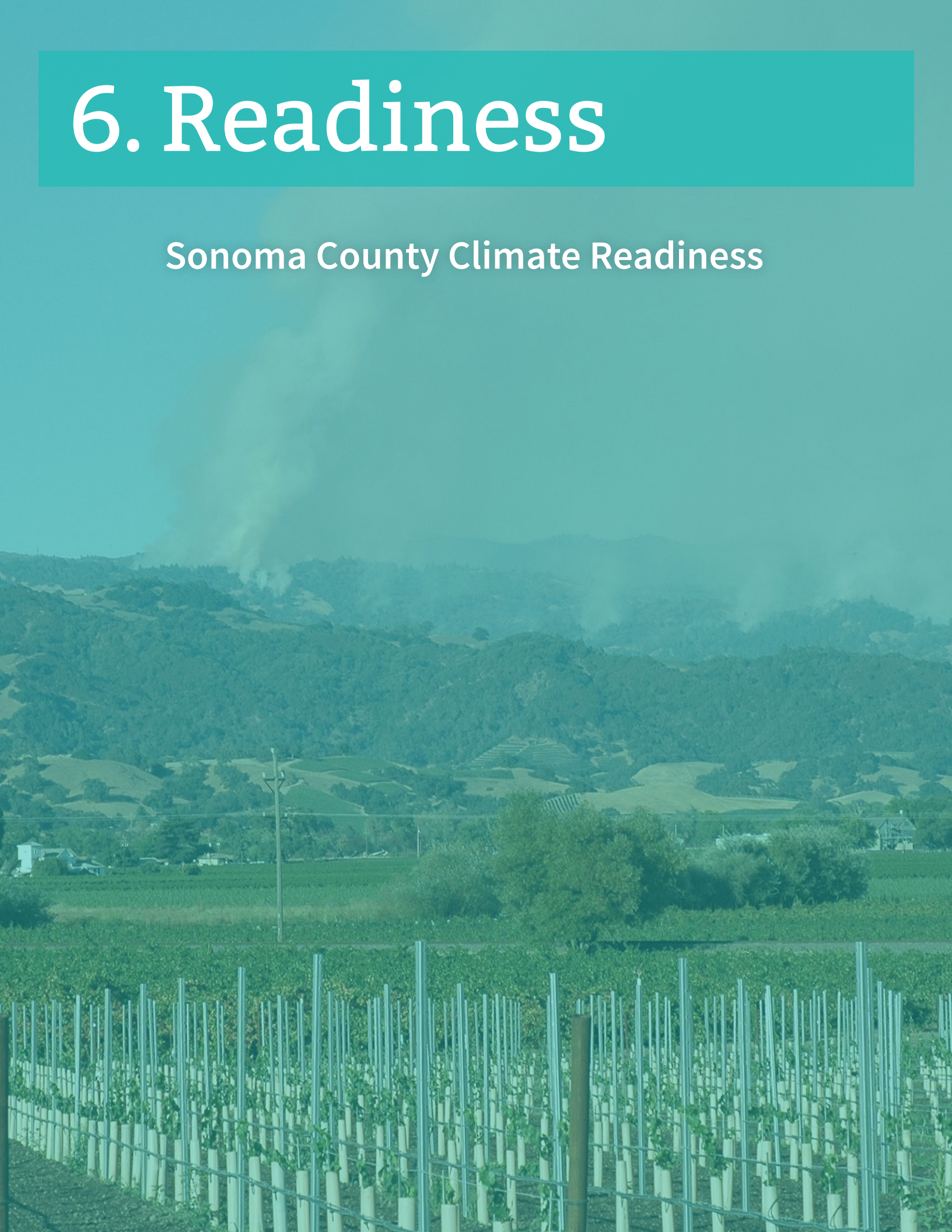
6. Readiness

Sonoma County Climate Readiness



Chapter 6
Sonoma County Climate Readiness

6.1 Introduction and Background

Sonoma County has long been a leader in addressing greenhouse gas (GHG) emissions and working to reduce the pace of climate change. Much of this work has focused on *climate mitigation*, which refers to reducing the amount of climate change, primarily through measures like those described in Chapter 3, *Reducing Community Emissions*.

However, even with the aggressive climate mitigation measures in Climate Action 2020 (CA2020), climate changes cannot be avoided entirely. Preparing for a changed climate is therefore a fundamental part of Sonoma County's overall climate action program. Reducing vulnerability to climate change hazards and bolstering community readiness to face the unavoidable climate impacts already underway are collectively referred to as *climate adaptation*. While climate mitigation and adaptation have different objectives, many strategies can be used to simultaneously achieve both goals (see Section 6.4.2).

This chapter provides a vulnerability assessment that evaluates potential impacts from anticipated climate change hazards on three key community resource areas. The assessment is not a comprehensive vulnerability analysis, nor does it provide site-specific prescriptions for action. Instead, the analysis provides a starting point for a countywide discussion on climate impacts and vulnerabilities and sets forth goals that the Regional Climate Protection Authority (RCPA) and local communities can use to guide future climate adaptation actions. This chapter also discusses strategies already underway to prepare for climate change, as well as recommendations for further improvement.

Information summarized in this chapter is drawn from the *Climate Ready Sonoma County: Climate Hazards and Vulnerabilities* report prepared by North Bay Climate Adaptation Initiative (NBCAI) for RCPA (Cornwall et al. 2014). NBCAI is a non-governmental organization comprising natural resource managers, policy makers, and scientists committed to working together to create positive solutions to the problem of climate adaptation for the ecosystems and watersheds of Sonoma County.

6.2 Climate Change Projections

Climate change projections analyze the likelihood that certain climate conditions will occur in the future. Various climate change models include different assumptions regarding the amount, location, and timing of change, and are thus subject to uncertainty regarding their results. The two primary sources of uncertainty in climate projections are *natural variation* and *climate mechanics*. Natural variation includes numerous independent processes that drive natural

patterns on time scales ranging from minutes to seasons to decades, whereas climate mechanics refers to the complex physical processes that influence climate and how it responds to changing conditions. There is also uncertainty about how quickly and vigorously humanity will reduce GHG emissions. Given this uncertainty, climate change modeling projections are often considered "scenarios" based on long-term trends and estimates of variability (uncertainty is discussed in greater detail in the *Hazards and Vulnerabilities* report).

Despite the uncertainty and complexity inherent in climate change models, there are recurring themes that scientists agree are important to understanding what the future may hold for the region. Sonoma County already benefits from a number of cutting-edge efforts to understand climate trends, in part because local entities are key participants in these efforts. In particular, NBCAI used a set of projections for local temperature, precipitation, and hydrology across Sonoma County derived from the Basin Characterization Model (BCM) prepared by scientists from the U.S. Geological Survey and the University of California, Davis Center for the Environment (Flint et al. 2013). These projections were developed by applying global circulation models at a scaled-down resolution that helps identify watershed-level impacts of climate change here in Sonoma County.

Four of the BCM climate scenarios were selected to inform the vulnerability assessment. The two major variables among the four scenarios are GHG emission levels and precipitation. For example, if humans succeed in significantly reducing global HG emissions in the near term ("mitigated HG emissions") and precipitation levels increase ("more precipitation"), the future will be "warm/wet." Figure 6-1 identifies the scenarios based on the relationship among the two variables. The scenarios are described in greater detail in the *Hazards and Vulnerabilities* report.

Figure 6-1. Future Climate Scenarios for Sonoma County

High GHG Emissions (greater temperature increase)	**Hot/Dry"**	
Mitigated GHG Emissions (less temperature increase)	**Warm/Dry**	

The difference between the "hot" and "warm" scenarios is based on the effects of higher H G emissions versus lower (more mitigated) GHG emissions. There is uncertainty around precipitation in the global circulation models. Therefore, the difference between the "wet" and "dry" futures reflects the fact that different global climate models produce different rainfall projections.

6.3 Vulnerability Assessment

Climate vulnerability consists of the combined effect of exposure, sensitivity, and adaptive capacity, as defined below.

Different areas in Sonoma County will have different exposures to various climate change effects. For example, due to the county's coastal location, it will not be exposed to flooding from increased and rapid snowmelt. However, portions of Sonoma County will likely be subjected to an increased future risk of sea-level rise. Therefore, *exposure* is how much change a species or system is likely to experience. Section 6.3.1 identifies the climate change exposures that are projected to occur in Sonoma County.

Baseline conditions in communities and natural systems will influence sensitivity to a particular climate exposure. For example, an increase in extreme heat events is likely to disproportionately harm people, plants, and animals not acclimatized to extreme heat. In all locations, extreme heat will do more harm to those with compromised or fragile health. *Sensitivity*, then, is a measure of whether and how much a species or system is likely to be affected by its exposure. Section 6.3.2 evaluates the sensitivity of various community resources to the climate change exposures identified in Section 6.3.1.

An adaptation capacity assessment—an evaluation of the ability to avoid, accommodate, or cope with climate change impacts—is not included in this chapter. However, strategies already underway to prepare for climate change and goals for further improvement are described in Sections 6.4 and 6.5.

6.3.1 Climate Change Hazards in Sonoma County

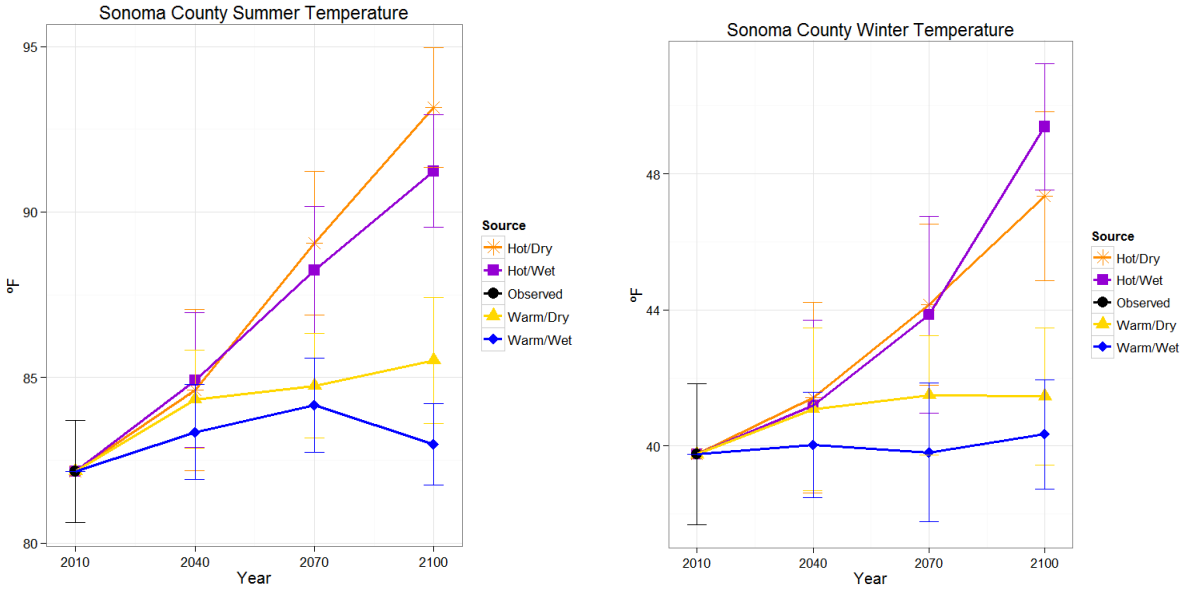
The BCM scenarios and other recent studies indicate that climate change could affect Sonoma County in the following ways.

Hotter, Drier Weather with Longer Summers
 More extremely hot days
 More frequent and intense droughts
 More frequent and intense wildfires
 Fewer winter nights that freeze
More Variable Rain
 Greater risk of extreme floods
Sea Level Rise
 Higher sea level and storm surge

Hotter, Drier Weather with Longer Summers

Higher Average Temperatures and More Extreme Heat Events: Sonoma County is expected to experience more very hot days and overall higher temperatures over a longer warm season. Average monthly maximum temperatures have already risen by 2.7 degrees Fahrenheit (°F) since 1900. Most climate change models project that temperatures will continue to rise, whether they use high or mitigated carbon emissions trends. Figure 6-2 depicts average summer high temperatures projected by the four models chosen for comparison in this report. In the two scenarios with mitigated emissions, summer high temperatures are expected to rise by 1 to 2°F. In the scenarios with uncurbed emissions, average summer high temperatures projected to increase by up to 9 to 11°F by 2100.

Figure 6-2. Observed (1981–2010) and Projected Future Summer and Winter Temperature for Sonoma County



Data source: California Basin Characterization Model, Flint et al. (2013).

Table 6-1 shows how these temperature increases can create public health and safety risks, by comparing the increases to the temperature threshold (95°) for an “extreme heat event” as defined for the Santa Rosa area.

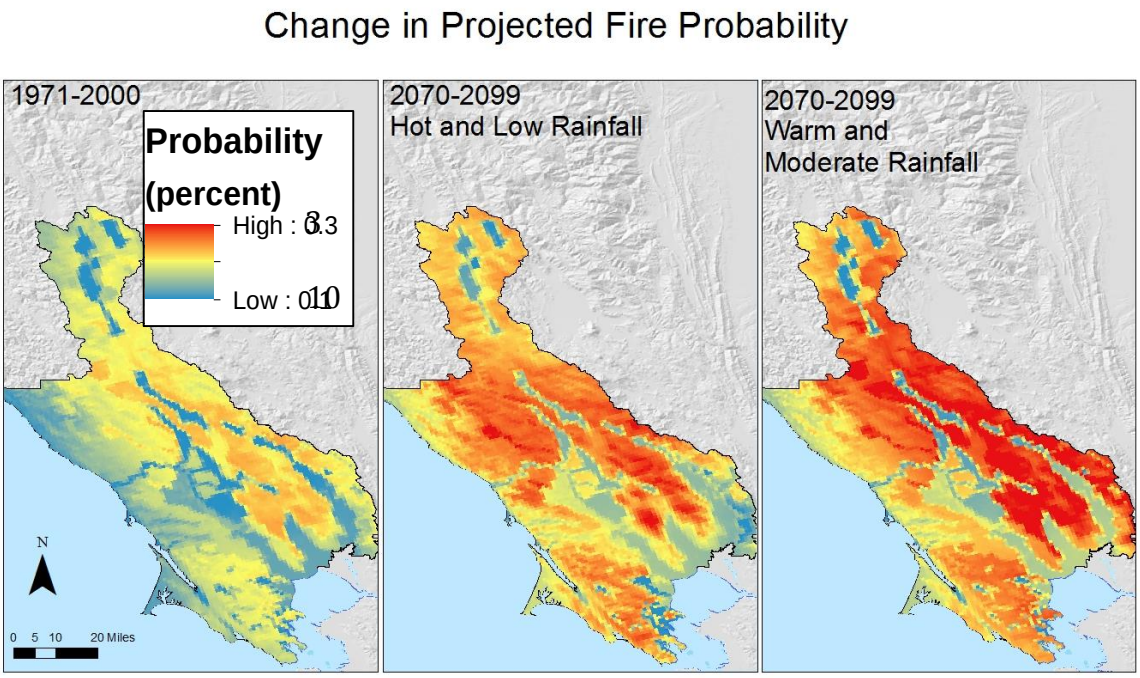
Table 6-1. Number of Times per Year When Maximum Temperature Is Projected to Exceed 95°F for 3 or More Consecutive Days in the Santa Rosa Plain

Period
1981–2000
2010–2039
2040–2069
2070–2099

More Frequent and Intense Droughts: Whether the North Bay region experiences more or less rainfall overall, the land will likely be drier overall because warmer temperatures increase evapotranspiration (the loss of water from plants and soil into the air) even under the two "wet" scenarios. Climatic water deficit (CWD) is a numeric measure of drought stress that quantifies the extent to which plants' need for water exceeds moisture available in the soil. Three of the four climate scenarios examined in this report indicate a rising CWD for the 21st century while the "Warm/Wet" scenario indicates nearly equivalent CWD to the historic period. The CWD is projected to increase over this century, producing 10 to 20% drier soil conditions in the summer months, leaving less water available for groundwater recharge or runoff into rivers and creeks, increasing irrigation needs, and causing stress to natural vegetation and water-dependent ecosystems. The greatest increases in soil dryness are projected in the south and southeastern portions of the county.

More Frequent and Intense Wildfire: Risk of fire is likely to continue to rise due to increased dryness of vegetation, compounded by productivity of plants in the spring (which creates more fuel for dry season wildfires). By the end of this century, the chances of one or more fires during a 30-year period are projected to increase from 15–20% at present to 25–33% in the mountainous areas of the county, a fire regime akin to that experienced today in the Santa Monica Mountains of Southern California. See Figure 6-3.

Figure 6-3. Changes in Projected Fire Probability for Sonoma County



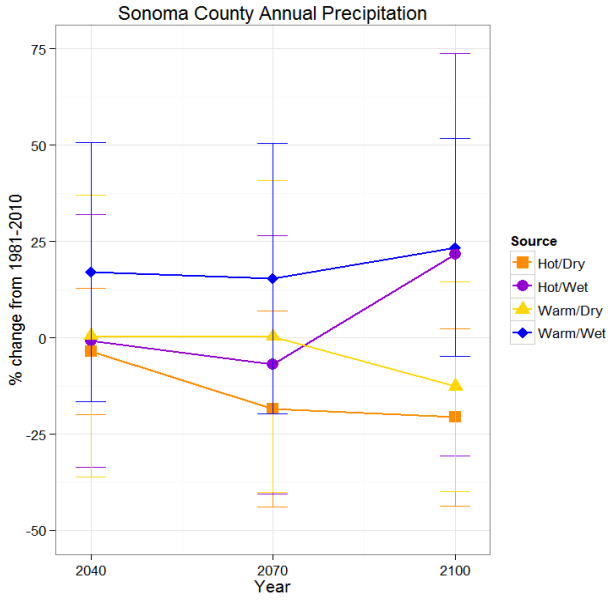
Fewer Winter Nights that Freeze: Projected winter low temperatures are also expected to rise in the future. In general, the coast, ridges, and mountain peaks will experience the most significant warming, whereas valley bottoms are projected to warm less dramatically. Figure 6-3 depicts projected winter low temperatures under the four scenarios included in this chapter. In the two models with mitigated emissions, winter low temperatures are expected to rise by 1 to 2°F. In the two models with uncurbed emissions, average winter low temperatures are projected to increase by up to 7 to 9°F by 2100. These increases have potential implications for controlling disease vectors, agricultural pests, and agricultural practices.

More Variable Rain

While there is a direct link between higher GHG emissions and higher temperatures, there is disagreement about whether the future will be wetter or drier overall. Some models predict less annual rainfall in our region, while others predict more. However, all four climate scenarios evaluated in this chapter include more variation in the timing and amount of precipitation from individual rain events. All of the BCM scenarios indicate that Sonoma County will continue to have some years with precipitation similar to historic averages interspersed with more extreme conditions. The "Warm/Wet" scenario projects some years with an almost 75% increase in mean annual precipitation, while the "Hot/Dry" and "Warm/Dry" scenarios project years with decreases

between 25–50% of historical averages (see Figure 6-4). Overall, the wettest scenario projects almost a 25% increase in precipitation compared to historical (20th century) conditions, whereas the driest scenario projects an approximately 20% decrease.

Figure 6-4. Graph of Annual Precipitation Projected under Four Representative Climate Futures



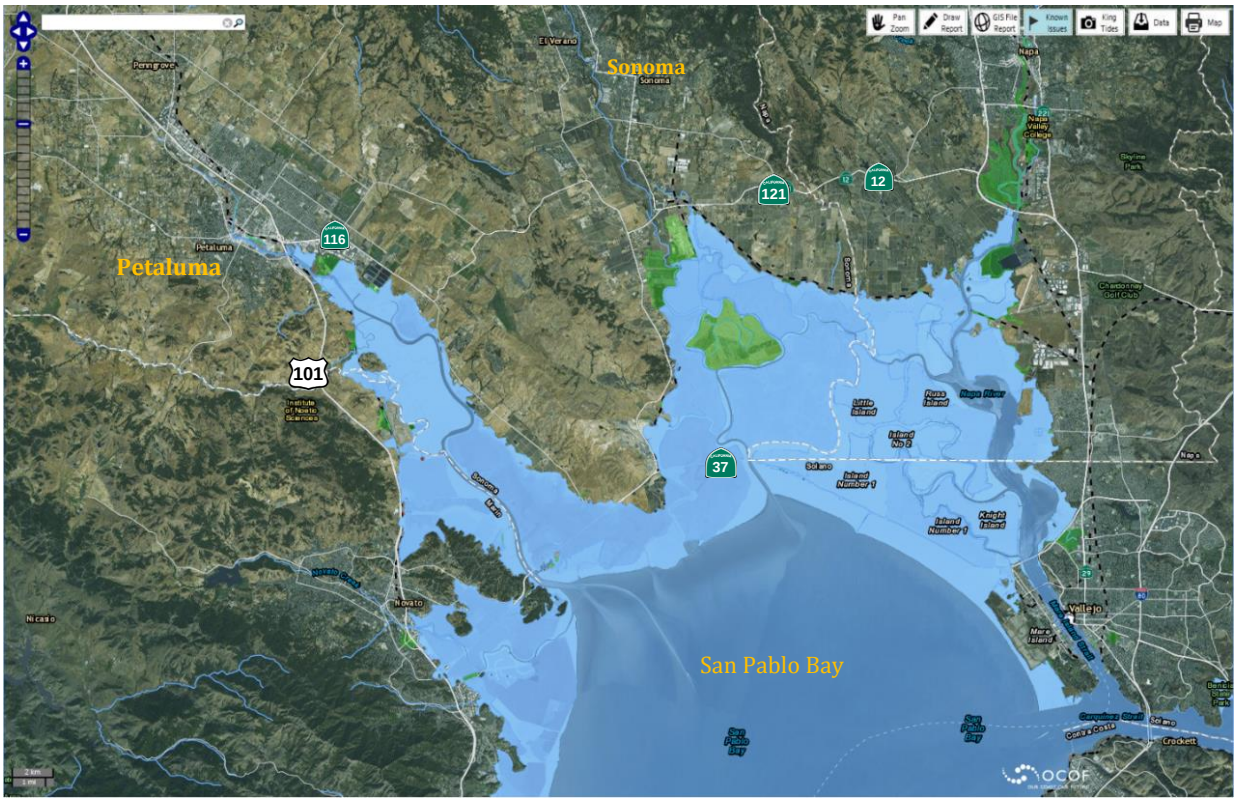
Whether the North Bay region experiences more or less total rainfall, the land will likely be drier overall because warmer temperatures increase evapotranspiration. Because most models project a shorter, more condensed wet season, this shift in rainfall timing combined with warmer weather causes soils and plants to dry out more by the end of the summer season compared to current conditions. Even models that project more winter rain also project reduced available soil moisture.

Increased Risk of Extreme Floods: The climate scenarios project increased seasonal variability of precipitation, runoff, and stream flows for Sonoma County, along with increased likelihood of "extreme" precipitation and drought events that were rare or unprecedented in the historic past. The precise risk of flood events is difficult to predict, however. Much of Sonoma County's wintertime precipitation comes in the form of "atmospheric rivers" from the Pacific Ocean. An atmospheric river is a relatively narrow ribbon of moisture in the atmosphere with ample moisture and strong winds. These atmospheric phenomena can produce very high precipitation in relatively focused areas. The amount and intensity of precipitation therefore depends greatly on where these atmospheric rivers make landfall. Under climate change projections for California, the average intensity of a typical atmospheric river does not increase, but there may be more years with more frequent storm events and occasional events that are much stronger than historical ones. Moreover, the length of the season over which storm events may occur is predicted to increase. These changes to the patterns of storm events may result in more frequent and more severe floods in Sonoma County.

Sea Level Rise

More Frequent Coastal Flooding, Increased Erosion, and Saltwater Intrusion: Sea levels are projected to rise between 16.5 and 65.8 inches by the end of this century. Rising sea levels, combined with increased storm surge, will lead to more frequent inundation of low-lying areas, and flooding of homes, infrastructure, agricultural lands, and natural areas on the shores of San Pablo Bay and the ocean coast, with the greatest impact anticipated during winter storms.

Figure 6-5. Areas at Risk of Flooding with 39 Inches of Sea-Level Rise in Southern Sonoma County



The areas at risk of flooding in southern Sonoma County with 39 inches of sea-level rise and a 20-year storm near the cities of Petaluma and Sonoma are shown in light blue. Darker blue is the current extent of the bay. Bright green areas are low enough to flood, but are protected by features such as levees or berms. Source: Our Coast Our Future (2014).

Figure 6-6. Areas at Risk of Flooding with 39 Inches of Sea Level Rise near Bodega Bay

Areas at risk of flooding near Bodega Bay with 39 inches of sea-level rise and a 20-year storm are shown in light blue. Darker blue is the current extent of the ocean. Bright green areas are low enough to flood, but are cut off from inundation by features such as levees or road berms. The light green dots show the extent of waves during a 20-year storm; note that waves are projected to pass over Doran Beach and into Bodega Harbor. Source: Our Coast Our Future (2014).

6.3.2 Climate Vulnerabilities in Sonoma County

The discussion in Section 6.3.1 shows that Sonoma County will be exposed to a variety of unavoidable climate change effects. However, as noted above, exposure does not necessarily mean that the community will be sensitive to the effect; individuals, property, and the environment may be exposed to a climate change threat but not sensitive to its consequence. For example, most healthy adults will adjust to small increases in average annual temperatures.

This section explores key vulnerabilities for three categories of community resources—people and social systems, built systems, and natural and working lands. A high-level overview of the resource, including essential functions and importance to the community, is presented first. Because climate sensitivity depends, in part, on baseline conditions, existing climate stressors are also briefly described for each resource. Anticipated vulnerabilities to the hazards identified in Section 6.3.1 are subsequently analyzed. Please refer to the *Hazards and Vulnerabilities Report* for summaries of climate exposures and vulnerabilities for each resource.

People and Social Systems

People and social systems include Sonoma County's residents and visitors, households, neighborhoods, cities, economic activities, social services, food systems, education, business, emergency services, public safety, and law enforcement. These communities and community systems will exhibit a wide range of abilities to prepare for, respond to, and recover from climate hazards. In particular, disparities in health, education, and income levels will make certain populations and communities more vulnerable to climate change. The social systems that help support basic needs for people—including food, water, shelter, transportation, and healthcare—are also vulnerable to breakdown from climate-related crises, especially those systems that currently suffer from dwindling resources and financial support.

Table 6-2. Climate Change Effects on People and Social Systems

Hotter, Drier Weather with Longer Summers	
More extremely hot days	• Increased heat-related illness, particularly among those inland, in poor health, working outdoors, in urban heat islands, and/or without air conditioning • Premature death • Added stress on emergency services and health care systems
More frequent and intense droughts	• Higher prices for water and food • Water shortages from reduced surface and groundwater supplies • Food shortages • Potential pressure on housing and social services due to climate migrants • Increase in respiratory problems • Economic loss from decline in water-dependent recreation and tourism activities
More frequent and intense wildfires	• Risk of lost connections to energy, water, and food supplies, especially for isolated populations • Displacement and loss of homes • Injuries and death from burns and smoke inhalation • Lung damage and exacerbation of eye and respiratory illness • Economic loss from decline of recreation and tourism following a major fire
Fewer winter nights that freeze	• Potential increase in disease vectors such as mosquitoes and rodents
More Variable Rain	
Increased risk of extreme floods	• Death from drowning and injuries from flood • Economic losses for people in low-lying areas along rivers and bay lands, especially those without reliable transportation • Public health risks from damage to sanitation, utility, and irrigation systems • Limitations on access to critical services • Economic impacts on businesses, including agricultural operations, affected by flooding
Sea Level Rise	
Higher sea level and storm surge	• Physical danger and economic impact for people living near bay lands or the coast • Disruption in the movement of people and goods • Economic loss from inundation of agricultural land

Built Systems

Built systems include residential and non-residential buildings and facilities, and the infrastructure associated with providing water, sanitation, drainage, communications, transportation, and energy. These systems are necessary for maintaining a healthy and well-functioning society, and represent a huge capital investment by both private and public entities. Unfortunately, many built systems and structures are at increased risk of failure due to age and deferred maintenance. For example, Sonoma County's local road network is also falling into

disrepair at an increasing rate. These existing risks are magnified when multiple systems fail at the same time (as in a flood, fire, or other calamity), resulting in cascading impacts throughout the built environment.

Table 6-3. Climate Change Effects on Built Systems Error! Bookmark not defined.

Hotter, Drier Weather with Longer Summers	
More extremely hot days	• Damage and disruption to paved roads, rail lines, bridges, electricity transmission lines, and solar and battery facilities • Thermal expansion of bridges • Spikes in energy and water demand; potential stress to supplies • Reduced outputs from thermal power plants, transformers, and other parts of electric systems • Brownouts and blackouts
More frequent and intense droughts	• Increased water demand and reduced supply • Disruption of hydropower operations such as Warm Springs Dam; impacts on power generation facilities that rely on water for cooling • Algae and bacterial growth in water supplies • Increased pumping of groundwater leading to well failure, saltwater intrusion, and degraded water quality • Increased evaporation from reservoirs
More frequent and intense wildfires	• Disruption of electricity transmission lines • Impacts on roadways • Subsequent landslides that close roads and bury infrastructure, including water supply wells
Fewer winter nights that freeze	• None identified
More Variable Rain	
Increased risk of extreme floods	• Less predictable reservoir operation • Road closures, landslides, and loss of infrastructure such as bridges/culverts • Increased potholes and roadway damage from intensity of rainfall • Failure of stormwater and waste water treatment systems • Increased cost and complexity for development and infrastructure projects and for retrofitting existing infrastructure
Sea Level Rise	
Higher sea level and storm surge	• Damage and/or closure of roads crossing former tidal or estuarine areas (Highways 1 and 37) • Increased storm damage to boats and related shoreline infrastructure • Flooding of low-lying infrastructure such as Sonoma Valley County Sanitation District • Saltwater intrusion and reduced water quality • Disruption of transit routes and travel delays

Natural and Working Lands

Natural lands include Sonoma County's public and private natural and open space areas and the ecosystems these lands support, including wildlife, streams and wetlands, and sensitive species and habitats. Working lands include Sonoma County's diverse and productive agricultural lands. Sonoma County's vineyards, farms, ranches, and timberlands are the cornerstone of the county's economy and add immeasurably to the area's scenic beauty.

Sonoma County has high biodiversity in many of its landscapes and species, potentially increasing the resilience of natural areas overall. However, the county also has many threatened and endangered species, some of which are found only in very limited areas. Stressors such as pollution, loss of streamflow, and invasive species are already causing numerous plants and animals to decline. Habitat fragmentation and development have also compromised the ecological integrity of some landscapes throughout the county, making them more susceptible to climate change hazards. The county's working lands are subject to these same hazards. Agricultural operations depend heavily on the region's historically moderate climate and are therefore vulnerable to the entire range of climate change hazards.

Table 6-4. Climate Change Effects on Natural and Working Lands

Hotter, Drier Weather with Longer Summers	
More extremely hot days	• Loss of wine grape quality • Land use pressure to develop vineyards closer to the coast • Changes in yield, types, and cultivars of crops • Increased animal vulnerability to pests, stress, and mortality • Lower production in animals • Reduced chill hours
More frequent and intense droughts	• Increased need for water agricultural land and water-dependent ecosystems • Increased urban water use, at possible expense of agriculture water availability • Shortage of animal feed or rise in cost and access • Increased evapotranspiration from open water sources • Decline or death of water-dependent plants and animals • Potential change in suitable crop varieties, including wine grapes • Increased tree stress and death in timberlands and other forests • Increased off-stream storage of water for agriculture
More frequent and intense wildfires	• Loss of habitat and agricultural lands • Death of wildlife • Loss of recreational lands and commercial forests • Losses from subsequent erosion and landslides, and sedimentation of streams and wetlands
Fewer winter nights that freeze	• Unpredictable, potentially sudden, shifts in populations of disease, pests, or invasive species • Earlier vineyard bud break may lead to increased use of water for frost protection
More Variable Rain	
Increased risk of extreme floods	• Increased erosion and sediment pollution in streams and wetlands • Damage to crops and agricultural lands
Sea Level Rise	
Higher sea level and storm surge	• Loss of prime recreational and natural areas, including marshes, beaches, mudflats, and dunes • Risk of levee breaches and inundation of agricultural land in formerly tidal areas in southern Sonoma County

6.4 Responding to Climate Change Vulnerabilities

The vulnerabilities outlined in Section 6.3 are significant and cut across virtually all of the county's human and natural systems. Fortunately, many entities in Sonoma County have already begun planning and implementing strategies to increase resilience and readiness for climate change. These strategies target public health and social vulnerability, energy independence, water resource planning, food security, transportation, and conservation. These existing efforts are too

broad to fully capture here, but a sample of critical activities underway is summarized in Table 6-5.

Although impressive and forward-thinking, these current efforts only skim the surface of the effort needed to make our communities truly resilient in the face of climate change. While many entities are increasingly incorporating a climate-changed future into their planning, such as those listed in Table 6-5, a higher-level, more comprehensive approach is also needed to match the scale and variety of climate hazards facing Sonoma County. This broader effort has been led by RCPA and the NBCAI, a collaborative of local organizations. This includes the *Climate Hazards and Vulnerabilities* report that is the basis for this chapter. In 2015, NBCAI and RCPA also sponsored two events with broad participation that clarified the climate readiness challenge and its opportunities for Sonoma County. Section 6.4.1 describes these findings.

6.4.1 Sonoma County Climate Ready Goals

NBCAI, in conjunction with RCPA and other non-governmental partners, is developing a *Roadmap for Climate Resilience* in Sonoma County based on extensive input from public meetings, workshops, focus groups, and technical experts. Over 230 people participated. Out of these events and extensive discussion with multiple interest groups, NBCAI and RCPA developed the following mission for climate readiness efforts in Sonoma County.

Increase the health and resilience of social, natural, and built resources to withstand the impacts of climate change.

The nine goals listed in Table 6-6 are included as part of CA2020 to support this mission. Adoption of these goals by RCPA and local partner agencies (cities and the County) will help set the course for future actions that will increase the adaptive capacity of Sonoma County communities, reduce vulnerability to climate change, and make the county more climate-ready. These goals can also help prioritize the climate mitigation actions identified in Chapter 4 by identifying actions that will increase climate resilience as well as reducing GHG emissions.

Table 6-5. Sample of Existing Local Efforts that Increase Resilience to Climate Change

Public Health and Social Vulnerability	
Hazard Mitigation Planning	Every 5 years, the County updates a local Hazard Mitigation Plan that seeks to reduce death, injuries, property loss, and community disruption caused by natural hazards by analyzing those hazards to which the county is most vulnerable, identifying tools to reduce the adverse effects of those hazards, and developing an implementation plan. Climate change is exacerbating hazards that are already prepared for through the Hazard Mitigation Plan process.
Health Action	Health Action is the framework for a community engagement effort, backed by the County, to create a healthier Sonoma County for all residents. Pursuit of Health Action goals in education, health care, and economic security will increase the adaptive capacity of the Sonoma County communities that are most vulnerable to climate change.
Energy	
Energy Independence	The County and cities have implemented a countywide renewable energy and energy efficiency retrofit program that provides incentives, financing, tools, and technical assistance to residential and non-residential property owners. Reducing energy use and increasing on-site generation not only lowers GHG emissions, it also reduces energy costs and helps minimize the health and economic impacts of future climate change-related outages.
Sonoma Clean Power	The County and cities have created a community choice aggregation program that allows more local control in obtaining lower-emission, lower-cost, and more distributed power supplies. These distributed and renewable power sources are less vulnerable to climate-related disruption and come back online faster following an emergency.
Water	
Integrated Water Resource Planning	The Sonoma County Water Agency's *Water Supply Strategies Action Plan* is a framework for regional integrated water management to increase water supply system reliability, resiliency, and efficiency in the face of limited resources, regulatory constraints, and climate change. The plan, first adopted in 2011 and updated in 2013, includes nine key strategies, including implementation of the Biological Opinion for protection of coho and steelhead, and development of an adaptation plan.
Groundwater Management	Sonoma County Water Agency has led development of Groundwater Management Plans in the Sonoma Valley and Santa Rosa Plain. These planning efforts have engaged the public, collected substantial new data on groundwater conditions, and set management objectives that will improve the ability of groundwater-dependent communities, agricultural operations, rural residents, and ecosystems to function during drought periods. Sonoma County cities, SCWA, the County and water districts are currently engaged in early implementation of the state's new Sustainable Groundwater Management Act.
End-use Water Efficiency	Municipal water and sanitation utilities throughout the county have established programs such as Direct Retrofit Installation Programs, Cash for Grass, Laundry to Landscape, Pay As You Save (PAYS), and Mulch Madness to support property owners in reducing water use while investing in upgrades to their properties.
Food	
Sonoma County Healthy and Sustainable Food Action Plan	The County Department of Health Services has partnered with the Food System Alliance to develop a guide to local action on food production, land and natural resource stewardship, job development, public health, and food system equity, all of which help increase the community's climate resilience. It also encourages practices to support the agricultural sector's ability to adapt to climate change.
Transportation	
Transportation Planning and Investment	Many projects to modernize the transportation system and increase the viability of multiple mobility options are underway through implementation of the Comprehensive Transportation Plan adopted by Sonoma County Transportation Authority. The SMART passenger rail will begin operations in 2016. Countywide Bicycle and Pedestrian Master Plan implementation and Safe Routes to Schools projects support expanded use of lower-cost transportation options that are more reliable under projected climate conditions.
Highway 37 Sea Level Rise planning	Due to its proximity to San Pablo Bay, Highway 37 is at significant risk from sea-level rise and storm surge. Local, regional, and state partners are working to address this infrastructure vulnerability while incorporating habitat enhancements that promote resilience to flooding and storm surge.
Natural and Working Lands	
Climate Action through Conservation	The Sonoma County Agricultural Preservation and Open Space District was created in 1990 to protect working farms and ranches, scenic hillsides, and natural areas that make the county special. The District has preserved over 100,000 acres to date. The District is also working on a *Climate Action Through Conservation* program to incorporate GHG mitigation and sequestration benefits into land use choices, as well as evaluating the ecosystem services provided by landscapes that will be increasingly important under future climate projections.

Table 6-6. Climate Change Adaptation Goals and Opportunities

Goals	Opportunities	Climate Hazards Addressed
Promote healthy, safe communities	Invest in measures to increase community knowledge and capacity to respond and adapt to climate hazards, including improving baseline health, well-being, and financial security, especially in vulnerable populations. Link vulnerable populations to services that reduce the safety, health, and financial risks related to climate hazards. Reduce non-climate economic and health stressors.	All hazards, especially those sensitive to demographic and economic changes
Protect water resources	Conserve and reuse water, protect and enhance groundwater recharge areas, capture storm- and flood water, protect streamside areas, invest in natural infrastructure. Reduce non-climate stressors such as hydro-modification, pollution, and overuse of water.	Drought, flooding, and infrastructure failure risks to water quantity and quality
Promote a sustainable, climate-resilient economy	Better define the economic risks of climate change. Communicate to businesses and the broader community about practices that contribute to climate resilience and how to implement them. Reduce non-climate stressors.	All hazards, especially those sensitive to demographic and economic changes
Mainstream the use of climate projections (not just past patterns) in planning, design, and budgeting	Educate and share information among government agencies. Create and promote guidelines for how to use climate information in planning and decision making.	All hazards, especially sea-level rise, drought, wildfire, and flooding
Protect coastal, bayside, and inland buffer zones	Protect, expand, and enhance wetlands, water source areas, fire management zones, and flood zones. Review/revise land management plans, development codes, parks plans, and prevention and response plans for floods and fires. Reduce non-climate stressors in these areas.	Sea-level rise, changing temperature and rain patterns, drought, wildfire
Promote food system security and agricultural climate preparedness	Promote peer-to-peer agricultural adaptation networking, including potential need to cultivate alternative crops or adopt new agricultural land management strategies. Reduce non-climate stressors, such as the high cost of land for food production.	Changing temperature and rain patterns, drought, higher food prices
Protect infrastructure: buildings, energy systems, communications systems, water infrastructure, and transportation systems	Conduct a risk assessment by evaluating potential climate impacts on key infrastructure, buildings, and transit systems. Invest in strategies to ensure the long-term sustainability and reliability of energy resources. Reduce non-climate stressors such as deteriorating infrastructure.	Drought, flooding, wildfire, and extreme heat
Increase emergency preparedness	Support continued interagency emergency planning. Educate the public about climate hazards. Assess and address gaps in vulnerable populations' capacity to respond to extreme events. Reduce non-climate stressors such as forest health problems and provide adequate funding for emergency preparedness and response.	Public health and safety impacts of heat, flooding, and wildfire
Monitor the changing climate and its biophysical effects in real time	Measure actual conditions to validate and/or refine models of climate and climate change effects in order to plan and manage with better information.	All hazards

6.4.2 Climate Resilience Co-benefits from GHG Reduction Strategies in CA2020

The GHG reduction measures described in Chapter 4, *Reducing Community Emissions*, will also contribute to the climate readiness of Sonoma County and its resources. Measures in the Building Energy sector will help conserve energy and expand localized, renewable energy generation. These measures will reduce community reliance on the electrical grid, which is vulnerable to climate hazards including extreme weather events, sea-level rise, and heat waves. This, in turn, will help reduce climate-related personal and economic risks for residents and businesses in Sonoma County.

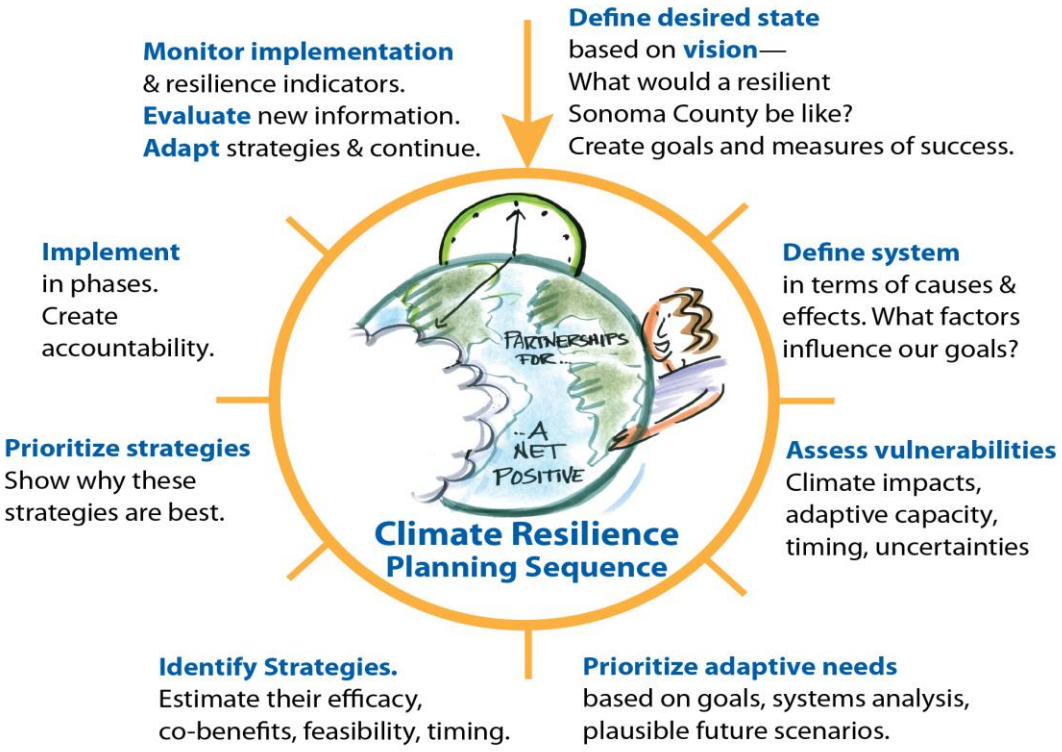
GHG reduction measures in the on-road transportation sector will reduce vehicle miles traveled and increase alternative modes of travel, such as walking, biking, and transit. These measures help reduce stress on the county's aging transportation infrastructure, which is also vulnerable to climate change hazards. Reducing stress on the transportation system helps protect a significant capital investment and avoid service disruptions and the resulting risks to residents and businesses throughout the county.

GHG reduction measures in other sectors also provide various resiliency benefits. Strategies to reduce emissions in the livestock and fertilizer sector will also help preserve soil fertility, conserve water, reduce energy use, and support sustainable agricultural products, all of which benefit a community adapting to a changed climate. Increasing reuse of materials and recycling in the solid waste sector helps reduce natural resource use in the manufacture of goods from original materials, thus helping to preserve water supplies, energy supplies, and natural resources that will likely be stressed in the future due to climate change impacts. Protection or enhancement of forests, wetlands, floodplains, or stream systems will not only increase carbon sequestration, but will also bring benefits for water supply, flood control, temperature moderation, and pollination. GHG reduction measures that reduce water demand help reduce climate change vulnerabilities by reducing the demand for stressed water supplies, reducing the amount of water treatment, and reducing the costs associated with water consumption.

6.5 Next Steps

The pervasive nature of anticipated climate change hazards in Sonoma County requires that both public and private entities play a role in enhancing local resilience. The vulnerability assessment summarized above represents some of the first steps in the overall climate readiness sequence, as shown on Figure 6-7.

Figure 6-7. Overall Climate Readiness Sequence for Sonoma County



In line with the goals summarized in Table 6-6, existing efforts to prepare for climate change should be integrated, expanded, and evaluated to explore how well they are serving the community by increasing climate resilience.

On an ongoing basis, climate readiness strategies should be explicitly integrated into existing plans and programs that are already used to promote public health, safety, and prosperity in Sonoma County, including the following.

- Hazard Mitigation Plans. Sonoma County's 2016 hazard mitigation plan will be the first to incorporate current knowledge about climate change and climate hazards facing the county.
- General Plans, specific plans, and the Local Coastal Plan, particularly as they relate to locations vulnerable to flood, landslide, and coastal hazards, and locations important for water supply, groundwater recharge, and shoreline protection. As required under new state law (Senate Bill 379, 2015), general plan safety elements must include "climate adaptation and resiliency strategies," including "goals, policies, and objectives for their communities based on the most current information available regarding climate change adaptation and

resiliency." Senate Bill 379 also allows jurisdictions to use adopted climate action plans, such as CA2020, to meet this new requirement.

- Parks, trails, and open space plans.
- Water supply, stormwater, and flood management plans and ordinances. Sonoma County Water Agency is also undertaking an in-depth climate adaptation plan for its operations.
- Environmental impact reports.
- Transportation and other capital improvement plans.
- Public health monitoring.
- Emergency preparedness plans.
- Street tree and water-efficiency ordinances.
- Zoning, building, and fire codes.
- Groundwater management plans.
- Administrative policies, procedures, and initiatives.

In every sector, from road-building to public health to transit, help is needed to translate technical information about a changed climate future into appropriate actionable steps. Climate adaptation efforts in Sonoma County have already identified a need for Climate Ready Advisors who can help residents, businesses, local governments, and non-governmental organizations make sense of the growing volume of climate hazard information and produce climate-smart decisions, plans, budgets, and priorities.

Local leaders, residents, and stakeholders, such as RCPA, must work together to respond to the county's climate vulnerabilities, implement the goals in Table 6-6, and evaluate how well current and new strategies are increasing community readiness for climate change.

An effective response to the climate challenge requires substantial investment, and therefore calls for a deep analysis of how to make that investment cost effective. As the cities and County have already done with Health Action and an array of new clean-power programs, the community will need to re-imagine and re-align its investments so that new and existing incentives, disincentives, and funding streams result in climate-resilient behavior throughout Sonoma County.