

# Policy Framing Paper: Climate Resilience

Resilience is defined as the ability of a community to prepare for, respond to, and recover from disruptions created or caused by climate change. State law requires that the Contra Costa General Plan address climate change adaptation and resilience.

This policy paper discusses the regulatory framework for adding adaptation and resilience into County policies, the climate change hazards affecting the resiliency of Contra Costa County, and considerations when drafting resiliency policies in the General Plan update process. The policy considerations also include a brief summary of the results of the County’s vulnerability assessment. The full vulnerability assessment is available for review on the Envision 2040 website.<sup>1</sup>

## 1.1 REGULATORY FRAMEWORK

State law requires General Plans to address climate change adaptation and resilience. With the adoption of Senate Bill (SB) 379 in 2015, the State expanded California Government Code Section 65302(g) to require the Safety Element of the General Plan to include more information about wildfire hazards, flooding risks, and short-term and long-term threats posed by climate change. To address climate change adaptation, the safety element update must include: 1) a vulnerability assessment identifying the risks that climate change poses to the local jurisdiction; 2) a set of goals, policies, and objectives based on a vulnerability assessment for the protection of the community; and 3) a set of feasible implementation measures to carry out the goals, policies, and objectives. Safety elements must be reviewed and revised with each revision of the housing element or local hazard mitigation plan (LHMP), but no less than once every eight years, to address climate adaptation and resiliency and identify new information relating to flood and fire hazards.

The State prepared a guidance document, the Adaptation Planning Guide, to assist communities in addressing climate adaptation and resilience. This guide presents a step-by-step process for gathering the best available climate change science, completing a climate change vulnerability assessment, creating adaptation strategies, and integrating those strategies into general plans and other policy documents. The County’s adaptation planning efforts are consistent with the guidance in the Adaptation Planning Guide.

### Key Terms

**Climate Change:** *A change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer.*

**Adaptation:** *Making changes in response to current or future conditions, usually to reduce harm and to take advantage of new opportunities.*

**Mitigation:** *Sustained action taken to reduce or eliminate the long-term risk to human life and property through actions that reduce hazard, exposure, and vulnerability.*

**Resilience:** *The ability of a community to prepare for, respond to, and recover from disruptions created or caused by climate change.*

<sup>1</sup> <https://cocogis.maps.arcgis.com/apps/MapSeries/index.html?appid=869e23fd058d48dbb1e514ef15841831>

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### 1.2 RESILIENCE CONDITIONS IN CONTRA COSTA COUNTY

The County conducted a vulnerability assessment to assess the long-term impacts of climate change on community assets and populations throughout the county. The following sections describe 13 climate hazards affecting resiliency in Contra Costa County: agricultural pests and diseases, air quality, drought, extreme heat, fog, human health hazards, landslides and debris flows, seismic hazards, severe storms, sea level rise, shoreline flooding, inland flooding, and wildfire. Each of these climate hazards can occur on varying temporal scales. For example, a long-term drought could occur over multiple years, but within that timeframe an acute shoreline or inland flooding event could occur. Some hazards also have the chance to create additional hazardous conditions. For example, an extreme heat event could lead to poor air quality and increase the potential for human health hazards. Hazard maps can be found in the interactive vulnerability assessment, located online [here](#).<sup>2</sup>

#### Regional resilience efforts around the Bay Area

**ABAG Resilience Program:** *The Association of Bay Area Governments developed the Resiliency Program to assist local governments and residents in planning for earthquakes, the effects of climate change, and other hazards. The goal of this program is to develop a regional land use pattern that reduces risk of natural hazards, provide a platform for joint planning efforts, disseminate best available science and good policies, and provide tools to local governments to develop and implement adaptation and mitigation plans.*

**Adapting to Rising Tides:** *The San Francisco Bay Conservation and Development Commission and NOAA's Office for Coastal Management brought together local, regional, State, and federal agencies to collaborate on how current and future sea level rise will impact key community assets throughout the Bay Area, including the Delta region of eastern Contra Costa County.*

**Resilient by Design Challenge:** *The Resilient by Design Challenge focused on the flood risks created by increases in severe storms and sea level rise. This is a project-specific, collaborative effort to research and design innovative solutions to adapt to flood risks in nine locations throughout the San Francisco Bay Area. One of the projects, ourHome, is located in North Richmond.*

### Agricultural Pests and Diseases

The farms and ranches of Contra Costa County face risks from pests and diseases that may affect crop plants, trees, and livestock. These pests and diseases can cause plants and animals to grow slower, damage them so that their products are less appealing and harder to sell, or kill them. While there are treatment options for a number of agriculture and forestry diseases, some have no cure, and others can lead to community and ecological health risks due to increased use of pesticides. Temperatures are expected to get warmer earlier in the year and remain warmer until later in the year, creating a higher threat of infestation or infection because many pests and organisms that carry diseases are most active during warmer months.<sup>3</sup> Higher average temperatures can also indirectly harm many crop plants, trees,

<sup>2</sup> <https://cocogis.maps.arcgis.com/apps/MapSeries/index.html?appid=869e23fd058d48dbb1e514ef15841831>

<sup>3</sup> California's Governor's Office of Planning and Research (OPR), California Natural Resource Agency (CNRA), and California Energy Commission (CEC). 2018. "California's Fourth Climate Change Assessment". <http://www.climateassessment.ca.gov/>.

and livestock that are already weakened by changes in precipitation. The weaker plants and animals may not be able to fend off infestations or infections as well as a stronger plant or animal, causing pests and diseases to affect more of the population.

## **Air Quality**

The dominant sources of air pollution within Contra Costa County are ozone pollution from vehicle exhaust, particulate matter from industry and diesel trucks, and allergen distribution. Ground-level ozone, projected to increase in most places already experiencing high levels, is associated with a variety of negative health outcomes, including reduced lung function, pneumonia, asthma, cardiovascular diseases, and premature death.<sup>4</sup> During fall and winter months, high pressure weather systems can stay for long periods over the Bay Area region, which trap near-ground particulate matter primarily from wood-burning fireplaces. In areas with already high levels of particulate matter, this could cause particulate matter to stay in the air for longer periods of time. This could increase cardiovascular and asthma-related health complications.

## **Drought**

A drought occurs when conditions are drier than normal for a long period of time, making less water available for people, agricultural uses, and ecosystems. Droughts are a regular occurrence in California; however, scientists expect that climate change will lead to more frequent and more intense droughts statewide. Communities within Contra Costa County may experience water shortages during drought conditions, which could lead to mandatory water restrictions for both domestic and agricultural purposes. Farmers may need to cut back on irrigation, and ranchers may need to reduce their number of livestock. Less precipitation could lower water levels or decrease water quality at streams and lakes, which can affect both natural habitats and recreation. In urban areas of the county, the price of water could increase during drought periods, increasing the economic instability of low-income residents.

## **Extreme Heat**

Extreme heat occurs when temperatures rise significantly above normal levels for the local area. For example, an extreme heat day is where temperatures reach 93 degrees in Rodeo, 97 degrees in Alamo, and 102 degrees in Knightsen.<sup>5</sup> The countywide historical average of four extreme heat days per year is likely to increase to an average of 14 to 19 extreme heat days per year by mid-century and an average of 18 to 30 extreme heat days per year by the end of the century, although conditions may vary in different parts of Contra Costa County. Extreme heat can cause heat-related illnesses, such as heat cramps, heat exhaustion, and heat stroke, in addition to exacerbating respiratory and cardiovascular illnesses. Many homes, including older structures or homes in the west or central parts of the county, may lack air conditioning. As a result, people living in these homes may be more susceptible to harm from extreme heat events. If homes have air-conditioning, residents may find increase use cost prohibitive. These extreme temperatures can harm animals and plants that are not adapted to these conditions. Some types of infrastructure, including power lines and roadways, face greater stresses during high temperatures that

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<sup>4</sup> Ackerly, David, Andrew Jones, Mark Stacey, Bruce Riordan. (University of California, Berkeley). 2018. San Francisco Bay Area Summary Report. California's Fourth Climate Change Assessment. Publication number: CCCA4-SUM-2018-005.

<sup>5</sup> California Energy Commission. 2018. "Extreme Heat Days and Warm Nights." <http://caladapt.org/tools/extreme-heat/>.

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make failure more likely. Extreme heat can also increase the risk of wildfires by drying out plant material, and prolonged high temperatures can contribute to drought conditions. Very high temperatures make people less likely to venture outside, hurting economic sectors that depend on outdoor activities.

### Fog

Fog is a very low cloud that usually is low enough to touch the ground, which forms as a result of air near the surface reaching the right temperature to form water vapor in the air and condense into a cloud. In Contra Costa County, fog usually forms in two areas – as coastal fog in western Contra Costa County along the bayfront and as Tule fog in eastern Contra Costa County as part of the Central Valley. Climate scientists believe that the warmer temperatures created by climate change make it harder for the air to become cool enough to create fog, and warmer temperatures are more likely to evaporate any fog that does form. Tule fog may also be decreasing due to a decrease in air pollutants, which help water vapor condense. The cool air brought in by fog is necessary for the productivity of agriculture in the region and the growth of many tree dominated habitats in the hillsides of Contra Costa County. However, fog can be dangerous because it decreases visibility, which can lead to traffic accidents.

### Human Health Hazards

There are several diseases, such as hantavirus pulmonary syndrome, Lyme disease, West Nile virus, and influenza, that are linked to climate change and can be debilitating or fatal for some of the population. These diseases are carried by pests, such as mice, rats, ticks, and mosquitos. Climate change can increase the rates of infections because many of the animals that carry diseases are more active and expand in population size during warmer weather, higher levels of rainfall during storm events, and stagnant water after flooding, increasing the time for the disease to be transmitted. Additionally, following natural disasters, such as wildfires, landslides, and flooding events, mental health and stress related disorders increase.<sup>6</sup> Health hazards from air pollutants are evaluated as part of the air quality hazard discussion.

### Landslides and Debris Flows

Landslides occur when a slope, such as the side of a hill or mountain, becomes unstable, causing soil and rocks to slide down the slope. Landslides are most common on steep slopes made up of loose soil and other materials. Landslides can damage or destroy buildings and infrastructure in their path, block roadways, and injure or kill people caught in them. The vulnerability assessment focuses on landslides caused by precipitation, including debris flows and mudflows. During periods of heavy or long-lasting rainfall, the material on the side of a slope can absorb enough water to become loose and trigger a landslide. Climate change does not directly cause more frequent or intense landslides. However, it is expected to cause an increase in the conditions that can lead to landslides, such as an increase in the levels of rainfall during storm events, heavy storms, and wildfires that can saturate the ground, increase slope instability, and make a landslide more likely.

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<sup>6</sup> National Center for Environmental Health. September 2019. “Mental Health and Stress-Related Disorders”. [https://www.cdc.gov/climateandhealth/effects/mental\\_health\\_disorders.htm](https://www.cdc.gov/climateandhealth/effects/mental_health_disorders.htm), accessed March 2, 2020.

## Seismic Hazards

While climate change is not considered to be a cause of increase in seismic activity, seismic hazards are a natural hazard that can impact Contra Costa County. Five major faults that run through Contra Costa County: Calaveras (North Central) Fault, Concord-Green Valley Fault, Greenville Fault, Hayward Fault, and Mount Diablo Fault. An earthquake on any of these five faults, or a strong earthquake on a nearby fault such as the San Andreas Fault, could cause ground shaking, fault rupture, and liquefaction. Earthquakes can cause extensive damage to buildings and infrastructure within areas that experience ground shaking and fault rupture. A secondary effect of seismic activity is liquefaction, which can damage pipelines, cause roadways and airport runways to buckle, and damage or destroy building foundations.

## Severe Storms

Severe storms include strong winds, hail, and lightning. Severe weather is usually caused by intense storm systems, although types of strong winds can occur without a storm. The connection between climate change and severe storms is not as well established as other exposures, but new evidence suggests that severe storms may occur more often and become more intense than in the past.<sup>7</sup> Severe winds, such as the Diablo winds, can reach between 40 and 80 mph, damaging or destroying buildings, knocking over trees, damaging power lines and electrical equipment, and fanning small sparks into large wildfires. Hail can damage buildings and plants, and lightning can spark fires, injure people, or cause fatalities.

## Sea Level Rise

As global temperatures heat up, glaciers and other land ice near the north and south poles melt. The water flows into the ocean, increasing sea levels across the globe. Higher temperatures also cause water to expand in oceans, causing further raising of sea levels. Sea level rise is a gradual process, taking place over years or decades. In California, guidance suggests that sea levels will increase in most places by 6 to 10 inches by 2030, 13 to 23 inches by 2050, and 41 to 83 inches by 2100.<sup>8</sup> Eventually, sea levels may increase enough to permanently flood low-lying areas near the bay shore and in parts of the Delta. Sea level rise threatens buildings and infrastructure that may be temporarily or permanently flooded by water in the bay shore areas and Delta of Contra Costa County. Structures built above the increased sea level can still be harmed if the higher level of the water erodes away the rock or soil supporting the structure, potentially making it unsafe and at risk of collapse. This can cause bridges and roadways to become impassable, isolating communities and preventing access for emergency services. Natural ecosystems in the bay and Delta regions will be disrupted by the higher tide levels and intrusion of saltwater into freshwater systems. Much of the tidal marshes in Contra Costa County are expected to convert to another

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<sup>7</sup> Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja. (California Governor's Office of Planning and Research, Scripps Institution of Oceanography, California Energy Commission, California Public Utilities Commission). 2018. Statewide Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-013.

<sup>8</sup> California Coastal Commission. 2018. California Coastal Commission Sea Level Rise Policy Guidance: Science Update – July 2018. [https://documents.coastal.ca.gov/assets/slr/guidance/2018/3\\_Ch3\\_2018AdoptedSLRGuidanceUpdate.pdf](https://documents.coastal.ca.gov/assets/slr/guidance/2018/3_Ch3_2018AdoptedSLRGuidanceUpdate.pdf).

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habitat type, a process called “downshifting”, which will lead to different plant and animal species, and some features of these wetlands may be altered or lost.<sup>9,10</sup>

### Shoreline Flooding

Rising sea levels can also mean that shoreline floods can become more severe and more frequent along bay shore communities and areas within the Delta. Because the bay is at a higher level during normal conditions, shoreline floods such as king tides can reach further onto land. Higher sea levels can also give a “boost” to smaller floods that would not have been large enough to flood dry land during normal conditions, making shoreline flooding more frequent. During strong storms and king tides, shoreline flooding can damage or destroy buildings in low-lying areas, disrupt transportation routes, and harm important economic assets such as the oil refineries and the Delta. The areas facing the greatest risk in the county are Montalvin Manor, North Richmond, Rodeo, Crockett, Bay Point, Bethel Island, and Discovery Bay.<sup>11</sup> In many bay and Delta-fronting communities, Superfund sites, brownfields, and other hazardous materials sites could be damaged by shoreline flooding, resulting in the spread of contaminants to adjacent communities. Shoreline flooding could also damage water infrastructure and interrupt regional and statewide water services.

### Inland Flooding

Inland flooding can cause significant harm to buildings, people, and habitats. Floodwaters can be deep enough to drown people and may move fast enough to carry people or heavy objects (such as cars) away. Floods can be caused by heavy rainfall or long periods of moderate rainfall, or clogged drains during periods of rainfall. In rare instances, a break in a dam, water pipe, or water tank can also cause flooding. Additionally, heavy periods of rainfall can stress levee systems, and overtopping can lead to catastrophic flooding. Inland floods that develop very quickly are called flash floods and can be especially dangerous because there may be little or no warning. Persons experiencing homelessness and others who may be outdoors in the path of a flash flood can face particularly high risks from these events. Storm drainage systems throughout the county collect stormwater runoff and convey water to prevent flooding. These systems are typically designed based on winter storms recorded in the past and may not be designed to accommodate more intense storms. Scientists project that climate change will increase the frequency and intensity of floods within Contra Costa County, although total annual precipitation levels are not expected to change very much. Up to half of California’s precipitation comes from a relatively small number of intense winter storms, which are expected to become more intense with climate change.

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<sup>9</sup> Bay Area Conservation and Development Commission. 2015. San Francisco Bay Coastal Management Program: Final Assessment and Strategy – 2016 to 2020 Enhancement Cycle. <https://coast.noaa.gov/czm/enhancement/media/bcdc309-2016.pdf>.

<sup>10</sup> San Francisco Estuary Institute – Aquatic Science Center. 2015. Shifting Shores: Marsh Expansion and Retreat in San Pablo Bay. [https://www.sfei.org/sites/default/files/biblio\\_files/ShiftingShores%20SFEI%20063015\\_medres\\_final.pdf](https://www.sfei.org/sites/default/files/biblio_files/ShiftingShores%20SFEI%20063015_medres_final.pdf).

<sup>11</sup> Bay Conservation and Development Commission. 2017. “Adapting to Rising Tides: ART Bay Area Sea Level Rise and Shoreline Analysis Maps”. <https://explorer.adaptingtorisingtides.org/download>.

## **Wildfire**

Wildfires are a regular feature of the landscape in much of California. They can be sparked by lightning, malfunctioning equipment, vehicle crashes, or many other causes. Climate change is expected to lead to an increase in wildfires throughout California. Warmer temperatures, an increase in drought conditions and extreme wind events, and forestry pests and diseases are likely to create more fuel for fires in State and federal wildlands, leading to a greater chance that a spark will grow into a potentially dangerous blaze. Climate change is also expected to extend the fire season throughout much (or even all) of the year. Fire activity is projected to increase where development expands in the wildland-urban interface (WUI), in addition to the dry hills around the Mount Diablo region in Contra Costa County.<sup>12</sup> Because wildfires burn the trees and other vegetation that help stabilize a hillside and absorb water, more areas burned by fire may also lead to an increase in landslides and floods. Wildfires expose people and property to flames, increasing the risk of injury, death, and property damage or destruction. The smoke from wildfires increases air pollution levels and creates a significant health risk in the region, particularly under weather conditions that prevent smoke from clearing, such as those during the Camp Fire in 2018. Planned public safety power shutoffs to prevent wildfires have already impacted persons with chronic illnesses and disabilities that depend on electricity for their medical equipment or air conditioning. PG&E has stated that these shutoffs may continue for the next ten years.

## **1.3 POLICY CONSIDERATIONS**

As the County develops policies to address resiliency in the General Plan, the County's vulnerabilities to climate change should be considered along with other community issues and integrated into policy solutions.

### **Results of the Vulnerability Assessment**

General Plan policies should be responsive to the findings in the vulnerability assessment. The following table provides a summary of some of the key vulnerabilities for human, built, economic, and natural systems countywide. The three tables that follow describe more specific or unique vulnerabilities in the three sub-regions of Contra Costa County. Some categories may list no vulnerabilities in the sub-regional tables if there are no vulnerabilities of that category unique to that particular sub-region. The full results of the vulnerability assessment, including scores for all evaluated populations and assets, is given in the County's online vulnerability assessment report, available [at this link](#).

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<sup>12</sup> Ackerly, David, Andrew Jones, Mark Stacey, Bruce Riordan. (University of California, Berkeley). 2018. San Francisco Bay Area Summary Report. California's Fourth Climate Change Assessment. Publication number: CCCA4-SUM-2018-005.

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### COUNTYWIDE VULNERABILITIES

HUMAN	BUILT	ECONOMIC	NATURAL ENVIRONMENT
<p>Economically disadvantaged households and renters may face difficulties preparing and recovering from hazards that damage their homes.</p> <p>Seniors, persons with chronic illness, and young children may experience exacerbated health problems from air quality, extreme heat, and health hazards.</p> <p>Economically disadvantaged populations and those experiencing homelessness may not be able to afford new or additional healthcare costs.</p> <p>Seniors, those with limited mobility, and persons or communities living on single access roads can become isolated from other areas of the county, preventing access to emergency services and evacuation routes.</p>	<p>BART and cargo and passenger railways are vulnerable to being shut down due to damage or destruction of infrastructure.</p>	<p>Parks and recreation centers, including regional parks and the Bay Trail, can be damaged by wildfires, landslides, pests, and bayshore flooding, reducing the number of visitors.</p> <p>Oil refineries, including Phillips 66 and Nu Star, and other oil refinery or industrial operations can be damaged and work halted from Delta shoreline and bayshore flooding, inland flooding, landslides, and wildfires.</p> <p>Agricultural operations and rangeland are vulnerable to damage from agricultural pests and diseases, sea level rise, and Delta shoreline flooding.</p>	<p>Tidal marshes and Delta wetlands are vulnerable to sea level rise and the lack of space to migrate inland.</p> <p>Woodland habitat is vulnerable to diseases and damage from forestry pests, drought, severe storms, and wildfire.</p> <p>Chaparral and scrub habitats can be severely damaged by increased intensity in wildfires.</p>



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**WESTERN CONTRA COSTA COUNTY VULNERABILITIES**

<b>BUILT</b>	<b>ECONOMIC</b>
<p>I-80, I-580 (including the Richmond-San Rafael Bridge), and SR-4 are vulnerable to being shut down due to damage or destruction of infrastructure.</p> <p>Homes and businesses can face economic hardship from damage from wildfires, landslides, planned public safety power shutoffs, and bayshore flooding.</p> <p>Energy infrastructure can be damaged or spark wildfires from extreme weather events.</p> <p>Bayshore flooding can damage the Crockett Cogen powerplant, wastewater facilities, the West Contra Costa Sanitary Landfill, levees, and other infrastructure, potentially releasing hazardous materials into the environment.</p>	<p>Damage to bridges, BART, railways, and roadway infrastructure could prevent employees, customers, and clients from reaching their destinations.</p>

**CENTRAL CONTRA COSTA COUNTY VULNERABILITIES**

<b>BUILT</b>	<b>NATURAL ENVIRONMENT</b>
<p>I-680, SR-4, and SR-24 are vulnerable to being shut down due to damage or destruction of infrastructure.</p> <p>Residents, including mobile home park residents, and businesses can face economic hardship from damage from wildfires, landslides, and inland flooding.</p> <p>Medical centers, schools, industrial facilities, and government facilities are vulnerable to damage from inland flooding, landslides, wildfires, and Delta shoreline flooding.</p> <p>Inland and Delta shoreline flooding can disrupt water and wastewater services.</p>	<p>Riparian corridors can be harmed by inland flooding or landslide events.</p>

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### EASTERN CONTRA COSTA COUNTY VULNERABILITIES

HUMAN	BUILT	ECONOMIC	NATURAL ENVIRONMENT
Outdoor workers and undocumented persons are vulnerable to loss of work and housing or exposure to illnesses.	<p>SR-4 and Byron Highway are vulnerable to being shut down due to damage or destruction of infrastructure.</p> <p>Statewide water infrastructure is vulnerable to damage and failures from sea level rise and Delta shoreline flooding.</p> <p>Flood control infrastructure is vulnerable to destruction from seismic hazards, Delta shoreline flooding, sea level rise, and inland flooding, which could devastate the region.</p>	The Delta is vulnerable to changes in water quality, fish die offs, and damage to facilities from Delta shoreline flooding.	<p>Delta wetlands can be harmed by changes in quantity and quality of water and may not be able to recover during prolonged droughts.</p> <p>Aquatic habitats can have altered water quality due to extreme heat and drought, leading to algal growth and fish die offs.</p>

## Equity and Uncertainty

When addressing resilience through adaptation strategies or general plan policies, two factors should also be considered: equity and uncertainty.

Equity means that all people are justly and fairly included in society, and that everyone is able to participate, prosper, and achieve their full potential. Communities like North Richmond, Rodeo, and Bay Point already experience a disproportionate burden of the effects of climate change, environmental pollution, and historical socio-economic disparities.<sup>13</sup> Equitable climate adaptation planning involves identifying persons who are most vulnerable to climate change hazards, and ensuring that the planning process, distribution of resources, and efforts to address systematic wrongs are all conducted in an equitable manner. The County’s vulnerability assessment (available online at this link) identifies 16 vulnerable populations and assesses climate change impacts and the ability of these populations to prepare for, respond to, and recover from climate change hazards (see Chapter 3, Population Vulnerabilities, of the vulnerability assessment for this list).

Uncertainty is the second component to consider when creating adaptation policies. Climate change is driven by the concentration of greenhouse gases (GHGs) in the atmosphere. This concentration is affected

<sup>13</sup> Governor’s Office of Planning and Research. June 2018. Defining Vulnerable Communities in the Context of Climate Adaptation. [http://opr.ca.gov/docs/20180723-Vulnerable\\_Communities.pdf](http://opr.ca.gov/docs/20180723-Vulnerable_Communities.pdf)

by the adoption and implementation of local, State, federal, and international GHG reduction measures, which is not certain. The more action taken to reduce GHG emissions, the less adaptation should be necessary. The climate models use the concentration of GHG emissions to show the extent or intensity of hazardous events and other climate-related conditions. Even with these extensive models, potential impacts are ultimately uncertain. It is also unknown what the state of technology, socioeconomic conditions, and other human systems will be in the future. Research shows that the best approach to uncertainty is to prepare and adapt, by monitoring how the future evolves and allowing adjustments over time as new studies are completed.<sup>14</sup>

## **Resilience in Other Planning Mechanisms**

Resilience cannot only be integrated into the General Plan, but can also be incorporated into other comprehensive plans, focused plans and guidance, and implementation programs. Addressing climate change and hazard events in the General Plan can support other essential safety documents, such as the Contra Costa County Multi-Jurisdictional Hazard Mitigation Plan. Development standards such as residential buildings codes for building in the wildland urban interface, firesafe landscaping, and development of adequate evacuation routes can be integrated into the Contra Costa County Code. Policies that focus on emergency response to hazards can be included in evacuation plans or emergency operations plans. Adaptation measures that also reduce GHG emissions can be integrated into the County's Climate Action Plan and may support the Contra Costa Transportation Authority's Community-Based Transportation Plans. Policies related to drought and flooding may be integrated into the regional water management plans and the Stormwater Resource Plan. Furthermore, programs such as the Contra Costa County Code, Capital Improvement Plan, and subdivision regulations can help implement the resilience policies developed in the General Plan through specific projects, development codes, and budgeting.

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<sup>14</sup> Vincent A. W. J. Marchau, Warren E. Walker, Pieter J. T. M. Bloemen, Steven W. Popper (eds.). 2019. Decision Making under Deep Uncertainty: From Theory to Practice. Springer, p. 11.