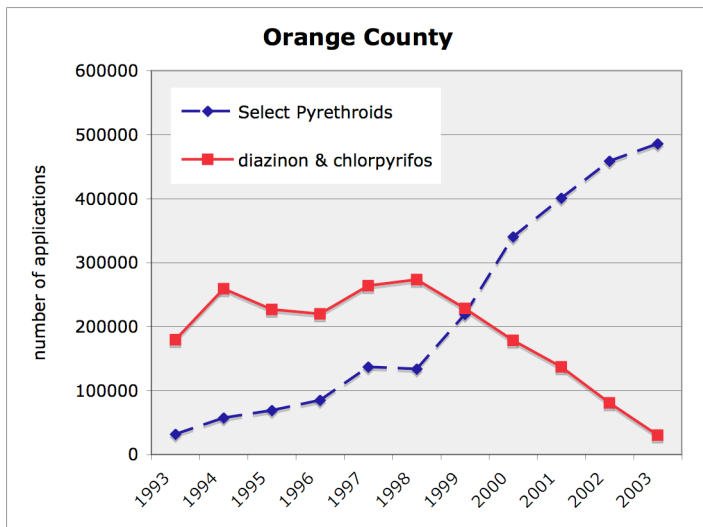


Figure 5.9 The number of select pyrethroid applications compared with the number of diazinon and chlorpyrifos applications made each year in Orange County



³⁵ Data about the number of applications made in Sacramento County is not available.

Pyrethroid Use Trends

The PUR data shows that pyrethroid use in Sacramento, San Diego, and Orange Counties is increasing. To further examine this trend, select pyrethroids were examined to determine what pyrethroid products show the highest use in each county. Figure 5.10 shows that cypermethrin is the leading pyrethroid used in Sacramento County.

Figure 5.10 Use Trends of Specific Pyrethroids in Sacramento County

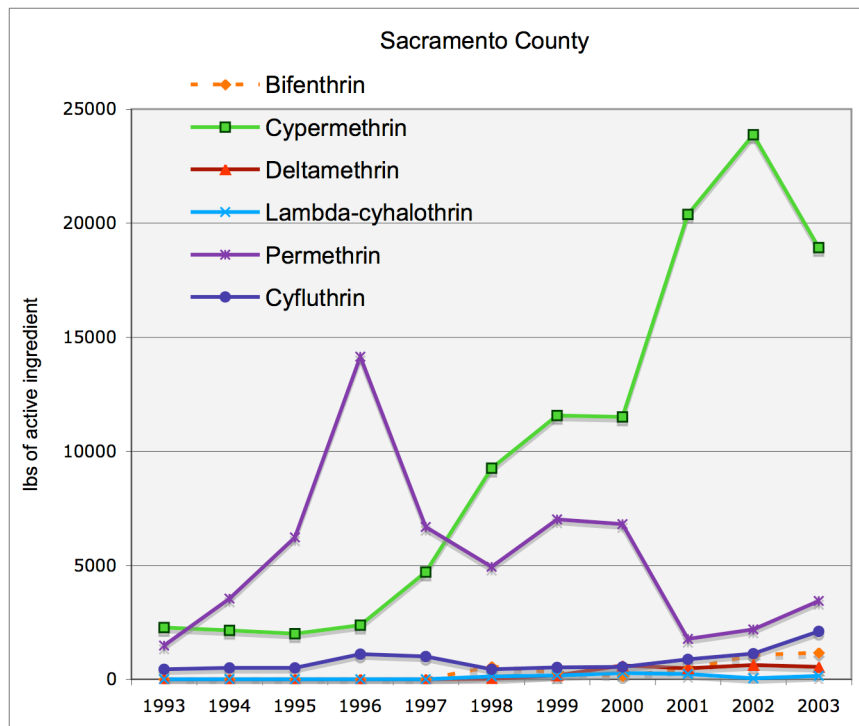
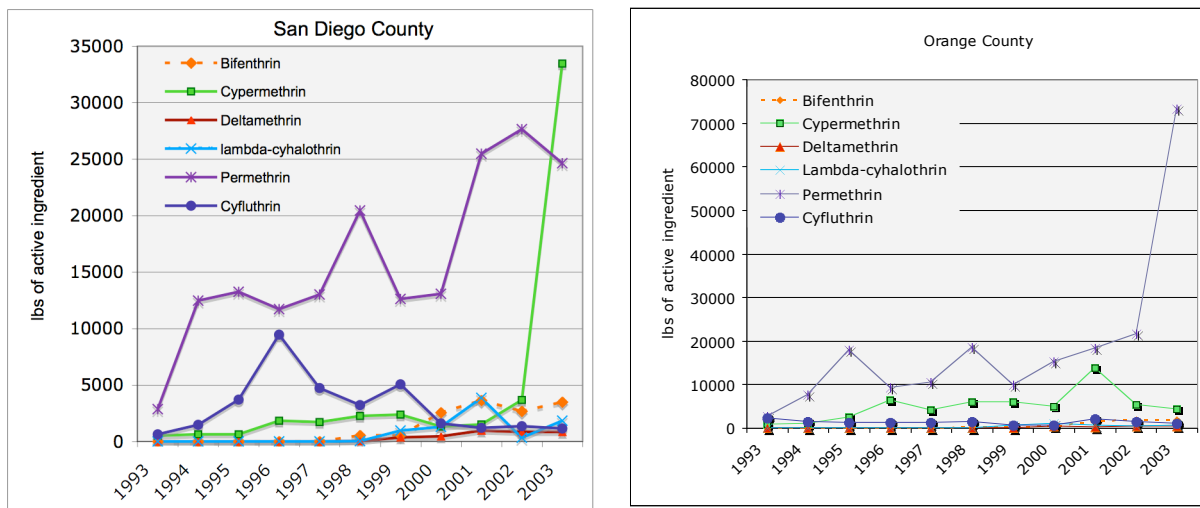


Figure 5.11 shows that the use of specific pyrethroid insecticides is different in San Diego and Orange counties. Permethrin consistently had the highest use of any pyrethroid in San Diego and Orange counties. Cyfluthrin use has decreased in San Diego County since 1996. The use of cypermethrin increased dramatically in 2003 in San Diego County, exceeding the use of permethrin. The use of all other pyrethroid products has remained below 5,000 pounds of active ingredient per year since 1993. Cypermethrin has had the second highest use of any pyrethroid product in Orange County since 1995. The use of all other pyrethroid products has remained well below 10,000 pounds of active ingredient per year since 1993.

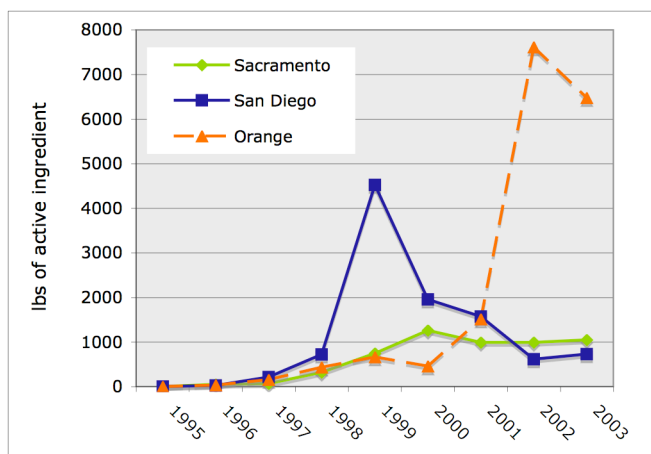
Figure 5.11 Use Trends of Specific Pyrethroids in San Diego and Orange County



Imidacloprid

Imidacloprid use for structural pest control is relatively small compared to the use of organophosphates or pyrethroid insecticides. One of the most popular imidacloprid products for structural pest control is Premise 75®. Five out of 23 pest control companies in Sacramento said that Premise 75® is one of the most popular insecticides they use to control ants and termites. The use of this insecticide has been rising since 1995, especially in Orange County (Figure 5.12).

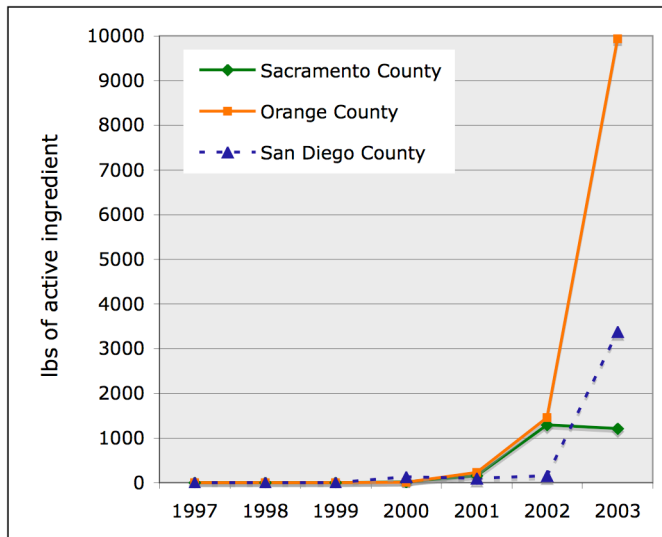
Figure 5.12 Imidacloprid Use Trends (1995-2003)



Fipronil

The insecticide product, Termidor® with the active ingredient fipronil, is one of the most popular insecticides used by structural pest control companies. Over half (12) of the respondents to the pest control company phone survey said that Termidor® is one of insecticides they most frequently use. Figure 5.13 shows that since 2001 the use of fipronil has increased in all three counties and has dramatically increased in Orange County.

Figure 5.13 Fipronil Use Trends (1997- 2003)



Disposal Practices of Structural Pest Control Operators

A survey conducted with 23 pest control companies in Sacramento indicates that most pest control companies follow pesticide label instructions and county guidelines. The disposal questions are included in the survey of SPCOs (Appendix D). A survey with ten pest control companies at the Target Specialty Products' seminar (Appendix E) also indicated that most pest control companies appropriately dispose of pesticides and participants gave the following responses to two disposal questions.

Question: How are the remaining pesticides disposed of?

Answers:

- We haul to the county dump
- Very compliant- disposed in Roseville
- Very compliant
- Inventory until containers are recycled for other uses
- Users check off the pesticide containers that are empty from a list. The Ag inspector makes sure that they are disposed of properly.
- Follow county recycle and disposal procedures

Question: If you have a spray tank, where is it rinsed out and what is done with the rinse water?

Answers:

- Containers are triple rinsed and water is recycled
- Water is recycled
- Re-use the water

Structural Pest Control Pesticide Information Sources

Structural pest control operators (SPCOs) acquire information about pesticides and other pest management practices from a variety of sources. The majority of pest control companies are dependent on the use of insecticides to control pests and this dependence on insecticides dictates the type of information they seek and who delivers it. As a result, most of the information SPCOs use comes from pesticide distributors and manufacturers. Pesticide distributors and manufactures communicate with their customer base through personal communication, literature, websites, and seminars/ meetings. It is important to examine the quality of information pesticide distributors and manufactures produce for SPCOs. Structural pest control operators also receive information that is independent from pesticide distributors and manufacturers, these sources include trade magazines, continuing education classes, regulatory agencies, professional associations, and seminars sponsored by research institutions.

There is currently little demand for additional educational materials from PCOs (Paulsen, 2003). This group prefers training and educational outreach activities that are convenient (must not conflict with work schedules) and inexpensive. At present, SPCOs get much of their information from the pesticide distributors Univar and Target Specialty Products. Univar offers convenient online courses for continuing education credits (www.pestweb.com).

The following three surveys were conducted to better determine where PCOs get information about pesticides and IPM:

Ten representatives from pest control companies at the Target Specialty Products' seminar were surveyed about where they get information about pesticides and IPM. The following are the questions and answers from this survey:

Question: Where do you get information about which pesticides to use?

Answer (includes percentage of responses):

- Seminars (40%)
- MSDS booklet (10%)
- Information mailed to the office (20%)
- Classes sponsored by the Department of Agriculture (10%)
- Information mailed to the office from the Target company (10%)
- A target representative at Clark Pest Control (10%)
- Target seminars (10%)
- Sales representatives (10%)

Question: Where do you get information about pest management practices such as pest identification, pesticide application rates, and the timing of applications?

Answers:

- Univar representative
- Seminars
- The PST book series
- UC IPM materials (book: Pests of Trees and Shrubs)
- The company IPM course
- Educational materials from Clark Pest Control Company
- UC Cooperative Extension
- PAPA seminars
- PCOC

A web-based survey was sent to the University of California Cooperative Extension (UCCE) specialists and advisors who are experts in urban pest control. Seventeen people responded to this survey. The survey asked the following question: How do SPCOs obtain information about pesticides and IPM?

Answers:

- | | |
|---|--|
| <ul style="list-style-type: none">• Workshops and training seminars• Trade magazines• Salesmen• In-house training• Pesticide dealer trainings• Internet• Correspondence courses | <ul style="list-style-type: none">• Private consultants• Regulators• Representatives of pest control manufactures• Studying for the field representative or operator's exam |
|---|--|

This survey also asked the respondents to rate the availability of reliable educational resources about pesticides and integrated pest management directed towards SPCOs. Five people responded to this question with three rating the availability as good, one as fair, and one as poor (the choices were excellent, good, fair, and poor).

A phone survey was conducted with 23 pest control companies to obtain information about where structural pest control companies get information about pesticides and IPM (Table 5.3)

Table 5.3 Top Ten Places Where Structural Pest Control Companies get Information about Pesticides and IPM

	Percent who gave this response ^a
1 Representatives from pesticide manufacturers and distributors (e.g. Target Specialty Products, Univar, and Syngenta)	74%
2 Trade Magazines (e.g. Pest Control Technology)	52%
3 Internet Resources (e.g. PestWeb®)	52%
4 Workshops, meetings, and training seminars	17%
5 Continuing education classes	17%
6 The pesticide label	17%
7 Technical handbooks (e.g. Handbook of Malice)	13%
8 Past experience using pesticides/ trial and error	13%
9 Professional organizations	9%
10 Word-of-mouth	9%

a. The percent of structural pest control companies interviewed in Sacramento County who gave this response; many of those interviewed gave multiple responses.

A Review of Some of the Most Popular Sources of Information

Internet- According to an industry estimate in 2002, 85% of the pest management professionals/businesses in the U.S. use the Internet (Porter, 2003). PCOs can obtain information about pest identification and pest management tactics from a variety of sources on the internet including chemical distributor, pesticide manufacturer, and university based websites.

PestWeb®- Univar, a leading chemical distributor in the United States, hosts one of the websites most frequently visited by PCOs, PestWeb® (www.pestweb.org). The PestWeb® website states, “PestWeb® is a professional pest control industry website, dedicated to providing useful information to PCOs, product manufacturers, suppliers and distributors, industry service organizations, Pest Control Associations, and others involved in the pest control industry (Univar, 2004).” PestWeb® contains the following services:

- Online equipment and pesticide catalog
- Product document and information database
- Online courses
- Ask Mr. Pest Control
- Hot products and promotions
- Pest control news
- Industry events
- Pest ID
- Weed ID
- Product information
- Manufacturer’s links
- General pest information
- Associations and Government links
- Business tools
- Classified Ads
- Tip of the week
- Monthly newsletter

Continuing education activities- The Structural Pest Control Board (SPCB) of California offers a list of approved continuing education activities on their website (www.pestboard.ca.gov/educate.htm). PCOs can refer to this information to choose courses/activities to take in order to maintain or obtain their Branch licenses. The majority of continuing education activities are sponsored by large pest control companies (ex. Orkin), pesticide distributors (mainly Univar), and pesticide manufacturers (ex. Bayer). Universities, public agencies, and professional organizations also sponsor some continuing education activities. These sample course titles include but are not limited to the following:

- Pest Identification and Biology
- Pesticides and Safety
- Numerous activities that focus on the control of one specific pest such as ants.
- Pesticide Storage, Transport, and Disposal
- Hazardous Materials Training and Fumigation
- Pest Control and Public Relations
- Safe Driving for Pest Control Technicians
- Mandatory Rules and Regulations
- Structural Pest Control Board Policies
- Residential, Industrial, and Institutional Pest Control
- Spill Control and Cleanup
- Respirator Safety
- Various courses on specific insecticides such as Demond CS Insecticide
- Warehouse and Food Processing Pest Control
- Materials and Equipment
- Basic Sales Strategies
- District meetings
- PAPA seminar

This list, available on SPCB's website (www.pestboard.ca.gov), contained 65 pages of activities for continuing education credits. Of these activities, the following focused on IPM training:

- Advanced Level Urban and Industrial Integrated Pest Management- Branch 2 sponsored by Purdue University.
- Developing and Implementing an IPM Program sponsored by Drescher and Associates
- IPM Workshop- Preventive Flea Management sponsored by Dewey Pest Control
- IPM: Principals of Trapping and Baiting sponsored by Fume A Pest and Termite Control
- IPM and Baiting for Control of Ants and Roaches
- Ground Termite IPM and General Pest Baits sponsored by Univar
- IPM Sanitation Report Writing sponsored by Western Exterminator
- Integrated Pest Management sponsored by Western Exterminator
- Putting IPM into Practice sponsored by the Bio-Integral Resource Center
- Organic Pest Control sponsored by Western Exterminator Co.
- Integrated Pest Management sponsored by Univar
- IPM for Ant Control sponsored by Whitmire Micro-Glen
- School IPM Symposium sponsored by Sacramento Co. Ag Comm./ CDPR
- IPM for Public Agencies Conference sponsored by UC Statewide IPM Program
- SPCA, IPM Protocols for Residential and Commercial Accounts sponsored by Dewey Pest Control.
- Second School and Urban IPM Ecologists sponsored by the Association of Applied IPM Ecologists
- Urban IPM Plus sponsored by the Association of Applied IPM Ecologists

- IPM in Zoos sponsored by the Association of Applied IPM Ecologists
- Putting Integrated Pest Management into Practice sponsored by Brandenburg and Associates

This lists shows that there are courses available for SPCOs about IPM. However, we have no data on how readily available these activities are and how often structural pest control companies attend these activities.

IPM Certification Programs- Some individuals suggested that implementation of IPM by SPCOs would be enhanced by IPM certification programs. In IPM certification programs, SPCOs receive special training and go through a certification process that allows them to market their services as “IPM” or environmentally friendly. There is an IPM certification program being developed in the Bay Area by Brandenburg and Associates (Brandenburg, 2004). This could serve as potential model for the rest of the state for implementing IPM certification programs. IPM Certification Programs that are currently implemented in the United States are the following:

- 1) Arizona Structural Pest Control Commission
- 2) New England Pest Management Association IPM Registry
- 3) Washington State University IPM Certification Program
- 4) Massachusetts Department of Food and Agriculture’s mandated IPM in all state buildings
- 5) PCOC’s Master Termite Certification
- 6) Dow Chemical’s Commitment to Excellence
- 7) IPM Institute- IPM Star
- 8) National Pest Management Association’s Quality Pro

Pesticide distributors- The most popular pesticide distributors for urban pest control professionals in California include Univar, Target Specialty Products, Whitmire Research, and Hydroscape. The companies offer pest control products and education/ training.

Professional Organizations- There are a number of professional organizations that represent the interests of SPCOs in California. They provide pesticide product information, educational materials about managing structural pests, and information about state regulations and licensing. The most popular professional organizations for SPCOs in California include:

- Pesticide Applicators Professional Association (PAPA)
- Pest Control Operators of California (PCOC)
- Entomological Society of America (ESA)
- National Pest Management Association (NPMA)

Trade Magazines- Some pest control companies seek information from trade magazines. The following are some of the key magazines used by the industry:

- Pest Control Technology
- Pest Control

5.2 Landscape Maintenance

Landscape maintenance encompasses a variety of different services involving management of pests on turf and ornamental plantings. As mentioned in Chapter three, pesticide use is variable, depending on the group who is managing a particular landscape setting. Pesticides are most commonly applied to landscapes at the following sites:

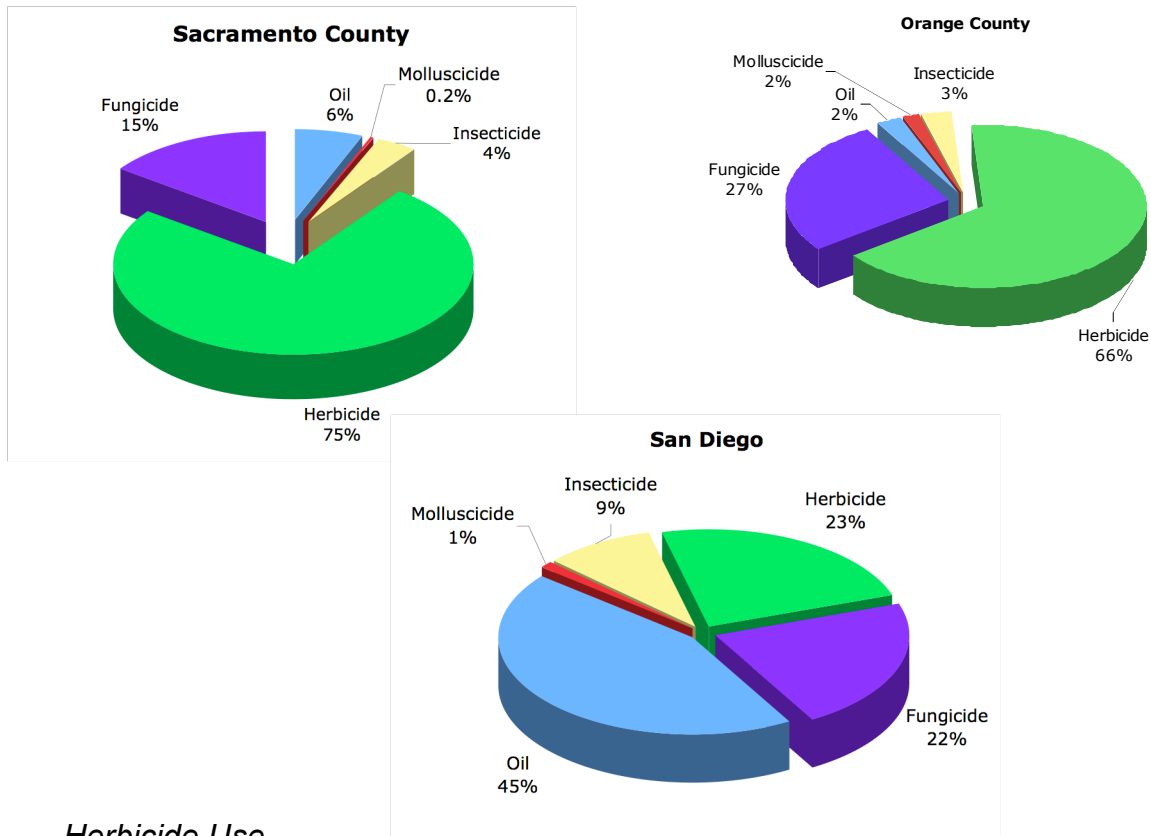
- Residential areas- homes, apartments, condominiums, and planned communities
- Commercial- Office parks and shopping areas
- Public spaces- parks, cemeteries, sports fields
- Schools and other educational institutions
- Other buildings with surrounding landscaping

Pesticide Use Trends of Landscape Pest Professionals

Nationally, large quantities of pesticides are used to maintain turf and ornamentals in urban watersheds. According to a study conducted by Specialty Products, LLC in 2003, nearly \$700 million (manufacturer level dollars) was spent on fungicides, herbicides, insecticides, and plant growth regulators for landscape pest management in the U.S. (Curl, 2004). During this same year, approximately two million pounds of pesticide (active ingredient) were reported in California under landscape maintenance. According to PUR data, in Sacramento, San Diego, and Orange Counties, 55537, 273862, 106584 pounds of active ingredient respectively of pesticides were reported.

Pesticides reported under the landscape maintenance category are used to control weeds, insects and other arthropods, plant diseases, and snails and slugs. The breakdown of what types of pesticides are reported under landscape maintenance varies depending on the year and the county. From 1998 to 2003, herbicides have had the highest pesticide use under landscape maintenance in Sacramento, San Diego, and Orange Counties, with the exception of San Diego County in 2002 when fungicides ranked highest in use and in 2003 when oils ranked highest in use. In 2003, of the total pesticides reported under landscape maintenance, 75% were herbicides in Sacramento County and 66% in Orange County (Figure 5.14). In San Diego County only 23% of the total use was herbicides; instead, oils were the most frequently reported pesticide (45% of the total). This high use of oils in San Diego County in 2003 was atypical. Historically, oil use in San Diego County has been similar to that in Sacramento and Orange counties. The second most frequently used group of pesticides in all three counties was fungicides. Fungicides are mainly applied to control turfgrass diseases. In all three counties, insecticides (other than oils) composed less than 10% of all pesticide use. The graphs and discussion that follows in this section includes only reported pesticide use. As indicated earlier, a substantial portion of pesticides applied by landscape pesticide professionals goes unreported.

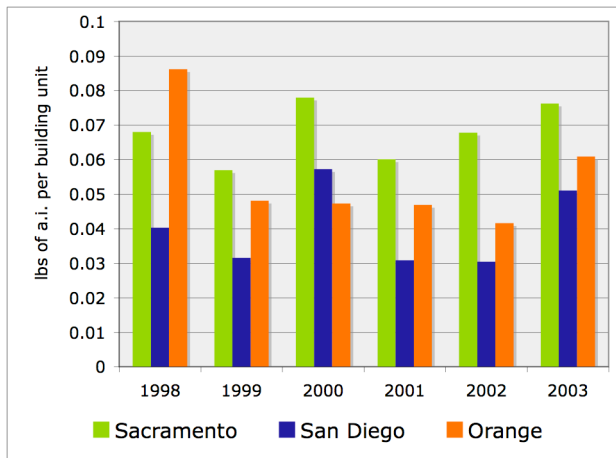
Figure 5.14 Landscape Pesticide Use Breakdown, 2003



Herbicide Use

Historically, herbicides are the most commonly used type of pesticide in the landscape. The use of herbicides in Sacramento, San Diego, and Orange Counties shows no discernable trend. In 2003, 39533, 58356, and 65366 pounds of herbicide (active ingredient) were reported in the PUR database in Sacramento, San Diego, and Orange Counties. Since 1998, the use of herbicides in all three counties has remained consistent (Figure 5.15), with the exception of Orange County in 1998 when there was substantial reported use of glyphosate.

Figure 5.15 Herbicide Use Trends, Adjusted for Building Unit Density



The most frequently used herbicide in all three counties is glyphosate (Table 5.3). Glyphosate is a broad spectrum, post-emergent herbicide with low mammalian toxicity (Toxicity Category III) (Peterson et al., 2001). In general, glyphosate use has remained consistent since 1993, with the exception in 1998 when there was a spike in use in Orange County³⁶ (Figure 5.16). The amount of other herbicides that follow glyphosate varies among these three counties. Herbicide selection depends on the weeds present, the surrounding ornamental landscaping, weed spread and growth, and landscaping budgets.

Figure 5.16 Glyphosate Use

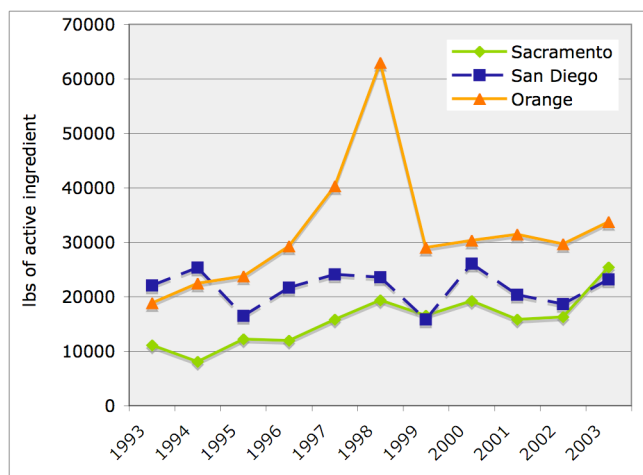


Table 5.3 The Top Five Herbicide Applied under Landscape Maintenance, 2003*

Sacramento County			San Diego County		Orange County			
Rank	Chemical	Lbs of a.i.	Rank	Chemical	Lbs of a.i.	Rank	Chemical	Lbs of a.i.
1.	Glyphosate	25,438	1.	Glyphosate	23,200	1.	Glyphosate	33,762
2.	Oryzalin	2,238	2.	Diuron**	14,785	2.	Prodiamine	13,805
3.	Pendimethalin	2,213	3.	Dichlobenil	4,409	3.	Triclopyr, Butoxyethyl Ester	2,860
4.	MSMA	2,083	4.	Dithiopyr	2,814	4.	Dithiopyr	2,753
5.	Prodiamine	1,978	5.	Oryzalin	2,484	5.	2,4-D	1,966

* Based on the pounds of active ingredient applied, ranked highest to lowest

** According to the PUR records for 2003 one use number is responsible for over 90% of the diuron applied to a landscape in San Diego County. The PUR record is as follows: 5 applications of Du Pont Karmex DF Herbicide, totaling 14,607 lbs of active ingredient and 18,259 lbs of product used. It is unknown the total area this herbicide was applied to.

³⁶ No outliers were found for this year in Orange County. It is unknown where there was such a high use of glyphosate in Orange County during 1998.

Insecticide Use

Insecticides (other than oils) account for only a small percentage of the total amount of pesticides used on landscapes. In 2003, 1934, 22737, and 2929 pounds of insecticide (active ingredient) were reported in the PUR database in Sacramento, San Diego, and Orange Counties respectively. Figure 5.17 shows that when adjusted for building density, total insecticide use in Sacramento County has been decreasing since 2000 and decreasing in Orange County since 1999. Orange County has the lowest reported insecticide use since 2000. Insecticide use in San Diego County does not show a general decreasing trend. While landscape professionals have reduced use of diazinon and chlorpyrifos, it is less clear what insecticides (if any) are being used to replace them in the landscape, unlike the cases for structural pest control.

Figure 5.17 Reported Insecticide Use (does not include oils), Adjusted for Building Density

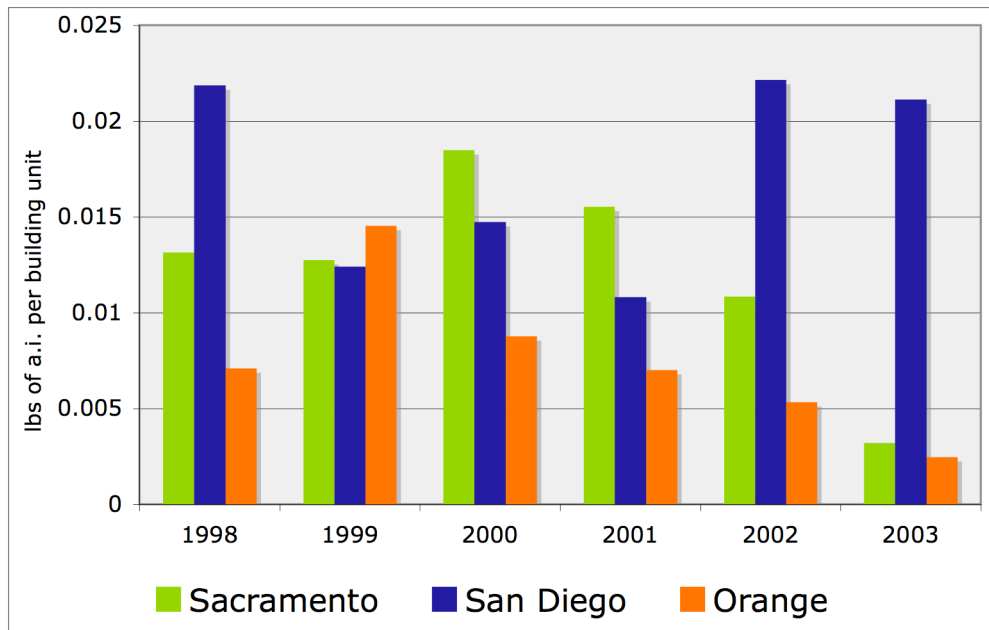


Table 5.4 lists insecticides with the highest reported use in 2003. Imidacloprid was one of the top three insecticides with the highest use in all three counties. A number of organophosphate insecticides including diazinon, chlorpyrifos, malathion, acephate, and oxydemeton- methyl were listed among the top ten insecticides used in all three counties. In Orange County, chlorpyrifos was ranked number one in use followed by diazinon. In Sacramento County, diazinon ranked as the second most highly used insecticide in 2003 (Table 5.4).

Table 5.4 The Top Ten Insecticides Used For Landscape Maintenance (2003)*

Sacramento County		San Diego County		Orange County		
Chemical	Lbs of a.i.	Chemical	Lbs of a.i.	Chemical	Lbs of a.i.	
1	Imidacloprid	600	Disodium Octaborate Tetrahydrate	16,877	Chlorpyrifos	402
2	Diazinon	225	Imidacloprid	1,355	Diazinon	359
3	Malathion	196	Potash Soap	845	Imidacloprid	302
4	Carbaryl	151	Boric Acid	707	Potash Soap	260
5	Permethrin	149	Cyfluthrin	609	Acephate	245
6	Acephate	122	Acephate	526	Bifenthrin	208
7	Chlorpyrifos	49	Chlorpyrifos	401	Permethrin	196
8	Bifenthrin	39	Permethrin	234	Boric Acid	176
9	Polymerized Pinene	30	Diazinon	173	Oxydemeton-methyl	139
10	Cyfluthrin	26	Bifenthrin	159	Limonene	86

* Excluding oils and insect growth regulators

Diazinon and Chlorpyrifos Use

The pesticide use trends of diazinon and chlorpyrifos are similar to the trends described under structural pest control. Even though the latest PUR data indicated that these insecticide products remain popular (Table 5.4), diazinon and chlorpyrifos use has been decreasing in all three counties since 1998 (Figure 5.18). In 2003, diazinon and chlorpyrifos use was below 1,000 lbs of active ingredient for all three counties.

Figure 5.18 Diazinon and Chlorpyrifos Use Trends

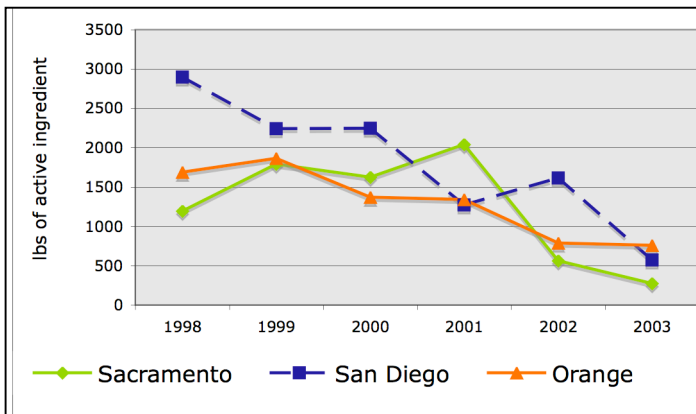
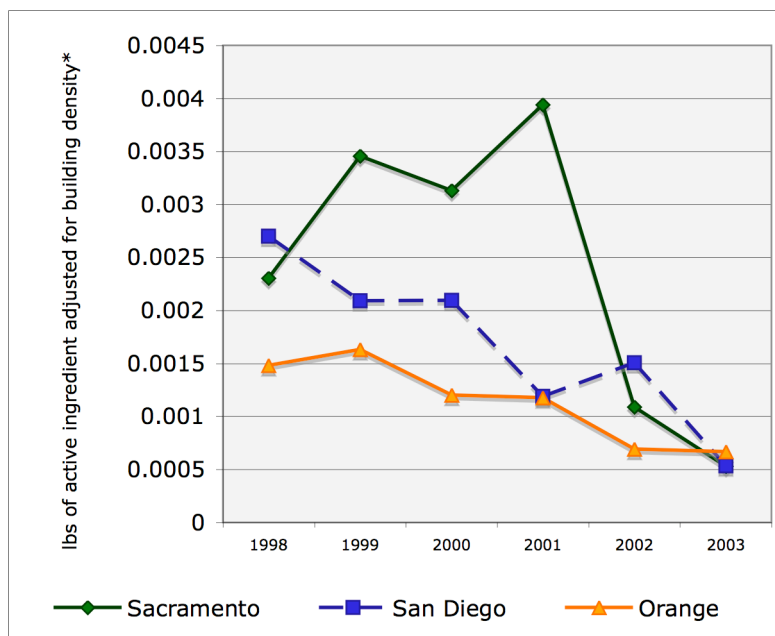


Figure 5.19 indicates that when the PUR data for diazinon and chlorpyrifos is adjusted for building density, there is a decreasing trend in use for all three counties. However, the use in Sacramento County for 1999, 2000, and 2001 was much higher than in San Diego or Orange Counties. In 2003, the use in all three counties was very similar. Unlike diazinon and chlorpyrifos trends for structural pest control, use under landscape maintenance is not as closely correlated.

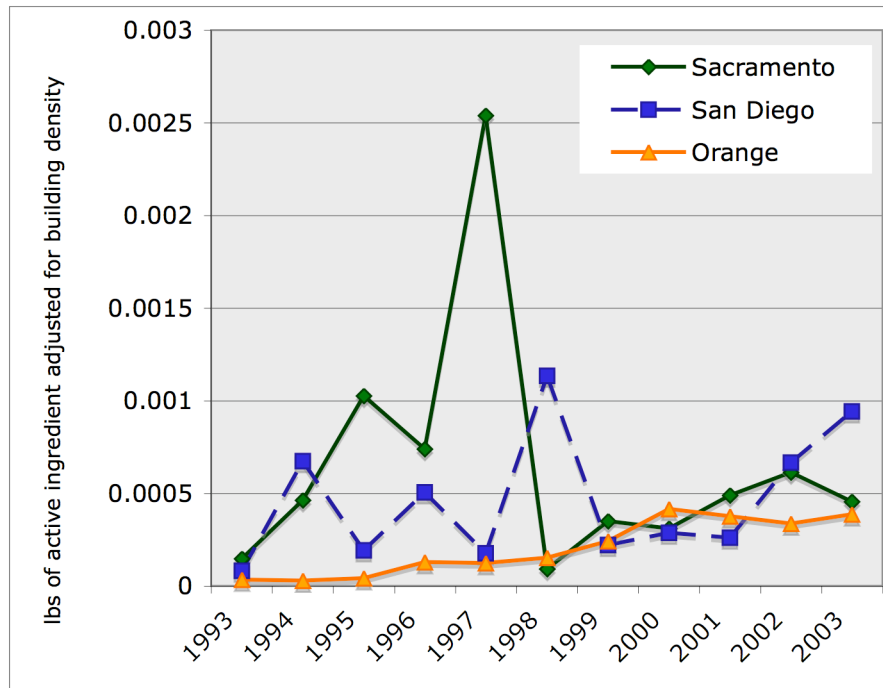
Figure 5.19 Diazinon and Chlorpyrifos Use, Adjusted for Building Density



Pyrethroid Use

According to Figure 5.20, reported pyrethroid use in Sacramento, San Diego, and Orange County has increased slightly since 1993. The use of select pyrethroids³⁷ in Orange County has been steadily increasing since 1993 but pyrethroid use in Sacramento and San Diego County has greatly fluctuated since 1993. Pyrethroid use after 1998 has increased more steadily in all three counties. The pyrethroids, bifenthrin, cyfluthrin, and permethrin have consistently had the highest use of any pyrethroid in all three counties since 1993.

Figure 5.20 Select Pyrethroid Trends, Adjusted for Building Density

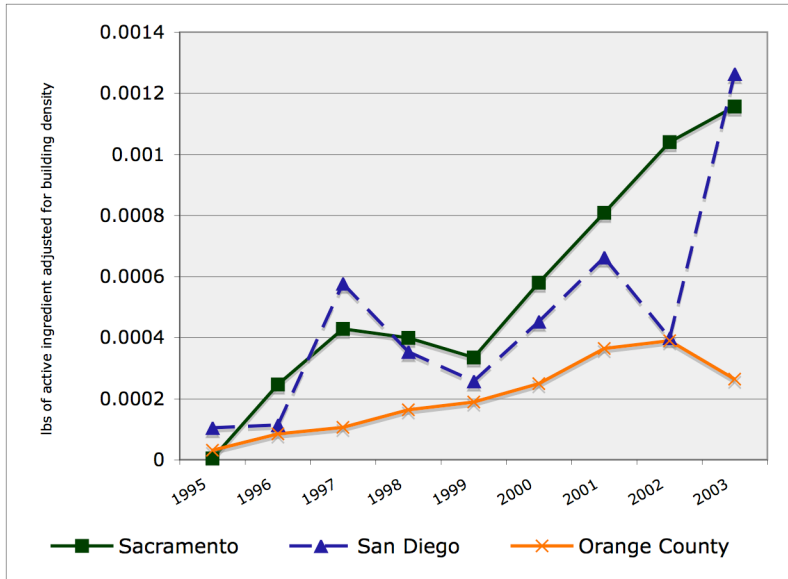


Imidacloprid

In 2003, imidacloprid was one of the insecticides with the highest reported use in Sacramento and San Diego County (Table 5.4). According to Figure 5.21, the use of imidacloprid has been increasing in Sacramento, San Diego, and Orange Counties since 1995. When adjusted for building density, the use in Sacramento and San Diego County has been higher than in Orange County. In 2003, San Diego had the highest use with 1,355 lbs of active ingredient.

³⁷ Select pyrethroids include permethrin, bifenthrin, lambda-cyhalothrin, cyfluthrin, cypermethrin, and deltamethrin.

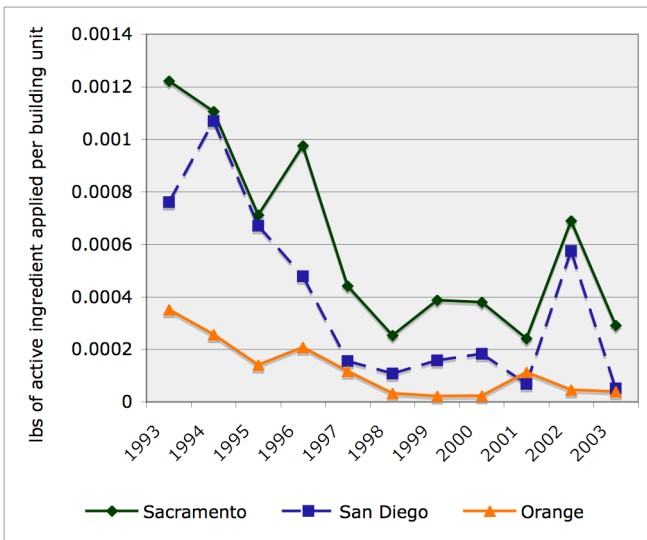
Figure 5.21 Imidacloprid Use, Adjusted for Building Density



Carbaryl

The use of carbaryl in Sacramento, San Diego, and Orange Counties has been decreasing since 1993. Figure 5.22 shows that when adjusted for building unit density, Sacramento had the highest use closely followed by San Diego County. In 2003, carbaryl use in all three counties was below 200 pounds of active ingredient.

Figure 5.22 Carbaryl Use, Adjusted for building unit density



Pesticide Information Sources

Landscape Pest Professionals

Licensed landscape professionals obtain information about pesticides and IPM from a variety of sources. In general, this group is reachable with pest management information because they belong to professional organizations and attend meetings/ seminars to fulfill continuing education requirements. This group also reports pesticide use under the category landscape maintenance.

Professional Landscape Pest Professionals Obtain Information about Pesticides and IPM From the Following Sources:

Trade Magazines
Professional Organizations
Continuing Education Classes
Commercial Contacts/ Sales People
Books and Online Publications
Internet
In-house Training
Univar and Target Specialty Products

Specific Pesticide and IPM Information Sources for Each Group

Public and Private Golf Course Superintendents

In general, there is an abundance of information about pesticides and IPM available for golf course superintendents. We have no data on how many people actually utilize these resources and how applicable this information is for specific pest problems in California. Numerous IPM programs have been developed through university research project that have been funded by the United States Golf Association (USGA) and the Golf Course Superintendents Association of America (GCSAA) but they have not necessarily been conducted in California. According to an article in the trade magazine, *Golf Course Management*, golf course superintendents and other professional turf managers have widely accepted IPM as a working strategy to reduce inputs and advocate environmental responsibility (Turner et al., 2003). However, the majority of UCCE Advisors who responded to our survey stated that the availability of information about pesticides and IPM for golf course superintendents is not that good in California.

According the web-based survey that was sent to UCCE Advisors, golf course superintendents get information from the following sources:

- Professional groups
- Continuing education credit classes
- Commercial contacts/ sales people
- Conferences/ seminars/ trade meetings
- Websites
- Newsletters
- Pesticide vendors
- Peer networks
- UCCE
- UCIPM
- Educational meetings and short courses sponsored by PAPA

This survey also asked Advisors to rate the availability of reliable education resources about pesticides and IPM directed towards golf courses. Of the seven people who responded, one

rated the availability as excellent, two as good, and four as fair (the choices were excellent, good, fair, and poor).

Public and private golf course superintendents also seek information from trade magazines and professional organizations. The following are a few examples:

Trade magazines

- Landscape Management
- Golf Course Management

Professional organizations

- United States Golf Association (USGA)
- Golf Course Superintendents Association of America (GCSAA)
- Golf Range Association of America (GRAA)
- National Golf Course Managers Association

Public and Private Cemetery Grounds Managers

A total of 12 cemetery representatives were interviewed and asked about where they get information about pesticides and IPM. They responded with the following sources:

- Training classes for certification
- Employees at the local hardware store
- Peers who are pest management professionals (PCAs)
- The pesticide label
- Cemetery horticulturalist who advises landscape manager
- General manager of the cemetery

Parks and Recreation Landscape Maintenance Managers

According to Steven Bourke, a landscape maintenance superintendent for the City of Irvine in the San Diego Creek Watershed, many city parks and recreation departments are beginning to contract with landscape pest control companies instead of applying pesticides themselves. This group uses the same sources as most professional pesticide applicators. Landscape maintenance superintendents may also receive information from PCAs, UCCE, and the UC IPM website.

General Professional Landscape Pesticide Applicators and Landscape Maintenance Companies with Landscape Pest Professionals

The survey of UCCE Advisors included the following: How do professional landscape pesticide applicators obtain information about pesticides and IPM? They responded with these sources:

- | | |
|---|-----------------------------------|
| • Trade Magazines | • Homeowners Associations |
| • Professional Organizations | • Books and other publications |
| • Continuing Education Classes | • UCCE |
| • Commercial contacts/ sales people | • Short courses sponsored by PAPA |
| • UC IPM (meetings, short courses, newsletters, and websites) | • Pesticide vendors |
| | • CAPCA |

This survey also asked the Advisors to rate the availability of reliable education resources about pesticides and IPM directed towards landscape maintenance workers. Eight people responded to this question with two rating the availability as excellent, four as good, one as fair, and one as poor (the choices were excellent, good, fair, and poor).

Most landscape pest professionals have a QAL or a QAC license. They obtain a substantial amount of pest management information while preparing for the QAL and QAC license exams. They also get information about pesticides and IPM from fulfilling their continuing education requirements.

5.3 Public Agency Pest Control

Public agency pest control includes those who apply pesticides under the authority of state agencies, the county or city governments. As mentioned in Chapter 3 this includes three groups who report pesticide use: right-of-ways, public health pest control, and regulatory pest control.

5.3.1 Right-of-ways

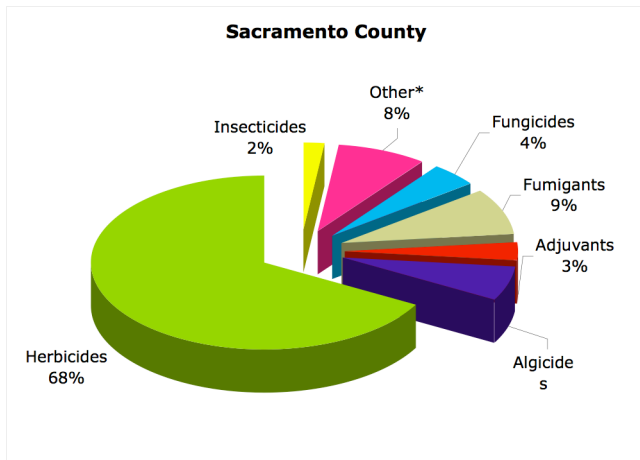
Pesticide Use (PUR Analysis)

Pest control on right-of-ways is conducted by many different groups including Caltrans, county public works departments, city public works departments, private pest control companies that work under contract, and utility companies. Pesticides are applied by these groups to the following sites:

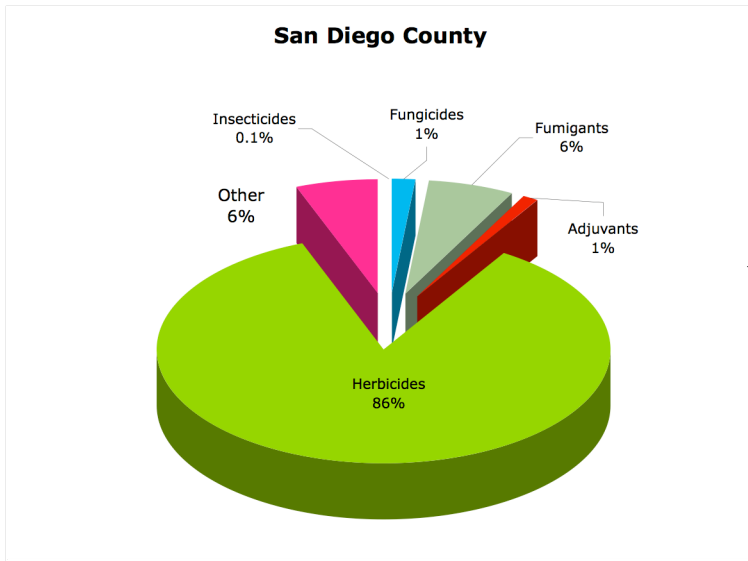
- Federal, state, county, and township highways and roads
- Electric utilities including substations, switching stations, transmission lines, distribution lines
- Pipelines (including pumping stations)
- Public surface drainage ways
- Median strips
- Ditch bands
- Airport runways
- Railroads
- Public irrigation waterways
- Banks of public bargeways and areas around locks and dams
- Parking lots
- Cell phone towers
- Bike trails and other public paths outside of recreational areas
- Flood control sites

According to the Caltrans Maintenance Manual, pesticides are applied to freeways and state highways to ensure visibility for safety, provide fire-risk management, protect pavement surfaces, control noxious weeds, assist in preventing erosion, and for aesthetics (Caltrans, 1998). Pesticide applications are also made to landscape vegetation planted within right-of-ways. These landscape plantings are designed to provide traffic screening, preserve property values of adjacent development, and improve aesthetic values of local communities (Caltrans, 1998). The most recent PUR data (2003) indicates that Sacramento County had the highest pesticide use among the three counties under right of ways with a total of 166,451 pounds of active ingredient (Figure 5.23).

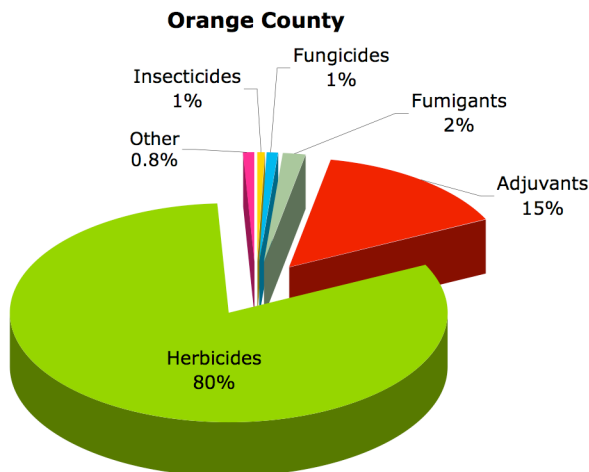
Figure 5.23 Reported Pesticides Used on Right-of-ways in Sacramento, San Diego, and Orange County, 2003



Pounds of Active Ingredient Used	
Herbicides	56825
Fumigants	7259
Other*	7207
Algicides	5313
Fungicides	3805
Adjuvants	2893
Insecticides	1581
TOTAL	84884



Pounds of Active Ingredient Used	
Herbicides	91943
Fumigants	6529
Other*	6345
Fungicides	1599
Adjuvants	1424
Insecticides	137
TOTAL	107977



Pounds of Active Ingredient Used	
Herbicides	58928
Adjuvants	10781
Fumigants	1195
Other*	610
Fungicides	570
Insecticides	434
TOTAL	72518

* Other pesticides includes: oils, rodenticides, molluscicides, wood preservatives, and other pesticide products.

Herbicide Use

In 2003, the majority (over 60%) of the pesticides reported under right-of-ways in Sacramento, San Diego, and Orange Counties were herbicides (Figure 5.23). Herbicides are applied to control vegetation that are blocking visibility, creating a potential fire hazard, or impeding the continuity of utility services. Herbicides may also be used if weeds are damaging road surfaces, railroad ballasts, utility wire poles or supports, and pipelines and pumping stations. Herbicides applied to roadsides may contribute to surface water quality problems; especially highly soluble herbicides such as ammonium sulfate, cacodylic acid, chlorsulfuron, clopyralid, dicamba, diquat, magnesium chloride, methylarsonic acid (MSMA), sethoxydim, tebuthiuron, and triclopyr (Caltrans, 2004).

Table 5.5 lists the top ten herbicides with the highest use (pounds of active ingredient applied) in 2003. Four of the five herbicides listed in Table 5.5 oryzalin, isoxaben, diuron, and glyphosate were examined in an herbicide characterization study by Caltrans during the 2002-03 monitoring season. The objective of this study was to determine whether best management practices currently employed by the Department during herbicide application protected adjacent surface waters from herbicide runoff (Caltrans, 2004). The major findings of this study were that the herbicides were found in runoff for the entire monitoring season. The highest concentration found at the two monitoring stations ranged from 10 µg/ L for glyphosate and diuron to as high as 200 µg/ L for oryzalin (Caltrans, 2004). They also stated that herbicide runoff is highly dependent on highway configurations and that in order to reduce herbicide runoff concentration in receiving water bodies, roads should be designed with a convex configuration with a berm and a long vegetative slope (Caltrans, 2004).

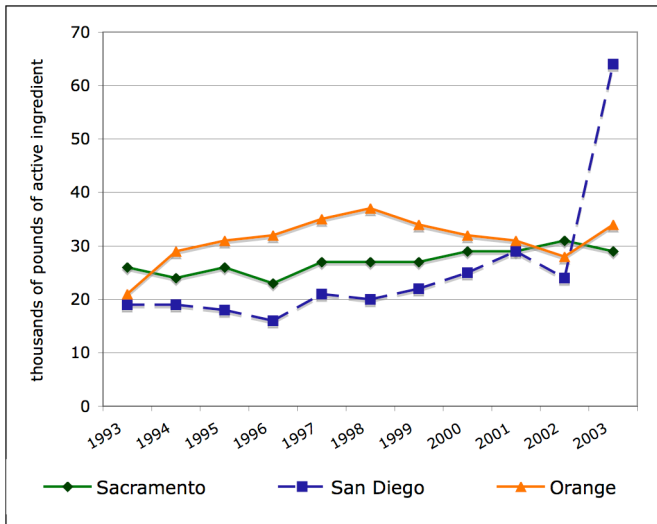
In 2003, the two most frequently applied herbicides in all three counties were glyphosate and diuron (Table 5.5). According to Figure 5.24, from 1993 until 2002 glyphosate use was the highest in Sacramento County; however, glyphosate use in this county has been decreasing since 1997. Glyphosate use in San Diego and Orange Counties has slightly increased since 1993. Diuron use remained between 15 and 35 thousand pounds of active ingredient (with the exception of San Diego County in 2003) between 1993-2002. In 2003, there was an unexplainable spike in the amount of diuron applied in San Diego County (Figure 5.25)

Table 5.5 Top Ten Herbicides With the Highest use for Right-of-ways, 2003

Sacramento County*			San Diego County		Orange County	
	Chemical	Lbs of a.i.	Chemical	Lbs of a.i.	Chemical	Lbs of a.i.
1	Glyphosate	28,803	Glyphosate	63,557	Glyphosate	33,739
2	Diuron	15,212	Diuron	17,934	Diuron	11,243
3	Oryzalin	4,111	Oryzalin	3,140	Oryzalin	7,076
4	Prodiamine	1,743	Tebuthiuron	3,137	Diquat dibromide	1,042
5	Triclopyr, butoxyethyl ester and salt	1,417	Triclopyr, salt and ester	1,201	Oxadiazon	834
6	Trifluralin	898	Isoxaben	790	Isoxaben	680
7	Isoxaben	842	Imazapyr	636	Tebuthiuron	663
8	Diquat dibromide	644	Diquat dibromide	535	Prodiamine	611
9	Pendimethalin	503	Sulfometuron methyl	211	2,4- D, Butoxyethanal ester	561
10	Tebuthiuron	461	Chlorsulfuron	126	Oxyfluorfen	538

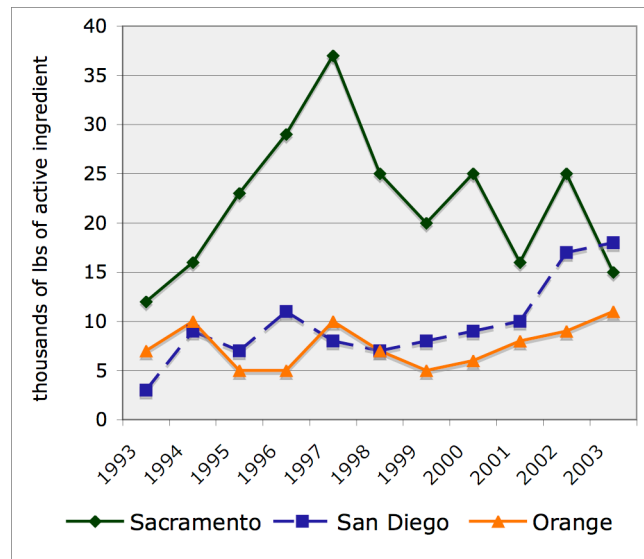
* In Sacramento County in 2003, 1,373 lbs of borax active ingredient were applied on right-of-ways. In the previous Figure 5.23 this pesticide was classified under insecticides; however, borax is also used as an herbicide. It is unknown what use type this product was applied.

Figure 5.24 Glyphosate Use Trends



* No outliers were found for glyphosate use in San Diego in 2003. PUR records show multiple use records with a large amount of glyphosate use.

Figure 5.25 Diuron Use Trends



Right-of-way Pesticide Information Sources

In general, groups that apply pesticides to right-of-ways obtain information about pesticides and IPM from outlets that are similar to other licensed landscape pest professionals. All right-of-way pesticide applicators must have a QAC or be supervised by someone with a QAC. Right-of-way pesticide applicators who work for city public works departments may have to follow a pest management plan or IPM policy developed by the city. Landscape maintenance companies who apply pesticides to right-of-ways that have contracts with state, county, or city transportation authorities must also be licensed and report their pesticide use. Licensed applicators get information about pesticide and IPM from continuing education classes, seminars, and professional associations.

Caltrans provided detailed information about where roadside maintenance crews get information about pesticides and IPM. Caltrans maintenance crews must follow the Caltrans Vegetation Control Policy. This policy includes an integrated vegetation management plan aimed at reducing herbicides in roadside environments. Caltrans maintenance crews and their private contractors may only select herbicides from an approved list that follows the Environmental Impact Report (EIR) (Caltrans, 1998). The District Landscape Specialist for the District Division Chief for Maintenance and Operations must write a Vegetation Control Plan (VCP) each year and includes information about pesticide applications. The guidelines for this policy are found in Chapter C2, Vegetation Control, of the Caltrans Maintenance Manual (found online at www.dot.ca.gov/hq/maint/maintman.htm). This manual contains the following information:

- Non-Landscaped Vegetation Control
- Disease and Insects (Biological Control)
- Pruning of Vegetation
- Tree Inspection
- Vegetation Control of Specific Areas
- Highway Tree Maintenance
- Laws and Regulations Regarding Use of Pesticides
- Certification of Applicators of Restricted Materials
- Recordkeeping
- Pesticide Use Recommendations
- Requirements for Safe Handling and Storage of Pesticides
- Environmental Concerns
- Toxicity of Chemicals
- Annual Pesticide Worker Safety Training
- Proper Use and Handling of Pesticides
- Considerations in Planning a Chemical Vegetation Control Program
- Selection of Herbicides
- Pesticide Spraying Operations
- Guidelines for Ordering Pesticides

Landscape maintenance crews (Caltrans employees and contract workers) who maintain the vegetation planted with the State highway right-of-way must also follow Chapter E, Landscaping, in the Caltrans Maintenance Manual. This chapter contains the following information:

- Irrigation Systems
- Plantings
- Tree and Shrub Maintenance
- Controlling Eucalyptus Longhorn Borer and Pine Pitch Canker
- Ground Cover Maintenance
- Turf and Lawn Maintenance
- Lawn Diseases
- Pruning
- Fertilizing
- Weed Control (chemical management and toxicity of landscape chemicals)

The County of Sacramento Department of Transportation, which manages right-of-way pests on Sacramento County roads, provided an example about who makes pest management decisions at county public works departments. The County of Sacramento Public Works Agency Department of Transportation contracts with a private licensed company, California Landscape Associates, to maintain landscape areas that are located within the road right-of-way including medians, roadway frontages, and mitigation areas³⁸ (SCDT, 2004). Landscape maintenance companies with public works department contracts get information about pesticides and IPM from the same resources other professional landscape pest managers use.

³⁸ Detailed information about this contract is available at www.sacdot.com/services/Contract_Landscape.asp

5.3.2 Public Health Pest Control

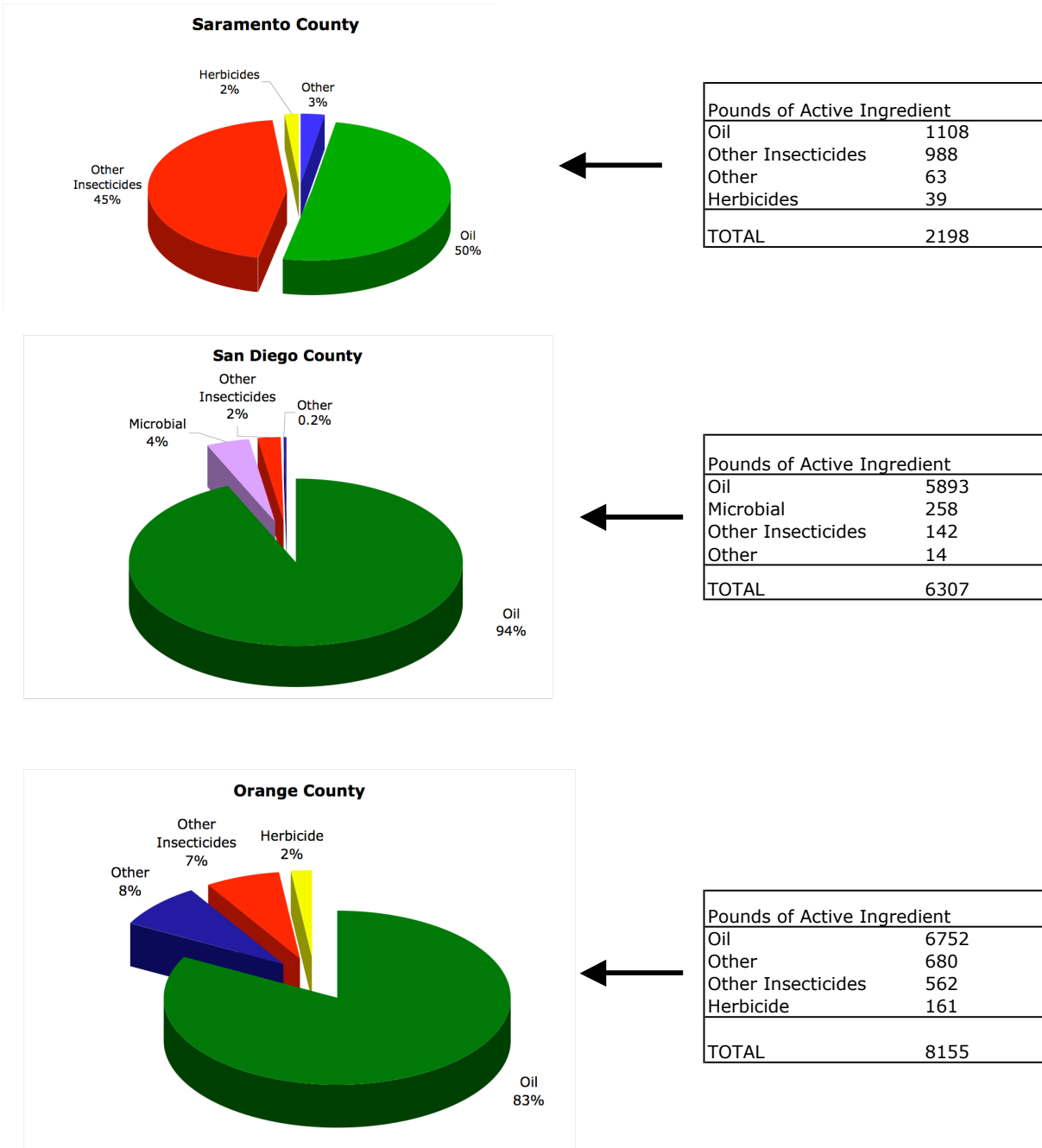
Pesticide Use (PUR Analysis)

Of the total reported non-agricultural pesticide use in California, only 12% is reported under the category public health pest control. Less than 10,000 pounds of pesticide (active ingredient) were applied in Sacramento, San Diego, and Orange County in 2003 for public health. Over 50% of the pesticides used in these three counties in 2003 were oils (Figure 5.26). Vector control districts in these three counties have implemented IPM programs and only use reduce-risk pesticides. Table 5.6 lists the top five pesticides used in 2003.

Table 5.6 Top Five Pesticides with the Highest use Under Public Health Pest Control, 2003

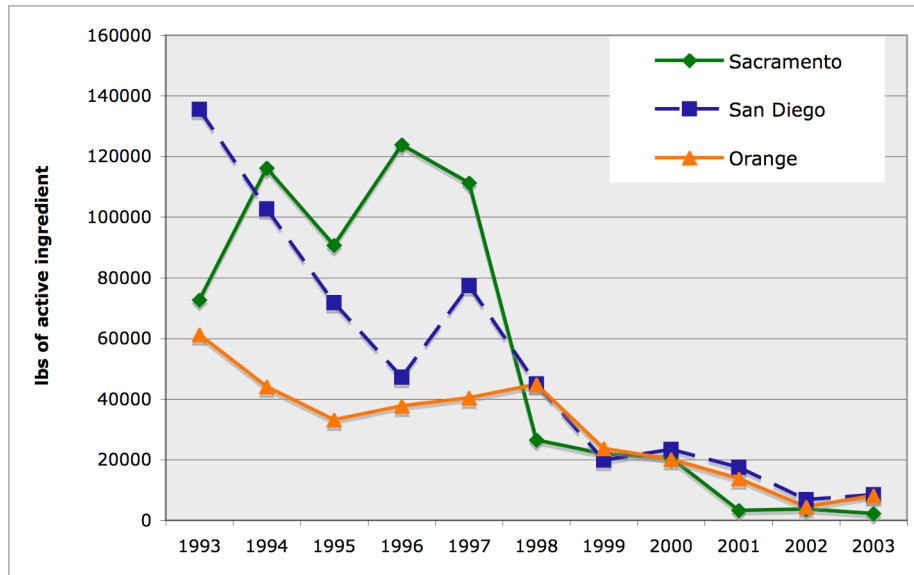
Sacramento County			San Diego County		Orange County	
Chemical	Lbs of a.i.	Chemical	Lbs of a.i.	Chemical	Lbs of a.i.	
1	Petroleum Distillates	1,108	Petroleum Distillates	5,893	Petroleum Distillates	6,752
2	<i>Bacillus sphaericus</i>	754	Sodium Hypochlorite	258	Piperonyl Butoxide	662
3	<i>Bacillus thuringiensis</i> (Berliner)	114	<i>Bacillus sphaericus</i>	115	Resmethrin	221
4	Methoprene	101	Calcium Hypochlorite	13	Glyphosate	161
5	Piperonyl Butoxide	49	Methoprene	8	<i>Bacillus sphaericus</i>	160

Figure 5.26 Reported Public Health Pesticide Use, 2003



*Other pesticides includes: synergists, rodenticides, miticides, microbials, and other misc. pesticide products.

Figure 5.27 Trends in Public Health Pesticide Use (1993- 2003)



Since 1993, pesticide use in Sacramento, San Diego, and Orange County for mosquito and vector control has drastically decreased (Figure 5.27). In all three counties, pesticide use has remained below 20,000 lbs of active ingredient since 2001. In 2003, Sacramento County used the least amount of pesticides, with only 2,198 lbs of active ingredient applied. However, with the increase in mosquito control efforts in 2004 due to West Nile Virus, we expect that there will be an increase in insecticide use for this category in 2004 data.

Public Health Pesticide and IPM Information Sources

Each vector control district has a team of qualified scientists and pest control experts who make decisions about what pesticides to apply. There is substantial literature on least toxic methods of mosquito control available through vector control professional organizations and universities that are accessible to these scientists. Because mosquito control materials are generally applied near water or directly to water, vector control districts are very cautious about applying materials that may pose hazards to aquatic organisms or humans.

5.3.3 Regulatory Pest Control

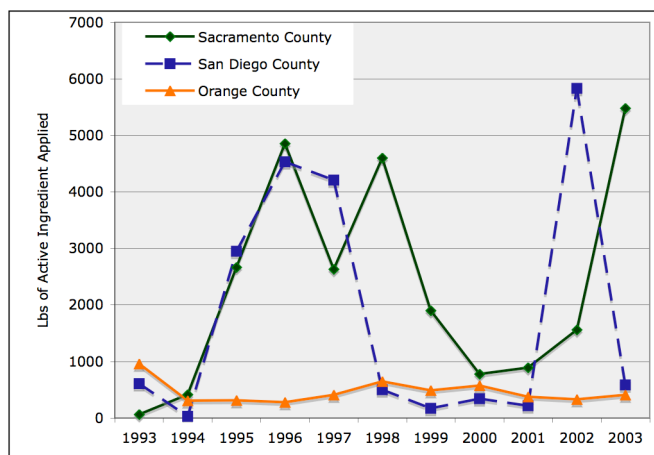
Pesticide Use (PUR Analysis)

Pesticides for regulatory pest control are applied by public agencies to control regulated pests which are usually invading exotic pests or pests which pose serious risk for health or environment. Of the total non-agricultural pesticide use in California in 2003, only 1% was reported under the category regulatory control. During this same year, pesticide use in Sacramento County was much higher than Orange and San Diego Counties with 5,482 lbs of active ingredient applied. The majority of this total use in Sacramento County was glyphosate (Table 5.7). Since 1993, Orange County has had the lowest amount of pesticide use (Figure 5.28). Pesticide use in San Diego and Sacramento County has greatly fluctuated over the past ten years (Figure 5.28).

Table 5.7 Top Five Pesticides with the Highest use for Regulatory Pest Control, 2003

Sacramento County			San Diego County		Orange County	
Chemical	Lbs of a.i.	Chemical	Lbs of a.i.	Chemical	Lbs of a.i.	
1	Glyphosate	2,674	Naled	186	Piperonyl Butoxide	195
2	Nonyl Phenoxy Poly Ethanol	1,292	Spinosad	106	Resmethrin	81
3	2,4-D	1,124	Malathion	102	Bifenthrin	49
4	Butyl Alcohol	144	Methyl Bromide	93	Piperonyl Butoxide, Other related	49
5	Prodiamine	111	Glyphosate	75	Glyphosate	15

Figure 5.28 Regulatory Pesticide Use Trends (1993-2003)



Regulatory Pest Control Pesticides and IPM Information Sources

Pest professionals who apply pesticides under the category regulatory pest control must have a QAC license under the regulatory category. Regulatory pesticide applicators get information from the United States Department of Agriculture's Animal and Plant Health Inspection Service (USDA APHIS), California Department of Food and Agriculture (CDFA), the University of California, and county Agricultural Commissioners office about how to manage pests that are being regulated in a certain area. The U.S. Environmental Protection Agency (EPA) has set the following standards for regulatory pest control:

“Applicators shall demonstrate practical knowledge of regulated pests, applicable laws relating to quarantine and other regulation of pests, and the potential impact on the environment of restricted- use pesticides used in suppression and eradication programs. They shall demonstrate knowledge of factors influencing introduction, spread and population dynamics of relevant pests (Baker et al., 1997).”

5.3.4 Summary for all Public Agency Employees: Information Sources for Pesticides and IPM

According to the survey that was sent to UCCE Advisors, public agency employees receive information from the following sources:

- UCCE
- UCIPM (meetings, short courses, newsletters, websites)
- Commercial contacts
- Trade magazines
- PAPA
- Continuing education classes
- Internet
- Vendors
- Agricultural Commissioner

This survey also asked the Advisors to rate the availability of reliable education resources about pesticides and IPM directed towards public agency employees. Nine people responded to this question with two rating the availability as excellent, six as good, and one as poor (the choices were excellent, good, fair, and poor).

6. Pesticide Use Trends and Information Sources of Groups that do not Report Pesticide Use

6.1 Maintenance Gardeners

Small landscape maintenance companies are very prevalent throughout California yet little is known about their pesticide use practices. A short survey was conducted with landscape maintenance gardeners in the Arcade Creek, Chollas Creek, and San Diego Creek Watershed³⁹ to determine their pesticide use behavior. The landscape maintenance enterprises interviewed mostly consisted of less than ten employees who work on residential, commercial, and industrial properties. The landscape maintenance services they offer are generally dictated by what the customer wants.

Maintenance gardeners are required to report pesticide use, yet only a small percentage actually report use. Between 33 to 41% of the gardeners in all three watersheds who stated that they use pesticides said that they also had a license or were supervised by someone with a license (Table 6.1). San Diego had the highest percentage (41%) of gardeners who said that they had a license or worked under the supervision of someone who had an applicators license. The following table is a summary of the survey results.

Table 6.1 Summary of the Landscape Maintenance Survey

	Arcade Creek	Chollas Creek	San Diego Creek
<i>Percentage of respondents who use pesticides</i>			
herbicides	43%	74%	100%
insecticides	7%	68%	69%
<i>Percentage of respondents who have a license (or supervisor has one) to apply pesticides.</i>			
	33%	38%	41%
<i>Total groups interviewed</i>			
	14	19	32

More gardeners in San Diego and Orange Counties stated that they used herbicides than gardeners in Sacramento County. The majority of the herbicide use was glyphosate; 36%, 63%, and 78% of the gardeners who were interviewed in Arcade Creek, Chollas Creek, and San Diego Creek/ Upper Newport Bay respectively said they used Roundup®. Other herbicide products that gardeners said they used included Weed-N-Feed (various non-specific combinations of herbicide and fertilizer), MSMA (Trimec Plus®), and clethodim (Envoy®).

Only 7% of the gardeners in Arcade Creek used insecticides compared with 68% in Chollas Creek and 69% in San Diego Creek/ Upper Newport Bay. The type of insecticide products varied greatly. Many of the gardeners did not know the name of the insecticides they were applying. The gardeners who were able to recall the type of insecticides they used mentioned

³⁹ Detailed information about the methods used to conduct this survey is listed in Chapter 2.

the following products: Ortho brand insecticides, lawn insecticides for grubs, imidacloprid (Merit®), bifenthrin, permethrin, diazinon, malathion, carbaryl, and insecticidal soap. Lawn pests (grubs mostly) were the only insect mentioned in Arcade Creek. Many gardeners in San Diego and Orange Counties said that whiteflies were a major pest. Gardeners in these counties also said that they applied insecticides to control aphids, ants, scales, mites, and spiders.

The disposal practices of maintenance gardeners

Maintenance gardeners in Arcade Creek, Chollas Creek, and the Upper Newport Bay/San Diego Creek watersheds were asked: How do you dispose of pesticide containers and left-over product? Many of the gardeners surveyed were following acceptable practices for the disposal of home-use products. The results are listed in Table 6.2.

Table 6.2 The Disposal Practices of Maintenance Gardeners

Pesticide Container Disposal Practices:	Number of respondents
Place empty containers in the trash	14
Place empty containers in the recycle bin	12
Punch holes in the container then place in trash	3
Rinse containers (recycle water), punch holes, and then place in trash/ recycle bin	5
Take containers back to the main office	6
Rinse containers (recycle water), punch holes, and take to a hazardous waste disposal site	2
Follow the disposal instructions on the label	1
Rinse then place in trash	1
Take container back to the store where they bought it from	1
Wash containers and re-use them	2
Keep containers in storage	1
Do not know	6

None of the maintenance gardeners interviewed stated how they disposed of left-over product. Maintenance gardeners may not have fully understood the question or there was an error in how the question was asked (a possible error in the translation of the question to Spanish).

Information Sources for Maintenance Gardeners and Pesticides and IPM

According to the survey that was sent to UCCE Advisors, maintenance gardeners receive information from the following sources:

- Peer networks, other maintenance gardeners
- PAPA meetings
- Some continuing education classes
- Vendors
- Word-of-mouth
- Do not obtain any information from any source

This survey also asked the Advisors to rate the availability of reliable education resources about pesticides and IPM directed towards maintenance gardeners. Eight people responded to this question with four rating the availability as good, one as fair, and three as poor (the choices were excellent, good, fair, and poor).

Results from maintenance gardener survey:

Landscape gardeners who work for larger businesses (more than 10 employees) do not always make pesticide use decisions. Often the supervisor or owner who has a license to apply pesticides will make decisions. However, during our survey many gardeners did say that they can make recommendations about what pesticides to use. Some landscape businesses offer short training courses for their workers about pesticide safety, use, and disposal (this is required by law if pesticides are used as part of the job). These larger landscape companies could be classified under the professional landscape gardeners group. The larger and more professional a business is, the more likely they are to report pesticide use.

Small landscape businesses (less than five employees) get more of their information about what pesticides to use from store employees at Home Depot, Hydroscape, Orange County Farm Supply, or other local garden supply stores. Maintenance gardeners often meet early in the morning at these stores to buy supplies, including pesticides. At this time they may communicate with other gardeners about how to manage certain landscape pests. Their clients are mostly homeowners who often dictate what pesticides to use. Maintenance gardeners also seek information from their homeowner clients. The homeowner may even purchase the pesticide for the gardener and then ask them to apply it. The following table is summary of the responses from the survey conducted in each watershed with maintenance gardeners. The responses are ranked starting with the most popular sources of information; often the maintenance gardeners interviewed stated multiple sources of information (Table 6.3).

Table 6.3 Top Ten Places Where Maintenance Gardeners get Information about Pesticides and IPM

	Percent who gave this response ^a
1 Store employees where they purchase pesticides	35%
2 Past experiences working as a gardener ^b	23%
3 Educational materials (e.g. MSDS sheets in Spanish and English) and/or training provided by the landscape company ^c	14%
4 The supervisor or homeowner decides what pesticide to use	14%
5 The pictures on the pesticide container	8%
6 Other maintenance gardeners	6%
7 Horticulture and pest management classes	5%
8 Pesticide product label	5%
9 Books, newspapers, magazines, and newsletters	3%
10 Pesticide vendor (e.g. Target Specialty Products)	3%

a. The percent of maintenance gardeners interviewed in Sacramento, San Diego, and Orange counties who gave this response; a total of 65 groups of maintenance gardeners were interviewed.

b. These gardeners said that they rely on their own knowledge about pests and pesticides to make management decisions.

c. These gardeners said that they received printed information or short training courses from the landscape company they work for. Most of the gardeners who gave this response work for landscape companies with more than 10 employees. The level of training varies greatly depending on the landscape company. Pesticide training is usually coupled with landscape equipment (such as mowers and leaf blowers) training.

Special Certification Programs

Maintenance gardeners may get information through certification programs in specific regions in California (no certification programs were identified in the three watersheds for this project). The Green Gardener Certification Program, based in Santa Barbara, California, is the best example of a current certification program for maintenance gardeners in California. This program offers education, a ten-week training session, a certification as a Green Gardener, and promotion of participating gardeners and landscape contractors via the Green Gardener website. In order to be certified, gardeners must have 45 hours of training covering topics such as sustainable landscaping practices (especially water efficient landscaping principals), green waste reduction, and minimizing runoff pollutants. They must pass an exam given at the end of the training sessions. The training is held twice a year in both English and Spanish. Annual renewal requirements are met by attending a specified number of continuing education classes and submittal of customer feedback forms. Since the program began in 2000, this program has trained about 700 landscape professionals, and more than 60% of them are Spanish speaking. Many Green Gardeners had no previous formal training in pesticide use, IPM, or runoff prevention.

6.2 Private Business and Commercial Pesticide Users

Pesticide Use:

Owners or employees of private businesses who apply pesticides as part of their job do not report pesticide use. However, if a structural pest control or landscape pest control company is hired, pesticide applications on these properties are reported. Most large corporations, such as those with many retail outlets, restaurant chains, hotel chains, or chain stores, have developed standards for pest control that usually involve outside contractors. Pest control companies such as Orkin have forged relationships with these corporations and provide multiple pest management services. Smaller businesses are more likely to make their own pesticide applications.

Apartment Complex Survey

- Ten apartment complexes were contacted in the Arcade Creek Watershed to determine who applies pesticides. Representatives from nine apartment complexes responded to the following question: Do you handle your own pest control or is the pest control contracted out to a private firm?

Seven apartment representatives said that they contract all of their pest control with a pest control company⁴⁰. Only one apartment complex said that they handle all of their own pest control on a need basis. They explained that apartment employees would only apply pesticides if there was a customer complaint.

Retail Nurseries and Garden Centers

Most box store retail nurseries such as Home Depot do not apply pesticides to the plants they are selling. However it is important to note that this project did not include any interviews with managers at retail nurseries or garden centers; therefore, some of these businesses may apply pesticides. According to John Lewis, an environmental specialist within the Water Protection Division for Sacramento County who works with retail nurseries in Sacramento, retail nursery

⁴⁰ One apartment complex did not want to tell us if the contract with a pest control company or do the pest control themselves.

employees make very few if any pesticide applications to ornamental plants. However, production nurseries do make pesticide applications and report pesticide use. Production nurseries are categorized under agricultural pesticide use and their use was not examined for this report.

Pesticide Information Sources for Specific Businesses:

All Private Businesses

According to the survey that was sent to UCCE Advisors, private businesses obtain information about pesticides and pest management primarily on an individual basis or from a local pest control company. This group is largely not informed and do not come to educational meetings about pesticides and IPM. This survey also asked Advisors to rate the availability of reliable education resources about pesticides and IPM directed towards private businesses, five people responded to this question with one rating the availability as good, one as fair, and three as poor (the choices were excellent, good, fair, and poor).

The majority of private businesses hire a company to perform any pest control. While information is available about pesticides and IPM through local UC Cooperative Extension offices, local business environmental resource groups, the county Agricultural Commissioner's office, state agencies such as CDPR and the State Water Resources Control Board (SWRCB), local non-profit organizations, and the University of California's Statewide IPM Program, it is unknown how many business owners, facility managers, janitors, and/or general employees utilize these resources.

In Sacramento County, business owners, facility managers, janitors, and/or general employees can obtain information about environmental regulations and limited pesticide use through the Business Environmental Resource Center (BERC). BERC is a one-stop, non-regulatory permit assistance center to help Sacramento County businesses understand and comply with federal, state, and local environmental regulations. BERC offers free and confidential consultative services for both environmental and non-environmental issues. The BERC website provides links to IPM information including the USEPA Office of Pesticide Programs, USDA IPM home page, University of California Statewide IPM Program, IPM Net, IPM Institute of North America, and the Bio-Integral Resource Center (BERC, 2005). The BERC website also provides stormwater management resources including links to the City of Sacramento's Stormwater Management Program (SMP).

The SMP program in Sacramento provides information about how to manage specific pests through WaterWise Consumer Cards. These pest cards were developed by the University of California's Statewide IPM Project and can be downloaded on the SMP's website at, <http://www.sacstormwater.org/wise/index.html>. It is unknown how many businesses in Sacramento County seek information about pesticides through BERC or Sacramento's SMP.

The U.S. EPA Small Business Division / Small Business Ombudsman also provides information for small businesses about environmental compliance and pollution prevention. This EPA Division has a website that serves as hub of information for small businesses across the United States (www.smallbiz-enviroweb.org). In California, each Cal/EPA program and regional office has designated an ombudsman as a single point of contact to work with applicants and the public to clarify permit requirements and resolve regulatory conflict (USEPA, 2004b).

Trade magazines offer a limited amount of information about pesticides and IPM for business owners, employees, and facility managers. Business such as retail stores may seek this

information through the trade magazine, *Chain Store Age*, a *Newsmagazine for Retail Executives*⁴¹. This trade magazine recently published an article about how retail design impacts pest problems. Hotel managers and employees can get information about pest management through the trade magazine, *National Hotel Executive [The Publication for Hotel Owners, Operators, Senior Executives, and Hospitality Professionals]* available online at www.hotelexecutive.com. This magazine recently published an article about how hotels can prevent pest infestations using IPM. Facility managers can also get information about pest control through trade magazines such as, *Today's Facility Manager (TFM)* available online at www.todayfacilitymanager.com.

Retail Nurseries and Garden Centers

Employees at retail nurseries and garden centers may seek information about pesticides and IPM from a number of different sources depending on the scale of operation and if they apply pesticides at their facility. The California Association of Nurseries and Garden Centers (CANGC) provided excellent information about pesticides and IPM. They have a California Certified Nursery Professional Certification (CCNPro) program for employees in pest management. According to the survey sent to UCCE Advisors, retail nurseries obtain information from the following sources:

- CANGC sponsored meetings
- UCCE
- UCIPM
- CAPCA
- PAPA
- PCA's
- PCO's
- Pesticide vendors
- Association Commodity newsletters

This survey also asked UCCE Advisors to rate the availability of reliable education resources about pesticides and IPM directed towards retail nurseries. Nine people responded to this question with one rating the availability as excellent, two as good, two as fair, and three as poor (the choices were excellent, good, fair, and poor).

6.3 Pet Groomers and Kennels

Pet care businesses often use flea and tick control products that contain pesticides. The residues from flea dips and shampoos have the potential to contaminate treated wastewater. These animal care facilities may also apply insecticides around facilities that house animals to manage flea and ticks.

Pesticide Use:

According the US EPA the following are the most common active ingredients found in flea and tick pesticide products (USEPA, 2004a):

⁴¹ *Chain Store Age*, is a monthly news magazine for corporate executives at headquarters in all the major segments of retailing: home centers, supermarkets, drug chains, specialty stores, discount, convenience, and department stores (www.chainstoreage.com).

- Phenothrin and Pyrethrum
- Methoprene
- Carbaryl
- Imidacloprid
- Fipronil
- Permethrin
- Cypermethrin

Eight pet groomers and kennels were contacted in Sacramento County to ask what flea and tick product they use and where they wash the animals. All of these pet groomers said that they wash their animals indoors and that the water drains into the sewer. The majority also said that they use a botanical pesticide based shampoo (either pyrethrum, limonene, or neem active ingredients). Many also said that the shampoo they use contains no pesticide active ingredients (common product was called “Dirty Dog”).

The active ingredients for the flea and tick shampoos from the pet groomer/ kennel survey in Sacramento County:

- Neem
- A product with pyrethrins (0.15%), piperonyl-butoxide (1.5%), and N-oxytl bycarbomoxid (0.5%)
- Citrus oil

Pesticide Information Sources:

There are resources available for pet groomers and kennels about pesticides and IPM; however, it is unknown how many pet groomers or kennels seek information from these resources. For example, the UC IPM website provides excellent information about how to manage fleas and ticks. The Sacramento County Environmental Management Department (EMD) also provides educational materials to pet groomers and kennels in the areas about pesticide use and water quality problems. Starting on July 1, 2004, EMD started to conduct stormwater quality compliance inspections at kennels in Sacramento County (EMD, 2004). Pet groomers and kennels in Sacramento County can also contact the Business Environmental Resource Center (BERC) for more information about how to meet environmental compliances. The challenge is informing these animal facilities about these resources.

6.4 Institutional Pesticide Users

Pesticide Use

Institutional pesticide users, such as schools and hospitals, are not required to report pesticide use; as a result, it is difficult to determine any significant trends in pesticide use. However, there have been studies conducted with institutions to determine pesticide use trends. The following section highlights some of these studies.

Case Study: The Irvine Unified School District

On August 24, 2004 a landscaping crew for the Irvine School District was interviewed at a school in the San Diego Creek Watershed. They stated that all landscape pesticide applications in the Irvine School District are performed by a licensed pest professional who fills out a pesticide use report. They also report all pesticide use to the school district through a weekly report. They mostly use glyphosate around the landscaping and an insecticide (the group interviewed did not know the specific type) to control whiteflies and aphids on ornamental

plants. All of the pesticides they use are purchased through Target Specialty Products. This group of landscapers was also asked what influences their decision when purchasing pesticides. They said that they have been using the same pesticide for a long time. They are currently happy with the effectiveness of the products they use and mostly rely on past experiences to choose products.

In this interview the landscaping crew also stated that janitors throughout the school district apply pesticides indoors to control ants and cockroaches. The Irvine Unified School District's maintenance and operations staff does have a website⁴² that provides the following information (Irvine Unified School District, 2004):

- Brief summary of the healthy school act
- 2004-2005 site pesticide application schedule
- Non pesticide alternatives
- Parent pesticide notification application
- Employee pesticide notification application

According to the 2004-2005 site pesticide application schedule, the custodial staff applies the following insecticides at all school locations:

- Demand CS® (lambda cyhalothrin)
- Dragnet® (permethrin)
- Termidor SC® (fipronil)

The grounds maintenance crew (same group that was interviewed) apply the following pesticides at all school locations:

- Roundup Pro® (glyphosate) for weeds
- Eatons® (Diphacinon indandione) for rats and mice

Childcare Centers

Phil Boise, director of the GreenCare for Children and Urban/ Ag Ecology Consulting Services, surveyed 457 family childcare providers and 291 center-based childcare providers in San Luis Obispo, Santa Barbara, and Ventura counties. Eighty-eight percent of the survey respondents said that they had a degree of responsibility in the decisions made about pest management at their facilities. This survey found that childcare facilities are 12 times more likely to spray pesticides than apply a bait (the majority of pesticides are used to kill ants and spiders).

According to this survey, outdoor pesticide use is more common than indoor use and most commonly applied on the following landscape features (Boise et al., 2004):

- 84% lawns
- 46% sandboxes
- 29% neighborhood playgrounds
- 19% vegetable gardens.

Hospitals

In 2001, a survey was conducted by Health Care Without Harm⁴³ with 171 hospitals throughout the U.S. to determine pesticide use, methods of notification to staff, patients, and the public

⁴² <http://www.iusd.org>

⁴³ Health Care Without Harm (HCWH) is an international coalition of hospitals and health care systems, medical professionals, community groups, health-affected constituencies, labor unions, environmental health organizations

about pesticide applications, record keeping, and Integrated Pest Management (IPM). Twenty-two hospitals responded to this survey, the highlighted results include the following (Owens, 2003):

- 64% have a written pest management plan
- 73% claim to use an IPM approach to pest management
- 73% hire a pest control company to manage the majority (98% or greater) of the hospitals structural pest management program
- 36% hire a pest control company to manage the majority (98% or greater) of the hospital grounds
- 91% use indoor pesticides and 77% use outdoor pesticides
- 100% use pesticides either on its grounds and/or inside buildings
- 45% use one or more pesticide products containing boric acid (this was the most commonly used pesticide by surveyed hospitals)
- 36% use pesticide products that are no longer registered for use by the EPA
- 18% use a pesticide product that is being phased out by the EPA
- 14% post notification signs for indoor and outdoor pesticide applications
- 91% have copies of the pesticide products' Materials Safety Data Sheet (MSDS) available to staff for all pesticide products used.
- 27% have provided pesticide safety training
- 77% keep records of structural pesticide applications
- 64% keep records of outdoor pesticide applications
- \$55 per bed is the average annual cost of pest management.

Seventeen hospitals provided a list of the pesticides they use at their facility. The insecticides used include pyrethroids (26%), organophosphates (13%), carbamates (13%), botanicals (9%), inorganics (9%), synergists (9%), and others (21%).

Institutional Pesticide Information Sources

It is currently unknown where most institutional pesticide users get information about pesticides and IPM; however the childcare survey does give us one example. Only 3.6% of the survey respondents stated that they had received formal training about pests and pesticides in the past two years. Childcare providers were also asked about general childcare information sources, they included (Boise et al., 2004):

- 70% childcare newsletters
- 22% local meetings
- 38% ECE classes

and religious groups. Its mission is to transform the health care industry worldwide, without compromising patient safety or care, so that it is ecologically sustainable and no longer a source of harm to public health and the environment (Owens, 2003).

- 28% internet
- 35% conferences

The *GreenCare for Children Report*, by Phil Boise, included a national search for existing comprehensive environmental data and training programs for the childcare industry. They stated that no satisfactory data or programs were identified statewide or nationally, with the exception of the “Five-Star Environmental Recognition Program for Childcare” of the Indiana Department of Environmental Management. The report concluded that this program is impressive and has served as an inspirational model (Boise et al., 2004).

Some examples of pesticide and IPM resources available to specific institutional groups are:

Schools

Most information about pesticides and IPM for schools in California comes from CDPR’s School Integrated Pest Management Program. This IPM program provides specific information about complying with the Healthy Schools Act for school administrators and IPM coordinators, maintenance and operations staff, pest control businesses, and parents and teachers. School pesticide users may use the CDPR California School IPM Guidebook as a guide to adopting IPM⁴⁴. CDPR also conducts training workshops for pesticide users about least-hazardous pest management practices.

Childcare facilities

The GreenCare for Children program, directed by Phil Boise in Santa Barbara, is designed to assist childcare providers in identifying and reducing routes of exposure to poor indoor air quality, lead, and pesticides as well as promote environmental stewardship such as recycling and resource conservation (Boise et al., 2004).

6.5 Industrial Pesticide Users

Pesticide Use

It is currently unknown what pesticides are applied to industrial facilities. It is assumed that the pesticide use trends are very similar to the category structural pest control.

Information Sources

It is currently unknown where industrial pesticide users who are not trained pest professionals get information about pesticides and IPM.

6.6 The Department of Defense

Pesticide Use

Specific pesticide use data at military site locations within the three watershed study sites are unavailable. Pest management services may be contracted out to commercial pest control companies (Department of Defense, 1997). In California, pest control companies who make pesticide applications to military property would report pesticide use under the categories structural pest control or landscape maintenance. Certified military pest management professionals also apply pesticides and follow Armed Forces Pest Management Board (AFPMB)

⁴⁴ This guidebook is available online at: www.cdpr.ca.gov/cfdocs/apps/schoolipm/managing_pests/guidebook.cfm?crumbs_list=1,5,37

guidelines. The AFPMB states that they promote pest management, biopesticides, and least toxic pesticides for installations and deployments (AFPMB, 2005).

Information Sources

Pest management professionals in the US Military are trained and certified under guidelines from the AFPMB.

7. Recommendations

7.1 Outreach approach/ strategies for all pesticide user groups

The first step in mitigating water quality issues associated with pesticide use in urban watersheds is identifying pesticide user groups. Each pesticide user group manages different types of pests and uses different materials and procedures. As a result, some groups contribute more to water quality problems than others. In addition, each user group has different professional and educational resources available and groups vary considerably in terms of education, professional training, and regulatory oversight. Because of these differences a comprehensive outreach strategy must be developed and conducted separately for each user group. The goal of such outreach programs would be to reduce the use of problem pesticides, to be sure proper use and disposal practices are followed when pesticides are used, and to encourage IPM practices that are adapted to the unique pest problems of each group.

Developing a Comprehensive Outreach Strategy

A comprehensive outreach strategy for non-residential urban pesticide user groups should include components directed both at professionals and the general public they serve. Educational needs for urban professional users include information on proper use and disposal of pesticides, alternatives that reduce water quality risks, and information on environmental and economic impacts. The public also needs to know about alternatives and risks so they can demand services that optimally protect their health and the environment. Many outreach mechanisms are available. Suitability depends on the user group. Any outreach program will require substantial additional funding to what is currently available for federal, state, and university resources.

The components for a successful outreach strategy should include the following:

5. Public Education
 - i. Educate private citizens and businesses to demand IPM services
 - ii. Encourage private businesses and public agencies to adopt IPM programs and/or policies that encourage the minimal use of pesticides in and around facilities.
6. Professional Education
 - i. Educate people who are not reporting about the appropriate laws and regulations
 - ii. Develop an educational campaign and more convenient facilities for the disposal of pesticide products and containers
7. Partnerships
 - i. Develop IPM certification programs with incentives for companies to participate
 - ii. Take advantage of current pest control product vendors as an outreach channel
8. Outreach mechanisms
 - i. Deliver IPM information in a clear and simple manner in a way easily accessible to the user group
 - ii. Develop a resource directory for different pesticide user groups to find IPM training materials and supplies
 - iii. Produce informational updates from unbiased sources

General Recommendations for all Pesticide User Groups

The following is a list of recommendations for all pesticide user groups in the Arcade Creek, Chollas Creek, and Upper Newport Bay/San Diego Creek Watersheds. These recommendations were developed through conversations with pest management experts in the field, interviews with landscapers and pest control companies, discussions with the project development team (Cheryl Wilen, Nila Kreidich, Mary Louise Flint, Minghua Zhang, and Nan Singhasemanon), and through a literature review of developing and/or existing educational programs. We prioritized these nine outreach strategies considering both their importance and potential for rapid implementation. Some strategies that we felt could have lasting benefits, such as certification programs or electronic newsletters, were ranked lower because major resources (e.g. financial resources and human capital) and stakeholder cooperation would be required to implement them. The following is a list of nine outreach strategies for all pesticide user groups, listed in order of importance:

1) Deliver IPM information in a clear, simple manner

The concepts of integrated pest management are often confusing. To add to this confusion, many different groups have developed their own concept of IPM. Pesticide manufacturers and distributors contradict basic IPM principles by advertising their products nationally as integral components of an effective IPM program; some even promote the routine use of broad-spectrum insecticides. IPM information needs to be delivered from unbiased sources in a clear and simple manner. Specific recommendations include the following:

- IPM educational materials should contain more illustrations and less text.
- Common pesticide names should be placed prominently on pesticide labels.
- A reliable database is needed to make urban pest managers aware of existing pesticide and IPM information resources (ex. a user-friendly website that is a clearing house of information about different pest problems and solutions).

2) Educate customers to demand IPM services

Businesses, public agencies, and homeowner associations need additional information about hazardous pesticides and the advantages of IPM services. Educated consumers will create a market demand for IPM services from structural and landscape pest companies. These pest management companies will then have the incentive to adopt IPM principles and reduce pesticide use. Specific recommendations include the following:

- Encourage local agencies to identify and market green businesses.
- Deliver information about pesticides and available IPM services through public service announcements and newspaper articles.
- Encourage local utilities to deliver information about pesticides and IPM.
- Provide information on what to require in contracts with pest control companies.
- Create a public campaign about the benefits of adopting IPM programs including reduction of risks to health and the environment and better in terms of pest control.

3) Educate groups who are not reporting about the laws and regulations regarding pesticide use in California.

Currently there are many different groups who apply pesticides in urban areas who do not have a license. Businesses who use pesticides may not realize that they need to have a licensed pest control expert on staff. Currently the State of California's Qualified Applicator Certificate includes the following pest control categories:

- A. Residential, Industrial, and Institutional
- B. Landscape Maintenance
- C. Right-of-Way
- D. Plant Agriculture
- E Forest
- F. Aquatic
- G. Regulatory
- H. Seed Treatment
- I. Animal Agriculture
- J Demonstration and Research
- K. Health Related
- L. Wood Preservation
- M. Antifouling Paints or Coatings Containing Tributyltin
- N. Sewer-line Root Control
- Q Maintenance Gardener

Government agencies, universities, and/or non-governmental organizations should educate all pesticide user groups about current pesticide laws and regulations. The Business and Environmental Resource Center in Sacramento is an example of a non-governmental organization in California that delivers this kind of information to businesses.

4) Encourage private businesses and public agencies to adopt IPM programs and/or policies that encourage the minimal use of pesticides in and around their facilities.

Developing an IPM policy would help facilitate private businesses and public agencies to reduce the use of pesticides. This should include training programs for employees who apply pesticides and information about how to establish contracts with pest control and landscape maintenance companies who practice IPM. A publicly assessable database of licensed structural and landscape PCOs who have adopted IPM practices could also help private businesses and public agencies develop contracts that match their IPM policies. Specific recommendations include:

- Non-technical information describing legal and environmental benefits of IPM.
- Resources for developing IPM policies
- Information about how to evaluate a pest control contract for IPM services.
- Education facility and grounds managers about certifications currently available such as the Certified Grounds Manager (CGM) and the Certified Grounds Technician (CGT) sponsored by the Professional Grounds Management Society (PGMS).

5) Develop an educational campaign and more convenient facilities for the disposal of pesticide products and containers.

Specific recommendations include:

- Develop convenient disposal sites for containers and leftover product. This should include large community containers where commercial pesticide users can dump leftover pesticides.
- Have an effective educational campaign about proper disposal.

6) Take advantage of current pest control product vendors as an outreach channel

The majority of pest control professionals in Sacramento, San Diego, and Orange Counties use pest control product vendors as their prime resource for information about pesticides and IPM. Pest control product vendors include pesticide distributors (ex. Univar, Target Specialty Products, and Hydroscape), box stores that sell pesticides (ex. Home Depot, Lowes, and Walmart), pesticide manufacturers (ex. Ortho, Bayer, Dow Agrosiences, and Syngenta), and independent pesticide sales people. Some pesticide vendors not only produce and/or sell pesticides but provide outlets where pest control companies can get information about pest identification, pesticide labels, and IPM. Product vendor employees may also give information to customers about what pesticides to purchase. These communication outlets are well established but are underutilized by university researchers, UCCE, regulatory agencies, and non-governmental organizations. Product vendors do present a conflict of interest because their goal is to sell pesticides. However, these product vendors also sponsor trade magazines, websites, and conferences. There are multiple opportunities to forge relationships with these vendors. Information about pest identification, pesticides, and IPM could be displayed in hardware stores and retail nurseries. It may be impossible to advocate the elimination of pesticides but these vendors can be encouraged to deliver information about least toxic pesticides and other pest management tactics. Some examples include the following:

- Pesticide product vendors could distribute UC IPM educational materials such as pest cards.
- Encourage UC urban pest management specialists to attend vendor workshops and give presentations at meetings.
- Train store employees about pesticides and IPM so that they can make appropriate suggestions to customers about how to manage specific pests.
- Encourage vendors to link their websites to the UC IPM website.

7) Develop a resource directory of IPM training materials and supplies for pesticide user groups.

Currently there are a variety of IPM training materials and supplies available for different groups who apply pesticides in urban areas. Often, well-balanced scientifically-based IPM training materials are underutilized by those who apply pesticides in urban areas, especially facility or grounds managers. In some cases, information from the pesticide manufacturer and distributor are more easily accessible to the urban pesticide user. Training materials offered by pesticide distributors often lack information about monitoring pests and pest prevention and instead focus on selecting the appropriate pesticide to use against a specific pest or a combination of pests. As an alternative, information about the impact of pesticides on water quality and proper disposal practices should be essential parts of a training program. IPM training materials that are available are not being fully utilized by certain pesticide user groups. For example, the

survey with 23 structural pest control companies in Sacramento indicated that this group gets most of their information from pesticide manufacturers and distributors.

Many different groups including the University of California Cooperative Extension and the United States EPA have published well-balanced information about urban IPM. For example, the UC Statewide IPM Program offers a number of publications including free publications online, pest management books (one example for landscape pest managers is the book: *Pests of Landscape Trees and Shrubs; An Integrated Pest Management Guide*), UC Pest Management Guidelines and Pest Notes, and pesticide safety/ training books and leaflets. The challenge is letting different pesticide user groups know how to find this information.

A directory could include materials from:

- UC IPM
- US EPA
- UC IPM publications
- Pesticide Applicators Professional Association (PAPA)
- California Association of Nurseries and Garden Centers (CAN)
- California Association of Pest Control Advisors (CAPCA)
- University of California Cooperative Extension (UCCE)
- Professional Grounds Management Society (PGMS)
- Professional Lawn Care Association of America (PLCAA)
- The Arborist Society

8) Produce e-newsletter updates from unbiased sources (e.g. UCCE)

Pest control companies, facility managers, and landscape maintenance groups need unbiased sources of information about pesticides, regulations, and IPM. Not only do these groups need information about IPM but they must be educated to understand the importance of IPM and reducing pesticide use. E-newsletters offer an alternative form of communication that is simple and easily accessible. These newsletters could offer information about how pesticides impact water quality, how to avoid pesticide pollution with IPM practices and pesticide-related toxicity information. These newsletters would be especially helpful for facilities managers who are establishing IPM policies or who are looking for a pest control company to contract with.

For example, the University of Florida Cooperative Extension currently produces two monthly newsletters: *Retail Garden Newsletter* and *Commercial Horticulture Newsletter*⁴⁵. Landscape professionals can receive either e-mail or fax subscriptions to these newsletters. Both newsletters discuss new and interesting publications. They highlight seasonal gardening and pest problems and offer helpful tips. It also contains an events calendar and lots of pictures and diagrams. The Retail Garden Newsletter is intended for both retail garden professionals and newer employees of other horticultural service businesses. The Commercial Horticulture Newsletter is intended to educate commercial and municipal horticulture professionals. It contains horticultural information but also some business and pesticide information. It may be better suited for supervisors, managers, and business owners than entry-level employees.

⁴⁵ Available at <http://prohort.ifas.ufl.edu/Newsletters.htm>

9) Develop IPM certification programs with incentives for companies to participate.

There is currently a lack of IPM certification programs for pest control companies in California. Having IPM certifications available would increase the professionalism of the pest control industry. Current or developing certifications need to be reviewed by public agency or reputable professional organizations for potential problems. The first step is to provide incentives for companies to participate in such certification programs. These incentives could be:

- Special listing in a county or state directory
- Rebates in advertising as a “Certified Company”
- Government bidding preference

Certification should include documentation of or training in:

- Monitoring
- Pest ID
- Toxicology
- Water Quality
- Integrating compatible and environmentally sound management tools

7.2 Specific Suggestions for Pesticide User Groups

1) Structural Pest Control Operators

IPM outreach efforts should focus on small pest control businesses. According to the trade magazine, *Pest Control*, the majority of pest control businesses (67%) in the United States have less than five full time technicians (Porter, 2004). In general, these smaller pest control companies have less time for pest management training because their technicians are always out in the field (Gonyo, 2000). Larger pest control companies have more flexibility and can send their technicians to training. As a result, smaller pest control companies often have less professionalism and are less likely to use IPM practices (Rust, 2004). If there are training and educational programs tailored to smaller companies there may be a significant change in pesticide use behavior. In general, a more professional industry will lead to more adoption of IPM practices.

Although 85% of structural pest control businesses in California are members of PCOC, UCCE and PCOC reach less than 40% of the structural pest control industry (Rust, 2004). The same (approximately 300) SPCOs attend most of the seminars and conferences in California year after year but over 6,000 structural pest control companies are registered in California (Rust, 2004). Additional research is needed to identify what factors impede pest control professionals from attending meetings sponsored by PCOC or UC Cooperative Extension.

The pest control industry needs information about how to retain and train employees. Pest control companies are more likely to invest in IPM training for their technicians if they know they are going to retain employees (Ricca, 2004). Structural pest control operators (SPCOs) also need well-balanced training materials. Currently, most SPCOs get information about pesticides and IPM from pesticide distributors and manufacturers. There is a need for IPM training materials that contain information that is specifically geared towards structural pest control, including:

- Pest management tactics for homes
- A comprehensive strategy for managing ants
- Treatment thresholds for the most common structural pests

- The importance of physical and cultural control measures

2) Landscape Pest Professionals (Public Agency Personnel and Private Business)

Public and private golf course superintendents

Public and private cemetery grounds managers

Parks and recreation landscape managers

Sports turf managers

Landscape maintenance companies who report pesticide use

IPM training programs for landscape pest professionals should include:

- Demonstration type educational programs in landscape environments.
- Landscaper to landscaper meetings where they discuss how to adopt practical pest management tactics that will reduce pesticide use.

3) Maintenance Gardeners

Maintenance gardeners are more difficult to reach than licensed landscape pesticide applicators. They are often unlicensed and less educated and do not seek information from conventional sources. Pest control is also only a minor part of their job; therefore, education about pesticides and IPM is less of a priority. Maintenance gardeners need IPM information delivered to them in a clear simple manner. Many maintenance gardeners are immigrants and may be better able to understand information in their native language. The majority of the maintenance gardeners interviewed in San Diego and Orange Counties were Hispanic. This group stressed that they would like to see more information about how to use pesticides in Spanish. Asian as well as Hispanic gardeners are common in northern California.

In general, maintenance gardeners do not apply the concepts of IPM to their business. Unlike landscape pest professionals, their primary work is not pest control. The focus of their work is mowing, trimming bushes, and cleaning up lawn debris. Often the customer is the one who requests pest control services in addition to landscape maintenance activities. The maintenance gardener must then choose the appropriate pesticide with little or no formal training in pest management. They often seek the advice of store employees when choosing a pesticide. Unfortunately many store employees lack the same pest management training and give poor advice about pesticides. Store employees and maintenance gardeners need more information about how to make smart pest management decisions.

The following is a list of specific recommendations for maintenance gardeners in California:

- Create an IPM Certification Program for maintenance gardeners across the state of California that is similar to the Green Gardener Certification Program in Santa Barbara, California.
- Train store employees where maintenance gardeners purchase pesticides about IPM and alternative practices.
- Visit stores where gardeners buy pesticides early in the morning and distribute IPM information.
- Display information about pesticides and IPM (in many different languages) in stores where maintenance gardeners purchase pesticides.
- Create a landscape pest management guide that is in Spanish and English, uses simple language, and contains detailed illustrations.
- Deliver IPM information via Spanish TV and radio.

Conclusions

Non-residential pesticide users contribute a proportion of the pesticide runoff to urban creeks in Sacramento, San Diego, and Orange Counties. Structural Pest Control Operators, landscape maintenance groups, and right-of-way pesticide applicators are major contributors to non-residential pesticide use in these three watersheds. Other groups such as business owners and employees, facility managers, and janitors at commercial, institutional, and industrial facilities contribute less to non-residential pesticide use. These groups generally rely on SPCOs, QALs, QACs, and landscape maintenance companies to manage most pest problems at their facilities.

The PUR database is a valuable tool to determine general pesticide use trends. However, PUR data only represents a fraction of the overall use in urban areas because many people who use pesticides in landscape are not licensed and do not report. PUR data is generally reliable for the structural pest control and public agency pest control groups.

Structural Pest Control Operators, landscape pest professionals, and public agency pest professionals receive most of their information about pesticides and IPM from educational meetings and training seminars (to meet continuing education requirements), trade magazines, representatives from pesticide distributors and manufacturers, studying for exams to obtain licenses, professional organizations, in-house training, and the Internet. The University of California (UCCE and UC IPM), government agencies, and non-governmental organizations also provide information about pesticides and IPM to these groups.

It is less clear where other groups that do not report pesticide use or do not have a license get information about pesticides and IPM. Many of these groups receive information where they purchase pesticides from store employees. Groups such as maintenance gardeners may also exchange information through peer networks. Trade magazines for business owners and facility managers provide a limited amount of information about pest prevention, pesticide use, and how to contract with a pest control company.

This report suggests a number of outreach approach/ strategies to reach all of these pesticide user groups with comprehensive information about the safe and appropriate use of pesticides, pesticide regulations, and IPM practices. IPM information and training materials need to be delivered from unbiased sources in a clear, simple manner to each pesticide user group. These outreach suggestions are designed to guide CDPR in promoting a comprehensive outreach plan to mitigate existing water quality problems associated with urban use of pesticides. Outreach programs should involve University of California Cooperative Extension, state and local agencies, non-governmental organizations, professional associations, and user groups as appropriate.

References

- AFPMB. 2005. Armed Forces Pest Management Board [Online]. Available by Armed Forces Pest Management Board <http://www.afpmb.org/mission/afpmbstatement.htm> (verified 1-02-05).
- Baker, N., B. Hartzler, and J. Hanstad. 1997. Iowa Commercial Pesticide Applicator Manual: Regulatory Pest Control. Iowa State University, Ames, Iowa.
- BERC. 2005. BERC, Helping business and the environment [Online]. Available by The Business Environmental Resource Center (BERC) <http://sacberc.org> (verified 01-03-05).
- Boise, P., E.R.A.N. Smith, and J. Carey. 2004. GreenCare for Children; Measuring Environmental Hazards in the Childcare Industry: Pesticides, Lead, and Indoor Air Quality. Community Environmental Council and Urban/ Ag Ecology Consulting Services, Gaviota, California.
- Brandenburg, B. 2004. IPM Certifications, *personal communication*, (ed.), Oakland, CA.
- Caltrans. 1998. Vegetation Control, *In* S. o. C. D. o. Transportation, ed. Maintenance Manual Volume One. State of California Department of Transportation, Sacramento, California.
- Caltrans. 2004. Storm Water Annual Report Fiscal Year 2002-2003. California Department of Transportation Division of Environmental Analysis, Sacramento, California.
- Carter, A.D. 2000. Herbicide movement in soils: principals, pathways, and processes. *Weed Research* 40:113-122.
- CDPR, 2000. DPR Pesticide Use Reporting, An Overview of California's Unique Full Reporting System. California Department of Pesticide Regulation, Sacramento, California.
- CDPR. 2003. Summary of Pesticide Use Report Data 2002, Indexed by Commodity, pp. 8, *In* California Department of Pesticide Regulation, (ed.).
- CDPR. 2004. State of California Qualified Applicator Certificate Pest Control Categories. California Department of Pesticide Regulation, Sacramento, California.
- Curl, G. 2004. Business Outlook. *Pest Control* 72:15.
- Department of Defense. 1997. Department of Defense Pest Management Training and Certification. Department of Defense, Washington, D.C.
- Domagalski, J.L. 2000. Pesticides in Surface Water Measured at Selected Sites in the Sacramento River Basin, California 1996-1998. U.S.G.S W.R.I.R. 00-4203, Sacramento.
- Domagalski, J.L., D.L. Knifong, P.D. Dileanis, L.R. Brown, J.T. May, V. Connor, and C.N. Alpers. 2000. Water Quality in the Sacramento River Basin, California, 1994-1998. USGS.
- Dow AgroSciences. 2000. Specimen Label Vikane, pp. 5. Dow AgroSciences, Indianapolis, Indiana.
- EMD. 2004. Water Protection Division Stormwater Compliance Program [Online]. Available by County of Sacramento www.emd.saccounty.net/WP/EMDstormwater.htm (verified 12-29-04).
- Federighi, V., and G. Brank. 2001. Regulating Pesticides: The California Story, A Guide to Pesticide Regulation in California. CDPR.

- Foothill Associates. 2003. Arcade Creek Watershed Management Plan. Department of Parks and Recreation, Sacramento, CA.
- Geiger, C.A., and D.H. Tootelian. 2002. 2002 Integrated Pest Management Survey of California School Districts. California Department of Pesticide Regulation, Sacramento, California.
- Gonyo, J. 2000. A Guide to PCO Industry Consolidation. *Pest Control* 68:6,8.
- Huang, X., T. Pedersen, M. Fischer, R. White, and T.M. Young. 2004. Herbicide Runoff along Highways. 1. Field Observations. *Environmental Science Technology* 38:3263- 3271.
- Irvine Unified School District. 2004. Maintenance and Operations [Online]. Available by Irvine Unified School District <http://www.iusd.org/mno/welcome.htm> (verified 12-01-04).
- Kiely, T., D. Donaldson, and A. Grube. 2004. Pesticide Industry Sales and Usage, 2000 and 2001 Market Estimates. United States Environmental Protection Agency, Washington D.C.
- Kollman, W.S. 2004. Environmental Fate of Sulfuryl Fluoride. Department of Pesticide Regulation Environmental Monitoring Branch, Sacramento.
- Kuivila, K.M., H.D. Barnett, and J.L. Edmunds. 1997. Herbicide Concentrations in the Sacramento- San Joaquin Delta, California. U.S Geological Survey, Sacramento, California.
- Moran, K.D. 2003. Insecticide Market Trends and Potential Water Quality Implications. TDC Environmental, San Mateo, CA.
- OCVCD. 2004. Vector Control Strategies [Online]. Available by The Orange County Vector Control District www.ocvcd.org (verified 12-15-04).
- Owens, K. 2003. Healthy Hospitals, Controlling Pests Without Harmful Pesticides. Health Care Without Harm, Washington, D.C.
- Pardy, L., and J. Smith. 2002. Technical Report for Total Maximum Daily Load for Diazinon in Chollas Creek Watershed San Diego County.
- Paulsen, E. 2003. Educational Resources for SPCOs, *personal communication*, Davis, California.
- Peterson, D., C. Thompson, D. Regehr, and K. Al-Khatib. 2001. Herbicide Mode of Action. Kansas State University, Manhattan, Kansas.
- Porter, S. 2003. On the rebound? *Pest Control* [Online] <http://www.pestcontrolmag.com/pestcontrol/article/articleDetail.jsp?id=67930> (verified 01-05-05).
- Porter, S. 2004. All Bets are Off. *Pest Control* 72:S3- S17.
- Ricca, S. 2004. Make the match. *Pest Control* 72:S3- S17.
- Rust, M. 2004. Outreach activities for SPCOs, *personal communication*, Sacramento, CA.
- Rust, M., J. Klotz, C. Amrhein, and R. Krieger. 2004. In search of the 'sweet spot'. *Pest Control*. [Online] <http://www.pestcontrolmag.com/pestcontrol/article/articleDetail.jsp?id=122653> (verified 01-05-05).
- SCDT. 2004. Leading the way to Greater Mobility, Strategic Operating Plan. Sacramento County, Sacramento, CA.

- SPCB. 2004. What is Structural Pest Control? [Online] <http://www.pestboard.ca.gov/whatis.htm> (verified 4-10-04).
- Spector, C., D. Daniels, G. Davis, J. Karkoski, and Z. Lu. 2004. Total Maximum Daily Load (TMDL) Report for the Pesticides Diazinon and Chlorpyrifos in: Arcade Creek, Elder Creek, Elk Grove Creek, Morrison Creek, Chicken Ranch Slough, and Strong Ranch Slough In Sacramento County, California. California Environmental Protection Agency, Rancho Cordova.
- SRWP. 2004. Annual Monitoring Report 2002-2003. Sacramento River Watershed Program, Sacramento, CA.
- Strauss, A. 2002. Total Maximum Daily Loads for Toxic Pollutants, San Diego Creek and Newport Bay, California. U.S. Environmental Protection Agency, Region 9.
- Turner, K., E. Nelson, L. Lee, and B. Harriman. 2003. Breeding turfgrass for better golf. Golf Course Management. [Online] <http://www.gcsaa.org/GCM/2003/jan03/PDFs/01Breeding.pdf> (verified 01-08-05).
- U.S. Army Corps of Engineers. 2001. Newport Bay/ San Diego Creek Watershed Management Study. U.S. Army Corps of Engineers, Orange County, CA.
- U.S. Census Bureau. 2004a. California QuickFacts [Online]. Available by U.S. Census Bureau <http://quickfacts.census.gov/qfd/states/06000.html> (verified 01-05-05).
- U.S. Census Bureau. 2004b. State and County QuickFacts [Online] <http://quickfacts.census.gov/qfd/states/06000.html> (verified 7-09-04).
- UC IPM. 2000. Fleas [Online]. Available by UC IPM <http://ipm.ucdavis.edu/PMG/PESTNOTES/pn7419.html> (verified 12-28-04).
- Univar. 2004. PestWeb [Online]. Available by Univar <http://www.pestweb.com/aboutpestweb/mission.cfm> (verified 3-05-04).
- USEPA. 2000a. Chlorpyrifos Revised Risk Assessment and Risk Mitigation Measures [Online] <http://www.epa.gov/pesticides/op/chlorpyrifos/consumerqs.htm> (verified 12-28-04).
- USEPA. 2000b. Diazinon [Online] <http://www.epa.gov/oppsrrd1/op/diazinon.htm> (verified 12-08-04).
- USEPA. 2000c. Organophosphate Pesticide Information, Chlorpyrifos Summary [Online] <http://www.epa.gov/oppsrrd1/op/chlorpyrifos/summary.htm> (verified 12-27-04).
- USEPA. 2000d. Organophosphate Pesticide Information, Diazinon Summary [Online] <http://www.epa.gov/oppsrrd1/op/diazinon/summary.htm> (verified 12-27-04).
- USEPA. 2004a. Taking Care of your Pet During Flea and Tick Season [Online] www.epa.gov/pesticides/factsheets/flea-tick.htm (verified 12-08-04).
- USEPA. 2004b. Cal/EPA Ombudsman Program [Online]. Available by Cal/EPA www.calepa.ca.gov/Ombudsman/ (verified 12-05-04).

Appendices

Appendix A: UC Cooperative Extension Survey June 2004

Survey Part I: Applicator Groups

Structural Pest Control

How many of the survey respondents work with SPCOs?

5

Structural Pest Control Operators obtain information about pesticides and IPM through various meetings, workshops, training seminars, trade magazines, salesmen, in-house training by pest control companies, pesticide dealer trainings, internet, correspondence courses, private consultants, regulators, and representatives of pest control manufacturers.

SPCOs are first exposed to information about IPM when they are studying for the field representative or operator's exam given by the SPCB. While studying for the exam they many also receive information through a correspondence course or in the classroom.

Opinions about the availability of reliable educational resources about pesticides and integrated pest management directed towards SPCOs:

3- Good

1- Poor

1- Fair

Landscape Maintenance

How many respondents work with licensed/ certified commercial landscape pesticide applicators?

8

This group obtains information about pesticides and IPM through UCCE continuing education classes, UNX, commercial contacts, trade magazines, salesmen, PAA, and UC Davis classes.

Opinions about the availability of reliable educational resources about pesticides and IPM directed towards landscape maintenance workers:

2- Excellent

4- Good

1- Fair

1- Poor

Maintenance Gardeners

How many respondents work with maintenance gardeners?

8

This group obtains information about pesticides and IPM through friends, PAPA meetings, other maintenance gardeners, some continuing education classes. According to one respondent, most of them do not get their information from anywhere and they do not come to meetings.

Opinions about the availability of reliable educational resources about pesticides and IPM directed towards this group:

- 4- Good
- 1- Fair
- 3- Poor

Public Agency Employees

How many respondents work with public agency employees?

9

This group obtains information about pesticides and IPM through UCCE, UNX, Commercial contacts, trade magazines, PAPA, continuing education classes, and the internet. One respondent said that this is on an individual basis or they might attend a conference or seminar.

Opinions about the availability of reliable educational resources about pesticides and IPM directed towards this group:

- 2-Excellent
- 6-Good
- 1- poor

Golf Courses

How many respondents work with golf courses?

7

This group obtains information about pesticides and pest management through USGA, UCCE, UNX, commercial contacts, salesmen, trade magazines, trade meetings, websites, newsletters, continuing education classes including some very good golf course management classes.

Opinions about the availability of reliable educational resources about pesticides and IPM directed toward this group:

- 1- Excellent
- 2-Good
- 4-Fair

Retail nurseries

How many respondents work with retail nurseries?

9

This group obtains information about pesticides and pest management through CAN, sales representatives, product labels, UCCE, trade magazines, CCN PRO, CAPCA, PAPA, PCA's, PCO's, and association commodity newsletters.

One respondent quotes, "I'm not sure, California Association of Nurserymen, UC/ internet... it is clear that they, like maintenance gardeners haven't a clue about correct pesticide use and recommendations."

Opinions about the availability of reliable educational resources about pesticides and IPM directed toward this group:

- 1-Excellent
- 2-Good

2-Fair
3-Poor

Private Businesses

Who many respondents work with private businesses?

5

This group obtains information about pesticides and pest management primarily on an individual basis, retail sales staff, local pest control company, and if they are certified continuing education hours. This group is largely out of the loop and do not come to meetings. UC Cooperative Extension is also available to those few who are aware of its existence.

Opinions about the availability of information about pesticides and pest management:

1- Good
1- Fair
3- Poor

Survey Part II: Outreach approaches

Methods, approaches, and avenues to best reach these groups with information about pest management and water quality:

Structural Pest Control Operators:

- University outreach via continuing education classes: workshops and conferences.

Maintenance Gardeners:

- Literature in English and Spanish

Employees of Retail Nurseries:

- Payment (cash or valued publication on pest management) to individuals to participate in training
- free training at job site
- direct mailing or e-mail to employee at home
- CAN

In general for all groups:

- Conferences and workshops
- Presentations to trade group meetings and continuing educational meetings
- Through PAPA and CAN
- Site visiting, personal contact
- Continuing education classes that should include how to navigate the UC IPM website.
- Targeting the classes where the pesticide dealers like VWR and Target give new product information would be an excellent start.
-

Activities that you have been involved in to disseminate information to these groups:

Structural Pest Control Companies:

- Seminars and Conferences
- Chair of the Annual Urban Pest Management Conference at UC Riverside
- Presentations at Target Specialty Products seminars
- Consultations with technical directors of pest control firms

- Authoring extension bulletins

Licensed Commercial Landscape Pesticide Applicators:

- Meetings
- Classes
- Personal contact
- Presentations at meetings

Public Agency Employees:

- Meetings
- Classes
- Personal Contact

Golf Courses:

- Meetings
- Classes
- Personal Contact
- Field research and demonstration
- Talks
- Newsletters

In general for all groups:

- Presentations at meetings
- At the Sutter County Agricultural Department we give grower continuing education classes but, send flyers to gardeners and landscapers and nurserymen to encourage participation. As we get new information we try to pass it on to the above groups.

Obstacles to getting information to these groups:

Structural Pest Control Operators:

- New regulations that are coming with respect to CE requirements (topics and testing) will make it more difficult to provide quality programs.

Maintenance Gardeners:

- Literacy
- Developing a good list and a reason for them to come to meetings
- Employees of retail nurseries:
- Businesses do not value trained employees, rapid turnover of employees, emphasis on product sales, disincentive to spend time providing customers with information.

If general for all groups:

- Attendance
- Listening
- Ego
- Isolated, don't feel like they need the information or that IPM takes more time than spraying.

The most successful methods for reaching one or more of these groups:

Structural Pest Control Operators

- The Annual Urban Pest Management Conference has been a tremendous success in providing PCO's with the latest research on urban pest management and updates on regulatory issues.

Licensed Commercial Landscape Pesticide Applicators

- Working through CAPCA and PAPA is most efficient because of the large database and mailing lists that they have. We can easily reach hundreds at a time per locality when we speak at these group meetings.

Methods to reach all groups:

- Classes
- Seminars and training conferences
- To find them out of compliance with pesticide enforcement and then strongly encourage them to come to our CE meetings where I try to have UC people there talking about IPM.

Other comments from survey:

Stricter pesticide regulations

There are too many products on the market that are not very effective. California registration of pesticides for home use should be more stringent. Only businesses with trained employees should sell home/garden pesticides.

More funding for urban IPM research

For decades the federal and state agencies have funded agricultural IPM research and extension. We simply don't have that support in the urban sector. For most pests, we don't have data or demonstration projects showing alternatives are effective. If we are going to change the practices of the pest control industry we must have workable solutions.

More personal communication with pesticide user groups

Printed material and websites are a great source for those so inclined. The ones we are missing need face to face delivery methods, such as at required pesticide license C.E. meetings.

Outreach to Maintenance Gardeners

The hardest job will be getting the tail gait gardeners who just spray some Roundup now and then. These folks are out of the loop and I don't know how to get them. I have tried for years and now have given up on the idea of ever doing so.

Increase education and enforcement

Clearly I am stacked on the enforcement side so I see things you folks won't. If there was a list, or somehow put together a list of people, willing to talk at continuing education classes so we can pass the IPM for all, attitude around.

Appendix B: Commercial Pest Control Company Survey Questions

1. To get an idea of the size of this business, how many employees work there?
2. What services does this business offer? Ex. Structural pest control, control of landscape pests...
3. Who is your clientele (residential, commercial, industrial, or all three)?
4. How many years has this company been in business?
5. Are you a member of Pest Control Operators of California?
6. Do you conduct pest control in the communities of Citrus Heights, Arcade, Carmichael and Fair Oaks?
7. What are the top three pests you treat for?
8. What are the top three insecticides you use to treat these pests?
9. Where do you purchase these pesticides?
10. Where do you get information about which pesticides to use?
11. Do you use the Internet to obtain information about pest management practices such as pest identification, pesticide application rates, and timing of pesticide applications?
12. What are the top three websites you frequent the most for information about pest management?
13. What other sources do you use to get information about pest management, product availability, pest identification, and government regulations?
14. When choosing a pesticide, what influences your decision?
15. How do you dispose of pesticide containers and left-over product?
16. Do you have a pesticide applicators license?
17. If so, does your company file a monthly use report with the agricultural commissioner?
18. Could you benefit from additional information about managing pests?
19. What would be the best way for UC Cooperative Extension to get information to you about new pests, pest management practices, or pesticide hazards?

Appendix C: Business Survey Questions

1. Do you handle your own pest control, is pest control contracted out to a private firm, or is it a combination of the two?
2. What is the name and phone number of the pest control company?
3. Could you also give me the name and number of the landscape maintenance company you use?
4. If you handle your own pest control.....
5. Do you use insecticides and or/herbicides?
6. What are the key insects and or weeds you treat with pesticides?
7. Where do you buy your pesticides?
8. What are some of the most common insecticides/herbicides you use?
9. Where do you get information about which pesticides to use?
10. Where do you get information about pest management practices such as pest identification, pesticide application rates, and timing of pesticide applications?
11. When choosing a pesticide, what influences your decision?
12. How do you dispose of pesticide containers and left-over product?
13. Do you have a pesticide applicators license?
14. If so, does someone in your company file a monthly report with the agricultural commissioner?
15. Could you benefit from additional information about managing pests?
16. What would be the best way for UC Cooperative Extension to get information to you about new pests, pest management practices, or pesticide hazards?

Appendix D: Landscape Maintenance Survey Questions

1. Are you self-employed or do you work for someone?
2. What kind of gardening services do you offer?
3. How do you manage weeds and/or insects?
4. Do you use any herbicides or insecticides?
5. What are the key insects/ weeds you treat with pesticides?
6. Where do you buy your pesticides?
7. What are some of the most common insecticides/herbicides you use?
8. Where do you get information about which pesticides to use?
9. Where do you get information about pest management practices such as pest identification, pesticide application rates, and the timing of pesticide applications? (This was a difficult question for the landscape gardeners to understand, it was often simplified or omitted)
10. When choosing a pesticide, what influences your decision?
11. Do you consult with the property owner before applying pesticides?
12. How do you dispose of pesticide containers and left-over product?
13. Do you have a pesticide applicators license?
14. If so, do you or does someone in your company file a monthly report with the agricultural commissioner?
15. Could you benefit from additional information about managing pests in Spanish?

Appendix E: Professional Pesticide Users Survey

1. What are the key pests you treat for?
2. What kind of license, if any, do you have?
3. What are the three most commonly used insecticides/herbicides?
4. Who buys the insecticides/herbicides you use?
5. Where do you purchase these pesticides?
6. Does your business apply pesticides in Sacramento, San Diego, or Orange County?
7. Who applies the pesticides?
8. What kind of training do they have?
9. Who supervises them (if applicable)?
10. What application methods do they use?
11. What type of license do they have (the people that apply the pesticides)?
12. How do you report the pesticides you use? Do you fill out a pesticide use report form?
13. If so who fills it out? What problems do you have with this form?
14. What pesticides do you report?
15. Where/who do you think most of the pesticide runoff problems come from in Sacramento county?
16. Where do you get information about which pesticides to use?
17. Where do you get information about pest management practices such as pest identification, pesticide application rates, and the timing of applications?
18. Who do you contact about environmental regulations concerning pesticide use?
19. Have you been to any educational meetings in the last 12 months? Who sponsored it?
20. How are the remaining pesticides disposed of and who disposes them?
21. If you have a spray tank, where is it rinsed out and what is done with the rinse water?