Final Report | 2016

[Smith River Community Health Assessment]

Siskiyou Land Conservancy

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Executive Summary

The small town of Smith River is located alongside the estuary of the river of the same name, on the Northern California coast near the Oregon border. This is the only region in the United States where Easter lily bulbs are commercially cultivated. To grow their crops, lily cultivators in Smith River utilize high levels and several varieties of toxic soil fumigants and other pesticides, including some of the highest per-acre applications in California of 1,3-Dichloropropene (Telone II) and Metam Sodium (VAPAM). The Smith River Elementary School and many of the town's residences are in close proximity—often adjacent—to lily bulb fields.

In February 2016 Siskiyou Land Conservancy mailed a survey to all Smith River residents designed to assess various aspects of their experience with pesticides, including: knowledge of and concerns about local pesticide applications, potential exposures of local residents to pesticides, and the prevalence of local health conditions which could be related to pesticide exposure. Respondents to the survey represented at least 14% of Smith River residents.

The survey found that Smith River residents experience many potential pathways of exposure to pesticides. More than half of respondents live within ¼ mile of an agricultural field, including 17% who live within 100 feet of a field. Many of these respondents rely at least partially on private residential wells for drinking water. Nearly half reported that their children have attended, currently attend, or will soon attend Smith River Elementary School, which is within 100 feet of fields used for lily bulb production. Few respondents reported being notified about pesticide applications near their homes or the school.

The state and federal governments have associated eye, skin and respiratory problems, along with increased cancer risk, with exposure to the pesticides most commonly applied to local lily bulb fields. Results show that respondents experienced many of these conditions more frequently after moving to Smith River. Eye problems in particular were experienced five times more frequently after moving to Smith River. Other significantly elevated impacts included skin rashes, chronic coughs, headaches, infections, ear problems, heart disease, neurological disorders, and cancer. Unsurprisingly, respondents expressed high levels of concern about exposure to pesticides and the potential health effects of such exposure.

Our findings cannot directly link specific health conditions of Smith River residents to pesticide exposures. However, results of the health assessment clearly indicate that Smith River residents are concerned about pesticide exposure and its effects, and that these concerns may be well founded. Responsible federal, state and local agencies should use these results as the basis for more intensive investigation and regulatory action.

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Project and Organization

Siskiyou Land Conservancy (SLC) is a small non-profit organization in Northern California dedicated to protecting biological diversity and building sustainable communities in our region. Siskiyou Land Conservancy protects private lands by holding fee-title ownership and conservation easements. Siskiyou Land Conservancy serves five northwestern California counties: Humboldt, Mendocino, Del Norte, Siskiyou and Trinity.

Since 2001, SLC and its predecessor, the Smith River Project, have led efforts to examine and address the human and ecological impacts of the annual application of 300,000 pounds of highly toxic fumigants, herbicides and fungicides concentrated on 1,000 acres of bottomland that surround the Smith River estuary and the town of Smith River in Del Norte County. These pesticides are used to produce Easter lily bulbs (*Lilium longiflorum*) on the Smith River Plain. This is the only region in the U.S. where Easter lily bulbs are cultivated for wholesale distribution across North America. Two of the pesticides most frequently used on Smith River lily fields — 1,3-Dichloropropene (Telone II) and Metam Sodium (VAPAM), both of which are carcinogenic and deadly to aquatic organisms — are applied in pounds-per-acre amounts that are among the highest in California (Bailey & Lappé 2002; California Department of Pesticide Regulation).

Since its founding in 2004, dozens of residents of Smith River have contacted Siskiyou Land Conservancy to complain of health impacts that they associate with pesticide exposure. With no analysis of these impacts by local, state or national health experts, in 2015 SLC opted to conduct a health assessment in the small town to gauge the level of community-wide concern and the general health of residents, before and after moving to Smith River. Siskiyou Land Conservancy understands that no public agency has ever made a concrete connection between pesticides and human health in Smith River. We also understand that impacts to human health can be caused by a variety of factors that are not associated with pesticide exposure.

On February 19, 2016, SLC mailed surveys, in English and Spanish, to all Smith River P.O. boxes and residential mailboxes. Survey participants mailed their responses to the Siskiyou Land Conservancy P.O. Box in Arcata, California. All information was provided anonymously.

Purpose of Study

The purpose of this study is two-fold: 1) to provide residents of Smith River an opportunity to anonymously state their level of concern regarding pesticides in their community and 2) to assess exposure pathways and health conditions among Smith River residents before and after relocating to the area.

Information collected from this study will be used to guide further action by our organization involving pesticide use and its interaction with local environmental and human health in Smith River. Recommendations for more comprehensive investigation will be informed by the results of this study. This report will be used to communicate some of the complexities of this issue and to advocate for appropriate and timely action by local, state and federal agencies

responsible for protecting residents and the environment from pesticide exposure and contamination.

Background

Pesticide Use in Smith River

Several highly toxic chemical pesticides have been used on the Smith River Plain since the early 1950's for the commercial production of Easter lily bulbs. Today, nearly 300,000 pounds of nematicides and fungicides are applied annually for the purpose of combating nematodes and funguses that infest the soil and damage the root bulb of the plant during the 2-4 year growing period. Many of the pesticides previously used in Smith River have since been banned due to resulting groundwater contamination and negative impacts to human and environmental health. However, new chemicals continue to be developed and applied despite their known toxicity.

Many of the products used in Smith River are currently on the state of California's Proposition 65 list of chemicals known to cause cancer and/or identified by the National Marine Fisheries Service as harmful to salmon including: 1,3-Dichloropropene, Metam Sodium, chlorothalonil, Diuron, Ethoprop, Disofulton, Phorate, Captan, Maneb and copper products.

The most recent Pesticide Use Report (California Department of Pesticide Regulation) for Del Norte County states that pesticides were applied 2,843 times in 2013, adding up to 284,086 total pounds of pesticides used. The majority of these pesticides were applied to lily fields in Smith River, including 122,499 pounds of 1,3-D, 100,122 pounds of Metam Sodium and 46,639 pounds of Class I copper fungicides (copper hydroxide and copper sulfate).

Local Effects on Water Quality

Smith River has a history of well contamination from Easter lily pesticides that have leached into the groundwater (Northcoast Regional Water Quality Control board, 1986, 2002, 2010, 2013). Groundwater on the Smith River Plain occurs in and moves through unconfined aquifers at shallow depths, limiting the amount of natural filtration that would normally occur through the ground (McMillian and Gibson 1987). These factors, in addition to acidic soils and cool temperatures make groundwater in this region particularly vulnerable to contamination from pollutants including pesticides, nitrates and fecal coliform bacteria.

Between 1982-1985 the California North Coast Regional Water Quality Board ("Water Board") identified high levels of two nematicides, 1,2-dichloropropane (1,2-D) and aldicarb, in addition to high nitrate levels, in domestic wells. Levels of 1,2-D and aldicarb continued to occur above legal thresholds for drinking water as late as 2002, long after the use of 1,2-D and aldicarb were suspended.

In 2002, Smith River Project (predecessor to Siskiyou Land Conservancy) conducted free well testing for concerned residents in Smith River and found that at least a dozen wells remained contaminated with 1,2-D. As a result of this water testing, the Water Board conducted

additional testing and found that 1,2-D was above legal threshold levels in 8 out of 19 wells tested.

In 2010, acting on repeated requests by Siskiyou Land Conservancy, the Water Board tested Smith River estuary surface waters and found that the water in one creek that passed through Easter lily fields was toxic to the invertebrate species that make up the base of the salmonid food chain. The Water Board also found copper levels that were 28 times higher than allowed in surface water by state law. Easter lily farmers use approximately 40,000 pounds of Class I copper fungicides annually (California Department of Pesticide Regulation).

In 2013 the Water Board returned to Smith River to conduct further sampling. Results showed detectable amounts of ten pesticides in surface waters,[1] and identified four locations within three streams -- Upper and Lower Rowdy Creek, Morrison Creek, and Deliliah Creek -- to be toxic to invertebrate species. All samples were taken downstream of Easter lily fields.

In late 2015 the Water Board issued a report on its findings of toxicity in the lower Smith River (North Coast RWQCB Rep. 2015). The Water Board is in the process of developing an Agricultural Discharge Permit for Smith River that may set restrictions on pollutants from agricultural activities entering the ground and surface waters. Siskiyou Land Conservancy is currently a stakeholder in this process and will be commenting on the draft permit in 2016.

Local Effects on Air Quality

Fumigants most extensively used across the state and in Smith River include 1,3-Dichloropropene and Metam Sodium. These fumigants volatilize into the air shortly after being injected into the soil. Both of these fumigants are listed on the California Department of Pesticide Regulation's (DPR) Toxic Air Contaminants List, and on California's and U.S. EPA's lists of known carcinogens.

The only known air quality monitoring study of pesticides conducted in Del Norte County was done in Smith River by DPR in 2005. The purpose of the study was to monitor air quality after the simultaneous application of 1,3-Dichloropropene and Metam Sodium to Easter lily fields. Concentrations of 1,3-D and MITC, the breakdown product of Metam Sodium, were measured in the air over a 6-day period. Results show peak levels of MITC in the air 24 hours after application and then dropping off significantly after that, while air concentrations of 1,3-D continued to increase every day after the application. Measured concentrations of 1,3-D on the sixth day approached 200 $\mu g/m^3$, ten times the established federal "reference concentration" for safe exposure. Peak levels of 1,3-D may have occurred after the 6-day period, but at that point the Easter lily farmers ordered state scientists to leave their land. No follow-up studies have been conducted. Figures highlighting the main results from the study are included in Appendix E.

[1] Pesticides (with maximum concentration detected in µg/L): aldicarb (0.01), captan (1.601), carbaryl (0.087), carbofuran (0.021), diuron (0.139), ethoprop (0.183), fenpropathrin (0.0003), lindane (0.005), hexachlorobenzene (0.001), simazine (0.002).

Pesticide Exposure and Human Health

Pesticides pose a high health risk not only for those who are in direct contact with the chemicals as part of their jobs, but also for those residing, working and playing in communities in close proximity to fields where these chemicals are applied (US EPA; Pesticide Action Network). While acute exposures to pesticides do occur via direct dermal contact and ingestion, residents are more commonly exposed to lower levels of pesticides in their environment, including the air, drinking water, surface waters, soil, pets that have entered sprayed areas, and fine residues within their homes. These lower, long-term levels of pesticide exposure can also result in severe chronic health impacts (Wang et al. 2011).

Children have a greater risk of developing health issues associated with pesticide exposure than adults (Coronado et al. 2004; Etzel and Balk 2003). Most pesticides are known neurotoxins, genotoxins and carcinogens, posing high risks of neurodevelopmental issues (Roberts et al. 2007; Shelton et al. 2014) and cancer in children. Several studies show that pesticide exposure in the womb and throughout childhood increases the risk of cancer among children (Daniels et al. 1997; Gunier et al. 2001; Mills and Zahm 2001).

Pesticides can trigger cancer in a variety of ways, including disrupting hormones, damaging DNA, inflaming tissues and turning genes on or off. A recent case study found that pesticides may also be interacting in complex ways to cause synergistic effects on human health (Zaunbrecher et al. 2016). This study specifically demonstrates that two abundantly used and simultaneously applied pesticides in Smith River – 1,3-Dichloropropene and Metam Sodium—may work together to prevent the body's enzymes from repairing damaged DNA, alter gene expression and/or result in uncontrolled cell growth, increasing the likelihood of cancer.

Methods

Survey

Surveys were mailed out mid-February to all Smith River residences and post office boxes, for a total of 1130 surveys. One hundred fifty-seven were returned between the mail-out date and mid-April, equating to a 14% response rate. However, it is likely that some residents of Smith River received surveys at both a post office box and a residence, meaning that the actual proportion of the local population represented by survey respondents may be higher. All responses were mailed to the Siskiyou Land Conservancy post office box in Arcata, CA.

The survey included a total of 24 questions, and residents provided a response to each question by either selecting from a list of choices or by providing written information. Data collected from our survey were both qualitative and quantitative. For the health assessment portion of the survey, residents were presented with a list of 33 health conditions that are commonly associated with pesticide exposure. Residents were asked to indicate whether any member of their household experienced any of those health conditions before and/or after moving to Smith River by checking the appropriate box. All information collected was provided anonymously.

Analysis

Descriptive and qualitative analyses appropriate to the data were conducted. All answers to survey questions were coded and quantified, and the percent of each response type in relation to the total number of responses were calculated. Percentages were summarized graphically for each question and additional comments from survey respondents were compiled and coded with a number to match the rest of the individual's survey responses. The number of health conditions self-reported by residents before and after moving to Smith River were quantified to observe any potential trends. No comparisons were made with other populations, because no control group could be identified.

Results

Respondents

Figure 1 summarizes how long respondents have lived in the town of Smith River. **120**/154 or 78 percent of survey respondents have resided in Smith River for more than 5 years. **11**/154 or 7 percent claim residency between 3-5 years, **15**/154 or 10 percent between 1-3 years, **3/**154 or 2 percent between 6 months – 1 year, and **5**/154 or 3 percent between 0-6 months. These results indicate that most respondents are established residents of Smith River and are likely well aware of the issues surrounding agricultural pesticide applications in and around their community.

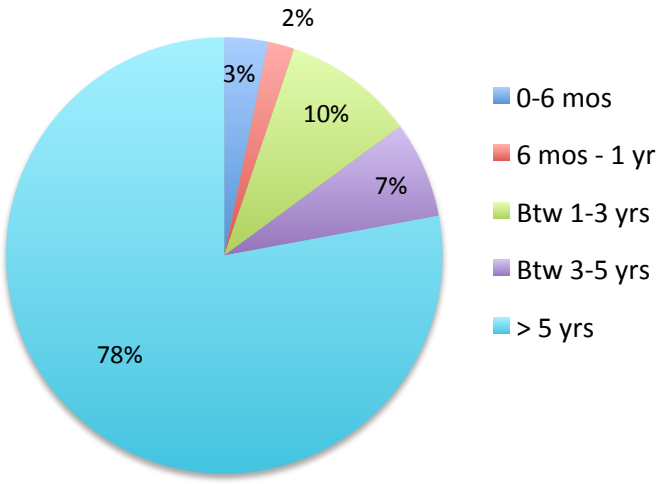


Figure 1. Length of Residency in Smith River

Survey results are thus reflective of long-term experience with and exposure to pesticides in the community of Smith River.

Figure 2 summarizes proximity of respondents' residences to an agricultural field. In total, more than half of respondents live within a quarter-mile of an agricultural field, illustrating the intensely agrarian nature of the region. A total of **25**/150 or 17 percent of respondents lived less than 100 ft from an agricultural field, **27/**150 or 18 percent lived between 100 ft – 300 ft, **34/**150 or 23 percent live between 500 ft and ¼ mile, **48/**150 or 32 percent live between ½ mi – 1 mile, **10/**150 or 7 percent live greater than 1 mile, and **6/**150 or 6 percent did not know how close their residence was to an agricultural field.

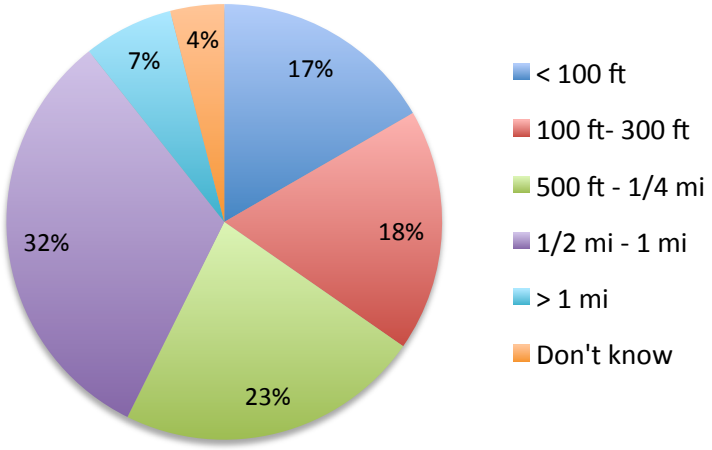


Figure 2. Proximity of Residence to an Agricultural Field

Figure 3 represents the **current** use of the agricultural field within closest proximity to the residences of respondents. Many respondents selected more than one use, indicating that their residence is within close proximity to multiple fields and/or a single field that rotates annually through multiple uses. Fields are most commonly used for grazing cattle and/or growing Easter lilies, with 71 percent of respondents reporting some Easter lily use and 67 percent reporting some cattle grazing. Thirty-eight percent or **51/**133 residents reported both cattle grazing and Easter lilies (C,L) and 17 percent or **20**/133 reported cattle, Easter lilies and other uses (C,L,O), in addition to 12 percent or **16/**133 reporting cattle grazing and **21**/133 or 16 percent reporting Easter lilies. Respondents also indicated other uses: **3/**133 cover cropped (CC), **6**/133 cover cropped and other uses (CC,O), **3/**133 fallow/un-planted, **4**/133 reported other (O) uses including a leach field for sewage and **7/**133 did not know the use of the field.

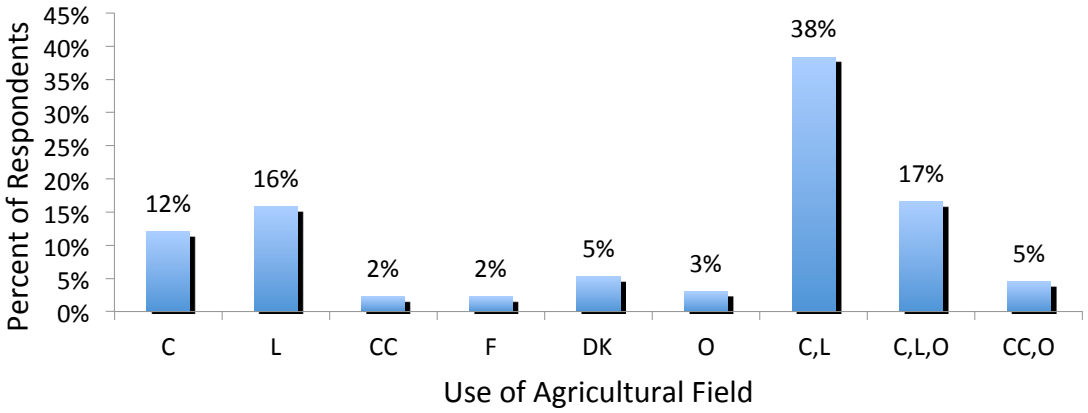


Figure 3. Use of Agricultural Field Closest to Residence. C = Grazed by Cattle, L = Easter Lilies, CC = Cover Cropped, F = Fallow, DK = Don't Know, O = Other, C,L = Cattle + Lilies,; C,L,O = Catle, Lilies, + Other Uses; CC, O = Cover Cropped

Smith River Elementary School

Figure 4 summarizes whether respondents have members of their household in attendance at Smith River Elementary School. The school is within close proximity (<100 ft) to agricultural fields that are planted on a rotating basis with Easter lilies that receive pesticide applications throughout the year. Forty-five percent of respondents (**68**/150) have children in attendance currently, previously or will in the near future, while 55 percent (**82**/150) do not have any children that attend or have attended Smith River School.

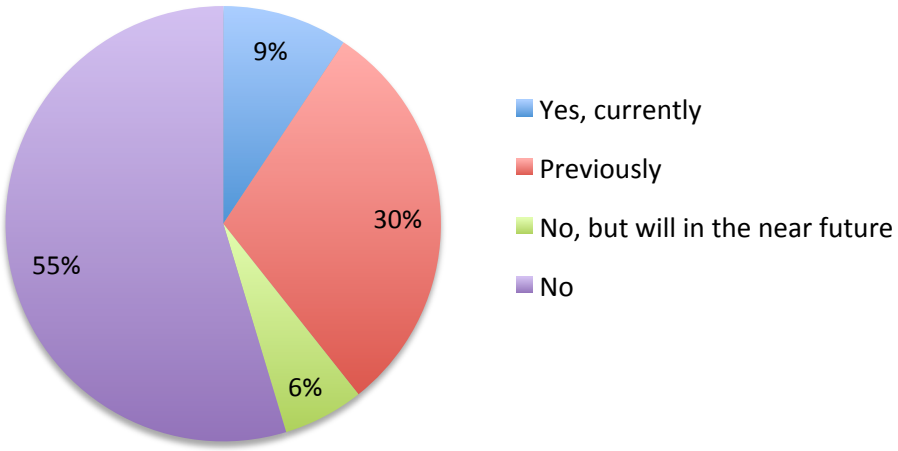


Figure 4. Attendance at Smith River Elementary School

The following comments are from residents expressing concern about pesticide applications near the school:

"The elementary school is often downwind of applications regardless of wind direction or velocity."

"My car was sprayed by Smith River School while parked for work."

"A couple times a year they spray the field at the side of the school and behind our houses. The chemicals make it very hard to breathe. No one should be outside when this chemical is being used. This chemical cannot be ok in a neighborhood with people, pets and children."

"The Smith River area really needs to be tested; air quality, soil and even the people/families that live here. My husband and I worry daily what our children are breathing while at Smith River School, as well as when they play in our own back yard."

Notification of Pesticide Application

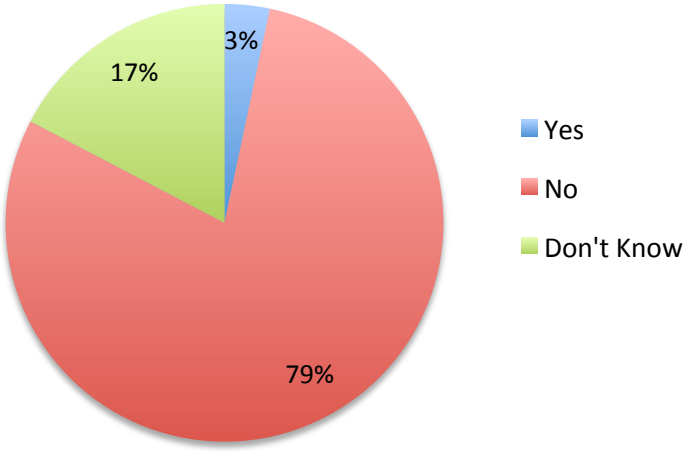


Figure 5. Advanced Notification of Spraying Near School

Seventy-nine percent **(119**/150) of residents report that they do not believe the Smith River Elementary School is notified prior to spraying (Figure 5). No current California state regulations require pesticide applicators to provide advanced notification to schools, nor has a uniform restriction zone been established around these sensitive areas. However, since 2002, Assembly Bill (AB) 947 (Jackson) has allowed county agricultural commissioners in California to set special restrictions around schools, subject to approval/disapproval by the Director of Pesticide Regulation (California Environmental Health Tracking Program 2014).

Figure 6 summarizes how residents of Smith River become aware of pesticides being applied in their community. Some residents reported more than one method of notification. A significant

majority of responses indicate that residents do not receive notice prior to spraying, while others report seeing signs posted near fields, or identify it by smell or visually.

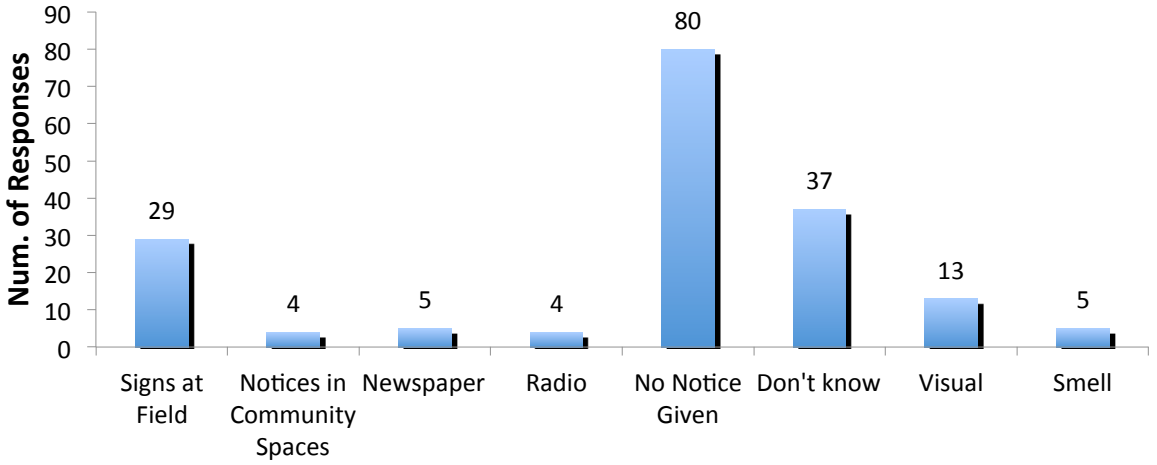


Figure 6. Method of Advanced Notification of Pesticide Application

The following comments are from residents who have seen and/or smelled pesticides being applied in Smith River:

> "I would like to be told when any pesticide is used anywhere near my house, including those used on public roads."
>
> "2015: The smell was overwhelming for over a month during injection in August. July 27, 2015 was first day I noticed an unusual odor reminiscent of garlic and dog poo while driving to work alongside finely tilled fields (I have lived/driven here 22 yrs and don't recall this strong of an odor before), on Jul 31 the smell woke me up…Aug 1, stopped to read posted signs saying VAPAM[2] in use…Sometime around this, I happened to be driving behind a tractor on hwy 101 South of Smith River with the injection rig attached and the tractor driver was wearing a white coverall and breathing through a respirator, the odor again was overpowering despite having all air intake stopped/closed in my car! The smell around these fields lasted for about a month this year...Also this odor caused a burning in my nose/throat and caused a cough that lasted for months."
>
> "When the wind is blowing above 15 mph, not supposed to spray. Always happens anyway. We close all windows but can still smell the pesticides so stay inside - yuck."

In California, any chemical federally listed as "Restricted Use" or state listed as a "Restricted Material" must be applied by an applicator licensed by the state (California Department of

[2] Metam Sodium

Pesticide Regulation 2015). In order to apply a "Restricted Material," applicators must obtain a permit from the County Agricultural Commissioner, and must provide the Commissioner with a Notice of Intent to Apply a Restricted Material (NOI) at least 24 hrs in advance of application. Applicators must follow the use label provided with the chemical and comply with any additional permit conditions added by the County Agricultural Commissioner, either of which may require additional notification of workers, surrounding residents, or others (California Department of Pesticide Regulation n.d.).

Some of the most heavily used pesticides in Smith River are soil fumigants including Telone II (1,3-Dichloropropene) and VAPAM (Metam Sodium). The chemical use label for Telone II requires applicators to: "Notify workers of the application by warning them orally and by posting fumigant warning signs at entrances to treated areas. The sign must bear the skull and crossbones symbol and state: (1) '**DANGER/ PELIGRO,'** (2) Areas under fumigation, '**DO NOT ENTER/NO ENTRE,'** (3) the date and time of fumigation, (4) 'Telone II Fumigant in use,' and (5) name, address, and telephone number of the applicator" (Dow AgroSciences). The label for VAPAM contains similar restrictions and also prohibits application near occupied schools and requires the applicator to maintain buffer zones free of people around the application, and in some cases to notify surrounding residents.

A wide range of highly toxic chemicals, including chlorothalonil and captan, are not classified as "Restricted Materials" and are applied to the same fields throughout the year without notification. Easter lily farmers also apply approximately 45,000 pounds annually of Class I (most toxic) copper products, including copper sulfate and copper hydroxide.

Air Quality

Figure 7 summarizes the level of concern Smith River residents expressed regarding agricultural pesticides in the air. Seventy-one percent of respondents indicated either a "High" (**68**/152) or "Moderate" (**40**/152) level of concern, with 29 percent expressing a "Low" level (**24**/152) or "No Concern" (**20/**152).

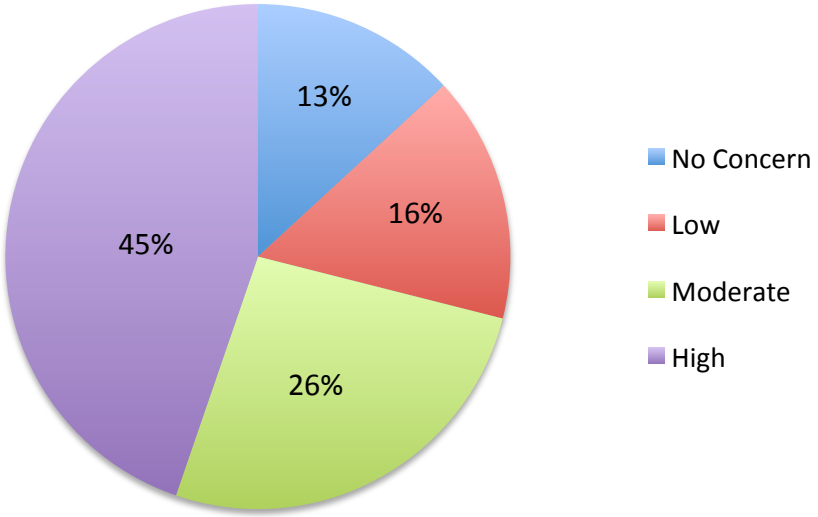


Figure 7. Level of Concern Regarding Agricultural Pesticides in the Air

Water Quality

Figure 8 indicates widespread concern about agricultural pesticides contaminating the water in Smith River. A total of 79 percent of residents reported either "High" (**87**/150) or "Moderate" (**27**/150) levels of concern.

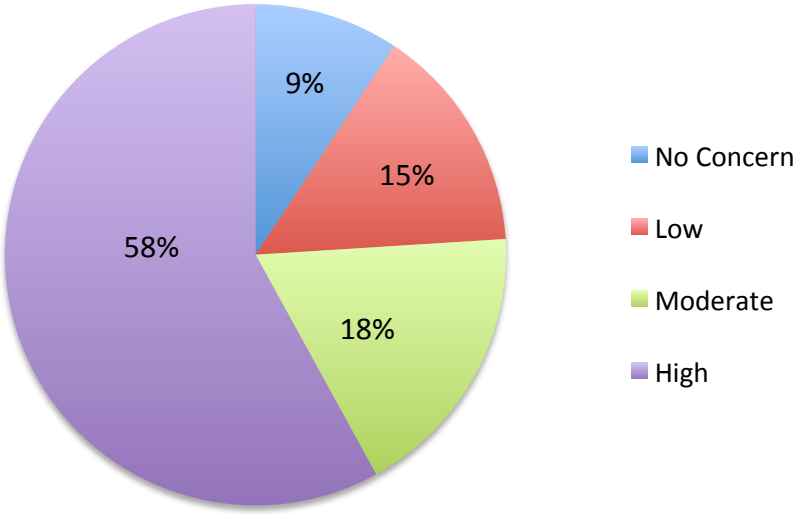


Figure 8. Level of Concern Regarding Agricultural Pesticides in the Water

Figure 9 shows the source of residents' drinking water. Twenty-two percent use at least some well water (19+3), and 24 percent use at least some bottled water (13+8+3). Fifty percent rely exclusively on the Smith River Community Services District. Many respondents expressed concern about the potential contamination of their water by pesticides, including elevated levels of copper that have been publicly reported and anecdotally indicated by the condition of respondents' sinks and pipes. The consumer report issued by the Smith River Service District has found copper levels at 1900 ppb, well above the "Action Level" of 1300 ppb; notably, these results come from testing in 1998, and there has apparently been no testing for copper since then (Appendix F).

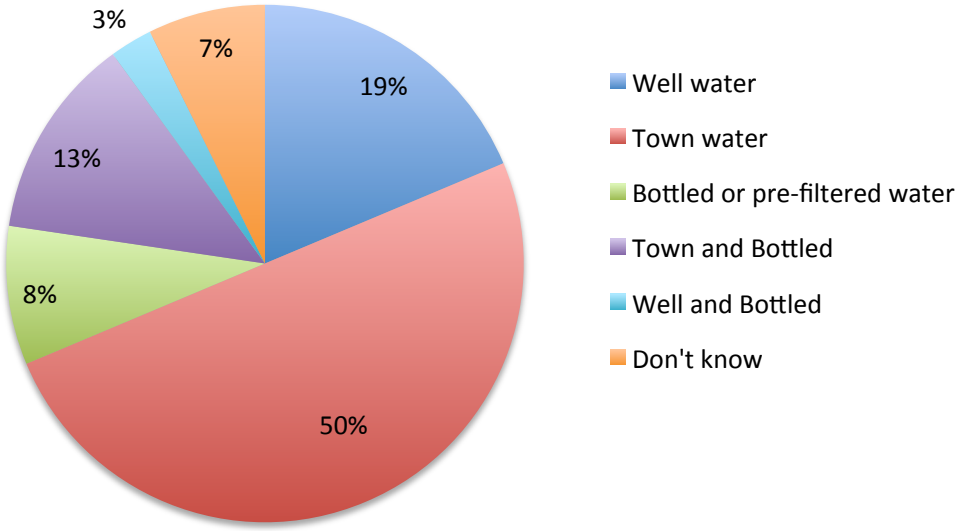


Figure 9. Source of Smith River Residents' Drinking Water

Following are some comments from residents regarding their water:

> "We were told the level of copper in the water had been reduced, but our tubs and sinks still turn blue from the copper in the water. We have had lots of water pipe problems and have been told it's from the copper in the water. Two people have developed major heart problems after moving here."
>
> "We have animals (domestic) and over the years lost them to organ cancers, lymphnode cancer. I'm concerned about the water and soil due to the many years the field across from our home was used for lilies, now used for hay."
>
> "[Water] often smells fowl, sometimes water tastes funny and gets cloudy when the well gets low. When I first moved here my water was positive for e-coli."

> "Driving hwy 101, there are sometimes clouds of pesticides blowing across the highway. Spraying continues even though wind increases. There are signs of pesticides in our town water, which comes from Rowdy Creek."

For residents who reported having wells, we asked them to estimate how close the well was to the nearest agricultural field (Figure 10). Figure 10 shows that 41 percent (**15**/37) estimate that their wells are 500 feet – ¼ mile from an agricultural field, while 32 percent (**12**/37) estimate their wells to be 300 feet or less from an agricultural field.

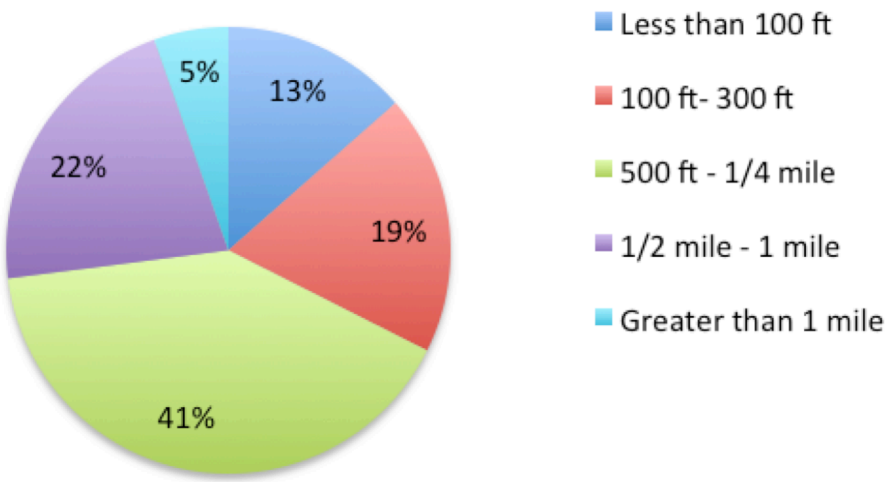


Figure 10. Proximity of Residential Wells to Nearest Agricultural Field

A total of 5 survey respondents indicated that their residential well was less than 100 feet from an agricultural field. Residents did not verify what type of agricultural field was near their well. However, 4 of the 5 reported that an Easter lily field was closest to their residence. The label for the most abundantly used pesticide in Smith River, Telone II (1,3-Dichloropropene) states: "Do not apply within 100 feet of any well used for potable water" (Dow AgroSciences, Telone II Restricted Use-Label). However, it is unclear how or whether pesticide applicators would be able to ascertain the locations of all residential wells in order to comply with this label restriction.

Furthermore, a **groundwater advisory** is listed on the Restricted-Use Label from Dow AgroSciences: "1,3-Dichloropropene is known to move through soil and under certain conditions has the potential to reach groundwater as a result of agricultural use. Application in areas where soils are permeable and groundwater is near the surface could result in groundwater contamination." Local soils in Smith River seem to meet the specified conditions.

Pesticide Exposure

Respondents were asked whether they had been exposed to pesticides at their workplace and/or at their residence. The following figures summarize the results from these questions: 27 percent (**41**/151) of people report being exposed at the workplace (Figure 11), while 17 percent (**25**/147) report being exposed while at their residence (Figure 12). 56 percent of respondents

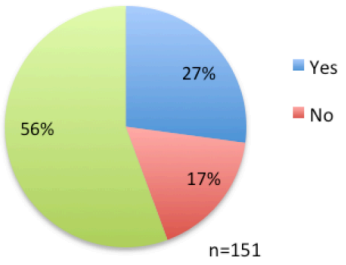


Figure 11. Pesticide Exposure at the Workplace

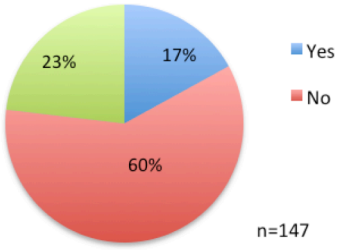
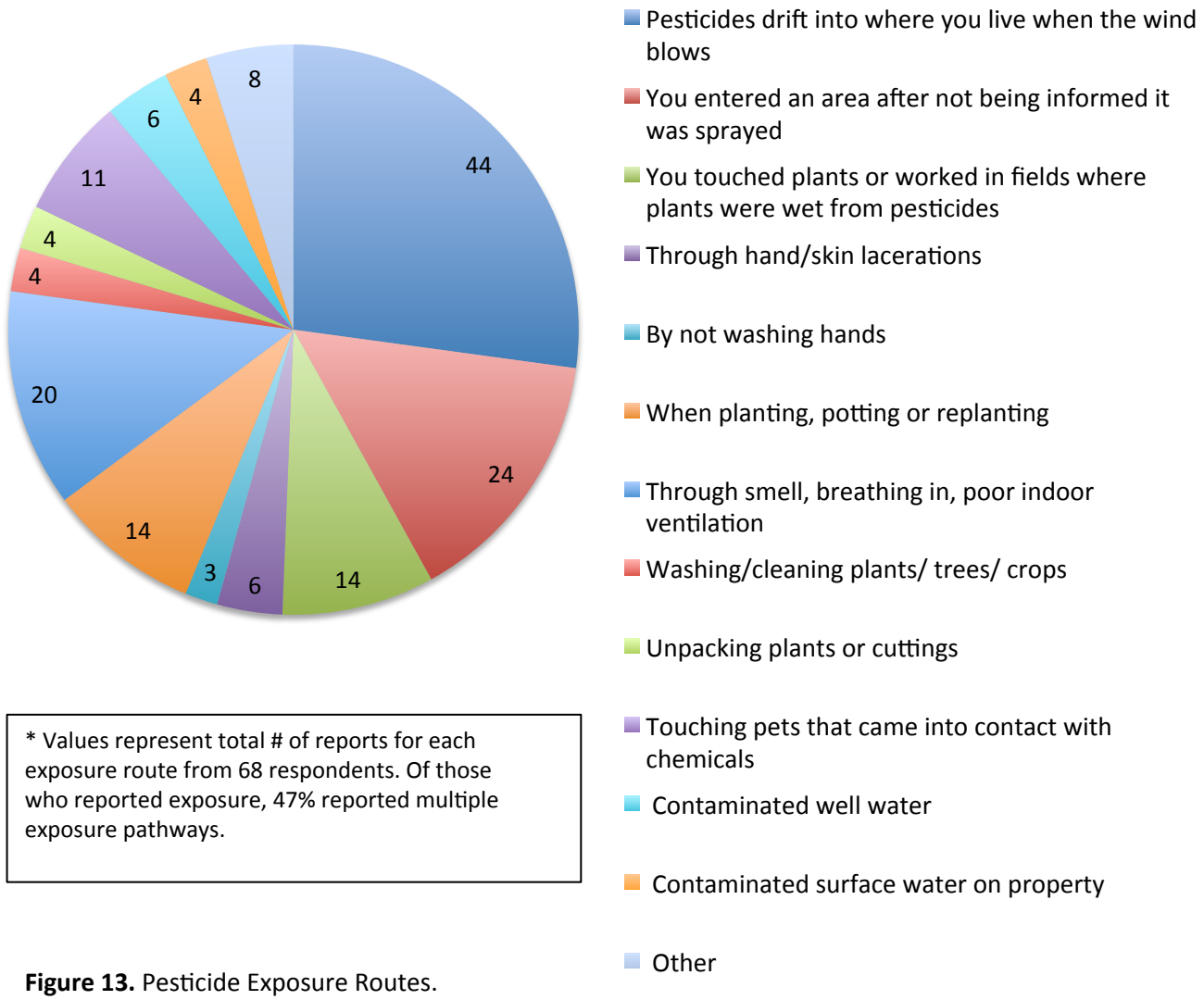


Figure 12. Pesticide Exposure at Residence

reported that they did not know whether they were exposed at their workplaces, while 23% reported that they did not know whether they were exposed at home.

People who reported either occupational or residential exposure further indicated the pathway(s) by which they were exposed. Figure 13 provides a breakdown of these results from 68 survey respondents reporting pesticide exposure. Many residents reported multiple exposure routes. Residents identify pesticide drift/inhalation as the leading exposure route, with 44/162 reporting that pesticides drift into where they live when the wind blows and 20 reports of contact through smell/breathing in as a result of poor indoor ventilation. A total of 24 people report pesticide exposure via washing/cleaning plants/trees/crops, 14 reports of contact through unpacking plants or cuttings, and 14 reports of exposure when planting, potting or replanting.



* Values represent total # of reports for each exposure route from 68 respondents. Of those who reported exposure, 47% reported multiple exposure pathways.

Figure 13. Pesticide Exposure Routes.

Health Assessment

Respondents were queried about 33 health conditions and asked to report whether they experienced these conditions before or after moving to Smith River. A breakdown of all surveyed health conditions, before and after moving, is provided in Figure 14. The following figures are derived from 156 survey responses, representing respondents who experienced health conditions after moving to Smith River but not before.

Health conditions reported more frequently by residents AFTER moving to Smith River are presented in Figure 15 and include the following: Eye problems (itchy, swollen), skin problems/recurrent rashes, chronic coughing, sleep loss, frequent headaches or migraines, cancer, digestive problems, frequent infections, stress, ear aches or ear infections, urinary problems, heart disease, neurological disorders, and nosebleeds.

Table 1 lists the raw data (sums) for each health condition, the percentage of respondents with those conditions and the relative risk associated with each condition, calculated by comparing the number of reports before and after moving to Smith River (Figure 16). Results from Figure 16 show that eye problems (itchy, swollen) occur 5 times more frequently among respondents AFTER moving to Smith River, relative to the number of eye problems reported prior to moving to Smith River. Likewise, incidences of skin rashes, chronic coughs, cancer, infections, ear problems, heart disease and neurological disorders all more than doubled AFTER respondents moved to Smith River.

Figures 17, 18 and 19 examine the relationship between health conditions and proximity of residence to agricultural fields. Figure 17 plots the sum of health conditions before and after moving to Smith River in relation to agriculture, while Figure 19 shows only the sum of health conditions per household after moving to Smith River in relation to agricultural fields. While neither graph shows any distinct trends, Figure 18 shows the sum of health conditions per household after moving to Smith River, the range of values, and the median number of health conditions experienced in relation to agriculture as a series of boxplots. Most respondents reported between 0 and 10 health conditions after moving to Smith River.

The following comments highlight health concerns and conditions experienced by Smith River residents and their pets:

> “There are 5 homes that I am personally aware of that one or more of the residents were diagnosed and treated for cancer. This is all on the same street. I have had cancer twice, the person we bought the home from had cancer. One of our neighbors also had cancer twice and one of the other neighbors died due to cancer.”
>
> “Neighbor got cancer and died, my mom got cancer and died, I got cancer again, still here, in remission. In 22 years living here, 4 dogs and 2 cats all died of cancer.”
>
> “My dog died of pancreatic cancer in Dec. 21, 2015, came on very quickly and severe. I felt very sick and lost a lot of weight over 65 pounds in a very short amount of time, nausea, stomach pain, vomiting. My dog also suffered dizziness, confusion, falling over, stress, anxiety, not eating, stomach and bowl problems as well as being diagnosed with terminal cancer and etc…Myself, severe headaches, stomach pains, depression, anxiety, worse arthritis feelings in all joints and nose and throat and eye problems, severe weight loss and etc...”
>
> “Our dogs skin became infected about 6 months after moving to Smith River. She now has severe allergies and is taking daily medication to try to keep her allergies and skin infections under control.”

"Please stop the use of pesticides in the fields which are in close proximity to residences. They say that Smith River leads the area in rates of cancer. Scary! Would not have moved here if I were aware of this."

"I am a 50-year-old life-time resident of S.R. Both of my parents and many locals I know have died or are dying of cancer. My mother passed away at age 39. My father at age 55."

"We have animals (domestic) and over the years lost them to organ cancers, lymph node cancer. I'm concerned about the water and soil due to the many years the field across from our home was used for lilies, now used for hay."

"Have considered moving out of Smith River for my children's health and all the spraying on the lily fields."

"I am overly concerned. They have changed lily chemicals several times since 1977 when we moved into this home. 'Timic' stayed in the wells. When the fields are injected with gas it is sickening. They did cover the fields, now they leave them uncovered and it is really scary because of the rain and run out to the river to the ocean. But most of all it's all for money not health. I have watched families with bad wells have high cancer in the family. But then they can have both children with cancer and not want to complain because they live in the place that employs them. They must be afraid to have no job. Hard for me to understand. I question their reasoning. We give up our well because we weren't sure about the mill site or the lilies and can't believe the testing because of the 'good old boy thing'. I didn't trust it. People are afraid of the Lily growers. They will hurt your families if you talk. There is a very high cancer in people and animals in this area. We have had hives of bees die, complete hives in one day."

"I have [been here] 15 year[s] with multiple health problems. We are on well water. [Pesticides] cover the cars when the wind blows. My son now sees a neurologist, orthopedic specialist and geneticist. Plus my husband and I have several health problems."

"I have leukemia."

"Easter lilies growers [spray] the herbicides, fungicides during windy days w/no care for human health. With rain coming throughout year run-off is great. Please try to stop the use of herbicides and fungicides in such huge amount. They are killing the lower river and hurting us!"

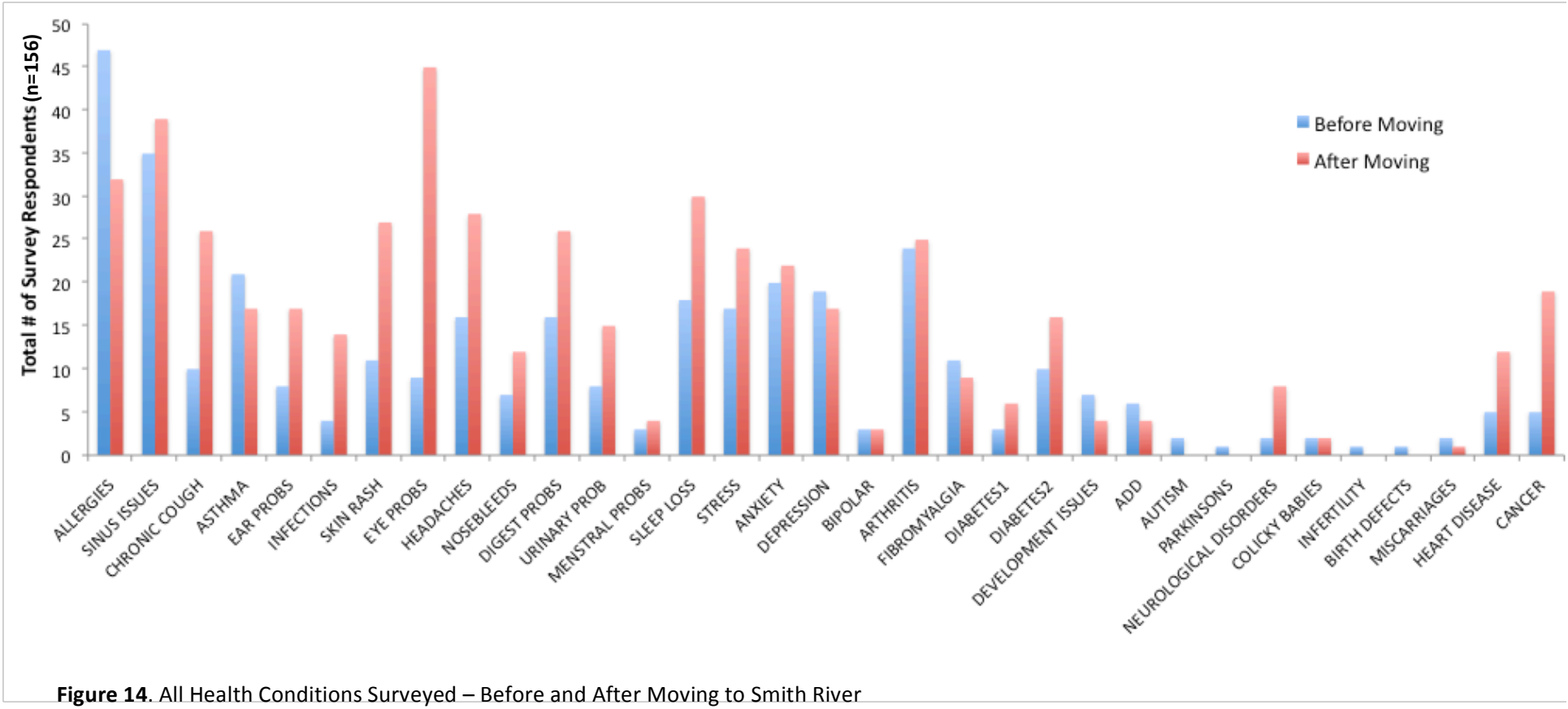


Figure 14. All Health Conditions Surveyed – Before and After Moving to Smith River

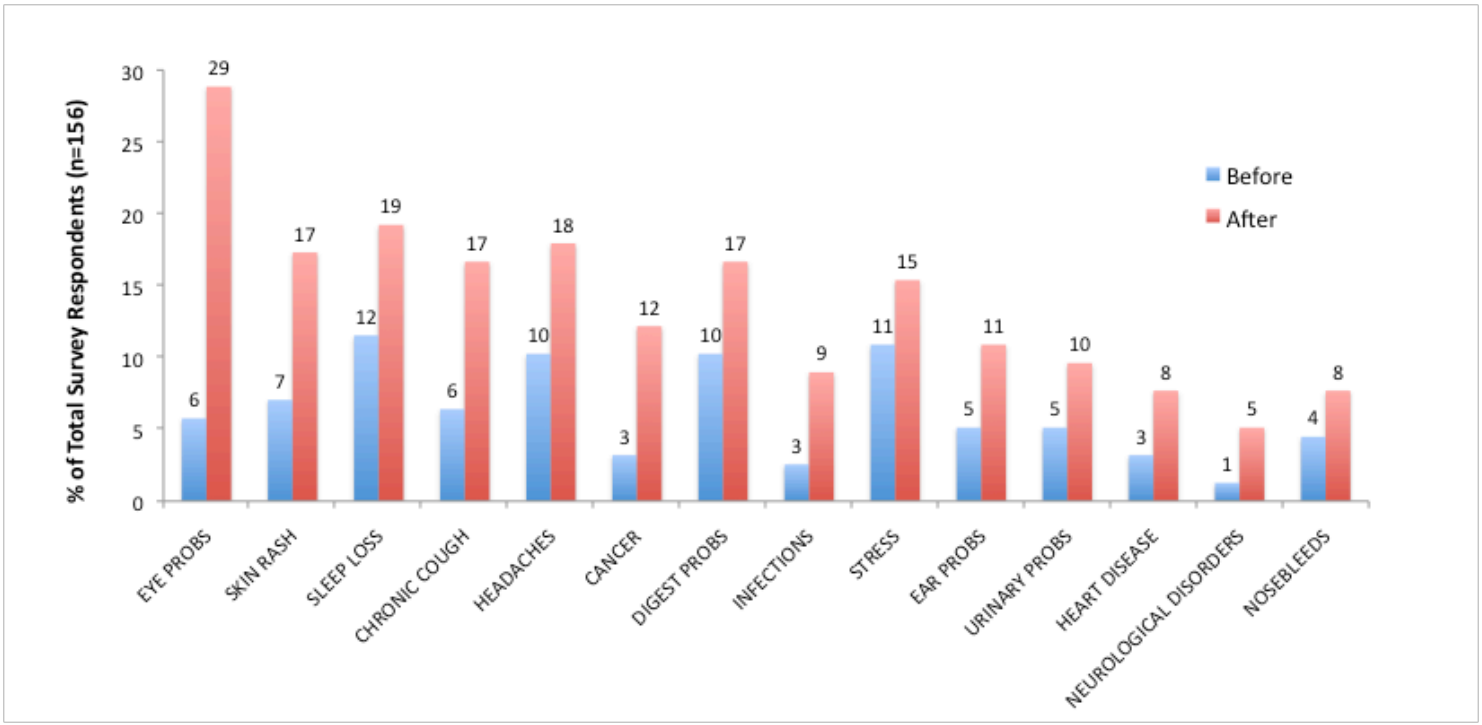


Figure 15. Health Conditions Reported Most Frequently AFTER Moving to Smith River

Figure 16. Relative Risk of Health Conditions After Moving to Smith River. Relative risk (RR) was calculated by comparing the number of residents reporting a specific condition before moving with the number of reports after moving to Smith River. RR values > 1: increased risk after moving, RR = 1: same level of risk before/after, RR < 1: less likely to occur after moving.

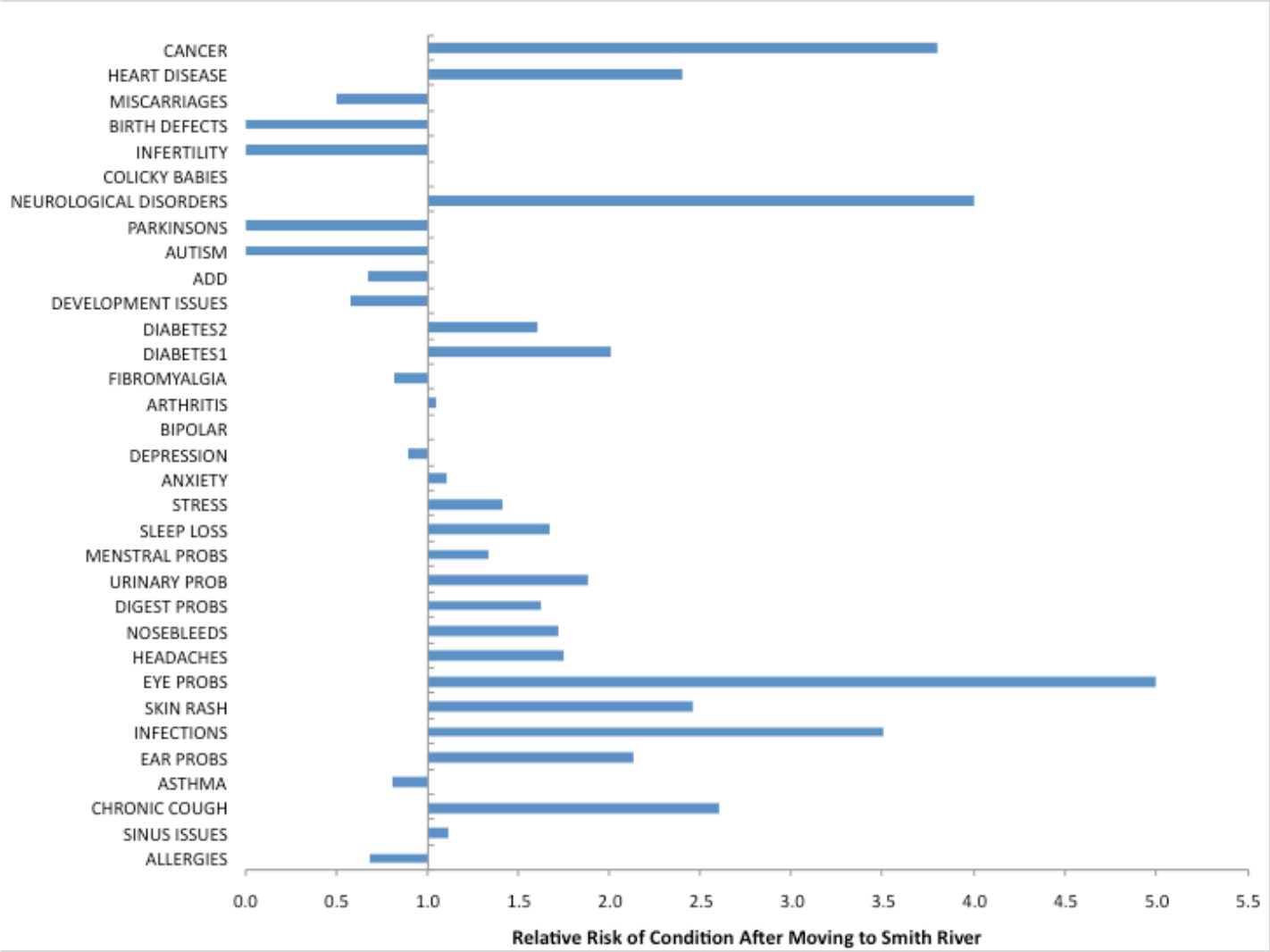


Table 1. Survey data for all 33 health conditions reported before and after moving to Smith River (n=156). The sum includes the total number of people reporting the occurrence of that condition in their household.

CONDITION	BEFORE MOVING (SUM/RAW#)	AFTER MOVING (SUM/RAW#)	BEFORE MOVING (%)	AFTER MOVING (%)	RELATIVE RISK
ALLERGIES	47	32	30%	21%	0.7
SINUS ISSUES	35	39	22%	25%	1.1
CHRONIC COUGH	10	26	6%	17%	2.6
ASTHMA	21	17	13%	11%	0.8
EAR PROBS	8	17	5%	11%	2.1
INFECTIONS	4	14	3%	9%	3.5
SKIN RASH	11	27	7%	17%	2.5
EYE PROBS	9	45	6%	29%	5.0
HEADACHES	16	28	10%	18%	1.8
NOSEBLEEDS	7	12	4%	8%	1.7
DIGEST PROBS	16	26	10%	17%	1.6
URINARY PROBS	8	15	5%	10%	1.9
MENSTRAL PROBS	3	4	2%	3%	1.3
SLEEP LOSS	18	30	12%	19%	1.7
STRESS	17	24	11%	15%	1.4
ANXIETY	20	22	13%	14%	1.1
DEPRESSION	19	17	12%	11%	0.9
BIPOLAR	3	3	2%	2%	1.0
ARTHRITIS	24	25	15%	16%	1.0
FIBROMYALGIA	11	9	7%	6%	0.8
DIABETES1	3	6	2%	4%	2.0
DIABETES2	10	16	6%	10%	1.6
DEVELOPMENT ISSUES	7	4	4%	3%	0.6
ADD	6	4	4%	3%	0.7
AUTISM	2	0	1%	0%	0
PARKINSONS	1	0	1%	0%	0
NEUROLOGICAL DISORDERS	2	8	1%	5%	4.0
COLICKY BABIES	2	2	1%	1%	1.0
INFERTILITY	1	0	1%	0%	0
BIRTH DEFECTS	1	0	1%	0%	0
MISCARRIAGES	2	1	1%	1%	0.5
HEART DISEASE	5	12	3%	8%	2.4
CANCER	5	19	3%	12%	3.8

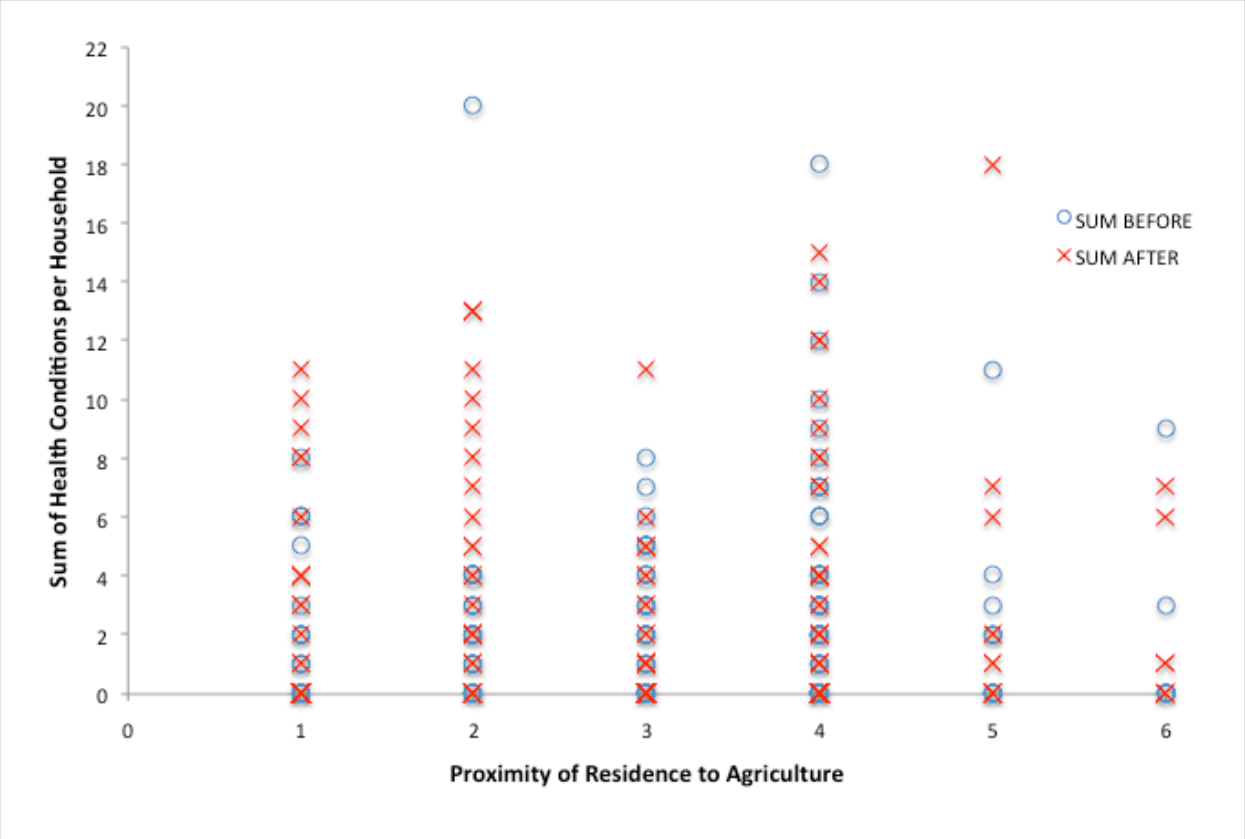


Figure 17. Sum of health conditions per household experienced BEFORE and AFTER moving to Smith River in relation to nearby agricultural fields (n=150). Values in the x-axis represent the following distances: **1** = < 100 ft, **2** = 100 ft - 300 ft, **3** = 500 ft – ¼ mi, **4** = ½ mi – 1 mi, **5** = >1 mi, **6** = Don't know.

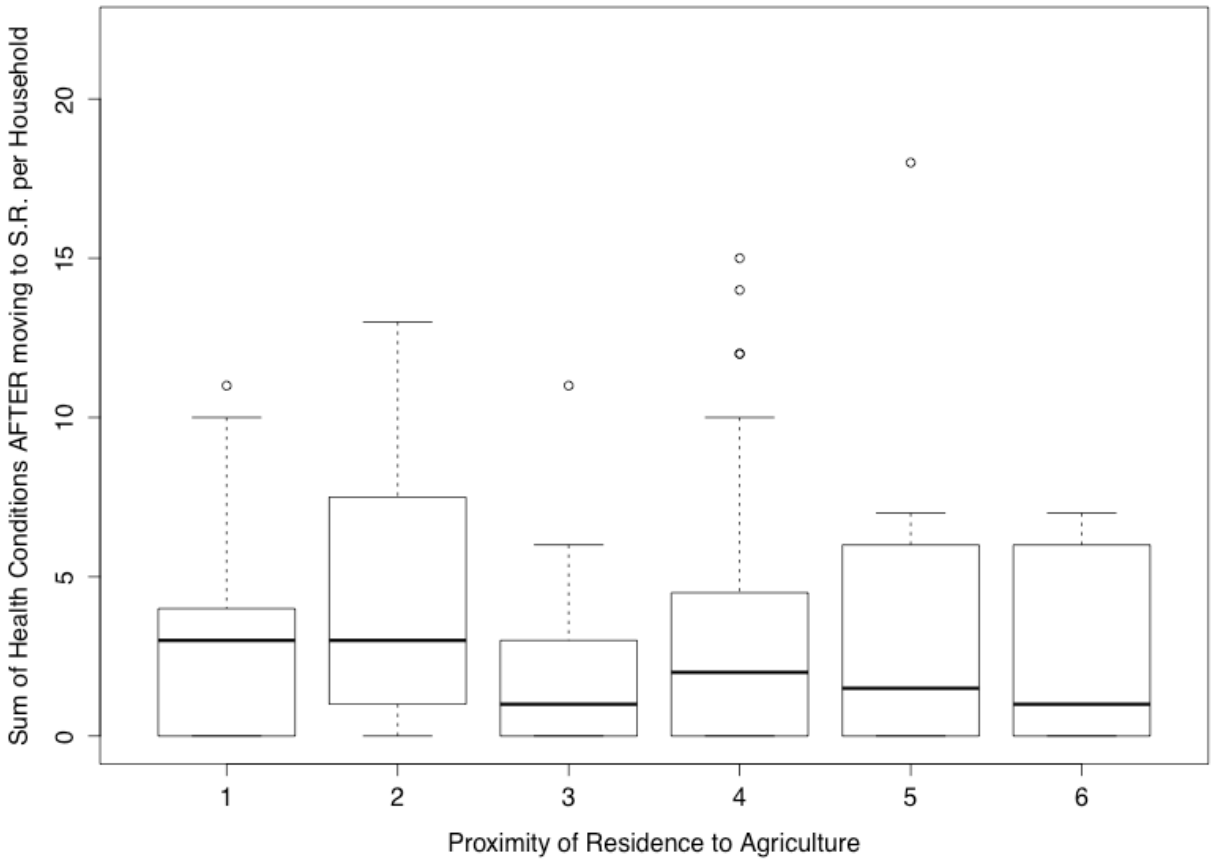


Figure 18. Sum of health conditions per household experienced AFTER moving to Smith River in relation to nearby agricultural fields (n=150). Values in the x-axis represent the following distances: **1** = < 100 ft, **2** = 100 ft - 300 ft, **3** = 500 ft – ¼ mi, **4** = ½ mi – 1 mi, **5** = >1 mi, **6** = Don't know. Boxplots show the range of values reported and the median (dark line) or average number of health conditions experienced in relation to agriculture. Most respondents reported between 0 and 10 health conditions after moving to Smith River.

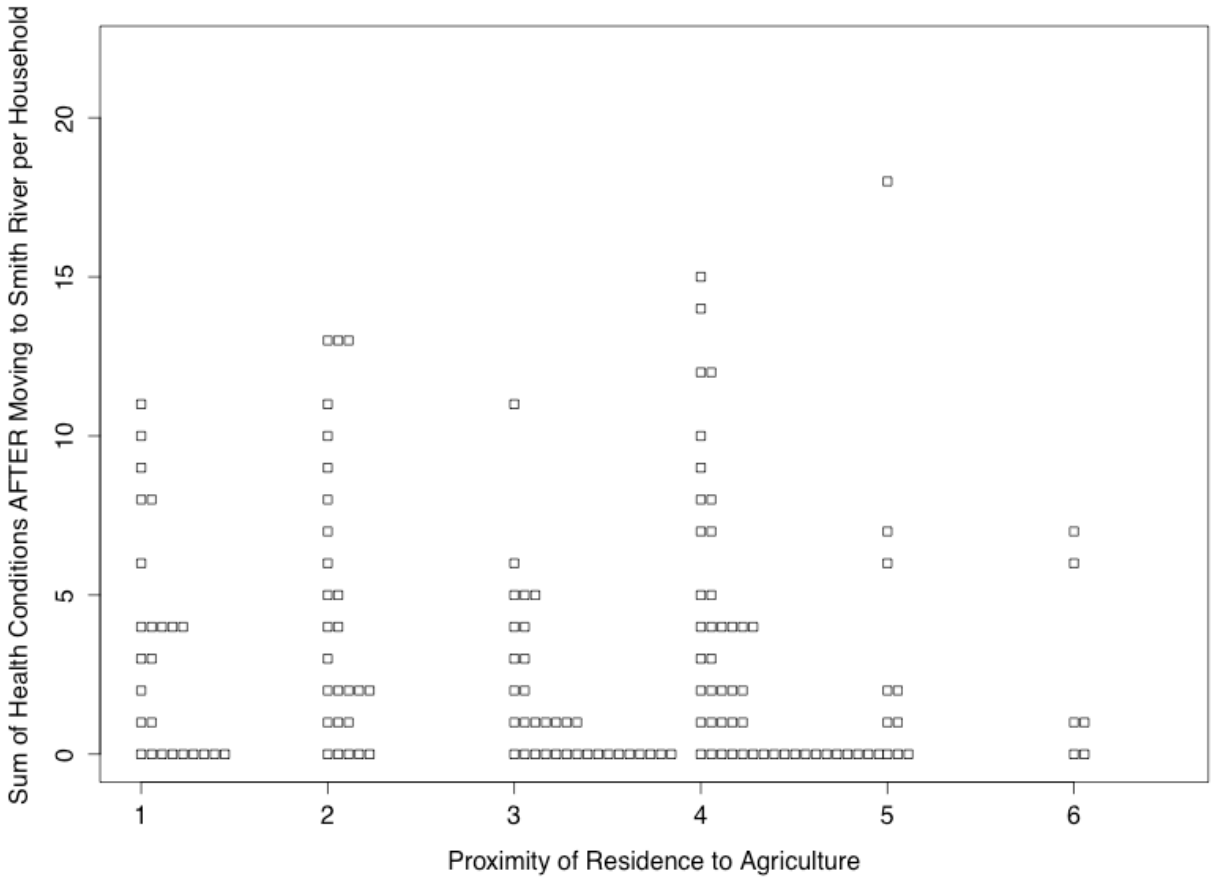


Figure 19. Sum of health conditions per household experienced AFTER moving to Smith River in relation to nearby agricultural fields (n=150). Each point represents one household. Values in the x-axis represent the following distances: **1** = < 100 ft, **2** = 100 ft - 300 ft, **3** = 500 ft – ¼ mi, **4** = ½ mi – 1 mi, **5** = >1 mi, **6** = Don't know.

Conclusions and Recommendations

This study is the first of its kind to collect information regarding pesticide exposure, health and level of concern among Smith River residents. Results show that residents of Smith River are highly concerned about pesticides in their environment, particularly in the water they drink and the air they breathe. The frequent and concentrated applications of several highly toxic pesticides near and upwind of homes and a school clearly indicate that these concerns must be taken seriously. Many of these pesticides are known carcinogens, neurotoxins, endocrine disrupters, and developmental and reproductive toxins.

Many residents stated that they would like to be notified in advance of pesticides being sprayed in their community, especially when in close proximity to the Smith River elementary school. A total of 44 residents reported that they had been exposed to pesticide drift at their residence, suggesting that spraying is occurring too close to occupied homes and/or in high winds.

Responses to our health assessment revealed that eye problems occur 5 times more frequently after moving to Smith River. Other conditions with higher frequencies after moving to Smith River include skin rashes, chronic cough, infections, headaches, neurological disorders, cancer, and many other conditions. This list of conditions overlaps substantially with conditions known to result from exposure to pesticides commonly applied in Smith River. For example, labels for both Telone II (1,3-Dichloropropene) and VAPAM HL (Metam sodium) identify these chemicals as irritating and/or damaging to human eyes, skin, and respiratory systems, and both chemicals are on the state of California's Proposition 65 list of chemicals known to cause cancer.

While no definitive relationship between pesticide exposure and health conditions of Smith River residents can be drawn from our study, the results raise significant concerns and require attention and action from public agencies. We recommend that a thorough medical and epidemiological assessment be conducted in the community of Smith River by government agencies responsible for protecting human health. These agencies would include but not be limited to the California Department of Public Health; the California Department of Pesticide Regulation/CalEPA; the California North Coast Regional Water Quality Control Board; the U.S. Environmental Protection Agency; and the U.S. Centers for Disease Control and Prevention. The Del Norte County Department of Health and Human Services should also be involved but to ensure impartiality should not lead the study.

We further recommend routine environmental monitoring, including well and surface water testing and air quality/drift monitoring during peak application periods. Finally, if a definitive link is found between pesticide use and adverse human health impacts in Smith River, pesticide use should be discontinued.

Limitations of study

It is difficult to capture a general assessment of an entire community when survey responses are voluntary, and some biases may have occurred due to our method of data collection. For example, it is possible that respondents with little to no concern were less likely to respond to

our survey, while those experiencing serious health problems may have been more apt to reply, thus skewing our dataset toward those with more health problems and greater concern over pesticide exposure.

Furthermore, the results of our health assessment reflect trends from individuals who reported conditions on behalf of their entire household. It is unclear precisely how many individuals report experiencing the specific conditions surveyed. All health conditions were self-reported and were not verified by a medical professional, nor was information regarding age, gender, or family history collected.

However, these limitations do not negate the central conclusions of this study. Rather, they further highlight the need for the kinds of follow-up public agency research and monitoring described above.

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Appendix A: Comments from Smith River Residents – Community Health Survey*

"I would like to be told when any pesticide is used anywhere near my house, including those used on public roads."

"There are 5 homes that I am personally aware of that one or more of the residents were diagnosed and treated for cancer. This is all on the same street. I have had cancer twice, the person we bought the home from had cancer. One of our neighbors also had cancer twice and one of the other neighbors died due to cancer."

"[Water] often smells fowl, sometimes water tastes funny and gets cloudy when the well gets low. When I first moved here my water was positive for e-coli."

"Our dogs skin became infected about 6 months after moving to Smith River. She now has severe allergies and is taking daily medication to try to keep her allergies and skin infections under control."

"2015: The smell was overwhelming for over a month during injection in August. July 27, 2015 was first day I noticed an unusual odor reminiscent of garlic and dog poo while driving to work alongside finely tilled fields (I have lived/driven here 22 yrs and don't recall this strong of an odor before), on Jul 31 the smell woke me up…Aug 1, stopped to read posted signs saying VAPAM in use. Looked up VAPAM online, their site, application instructions recommend 80% soil moisture content but this much moisture not present in the soil this year - soil was so dry this year that a large plume of dust [blew] up behind the tractors. We had 0.09'' of rain in July, June had only 0.88''. Sometime around this, I happened to be driving behind a tractor on hwy 101 South of Smith River with the injection rig attached and the tractor driver was wearing a white coverall and breathing through a respirator, the odor again was overpowering despite having all air intake stopped/closed in my car! The smell around these fields lasted for about a month this year. Thank you for investigating this - I had no idea who to turn to! Also this odor caused a burning in my nose/throat and caused a cough that lasted for months." – *This resident reports their household having frequent sinus problems, chronic coughing, skin problems, frequent headaches, digestive problems, Type 2 Diabetes, heart disease and cancer after moving to Smith River. Their residence is between 100 – 300 ft of ag fields (cows and lilies).*

"When the wind is blowing above 15 mph, not supposed to spray. Always happens anyway. We close all windows but can still smell the pesticides so stay inside - yuck."

* All comments transcribed as received.

"This survey is a good idea. I hope it helps the health of all people in the affected area!"

"We would like to see a healthy estuary for people and salmonids - keep up the good work SLC, do not get discouraged."

"We were told the level of copper in the water had been reduced, but our tubs and sinks still turn blue from the copper in the water. We have had lots of water pipe problems and have been told it's from the copper in the water. Two people have developed major heart problems after moving here."

"I would like the Land Conservancy to also take a look at the usage of herbicides associated with the logging in the Smith River hills water run-off (if any is used)."

"A couple times a year they spray the field at the side of the school and behind our houses. The chemicals make it very hard to breathe. No one should be outside when this chemical is being used. This chemical cannot be ok in a neighborhood with people, pets and children."

"Neighbor got cancer and died, my mom got cancer and died, I got cancer again, still here, in remission. In 22 years living here, 4 dogs and 2 cats all died of cancer."

"Spawning salmon no longer come to Morrison Creek. They have to pass through lily fields and grazing lands."

"Please stop the use of pesticides in the fields which are in close proximity to residences. They say that Smith River leads the area in rates of cancer. Scary! Would not have moved here if I were aware of this."

"My dog died of pancreatic cancer in Dec. 21, 2015, came on very quickly and severe. I felt very sick and lost a lot of weight over 65 pounds in a very short amount of time, nausea, stomach pain, vomiting. My dog also suffered dizziness, confusion, falling over, stress, anxiety, not eating, stomach and bowl problems as well as being diagnosed with terminal cancer and etc…Myself, severe headaches, stomach pains, depression, anxiety, worse arthritis feelings in all joints and nose and throat and eye problems, severe weight loss and etc..."

"Si no estau diciendo cuando van a fumigar, me pregunto estas persona estam coupliendo con las lexes que protegueu individual alrede dor de las siembra. Lo que yo pieuso es que los pecticidas se transminar al suelo y contaminar los suelos y el agua de la cual usamos para tomar y uso eu el hoger y la mayou a de la poblacion depende de norias y los rios y arrollos se afectar tambien po los pecticidas y nuetro air y agua."

“Espero que esta eucuenta se hace de auyda pora que se refuercer or aplicau lexes que coutroleu or prohibau el uso de quimicos cerca de hogares, escuelas, rios y arroyos. Tambien me gustaria sabe el resultado de la encuesta y que se planea hacer al respecto.”

“Como recidentes de Smith River nos preocupa todo tipo de quimicos que usan en los files. T por los ninos que des afecta y a todos las personas.”

“The use of pesticides seems to be done by individuals or companies that benefit themselves financially. They are not concerned with the community health and welfare. They are financially selfish.”

“These are poisons and should not be used on crops or breathed, drank or ingested. Field spray drains into water supplies which enter the bio-food chain.”

“The field across from my residence slopes downward toward my property then to the beach. There is substantial run off to a heavy flowing creek right to the ocean - all the additives wash right into the ocean directly.”

“The Smith River Service District has a questionable source of water for our residential water.”

“I am a 50-year-old life-time resident of S.R. Both of my parents and many locals I know have died or are dying of cancer. My mother passed away at age 39. My father at age 55.”

“Living here has been just great, so far!! Hope life continues to be great and the area does not become contaminated.”

“We have animals (domestic) and over the years lost them to organ cancers, lymph node cancer. I'm concerned about the water and soil due to the many years the field across from our home was used for lilies, now used for hay.”

“Have considered moving out of Smith River for my children's health and all the spraying on the lily fields.”

“The Smith River area really needs to be tested; air quality, soil and even the people/families that live here. My husband and I worry daily what our children are breathing while at Smith River School, as well as when they play in our own back yard.”

“I am overly concerned. They have changed lily chemicals several times since 1977 when we moved into this home. "Timic" stayed in the wells. When the fields are injected with gas it is sickening. They did cover the fields, now they leave them uncovered and it is really scary because of the rain and run out to the river to the ocean. But most of all it's all for money

not health. I have watched families with bad wells have high cancer in the family. But then they can have both children with cancer and not want to complain because they live in the place that employs them. They must be afraid to have no job. Hard for me to understand. I question their reasoning. We give up our well because we weren't sure about the mill site or the lilies and can't believe the testing because of the "good old boy thing". I didn't trust it. People are afraid of the Lily growers. They will hurt your families if you talk. There is a very high cancer in people and animals in this area. We have had hives of bees die, complete hives in one day."

"The elementary school is often downwind of applications regardless of wind direction or velocity. The aquatic health of the Smith River Estuary may be negatively impacted by current practices too close to waterbodies."

"I have lived here for 58 years -- Smith River has been a farming community since the beginning of time. The farmers do an excellent job of protecting the environment. If people don't like living in a farming community then maybe they should live somewhere else! Environmental groups like you should be more concerned about invasive species that are destroying our beautiful rivers and leave the farmers alone."

"If the farmers are going to spray, posted signs indicating that pesticides are going to be used will give residents a "heads-up" so that we can limit our time outdoors. It should also be noted that our well water is taking on a different taste. It is not a bad taste, however is a different taste. I have tried different brands of filters but to no avail."

"Driving hwy 101, there are sometimes clouds of pesticides blowing across the highway. Spraying continues even though wind increases. There are signs of pesticides in our town water, which comes from Rowdy Creek." (148)

"Agriculture pesticide laws in the State of California are the strongest in the world…Again, CA State laws protect me. If Smith River is in danger then the entire state has a worse problem. My parents lived here all their lives and were in their nineties when they died. I have lived here all my life, 70+ years and am in excellent health! Why don't you people go back to where you are from and clean up the mess you made down there."

"Because of the threat to bees, I would like to know if nicotinoids are being used. Would be so against that and alarmed, if so."

"[Air] smells of acid. Have white spots on leaves of plants."

"This is a poorly designed and inadequate 'survey' which is clearly purposed to stop all Smith River agriculture."

"I have [been here] 15 year[s] with multiple health problems. We are on well water. [Pesticides] cover the cars when the wind blows. My son now sees a neurologist, orthopedic specialist and geneticist. Plus my husband and I have several health problems."

"I have leukemia."

"Easter lilies growers [spray] the herbicides, fungicides during windy days w/no care for human health. With rain coming throughout year run-off is great. Please try to stop the use of herbicides and fungicides in such huge amount. They are killing the lower river and hurting us!"

"I notice that cows are grazed on fields that had Easter lilies in previous years. That seems poisonous. It would be good to know regulations about use of pesticides. It seems it pollutes the watershed and the soil. How long does it take to go away. Is our tap water tested. Thanks for looking into it. Is it possible to use organic ways to grow lilies so we do not put people out of work?"

Appendix B: "Bad Actor" pesticides used on lily fields surrounding the Smith River estuary in 2013, and their effects*

*In 2013 Easter lily farmers applied **284,000 pounds** of pesticides on bottomlands surrounding the Smith River estuary, in Del Norte County, California. Following are the most toxic pesticides used by Smith River lily farmers, the amounts used in 2013, and their toxicological effects. Seven of the pesticides (marked ☠) are found on the state of California's Proposition 65 list of chemicals known to cause cancer. Most are also harmful to aquatic species and other wildlife. In addition to the dangers posed by these chemicals to humans and wildlife, when combined they can be equally or even more dangerous. Lily farmers applied pesticides 2,834 times during the year.*

1) 1,3-Dichloropropene (Telone II) ☠
USE: nematicide, soil fumigant
AMOUNT USED: 122,499 pounds
TOXICOLOGICAL EFFECTS: Chest pains, respiratory problems, coughing, rashes. Single doses can cause lung damage and the kidney ailments. Most typical exposure is via inhalation, though ingesting it is most toxic.
CLASS: Probable human carcinogen & probable reproductive toxin.
ENVIRONMENTAL FATE: Highly soluble in water and does not evaporate readily, likely to contaminate groundwater. Aquatic organisms can be killed by concentrations of less than 10 parts per million.

2) Metam Sodium ☠
USE: soil fumigant, nematicide
AMOUNT USED: 100,122 pounds
TOXICOLOGICAL EFFECTS: Skin irritation, eye irritation, nervous system damage. Can cause allergies via sensitization, primary breakdown product is MITC (methylisothiocyanate) which can induce asthma.
CLASS: reproductive toxin, immune system toxicant, and probable human carcinogen.
ENVIRONMENTAL FATE: Highly toxic to fish; 1 part per trillion caused 100% mortality in tadpoles. MITC can catastrophically impair reproduction of invertebrates that salmonids feed on.

3) Chlorothalonil ☠
USE: fungicide
AMOUNT USED: 5,408 pounds
TOXICOLOGICAL EFFECTS: Irritating to the eyes and skin, can cause allergic rashes and swelling.
CLASS: probable human carcinogen, reproductive toxin.
ENVIRONMENTAL FATE: Chlorothalonil can contaminate the air traveling beyond the field and has been found in nearby residential neighborhoods. It is a potential groundwater contaminant, persistent in soils and acutely toxic to fish, crabs and frogs.

4) Diuron ☠
USE: herbicide
AMOUNT USED: 1,530 pounds

* Sources include but are not limited to: Pesticide Action Network/North America; Northwest Center for Alternatives to Pesticides; U.S. EPA; CalEPA; California Air Resources Board; California Department of Food and Agriculture; World Health Organization; U.S. Department of Health and Human Services; trade magazines; university research.

TOXICOLOGICAL EFFECTS: This chemical is slightly toxic by all routes.
CLASS: Carcinogen. At high doses Diuron can cause birth defects.
ENVIRONMENTAL FATE: Persistent in soils, can contaminate groundwater.
Highly toxic to aquatic invertebrates.

5) Phorate
USE: Insecticide, nematicide
AMOUNT USED: 1,819 pounds
TOXICOLOGICAL EFFECTS: Highly toxic through all routes of exposure. Exposure can cause convulsions, sweating, labored breathing, abdominal cramps, diarrhea, vomiting
ENVIRONMENTAL FATE: Groundwater contaminant. Extremely toxic to birds, fish and aquatic organisms. Kills rainbow trout at the minute concentration of just 13 parts per billion.

6) Ethoprop
USE: Insecticide, nematicide
AMOUNT USED: 1,161 pounds
TOXICOLOGICAL EFFECTS: Highly toxic through all routes of exposure.
CLASS: Carcinogen, cholinesterase inhibitor (can damage the central nervous system)
ENVIRONMENTAL FATE: Groundwater contaminant. Moderately toxic to fish, highly toxic to crustaceans and zooplankton.

7) Maneb
USE: Fungicide
AMOUNT USED: 228 pounds
TOXICOLOGICAL EFFECTS: Respiratory, skin and eye irritant.
CLASS: Carcinogen and reproductive toxin.
ENVIRONMENTAL FATE: Toxic to aquatic species.

8) Daminozide
USE: Plant growth regulator
AMOUNT USED: 102 pounds
TOXICOLOGICAL EFFECTS: Respiratory, skin and eye irritant.
CLASS: Carcinogen.
ENVIRONMENTAL FATE: Moderately toxic to aquatic species particularly fish and zooplankton.

9) Diquat dibromide
USE: Herbicide
AMOUNT USED: 139 pounds
TOXICOLOGICAL EFFECTS: Respiratory, skin and eye irritant. Can cause a burning pain in the mouth, throat, chest, and upper abdomen, as well as pulmonary edema, pancreatitis, and renal injury.
ENVIRONMENTAL FATE: Potential groundwater contaminant. Slightly toxic to aquatic species.

Copper

In 2012 Smith River lily farmers applied copper products 868 times for a total of **47,573** pounds. Copper is less harmful to humans and wildlife than the above chemicals (though it can still have deleterious effects), but it is highly toxic to fish. In August 2010 state scientists found copper levels in a stream leading to the Smith River estuary that were 28 times higher than allowed by the California Toxics Rule. According to Cornell University, "Copper … is highly toxic to fish. Even at recommended rates of application, this material may be poisonous to trout and other fish."

Appendix C: Community Health Survey for Residents of the Town of Smith River

This is an anonymous survey. Please do not include personal information, such as your name or names of any household members.

1. How long have you lived at your current residence? Check one of the following:

   0-6 months _____

   6 months – 1 year _____

   Between 1-3 years _____

   Between 3-5 years _____

   More than 5 years _____

2. How close is your residence to an agricultural field? Check one of the following:

   Less than 100 ft. _____

   100 ft. – 300 ft. _____

   500 ft. – ¼ mile _____

   ½ mile – 1 mile _____

   Greater than 1 mile _____

   Don't know _____

   If your residence is less than 1 mile from an agricultural field, please answer question 2a. If your residence is greater than 1 mile from an agricultural field, continue to question 3.

   2 a.) What is the current use of the agricultural field closest to your residence? Check any of the following that apply:

   Grazed by cattle _____

   Easter lilies _____

   Cover cropped _____

   Fallow/unplanted _____

   Don't know _____

   Other (please specify): _____

3. Do members of your household attend Smith River Elementary School? Check one of the following:

   Yes, currently _____

   Previously _____

   No, but will in the near future _____

   No _____

4. Do members of your household attend a day care facility in Smith River? Check one of the following:

   Yes, currently _____

   Previously _____

   No, but will in the near future _____

   No _____

4 a.) If yes, how close is the day care to an agricultural field? Check one of the following:

Less than 100 ft. _____

100 ft. – 300 ft. _____

500 ft. – ¼ mile _____

½ mile – 1 mile _____

Greater than 1 mile _____

Don't know _____

4 b.) What is the current use of the agricultural field closest to your day care? Check any of the following that apply:

Grazed by cattle _____

Easter lilies _____

Cover cropped _____

Fallow/unplanted _____

Don't know _____

Other (please specify): _____

5. Are local schools given advance notice of when pesticide spraying is going to occur?

   Check one of the following:

Yes _____

No _____

Don't know _____

6. How do residents know when agricultural pesticides are being used in your community? Check all that apply:

   Signs posted near fields _____

   Notifications posted to community spaces _____

   Newspaper _____

   Radio _____

   No notice is given _____

   Don't know _____

   Other (please specify): _____

7. Are you concerned about exposure to agricultural pesticides in the air? Indicate your level of concern:

   No concern Low Moderate High

   If you would like to provide further details, please indicate in the space below:

8. Are you concerned about exposure to agricultural pesticides in the water? Indicate your level of concern:

   No concern Low Moderate High

   If you would like to provide further details, please indicate in the space below:

9. What is the source of your household's drinking water? Check one of the following:

   Well water _____

   Town water _____

   Bottled or pre-filtered water _____

   Don't know _____

10. If the source of your household's drinking water is from a well, what is its proximity to the nearest agricultural field? Check one of the following:

    Less than 100 ft. _____

    100 ft. – 300 ft. _____

    500 ft. – ¼ mile _____

    ½ mile – 1 mile _____

    Greater than 1 mile _____

    Don't know _____

11. Has your well or tap water ever been tested for contaminants? Check one of the following:

    Yes _____

    No _____

    Don't know _____

If you answered, "Yes" to question 11, please answer question 11a. If you answered "No" or "Don't know", please continue to question 12.

11 a.) Did the results raise concern? Indicate your level of concern:

No concern Low Moderate High

If you would like to provide further details, please indicate in the space below:

12. Have you ever been exposed to pesticides near your residence? Check one of the following:

Yes _____

No _____

Don't know _____

13. Do you use commercial pesticide products (herbicides, insecticides, fungicides, etc.) in or around your residence? Check one of the following:

    Yes _____ (please specify): _____

    No _____

    Don't know _____

14. Have you ever been exposed to pesticides at your workplace? Check one of the following:

    Yes _____

    No _____

    Don't know _____

If you answered, "Yes" to question 12, 13, and/or 14 please answer questions 15 - 20. If you answered "No" or "Don't know", please skip to question 21.

15. How were you exposed to pesticides? Check all that apply:

    Pesticides drift into where you live when the wind blows _____

    You entered an area after not being informed it was sprayed _____

    You touched plants or worked in fields where plants were wet from pesticides _____

    Through hand/skin lacerations _____

    By not washing hands _____

    When planting, potting or replanting _____

    Through smell, breathing in, poor indoor ventilation _____

    Washing/cleaning plants/ trees/ crops _____

    Unpacking plants or cuttings _____

    Touching pets that came into contact with chemicals _____

    Contaminated well water _____

    Contaminated surface water on property _____

Other (please specify): _____

Don't know _____

16. Do you know what pesticides or chemicals you were exposed to? Check one of the following:

Yes _____

No _____

Don't know _____

16 a.) If yes, what was the name(s)?

_____

17. Did you seek medical attention? Check one of the following:

Yes _____

No _____

18. If yes, where did you go? Check all that apply:

Local clinic _____

Private doctor _____

Hospital emergency room _____

Company nurse _____

Took care of it at home _____

Other (please specify): _____

19. What did the doctor or health care provider tell you to do?

20. Did that advice help you?

Yes _____

No _____

Don't know _____

21. Have you ever smoked tobacco?

Yes, currently _____

Yes, previously _____

No, never _____

22. Have you ever lived in a household with a tobacco smoker who smokes indoors?

Yes, currently _____

Yes, previously _____

No, never _____

23. Do you or anyone in your household suffer from any of the following conditions? Please indicate whether the condition appeared before (B) or after (A) moving to Smith River by checking the appropriate box. Check all health conditions that apply:

	B	A		B	A		B	A
Allergies	☐	☐	Urinary troubles	☐	☐	Learning or developmental disabilities	☐	☐
Frequent sinus problems	☐	☐	Menstrual problems	☐	☐	ADD/ADHD	☐	☐
Chronic coughing	☐	☐	Sleeping difficulties	☐	☐	Autism	☐	☐
Asthma	☐	☐	Stress	☐	☐	Parkinson's disease	☐	☐
Ear aches or ear infections	☐	☐	Anxiety	☐	☐	Neurological disorders	☐	☐
Frequent infections	☐	☐	Depression	☐	☐	Colicky babies	☐	☐
Skin problems, recurrent rashes	☐	☐	Bipolar	☐	☐	Infertility	☐	☐
Eye problems (itchy, swollen)	☐	☐	Arthritis	☐	☐	Birth defects	☐	☐
Frequent headaches or migraines	☐	☐	Fibromyalgia	☐	☐	Miscarriages	☐	☐
Nosebleeds	☐	☐	Diabetes (Type 1)	☐	☐	Heart disease	☐	☐
Digestive problems	☐	☐	Diabetes (Type 2)	☐	☐	Cancer	☐	☐

24. If there is any additional information, comments or concerns you would like to add, please use the back of this page.

Appendix D: Encuesta de salud comunitaria para los residentes de Smith River

Se trata de una encuesta anónima. Por favor no incluya información personal, como su nombre o nombres de miembros de la familia.

1. Cuánto tiempo tiene usted viviendo en su residencia actual? Marque uno de los siguientes:

0-6 máses ____

6 máses– 1 año _____

Entre 1-3 años_____

Entre 3-5 años_____

Más de 5 años_____

2. Qué tan cerca está su residencia a un campo agrícolo? Marque uno de los siguientes:

Menos de 100 pies. _____

100 pies - 300 pies. _____

500 pies – 1/4 milla _____

1/2 milla - 1 milla_____

Mas de 1 milla_____

no sé_____

Si su residencia es menos de 1 milla de un campo agrícolo, por favor responda la pregunta 2a. Si su residencia es superior a 1 milla de un campo agrícolo, continúe a la pregunta 3.

2 a.) Cuál es el uso actual del campo agrícolo más cercano a su residencia? Compruebe cualquiera de los siguientes que se aplican:

Pastoreados por ganado _____

Cubrir recortado _____

Barbecho sin sembrar _____

No Se _____

Otro (especifique):_____

3. Hay miembros en su familia que asisten en la escuela primaria de Smith River? Marque uno de los siguientes:

Sí, actualmente _____

Anteriormente _____

No, pero en el future cercano _____

No _____

4. Hay miembros de su familia que asisten a una guardería en Smith River? Marque uno de los siguientes:

Sí, actualmente _____

Anteriormente _____

No, pero en el future cercano _____

No _____

4 a.) En caso afirmativo, ¿qué tan cerca está la guardería a un campo agrícolo? Marque uno de los siguientes:

Menos de 100 pies. ____

100 pies - 300 pies. _____

500 pies – 1/4 milla _____

1/2 milla - 1 milla_____

Mas de 1 milla_____

no sé_____

4 b.) Cuál es el uso actual del campo agrícolo más cercano a su residencia? Compruebe cualquiera de los siguientes que se aplican:

Pastoreados por ganado _____

Cubrir recortado _____

Barbecho sin sembrar _____

No sé_____

Otro (especifique):_____

5. Son las escuelas locales aviso anticipado de pesticida cuando va a ocurrir? Marque uno de los siguientes:

Si _____

No _____

No sé _____

6. Cómo saben los residentes cuando los pesticidas agrícolas están siendo utilizados en su comunidad? Marque todas las que correspondan: los

Letreros colocados cerca de campos_____
Notificaciones publicadas en espacios comunitarios _____
periódico _____
Radio _____
No se da aviso de _____
No sé _____
Otro (especifique): _____

7. Le preocupa la exposición a plaguicidas agrícolas en el aire? Indique su nivel de preocupación:

No hay preocupación moderada baja alta

Si desea proporcionar más detalles, por favor, indíquelo en el espacio a continuación:

8. Le preocupa la exposición a plaguicidas agrícolas en el agua? Indique su nivel de preocupación:

No hay preocupación moderada baja alta

Si desea proporcionar más detalles, por favor, indíquelo en el espacio a continuación:

9. Cuál es la fuente de agua potable de su hogar? Marque uno de los siguientes:

agua de pozo _____
agua del Municipio _____
agua embotellada o agua filtrada _____

No sé _____

10. Si la fuente de su agua potable del hogar es de un bien, cuál es su proximidad al campo agrícola más cercana? Marque uno de los siguientes:

Menos de 100 pies. ____
100 pies - 300 pies. _____
500 pies – 1/4 milla _____
1/2 milla - 1 milla_____
Mas de 1 milla_____
no sé_____

11. Tiene su pozo o agua del grifo nunca ha probado para contaminantes? Marque uno de los siguientes:

Si _____
No _____
No sé _____

Si usted contestó "Sí" a la pregunta 11, por favor, responda a la pregunta 11a. Si usted contestó "No" o "No sabe", continúe con la pregunta 12.

11 a.) Los resultados suscitan preocupación? Indique su nivel de preocupación:

No hay preocupación moderada baja alta

Si desea proporcionar más detalles, por favor, indíquelo en el espacio a continuación:

12. Alguna vez has sido expuestos a pesticidas cerca de su residencia? Marque uno de los siguientes:

Si _____
No _____
No sé _____

13. Usa comercial productos plaguicidas (herbicidas, insecticidas, fungicidas, etc.) en o alrededor de su residencia? Marque uno de los siguientes:

Si _____(por favor especifique): _____

No _____

No sé _____

14. Alguna vez has sido expuestos a pesticidas en su lugar de trabajo? Marque uno de los siguientes:

Si _____

No _____

No sé _____

Si usted contestó "Sí" a la pregunta 12, 13 y/o 14 Por favor, responda a las preguntas 15 - 20. Si usted contestó "No" o "No sabe", pase a la pregunta 21.

15. ¿Cómo fuiste expuestos a pesticidas? Marque todas las que correspondan:

Plaguicidas deriva en donde usted vive cuando sopla el viento _____

Entro en una zona después de que no se le inform que fue rociado _____

Tocó las plantas o trabaja en campos donde las plantas estaban mojadas de pesticidas _____

A través de la laceraciones de mano _____

Por no lavarse las manos _____

Cuando la plantación o replantación de rellenado, _____

A través del olfato, la respiración, mala ventilación interior _____

Lavado/limpieza de plantas/ cultivos de árboles _____

Desembalaje de plantas o esquejes _____

Tocar mascotas que entró en contacto con los productos químicos _____

Contaminado el agua de pozo _____

Las aguas superficiales contaminadas en la propiedad _____

Otro (especifique): _____

No sé _____

16. Sabe usted qué plaguicidas o productos químicos fueron expuestos? Marque uno de los siguientes:

Si _____

No _____

No sé _____

16 a.) Si la respuesta es sí, ¿cuál era el nombre(s)?

_____

17. Usted busca atención médica? Marque uno de los siguientes:

Si _____

No _____

18. Si la respuesta es sí, ¿dónde fue? Marque todas las que correspondan:

Clínica local _____

Médico privado _____

La sala de emergencias del hospital _____

Enfermera de la empresa _____

Se encargó de ello en casa _____

Otro (especifique): _____

19. Qué dijo el médico o proveedor de atención médica le diga que hacer?

20. El consejo le ayudo?

Si _____

No _____

No sé _____

21. Alguna vez has fumado tabaco?

Sí, actualmente _____

No, nunca _____

Sí, previamente _____

22. Alguna vez has vivido en un hogar con un fumador de tabaco que se fuma en el interior?

Sí, actualmente _____

No, nunca _____

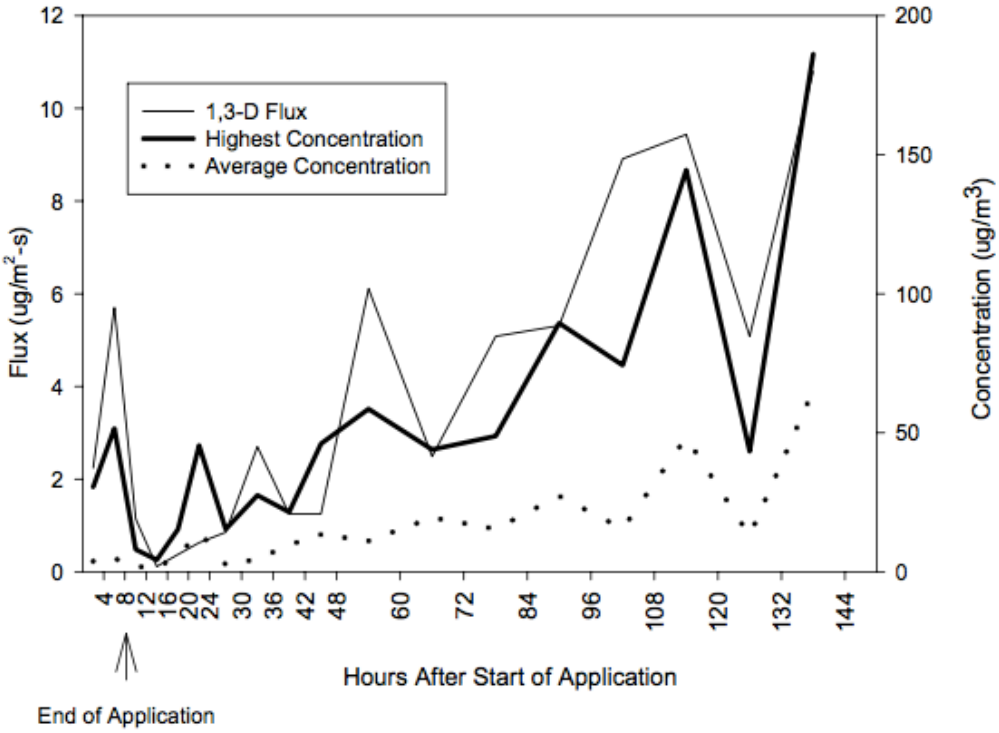
Sí, previamente _____

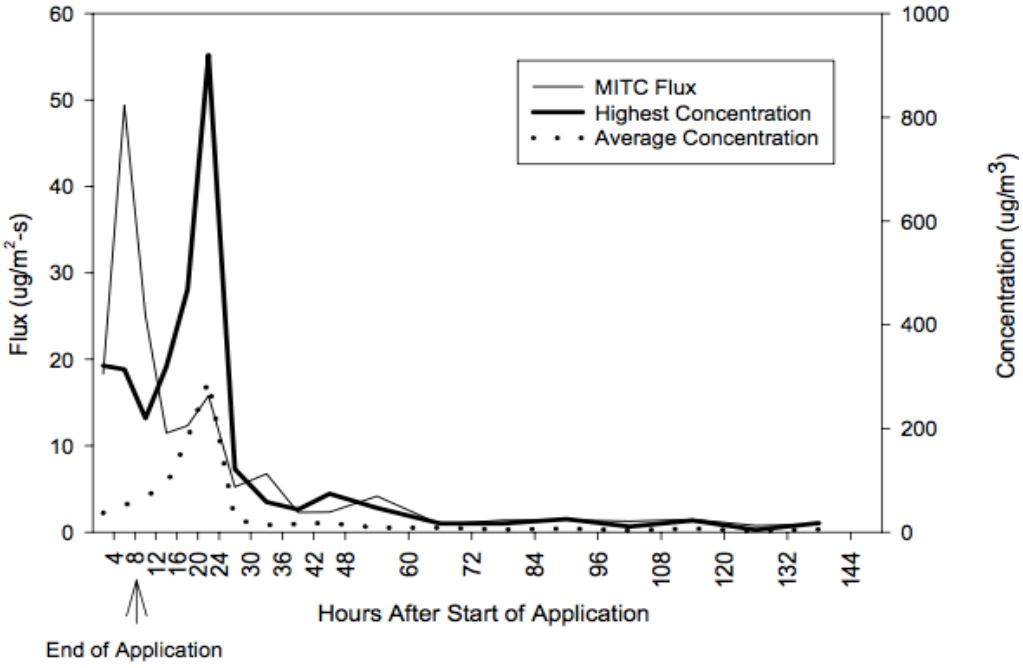
23. Usted o alguien de su familia sufre de alguna de las siguientes condiciones? Indicar si el estado apareció antes (B) o después (A) moviendo a Smith River marcando la casilla correspondiente. Compruebe todas las condiciones de salud que se aplican:

	B	A		B	A		B	A
Alergias	☐	☐	Problemas urinarios	☐	☐	Desarrollo de discapacidades de aprendizaje	☐	☐
Problemas de sinusitis frecuentes	☐	☐	Problemas menstruales	☐	☐	ADD/ADHD	☐	☐
Tos crónica	☐	☐	Dificultades para dormer	☐	☐	El autism	☐	☐
Asma	☐	☐	Estrés	☐	☐	Le enfermedad de Parkinson	☐	☐
Dolores de oído o infecciones del oído	☐	☐	Ansiedad	☐	☐	Trastornos Neurológicos	☐	☐
Infecciones frecuentes	☐	☐	Depresión	☐	☐	Bebés con cólico	☐	☐
Problemas de la piel, erupciones recurrentes	☐	☐	Bipolar	☐	☐	La infertilidad	☐	☐
Problemas oculares (picazón, inflamación)	☐	☐	Artritis	☐	☐	Defectos congénitos	☐	☐
Frecuentes dolores de cabeza o migrañas	☐	☐	La fibromialgia	☐	☐	Abortos	☐	☐
Sangrados nasals	☐	☐	Diabetes tipo 1	☐	☐	Cardiopatía	☐	☐
Problemas digestivos	☐	☐	Diabetes tipo 2	☐	☐	Cáncer	☐	☐

24. Si hay alguna información que le gustaría añadir sobre su salud o sus prácticas agrícolas en Smith River indique agregarlo en el reverso de esta página.

Appendix E: DPR Air Quality Monitoring in Del Norte County (2005)





Concentrations of fumigants 1,3-Dichloropropene and MITC (break down product of Metam Sodium) in the air near the site of soil injection at an Easter lily farm in Smith River, CA. Levels of 1,3-D continue to increase six days after the initial application (Wofford *et al.* 2005).

Appendix F: Smith River Service District Consumer Report 2014

2014 Water Quality Consumer Confidence Report

Water System Name: Smith River Community Service District

For additional information concerning your drinking water, contact the district office **(707) 487-5381**.

Name, type and location of source(s): **Well Field**

Smith River, California 95567.

DEFINITIONS OF SOME OF THE TERMS USED IN THIS REPORT:

Maximum Contaminant Level (MCL): The highest level of a contaminant allowed in drinking water. Primary MCLs are set as close to the PHGs (or MCLGS) as is technologically, and economically feasible.

Primary Drinking Water Standards (PDWS): MCLs for contaminants that affect health along with their monitoring and reporting requirements, and surface-water treatment requirements.

Public Health Goal (PHG): The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency.

Maximum Contaminant Level Goal (MCLG): The level of a contaminant in drinking water below which there is no known or expected risk to health. The Federal Environmental Protection Agency (USEPA) sets MCLGs.

Regulatory Action (AL): The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

ppm: Parts Per Million or milligrams per liter
ppb: Parts per Billion or micrograms per liter
ND: Non-Detectable at testing limit
TDS: Total Dissolved Solids

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

- *Microbial contaminants,* such as viruses and bacteria that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- *Inorganic contaminants,* such as salts and metals, that can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- *Pesticides and herbicides,* which may come from a variety of sources such as agriculture, urban storm water runoff, and residential uses.
- *Organic chemical contaminants,* including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can, also, come from gas stations, urban storm water runoff, and septic systems.
- *Radioactive contaminants,* which can be naturally occurring or be the result of oil and gas production and mining activities.

GENERAL INFORMATION ON DRINKING WATER:

All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline at 1-800-426-4791.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immune-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly individuals, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The USEPA/Center for Disease Control guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are available from the Safe Drinking Water Hotline at 1-800-426-4791.

ADDITIONAL INFORMATION FOR CONTAMINANTS EXCEEDING AND, MCL, AL OR PDWS:

Copper: "Copper is an essential nutrient, but some people who drink water containing copper in excess of the action level over a relatively short amount of time may experience gastrointestinal distress. Some people who drink water containing copper in excess of the action level over many years may suffer liver or kidney damage. People with Wilson's Disease should consult their personal doctor."

****Note: The District is currently in the treatment stage for the solution to eliminate residual Copper that is present in some residences within the District.*

****SI ES NESCECARO SE PUEDE TRADUSIR****

MICROBIOLOGICAL WATER QUALITY:

California state regulations require testing for bacteriological contaminants in the water distribution system. Regular testing verifies that the water system is free from coliform bacteria. The minimum number of tests required per month is **9**. In our distribution system, we completed **119** water tests for coliform bacteria for the year 2014. Out of the 119 samples only 2 samples tested positive for coliform.

LEAD & COPPER TESTING RESULTS:

California state regulations require testing for lead and copper from individual taps in the distribution system. The table below summarizes the most recent sampling for lead and copper.

	Year Tested	Number of samples collected	Number of samples required	90th Percentile Result (ppb)	Action Level (ppb)
Lead	1998	20	20	ND	15
Copper	1998	20	20	1900	1300

CHEMICAL SAMPLING RESULTS SHOWING DETECTED CONTAMINANTS:

The following table gives a list of all detected chemicals in our water during the most recent sampling. Please note that not all sampling is required annually so in some cases our results are more than one year old. These values are in parts per million (ppm) unless otherwise stated.

Chemical Tested	Source	Year Tested	Level Detected	MCL	DLR	PHG or(MCLG)
			INORGANICS			
Aluminum	Well Field	2010	ND	1	0.05	None
Antimony	Well Field	2010	ND	0.006	0.006	0.020
Arsenic	Well Field	2010	ND	.001	0.002	None
Barium	Well Field	2010	ND	1	0.1	(2)
Beryllium	Well Field	2010	ND	0.004	0.001	(0.004)
Cadmium	Well Field	2010	ND	0.005	0.001	0.00007
Hexavalent Chromium	Well Field	2015	0.0017	0.01	0.001	0.0025
Fluoride	Well Field	2010	ND	2.0	0.1	1
Mercury	Well Field	2010	ND	0.002	0.001	0.0012
Nickel	Well Field	2010	0.011	0.1	0.01	None
Perchlorate	Well Field	2010	ND	0.006	0.004	
Selenium	Well Field	2010	ND	0.05	0.005	(0.05)
Thallium	Well Field	2010	ND	0.002	0.001	0.0001
			NITRATE, NITRITE			
Nitrate (as NO3)	Well Field	2014	2.7	45	2	45
Nitrite (as N)	Well Field	2010	ND	1	0.4	1
			SECONDARY, STANDARDS			
Aluminum	Well Field	2010	ND	0.2	N/A	N/A
Foaming Agents (MBAS)	Well Field	2010	ND	0.5	N/A	N/A
Iron	Well Field	2010	ND	0.3	N/A	N/A
Manganese	Well Field	2010	ND	0.05	N/A	N/A
Silver	Well Field	2010	ND	0.1	N/A	N/A
Zinc	Well Field	2010	ND	5	N/A	N/A
Total Filterable Residue (TDS)	Well Field	2014	76	1500	N/A	N/A

Specific Conductance (E.C.)	Well Field	2010	120	2,200	N/A	N/A
Chloride	Well Field	2010	5.3	600	N/A	N/A
Sulfate	Well Field	2010	2.7	600	N/A	N/A

Chemical Tested	Source	Year Tested	Level Detected	MCL	DLR	PHG or(MCLG)
		REGULATED	ORGANIC CHEMICALS			
Benzene	Well Field	2014	ND	1	.50	N/A
Carbon Tetrachloride	Well Field	2014	ND	.5	.50	N/A
Haloacetic Acids (five) (HAA5)	Well Field	2006	2.9	60	1	?
Ethyl Benzene	Well Field	2014	ND	300	.50	N/A
Total Alkalinity (as CaCO3)	Well Field	2014	32	none	1	N/A
pH	Well Field	2014	6.4	none	N/A	N/A
Calcium	Well Field	2014	4.5	none	0.5	N/A
Magnesium	Well Field	2010	6.9	none	0.005	N/A
Sodium	Well Field	2010	4.8	none	1	N/A
Trihalomethanes (TTHMs)	Well Field	2006	4.2	80	1	?
Total Hardness (as CaCO3)	Well Field	2010	44	none	N/A	N/A
			UNREGULATED	ORGANIC CHEMICALS		
Bromobenzene	Well Field	2014	ND	none	0.50	N/A
Bromomethane (Methyl Bromide)	Well Field	2014	ND	none	0.50	N/A
Chloroethane	Well Field	2014	ND	none	0.50	N/A
Chloromethane (Methyl Chloride)	Well Field	2014	ND	none	N/A	N/A
Dichlorodifluoromethane(Freon 12)	Well Field	2014	ND	none	0.50	N/A
Ethyl-tert-butyl ether (ETBE)	Well Field	2014	ND	none	3.0	N/A
Isopropyltoluene	Well Field	2014	ND			
tert-Amyl-methyl ether(TAME)	Well Field	2014	ND	none	3.0	N/A
tert-Butyl benzene	Well Field	2014	ND	none	0.50	N/A
1,2,3-Trichloropropane	Well Field	2014	ND	none	.005	N/A
1,2,4-Trimethylbezene	Well Field	2014	ND	none	0.50	N/A
			NATURAL	RADIOACTIVITY		
Gross Alpha	Well Field	2014	ND	15 pCi/l	1	N/A
Radium 228	Well Field	2007	0.11	2.0	1	N/A
Uranium	Well Field	2001	ND	20pCi/l	2	N/A

"In addition to the above listed constituents, Smith River CSD has tested for more than seventy other constituents, none of which were found"

***NOTE:** The California Domestic Water Quality and Monitoring Regulations Title 22 Sec. 64463.1 requires Water Districts has copies of annual report for their Customers. The Board of Directors and Staff of the Smith River Community Service District are committed to providing you with safe and reliable supply of High Quality Drinking Water. **Property owners with additional occupied dwellings are required to provide a copy of this report to the tenant.**