

PEOPLE, PLACE AND HEALTH: A SOCIO.SPATIAL PERSPECTIVE OF AGRICULTURAL WORKERS AND THEIR ENVIRONMENT

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ABSTRACT

This project employs a mixed-method, place-based approach to study agricultural worker health issues related to pesticide use in rural California. Sociospatial analysis considers space, place and social indicators in a holistic and integrated fashion (Steinberg and Steinberg 2008). This project utilizes Geographic Information System (GIS) to effectively integrate environmental and social data related to farmworker health and pesticide use. GIS is a computerized system of mapping. The value of a sociospatial approach is that it allows for the spatial portrayal of social and environmental data in a holistic fashion. In this case, our sociospatial approach highlights the interplay between people and place. We focus on environmental and social issues for farmworkers in the three communities in both Monterey and Tulare counties. Using this visual approach for communication and portrayal of data proves to be effective across both language and literacy barriers.

To conduct this study, the California Center for Rural Policy and the Institute for Spatial Analysis, located at Humboldt State University, worked in partnership with the Agricultural Worker Health Initiative (AWHI) funded by the California Endowment, including Poder Popular - a community-based group to empower farmworker communities throughout the state of California. We wish to thank the California Endowment for support of this project. We would especially like to thank Mario Gutierrez, M.P.H., Director, Rural and Agricultural Worker Health Program for his vision in supporting this work.

This report contains sociospatial data, consisting of both maps and interview data integrated to tell the stories of farmworkers, their communities and pesticide drift. The project also incorporated extensive environmental mapping of pesticide use and application rates within the study region with associated qualitative data relating to farmworker health. The complete map

set along with details regarding spatial analysis methods and data are detailed in a separate document, *People, Place and Health: A Pesticide Atlas of Monterey County and Tulare County, California*. Methods used include key-informant interviews, ethnographic methods, public participation GIS, attending community meetings, and environmental mapping. We highlight how a community-based participatory research approach is a means to understand community members' interests and knowledge about pesticides. Particular emphasis is placed on the amount and types of pesticides and fumigants used near schools, neighborhoods and community gathering places. The report concludes with a summary of our findings and policy recommendations.

RESEARCH TEAM

PRINCIPLE INVESTIGATORS

The lead investigators for this project are Drs. Sheila and Steven Steinberg. The Steinbergs possess relevant experience in the field of social science and GIS. Together they co-authored a book for Sage Publications (2006) titled *GIS for the Social Sciences: Investigating Space and Place*. This book has been widely adopted by academic institutions and practitioners alike, reaching both a national and international audience.

Dr. Sheila Lakshmi Steinberg, Director of Community Research, California Center for Rural Policy (CCRP) and Associate Professor of Sociology at Humboldt State University conducts community-based research related to environment and has conducted numerous projects in this area. She speaks Spanish and spent approximately three years in Guatemala as a U.S. Peace Corps volunteer and professor at the University of San Carlos in Guatemala. Dr. Sheila Steinberg worked as a professor in rural New Mexico at Western New Mexico University, designated a Hispanic Serving Institution where 70% of the student body are Latinos. In 2000, she joined Humboldt State University where she currently teaches classes on human interactions with the physical environment at the local, national and global levels.

Dr. Steven J. Steinberg, Director of the Institute for Spatial Analysis (ISA) is an Associate Professor in Humboldt State University's Natural Resource Planning Program with emphasis in GIS and Remote Sensing. He came to Humboldt State University in 1998 and has taught courses in map analysis, GPS, GIS and Image analysis as well as the ethics of mapping. His Ph.D. emphasized the introduction and adoption of GIS-based tools in seven rural communities throughout the State of Minnesota. In 2004, he was selected as a Fulbright Scholar and received an appointment as Distinguished Chair at the Centre for Scientific Computing, Simon Fraser University in Vancouver, British Columbia, Canada. In 2005

he was honored with Humboldt State University's Alistair McCrone Promising Faculty Scholar award. Dr. Steinberg has researched and presented extensively on the application of spatial analysis technologies for modeling and visualization in both human and natural environments.

PROJECT STAFF

Jennifer Kauffman, M.S., Geospatial Analyst, Institute for Spatial Analysis. Gathered and analyzed pesticide and weather data and oversaw cartographic design for project Atlas.

Nanette Yandell, Research Analyst, CCRP. Conducted qualitative analysis on the project, participated in key-informant data collection efforts, field research participant.

Josef Eckert, Research Analyst, Institute for Spatial Analysis. Gathered and analyzed GIS pesticide data. Created maps, analyzed Public Participation GIS (PPGIS) and organizational networks data. Assisted with field collection of PPGIS and groundtruthing of data and assisted with collection of key-informant interviews.

Marian Strong, Research Analyst, CCRP. Conducted qualitative analysis on the project, participated in key-informant data collection efforts, field research participant.

Launa Peeters, Research Assistant, CCRP. Conducted bibliographic research and assisted in key-informant interview and field data collection efforts.

Adrianna Bayer, Research Assistant, CCRP. Conducted preliminary data collection and assisted in preparation of interview materials. Identified key themes and topics brought forward in the data.

PROJECT AND ORGANIZATION BACKGROUND

In May 2007, the California Center for Rural Policy and Institute for Spatial Analysis received a research contract from the California Endowment to examine the relationship between farmworker health and pesticide drift in Tulare and Monterey counties. The project centered on these two counties which are at the hub of the California Endowment Agricultural Worker Health Initiative (AWHI) Project. Furthermore, Tulare County is the second highest agricultural producing county, by dollar value, in California; followed by Monterey County in the number four slot (California Department of Food and Agriculture 2007).

The project employs a multi-method approach including a combination of qualitative and quantitative research methods in a geospatial context.

Key-informant interviews were conducted in both Tulare and Monterey counties with community leaders, educators, farmworkers and local non-profits to better understand the link between farmworker health and the surrounding environment.

These interviews provided insight into primary issues of relevance related to pesticide use, pesticide drift, agricultural worker health and other community issues in these regions. Analysis of these interviews helped us to understand issues related to pesticide exposure, how farmworkers are affected by pesticide drift, where and how they go to seek treatment in instances of possible exposure to pesticides and other specific areas of concern in these communities. Furthermore, by conducting interviews with various parties working on pesticide issues, including non-profit groups, agricultural and county officials, farmworkers and community members, topics of importance and which may benefit from policy changes emerge. These interviews provide the basis for developing a deeper understanding of the various farmworker/pesticide drift interactions and perspectives presented in this report.

PURPOSE

Our place-based study provides an opportunity to examine interrelationships between farmworkers, their health and environment. The California Endowment has already invested significant effort into the two intensive sites of Tulare and Monterey counties. Processes and results of this study provide a basis to understand some of the outcomes of this work as well as to enhance similar work conducted elsewhere in the state. The importance of understanding exposure to pesticide drift and exposure extends beyond these two intensive sites to all agricultural areas within California and elsewhere.

Our project provides analysis of the environment, use patterns of pesticides and health using Geographic Information Systems (GIS) derived map displays that can be integrated into educational materials to share with farmworkers and used by policy makers to understand and affect changes related to pesticide use, drift and potential effects on farmworker and community health.

The associated pesticide atlas supports on the ground efforts via Poder Popular and will provide a geographic, community-based context which may help to guide future policy efforts. Additionally, this report and the associated pesticide atlas will serve community members by providing relevant, place-based information about their local communities. The report outlines some possible policy solutions/suggestions that arose from our sociospatial analysis of data.

PROJECT NEED

The need for such a study arose from the persistently observed relationship between farmworker occupation and farmworker health. The very nature of agricultural work frequently exposes farmworkers to pesticides as a part of their occupation. However,

the relationships between farmworkers, environment and health present ongoing issues of concern for many agricultural communities. This is a timely project which we believe will identify salient areas for future focus. Geospatial analysis can assist in identifying areas of greatest concern thus helping to target educational and policy efforts to achieve the highest level of effectiveness.

In this report and the accompanying pesticide atlas, we incorporate community-based knowledge from interviews conducted in the study site. Geospatial data obtained from other sources (e.g. official agency records) was groundtruthed and cross-checked with local people's knowledge. This process allows residents of the affected communities to provide input regarding the accuracy of these maps while simultaneously presenting an opportunity for community members to suggest additional data and other features to more effectively communicate realities on the ground. Local residents are knowledgeable about issues affecting their communities and this process allows community members to provide our research team with relevant feedback about our efforts.

Our project incorporated both primary and secondary data sources as a part of our process. Primary data consists of information collected by our research team directly on the ground through field work and interviews with residents in the study regions. Secondary data consisted of information obtained from existing sources, including published reports, websites, agency records and geospatial datasets obtained from local, state and federal agency sources responsible for mapping of relevant environmental information related to pesticides, pesticide drift, water quality, and other environmental and infrastructure data for the region. Using GIS to map and model a variety of primary and secondary data, we provide a holistic perspective of the region and health issues facing farmworkers as related to their surrounding physical environments and important interactions within these environments.

Our study generated a wide variety of visual map displays that can be used for educational purposes, to help these communities and policy makers to better understand issues facing agricultural workers in California. These maps provide an important context for community members, partners and policy makers alike to better understand, in a visual context, the larger environment in which farmworker live and work, and to explore the links between farmworker health and environment.

The maps contained in the pesticide atlas generated as a part of this project illustrate the environmental context, including topography and relative locations of communities, schools, fields and other infrastructure in which farmworkers from Tulare and Monterey counties live and work. The maps provide a visual context for communication with and education of members of the farmworker community, policy-makers and other interested individuals. Coupled with excerpts from the key-informant interviews this report and the pesticide atlas provide the experiential context for the farmworkers and issues that face related to pesticide drift. Visual communication of this type is particularly useful for the presentation of complex data in a readily accessible format to a variety of audiences ranging from agricultural workers and growers to local and state level policy makers.

These maps and associated analysis support the mission of the Poder Popular program by empowering multi-sector community groups and partners by giving them a broader picture of place, space and environment in which they are functioning. Employing public participation GIS farmworkers and community members themselves have the opportunity to define and clarify issues they face on a daily basis.



Community members in Monterey County take part in a Public Participation mapping project to identify areas of interest within and around the three Poder Popular communities of Salinas, Gonzales and Greenfield.

The visualizations provided in the resulting maps provide important information that can be used in the community building process. It will provide farmworkers and Poder Popular partners with a place to begin a conversation within their own communities and to broaden outward to affect policy at local, regional and state levels.

OBJECTIVES

The objective of this project included:

- Provide a context to better understand the environmental and social conditions that farmworkers in Tulare County and Monterey County face.
- Answer questions relating to patterns in the types of land use, pesticide use, illness and farmworker perceptions of

health, that surface when using overlaid GIS data layers? What picture does this present of health, environment and community for the farmworker?

- Integrate our work with the Poder Popular program at the grassroots and policy level.
- Produce information useful to improving the social and environmental contexts for farmworkers and their communities.
- *Produce the final project report and an accompanying pesticide atlas.*
- *Present project findings to the August 2007 AWHI conference in Sacramento, California.*
- *Present our findings to the communities of interest in Tulare and Monterey Counties.*

TOPIC BACKGROUND

Each year, millions of migrant and seasonal farmworkers are employed to work in the agriculture fields of the United States and California. In 2006, it was reported that agricultural workers held about 859,000 jobs and that the majority of farmworkers (over 68 percent) worked for crop and livestock producers (Bureau of Labor Statistics 2008). In terms of the job-outlook, little or no change is expected in farmworker jobs during the decade from 2006-2016 (Bureau of Labor Statistics 2008).

California is the state with the most productive agricultural sector in the United States, “leading the national production in over 77 different products including dairy and a number of fruit and vegetable ‘specialty’ crops (Governor’s Office of Planning and Research 2003). California produces more than half the nation’s fruits and vegetables annually. California is also the state that employs the largest number of farmworkers in the country

(Bureau of Labor Statistics 2008). The state of California includes nine of the top 10 agricultural counties nationwide (California Department of Food and Agriculture 2007). The top five counties by agricultural value in 2005 were:

1. Fresno (agricultural value \$4,604,139,000)
2. Tulare (agricultural value \$4,037,351,000)
3. Kern (agricultural value \$3,213,846,000)
4. Monterey (agricultural value \$3,090,000,000)
5. Merced (agricultural value \$2,365,494,000)

Agriculture work has been identified as one of the most dangerous occupations in the country (Donham and Thelin 2006; McCurdy and Carroll 2000; McCurdy et al. 2003). Of increasing concern is pesticide exposure among farmworkers. In 2000, 188 million pounds of pesticides were applied to crops in California (California Department of Pesticide Regulation 2001) whereas in 2006, 189.6 million pounds of pesticides were applied. Over a six year period, the total amount of pesticides used increased by 1.6 million pounds.

AGRICULTURAL WORKER PROFILE

The most recent nationwide survey of agricultural workers, the National Agricultural Workers Survey was conducted in 2001-2002. This survey, although now several years old, provides a glimpse into the composition of our nation's farmworker population.

Over three-quarters (78 percent) of the agricultural workers are foreign born (U.S. Department of Labor 2007). A sizable portion of the crop workers (42 percent) are defined as "migrants" meaning they have travelled at least 75 miles within the previous year to obtain a farm job (U.S. Department of Labor 2007).

The average age of farmworkers in the United States was 33, with half reportedly less than 31 years of age. Seventy nine percent were male, 58% were married, and 51% reported having two children. In addition, 75% of all hired farmworkers in the United States were born in Mexico, and 44% reported not being able to speak any English. Of the U.S. born farmworkers, 56% reported that they had completed a full twelve years of schooling (through high school) while only six percent of foreign born farmworkers had done so. On average, farmworkers had only completed seven years of formal education. Surprisingly, farmworkers are provided with minimal training to do their jobs, and the Bureau of Labor Statistics reports that “the majority of agricultural workers learn their skills on the job in less than a month” (Bureau of Labor Statistics 2008).

In 1999 the California Agriculture Worker Health Survey (CAWHS) was developed to specifically evaluate the health of California’s agriculture work force. According to this study ($n = 971$), the average age of workers was 34, 92% were foreign born with 96% reporting being Latino/Hispanic/Mexican, 64% were male, 59% were married, and 63% reported less than seven years of formal education. This sample is fairly consistent with the demographics reported by National Agricultural Worker Survey describing farmworkers across the nation, with the exception of ethnicity and place of birth. Nearly all of Californian agriculture workers are of Latino/Hispanic/Mexican decent and are foreign born.

ADVERSE HEALTH EFFECTS OF PESTICIDE EXPOSURE

A substantial amount of research has examined the damaging effects of pesticide exposure on the health of farmworkers and their families. One alarming fact is that children are at a much higher risk for developing problems associated with the exposure to pesticides than adults (Coronado et al. 2004; Etzel and Balk 2003). In part this is because children experience exposure through multiple pathways (Chensheng et al. 2000). Infants and

young children often spend more time on the floor where pesticide residues are likely to be found. Children also consume more oxygen and more food than adults (relative to their body mass), thus they are at higher risk for negative health effects due to inhaling or ingesting pesticide residues (Etzel and Balk 2003).

Furthermore, pesticides can drift into areas where children live, work and play. As a result, increased pesticide exposure can occur for households, daycares or schools that are in close proximity to agricultural lands treated with pesticides (McCauley, et al 2001; Richter et al. 1992). A study by Loewenherz (1997) found that children of pesticide applicators experience greater pesticide exposure than other children in the same community. In their study, they tested the levels of DMTP metabolites in 88 children of pesticide applicators. Their results demonstrated a pattern of increasing concentration levels of DMTP associated with decreasing age among the children ($p < 0.060$). The same trend was observed within households such that younger children had higher levels of DMTP than their older siblings ($p < 0.040$).

In a similar, more recent study Alexander et al. (2007) measured the level of 2,4-D pesticide residue in the urine of 34 farm families one and three days after pesticide application. Results from this study found children between the ages of four and eleven had higher levels of 2, 4-D in their urine than either children above age 12 or adults.

When children are at a higher risk for exposure to pesticides, they have a higher chance of developing chronic illnesses associated with that exposure. Studies have examined the link between children of workers exposed to pesticides and the increased risk of cancer (Daniels et al. 1997; Gunier et al. 2001; Mills and Zahm 2001).

METHODS

This study utilized a multiple methods approach including: extraction of secondary pesticide data from the California Department of Pesticide Regulation database (2005), acquisition of geospatial data from a variety of local, state and federal agency sources, key-informant interviews, Public-Participation GIS, field work including windshield reconnaissance and ethnographic methods.

ENVIRONMENTAL AND PESTICIDE DATA

Mapping pesticide use

The 2005 Pesticide Use database was obtained from California Department of Pesticide Regulation (DPR). This database provides county specific information on pounds of pesticides applied by public land survey (PLS) section, individual commodity to which a pesticide was applied, and total acreage treated. Because reported pesticide information is aggregated by the state into PLS sections of approximately one square mile, specific fields to which pesticides were applied cannot be determined. For consistency with the state data and prior pesticide mapping projects, all geospatial analysis completed for this project was mapped at this same scale and where appropriate, using the same categorical breaks (e.g. pounds/square mile) as presented in prior studies.

The pesticide use database provides a system for flagging potentially erroneous records. Any record flagged as having a possible error was removed from the database prior to our use in analysis and mapping. Fumigants were of concern to AWHI due to their tendency to drift. Any chemical labeled as a fumigant in the use database was mapped as pounds of the active ingredient applied per square mile. The total amount of fumigants, in pounds, applied in a particular square mile was also mapped. Two other specific chemicals which are prone to drift were also

mapped. Chloripyrifos and Diazinon were mentioned by Californian's for Pesticide Reform as being of concern.

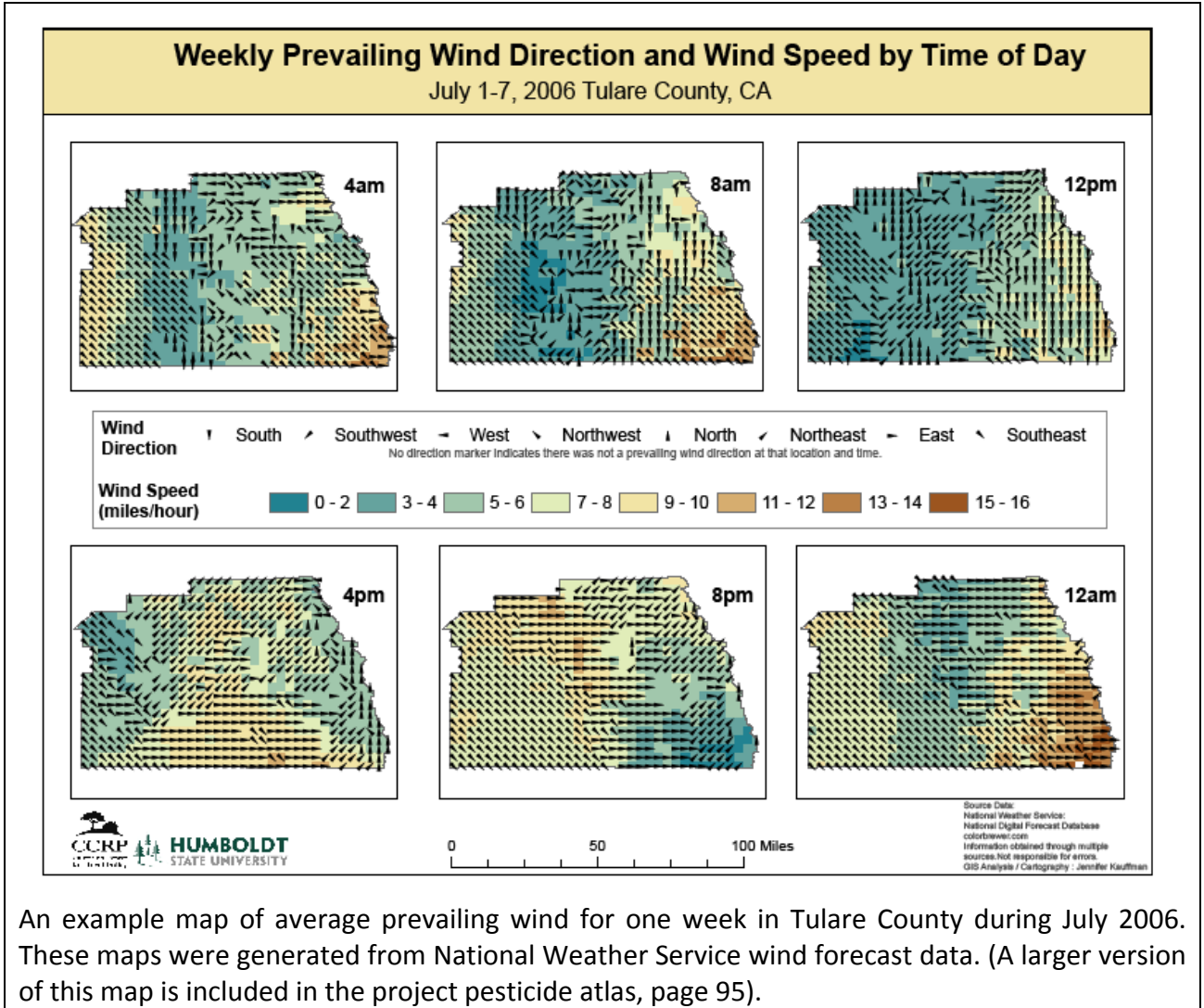
The total pounds per square mile for all active ingredients were mapped for both Monterey and Tulare counties. Application rates were generated by dividing the pounds of active ingredients applied by the acres treated with that chemical (pounds/acre). The number of acres treated represents the total acres treated for each individual pesticide application. The DPR database provides no information as to whether an individual field had multiple applications during the year. Thus rates are also reported on the basis of the PLS section in which the treatment occurred.

Maps were created for each county and each focus community. County comparison maps illustrate application rates for specific chemicals and overall county application rates. Pesticide data was also mapped in relation to school locations and residential areas. Comprehensive maps illustrating school locations do not exist for Monterey and Tulare Counties. Therefore, for the objective of mapping schools, multiple data sources were consulted to locate and generate school property boundaries. Property boundaries were preferred to points identifying locations since playgrounds and activity fields associated with schools often extend well beyond the actual school building and in some cases across multiple parcels as mapped by the County Assessor's office.

Mapping prevailing wind direction and speed.

Historic weather forecast data was acquired from the National Weather Service National Digital Forecast Database (NDFD). This database provides weather data in a format compatible with GIS mapping. Wind direction and speed were requested for the week of June 1-7, 2006. Data was provided in a Gridded Binary Edition 2 (GRIB2) format. The National Weather Service provides a decoder system to unpackage the digital data for GIS use. The decoder system, degrib2, runs via a graphic user interface. The user interface allows specific predicted weather elements to be

mapped in 5km gridded cells. It generates GIS compatible shapefiles for requested historic forecasted weather data.



An example map of average prevailing wind for one week in Tulare County during July 2006. These maps were generated from National Weather Service wind forecast data. (A larger version of this map is included in the project pesticide atlas, page 95).

Predicted prevailing wind direction and speed were calculated in four hour intervals over a 24 hour period for the week of June 1-7, 2006. Calculations were made for each day for the following time periods; 0400, 0800, 1200, 1600, 2000, and 2400. Forecasts are generated every hour and extend out in three hours intervals over the following 13 days. The earliest forecast for the time period of interest was used. This provided the best prediction of wind direction and speed for the particular time and date of interest.

We opted to use the historic forecast dataset rather than the actual wind direction and speed data for the same period. While these actual weather data do exist, the spatial resolution (32km) does not provide fine enough detail for this project. Furthermore, should wind data be considered as a parameter for incorporation into pesticide drift models for use in policy-making, it would be predicted wind as opposed to actual wind that would be available for this purpose.

Calculations for wind direction and speed for each day at each time period were averaged to generate the dominant prevailing direction and speed. Prevailing wind speed and directions were mapped for Monterey and Tulare counties in CA.

Public Participation GIS Activity

Public Participation GIS (PPGIS) is a process where individuals who are going to be affected by the research (the community of interest) provide spatial feedback on aspects of the topic of interest. The community of interest, which in this case is the farmworkers and agricultural community members, interact with mapped information and the researchers in order to produce relevant data based on their personal on-the-ground experiences. After processing and analysis, the data is then returned to the community for their own use along with the results of the study.

While PPGIS may be accomplished by bringing computers with GIS software and data to the field, this is not typically done. Technology in the field can be perceived as intimidating to the community of interest. Instead, we brought large scale, printed maps of each of the six communities in the study region to the field. Participants in the PPGIS activities were then asked to mark data directly on the maps for later capture into the digital geospatial database.

On July 9, 2007, a PPGIS activity was held at the Poder Popular organizers' meeting in Salinas, California. Three communities in

Monterey County were focus areas: Salinas, Greenfield, and Gonzales. Imagery from the 2005 National Aerial Photography Program (NAIP) was used as base data to produce three large scale maps for each community. Each map had a particular thematic focus. Healthcare facilities, places of recreation, or housing and demographics (income and ethnicity) were topics of interest. Directions were printed in color, and the names each color were printed in the color they represent. Participants were asked to do the following via written direction in English:

Healthcare:

Please circle the location of nursing homes in PURPLE

Please circle the location of where children stay during the day when not in school in BLUE

Please circle the location of where farmworkers go if they are sick or injured in RED

Recreation:

Please circle the location of churches in PURPLE

Please circle the location of city parks in BLUE

Please circle the location of where farmworkers gather for recreation in RED

Please circle the location of where farmworkers' children go to school in GREEN

Housing and Demographics:

Please write the name of neighborhoods in BLACK

Please describe the people that live in each neighborhood in PURPLE

Please circle the location where farmworkers live (including those not in houses) in RED

Please circle the location where farmworkers have witnessed drift in **BLUE**

It is of note that during the Salinas meeting some participants utilized computers to help identify and label some locations, especially those locations of schools. This means that schools that have been circled and labeled are not necessarily those schools with farmworkers' children attending.

On July 18, 2007, a PPGIS activity was held at the La Union del Pueblo Entero (LUPE) (Parlier/Fresno) meeting in Fresno, CA. Four communities in Tulare County were focus areas: Cutler, Oroquieta, Woodlake, and Lindsay. Due to their small size, close proximity, and local custom, Cutler and Oroquieta were treated as one town for mapping purposes and for purposes of this study. Imagery from the 2005 National Aerial Photo Program (NAIP) was used as base data and overlain with additional geospatial data identifying local features. One large scale map for each of the three towns was shown to participants and they were asked to indicate the following features via written direction in English and Spanish:

Please circle the location of churches where members of your community attend in **PURPLE**

Please circle the location of city parks where members of your community go in **BLUE**

Please circle the location of where members of your community gather for recreation in **RED**

Please circle the location of where your community's children go to school in **GREEN**

Please circle the location of where your community's children stay during the day when not in school in **BLACK**.

On July 19, 2007, a PPGIS activity was held at the Poder Popular meeting in Visalia, CA. Four communities in Tulare County were the area of focus: Cutler, Orosi, Woodlake, and Lindsay. Due to small size, close proximity, and local custom, Cutler and Orosi were treated as one town for mapping purposes. While Cutler and Orosi are politically two separate towns, locals generally refer to them as one town Cutler-Orosi due to their close proximity and sharing of goods and services that occur between the towns.

Imagery from the 2005 National Aerial Photo Program (NAIP) was used as base data and overlain with additional geospatial data identifying local features. One large scale map for each of the three towns was shown to participants and they were asked to indicate the following via written direction in English and Spanish:

Please write the name of neighborhoods in **BLACK**

Please write “Anglo” or “rich” for neighborhoods that are primarily Anglo or rich in **PURPLE**

Please circle the location of where farmworkers go if they are sick or injured in **RED**

Please circle the location where people in your community live (including those not in houses) in **BROWN**

Please circle the locations where people in your community have witnessed drift in **BLUE**

Please circle the locations of where your community’s children go to school in **GREEN**

Please circle the locations of elderly care where members of your community are housed in **PURPLE**

Each of these maps containing community members’ indigenous knowledge about the local area were returned to the Institute for Spatial Analysis at Humboldt State University. Utilizing head’s-up, digitizing techniques, data obtained via the PPGIS activities were

digitally recorded into a GIS and stored as geospatial shapefiles. The result is a digital translation of the information collected in the field into a format which can be analyzed in conjunction with other geospatial data in a GIS.

Because data collected via a PPGIS process is not precise some allowances were made for the sake of clarity of interpreted PPGIS information. For example, where the extent of drift was not drawn by participants, the area where the word “drift” appeared was treated as the centroid of the plot marked. Drawn ovals were changed to circles, rectangles, or polygons in the same approximate shape and area shown on the printed maps.

In instances where differences in color were hard to discern or the incorrect color was used, we utilized labels written on the map by participants and confirmed these interpretations with the researchers who monitored the PPGIS process in the field for each map. Every street intersection with a drawn line was treated as belonging to the participants’ drawn boundary. For these reasons, and because PPGIS is not a precise methodology for mapping, locations of features and events mapped via this technique should not be viewed as exact. However, given the accuracy of the pesticide database is +/- one mile we are confident that PPGIS mapped features are well within the accuracy of the maps produced as a component of this project. Each individual theme was captured in a county wide shapefile.

The resulting shapefiles include the following attributes in their associated data table: “city”, “name”, “PP_notes”, and “comments”. The attribute “city” identifies the community the feature is located in. “Name” corresponds to the proper name designated by the digitizer, which either was marked on the map by participants or compared to other external data sources for validation. For example, if the name of a school was written, it was recorded in the name field. “PP_notes” represent any commentary written on the map by participants, and is entered

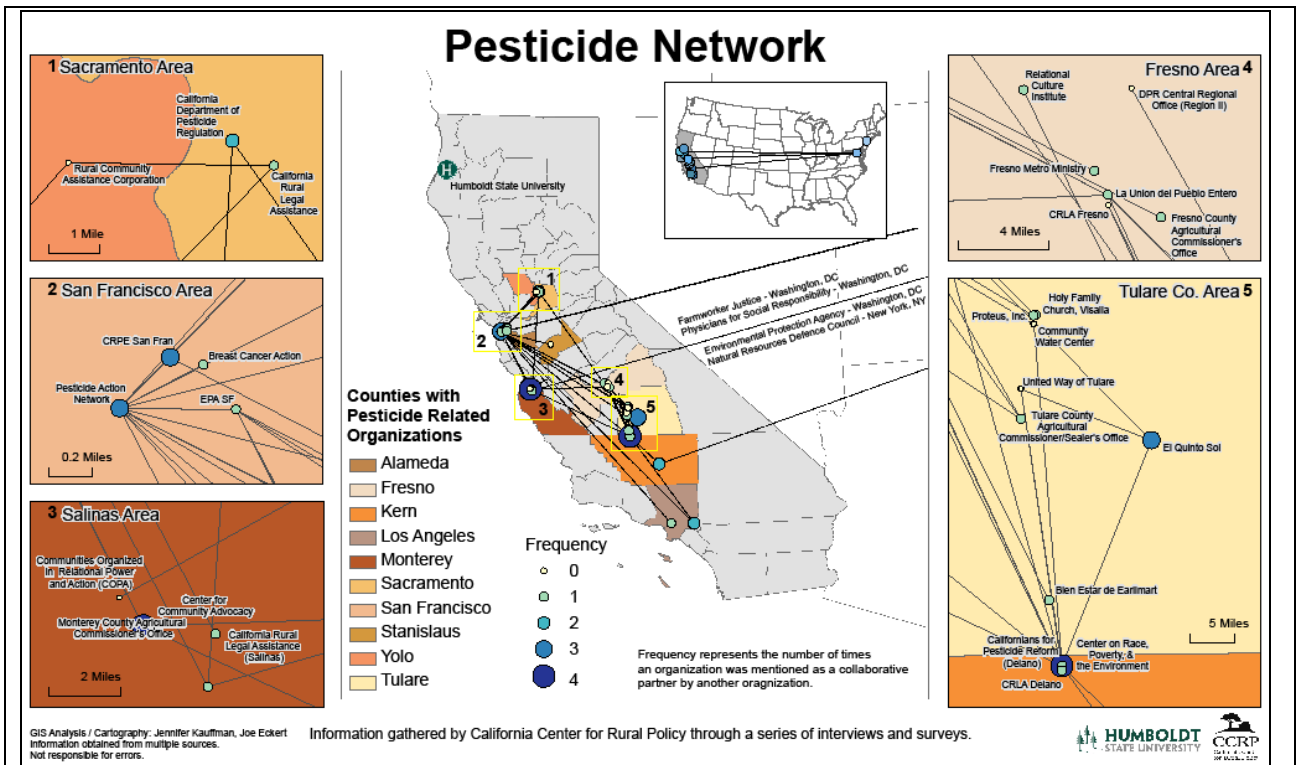
just as it appeared on the map. The “comments” field refers to comments made by the digitizer.

General Mapping methods

Maps combining various geospatial were generated for Monterey and Tulare Counties. School property boundaries were buffered by ¼ mile. The area of agriculturally zoned land located within ¼ mile of schools was quantified to determine actual and percent of the total agricultural landscape within this zone. A comprehensive map of school property boundaries does not exist for either of these two counties. Until comprehensive school mapping exists, quantities reported as within the ¼ mile buffer of schools should be viewed as an estimate based upon currently available data. Data obtained from PPGIS activities was also mapped in combination with 2000 Census data.

Mapping social networks

State and county boundaries were acquired through TIGER boundary shapefiles from the United States Census Bureau. Participants in interviews and presentations were asked the physical address of their organization along with the names of the two organizations with which they worked most often. These addresses were placed into a table and geocoded using the <http://www.batchgeocode.com> website. Geocoding is a process for locating the specific latitude and longitude position for an individual street address. The resulting latitude longitude for each organization was then imported into GIS and stored as a shapefile. Arrows were then drawn from the originating interview or participation response to the organizations listed by the participant to develop a social interaction network map of organizations working on pesticide issues.



Pesticide network map indicating the location and relative level of connectivity between organizations and agencies working on pesticide issues in California. (A larger version of this map is included in the project pesticide atlas, page 14).

Key Informant Interviews

Key informant interviews were conducted from June through August 2007. We conducted both face-to-face interviews and phone interviews with a total of 16 key informants. Key informants included community leaders, county officials, farmworkers, and Poder Popular leaders. The interview consisted of 19 questions and took approximately 40 minutes to complete.

A snowball sampling method was used (Babbie 2001) to select the key-informants. Snowball sampling is a non-probability sampling technique. This method involved beginning interviews with members of the initial target population and at the end of the interview asking them to recommend other possible informants. The term snowball is used to refer to “a process of accumulation

as each located subject suggests other subjects” (Babbie 2001: 180). Using this technique, once you begin to see suggested names of additional individuals to interview repeated numerous times, you know that you have achieved a saturated sample. This method was selected based on time constraints of this study, and the sensitive nature of the topic. All interviews were conducted by members of the research team based on a standard set of questions.

Our original list of informants was selected from a list of partners related to the AWHI Poder Popular program. Additionally, we organized interviews with agricultural officials in both Tulare and Monterey counties. Our team established initial contact with potential informants using both telephone calls and email.

At the time of contact, informants were asked if they would be willing to participate in a 40 minute phone interview related to agricultural workers’ health and pesticides. If the individual agreed, the research team member scheduled a mutually agreed upon time to conduct the full phone interview. Prior to the interview, participants were faxed an informed consent form that described the project which was signed and returned to CCRP before the interview could be conducted.

During the interview, participants were asked approximately 19 questions relating to pesticide use, agriculture workers health, community and family health, the environment, and social networks. At the end of the interview, participants were asked to provide names of two or three people that had knowledge of the subject matter and might be contacted for a possible future interview. Key informant interviews were transcribed and content analysis was used to identify themes for various topics of relevance to the study.

Public Participation GIS

The AWHI Field Research team conducted two community-based meetings with farmworkers and the leadership from Poder Popular; one meeting held in each county (Monterey and Tulare). Participants were contacted by phone prior to researchers going to the field. In both counties, during the field visit, a public-participation GIS meeting was planned.

An essential component of our project was to ground-truth the data and GIS maps related to the study by traveling to the sites and talking with local people. The objective in this process is to determine whether the maps we create accurately reflect the day-to-day reality that they know from living in their communities and working in the fields.

Where there was a divergence between the maps and the community input we focused our efforts to further refine the mapped information and to differentiate real and perceived conditions. Both real and perceived information is important to understanding the social and physical environment in which these communities exist and from which decisions are generated.

The goal of the two Public Participation GIS meeting was to present the pesticide maps to members of the community in order to gain feedback from community members about the data that had been assembled and analyzed through that point in the project. There are two main objectives to this exercise:

1. Groundtruth existing data for accuracy.
2. Harness and capture local indigenous knowledge about relevant topics and information.

Throughout the PPGIS process, research assistants made observational notes, assisted with Spanish translation for the participatory mapping exercise and talked with participants about their experiences with farmworkers and pesticides in the area.

Meeting attendees were asked:

1. In their opinion, were mapped items accurate?
2. Where are the schools located?
3. Which schools did farmworker children attend? Which do non-farmworker children attend?
4. Where are the farmworker, Latino and white communities located?
5. Are there any notable locations of pesticide drift, spills or other incidents related to pesticide use?
6. What type of crops is grown in specific fields?

In Monterey County, a special meeting was organized for our research team with representatives from Poder Popular and other interested community members. The research team presented GIS-based pesticide maps of the Monterey County communities of Salinas, Gonzales and Greenfield and engaged in public participation GIS methods with the meeting attendees. Meeting attendees totaled about 20 at the Monterey meeting and 40 at the Tulare County meeting.

Field Research Methods

In June and July 2007 the research team travelled to both study counties, Monterey and Tulare. The field work consisted of the following:

1. Presenting at public meetings where farmworker constituents were in attendance.
2. Attending a Poder Popular Policy meeting in both Monterey and Tulare counties.
3. Going on driving tours in the towns of Cutler-Orosi and Earlimart (located in Tulare County) hosted by local

individuals who had first-hand experience and knowledge of pesticide drift and farmworker's living conditions in Tulare County.

4. Visiting with community members in their homes to conversationally discuss issue of pesticide drift for people in the community.
5. Interacting with Poder Popular leaders in both Tulare and Monterey counties.
6. Windshield reconnaissance.

The field research methods included field observation and ethnographic methods. One form of field observation we engaged in is called windshield reconnaissance. Windshield reconnaissance occurs when a team of researchers, drive in and around a Study area or region to “get a real feel for them” (Luloff 1999: 317). It is a form of observation whereby the researcher geographically experiences the environment in which they are conducting their research. In our study the research team employed this method as an independent team in both Monterey and Tulare counties. Additionally, in Tulare County they were accompanied by local community activists who led the group on driving tours of the region.

In our study, the research team interacted with community members in farmworker communities and visited with various community members in their households to hear their stories and experiences. Members of these agricultural communities were eager to share experiences, observations and stories about working in the fields and their community's experience with pesticides and pesticide drift.

The unique nature of this research project is that although we were given a six month timeline to conduct our work we were able to gain entre to many community members and information that we normally would not have if we had just come into the

study could be as unknown to people in the region. Because we were funded by the California Endowment and introduced through the California Endowment funded program, Poder Popular and the affiliated non-profit groups who work with this organization and support farmworkers in each county, we were provided access to a variety of community leaders.

As a result the research team quickly established a much richer connection to the community than would be typical in this type of study because the Poder Popular program had been ongoing for the last five years. This played out especially in Tulare county where we were invited into various community members' homes and taken on a "Toxic Tour" of the region by a concerned local mother and citizen. Local people provided such an intimate view into their homes and lives for several reasons:

1. They have a very important and passionate story to tell
2. We had an insider connection and trust due to Poder Popular.

The tour consisted of a drive around the farms and the town with information given by a local concerned citizen about environmental effects of pesticides on the community's health.

Interviewees were contacted prior to arriving by phone. In addition, we visited three community members' homes and talked to them about their experiences living in Earlimart. All three of the individuals discussed the pesticide cloud that surrounded the town in 1999. Field researchers also took a guided tour around the area of Cutler-Orosi visiting schools, and other sensitive sites and talking with several area residents in their homes or in community gathering places. During both of these tours we also obtained photographs and video footage of some of the farmworker housing and communities.

Public Presentations

In addition to the presentations within the counties of interest, three presentations were given at different points in the project to gain feedback and in effect groundtruth project findings through engaging in public participation GIS. These meetings were:

1. Policy Leadership Council, Sacramento, CA sponsored by California Endowment (June 2007). This group consisted of a series of leaders from various Poder Popular community groups, along with representatives from Spanish radio stations, growers, representatives from farmworker advocacy groups. The leadership from this group provided helpful feedback on the early version of the pesticides maps that our research team had created.
2. LUPE, Fresno, California. (July 2007). The AWHI research team gave a public presentation to La Union del Pueblo Entero (LUPE) in Fresno California. This is a community organization founded by the United Farmworkers in the late 1980s to focus on farmworker issues. Members of LUPE, several who were residents of Tulare County, provided helpful feedback on the PPGIS maps and research project in general.
3. Agricultural Worker Health Initiative Conference: Cultivando Cambio Para el Futuro in Sacramento, California. (August 2007). A conference sponsored by the California Endowment in support of the Agricultural Worker's Health Initiative. Attendees come from throughout the state of California and range from farmworkers themselves to policy leaders and statewide health organizations that work with agricultural workers. Our team received valuable feedback on the maps and study findings.

RESULTS

The primary results of this study are in two forms, first, the results from GIS-based mapping and analysis, including those collected via the PPGIS activities held in each of the study counties and secondly the findings that resulted from the thematic content analysis of the key informant interviews.

MAPPING RESULTS

Results of the mapping work are shown in the accompanying document: *People, Place and Health: A Pesticide Atlas of Monterey County and Tulare County, California*. Several key observations from these maps are detailed below and include references to the appropriate page in the pesticide atlas.

COLLABORATIVE SOCIAL NETWORKS

One goal of the mapping project was the production of a social network detailing the interactions between various agencies and organizations working with one another on issues of agricultural workers' health as it relates to pesticides. Key-informant interviewees were asked the question, "What two organizations or groups that you collaborate with most frequently, are related to pesticide issues?" This was a question in the key-informant interview and a question that was posed to attendees at a Poder Popular leadership council meeting in June 2007. The responses from both the key-informant interviewees and Poder Popular Leadership council meeting were tabulated together.

Responses were tabulated and the addresses of the organizations listed were used to map their geographical relationship to one another. The resulting map (pg 14) illustrates relationships between the different organizations with lines connecting organizations to one another. A line between two organizations

on this map represents at least one organization listing the other as their most frequent collaborator.

The circle representing each organization on the map is larger in size with an increased frequency of being listed as a collaborator. In other words, the greater in size the circle, the more often this organization was mentioned as being involved as a frequent collaborator. This organizational network map highlights collaborative relationships between organizations and indicates those which other turn to for information and/or assistance. This map does not show however, the direction of information flow between organizations.

Some preliminary themes can be derived from these data. The frequency with which an organization was listed ranged from “0” to “4”. In total 39 responses were collected, and the mean frequency for organizations was 1. Those organizations scoring above the mean were either social activist groups that had recently participated in activities in the area, or larger non-profit groups with offices local to the geographic area but resources that extend beyond that area. The only government organization to score a frequency above the mean was the California Department of Pesticide Regulation. This suggests that those respondents queried were unlikely to turn to governmental organizations (such as the Agricultural Commissioner’s office for the area) for issues pertaining to pesticides, and additionally underscores the need for further outreach on the part of policy makers.

Respondents were additionally asked the question, “What type of things do you collaborate on?” Responses were varied, but community organizing, legal assistance, education and outreach, and creating publications were most common. These can be understood as the items of community interest, and agencies should attempt to address these needs to increase the levels of communication between non-profit and governmental entities.

One notable result of this mapping is that in several cases, organizations that are geographically close together are not

connected, meaning they do not have a high level of interaction. In many cases these same organizations are more closely tied to organizations that are geographically removed, and in several cases are sited across the country.

LAND COVER AND LAND USE MAPS

The atlas also includes series of maps by county representing agricultural land use (pgs 16 and 70) and land cover (pgs 17 and 71). The latter of these representing the range of different land cover categories across each of the study counties. Not surprisingly, the valleys of both counties are dominated by agricultural uses.

Maps of total pesticide applications are included for each county in combination with other geospatial data of interest including state assembly, senate and supervisory districts (pgs 19 – 21 and 73 - 76). Similarly, total pesticide applications for each county were overlain with school district boundaries (pgs 23, 25, 27, 78, 79 and 80). These combinations of data provide individuals viewing these maps an opportunity to compare the level of overall pesticide use relative to various levels of government representation.

Additional county level data presented in the atlas shows total amounts of reported applications of pesticides and fumigants as well as individual maps of a variety of active ingredients of concern as highlighted through the key informant interviews. (pgs 29-40 and 82-93).

One example of a PPGIS map is included on page 42 of the atlas. The reasoning behind the PPGIS process was two-fold, first one perception that arose through the key informant interviews was that the United States Census does not accurately represent the communities included in this study and secondly as a means to locate particular locations of interest (schools, neighborhoods, and locations of observed drift). Much of this PPGIS data was used

to groundtruth the accuracy of data obtained from other official sources.

The example included in the atlas demonstrated that there was a strong correlation between the mapping data provided in the 2000 census and the locations of socioeconomic groupings mapped through the PPGIS process. This was consistent throughout the PPGIS data and gave us confidence in both the accuracy of the official data sources as well as the local knowledge of community members.

Wind mapping was completed for a one week period (July 1-7, 2006) for each county. Mapping was developed for four hour intervals averaged through this week as an example of conditions during the growing season when many pesticides are applied (pgs 44 and 95). The most interesting result observable in these maps is the fact that winds tend to be lower during the daytime hours and stronger during the nighttime. Information obtained through the key informant interviews indicated that many pesticide applications are conducted during the nighttime hours.

The final map analysis done at the county level was a $\frac{1}{4}$ mile buffer zone around schools (pgs 46 and 97). We derived buffers with the GIS representing the total area contained within $\frac{1}{4}$ mile around each known school property boundary. From this buffer, we calculated how much agriculturally zoned land falls within the buffer region for each of the six study communities.

In Monterey County where we did not have comprehensive coverage, the total agricultural land within buffers could only be computer for the three study communities and amounted to 844 acres out of 125,910 acres in agriculture in the areas immediately surrounding the study communities. This amounts to approximately 0.67% of the agricultural lands.

In Tulare County we were able to locate a county-wide database of school locations and thus computed both the total agricultural land within buffers for the study communities. This amounted to

751 acres out of 35,996 acres within a 3 mile radius of the three study communities. This amounts to approximately 2.09% of all agricultural lands immediately surrounding these communities. County wide the total agricultural land within ¼ buffers around all schools totaled 35,420 acres out of 5,611,049 acres in agricultural use, approximately 0.63% of all agricultural lands in Tulare County.

The remaining series of maps throughout the atlas primarily focus on the six individual communities of focus in this study. For each community we provide overlays of geospatial data to make it possible to visualize relationships between agricultural parcels, residential areas, school locations and amounts of pesticides applied.

The final series of maps provided in the atlas show comparisons between Monterey and Tulare Counties in use of pesticides, fumigants and some specific active ingredients (pgs 119-123). The interesting result observed in these maps, as well as some of the more detailed community maps, is that there are clear differences in the amounts and types of pesticides and fumigants in use in different locations throughout the study region.

KEY INFORMANT INTERVIEW RESULTS

A total of 16 key-informant interview were completed for this project. The majority of questions asked in our key-informant interviews were open-ended questions, meaning interviewees were asked a question but not provided with categories of answers to choose from. After answers were recorded they were grouped into themes and tabulated in a quantitative fashion. Tables summarizing these findings are presented in this section.

Key informants interviewed for this study came from the following organizations:

1. California Rural Legal Assistance Foundation (CRLAF)

2. United Way of Tulare County/Poder Popular
3. Californians for Pesticide Reform
4. CRPE, Center on Race, Poverty, & the Environment
5. California Rural Legal Assistance, Inc.
6. Monterey County Agriculture Commissioner's Office
7. Farmworker Justice Fund, Inc.
8. Tulare County Agricultural Commissioner/Sealer's Office
9. Community Water Center
10. LUPE
11. Poder Popular Monterey County
12. Rural Community Assistance Corporation, RCAC

Table 1 presents a list of geographic location of the organizations key-informants were from, populations they serve and the type of services provided by each organization. Key informants were asked, "What is your organization or group name?" In total, seven organizations were located in Tulare County and three in Monterey County. The remaining organizations also conduct work related to pesticides and farmworkers within the study site however do not maintain physical offices there.

POPULATION SERVED

Key-informants were asked, "Who does your organization serve?" It should be noted that any one organization can provide multiple services as indicated in Table 1 and therefore fit into multiple categories. The top two responses were "community," and "advocacy" both reported by 75 percent of informants. "Pesticides" was the third most common answer reported by 69 percent and "farmworkers" fourth most common response reported by 56 percent of the key-informants.

In relation to community service, one informant said:

“We work with the community, mostly low income communities, and all the issues about discrimination because of race and government companies established near those communities. These people don’t have a voice. What we do is provide technical support; we also have an organizational department. We do capacity building to help with grass roots issues.”

The term “advocacy” was a main theme that emerged from the interviews. As one informant noted:

“Well, we serve migrant seasonal farm workers and we work very closely with farm worker organizations because we don’t work directly with farm workers... We do a variety of things. We do litigation. We do judicial. We work closely with EPA to get good regulations passed or dangerous pesticides taken off the market. We also do education programs. Even in the education programs, we would work in partnership with a local organization that would be close to the farm workers on the ground they’d handle.”

Another informant noted the role of advocacy in relation to water concerns:

“We serve low income communities of color. Small rural, small rural low income, pretty much all unincorporated areas, focus most on the ground water. We focus our organization group on Tulare County and San Joaquin. Coalition we know and talk a lot and provide technical assistance to San Joaquin and Tulare County. Because issues are so similar we have a lot of experience that is relevant. In practice means predominately farm worker community. We work with some people in Lindsay.”

TABLE 1: ORGANIZATIONS AND POPULATIONS SERVED

ID #	City	County	Farmworkers	Community	Legal	Advocacy	Civic	Pesticides	Research	Govt.	Grass Roots
1	Sacramento	Sacramento	X		X	X					
2	Tulare	Tulare		X			X				
3	San Francisco	S.F.	X	X		X		X			X
4	Earlimart	Tulare	X	X		X		X			X
5	Delano	Kern		X		X			X		X
6	Salinas	Monterey	X		X	X					
7	Salinas	Monterey						X		X	
8	Washington	D.C.	X		X	X		X			
9	Tulare	Tulare		X				X		X	
10	Tulare	Tulare		X				X		X	
11	Visalia	Tulare		X		X		X			
12	Parlier	Tulare	X	X		X		X			
13	Salinas	Monterey	X	X		X		X			
14	Visalia	Tulare	X	X		X		X			
15	Fresno	Tulare	X	X		X		X			
16	West Sacramento	Yolo		x	X	X					
Total:			9	12	4	12	1	11	1	3	3

One interviewee described the many different areas covered by their organization relating to the community, farm workers, and pesticides:

“We have many different members and the only thing that joins them is to become members of California Pesticide Reform by signing on to our 4 point platform. We serve our constituency. There are a few campaigns; some are urban focused, some are in agricultural and nonagricultural settings. There’s a lot of use of pesticides in schools. Our biggest campaign is Safe Air for Everyone, focusing on airborne pesticides in agricultural areas. Focus areas for our work include Tulare, Monterey, Kern, and Fresno counties.”

This respondent continued:

“In Monterey, our philosophy is to work with directly affected people, the people most affected by pesticide use. We work a lot in farm worker communities and just regular people in communities. We need to broaden this to other communities, mostly working with poor immigrant and Latino population.”

The other possible categories of responses to this question are (Table 1): Legal, Civic, Research, Government and Grass Roots. One interviewee voiced in relation to categories of pesticides and government:

“Regulatory agency, so we regulate activities with specific private sector people like weights and measures. We have a special quarantine unite that regulates exports; we have a fruit and vegetable division that regulates also with an emphasis on regulating head lettuce. The Pesticide Use Enforcement (PUE) program used to regulate pesticides in agriculture and non-agriculture settings.”

Informants were asked the question, “Is your organization working on any policy issues related to pesticides?” as a “yes” or “no” question. The second part of this question asked them to “please explain” in further detail.

Table 2 illustrates two primary results:

1. Whether organizations are involved in working on policy relating to pesticides.
2. The type of policy project underway.

We developed six categories for pesticide policies:

1. School pesticides.
2. Pesticide alternatives.
3. Pilot projects.
4. Water.
5. Laws.
6. Community outreach.

Organizations could report policies occurring in multiple categories. In total, 13 out of 16 informants responded that “yes” they were working on policy issues related to pesticides and three reported; “no” they were not working on pesticide issues. To summarize, Table #2 indicates that (13/16) or 81.2 percent of the organization are indeed working on policies issues related to pesticides and (3/16) or 18.8 percent are not working on policy issues related to pesticide use.

TABLE 2: TOPICS OF PROJECTS OR INITIATIVES FOR ORGANIZATIONS WORKING ON PESTICIDE POLICIES.

ID #	Yes	No	Working on Which Topics?					
			Schools and Pesticides	Pesticide Alternatives	Pilot Projects	Water	Laws	Community Outreach
1	X		X		X		X	X
2	X							X
3	X		X	X				X
4	X						X	
5	X		X				X	
6	X						X	
7		X					X	
8	X						X	
9	X						X	
10		X					X	
11	X					X		X
12	X							X
13	X						X	
14	X							
15		X					X	X
16	X				X		X	X
Total:	13	3	3	1	2	1	11	7

WORKING ON PESTICIDE POLICY

The three most common types of projects that informants reported working on were “legal,” “community outreach” and “school pesticides.”

Legal

“Legal,” reported by 11/16 informants or 69 percent of interviewees, was the most common answer. For this category of laws responses were taken from the words used by the respondents themselves such as law(s), Clean Air Act farm bill, lobbying, SB391 and class action law suit, or topics referring to lawsuits respondent had been associated with. One respondent notes in relation to laws:

“We have a foundation, CRLA foundation, that does a tremendous amount of policy work including intervention with policy DPR, including working with the state house and senate. We can't involve ourselves due to funding source. What we work on is enforcing laws. We reinforce past laws or past protection.”

The respondent continued to mention that:

“Voluntary compliance, the community workers go into the fields. When they see violations, they go to the foreperson or supervisor and seek an agreement that they will change their practice immediately. The other extreme for enforcement, for example, is last year grape growers wanted to apply sulfur and have their workers start back in the field after one day. However, current law states that you have to wait three days to go into the field after spraying sulfur. The growers went to the DPR to ask for an exemption that would permit the grape growers to go back into the field one day instead of three days. We sued the Department of Pesticide Regulations two or three weeks ago stating that there was no emergency to permit the exemption from taking place and

that the DPR did not follow appropriate procedures. So, the CRLA enforces through two measures: voluntarily and we sue the government.”

Another respondent went on to explain:

“We’re always working on policy issues on pesticides; it’s one of our major priorities. One thing is right now we’re lobbying congress to include pesticide safety measures within the farm bill. The farm bill is best known for subsidies of big growers, like beans or peanuts. Over the last decade there have been more efforts to open it up to other issues, like conversation programs, environmental concerns.”

The respondent further commented on the importance of safety as an issue related to laws:

“One thing we look to add is pesticide safety measures. Specifically, for example, right now under federal law, agriculture employers and commercial applicators are not required to keep records of all the pesticides they apply. Say someone who gets hurt, maybe not right away like a birth with birth defects and you want to know what they’ve been exposed to. There are no records to determine what the exposure was. And therefore hinders.”

Community Outreach

The second most common response was “community outreach” (7/16) reported by 44 percent of the interviewees. Community outreach was assigned as a category to those responses that included references to community, community connection or work that is done within the community. One respondent made this comment relating to community outreach:

“Right now, just this week we met with the DPR ground water program and he had an all day meeting with us and community

groups we work with. Community groups are concerned that the pesticides being applied are going into the ground water. We are in an early phase of regulatory policies to the degree of meeting with staff and identifying big gaps of what is being monitored for and regulating use into what is being put into the water sources. We focused on ground water not surface water.”

Another informant spoke on the topic of schools, pesticides and community outreach:

“That’s all we do! There’s a few of us that just keep the campaign running; I’m one of those people. Safe air for everyone, pesticide use in schools, low income housing, but on the AG end our SAFE campaign. The other thing things I’ve been trying to do, and this is where we could use some research help and the data out there, which we have no capacity to compile ourselves. One of the interesting things in terms of strategy is “stop using this stuff.”

“The other strategy is protection zones around schools and other sensitive areas. We are struggling in talking to scientists. If and when we get county authorities to the table, we’ll need backup, need data on what buffer zone would make a difference.”

The key informant highlighted efforts beyond the local level:

“We’re also urging state to do their own air monitoring along a gradient in terms of distance from the field in order to look at how quickly pesticide concentrate. It already exists in some risk assessments.”

The interviewee further explained the platform of their organization.

“Our four point platform is to reduce fumigants, get good response plans from county agencies when poisonings happen, to get medical costs covered for victims, and protection zones across

the state. We have multiple policies under each point, all mired up on the legislative level.”

This same person also noted:

“We won a lawsuit last year because the state was not implementing requirements under the Federal Clean Air Act to reduce emissions VOC levels – most VOC pesticides are fumigants, so there’s overlap in those areas.”

SCHOOLS AND PESTICIDES

Another area of major concern for the given organizations entails work dealing with school pesticide issues (3/16) reported by 19 percent of the interviewees. The category of school pesticides was determined by responses that indicated a concern for this topic.

One informant noted:

“With CPR and CRPE, partners brought another issue at the city level: Buffers around schools. Expand protection zones around schools. School boards have to vote on the pesticide buffer zones. LUPE has been involved, talked to parents, training community to get involved with policy change; community members speak their case to committee. CPR and CRPE walked them through this process, how to meet with committee members, how to get their case on the agenda. A few cases have been successful, but three of the five board members were growers who didn’t allow the issues to come up.”

The remaining topics of work on pesticide policies, including Pesticide alternatives, pilot projects, and water, while important to the communities they serve are not significant in the context of this figure, due to the lack of representation.

Interviewees were asked, “How do people know when pesticides are being used in their community?” Possible answers to this question include the following themes:

1. Community pesticide awareness.
2. Become sick.
3. Not applicable.
4. Just know.

Figure 1 summarizes responses to this question. Interestingly, the most common response to this question, reported by 11/16 people, or 69 percent of responses was “sensory” followed by, “don’t know” reported by 6/16 or 37.5 percent of interviewees. Sensory is defined by seeing, smelling or other forms of sense data. The response “don’t know” was coded when interviewees indicated that they simply “do not know” when pesticides are being used in their communities.

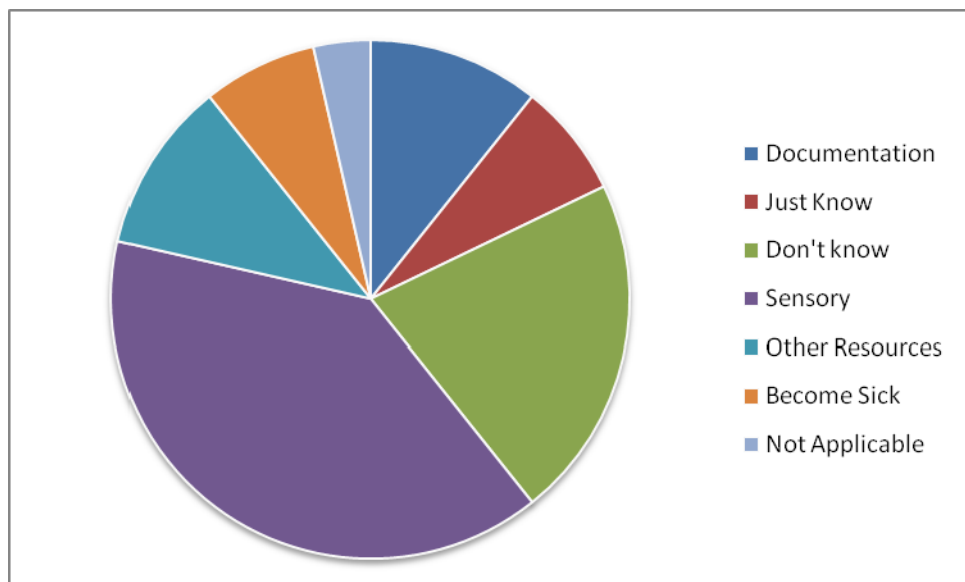


Figure 1: Community Pesticide Awareness.

Surprisingly, more than one-third of the interviewees (37.5%) reported that they do not know at all when pesticides are being used. Informants reported: “they [community members] don’t even realize it” or “property operator is suppose to be informing them” or “you might not know” or “did not advise” or respondent used this term themselves to determine the lack of awareness of pesticide usage. One informant notes:

“You might not know. If you smell something different or if you see the airplanes, driving through you see it but sometimes you don’t. They might have already sprayed ahead by the time you go through it.”

Another interviewee whose husband works in the field describes the following experience:

“My husband was working in the fields and the contractors did not advise the foreman and group of farm workers that they had sprayed the day before. The contractor wanted to finish that field so he sent people in to work. My husband developed [an] allergic reaction and headaches. He ended up applying to working for the factory.”

This informant noted that “all the workers were hurting,” but, she said “they care and want to finish working the fields.” Another informant explained how there is a lack of notification for pesticide application in places where children reside:

“There is no notification for pesticides in California with the exception of schools and daycares. Those are the only places that require pesticide Implementation. There is a strong noncompliance despite that it is a law. People only know when they are affected when they poison themselves or when they sense exposure. More often than not, people are being exposed and they don’t even realize it. The problem is that people don’t know. If they know they were exposed, they don’t know what to

do with it. There is a strong education piece that needs to be done with pesticides.”

Other responses to this question of “How do people know when pesticides are being used in their community?” included “documentation” reported by (3/16) or 18.75 percent of interviewees and “other resources” also reported by (3/16) or 18.75 percent. The code “documentation” was identified when interviewees spoke about notification and checking the computer system to determine whether or not people had been exposed to pesticides. The code “other resources” included contacting other resources within the community, such as the local agricultural commissioner.

Figure 2 shows how people in the community become aware of pesticide use. Interviewees were asked, “How do people know when pesticides are being used in their community?” Sensory awareness was the overwhelming response. Categories for answers to this question include the following responses:

1. See.
2. Smell.
3. Do not distinguish.
4. Other.
5. Not applicable.

The most common response was “see” 9/16, followed by “not applicable”, 5/16 and “smell” 4/16. A person’s answer was reported as not applicable if they did not respond.

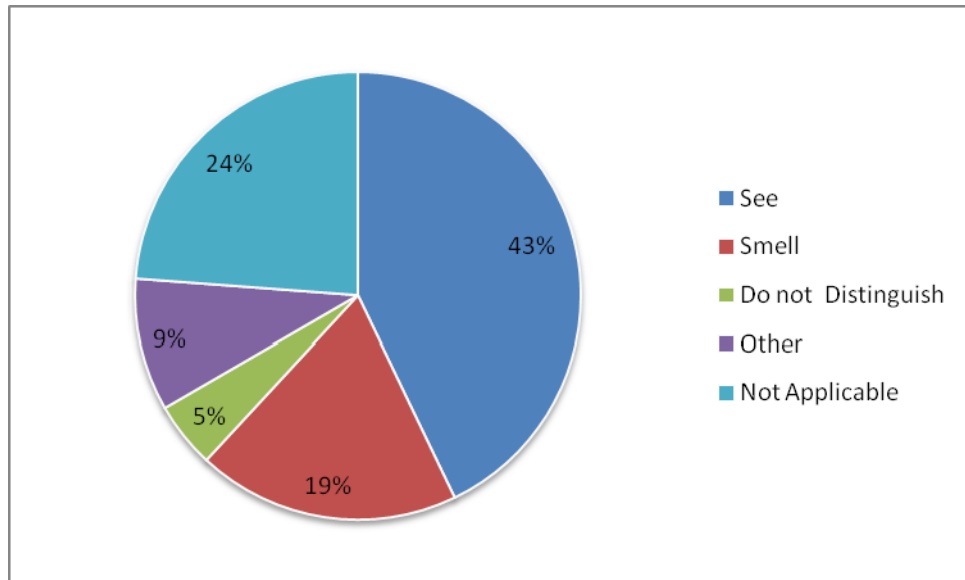


Figure 2: Community Pesticide Sensory Awareness.

Differentiation between the senses provides an opportunity to know how people’s senses explain the world around them. Nine out sixteen respondents, or 56 percent, know pesticides are being used in their area because they visually “see” it. As one interviewee noted:

“People see pesticides being used like crop dusters; it is pretty obvious and is next to their communities. There are no buffer zones, which is part of the SAFE campaign. Everyone knows they are being applied.”

Another informant noted:

“Sometimes they [farmworkers] just see an airplane or helicopter or tractor. But a lot of time these are done in the middle of the night. Not so much to hide them, but they don’t want to do them while people are in the fields.”

About one-quarter or 4/16 “smell” it and one respondent did not distinguish between the different types of senses. For example, one interviewee noted their awareness of pesticides as:

“We smell it. The ones that know about it will come and let me know so I’ll report it and others don’t know to report it so they just accept it.”

Another interviewee commented on smell:

“Typically they see the crop duster or they the folks doing it on the fields smell it at times and sometimes on the fruit they see when they pick it. It’s really bad in the cotton industry; they really have to cover up. They have nasal problems.”

One informant replied, that their awareness of pesticides having been applied in the following manner:

“Personal observation, they may actually see an application, whether it be a ground or aerial application. There are the restricted use materials. If it’s restricted use, they’re required to file a notice of intent. That gives us notification of the proposed job.”

The code “Do not Distinguish” was assigned as a category for one respondent that noted sensory as a theme but did not specify what sense what been used. The tangible nature of peoples experience in observing pesticide use leads to the conclusion that the use of pesticides cannot be minimized. However five out of sixteen respondents do not see the awareness of pesticides through sensory data.

Figure 3 demonstrates the source of knowledge for people becoming ill because of pesticides. Interviewees were asked the following questions: “Have you ever known anyone (including yourself) who became ill because of pesticides?” Answers could be coded as a “yes” or a “no.” This question was followed by, “If yes, please explain.” In total, 14 of the 16 replied “yes,” that they did have knowledge of someone, including themselves who became ill due to pesticides, one said “no,” they have no

knowledge of people becoming ill due to pesticides and one response said, “not applicable.”

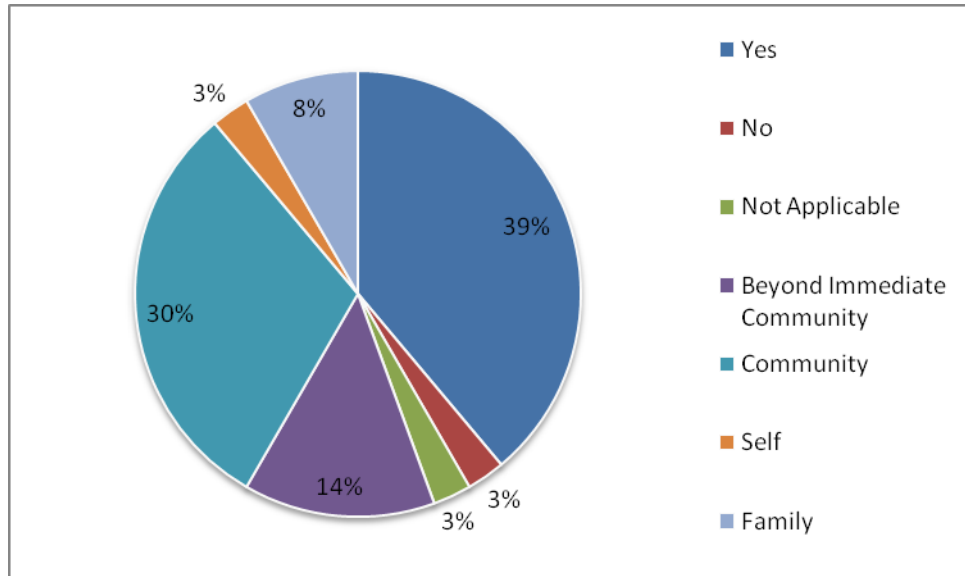


Figure 3: Knowledge of People Becoming Ill Due to Pesticides.

SOCIAL LEVEL OF PESTICIDE EXPOSURE

Responses to this question were categorized into three societal levels, “community,” “self,” or “family.” Interviewees commented on the fact that the exposure occurred at the community level, to them personally by the category “self,” or directly to members of their family, coded as “family.”

The most common responses were from people expressing that knowledge regarding pesticides was “community” reported by 11/16 or 69 percent of the informants.

One respondent notes the following statement relating to the topic of community:

“We are a statewide coalition who works with groups about pesticides. Many of the people we work with are involved because they were exposed or people they know where exposed. Hundreds of people, communities, several hundreds, were exposed. People

get exposed when they are driving around and when they are at school. It's impossible to pick one story. We have strong anecdotal evidence. People are getting drifted upon all the time. We put together a survey for Tulare that proved this."

This informant continued on to explain:

"Even if people know they got exposed and feel ill, the symptoms look like the flu or a hangover. They realize that they have to go to the doctors, but they don't go. Even if they do, we see that people, doctors, don't know how to identify exposure. Sometimes there are conflicts of interests. There are incentives for doctors not to identify pesticide illness. They don't ask. There is very little recording by doctors. Doctors are required to report them, but they don't know. If people are sick, they don't know who to call."

The same interviewee continues on to explain the reporting process:

"They should call the County Ag Commissioner, but they don't. The Ag Commissioner receives ten or twenty reports per year. From the Ag commissioner's perspective, it is not a problem. It is a very small percentage. They need to prove that there is a larger problem. We did about five hundred random surveys asking people if they knew what pesticide drift was and if they had been exposed. If they had been exposed, how many times? What symptoms did they experience? Did their children get pesticide drifts at school? A number of people reported having been drifted upon ten or more times. I think the numbers are on our website. There are a massive number of exposures happening, but they don't get reported."

Another interviewee made this comment relating to community:

"Most of the illnesses that we receive from doctor reports or phone contact from ERs, most of those are individuals that I've

never met before. We get some that are applicators, home owners, and field work duties.”

Yet another interviewee made a comment relating to community:

“I've met so many people. I don't know if I have been drifted on; it's kind of ubiquitous around here. Many of the community members that are involved with Teresa DeAnda in Earlimart. We are aware of what happened in 1999 November. Also, I have happened upon construction workers that have gotten sick. People in Alpa have been drifted on. I don't know of anyone in Orosi. People talk about their pets, a parrot that has gotten sick. I here lots of stories and concerns about pesticides in the Orosi area.”

The category of “Beyond Immediate Community” (4/16) reported by 25 percent of the informants and is indicated by the following recount:

“And that actually could be related to co-worker employees, including the former pesticide deputy here. His incident occurred maybe 20+ years ago. He wasn't performing duties; he was actually in standardization and quarantine in a post-harvest fumigation situation. The product was being fumigated for export and performing that inspection, there was a leak in the door and he had some relatively minor exposure.”

This highlights the fact that pesticide exposure is not just limited to the farmworker per se but has broad-reaching impacts.

Family (3/16) was defined by responses that indicated that the respondent was speaking directly about their family members. A respondent voiced a concern relating to community and family:

“One day on a Saturday they were celebrating with their family. It was different. The kids were playing basketball on the corner. She was choking and her husband was in the living room. She was

washing dishes and it smelled like a sewer. Her kids came inside and said they were getting nauseas, headaches, and couldn't breathe. Her husband's eyes were watering. Fifteen minutes after they heard sirens, police men and firemen came to their house and said "If you want to stay in your house you can or you can leave." Her husband is a pastor and asked where they were taking the people that needed help. To the school. He went there and he was close to his truck by the school and getting dizzy. He almost passed out. A fireman helped him and he went home. The next day her chest was hurting to breathe and she was scared to breathe. On Wednesday they had a big meeting at their church. On Friday a county doctor and state doctor came down to check out people. They took blood and it was negative; they checked their hearts and did a mammogram all was negative. The doctor concluded the body was exposed to foreign agents. The county knew what it was but was being careful about how they talk about it. They gave her medicine to clean out her body for two months. Pesticides were exposed to their nervous systems. It made the kids lazy. She can see the difference in her kids and saw them differently. Her son got real weak and got bronchitis. Her daughter Anna has a cough still to this day."

Another interviewee made this statement relating to their family:

"My daughter is seventeen now and has severe migraine headaches. We all got really sick. Our immune systems went down. We all had double ear infections. My grandson is autistic; I think there is a connection between autism and pesticides. My other grandchild had a rash for three years and it finally went away at age five. They were applying fumigant agents, such as metam sodium (iodomethane). The cloud came in the night. Tried to evacuate all of Earlimart but it was inconsistent. They told some people and not others. We left but when we came back it smelled worse. There were pockets where some people got sick and some didn't. They were told to take off their clothes, twenty-four men and women. These were the people taken to the school. There

were fire trucks there with hoses to spray the people down. Someone said that they felt like they were being raped. Some of the masks that were handed out didn't fit the kids. The oxygen was gone. One hundred of us went to the Board of Supervisors to complain. Sara Reyes was the assembly member that helped us."

Other interviewees note health issues relating to their friends and family:

"I have a friend who passed away from lung cancer. I believe it was the main reason for his health problem. My mother in law also passed away from blood cancer; she was a strawberry worker. Petrobromide is heavily used in strawberries. My sister in law had a tumor in her head. She is 35, deals with the problem. Three to four years she left school and was unable to work. She suffered some kind of problem but doesn't know what happened. She had to leave and she was working with pesticides. Doctor said it was probably pesticides or something else. A friend was exposed to pesticides. He kept working in the fields but he can't work where pesticides are; he gets sick. He has headache, dysentery."

The stories continue with this last comment relating to family:

"Her sister in law is working in the fields and is still sick now. Sister in law who was pregnant continued working after the baby was born, burning eyes, couldn't stop working because no way to pay rent, had a lot of kids, couldn't stop working. In the field you just don't stop because you have a cold or a headache. They have eight children that was her ninth baby."

Self (1/16) was defined by responses that indicated that the respondent was speaking about their own experiences.

The question was asked, "Are local schools given advance notice when spraying is going to occur?" Figure 4 illustrates whether respondents know of schools being given advanced notice when

pesticides are going to be sprayed in their areas. Answers to this question were coded into the following categories

1. Yes.
2. No.
3. Don't know.
4. No answer.

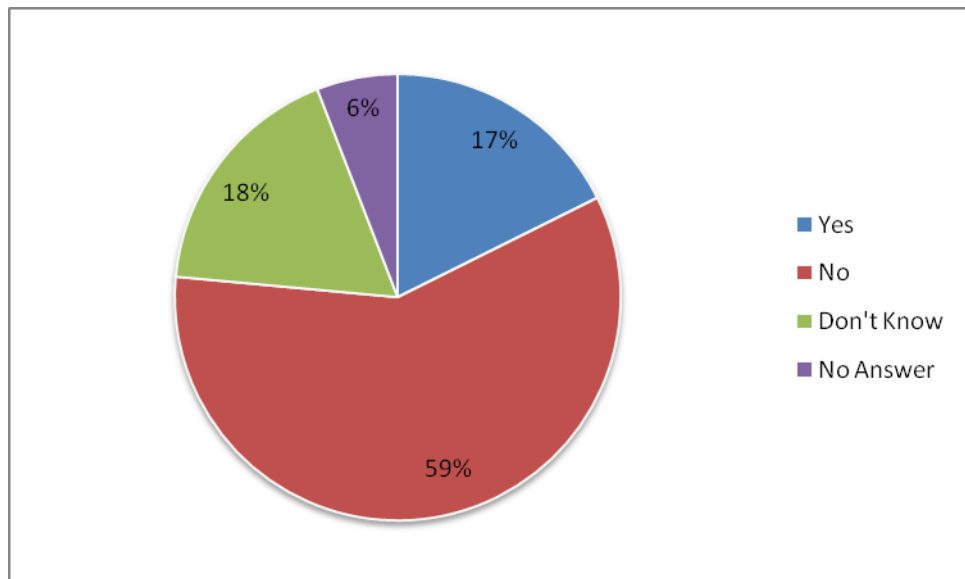


Figure 4: Schools Given Advanced Notice of the Spraying of Pesticides.

Ten out of thirteen respondents or 77 percent assert that schools are not given advanced notice of when spraying is going to occur in areas surrounding their schools. On the contrary three out of sixteen respondents accounted that “yes” schools are given advanced notice of spraying is going to occur. In addition three out sixteen respondents did not know if schools are given advanced notice of the spraying of pesticides.

We designed the question relating to schools being informed about nearby spraying to be a close-ended question. However, many informants chose to expand upon their simple, “yes/no” response and gave detailed explanation about “how” local schools

are or are not given notice. Figure 5 categorizes this additional qualitative information into the following codes: “communication gap (9/16),” “regulation/law (2/16),” “education/outreach (2/16)” “enforcement (3/16),” “voluntary notifications (3/16)”, “healthy schools act (2/16)” and “no answer (3/16).”

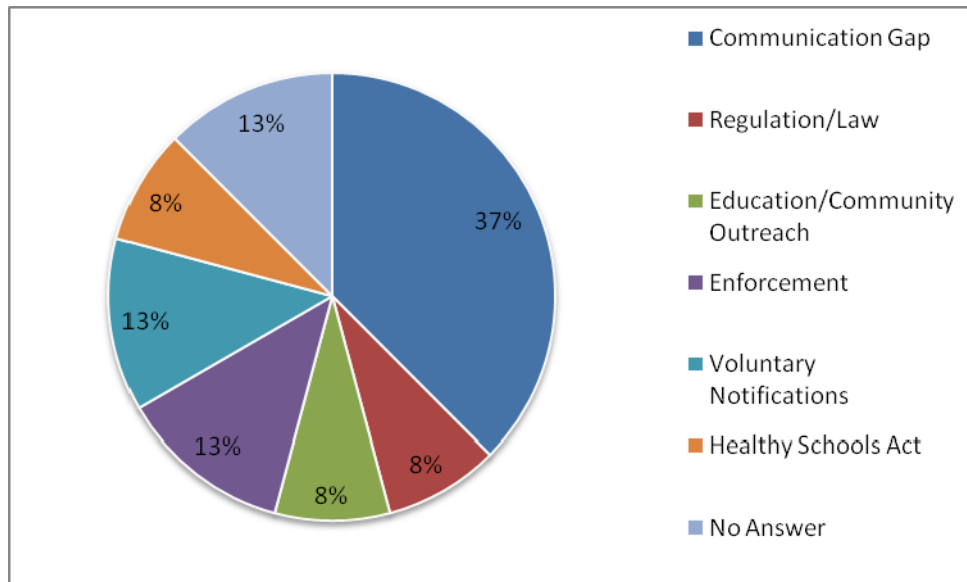


Figure 5: How Schools are Given Advanced Notice of the Spraying of Pesticides.

COMMUNICATION GAP WITH SCHOOLS

Nine out of sixteen respondents or 56 percent, note that there is a communication gap of information between the schools and the owners or contractors on the adjacent farms in charge of the spraying of pesticides. Communication Gap responses were indicated by responses such as “I don’t know the process”, “I don’t know California Codes,” “there are not notifications for the community”, “yes and no to the question of if schools are given advanced notice”, “we encourage the communication from applicators to the neighbors”, “many parents who feel they are not being told”, “I don’t think schools are really aware of the issue” and “nobody is notified”. The communication gap is addressed by the following key-informant statement:

“Yes and no. As part of the healthy schools act, it is required as part of the school act. The principle is required to notify the teachers with that type of notice. As far as farmers notifying the school, there is no requirement unless there is a permit condition. It is highly unlikely because we do not allow the pesticides to go that close.”

Another informant shares their thoughts on the “communication gap” and the topic of “enforcement” explaining:

“I don't know for sure if that happens in practice. I talked to many parents who feel they are not being told when spraying is going on.”

Another respondent noted the issue of the communication gap:

“No. I don't think so because my daughter goes to school in Monterey County. All of Monterey county should be aware of the pesticide issue because people who pass by all people that are living in the area are exposed to pesticides so of course schools need to be aware of that but I don't think schools are really aware of the issue.”

One informant noted how the “communication gap” relates to “voluntary notifications,”

“We present updates through private applicator gatherings or to licensees, like California Air Applicators, or advisors. In those settings, we always encourage applicators to communicate with the neighbors, and obviously some of those neighbors will be a school property. Many times the applicator will take the time and effort to warn the neighbors of when it's going to be, what it's going to look like, is it going to be a thirty minute application or a six hour application. That communication can be very beneficial. We encourage the communication from applicators to the neighbors.”

Voluntary Notifications

One method used for conveying knowledge of pesticide usage to the community is voluntary notifications (3/16) by owners or contractors to the schools. Interviewees used the words “voluntary” and “notification” and “encourage applicators to communicate with neighbors”. One interviewee addressed the topic of voluntary notifications with this statement,

“No. The notifications that take place for schools and daycares are for pesticide use on the school grounds only! There is no notification for pesticide use across the state in the fields. If it happens at all, it is voluntary. It is purely voluntary and extremely rare. It is not mandated by any law. No notification use for any agriculture spraying.”

The interviewee went on to explain activities in another county concerning similar issues within Tulare County.

“They are starting a pilot project in Kern County where growers will notify other growers when they are using pesticides. However, there are no notifications for the community. The Kern County Ag Commissioner is working on that. They are mapping using GIS. That was a result of people trying to pass laws that would force people to notify others. This was a first step. It’s in a pilot phase. It was the compromise from the legislature. Extensively, it was to let the growers know when someone was coming into the fields. Pesticide spraying causes problems for growers.”

Given the voluntary nature of notifications, a communication gap is created between the schools, farm workers, agricultural commissioners, owners or contractor of farms. Respondents note that changes need to be made in the process of providing the schools advanced notice of the spraying of pesticides. One such improvement which is immensely needed is the enforcement of currently established laws. Almost one-fifth (19 percent) of the

key-informants responded with answers relating to the topic of “enforcement” (3/16). Examples of these answers include: “result of people trying to pass laws that would force people to notify others”, “They have something on paper but its different implementing” and “I don’t know for sure if that happens in practice.”

A common theme expressed by respondents was the need to get out into the community to share information with them relating to pesticide use. Education/Community Outreach (2/16) responses were answered with “I believe in our continuing education efforts.” Regulation/Law (2/16) responses were answered with an explanation of Healthy Schools Act which is a law. The other response for the Healthy schools act was not included in this category because the other respondent was referring to the act more specifically in terms of communication problems.

The following question related to data sharing was asked, “Our organization creates maps using Geographic Information Systems (GIS). To create these maps requires data. Does your organization have any digital data that it would be willing to share?” This question was presented in a “yes/no” format.

Figure 6 highlights whether organizations have digital data they would be willing to share with CCRP. The purpose for gaining the digital data from organizations is to add sources of data for geographical Information Systems (GIS). Most frequently, respondents either agreed to share digital data with CCRP (5/16) or this question was not applicable (5/16). The category of “other” (4/16) was assigned when respondents neither agreed nor disagreed and continued to elaborate their response. The least common response was “no” (2/16).

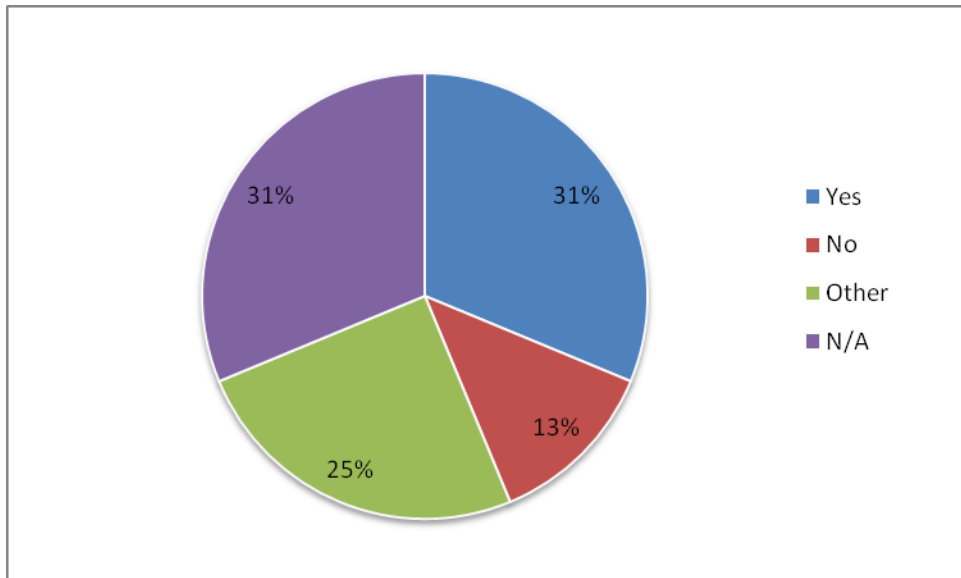


Figure 6: Does your organization have any digital data that it would be willing to share?

As a follow up question we asked “what type of data?” Figure 7 illustrates types of data informants would like to share. Of those who had data that they were willing to share, the most common response was (3/16) for the type of data is data relating to the department of Pesticide regulation (DPR) and the Pesticide Action Network (PAN).

The second most common answers to this question were “maps” (2/16) and “pesticides” (2/16). Other respondents noted that they would be willing to share data such reports (1/16) and information regarding schools (1/16). One informant expressed,

“We need to compare what kind of pesticides are applied near schools, and research what pesticides are being applied next to schools to identify them.”

Answers to this question highlight that many organizations are willing to share the information that they have readily available.

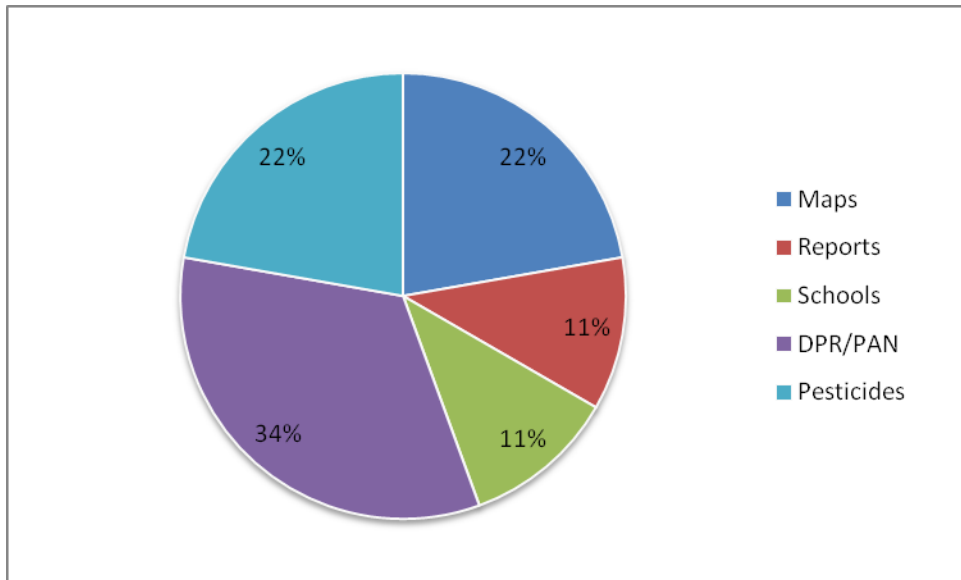


Figure 7: What type of data?

Informants were asked, “What are your top two questions related to pesticides and agricultural worker health? Figure 8 depicts answers to this question.

Since interviewees were asked for their top two questions and then some chose to elaborate and provide more than two questions, the table notes how many times a specific topic was mentioned. The top two questions developed by interviewees reflected the following common themes: “communication gap,” (12/16), “community education,” (11/16) and “health” (10/16).

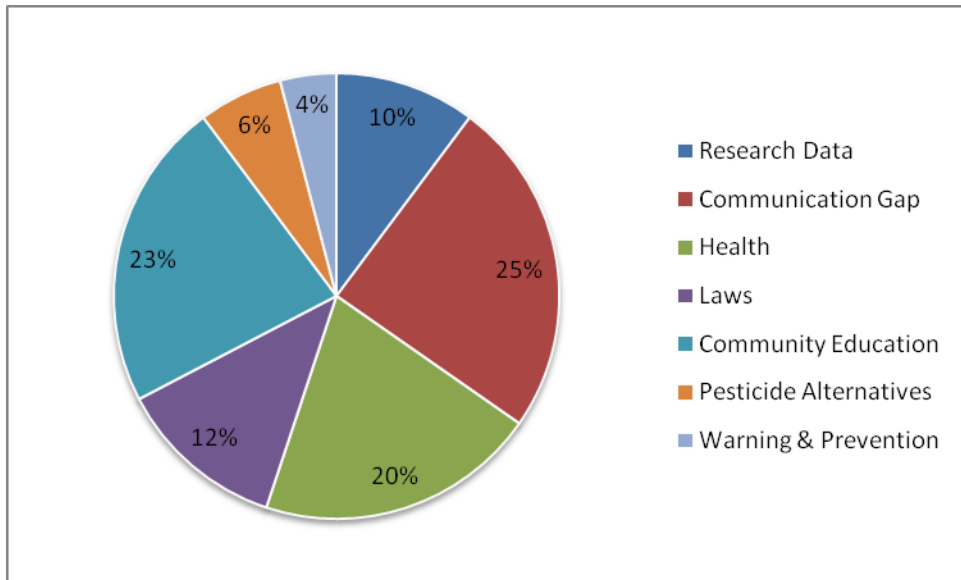


Figure 8: What are your top two questions related to pesticides and agricultural worker health?

COMMUNICATION GAP WITH COMMUNITY

The theme of “communication gap” reported by 75 percent of the informants, refers to a lack of understanding in linking the information they are given with meaningful action and/or mentioned a gap in action between finding out something such as a pesticide is harmful and yet not having it banned. This category also meant a gap in information and communication of health impacts relating to pesticides. An interviewee speaks to the topics of communication gap and community education with this statement:

“A lot of the pesticide applications that go on don’t have a lot of adverse impact. Yet every time this is portrayed in front of the activist groups, they state that not everyone is coming forward. There are people that are exposed. They need to educate these farm workers to report this, or report these themselves.”

One informant notes a way to address the communication gap:

“I would think trying to find common ground with the workers and the farms.” Another respondent accounts a similar statement of the topic communication gap and community education, “Knowing a bit better on what the workers in the field’s knowledge is, like what the workers really know.”

COMMUNITY EDUCATION

An important issue related to the agricultural worker community is that of educating the community about what is occurring in their environment. For the topic of community education (11/16) informants or 69 percent, frequently mentioned either working directly with the farm worker community by talking to them about their rights and about pesticides. One respondent articulated their position related to community education:

“Health care providers need to encourage on-going trainings that help workers to recognize the symptoms of pesticide exposure. They hear me coughing and they assume I have a cold. They need to take in to consideration the time and season of the year.”

Another interviewee speaks to the topics of research data and community education:

“Chronic use of pesticides; there is a lot about acute pesticide exposure but little information on low level continuous exposure. We’re constantly looking for ways to educate the community.”

One respondent notes that community education is an issue not only for the greater community but also for the governmental members for the community:

“Getting the politicians aware such as the agricultural commissioner. We must really put attention to the issue that is causing the pesticides.”

Additionally, this topic encompasses the need for more community outreach to bring education about pesticides to the farm workers.

HEALTH

The theme “health” (10/16) was reported by 62/5 percent of the interviewees. Answers in this topic focused around health or of health concerns for the farm workers and communities surrounding the fields. One respondent speaks on the topic of Health:

“Even if they aren’t working in the fields they are affected by the fields because the town is surrounded by fields. Earlimart is a little town surrounded by grape vines, almonds, and pistachios. Everybody fits the guise of being a farm worker because you are getting what is going on in the field. The communities are getting 95% of the crap that comes off of the fields.”

Another interviewee commented on the topic of health:

“Hardest question is what are the cumulative exposures through the different mediums, water, air, and physical contact?”

OTHER COMMON QUESTIONS

Questions related to “research data” (5/16) were reported by 31 percent of informants, and “laws” (6/16) was reported by 37.5 percent of interviewees. The term “research data” referred to models or research information that is readily available or those they would like available. One informant noted in relating to research data:

“Research hasn’t been done on the synergistic effects of pesticide – pesticides are evaluated individually, the effects of cocktail

suites in real life are completely unclear...The biggest thing is current models don't reflect reality on the ground. Who's using the pesticides? How are people of different genders and ages affected?...For example, in the Tulare drift catcher program – participants have no idea what the amount of pesticides in their bodies actually mean – it's scary to have your body tested for chemicals – what does this mean? No one knows the answer to this question; that's one of their biggest unanswered questions.”

Another informant incorporates topics of research data, health and laws into this statement:

“Now as part of this farm bill effort, one of the things that we're asking for is that money gets put into research to determine really in a comprehensive way how many farm workers gave birth to babies with birth defects that are associated with pesticides and how many have cancer that may be associated with pesticide exposure.”

For the topic of laws, informants mentioned laws that included types of laws or enforcement of laws. Due to the lack of representation, the remaining categories top questions of pesticide alternatives and warnings and prevention while important to the communities they affect are not significant in the context of this table. However, the categories were assigned by respondents stating “...come up with a plan to eliminate pesticide use” or “Are there alternatives to pesticide management that doesn't rely on chemicals” for the topic of pesticide alternatives. For the category of warning and prevention respondents discussed warnings in place and those carried out by farmers, agricultural commissioners, or by the community. In addition preventive methods to illuminate farm workers exposure to pesticides was also considered within this category. One informant noted the topic of pesticide alternatives:

“There is information that pesticides are bad for people; why are those pesticides not banned? Why doesn’t the government encourage and help growers to find other ways to grow?”

Another interviewee notes the topic of warnings and prevention:

“How can we be more effective in informing the public of not going into a field that will hurt them or damage their life? What can we do if local government and state government do not secure the health and safety of the workers? Oftentimes workers do get hurt but they are not reporting the incident. How are they going to get help, workers compensation or pesticide exposure?”

Figure 9 conveys the information informants would like to see mapped. The majority of requests for maps mentioned an overlay of multiple themes. Informants were not asked to put a limit on their answer, so one person could mention multiple topics. The most common answers to this question were “pesticide use and type,” (6/16), “pesticide drift and incidents” (6/16), and “schools” (5/16).

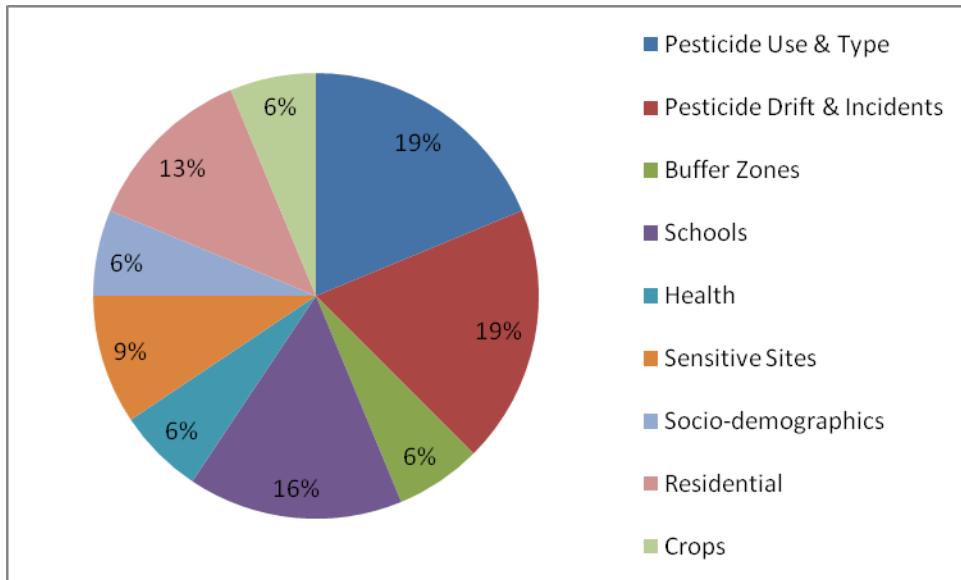


Figure 9: What type of Information would you like to see mapped?

PESTICIDE USE AND TYPE

Over one-third of interviewees reported wanting to see information mapped on “pesticide use and type.” The category pesticide use and type was assigned based on the mention of wanting maps that geographically show where pesticides is occurring and the type of pesticides that are used. One interviewee notes:

“We would like to see this data mapped: 1) What pesticides are used in certain areas 2) Reported pesticide drift incidents. We need to have data and maps housed in one central place available to all.”

PESTICIDE DRIFT AND INCIDENTS

Over thirty-five percent (37.5 percent) of interviewees reported they would like to see “pesticide drift and incidents” (6/16) mapped.” Another informant adds to this category by considering

issues related to water, pesticides used and type and sensitive sites:

“Potential pesticides that could contaminate ground water and those that have never been tested for, where they are applied and where in the communities.”

One informant made the point of how the data is represented on the map by this statement relating to the topics of pesticides used and type and pest drift and incidents:

“When you see a map of pesticides you know what kind of pesticides but the concept of pesticide is not just color coding but more conceptualized than just the color.”

SCHOOLS

One of the top three responses to this question about mapping information was schools. Close to one-third of the interviewees (31 percent) want to see information mapped about schools and or buffer zones:

“...schools and house are so close to the field and people do not go in until its safe. When the spray moves with the air, what is it? Drift.”

Another informant commented on the issues of buffer zones and schools:

“We’re interested in a buffer zone campaign around schools... What I’d like to see for public use would be ‘just schools’ one version with just schools and then one with all sorts of sensitive sites, homes, hospitals, businesses, day cares, labor camps.”

MAPPING OTHER INFORMATION

Varieties of other topics for mapping were also mentioned and include: “residential” (4/16), “sensitive sites” (3/16), “buffer zones,” “health” (2/16), “socio-demographics” (2/16), and “crops” (2/16).

For the topic of residential, interviewees referred to the locations where farm workers live and where specific homes are located. The category of sensitive sites includes: public organizations, open spaces, community centers, banks, grocery stores, liquor stores, farm worker communities, and water sources.

One interviewee comments on the topic of mapping socio-demographics:

“Potentially we could look at areas from the census that show blocks of neighborhoods that are medium income neighborhoods versus low income in a useful and positive way to show how to make it better not how it is broke.”

One more respondent noted the reason for why policy related to health is not where people would like it to be,

“There are a lot of laws in California that govern health and safety in the state. The problem is the state agencies and administrations do not have the resources to do their job. They are under-funded and understaffed.”

Figure 10 illustrates responses to the question, “How could our research best support the efforts of the Poder Popular programs?”

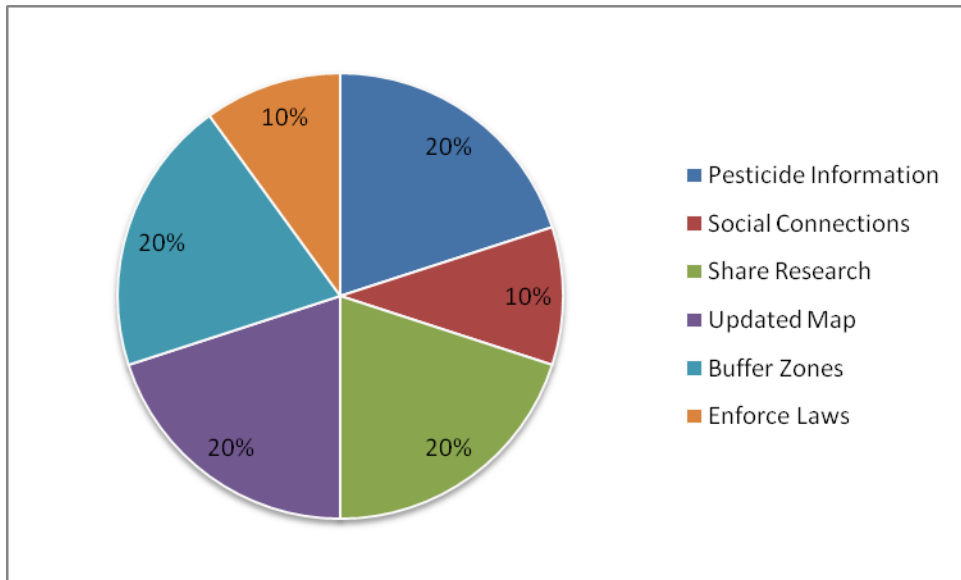


Figure 10: How could our research best support the efforts of the Poder Popular programs?

Answers to this question ranged across a variety of topics, including: “pesticide information (2/16), “share research” (2/16), “updated map” (2/16), “buffer zones” (2/16), “social connections” (1/16) and “enforce laws” (1/16). One informant speaks to the topic of buffer zones in this quote:

“Dew overnight evaporates during the day and the pesticides are airborne again. Take a real look at what pesticides are being applied.”

For pesticide information respondents mentioned creating maps of pesticide information such as listed in the previous question fourteen. One interviewee notes the topic of pesticide information:

“The problem is that people don’t report pesticide drift.”

For updated maps respondent briefly discussed how maps that are currently available are not updated frequently and so do not provide the full range of information needed for Poder Popular.

One interviewee explained the reason for the need of updated maps:

“We found out that over half the schools in Tulare County are within half a mile of a field.”

Other categories of social connections and enforce laws, while important to the communities they affect are not significant in the context of this table. However for the category of social connections respondents stated “forming personal connections with the people” attending group meetings of Poder Popular. Figure 11 illustrates suggestions for how to best to communicate with farm workers.

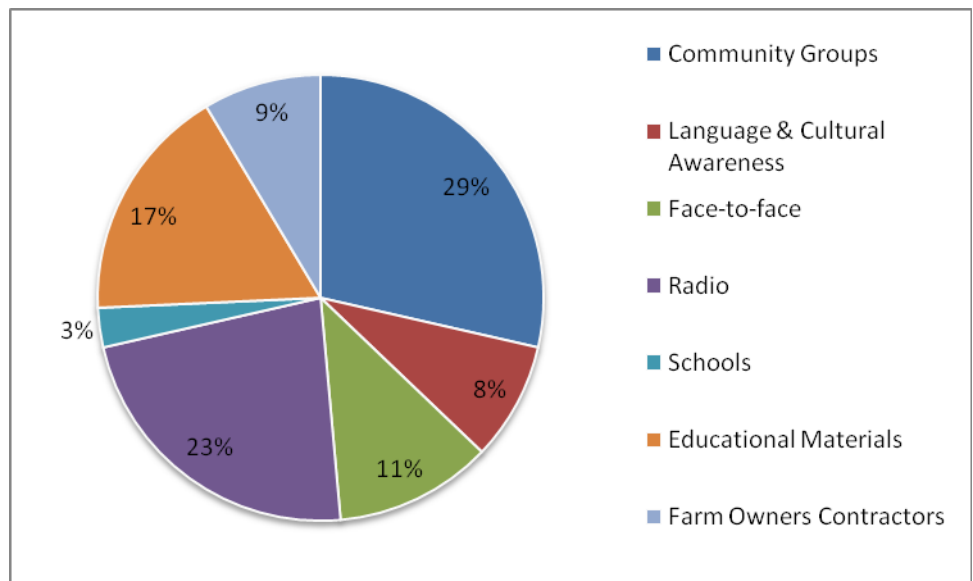


Figure 11: What is the best way to communicate with farm workers?

COMMUNITY GROUPS

The most common response to the question of how best to communicate with farmworkers, was “community groups” (10/16) reported by 62.5 percent of the interviewees. This category was based on responses suggesting that communication efforts focus on connecting with existing community groups and local leaders. The informants see the community groups as a major vehicle for communication in the areas of study. This interview explains the diverse possible groups to connect up with:

“United Farm Workers Union (UFW), Poder Popular, faith-based groups (e.g. Fresno Metropolitan Ministry- does great outreach). The challenging piece is organizing groups.”

Another interviewee further explained the types of community groups one can use to connect to the farm worker communities:

“Utilize existing groups: farm workers and grassroots. Health Fairs and community events in terms of helping people understand the information through existing groups; it is much more effective.”

Another interviewee adds to this sentiment by stating:

“This is the time for collaboration and collations. Go to organizations that are already working whether it is in community organizations or heath issues.”

This informant felt that sharing information through the schools would be a good approach:

“Through the schools. The school district that is interested in sharing info. Some will pass out flyers, but some have policies against this. We are working on trying to get protection zones for schools. It’s political sometimes because there are farmers on the

school board."

RADIO

Using "radio" is the second largest response, reported by 50 percent of the interviewees (8/16), as the best way to communicate with farm workers. One informant explains the connection between radio and work:

"Radio stations. Workers listen to radio on the way to work, on the way home, etc. Locally: Radio Bilingue and La Comasina, this was established by Cesar Chaves to communicate with farm workers."

This interviewee explains which radio stations and where:

"Radio Bilingue (Fresno)- best source for distributing info. Trikki once a week satellite, Salinas and Tulare."

One informant noted, *"Face-to-face and radio, radio campesina and Radio bilingue"* as the best way to communicate with farmworkers. This informant portrays the advantage of communicating through radio versus through an existing organization:

"Well, you can always communicate to them through their organizations. But to communicate directly, I think radio is a really good way."

EDUCATIONAL MATERIALS

The third most common suggestion for communicating with farmworkers was "educational materials" (6/16) reported by 38 percent of interviewees, as the most effective way to reach farmworkers. Educational materials include: flyers, handouts, reading and writing materials used to connect with the farm

workers and providing information that would benefit the farm workers. One interviewee noted the importance of giving farmworkers materials such as:

"...brochures and reading with them the materials. We are using our newsletter and through our Radio Compasina with Gerome Meranda (559.622.9401)."

This quote indicates the value of combined benefits of educational materials and radio. Another interviewee explained:

"If you're going to do something in print, you want it to be low literacy because people have a low reading ability in any language. And you know pictures are good."

A different informant thought that sharing information through the workplace would be the best approach:

"Through their employers. For example, one page of info about the types of pesticides being applied and info about how to protect themselves."

OTHER COMMUNICATION SUGGESTIONS

About one-quarter of the interviewees (4/16) indicated that "face to face" communication was the best way to reach out to farm workers. One interviewee notes the importance of being tied in with the farmworker community,

"The best way to share information is with personal connections with the farmworkers."

About 19 percent of interviewees reported focusing on "language and cultural" factors as being the best way to communicate with farmworkers. One interviewee explains the reason to be aware of language and cultural issues:

“I have received organizational materials about pesticides and given them to farmworkers but they are not well translated sometimes so you can't understand them... so I have to change them to readable Spanish...”

For language and culture interviewees stated that it is important when communicating with farm workers that we take the different language dialects, language barriers, and role of culture into consideration to be able to connect better with the farm workers. The following quote illustrates how different dialects are spoken by groups in various places:

“Central valley is not an issue, but Greenfield has several different dialects of Spanish (indigenous languages, e.g. Trikki). Frente Indiden, possible translators, lots of cultural awareness and community building.”

Focusing efforts on “farm owners and contractors” was suggested by about one-fifth of the interviewees. Interviewees described “contractors” as being involved and a part of the farm working community already. One interviewee notes the reason for needed community groups and increased communication with farm owners and contactors:

“They take the children to work in the fields, take them and let them sleep in the car. They came here to this county to work, so they work.”

The final question in our interview asked people: “Is there anything else that you would like to tell us about pesticides and agricultural workers health?” The goal of asking such a question at the end of an interview is twofold:

1. To give the informants an opportunity to share information that they felt had been left out in previous questions.

2. Second to give the interviewee a chance to comment or highlight their final thoughts on this topic for us.

Many of the respondents chose not to elaborate further in this question while others used the opportunity to reiterate previous issues.

Figure 12 displays any additional information informants wanted to share relating to pesticides and agricultural workers health. The most common answer reported by 44 percent of the interviewees (7/16), was “no.” This is a positive sign, because it indicates interviewees had adequately shared their perspectives on this topic in earlier questions.

Health

The second most common response was “health” reported by 5/16 or 31 percent of the interviewees and mostly focused around “health” of the agricultural worker. One interviewee makes this statement relating to the category of health:

“The central Valley is in a cup so no air moves. I have family members that are suffering now.” Another interviewee notes this relating to the topic of health, “we have a concept that all health issues are related to the conditions they are living in.”

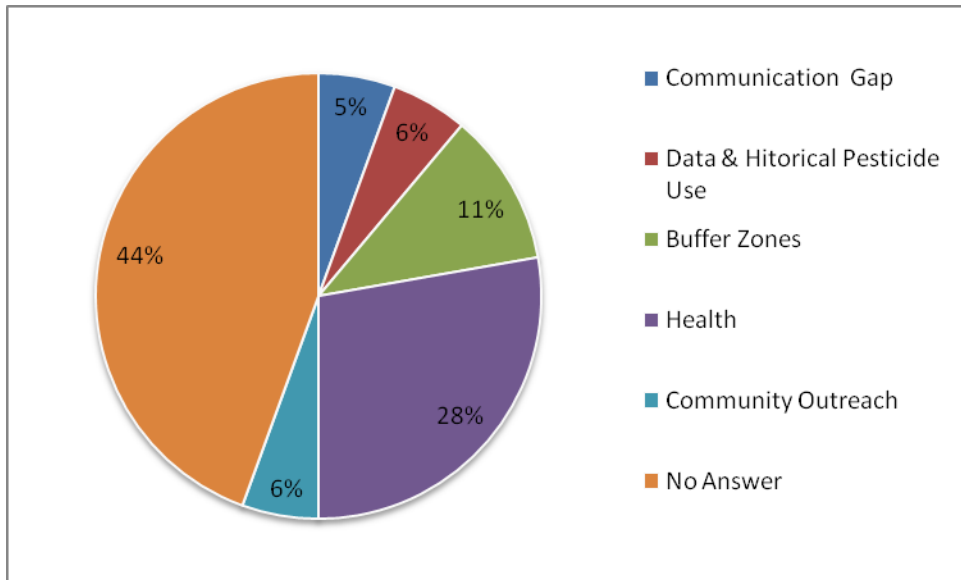


Figure 12: Is there anything else that you would like to tell us about pesticides and agricultural workers health?

Buffer Zones

Buffer zones (2/16) was a specific them reported by 13 percent of the interviewees. One interviewee elaborates on the topic of buffer zones:

“Encourage school districts to not put schools near agriculture operations.”

Another interviewee comments on the complexity of factors around this topic:

“The strategic work around the buffer zones and the community health piece is a major concern. In terms of pesticides, there are so many factors involved. What we need to be doing is working towards real solutions for what it takes to support growers to use different methods of growing. This push and pull method doesn’t work. We need to figure out together how society can support community health while keeping the prosperity of the agriculture.”

Other Responses

A variety of other topics were mentioned in response to this question and included the following topics: “communication gap,” “data and historical pesticide use” and “community outreach.” For the category of communication gap, interviewees referenced the lack of understanding and information from the farmworker and their toxic work environment. An example of this is the harmfulness to farmworker families when they come home with pesticides on their clothing.

One interviewee had this to say in relation to data and historical pesticide use:

“Where, historically, have pesticides been, like DBCP that has been banned is still contaminating the ground water and wells are still being closed. Lots of people in rural areas own private wells, so it is not being tested.”

One key-informant notes the connection between the topics of communication gap, health, and community outreach:

“Farm workers don’t understand. The crew boss needs to be informed; most people just go to work and don’t realize the consequences for coming in and contact with pesticides.”

CONCLUSIONS AND RECOMMENDATIONS

The data examined for this study suggest that pesticides and fumigants, in a variety of forms, are commonly present in and around agricultural communities in Tulare and Monterey counties. It is clear from this study that the issue of pesticide drift is one for all citizens of these agricultural communities and not just farmworkers in the fields. Pesticide drift does not discriminate based on demographics of the communities or schools around which they are used. Pesticide exposure should be a concern for all community members in the towns included in this study and the numerous similarly situated agricultural communities throughout the state of California.

There does not appear to be a high level of direct communication between the farmworkers and farm operators. There are a variety of possible explanations for this, including a lack of awareness about how to report pesticide issues, fear of repercussions, or communication barriers due to language. When issues related to pesticide exposure are brought forward, they are handled through an intermediary. Most commonly this is in the form of a non-profit advocacy organization which in turn handles communication with the farm operator or County Agricultural Commissioner's office. A variety of groups and organizations working on the issue of pesticide drift, including many of those contacted in the course of this study.

It is clear that citizens of these communities, as well as those who work in and around them, have experiences which they attribute to the effects of pesticide exposure and pesticide drift. They know it from a sensory standpoint and the results of our key informant interviews and field visit confirm this. While these events may not always be documented by the formal structure of the medical system or local and state government agencies, the effects are nonetheless real. Continued efforts to make the process of identifying and documenting pesticide exposure and its effects will be essential to gaining a better understanding of the extent

and depth of these effects as well as providing appropriate solutions. Farmworkers are concerned about the health and safety of their families, especially their children, and seek solutions that can simultaneously maintain the agricultural productivity of these communities while minimizing risk to those who live and work there.

Schools

One of the most prevalent concerns that was heard repeatedly throughout this study was the proximity of pesticide applications and drift near schools. While California state law ensures that pesticides used on school grounds must be reported to parents in advance of any application, this same reporting process is not required for pesticide applications on adjacent properties.

Furthermore, since the risk of exposure from drift caused by wind or pesticides carried in dew are not well understood. There is sufficient documentation of pesticides being carried to unintended locations to acknowledge that this is an issue worthy of concern and further research.

People that we interviewed clearly have had personal sensory experiences with pesticides that range from knowledge about their presence because they see or smell them. Furthermore, the issue of pesticide drift is important to consider because it impacts the health and safety of school children in these communities. This issue is of specific importance to those schools that are located adjacent to or relatively close to agricultural fields sprayed with pesticides.

We examined a ¼ mile buffer around schools as an example of one possible solution. Limiting the use of pesticides in areas close to schools and other sensitive sites could be an option worthy of further consideration. The total acreage in agricultural uses within close proximity of schools is relatively small relative to the amount of agricultural production in these counties.

Wind and Environmental Transport

A modeling of wind for a one week time period suggests that the greatest wind speed and consistent directionality occurs during evening, nighttime and early morning hours. Conversely midday winds tend to be much lower in velocity. This is interesting in context of our research, our interview data suggests that much spraying of pesticides occurs during nighttime hours. Spraying at night is likely to increase the chance of pesticide drift and therefore may increase the resulting level of exposure in adjacent locations within these communities.

Some small scale studies with drift catchers have been carried out, but the depth of understanding about how pesticides move through the environment is limited and varies depending on the form of the pesticide being applied as well as the technique used for the application itself.

Less is known about other avenues of transport including, transport in water as well as via the physical transport on the clothing worn by farmworkers from the fields via private and public transportation and back to their homes.

Communication

Our research project highlights the presence of a communication gap that exists at multiple levels. There is an obvious gap between growers, farmworkers, community members and policy makers at the local, regional and state level.

These gaps consist of the following components:

1. Communication
2. Information sharing
3. Understanding different points of view

4. Awareness of different groups' abilities, including the capacity and ability to affect change.

Some community members communicated an impression that decisions are made about agricultural communities without taking into direct consideration the thoughts, feelings and experiences of individuals in these community who are ultimately affected by these decisions.

Furthermore, policy makers do not necessarily observe firsthand the implementation of their policies. Decisions are made, but then there is a lack of follow-up to determine if these decisions are being effectively implemented at the local level.

For example, suggesting that individuals observing pesticide drift make a phone call to report the event may seem like a good idea. However, have policy makers determined if this is feasible in practice? Do members of the Latino community understand the process? Do they have access to phones so that they can report drift? Do they feel their personal rights will be protected if they report an event? Do they have confidence that something will actually be done if they do report it.

One simple suggestion, which some groups and organizations have done, is to make sure that all information relating to pesticide and health information is made available to community members in both Spanish and English. There needs to be an ongoing system in place for continuous communication between various stakeholders on this topic including farmer operators, farmworkers, community members and policy-makers.

UNDERSTANDING GROUP CAPACITY

Often there is a desire change without a clear understanding of how and where the appropriate agent of change is within the system. It is sometimes easier to assume that other groups are

opposed to change when, in fact, they may be a strong ally. We encountered representatives of growers who were very interested in the possibility of reducing the use of pesticides and the negative effects of exposure within communities in which they operate. It is important to develop a forum where various groups interact in a face-to-face setting to try and resolve issues by creatively developing solutions together and effectively leveraging the resources and influence each bring to the table.

For successful interaction, groups must feel they are being heard. It is essential that all of the stakeholder groups come together and to listen to one another, hear each other's concerns and issues of importance, without reacting negatively at first. Unfortunately this is a difficult step. It is always easier for groups to come together with other like-minded organizations and define the 'other' as the cause of the problems. However, if communities can come together and begin to know each other as people first the possibility of reaching creative, workable solutions is greatly enhanced.

There is significant power and creative energy that can come from a cross-pollinated group consisting of diverse membership, but first these groups need each be heard. The groups consisting of farmworkers, growers, and other community members coming together can have a far more effective conversation with policy makers than any one of these on their own. These conversations can be held with the presence of a skilled mediator to help foster effective communication among the groups.

Interaction and communication is good when there is a final goal in mind. In terms of pesticide drift and pesticide use, it would serve communities well to have focused and mediated discussions around the various points that we have raised in this report, particularly the concepts of effective reporting as well as the feasibility of buffer zones around schools and other sensitive sites.

It is not only farmworkers who are experiencing negative effects of pesticide exposure, but rather all members of the communities

near where these applications are a regular part of agricultural production who are experiencing it. This is not something that is just limited to the people in the fields, although they have potentially higher exposures.

Farmworkers are committed to their communities and do not want to leave them because of pesticide drift, but the increasing health issues are beginning to encourage some of them move away or to desire to move away. Ultimately this will damage the sense of community that is so important to the fabric of these towns and could have negative repercussions to the larger community, economy as well for the agricultural industry.

DEVELOP AN UNDERSTANDING OF PLACE

The issues explored in this study occur in a particular context from which they cannot be separated. It is important to understand the role of place when examining both issues of concern and possible solutions. Each community or subpopulation identifies specific geographic locations that are important to their general and wellbeing. For instance, this may be a park where community members recreate on the weekends or a church, school, community center or dance hall where people gather. Understanding where these places are in relation to agricultural fields and pesticide spraying becomes important as residents consider the health and safety of their families, not just when they are working in the fields, but for when they are participating in other activities and events important in their lives. Documenting and recognizing local knowledge and community preference for place also becomes important in making policy decisions related to pesticide use.

This study highlighted relationships between environmental, physical and social data. Incorporating geographical information in this study indicates what pesticides are being sprayed and where these pesticides are being sprayed in relation to places of

importance to the community. This is far more relevant than simply examining data without the sociospatial context in mind. The end result is that people living in these six communities are being exposed to pesticide drift and it is an issue that raises important concerns that should be addressed. Pesticide use and drift is not an issue that is just limited to the agricultural worker, but extends to the entire community.

There is clearly a lot of work to be done in this area. Preferably this important work can be accomplished by building and maintaining coalitions between the various groups already working on these issues. The social network mapping presented earlier provides a good example of opportunities for collaboration, sometimes in the same region, that are not currently being utilized to their full advantage. Working to understand different groups' focus areas and where these dovetail or overlap will be essential.

Connections Between Space and Place

What is unique about this study- it considers space, place and environment. Space can be defined as distance or proximity of one thing to another. Space also can be defined by patterns of movement or interaction. In space, things are relative to one another and the relativity is independent of the actual location. Place refer to a physical location that is geographically bounded. Places often have particular meaning or importance to some group. Common examples of places include a neighborhood, community, a gang's territory, or lover's lane.

As we saw in this study of agricultural workers and pesticide drift, different groups of people can occupy the same place, such as a community, but experience different "spaces." Our public-participation GIS highlighted the different residence patterns of different ethnic groups in a community. Residents or groups may live in the same place (community) but operate in different "spaces."

GEOGRAPHY OF INEQUALITY

A geography of inequality is a spatial construct affecting how a person experiences place. Examples of geographies of inequality are income, race, class, level of education. You may be next door neighbors to someone who is a higher status, a different caste or a different level of education and never interact because there is some sort of social barrier that separates you from your neighbor. These same barriers may apply to entire communities.

Our study explored some of these separate residential communities, barrios, recreational patterns experience by farmworkers. This barrier creates a geography of inequality. For farmworkers, the geographies of inequality are multiple; they are cultural, economic and racial. They may result in restricted mobility patterns for farmworkers and their families. Sometimes these patterns are played out in terms of inability to move away from a particular community. Other times the patterns reflect where a group of farmworkers reside.

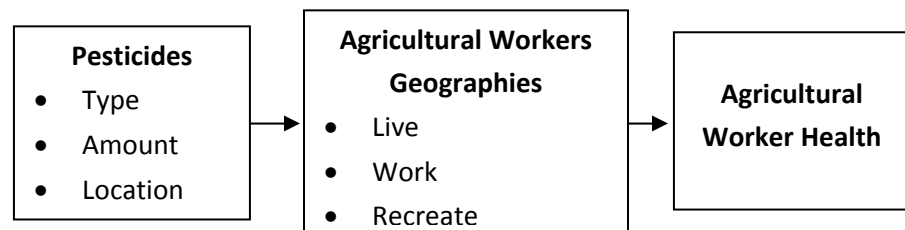
In our study, the community of interest was defined as agricultural workers living in the six Poder Popular communities in Tulare and Monterey counties. A “community of interest” is the pre-determined target group. As we completed this study we realized that the actual community of interest was much larger than just the farmworkers, it included entire agricultural communities in general.

Therefore, we propose that relative to issues of pesticide exposure an expanded view of the community of interest is necessary. Pesticides can affect community members in addition to farmworkers who do not work in the fields. To increase the health of the community, all affected groups and individuals should be at the table, growers, farmworkers, community members and community leaders. Through effective dialogue and recognition of a shared space within a particular place, the

groundwork can be laid to create healthier, more resilient agricultural communities for all.

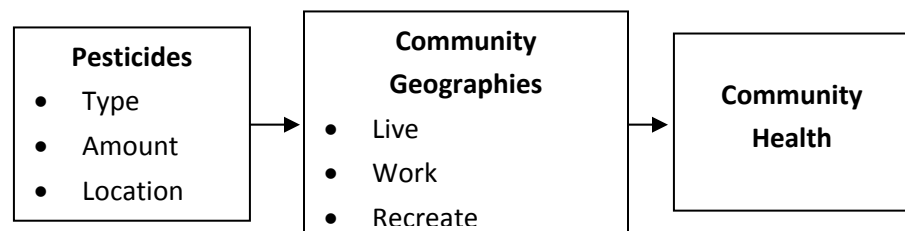
Our study operated under the below theoretical model. We developed this study based on the assumption that pesticide type, location and amount would affect agricultural worker health. Through our research we realized that the actual community of interest is entire agricultural community in general, not only the farmworkers, but their children and families as well as community members and families not working in the fields.

ORIGINAL CONCEPTUAL MODEL



Final Conceptual Model

Our final model replaces agricultural worker geographies and health with community geographies and community health.



The real community of interest is the community in general. Pesticides are something that all residents of a rural, agricultural community experience. By the very nature of their occupations farmworkers and their families may experience greater exposure

to pesticides. However, everyone in an agricultural community is exposed to the unhealthy effects of pesticides. Therefore, pesticide drift becomes a place-based issue. People who live in particular community are likely to experience the effects of the drift. Children of growers and farmworkers and other community members who attend schools or daycares located nearby agricultural areas sprayed by pesticides may experience drift.

The issue of pesticides in agricultural communities should be approached as an issue of place and community. However, while all residents of an agricultural community experience pesticides, those of higher socioeconomic status may have the option of physical mobility. The poor do not have this same option. The ultimate result then is then that geography of inequality is created.

STUDY LIMITATIONS

This study faced several limitations. It was conducted within a six month time period, so only presents a snapshot of the issue under study. The study was limited by the number of key-informant interviews (N=16). Given additional time and resources a more expansive study could ideally involve a greater number of key-informants over a longer period of time. Furthermore, our sample was very heavily focused on the farmworker experience. In the future, it would be important to obtain a more comprehensive sampling of community members from various geographic regions and socioeconomic backgrounds to assess the overall community level experience with pesticides drift.

Future efforts could explore the following issues:

1. Clearly identify geographies of inequality as well as where similarities between groups perceived as unrelated experience similar effects from pesticides.

2. Model wind direction and velocity at specific dates and times which are correlated to field-based observations of drift and/or exposure for agricultural communities.
3. Develop a system for spraying that take into account these wind and drift characteristics and protects sensitive sites such as schools.

POLICY SUGGESTIONS

Based on our findings in carrying out this work we would suggest exploration of policy options in three areas:

1. Improved communication protocols
2. Buffer zones around sensitive sites
3. Environmental considerations based on sound scientific data.
4. Develop an accessible, centralized database of pesticide information.

COMMUNICATION

For the first of these, communications there are several options worthy of further consideration. These fall into two categories, first are communications related to advance notification of pesticide applications and second, communications relating to reporting of pesticide exposure and drift.

It became clear through the course of this study that there is little or no advance notice given prior to applications of pesticides and fumigants. Data available regarding applications is most readily accessible well after the fact via the California Department of Pesticide Regulation, typically several months to a year later when annual pesticide reports are released.

While it may not be practicable to report each individual pesticide application in advance, it would be relatively simple to focus these communications on reporting of applications occurring near particular areas of concern, such as schools, day care facilities nursing homes, hospitals and neighborhoods. Many counties already use a GIS system to determine addresses of homes and businesses that lie within a particular distance of proposed projects and generate mailing lists to inform those in close proximity of the planned project. Simply informing nearby schools and other facilities would allow planning for basic precautions such as closing windows or wiping down playground equipment.

Since applicators are licensed and many pesticide applications are registered with the county, the necessary information on what pesticides are being applied is already being collected. Exploring opportunities to modify the current reporting system would be required as a first step in addressing this communication gap.

For reporting of events after the fact, there are already reasonably good opportunities for this to occur, either directly or via a third party in cases where an individual is concerned about negative ramifications resulting from reporting of an incident. Our primary recommendation in this regard is to improve the outreach to all members of the community to ensure the mechanisms for reporting are clear and provided in both English and Spanish language formats. Taking advantage of multiple means of communication (television, radio, print, and in-person) was also identified as an important component.

While not a focal point of our study, one other communication gap that was mentioned was with the medical professionals working in these communities. Since many of the symptoms of pesticide exposure are similar to other common medical maladies, (headache, nausea and shortness of breath) there is a high likelihood that incidents of exposure are not properly identified by the medical community. There may be opportunities to provide additional training and information to the medical community as

well as a mechanism to better document suspected cases of exposure.

In each of these situations it is essential that policy makers working on these issues understand the realities on the ground by having an open dialogue with the community prior to moving forward with policy changes. This is essential to developing policy-makers are really hearing and understanding what it is that community members need and desire versus what policy makers think they want and need.

BUFFER ZONES

There was a high level of interest in the possibility of establishing specific buffer zones around sensitive sites. Schools were most often addressed in this category; however other sensitive sites could include day care facilities, nursing homes, hospitals and residential areas.

One approach, reporting pesticide applications occurring within a specified distance of such sensitive sites was discussed above. A step up from this might be the establishment of pesticide-free zones around sensitive sites similar to existing legislation for drug-free zones or disallowing sexual predators to live close to schools. Pesticide-free zones would require a change in agricultural methods used in those areas within the defined zones. Other opportunities might include creation of physical buffers of vegetation such as riparian buffers used along river banks to reduce runoff and erosion or possibly the establishment of tax incentives or other compensation to encourage transitioning away from pesticide applications in these zones.

Our exploration of ¼ mile buffer zones in the areas immediately surrounding the study communities in Monterey County and for all of Tulare County demonstrated that the overall acreage of agricultural lands within these zones is relatively small, yet the potential benefits achieved in both real human health and welfare

as well as the goodwill may well be worth the cost of altering the agricultural methods used in these zones, or in removing these zones from production entirely.

ENVIRONMENTAL CONSIDERATIONS

While there have been some limited studies of pesticide drift, this is not a well understood phenomenon. Given the large variety of active ingredients and methods of application, attempting to conduct such studies would be a monumental task. Movement of pesticides via surface and ground water or other environmental transport mechanisms is similarly daunting. Such studies are certainly valuable and worth of further research, perhaps for a more limited number of particular pesticides of greatest concern. Regardless of specific studies, there is a potential for addressing some of these concerns via other approaches.

While some current regulations limit pesticide applications during particularly high winds, it may be worth considering additional factors relating to wind speed and direction. In particular given that prevailing winds are strongest during late evening through early morning hours this may be a window that airborne applications should be limited or avoided altogether.

Making note of the local prevailing winds may also help in adjusting application protocols to ensure that sensitive sites that are downwind of a field being treated are adequately protected. One possible approach would be to adjust pesticide free buffer zones to be slightly larger on the upwind side of sensitive sites. Spray when it is less windy even if this is during the day, which will minimize pesticide drift. Similar considerations may be appropriate to explore in relation to other transport mechanisms such as water.

Finally, it is essential that further research be conducted on the direct health effects (both acute and chronic) of pesticides in and around these agricultural communities. A greater understanding of the exposure risks and associated health effects may further

refine specific policy solutions based on knowledge of the direct relationships between specific active ingredients, application methods, transport mechanisms and health outcomes for members of these agricultural communities.

PROVIDE A CENTRAL SOURCE FOR INFORMATION

While it is true that the Department of Pesticide Regulation compiles a database for pesticide application in the state on an annual basis, this is not a useful means for communities to understand their own situation. The database is extremely large and cumbersome to work with and requires individuals with specialized training simply to extract data relevant to a particular chemical ingredient and location. Furthermore, the DPR database only facilitates production of a historic view of pesticide information. These historic views are available on the DPR website, <http://www.cdpr.ca.gov/>, on a county basis. However, since the reports are summarized by crop type and active ingredient as opposed to geography they do not provide a means to determine what chemicals were used near a particular location or sensitive site.

Optimally, a database of pesticide information and maps would be made accessible as application permits are approved, in near real time. Such a system would necessitate local level data regarding pesticide applications, permits, and other relevant information be entered on a regular basis for each county. This data could be organized spatially so that when individuals desire information for a particular region, they can click on a map and obtain information specific to that region. Given the strong interest in proximity to particular sensitive sites, such a system might also provide the ability to do map overlays of data such as schools, and neighborhoods as well as census-based socioeconomic and demographic data similar to those we produced for the pesticide atlas as a component of this project.

Providing ready access to this sort of place-based socioeconomic and environmental data clearly reflecting the context for other agricultural communities in California would be an valuable next step. The health the community is directly dependent upon the environmental health of the region. By adopting a systematic approach to documenting social and environmental conditions, communities could more accurately inform policy making efforts at the local, regional and statewide level.

Using GIS technology we were able to bring together a diversity of social and environmental findings to tell the story of these six agricultural communities, their hopes, fears and valuable suggestions for how to improve the health of their communities and environment. Ultimately, the health of agricultural communities may be greatly improved by involving community members in finding solutions that best meet their needs. Their voices need to be heard alongside the voices of the farm owners and growers who also have valid concerns and desire effective solutions.

This will enable further patterns to be documented and assessed throughout the state for farmworkers and their environments. By understanding the commonalities and differences between agricultural communities throughout the state more effective solutions may be developed.

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THE CALIFORNIA CENTER FOR RURAL POLICY

The California Center for Rural Policy (CCRP) conducts applied rural policy research on a issues related to community, health and the environment. The CCRP is housed at Humboldt State University located in Arcata, California. Its mission is to conduct rural research for rural people and environments. The CCRP was created in 2005 with the goal of conducting rural research for rural people throughout the state of California.

Initial funding for the creation of the CCRP was supplied by the California Endowment. The CCRP was envisioned as a center that could empower rural people and places by conducting relevant, applied community-based research that reflects the mission and ideals of rural California communities. The vision for the center emerged from a larger network of rural, diverse constituents.

THE INSTITUTE FOR SPATIAL ANALYSIS

The Humboldt state university Institute for Spatial Analysis (ISA) is a focal point for the advancement of spatial research, innovation and application. The ISA is dedicated to the expansion of spatial analysis methodologies across disciplines and the full spectrum of real world issues. We work closely with the public and private sector entities to achieve this goal.

The institute was originally established in 1995 as part of the Klamath bioregional assessment research project. Since that time the ISA has grown to support a wide range of projects and activities for research on spatial analysis and modeling. The facility serves as the focal point for graduate and faculty from across campus to effectively utilize Geographic Information Systems (GIS) and image processing technologies in a wide variety of projects and research.