

Climate Change in the San Joaquin Valley

A Household and Community Guide to Taking Action



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The Union of Concerned Scientists puts rigorous, independent science to work to solve our planet's most pressing problems. Joining with people across the country, we combine technical analysis and effective advocacy to create innovative, practical solutions for a healthy, safe, and sustainable future.

This report is available online (in PDF format) at www.ucsusa.org/resources/climate-change-san-joaquin-valley

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The authors dedicate this guide to Jose Ornelas, a San Joaquin city council member who died from COVID-19 in July 2020. Jose connected us with amazing people in the San Joaquin Valley who made this guide possible. He was an inspiration for us.

This guide is designed to help people living in the San Joaquin Valley understand how climate change threatens communities, and what they can do to prepare.

What Is This Guide?

This guide equips San Joaquin Valley (SJV) community members and advocates with information and ideas to address the rapidly evolving climate change issues affecting community members' health and to prepare for climate challenges.

You will find information about climate impacts on water and agriculture and about socioeconomic issues across cities and rural communities in the SJV, gathered through dozens of interviews and interactions with community leaders, climate scientists, water managers, community organizers, and members of grassroots advocacy organizations. These interviews and interactions reflected the perspective of more than 40 communities and showed an overwhelming concern about how climate change will affect water (and air) quality, water supplies, and flooding, as well as the future of agriculture and job opportunities in the SJV.

This guide is divided into seven sections based on the main concerns of community members around the impacts of climate change in the SJV. Each section includes communities' concerns shared during the interview process, explanations of how some of these issues are worsening due to climate change, and recommendations for how communities can prepare to advocate for industrial and agricultural best practices and combat and adapt to the changing climate in their regions. The guide also contains links to many additional resources. To access an online version of the guide with clickable links, please visit <https://www.ucsusa.org/resources/climate-change-san-joaquin-valley>. Links have been tested at the time of publication. UCS does not manage these domains and is not responsible for their content.

Why Are Your Actions Important?

Information is power. The Union of Concerned Scientists (UCS) hopes that the information and knowledge you gain from this guide will encourage you and others to advocate and develop community-driven adaptation strategies to climate change. While larger institutions like local, county, and state agencies are responsible for leading large-scale efforts to adapt to climate change, individuals and communities can educate themselves, become advocates, and start preparing community-based solutions now.

The Focus of This Guide Is on Water and Agriculture

In our interviews with people in the SJV, water quality problems were expressed in every conversation. Water is an everyday necessity, and when it does not meet a minimum quality for its use, it unleashes health problems, major inconveniences, and economic problems. While only one in 10 Californians lives in the SJV, the valley is home to more than half of the state public water systems that fail to meet water quality standards.¹ During the drought from 2012 to 2016, many wells went dry, further inhibiting community members' ability to access clean water.

Identifying communities' concerns is the first step to reducing the burden on people living in the Valley.

Climate change and groundwater regulations could also affect employment options in the SJV. Today, the main economic activity in the SJV is agriculture. However, agriculture jobs may decline in the coming years for reasons related to climate change as well as other factors such as increased automation. Efforts to diversify jobs in the SJV must consider the perspective of local stakeholders so that new opportunities align with the interests of farmers and communities.

Identifying communities' concerns around climate impacts is the first step to reducing the burden on current and future generations living in the SJV. While many of these issues unfortunately will persist for years, the power of information, education, and collaboration within and across communities has the potential to improve the quality of life for SJV residents.

“We do not inherit the earth from our ancestors; we borrow it from our children.”

The sections of the guide are as follows:

- What Is Climate Change, and What Does It Mean for the San Joaquin Valley?**
- Climate Change and Water Quality**
- Climate Change and Water Supply**
- Climate Change and Flooding**
- Climate Change and the Economy**
- Climate Change and Air Quality**
- Additional Resources**

A glossary of terms can be found on the last page of this guide. These terms are **bolded** and defined when first used in the text.

Disclaimer: The recommendations for adaptation strategies throughout this guide were identified based on scientific publications and have not been tested by UCS. UCS welcomes your comments, opinions, and recommendations. To get in touch, contact Dr. Pablo Ortiz at jportiz@ucsusa.org.



The San Joaquin Valley is a major food production hub and is uniquely vulnerable to the burdens of climate change. We must protect the region and its communities.

What Is Climate Change, and What Does It Mean for the San Joaquin Valley?

Climate Change Basics

The planet is warming faster than ever. **Heat-trapping gases**—such as carbon dioxide and methane—are building up in our atmosphere, creating a blanket around the globe that traps heat, like a greenhouse. This is also known as **global warming**, even though many of its effects go far beyond temperature changes. The global warming pollution comes from the use of **fossil fuels** such as oil, coal, and natural gas, and from agricultural and industrial activities. We burn fossil fuels to generate energy, to power vehicles and other transportation such as planes, and to manufacture countless products. The extra trapped heat has been changing important aspects of our climate and the **water cycle**, which is the movement of water in our planet (Figure 1).

For California, climate change means:²

- Higher temperatures
- Increasing evapotranspiration (water that evaporates or is used by plants)
- Longer and more severe droughts
- Declining snowpack
- More intense rain storms
- More frequent and extensive wildfires
- Sea level rise

Increasing Temperatures Impact People and Lead to Drier Conditions, Higher Evapotranspiration, Less Snowpack, and More Intense Fires

Extreme heat affects human health and well-being in many ways. Higher temperatures take a toll on farmworkers who, while working outdoors, are at risk of dehydration, nausea, or even heat stroke, which can be fatal. To better understand how higher temperatures are impacting farmworkers specifically, please refer to the UCS report [*Farmworkers at Risk*](#).

BOX 1.

Weather, Climate, and Climate Change

Weather describes the day-to-day changes in our atmosphere, as in “we may have some rain today” or “it’s going to be hot tomorrow.”

Climate describes weather patterns over longer periods, such as “it rains during winter in the Central Valley” or “temperatures in summer vary between 65 and 105 degrees.” One way to think about this is that weather is your mood on a single day, while climate is your personality as expressed over a longer period.

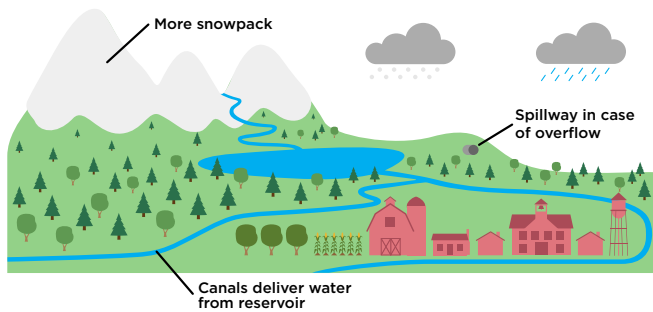
Climate change is the gradual, long-term change in all of the elements of weather (e.g., temperature, precipitation) on our planet over decades or even longer.⁸

The warming of the Earth reduces the moisture in the soil, increases **evapotranspiration** (water used by plants and evaporated from rivers and lakes), and speeds up the melting of snow and ice. Scientists also expect that the rainy season will become shorter.³ These changes facilitate the conditions for droughts and will increase their severity and frequency. Increasingly dry forests, grassland, shrubs, and other vegetation means increased fuel for intense wildfires, as California has seen in recent years.⁴ Fires and other climate-related events also put communities at risk as air quality worsens and increases the likelihood of respiratory illnesses. Both water⁵ and air⁶ quality issues increase the incidence of a number of health problems such as asthma, cancer, and birth defects.

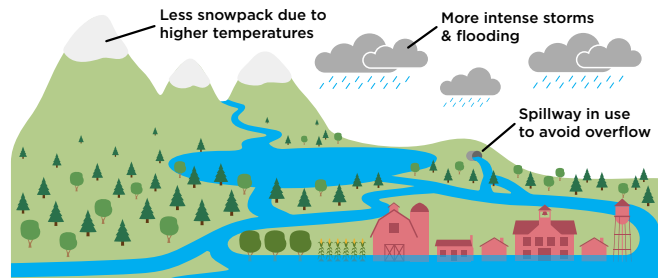
As temperatures rise, **precipitation** (water vapor that condenses and falls as rain, snow, or hail) is more likely to fall as rain, leading to reductions in the **snowpack**⁷ (the mass of snow that covers the mountains during winter and early spring). Snowpack in California is essential because it stores water that is used during the dry summer months to fill the state’s extensive system of reservoirs and deliver water to our homes and agricultural crops.

FIGURE 1. Expected Climate Change Impacts on California Water Supplies by the End of the Century

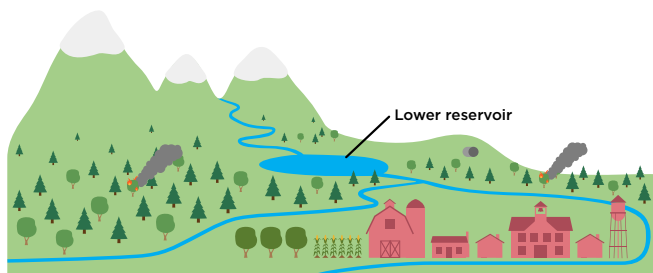
Historical - Winter



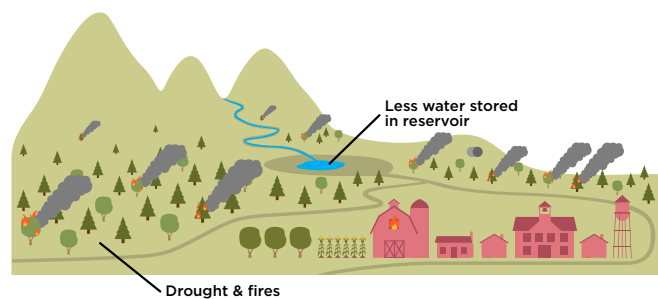
By End of Century (2100) - Winter



Historical - Summer



By End of Century (2100) - Summer



Scientists are certain that increasing temperatures, declining snowpack, and sea level rise are already happening. Longer and more severe droughts, more intense rainstorms, and more frequent and extensive wildfires are projected to materialize and intensify as heat-trapping pollution continues to be released into the atmosphere.¹⁰ In the San Joaquin Valley, these changes will directly affect water quality and availability.

Increasing Temperatures Lead to Floods and Sea Level Rise

Heat-trapping emissions are raising global temperatures, increasing evaporation from land and the oceans. For example, increased evaporation can be observed on hot days when you need to water your plants more often, because they release more water into the air via their leaves. Similarly, as the planet warms, water from the land and sea is evaporating into the atmosphere at a higher rate. A warmer atmosphere can also hold more water. This is one reason why, in a warmer world, scientists expect to see an increase in extreme climate events, such as extreme rainfall as well as more frequent and intense hurricanes that impact other regions in the United States, Puerto Rico, and the Gulf of Mexico.

As glaciers in the Arctic and Antarctica melt and as seawater expands due to higher ocean temperatures,

ocean levels are rising. In California, coastal cities will be affected by sea level rise, as will towns in the Delta, the area where the San Joaquin and Sacramento rivers flow into the San Francisco Bay. In Stockton, 10,000 people could be affected with three feet of sea level rise toward the end of the century at the current speed of global warming, and up to 50,000 people could be affected if levees fail.⁹

As the planet continues to warm, scientists expect an increase in extreme weather, such as severe storms and droughts.

Communities Can Increase Their Resilience Now

For these reasons, it is important to better understand the changes that are coming so that communities can prepare, reducing their **vulnerability** and increasing their **resilience**.

Climate change **mitigation** (efforts to reduce or prevent the emission of heat-trapping gasses) is under way. California and other states as well as countries around the world are moving away from fossil fuels and toward cleaner sources of energy, like wind and solar. In 2018, then-Governor Jerry Brown signed an executive order (B-55-18) requiring California to become **carbon neutral** by 2045. Carbon neutrality will mean that the carbon we remove from the atmosphere is equal to or greater than the carbon we emit.

“I realized that, very much like public health, climate change is related to everything going on.”

— Community organization member,
Bakersfield, CA

However, as of today, collective actions by cities, states, and countries fall short of what is needed for already-vulnerable communities. Even with rapid reductions in heat-trapping emissions, communities will still experience considerable climate impacts. Communities must be informed and act creatively to develop strategies to cope with and adapt to the impacts.

Collective actions by cities, states, and countries fall short of what is needed for already-vulnerable communities.

Climate Change and Water Quality

In UCS interviews with community members, water quality was among the top concerns. Poor water quality leads many people to rely on bottled water or interim water tanks for drinking and cooking, which represents a significant monthly expense. Others cannot afford bottled water, and access to clean water becomes a challenge during droughts. This can lead to people drinking contaminated water, which can have short- and long-term health effects, including cancer.

“We don’t think the water is that safe; we know there’s arsenic [and pesticides].”

— Community organization member, Lamont, CA

Community Members’ Water Quality Concerns

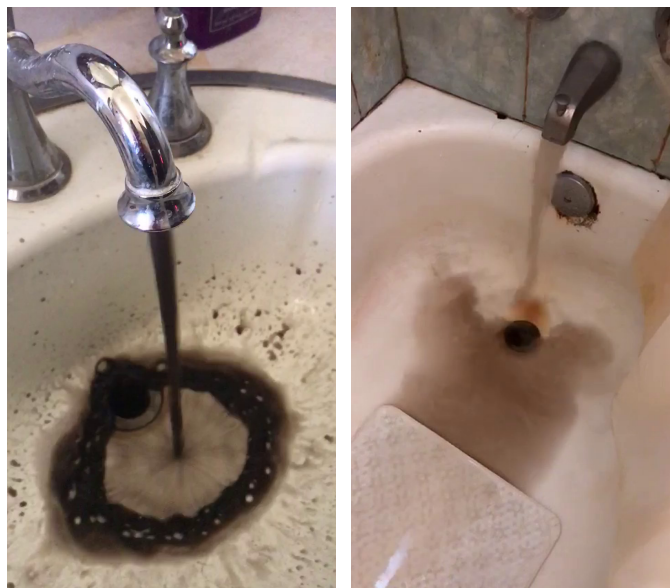
Interviews with SJV leaders and community members revealed several concerns related to water quality, including:

- Fear of drinking contaminated water from faucets or using it for cooking
- Fear that children do not have access to clean drinking water in schools
- Concern about dependence on expensive bottled water, interim tanks, and other temporary solutions
- Concern about their overreliance on septic tanks and the lack of basic sewage systems

These concerns are not unfounded. More troubling still, the problems communities identify today are bound to worsen with continued climate change.

“People complain that their clothes turn brown when they wash them. Or someone is bathing and all of a sudden it looks like they are bathing in mud.”

— City council member, San Joaquin, CA



Water with high concentration of sediments coming out of faucets in the city of San Joaquin. As climate change leads to droughts and increased water extraction, sediment and other contaminants are pulled into well intakes.

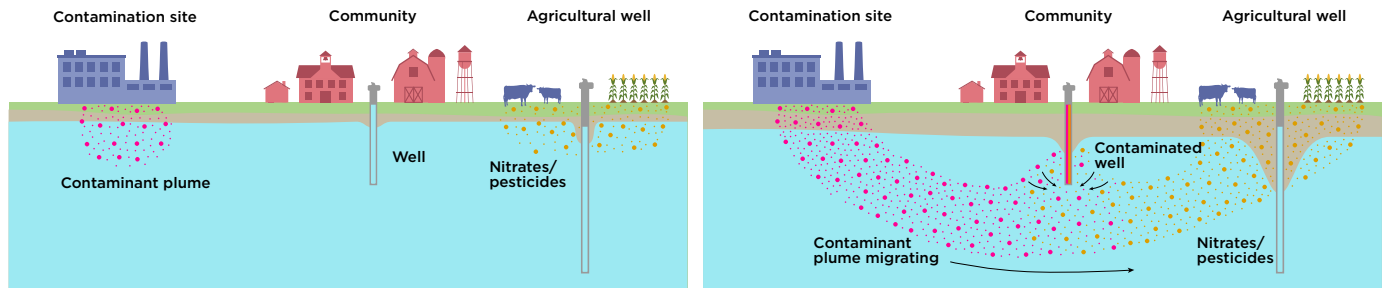
Provided by Jose Omelis

Connections between Water Quality and Climate Change

In California, groundwater levels usually rise during the winter wet season and decrease during the rest of the year, especially during summer. As climate change brings longer and more extensive droughts and as it concentrates the precipitation in the already-wet winter months, we can expect lower water levels in groundwater **aquifers** (a layer of rock and sand that is saturated with water) across the valley, further worsening water quality. These problems were observed during the 2012–2016 drought.¹¹

Increased water extraction concentrates existing contaminants, and moves contaminants closer to well intakes.¹² During prolonged droughts when the **water table** (the upper level of soil saturated with water) decreases due to

FIGURE 2. Contamination of Private and Community Water Supplies



Chemical processing plants and agricultural enterprises can leak contaminants such as nitrates and pesticides into groundwater, eventually contaminating the shallow wells and water supply of nearby communities. Climate change can further compound this issue, concentrating the contaminants.

increased groundwater pumping, chemical processes occurring between water and clay may also increase the concentration of arsenic in groundwater.¹³ Current evidence also suggests that groundwater pumping and irrigation increase the groundwater concentration of chromium VI (Cr(VI)), a contaminant associated with industrial activities.¹⁴

Climate change worsens water quality in rivers, lakes, and reservoirs as well. The combination of higher temperatures and the presence of nutrients like nitrates from agricultural land creates the ideal conditions for toxic algae to grow in rivers, lakes, and reservoirs. This can have devastating effects when algae consume all of the oxygen in the water, killing fish and other aquatic species.¹⁵

While a lower water table is linked to poorer water quality, the concentration of contaminants can be decreased through **groundwater recharge** (the movement of water downward from surface water to groundwater).¹⁶ Groundwater recharge occurs naturally when water from the rain, rivers, and lakes infiltrates into the ground. Groundwater levels in the SJV have dropped during the last century, and artificial recharge is now also being pursued by the Department of Water Resources to enhance recharge.

Eight Adaptation Strategies for Homes and Communities to Cope with Worsening Water Quality

The Environmental Protection Agency (EPA) advises you not to drink the water if contaminants are above the **maximum contaminant level (MCL)** (see Box 2, p. 9).

To protect yourself from the harms of poor water quality, and to work toward better water quality in your community, consider taking the following actions.

WATER TESTING, SEPTIC DISCHARGING, AND WATER FILTERS

- Determine the water quality level in your area. The EPA requires every community water system to produce and deliver an annual drinking water quality report to its customers and [provides information on how to read the report](#).
- To better know the quality of your water, you will need a water quality test. [MyTapWater.org](#) provides ideas on how to test your water quality for bacteria, pesticides, nitrates, and other contaminants.
- If you have a well, the nonprofit organization Self-Help Enterprise offers a water well assessment, repair, or replacement program in their service area (from Stanislaus County in the north to Kern County in the south). People living in the service area can call the Self-Help Enterprise at (559) 802-1685 or [complete a well assessment online](#).
- Never discharge septic tanks in your backyard or the street. Search for a septic tank cleaning and maintenance company that will properly empty the tank and dispose of the contents.
- You can reduce the concentration of multiple contaminants in your drinking water by using a granular activated carbon filter. These filters can be installed

continued on p. 10

Water Contaminants and Their Health Effects

Water quality problems in the SJV have both human causes and natural causes. Climate change is expected to increase the intensity and duration of droughts in the future, which will affect water quality. The main contaminants found in water supplies of the SJV that threaten human health are:

- Trichloropropane (1,2,3-TCP)
- Nitrates
- Arsenic
- Chromium VI or Cr(VI)
- Bacteria (*Salmonella* and *E. coli*)
- High concentrations of sediments

It is important that you know how to read water quality data to see whether the water is safe to drink. To obtain precise water quality data, you must have your water tested by a laboratory. However, you can get a general sense of what your water quality may be by visiting the [Drinking Water Tool](#) developed by the Community Water Center, a non-profit organization, and its partners.

The term maximum contaminant level (MCL) refers to a standard set by the EPA for the quality of drinking water. MCLs, expressed as concentrations, are established in order to keep public water systems safe by enforcing the legal limits on the amount of certain substances in drinking water. The following table show the MCLs for the most common contaminants in the SJV.

Trichloropropane (1,2,3-TCP) is a human-made chemical that was used for decades in agriculture. 1,2,3-TCP infiltrated

into the ground and, even though its use was banned in 1979, it has continued moving slowly into **groundwater** (water present below ground). 1,2,3-TCP has been shown to increase the risk of cancer and birth defects,¹⁷ and in some communities including Atwater, Wasco, and Shafter, it is present at levels more than twice the MCL.

Nitrates are formed when nitrogen combines with oxygen. In the SJV, nitrates mainly come from the application of nitrogen fertilizers on fields and from livestock facilities. Nitrate contamination in drinking water has been linked to cancer, birth defects, blue baby syndrome, and other adverse health effects.¹⁸ Nitrates also affect aquatic ecosystems because they encourage the growth of aquatic weeds. These weeds can impact navigation and recreational opportunities¹⁹ and make it harder for native plants and animals to survive. Near communities, another source of nitrates is septic tanks, which may leak or flood after heavy rains. Some people discharge them onto the ground, where their contents can seep back into the groundwater.

Arsenic is an element naturally found in rocks and soil, but overpumping has increased its concentration in the SJV's groundwater.²⁰ Arsenic in drinking water has been linked to an increased risk of cancer, heart diseases, and diabetes.²¹ Arsenic levels in the city of Tranquility surpass the MCL, and the city of Arvin has levels more than three times the MCL (see table for more information).

Chromium VI or Cr(VI) is a chemical whose presence in the SJV has both human and natural causes. While chromium VI can occur naturally in groundwater, industrial activities—such as metal plating, leather tanning, and others—can lead to elevated concentrations of this contaminant.²² Los Banos is an example of a community with more than three times the (currently unenforceable) MCL.

Some bacteria, microscopic organisms such as *Salmonella* and *E. coli*, and the parasite *Giardia* are associated with septic tanks. Emptying a septic tank in your backyard can contaminate the groundwater of your community and make your neighbors sick if they drink it or bathe with it.

A high concentration of sediments shows as dark brown water and is not uncommon in drinking water in SJV communities. It is related to old infrastructure, among other causes. In most cases, brown water coming out of faucets is a temporary burden and it becomes clear after letting it run; however, it represents a huge inconvenience when it happens while washing clothes, taking a shower, or performing other everyday activities.

Maximum Contaminant Levels of the Most Common Drinking Water Contaminants in the SJV

Contaminant	MCL
1,2,3-TCP	0.005 µg/L
Nitrates	45 mg/L
Arsenic	10 µg/L
Chromium VI	10 µg/L

Notes: µg = Microgram, L=liter. The MCL for chromium VI is no longer enforceable for reasons unrelated to knowledge about the chemical's toxicity, but represents a meaningful number for assessing water quality. The MCL was in place from 2014 to 2017, when it was suspended because of a technicality; the California Department of Public Health failed to present certain documents related to the economic feasibility of limiting levels of this toxin in drinking water.

in the plumbing at a faucet or be used in portable water pitchers. Be aware that these filters are unlikely to reduce certain contaminants below the MCL,²³ so this may reduce the impact but by no means solve the problem. Visit [EWG's Tap Water Database](#) to learn about a variety of filters and their pros and cons.

ADVOCATING FOR BETTER GOVERNMENTAL OVERSIGHT

- Advocate for safe and affordable drinking water with your government representatives. In 2012, California declared water to be a human right, stating in section 106.3 of the California Water Code: “every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.” Remind the State Water Resources Control Board of this declaration and make them aware that your right is not being fulfilled by sending an email to hr2w@waterboards.ca.gov. You may also contact the Central Valley Water Quality Control Board at (916) 464-3219 or send an email to info5@waterboards.ca.gov.

- At your local level, [your Groundwater Sustainability Agency \(GSA\)](#), which is responsible for creating a Groundwater Sustainability Plan, must avoid “significant and unreasonable” groundwater quality impacts. If you experience groundwater quality deterioration, let your GSA know.
- Ask your local city council representatives to apply for grants from the State Water Resources Control Board's Division of Drinking Water to improve infrastructure and water systems in your community.

Accountable Agency for Mitigating Water-Quality Climate Change Impacts

The California State Water Resources Control Board is responsible for water-related actions to prepare for and respond to climate change. You can contact them by phone (916) 341-5600 or email info@waterboards.ca.gov to ask them what actions they are implementing to protect your community from climate change impacts.



Drought and overpumping by the agricultural sector can leave people in the San Joaquin Valley without reliable access to safe, clean water, thereby forcing many to purchase bottled water, or like this Seville resident shown here, fill buckets with water.

Self-Help Enterprises

Climate Change and Water Supply

“Probably the biggest example is East Porterville. All those wells were failing very early in the drought. I mean, if you have contaminated water, at the very least you can wash your toilets, maybe take a shower. But if you don’t have any water, you can’t do anything.”

— Community organization member, Visalia, CA

Water Stress and the San Joaquin Valley

The SJV is California’s largest agricultural region and an essential contributor to the nation’s and world’s food supply. However, the region is increasingly experiencing **water stress**, which is the inability, or uncertain ability, to meet human and environmental water demands. Increased agricultural production in the SJV and its growing population have increased the demand for water over and above what is naturally available, making water stress more and more severe over the past decades and affecting households, businesses, schools, and other community institutions.

Typically in California, 60 percent of the water supply is from surface water (rivers, lakes, surface water reservoirs), and about 40 percent comes from groundwater. However, during a drought the situation is reversed, and the main source of water becomes groundwater. For example, during the 2012–2016 drought, about 60 percent of the water used came from groundwater and 40 percent was from surface water. The drought resulted in higher costs for the agricultural sector (for the energy required to pump more groundwater, for example) and in farmers’ overpumping of groundwater, and it triggered long-lasting effects including groundwater levels dropping beyond the reach of thousands of private and community wells. The region has responded by relying on bottled water and interim tanks.

Community Members’ Concerns about Not Having Enough Water

While droughts affect virtually everyone in California, low-income communities have fewer resources to deal with crises. Many communities in the SJV are especially

vulnerable because they are already coping with disproportionate poverty, high unemployment rates, diseases related to air and water pollution, and a lack of basic connections to water and sewage systems.²⁴ Additionally, during droughts, wells go dry faster in communities that depend on groundwater and are surrounded by agriculture. Because of these experiences, community members in the SJV are concerned about:

- A diminishing water supply due to wells going dry
- Job loss (as agriculture becomes less prominent in a more drought-stricken world)
- The cost of water

“We buy \$100 of [bottled] water almost every week.”

— Community member, Matheny, CA

More dry wells mean more people relying on bottled water and interim water tanks, or filling containers and hauling water from neighbors’ houses. There are also substantial economic costs. Because the main economic activity in the valley is agriculture, if it is affected by water stress, farmworkers might be at risk of losing their jobs. Lastly, multiple factors increase the cost of water and contribute to community members struggling to pay their bills. Among these reasons are water scarcity, being part of a small water system (with the cost distributed among fewer people), and having to pay for bottled water in order to ensure that drinking water is safe.



Self-Help Enterprises

A community member residing just outside on the southern edge of Visalia with a dry well fills water jugs to provide for their household's water.

Connections between Drought and Climate Change

California's complex geography and climate result in a great deal of variation in water availability from year to year. Scientists project that climate change will cause California to experience even more significant water variability in the future. This means more frequent, more intense, and longer-lasting droughts, and rainfall that is more extreme when it does arrive.²⁵ In other words, the dry season will be drier, and the wet season will be wetter.²⁶ These changes may lead to destructive floods and droughts, and the valley's infrastructure, cities, and farmlands are not prepared to balance or compensate for them.²⁷

Droughts also reduce energy generation from hydro-power, increase the risk of wildfires, degrade the quality of surface water and groundwater, reduce air quality, and harm fish and wildlife. As occurred during the 2012–2016 drought, excessive pumping lowers groundwater levels, causes private wells to go dry (as happened in East Porterville and Okieville), increases the energy and cost required to pump water, harms ecosystems that depend on groundwater, and reduces the water reserves needed to overcome future droughts. Aggressive overpumping can also dramatically increase the rate of **land subsidence**—the sinking of the land that can damage roads, buildings, and water systems.

“Climate change is a huge issue. And I guess that’s where the connection with the drought is, because climate change is reaching different extremes of hot and cold, and I know it has a huge impact on [agricultural] businesses.”

— Community organization member, Lamont, CA

As temperatures rise due to climate change, water demands are likely to increase.²⁸ Meeting California’s future water demands in an era of climate change and continued population growth will pose significant challenges for decades to come. Sustainable water resource management will require a balance between supply and demand that is yet to be achieved in California, and particularly in the SJV.

Seven Adaptation Strategies to Cope with Water Stress

- Fix leaks in your home and garden. Leaks not only waste water and increase your water bill, but also may damage walls and floors and cause mold. With time, mold can cause health issues such as allergic reactions or asthma attacks.

- Collect and use rainwater for irrigating or watering your garden.
- Use only the water that you need, and minimize the water that you use for a task. The organization American Rivers can provide you with [ideas](#).
- Consider [planting drought-resistant gardens with low water use](#), or use native plants instead of lawns, with these guidelines from the University of California.
- If you have fallen behind on your energy or water bills, the California Public Utilities Commission [may be able to help](#).
- If your community has been affected by wells going dry, talk with your community representatives and advocate for the closure of agricultural wells near communities or for less water-intensive crops. Also, advocate for reductions in the acreage of—or for fees for—less-essential crops such as almonds and pistachios, which are largely grown for export.
- Be aware of your behavior. Make sure that you maintain hydration in hot days, take breaks in the shade, and get protection from pesticides by using a face mask and gloves (especially if you work in the fields).

Accountable Agency for Mitigating Water-Supply Climate Change Impacts

The Department of Water Resources has a climate change program to ensure that Californians have an adequate water supply, reliable flood control, and healthy ecosystems, now and in the future. You can contact them at climatechange@water.ca.gov to ask them what actions they are implementing in your community, share your concerns, or offer ideas to implement.

Your local GSA is also responsible for managing groundwater resources sustainably. GSAs must take climate change into account and manage groundwater in a way that prevents unreasonable impacts from climate change. Find your local GSA by searching for your address on [this interactive map](#). Contact your local GSA to ensure that it is protecting your drinking water now and in the future as climate change impacts our water resources.



US Geological Survey

Between 1965 and 2018, some parts of the San Joaquin Valley sank 8.6 feet, a phenomenon known as land subsidence that is exacerbated by aggressive overpumping of groundwater. Because the land sinks unevenly, this can have devastating impacts on infrastructure such as roads.

Climate Change and Flooding

Flooding and the San Joaquin Valley

When people talk about flooding, the images that come to mind are heavy rains that damage homes and public infrastructure, leave cars floating in water, and produce huge agricultural losses. However, in some communities in the SJV, any rainfall event can produce flooding, since many communities lack sidewalks or basic sewage and sanitation systems.

Community Members' Concerns

Some community members report that parts of their communities flood because of a lack of drainage and sanitation infrastructure, and that these floods sometimes force children to walk through pools of water on their way to school (in some cases meaning that students spend all day with wet shoes and socks). Elderly and disabled adults can find it challenging or impossible to walk out of their houses when it floods because they risk falling and injuring themselves.

With that in mind, community members are concerned about:

- Flooding that makes it difficult or impossible to move about in their communities
- Lack of basic infrastructure for drainage and sanitation

Floods in the SJV have historically caused frequent disruptions in local communities, including Lamont, Fuller Acres, Mendota, and Huron, which become isolated when flooding occurs. In many vulnerable communities in the SJV, floods can prevent individuals from going to their workplace or getting food and prevent children from going to school. Often, mud and water accumulate on unpaved streets that lack sidewalks. The situation forces people to cross pooled water to get out of their homes or to public transportation. The water can be so deep that streets are difficult to navigate, even for cars.

“The drainage is not good, or there is none. Children have to get their feet wet and spend the rest of the day with wet shoes.”

— Community activist, Matheny, CA

Connections between Floods and Climate Change

In California, projections show that rainstorms during the wet winter months will likely become more extreme, with more water falling in shorter periods of time and potentially creating floods.²⁹ One way to understand this is to imagine the soil as a sponge. If you pour water on it slowly, the water will be absorbed until the sponge gets saturated. However, if you pour a large quantity of water on it all at once, much of the water will run off of the sponge and not be absorbed.

Increased rainfall also causes floods when rain falls on top of snow in the mountains.³⁰ The resulting rapid snowmelt has historically been a reason for major floods.³¹

Five Adaptation Strategies to Cope with Floods Worsened by Climate Change

Flood infrastructure (and infrastructure in general) is very expensive, and families and communities alone cannot—and should not—be expected to solve problems related to floods in their communities without government support and resources. However, there are things community members can do to deal with some of the impacts:

- Organize a carpool or ride-sharing system to take children to school during rainy days to prevent them from getting wet on the way.
- Dig temporary channels before the rainy season to move water from common areas that get flooded into shallow ponds.
- Demand that government representatives create drainage systems in your community.



Poor drainage infrastructure in the San Joaquin Valley has been disrupting people's activities and often forcing residents to travel through pooled water. Policymakers must invest in drainage and other strategies to reduce the impacts of flooding on communities.

- Keep the streets clear of trash and plastic to allow the water to flow.
- The EPA has guidance on how to [create a simple system to capture rainwater from your roof](#). This water can then be used for your plants and yard, to wash your car, or for other outdoor uses.

Accountable Agency for Mitigating Floods Impacts

To help manage some of the largest flood-related problems, the California Department of Water Resources is developing a program to replenish the groundwater aquifers in California using floodwater. This program, known as Flood-Managed Aquifer Recharge (Flood-MAR),

is “an integrated and voluntary resource management strategy that uses floodwater resulting from . . . rainfall or snowmelt for groundwater recharge on agricultural lands and working landscapes.”³² Flood-MAR has multiple objectives beyond reducing the risk of floods, including improving surface and groundwater quality, recovering wetlands and aquatic ecosystems, creating recreational opportunities, and replenishing aquifers to allow the state to be better prepared for future droughts. Flood-MAR will require large investments and the cooperation of landowners and others to be able to preserve California’s water resources for agriculture, communities, and the environment. However, this is an example of the type of thinking that state policymakers are using to better manage water in extreme precipitation and flood events using a framework to benefit everyone in California.

Climate Change and the Economy

Climate Change–Prompted Economic Shifts in the San Joaquin Valley

In addition to taking action in response to specific climate change impacts as discussed above, you may consider thinking more broadly about and start planning for potential climate-related changes in employment options in the SJV. Today, the main economic activity in the SJV is agriculture. Agriculture may decline in the coming years for reasons related to climate change, as well as other factors such as increased automation. However, these changes may also bring new opportunities to farmers and communities that are or may be superior to the current job options.

Community Members’ Concerns

A history of racist and exclusionary policies in the SJV has deliberately disconnected rural communities from their neighboring cities, leaving many of them unincorporated. Unincorporated SJV communities receive insufficient resources from county and state governments. For some communities, it would be beneficial for nearby cities to incorporate them (to share water and sewage systems, for example); for others, county and state governments should provide resources to improve infrastructure (sidewalks, street lights, parks), diversify job opportunities, and increase educational and recreational opportunities. Among the community members’ concerns are:

- Few job opportunities
- Low wages
- Automation in agriculture, which threatens to diminish job opportunities further

- Too few opportunities for education, training, and extracurricular activities
- High energy bills

Economy in the Central Valley and Climate Change

The economy in California’s Central Valley is heavily dependent on agriculture, which is already being affected by climate change.³³ As noted above, droughts are likely to occur more often. There is less snow in the mountains, and it melts earlier—sometimes too early to be used for irrigation. In addition, increased heat and dryness mean higher water demands; sea level rise threatens to salinize farmlands near the ocean and in the San Joaquin Delta; and there are fewer chill hours during the winter and warmer evening temperatures year-round, reducing the quality of some high-value crops like stone fruits. Furthermore, there is an increase in water demand in cities, and recent groundwater legislation, like the Sustainable Groundwater Management Act, is likely to impose limits on groundwater pumping, which may increase the cost of water and reduce agricultural land. To decrease the risk to agriculture, farmers could diversify their businesses to include other options such as carbon sequestration agriculture (practices to move carbon from the atmosphere into the soil), switching to drought-resistant crops (e.g., vines), or repurposing some of the land for new business activities.

Many vulnerable communities in the SJV depend on agriculture for jobs and will be directly affected by decreasing agricultural activity in the valley. Job insecurity may also increase as the fossil fuel industry shrinks (though this trend would bring broad benefits overall).

“Most people who work in the fields are people who live paycheck to paycheck. They are struggling every day with their annual income. I would say that about 50 percent of the people who live here make around \$15,000 to \$20,000 [per year].”

— City council member, San Joaquin, CA

In addition, agriculture is adopting new equipment, including robots, to do part of the labor. Machines will automate some tasks,³⁴ decreasing the necessity to hire farm workers. Agricultural employment will become more technical and specialized.

OPPORTUNITIES IN SOLAR BUSINESSES

With these climate change challenges, however, new businesses are appearing in the Central Valley that may bring new opportunities to communities. One example is solar panel installation and maintenance.³⁵ The government of California seeks to reduce the state's dependence on fossil fuels, and they are promoting the use of renewable energy. At the same time, an estimated 500,000 acres of irrigated cropland will be idled by 2040 under the Sustainable Groundwater Management Act.³⁶ Since farmers will need to repurpose land, many of them are starting to consider installing solar panels on land formerly used to grow water-intensive crops: This way, they will save in water and in energy bills. They can even sell the energy to others and start a new line of energy business on their farms. The price of solar panels and wind turbines is dropping, and the Central Valley is an ideal location for solar energy farms. More trained technicians will likely be needed to install and maintain them.

OPPORTUNITIES IN PROVIDING ECOLOGICAL SERVICES

Other profitable options for farmers are projects supported financially by the government, such as **management of aquifer recharge**, or **green wildlife corridors**. All of these changes can reduce agriculture-related job positions in vulnerable communities while bringing new opportunities to farmers and communities for the present and the future.

Seven Adaptation Strategies to Cope with a Climate Change–Affected Economy

California suffers from socioeconomic inequities that limit the opportunities in the SJV. Community members understand that education can improve some of the conditions in their communities, and a college degree may increase their opportunities (the more educated you become, the better your job tends to be).³⁷

*“What changed my life is education.
I’m the first one in my family
to graduate from high school.
First one to graduate from college.
And guess what? Everybody follows.”*

– City council member, Kerman, CA

While the Central Valley will continue to generate job opportunities in agriculture, there will be many new opportunities related to emerging industries, along with fewer job opportunities for workers without special or technical skills.

- If you're looking for future job opportunities, see California's [100 fastest growing jobs](#) or consider these areas:
 - Construction and maintenance of solar and wind energy farms
 - Training for residential solar installation. The non-profit GRID Alternatives [offers such programs](#).
 - Energy efficiency, including in heating, ventilation, and air conditioning (HVAC)
 - Land management and aquifer recharge
 - Wildlife management
 - Carbon sequestration in agriculture
- Look for careers that will flourish in the future and check out pre-apprenticeship and apprenticeship programs, vocational training, online classes, and certifications, and become college-educated if you can. Many schools have scholarship opportunities which you can learn about on their websites.
- If you have children, encourage them to pursue a college education and connect them with college-ready support groups, such as [99Rootz](#). There is strength in companionship, and this can open many doors. A few role models will encourage others to follow.
- Take advantage of the educational opportunities offered by many county education offices and local non-profits that provide educational support for at-risk youth.

“If you go to school hungry, you’re not going to learn enough, and I can tell you that because I went through those things myself.”

– Civil rights activist, Parlier, CA

- Advocate for an economic transition that benefits your community: community members must have a voice in what is going to happen near their homes, and the new economy must be beneficial for all regardless of race/ethnicity or income. This includes having safer industrial areas located near communities that provide fair wages and means keeping the clean energy generated in the valley first within the valley.
- Homeowners can apply to the [Energy For All Program](#) run by [GRID Alternatives](#) for rooftop solar installations.
- Stanislaus residents can visit the Central Valley Opportunity Center to [apply](#) for home improvements and energy assistance and crisis programs for installation of energy conservation devices or help to pay energy bills.



Self-Help Enterprises and Meza Films

Communities that border agricultural land, like those shown here in Fresno county, have historically experienced socioeconomic and environmental inequities. Climate change is triggering an important transition in the Valley that can only be mitigated by considering the expertise of its most vulnerable residents.

Climate Change and Air Quality

In addition to water quality, air quality is another major concern of people living in the SJV. Some areas of the SJV experience the worst air quality in the country.³⁸ The sources of the air quality problems are diverse, including nitrogen oxides (NOx) and particulate pollution from vehicle emissions, ammonia from cattle, NOx emissions from dairies, smoke from wildfires in other regions of the state, pesticide drift and dust from agriculture, agricultural burning, and residential wood and dry leaf burning, among others.³⁹ In addition, the SJV sits between two mountain ranges—the Sierra Nevada and the Coastal Mountain Range—where pollution accumulates. Air quality problems increase the incidence of respiratory diseases, including asthma. Some studies show that people living in areas with poor air quality have higher rates of illness and death due to cardiovascular and respiratory diseases, as seen with COVID-19.⁴⁰

Air pollution in the valley is made up of ozone and particles. **Ozone** is a gas that is beneficial when it exists high in the atmosphere, where it protects the earth from solar radiation. But at ground level, it is the main component of smog, formed by the combination of vehicle emissions and methane exposed to sunlight, and it can be harmful to our lungs. Health risks from breathing ozone include shortness of breath, asthma attacks (and emergency room visits associated with asthma),^{41,42} and other respiratory diseases.

Particle contamination (often referred as **PM_{2.5}** and **PM₁₀**, depending on the size) include many different pollutants, from the smoke coming out of cars' tailpipes to dust to pesticides. Health risks vary depending on particle type, but in general this pollution is associated with increased risk of heart disease, lung cancer, and asthma attacks.⁴³

While not entirely an air quality problem, another concern in some areas of the SJV is Valley fever, an often-fatal disease caused by inhalation of soil particles that contain spores of one of two fungus species. There are not always symptoms, but some patients show reaction similar to influenza or pneumonia.⁴⁴ Cases of Valley fever have increased in recent years.⁴⁵

Community Members' Concerns

Community members are concerned about:

- Pesticides drifting from agricultural areas into communities
- Dust storms
- Emissions and odors from agriculture and industry
- Increased cases of asthma, allergies, and Valley fever
- Pollution from industrial operations, oil refineries, heavy trucks

In some cases pesticides are sprayed by plane, and with moderate or strong winds they can float to nearby communities. People have reported that sometimes this happens in fields located next schools. In addition, dust is generated when the land is prepared for the growing season, during the harvest, and when some of the fields are idle during winter. Many community members mentioned how this pollution is getting into their lungs and affecting their health.

Communities close to Bakersfield reported odors and “heavy air” from nearby oil refineries. Other people close to Tulare complained about the smell coming from the manure used as fertilizer, and about the “heavy dust” that

“Air quality right now is the worst we have had. Even the farmers who are [spraying pesticides] are not even cautious [about spraying towards communities]... The other day they sprayed [pesticides] towards the house. There were strong winds, and everything came here.”

— Community member, Matheny, CA

sticks to the cars. The smell, they say, only gets worse on hot days.

The dust not only raises health concerns but also represents danger when driving during dust storms because of the reduced visibility.⁴⁶ The perception of community members is that dust storms have been getting worse in the last years. Among possible explanations for this are some agricultural practices that rely on intense tillage and removal of all vegetation cover, exposing the bare soil to the elements. This leaves the top layer of soil dry, facilitating its being lifted up during strong winds, potentially also carrying pesticides.

Air Quality and Climate Change

From a climate perspective, scientists are still investigating whether wind speeds that could potentially carry more pollution particles are likely to increase. There is more certainty about reductions in soil moisture, as climate change will increase the likelihood of soils getting dry to a point that dust flies from the fields to communities on a regular basis. In the case of ozone, higher temperatures and potentially more sunny days make it easier for it to form and harder for it to be removed.⁴⁷

Other non-climate reasons that may exacerbate the problem are regulatory processes related to the **Sustainable Groundwater Management Act of California (SGMA)**, as some of the agricultural land will need be repurposed to other land uses. If done correctly, land use changes can be an opportunity to solve part of the valley's air quality problem and prevent the retired lands with bare soils from being located close to vulnerable communities. Repurposing part of the agricultural land can also be an opportunity to transform some of the current fields into parks, wetlands, and conservation and recreational areas that with time may improve the air quality in the valley.

The case of Valley fever is concerning because some studies suggest that the shifts between high humidity for the spores to germinate and dry periods to disperse the

spores and reproduce⁴⁸ are similar to the shift shown in climate projections. More research is needed to reach a conclusion about any relationship between climate change and Valley fever.

Many of the solutions that would limit future climate change also help to improve air quality. With many residents of the Central Valley suffering from poor air quality, improving air quality by addressing climate change is a win-win.

Eight Adaptation Strategies to Cope with Worsening Air Quality Because of Climate Change

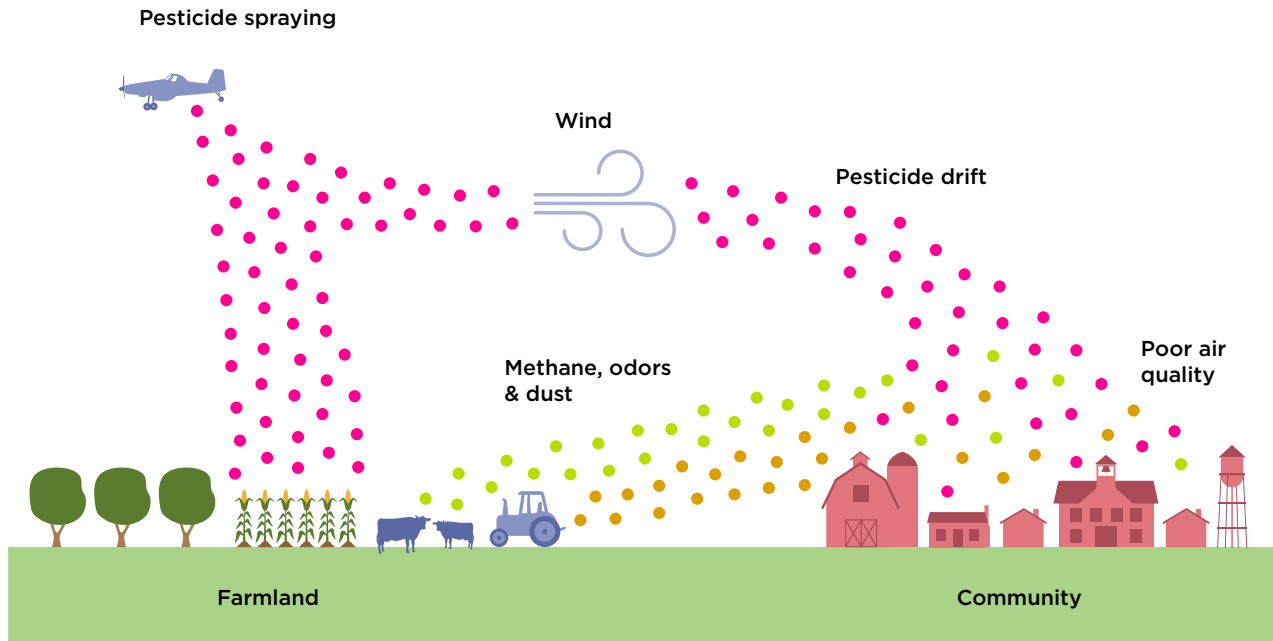
Here are some actions that you can take to reduce your exposure to air contaminants.

- Submit an air pollution complaint to the San Joaquin Valley Air Pollution Control District if you detect offensive odor, observe smoke, or observe pesticides drifting into communities, dust, or any other air pollution problem. Here are toll-free numbers for SJV counties:
 - San Joaquin, Stanislaus, Merced: (800) 281-7003
 - Madera, Fresno, Kings: (800) 870-1037
 - Tulare, SJV portion of Kern: (800) 926-5550
- Organize tree planting to form barriers between farmland and highways that can protect the most relevant areas of the community, such as schools. Local, state, federal, and private funding may be available for this kind of effort, for example, CalEPA grants or grants from the California Air Resources Board.
- Remain indoors with the windows closed during dust storms and when airplanes are spraying pesticides in areas nearby.
- For farmworkers, a good practice is to use a facemask while working in the fields, particularly while performing activities that cause dry soil to rise into the air when the wind blows.

“Once there were five members of my family with Valley fever. Only my brother survived. My other four family members died. I’ve had my nephew as young as 17 die of Valley fever.”

— City council member, Kerman, CA

FIGURE 3. How Pesticides and Other Contaminants Reach Communities



Pesticides sprayed over orchards and fields can be picked up by wind and carried to nearby communities, which can lead to serious health risks. Odors and dust from livestock and machinery can also drift, damaging air quality further.

- If you have asthma or other respiratory problems, stay indoors during days with high ozone concentrations. You can check real-time air pollution levels and other recommendations at the [World Air Quality Index Project](#) or at the [AirNow website](#).
- Advocate for cleaner vehicles, including large vehicles such as trucks.
- Advocate for communities to have regular access to personal protection equipment (PPE), such as N95 masks for adults and appropriate masks for children, for use

on days with poor air quality. These are especially valuable in sensitive sites, such as schools.

- People looking to purchase or lease a new vehicle may be eligible to apply for California Air Resources Board's [Clean Vehicle Rebate Project](#). These are rebates of up to \$7,000 for the purchase of certain zero-emissions or plug-in hybrid light-duty vehicles.

Accountable Agency for Mitigating Air Quality Impacts

In 2006, California passed the Global Warming Solutions Act (Assembly Bill 32),⁴⁹ which was the first program in the country for addressing climate change. This act requires the California Air Resources Board to implement the law and “...help mitigate risks associated with climate change, while improving energy efficiency, expanding the use of renewable energy resources, clean transportation, and reducing waste.”⁵⁰ If you don't feel like they are doing enough to address air quality and climate change concerns for your community, let them know at (800) 242-4450 or send an email to helpline@arb.ca.gov.



In addition to pesticide drift harming local vulnerable communities, dust raised by heavy machinery in orchards and fields can also be carried by the wind to nearby homes, exacerbating air quality issues.

Eliseo Gamino

Additional Resources

To access an online version of the guide with clickable links, please visit: www.ucsusa.org/resources/climate-change-san-joaquin-valley. Links have been tested at the time of publication. UCS does not manage these domains and is not responsible for their content.

Organizations

If you can relate to any of these concerns, know that there are people like you and many organizations working to improve the lives of people in SJV communities:

- [Community Water Center](#)
- [Leadership Counsel for Justice and Accountability](#)
- [Self-Help Enterprises](#)
- [Clean Water Action](#)
- [Central Valley Leadership Roundtable](#)
- [Central California Asthma Collaborative](#)

Guidance and Tools

[101 Small Ways to Make Small Changes](#)

At this website you can find ideas to awaken your creativity and gain inspiration to make small changes in your community that have a big impact. Big change can start with a smile.

[Appropriate Technology Guide](#)

The Rural Community Assistance Corporation developed this guide to help small water systems on selecting appropriate technology solutions.

[Cal-Adapt.org](#)

Here you can find data, tools, and resources to develop adaptation plans, by the California Energy Commission and Strategic Growth Council.

[California Adaptation Planning Guide](#)

The California Office of Emergency Services developed this guidance on how local governments can plan and adapt to climate change.

[Getting Involved in Groundwater](#)

This guide is designed to help you get involved in developing a local groundwater sustainability plan.

[Groundwater Technical Assistance Network](#)

The Groundwater Technical Assistance Network aims to connect local stakeholders and technical experts in order to enhance community participation in local groundwater planning efforts.

[Know Your Rights as a Farmworker](#)

The US Department of Labor provides information on your rights and how to prevent accidents and diseases related to working in agriculture.

[Rural and Small Systems Guidebook to Sustainable Utility Management](#)

The US Department of Agriculture and the Environmental Protection Agency developed this guidebook to help rural and small water and wastewater systems in their common mission to become more successful and efficient service providers.

[SB 379 Safety Elements of General Plans](#)

The bill requires the inclusion of climate adaptation and resilience strategies in the safety element of cities' or counties' general plans.

[SB 1000 Toolkit: Planning for Healthy Communities](#)

This guide, developed by the California Environmental Justice Alliance, provides guidance for local governments, planners, community-based organizations, and other stakeholders who will be working to develop environmental justice elements or policies for cities' or counties' general plans.

[Science Advocacy Toolkit](#)

Are you a scientist looking for ways to use your expertise for the good of your community? If so, this toolkit is for you.

[Social Media as an Advocacy Tool](#)

Social media can be a powerful tool to increase awareness and advocate for change. This toolkit provides ideas about ways you can be more impactful in social media platforms.

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[GLOSSARY]

Adaptation (to climate change). Anticipating the harmful effects of climate change and taking action to prevent or minimize the damage.

Aquifer. An underground layer of rock or soil that holds groundwater.

Carbon neutral. When the amount of carbon (most notably, carbon dioxide (CO₂)) removed from the atmosphere by natural means (such as trees) or technology (using machines that remove carbon from the air or water) is the same as or greater than carbon emissions.

Climate. The weather over a long period in a specific area.

Evapotranspiration. Water from the land or transpired by plants that becomes vapor.

Fossil fuels. Fuels including oil, coal, and natural gas, which were formed in the geological past from the remains of living organisms. The use of fossil fuels in transportation, agriculture, industry, and buildings is a major contributor to climate change.

Global warming. The gradual, long-term heating of the atmosphere observed since the pre-industrial period (1850-1900) and accelerating in recent decades.

Green wildlife corridor. An area of habitat connecting wildlife populations that are separated by human activities or structures (for example, roads, development, logging).

Groundwater. Water present beneath the Earth's surface in soil or rock.

Groundwater recharge. The process by which water moves downward from surface water to groundwater.

Heat-trapping gases. Gases present in the atmosphere capable of absorbing infrared radiation, thereby trapping and holding heat in the atmosphere.

Land subsidence. The compaction of soil and rock over time due to the withdrawal of the groundwater that supports it. Subsidence reduces the storage capacity of aquifers, and damages infrastructure (e.g., buildings, roads, water canals)

Management of aquifer recharge. Methods that recharge an aquifer using either surface or underground recharge techniques.

Maximum contaminant level (MCL). The highest level of a contaminant that is allowed by the Environmental Protection Agency (under the Safe Drinking Water Act) in drinking water.

Mitigation (of climate change). Efforts to reduce or prevent the emission of heat-trapping gases and, consequently, reduce or prevent further climate change.

Ozone. An odorless and colorless gas produced naturally, when the energy in sunlight acts on oxygen molecules in the air, and by human activities, in the form of smog.

Particle contamination (PM_{2.5} and PM₁₀). Air pollution that can be either solid or liquid and can come from many different sources. Particulate matter is tiny particles that can be inhaled and cause serious health problems.

Precipitation. Rain, drizzle, sleet, snow, and hail. The primary source of delivery of atmospheric water to Earth, a stage of the water cycle in which water is released from clouds.

Resilience (to climate change). Communities' and individuals' capacity to adapt and maintain functionality in response to stresses.

Snowpack. A mass of snow on the ground that is compressed and hardened by its own weight and melts during spring, replenishing reservoirs.

Sustainable Groundwater Management Act of California (SGMA). State legislation that, for the first time, attempts to achieve sustainable groundwater management in California.

Vulnerability (to climate change). Degree of susceptibility that occurs when someone is at risk and does not have the resources to overcome the risk.

Water cycle. A set of processes by which water circulates between the Earth's oceans, atmosphere, and land.

Water stress. An inability to meet human and ecological water needs while maintaining water quality and accessibility.

Water table. The upper level of soil saturated with water. Also called the groundwater table.

Weather. The day-to-day condition of the atmosphere—clear, cloudy, warm, cold, windy, etc.

Climate Change in the San Joaquin Valley

A Household and Community Guide to Taking Action

Local, county, and state agencies are responsible for leading efforts to mitigate and adapt to climate change. Individuals and communities can become advocates, and start preparing community-based solutions now.



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