

MEMORANDUM

DATE October 9, 2020

TO Whitney Wilkinson, County of Santa Barbara, Senior Planner

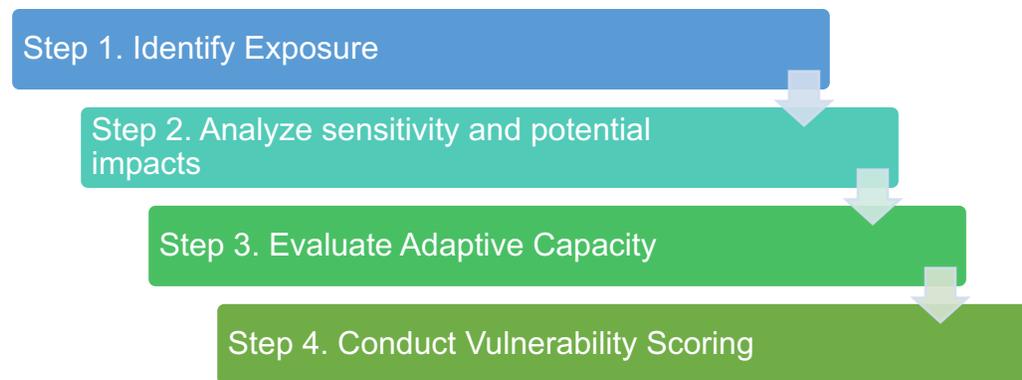
FROM Tammy L. Seale, PlaceWorks, Climate Action & Resilience Associate Principal
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SUBJECT Climate Change Vulnerability Assessment – Methods Report

Introduction to Adaptation Planning Guide Method

The Santa Barbara County Climate Change Vulnerability Assessment (CCVA) will follow the recommended process in the California Adaptation Planning Guide¹ (APG). This document was recently updated by the California Office of Emergency Services (Cal OES), and provides the steps for local governments to identify and reduce climate change hazards. The APG suggests that vulnerability assessments follow a four-step process, which is shown in **Figure 1** and is described herein.

Figure 1. California Adaptation Guide Vulnerability Assessment Method



Identify Exposure: In a vulnerability assessment, *exposure* is the presence of people; infrastructure; natural systems; and economic, cultural, and social resources in areas that are subject to harm. A *hazard*, or climate hazard, is an event or physical condition that has the potential to cause types of harm or loss. To prepare the vulnerability assessment, PlaceWorks will look at which climate change hazards different populations and assets are exposed to. This step will include confirming applicable hazards in the County, describing historical hazards, identifying new hazards, describing how hazards are expected to change, and mapping the hazards. PlaceWorks will use the list of hazards reviewed and discussed with County staff.

¹ California Governor's Office of Emergency Services. 2020. *California Adaptation Planning Guide*. <https://www.caloes.ca.gov/HazardMitigationSite/Documents/CA-Adaptation-Planning-Guide-FINAL-June-2020-Accessible.pdf>.

Analyze sensitivity and potential impacts: *Sensitivity* is defined as the level to which a species, natural system, community, government, etc. would be affected by changing climate conditions. Potential *impacts* are the effects of a climate change hazard, or the combination of *exposure* and *sensitivity*. For example, if an increase in extreme heat events is the exposure, then the greater risk of heat-related illness on susceptible persons is the impact and the degree to which they will be impacted is the sensitivity. Each population and asset in Santa Barbara County are likely to experience different impacts. In this vulnerability assessment, PlaceWorks will assess the sensitivities and potential impacts to each population or asset from each applicable climate change hazard.

Evaluate adaptive capacity: *Adaptive capacity* is the ability of people and assets to adjust to potential damage, to take advantage of opportunities, or to respond to the impacts of climate change. PlaceWorks will look at the adaptive capacity of each population or asset for each identified hazard as part of the vulnerability assessment.

Conduct vulnerability scoring: *Vulnerability* is defined as the combination of impact and adaptive capacity as affected by the level of exposure to changing climate conditions. In accordance with the process in the APG, PlaceWorks will use the impact and adaptive capacity scoring to identify and prioritize the most vulnerable populations and assets in Santa Barbara County.

Assessment Process

The hazards, populations, and assets selected by the Project Team and refined by the Core Team will be used to conduct the vulnerability assessment based on the APG's recommended process. Throughout this process, the Project Team, with support from the Core Team, will assess the impact, adaptive capacity, and vulnerability scores to provide local knowledge and additional accuracy for the assessment. The draft results will be presented in an Excel workbook for County staff and Core Team review. The results will also be presented in a user-friendly format for community stakeholder review.

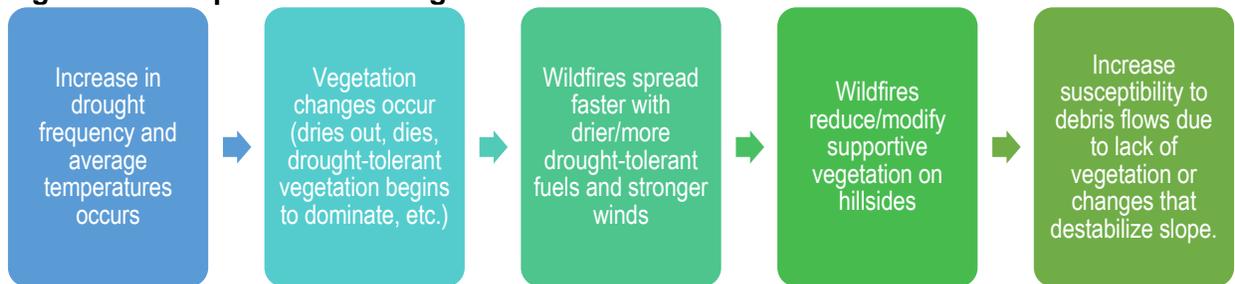
APPLICABILITY REVIEW

PlaceWorks will first identify which hazards are likely to affect which populations and assets, because not all hazards will affect all populations or assets. For example, human health hazards are likely to impact most populations, but they would not affect the structural stability of a bridge or a dam. The outcome of this step will be a matrix that identifies if a population or asset is likely to be exposed to a hazard, which will then be used for the impact and adaptive capacity assessments. The results of this step will form the foundation for the vulnerability assessment, which will develop a separate vulnerability score for each population or asset and hazard pairing.

If a population or asset has the potential to be affected directly or indirectly by a hazard, a "yes" will be indicated in the appropriate box. Direct impacts are those that affect physical assets, health, or immediate operations, which can lead to indirect impacts on the broader system or community, including asset types in a different category. For example, severe weather can *directly* damage electrical transmission lines causing power outages, which can *indirectly* impact persons with chronic illnesses who depend on electricity for life support systems. Therefore, both electrical transmission lines and persons with chronic illnesses who depend on life support systems would be marked as "yes" for being affected by severe weather and would be evaluated in the assessment.

Additionally, this will be where cascading effects are first considered in the analysis. Cascading or compounding climate change effects are where one climate change hazard can lead to another, which can “cascade” into additional hazardous conditions. In Santa Barbara County, the Thomas Fire and related events are a recent prominent example, when higher temperatures and lack of precipitation led to increased wildfire risks, eventually resulting in the Thomas Fire that spread quickly due to stronger winds, which helped create conditions that allowed an extreme rainfall event to set off a devastating mudflow in Montecito. **Figure 2** provides an example of these cascading effects. Human health hazards can also have cascading effects, such as workers being unable to work or visitors being unable to travel to an area, which can harm both economic drivers and key community services. These will be accounted for when developing the applicability matrix, during the assessment process, and as the vulnerability result summaries are developed..

Figure 2. Example of Cascading Effects



ASSESSING IMPACT

To assess the potential impacts that climate change hazards will have on populations and assets, PlaceWorks will consider various questions to ensure that the assessment broadly covers the range of potential harm. The questions below address physical or other impacts, the length of the impact, and how many people or assets could be directly or indirectly harmed. The following questions will allow PlaceWorks to account for both direct and indirect impacts:

- » What type of potential impacts may occur?
- » Could the potential impacts cause physical injury or damage? If not, is there a risk of behavioral or mental harm, loss of economic activity, or other nonphysical harm?
- » How many people or assets could be affected by both direct and indirect harm?
- » How long would the impacts persist after the exposure?
- » Is there a substantial chance of death or widespread destruction?

Based on the results of the impact assessment (IM), PlaceWorks will rank each population and asset on a five-point scale (0 to 4) for each relevant hazard. Some of these scores may be broken out into sub-regional levels if we anticipate significant regional variability in climate impacts. For example, the County could be divided into south coastal, north county, and Cuyama Valley, or we can divide the County based on climate zones. IM0 is the lowest score (lowest impact), and IM4 is the highest score (highest impact). An impact is considered a negative condition, and therefore, a higher impact score means that there is a higher potential for harm to a population or asset. A lower impact score means that there is a lower potential for harm to a population or asset. The Core Team will help inform the impact scoring based on their knowledge of the area conditions and roles in the social, built, natural, economic, and cultural systems. **Table 1** provides more detail about what each score will mean.

Table 1. Impact Scoring Matrix

IMPACT SCORE	MEANING (POPULATIONS AND ECOSYSTEMS)	MEANING (BUILDINGS, INFRASTRUCTURE, SERVICES, AND ECONOMIC DRIVERS)
IM0. Minimal Impact	Community members may not notice any change.	Damage, interruption in service, or impacts on the local economy is small or intermittent enough to mostly go unnoticed.
IM1. Low Impact	Community members notice minor effects. Daily life may experience mild, occasional disruptions.	There are minor but noticeable interruptions in service, damage, or negative effects on the economy.
IM2. Moderate Impact	There is a marked impact to the community. Quality of life may decline. Impacts may be chronic and at times substantial.	Damage, service interruptions, and other impacts are clearly evident. Impacts may be chronic and occasionally substantial.
IM3. Significant Impact	The well-being of the community declines significantly. The community's current lifestyle and behavior may no longer be possible.	Impacts are chronic. Buildings, infrastructure, and services may be often or always unable to meet community demand. Large sections of the economy experience major hardships.
IM4. Severe Impact	There is a severe risk of widespread injury or death to people, or of significant or total ecosystem loss.	Buildings, infrastructure, and services cannot function as intended or needed. Economic activities are not viable.

ASSESSING ADAPTIVE CAPACITY

PlaceWorks will next evaluate the adaptive capacity of the individual populations and assets for each relevant hazard. Following a similar process used to analyze impacts, PlaceWorks will consider various questions to help ensure that the adaptive capacity assessment covers the full ability of a population or asset to resist and recover from harm, given current programs and conditions. Examples of these questions include:

- » Are there existing programs, policies, or funding to provide assistance, reverse or repair damage, or restore or adapt resources or assets?
- » Are there barriers that limit response of recovery? Are these barriers, financial limitations, political challenges, lack of access to technology or other resources, or others?
- » Do alternatives exist in or near the County of Santa Barbara that community members can use? Are there redundant resources that may be brought online in case of failure or loss of function?

Based on the results of the adaptive capacity (AC) assessment, PlaceWorks will rank each population or asset on a five-point scale (0 to 4) ranging from AC0 (the lowest adaptive capacity) to AC4 (the highest adaptive capacity). As with the impact scoring, the adaptive capacity of populations or assets in different regions of Santa Barbara County may be scored differently. Adaptive capacity is considered a positive attribute, so a higher adaptive capacity score will mean that a population or asset may be more adaptable to the hazard. A lower adaptive capacity score means that a population or asset may have a harder time adjusting to the changing conditions. The Core Team and other stakeholders will inform the adaptive

capacity scoring using their local knowledge of the area and roles in social, built, natural, economic, and cultural systems. **Table 2** provides more detail about what each score means.

Table 2. Adaptive Capacity Scoring Matrix

ADAPTIVE CAPACITY SCORE	MEANING (ALL POPULATIONS AND ASSETS)
AC0. No Adaptive Capacity	Currently, there are no feasible means of adapting.
AC1. Low Adaptive Capacity	Adaptive solutions are available, but they are expensive, technologically difficult, and/or politically unpopular. Alternatives may not exist that can provide similar services.
AC2. Some Adaptive Capacity	Some adaptation methods are available, but not always feasible. Adapting may create significant challenges for some sensitivities. Some alternatives exist within the jurisdiction area that can provide similar services.
AC3. High Adaptive Capacity	Adaptation solutions are feasible for most or all sensitivities. There may be occasional or small-scale challenges to implementing adaptation methods. Many alternatives exist in the area that can provide similar services.
AC4. Outstanding Adaptive Capacity	Sensitivities can adapt with little or no effort. Quality of life is unchanged or may improve.

VULNERABILITY SCORING

PlaceWorks will use the impact and adaptive capacity scores (completed in the previous two steps) for each population and asset for each relevant hazard to determine the vulnerability score. The vulnerability (V) score will reflect how susceptible the population or asset is to harm from a particular hazard. Once this initial scoring is complete, PlaceWorks can adjust the IM and AC scores (and by extension, the vulnerability scores) in response to feedback from the Core Team and other stakeholders. Confirming and revising these scores with individual and agency stakeholders, through Core Team meetings and workshops, is critical to ensuring the CCVA accurately reflects the conditions present in the community. The revision process will be conducted by looking at the impact and adaptive capacity scoring to see if they accurately reflect the actual impacts to populations and assets and the current capabilities of populations and assets to adapt to the projected conditions.

Vulnerability is assessed on a scale of 1 to 5 (V1 through V5), as shown in **Figure 3**. **Table 3** shows how impact and adaptive capacity scores will combine and translate into a vulnerability score.

Figure 3. Vulnerability Scale

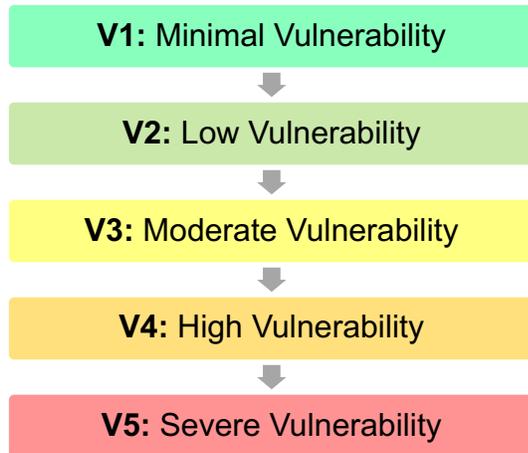


Table 3. Vulnerability Scoring Matrix

		IMPACT SCORE				
		IM0	IM1	IM2	IM3	IM4
ADAPTIVE CAPACITY SCORE	AC0	V3	V4	V5	V5	V5
	AC1	V2	V3	V4	V5	V5
	AC2	V1	V2	V3	V4	V5
	AC3	V1	V1	V2	V3	V4
	AC4	V1	V1	V1	V2	V3

Data Sources

The vulnerability assessment will be based on the best available science and information. PlaceWorks will use data from a variety of credible sources to prepare the vulnerability assessment, determine the impact and adaptive capacity scores, and support the vulnerability scoring conclusions. These sources will include scholarly research, locally provided data, and state and federal data.

SCHOLARLY RESEARCH

In support of the vulnerability assessment, the PlaceWorks team relies on an extensive body of scientific research that analyzes and summarizes how climate change may affect people and

community assets. In most cases, this research will not be conducted in the County of Santa Barbara, but the results will be applicable and relevant. Much of this research will be peer reviewed to ensure greater accuracy, and it includes studies published in academic reports such as the *Proceedings of the National Academy of Science*, *Geophysical Research Letters*, and *Climate Change*. PlaceWorks will augment the information in these studies and reports with local knowledge from the Core Team and other stakeholders, as well as websites and publications from scientific and academic institutions, government organizations, and credible local and national sources, including updated climate modeling from the UCLA Center for Climate Science.

LOCAL AND REGIONAL DATA

Local and regional government agencies have already prepared several plans and reports that support the vulnerability assessment or contain information relevant to the analysis. PlaceWorks will rely on several local and regional plans to prepare the vulnerability assessment, including:

- » Santa Barbara County Comprehensive Plan (2009–2016)
- » County of Santa Barbara Stormwater Management Plan (2012)
- » Santa Barbara Emergency Management Plan (2013)
- » Climate Change and Health Profile Report for Santa Barbara County (2017)
- » Santa Barbara Area Coastal Ecosystem Vulnerability Assessment (2017)
- » Santa Barbara County Coastal Resiliency Project, Sea Level Rise and Coastal Hazard Vulnerability Assessment (2017)
- » Santa Barbara County Multi-Jurisdictional Hazard Mitigation Plan (2017)
- » Santa Barbara County Agricultural Production Report (2018)
- » 2019–2024 Capital Improvement Program (2019)
- » Cuyama Basin Groundwater Sustainability Plan (2019)
- » Santa Barbara County Comprehensive Annual Financial Report (2019)
- » Santa Barbara County Homeless Point-in-Time Count and Survey (2019)
- » Santa Barbara County Integrated Regional Water Management Plan (2019)
- » Strategic Energy Plan for the County of Santa Barbara (2019)
- » Central Coast Region Water Resilience Portfolio (2020)
- » County of Santa Barbara 2020 Groundwater Basins Summary Report (2020)
- » Santa Barbara County Fire Department Unit Strategic Fire Plan (2020)
- » Santa Barbara County Association of Governments Multi-Modal Transportation Network Climate Change Vulnerability and Resiliency Assessments (2020)
- » Caltrans Climate Change Vulnerability Assessment, District 5 Technical Report (August 2019)
- » Santa Barbara County Association of Governments (SBCAG) and Ventura County Transportation Commission Transportation Emergency Preparedness Plan (Draft 2020)

PlaceWorks will also rely on spatial datasets maintained by Santa Barbara County. These data will show the locations of various buildings and infrastructure, different land uses, boundaries, critical facilities, and other items of importance to the vulnerability assessment.

STATE AND FEDERAL DATA

PlaceWorks will supplement the scholarly research and local or regional data with data from state and federal agencies, including published reports and datasets. PlaceWorks will rely on information from several agencies, including Centers for Disease Control and Prevention, Federal Emergency Management Agency, the United States Geological Survey (USGS), the National Oceanic and Atmospheric Administration, Caltrans, the California Energy Commission (CEC), the California Geologic Survey, California Governor's Office of Emergency Services (Cal OES), the California Governor's Office of Planning Resources, and the California Department of Forestry and Fire Protection. PlaceWorks will also rely on the U.S. Census Bureau and the California Department of Finance for demographic data, including information about frontline and disadvantaged persons in the community. Key state resources include the following guidance documents, reports, and tools.

- » The state's APG and the Fourth Climate Change Assessment, including the Central Coast Regional Report, will provide extensive information about climate-related exposures and vulnerabilities, as will federal reports such as the National Climate Assessment.
- » Cal-Adapt, a web-based tool developed by the CEC, will provide highly specific information about historic climate conditions and future climate projections for extreme heat, drought, severe weather, and wildfire.
- » CoSMoS, a web-based geographic information system (GIS) tool developed by the USGS, will provide County-specific spatial data on current and projected sea-level rise, and associated coastal storms and dune and bluff erosion.

Conclusion

The process described will follow the recommendations of the recently updated APG and incorporate Santa Barbara County specific components based on local, regional, state, and federal publications and datasets. This method will provide for the individual scoring of sensitivity, impact, and adaptive capacity for each population or asset to each hazard, which will enable the Project Team to prioritize vulnerable populations and assets more accurately. PlaceWorks will also collaborate with the Project Team and Core Team to ensure impact and adaptive capacity scoring reflect disasters that have occurred in the past, the effects on the community, and the current capabilities of the County and its residents to respond to future climate change hazards. Overall, this method will use the state's recommended step-by-step process, existing datasets and reports, and local knowledge to effectively assess the vulnerabilities of populations, infrastructure, buildings, economic drivers, natural resources, and community services within the County of Santa Barbara.