The following document is a preliminary draft of the Yolo Resiliency Collaborative (YRC) Resiliency Planning Toolbox. This document reflects the state of the template as of June 26, 2019, and the material is not finalized for planning documents. As of June 26, 2019, the YRC is collecting feedback for this draft from willing reviewers. Send feedback, comments, and questions regarding this draft to yoloresilience@gmail.com

The Yolo Resiliency Collaborative

Resiliency Planning Toolbox

Responses to Heat-Related Impacts

Draft 6/26/19

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Yolo Resiliency Collaborative Member Agencies

Capital Region Climate Readiness Collaborative

City of Davis

City of West Sacramento

City of Winters

City of Woodland

University of California, Davis

Yocha Dehe Wintun Nation

Yolo County

Yolo County Housing

Yolo Energy Watch

YOLO ENERGY WATCH

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Introduction

I. Purpose of Resiliency Planning Toolbox

The Yolo Resiliency Collaborative (YRC) created this Toolbox to help build stronger, more resilient communities. In the face of increasingly frequent and severe disasters exacerbated by climate change, bolstering community resilience to these disasters is imperative for our health, economy, infrastructure, environment, social equity, safety, and well-being. This toolbox provides strategies for addressing one of these disasters, extreme heat events.

Extreme heat events are one of the deadliest natural disasters. According to the NOAA (National Oceanic and Atmospheric Administration) National Weather Service, extreme heat is the leading cause of weather-related deaths in the United States[1]. In 2018, and for the ten-year average and 30-year average from 2009 to 2018, more people died from heat than floods, lightning, tornadoes, hurricanes, cold, or rip currents[2]. Therefore, as climate change heightens the frequency and impact of extreme heat, it is imperative that communities bolster their heat resilience.

This toolbox is also intended to streamline planners' abilities to comply with California state law[3]. Drafting planning documents can be time and money intensive, especially for jurisdictions with limited capacity. The toolbox offers draft language, policies, actions, and implementation recommendations to assist local governments, agencies, community organizations, and other jurisdictions in integrating heat resilience into their jurisdictional plans, as well as into their community and neighborhood institutions. By providing a comprehensive list of customizable strategies and resources, this toolbox allows jurisdictions to efficiently review, select, and integrate resiliency measures into planning documents, and increases capacity to prepare for disaster.

A. Addressing heat

[1] U.S. National Oceanic and Atmospheric Administration, National Weather Service, *Natural Hazard Statistics, Weather Fatalities 2018*, (Silver Springs Maryland, 2019), https://www.nws.noaa.gov/om/hazstats.shtml.

[2] U.S. National Oceanic and Atmospheric Administration, National Weather Service, *Natural Hazard Statistics, Weather Fatalities 2018*.

[3] Note: The YRC is based in the Sacramento area of California. Much of the content in this Toolbox is based on California realities, however this Toolbox is intended to be useful not only for California planners, but for any planner interested in heat resiliency.

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California is getting hotter. Temperatures are rising, snowpacks are declining, and extreme heat events are increasing in frequency[4]. Southern California has gotten 3°F warmer in the last century, the rest of the state has warmed as well, and this increase in temperature is projected to continue[5]. The average water supply from the California snowpack is projected to decline to ⅔ of historic levels by 2050, and if greenhouse gas emissions are not reduced, the supply could decline to ⅓ of historic levels by 2100[6]. Heat waves are also becoming more common in our state[7].

In Yolo County, between 1961-1990, the historical annual mean maximum temperature was 74°F and the average number of extreme heat days was four[8, 9]. Between 2061-2090, these numbers are expected to have increased to 79.4°F - 81.7°F and 32 - 52 days[10, 11]. The heat impacts of climate change have serious consequences at the local level. Extreme heat events heavily stress infrastructure, agriculture, service provision, and public health. However, counties and cities can take a wide variety of steps to mitigate, and in some instances prevent, these detrimental heat impacts. By planning for these extreme heat events in decision-making, our jurisdictions and communities can be prepared for extreme heat events, increase resilience to rising temperatures, better protect public health, strengthen our civil society and neighborhood institutions, and ultimately create communities that are better places to live.

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[4] California Natural Resources Agency, *California's Changing Climate 2018. A Summary of California's Fourth Climate Change Assessment,* James H. Thorne, Joseph Wraithwall, and Guido Franco. 2018. Web, http://www.climateassessment.ca.gov/state/docs/20180827-SummaryBrochure.pdf (accessed January 11, 2019).

[5] U.S. Environmental Protection Agency, *What Climate Change Means for California*. EPA 430-F-16-007, 2004. Web, https://www.epa.gov/sites/production/files/2016-09/documents/climate-change-ca.pdf (accessed January 11, 2019).

[6] California Natural Resources Agency, *California's Changing Climate 2018. A Summary of California's Fourth Climate Change Assessment*.

[7] U.S. EPA, *What Climate Change means for California*.

[8] "Annual Averages," Cal-Adapt, accessed January 8, 2019, https://cal-adapt.org/tools/annual-averages/#climatevar=tasmax&scenario=rcp45&lat=38.59375&lng=-121.46875&boundary=locagrid&units=fahrenheit.

[9] "Extreme Heat Days & Warm Nights," Cal-Adapt, accessed January 8, 2019. https://cal-adapt.org/tools/extreme-heat/.

[10] "Annual Averages," Cal-Adapt.

[11] "Extreme Heat Days & Warm Nights," Cal-Adapt.

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B. Commitments to Adaptation

i. California Law

In 2015, state Senate Bill 379 (SB 379) became law in California. This bill requires all California cities and counties to include climate change adaptation and resiliency strategies in the safety element of their general plans and/or local hazard mitigation plan. The bill stipulates that after January 1 2017 and before January 1 2022, adaptation and resiliency must be addressed upon the next revision of general plans and local hazard mitigation plans. SB 1035 (legalized in 2018) further clarifies this timeline; once general plans include climate adaptation and resiliency, local planning agencies must review and, if necessary, revise the safety element no less than every 8 years (in accordance with the update timelines of the housing element or local hazard mitigation plan), to ensure hazards addressed by adaptation and resiliency strategies are up to date.

Both SB 379 and SB 1035 follow on Governor Jerry Brown's Executive Order B-30-15 (legalized in 2015). This Executive Order established the California greenhouse gas emissions target for 2030 at 40% below 1990 levels, and requires California state agencies to plan for climate change in planning and investment decisions. SB 379 and SB 1035 build on this requirement and necessitate that local governments address climate change resiliency and adaptation in their planning and decision-making.

ii. Public Commitments

In addition to laws outside of California stipulating adaptation commitments, there are also many non-law public commitments and accords at many levels of governance and organizing that call for adaptation action. These public commitments include:

- 2015 United Nations Paris Climate Accord: requests that committed parties consider adaptation and strengthen adaptation efforts at regional levels[12].
- We Are Still In: since June 2017, over 3600 leaders in government, businesses, healthcare organizations, universities, and more have

[12] "Paris Agreement," conclusion date: December 12, 2015, United Nations Treaty Series Online, registration no. I-54113, https://treaties.un.org/pages/AdvanceSearch.aspx?tab=UNTS&clang=_en.

committed to supporting the Paris Climate Accord in their work and jurisdictions in the United States[13].

- Presidents' Climate Leadership Commitments: prioritizes carbon neutrality and resilience as areas of extreme importance for climate action in higher education. The Presidents' Leadership Commitment establishes commitments for university and college presidents and chancellors, and is organized by Second Nature, a US based nonprofit dedicated to climate action through higher education[14].
- Adaptation Pledge: participants at the 2017 US National Adaptation Forum created an Adaptation Pledge, which outlines commitments to pursuing adaptation and outlines a philosophical framework to support equitable, science-based, holistic adaptation. The Pledge is also meant to serve as a "tool for good practice" and may be useful for all resiliency planners[15].

II. Using this Toolbox

A. Resiliency Planning - Process Overview

Resiliency planning is a process for fostering the ability of communities to survive, thrive, adapt, and grow in a dramatically changing and stressful world. Climate change is already impacting communities around the globe, and these impacts will increase in severity and frequency. Reducing our greenhouse gas emissions and mitigating climate change is no longer enough to protect future generations from these impacts; we must adapt to allow present and future generations to cope with these impacts.

The longer climate adaptation is delayed, the fewer options will be available to future generations. Therefore, it is imperative that in the present we look towards the future and plan for climate change challenges that our communities will face in this century. Resiliency planning encompasses this future-facing approach and promotes adaptation. Resiliency planning encourages planners to address climate

[13] "'We Are Still In' Declaration," We Are Still In, accessed January 14, 2019, https://www.wearestillin.com/we-are-still-declaration.

[14] "The Presidents' Climate Leadership Commitments," Second Nature, accessed January 14, 2019, https://secondnature.org/signatory-handbook/the-commitments/.

[15] "Adaptation Pledge," National Adaptation Forum, accessed January 14, 2019, http://www.nationaladaptationforum.org/about/adaptation-pledge.

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issues before they become more costly (environmentally, socially, and economically) and to instigate changes that create positive impacts in the near and distant future.

The Toolbox includes template planning language, policies, actions, and implementation measures. These templates are meant to streamline jurisdictions' abilities to devise resiliency plans and put them into action. The templates may be included in Elements of General Plans (such as Safety or Housing), Climate Action Plans, Sustainability Plans, and other resiliency plans a jurisdiction, agency, or organization may seek to create.

Users of this toolbox should note that the language, policies, actions, and implementation measures in this document are primarily a list of suggestions that may or may not be relevant to your location or the plan you're working on. This document does not contain every section that could be incorporated into a local plan, as each of these plans should be tailored to local resources, vulnerabilities, and conditions.

Plan to plan: In order to make the best use of this Toolbox, we encourage jurisdictions and community organizations to take the time to map out and follow a step-by-step planning process. We suggest following the process steps recommended in the California Adaptation Planning Guide (Figure X), but each jurisdiction should amend and revise those steps, along with estimated timelines for the work, to match with their community and agency needs and resources.

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Figure X. The California Adaptation Planning Guide's "nine steps in adaptation planning development" graphic. The gray steps (1-5) encompass vulnerability assessments, the blue steps (6-9) encompass adaptation strategy development.

B. Vulnerability Assessments

All resiliency planning is best started with a vulnerability assessment. Vulnerability assessments help jurisdictions identify the most pressing climate change impacts facing their communities, and determine how best to respond to these impacts.

For California local governments, SB 379 mandates that the resiliency update to the safety element of general plans include goals, policies, and objectives based on the results of local vulnerability assessments. Therefore, before using this document to streamline local heat resiliency planning, planners should first determine how vulnerable their communities are to heat impacts. The State of California has published numerous guiding documents for creating these vulnerability assessments, including the Adaptation Planning Guide (APG). This toolbox was written in 2019, during months when the APG was being updated. The original 2012 documents offer specific guidance on conducting vulnerability assessments. Figure X shows the APG's suggested guidance for developing adaptation plans, the first five steps represent the steps of a vulnerability assessment.

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When determining vulnerability to heat specifically, jurisdictions should follow the outline of the Adaptation Planning Guide. Stemming from this guidance, local planners interested in heat resiliency should consider how extreme heat impacts your jurisdiction and evaluate the steps your jurisdiction has already taken toward heat resiliency. Some of the questions that should be considered when making these determinations and evaluations are listed below.

<u>How extreme heat impacts your jurisdiction</u>

- How are temperatures and extreme heat events anticipated to change in your jurisdiction?
- Are extreme heat events an impact of climate change that will affect your jurisdiction? To what degree?
- What members of your jurisdiction are particularly vulnerable to extreme heat?
- What assets, resources, and infrastructure in your jurisdiction are particularly vulnerable to extreme heat?

<u>Evaluating steps your jurisdiction has already taken toward heat resiliency</u>

- Has your jurisdiction implemented heat resiliency and heat response strategies into its governance and planning? Consider the questions in Table X.
    - Are there designated, well-known cooling centers?
    - Is there an updated heat-warning system in place?
    - Are cool building design programs and policies (cool/green roofs, cool pavements, cool parking lots, etc) encouraged and/or sanctioned?
    - Is land being used in ways that mitigate heat impacts (open and green spaces, urban forests, shade cover, community gardens, parks, etc)?

Table X. What steps has your jurisdiction taken toward heat resiliency?

Place	**People**	**Infrastructure**	**Labor**	**Governance**
Is land being used in ways that mitigate heat impacts (open and green spaces, urban forests, shade cover,	Are there campaigns to inform the public about the risks of extreme heat? Are people	Are there designated, well-known cooling centers? Have public infrastructure (roads, parking,	Does jurisdiction have plans in place for protecting outdoor laborers during heat events while still being able to	Is there an updated heat-warning system in place? Are cool building design programs and

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community gardens, parks, active farming, protecting farmland, etc) Have land management practices that reduce irrigation needs but also manage fire risk been implemented?	discussing and preparing for extreme heat in community meetings? Are social networks encouraging neighbor check-ups and community resiliency in place and encouraged?	water systems, etc) been designed and maintained to mitigate and withstand extreme heat events? Is clean drinking water easily accessible during extreme heat events?	accomplish needed work?	policies (cool/green roofs, cool pavements, cool parking lots, etc) encouraged and/or sanctioned?

- In your jurisdiction, how are the resiliency and response strategies that currently exist effective at mitigating and adapting to heat? How could they be altered and updated to be more effective and efficient in addressing the impacts of climate change?

C. Related Resources

There are many resources available to the public that can help local planners create comprehensive, useful, equitable data-based general plans. These resources include:

- California Resources
  - Alliance of Regional Collaboratives for Climate Change (ARCCA): Network connecting adaptation planners with peers across California. Resources include a newsletter with up-to-date legislative updates, news, and grant programs.
  - Cal-Adapt: Tools, data, and resources for examining how climate change will impact California. Offers projections about multiple climate change impacts at a regional level (can also upload your own shapefile for data/models for specific locations). Cal-Adapt data is peer reviewed and approved by the California state government, it's data was used as the basis for California's Fourth Climate Assessment.
  - California's Adaptation Planning Guide: Provides guidance to support regional and local communities in proactively address climate change. Offers a step-by-step process for local and regional climate vulnerability assessments and adaptation strategy development. Structured to allow for

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flexibility in the commitment of time, money and effort to suit the needs of the community.
    - CalEnviroScreen: A mapping tool that helps identify California communities most impacted by many sources of pollution. Helps identify vulnerable communities at a census tract level.
    - Cal OES Office of Access and Functional Needs: Information and resources (including a mapping tool) to help improve emergency preparation and response for individuals with disabilities and other access and functional needs.
    - California Heat Assessment Tool (ºCHAT): A mapping tool with heat event information by census tract and resources for extreme heat events. CHAT is funded by the California Nature Resources Agency as part of the state's Fourth Climate Assessment.
    - Healthy Places Index: A mapping tool exploring how local social, economic, and environmental factors influence people's health and community conditions in California.
    - Regional Opportunity Index: A mapping tool exploring how the vulnerabilities of people and places in California due to social, economic, and environmental factors.
    - ResilientCA.org: Online clearinghouse database of information, resources, and case studies on climate adaptation and resiliency efforts in California
- National Resources
    - Adaptation Clearinghouse: Online database and networking site for adaptation planning documents, grant programs, and other resources. Primarily lists US networks and resources, but could also be useful for international planners.
    - EPA Adaptation Resource Center (ARC-X): Contains adaptation information for regions in the US and climate change issues in those regions. Also lists EPA and other federal funding opportunities.
    - American Society of Adaptation Professionals (ASAP): Professional network to help adaptation practitioners exchange information and best practices, and connect with others in the field.
- International Resources
    - CDP (formerly the Carbon Disclosure Project): Contains datasets and analyses about environmental risks, opportunities, and impacts. Includes data on adaptation

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actions. Also offers a platform for companies and jurisdictions to report their environmental performance.

- Climate Adaptation Knowledge Exchange: Source for international case studies, documents, and tools. Can search through resources by international region, impact, scale, sector, or resource type. Also lists adaptation opportunities primarily based in the US.
- Climate Ready Communities: (focused in USA and Canada) A resource to guide communities through the climate resilience planning process. The Framework aims to develop resilience plan and strengthen local adaptive capacity, to ensure that communities have the skills necessary to update their climate resilience plans over time.
- UN Sustainable Development Goals: Knowledge Platform: Resources and information about the UN Sustainable Development Goals (SDGs). SDG 9, to "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" is particularly relevant to adaptation planning

III. Equity Framework

This toolbox was created using an equity framework. The suggestions listed in this toolbox are meant to prioritize the needs of people and populations most vulnerable to extreme heat. In this way, this toolbox was designed to promote not only heat resilience, but also equity in heat response and resilience.

Rising temperatures and extreme heat events impact neighborhoods, cities, and counties as a whole. However, sharing a geographic location does not mean people living in these areas and jurisdictions are all impacted by these challenges to the same extent. Populations vulnerable to extreme heat include children, the elderly, pregnant women, low-income individuals, people with existing health conditions, geographically isolated people, tribal communities, members of the LGBTQ+ community, people experiencing homelessness, some communities of color, outdoor workers and those active outdoors[16]. Local governments must ensure these populations are addressed and prioritized in planning for heat resilience and other emergencies.

[16] California Natural Resources Agency, *Safeguarding California Plan: 2018 Update*. 2018. Web, http://resources.ca.gov/docs/climate/safeguarding/update2018/safeguarding-california-plan-2018-update.pdf (accessed January 11, 2019).

Another aspect of equity frameworks include recognizing the institutional structures that have made some populations more vulnerable than others. A person is not inherently vulnerable due to their race, sexual orientation, gender identity, national origin, first language, religion, or zip code. Rather, historic and structural discrimination have constructed systems to create differences and increase the vulnerability of groups of peoples in our world. For example, economically-secure individuals and communities have greater access to resources for managing extreme heat. However, a long history of racially discriminatory policies in the US have significantly limited the abilities of many communities of color to accumulate wealth. The impacts of these policies are evident in a 2017 Institute for Policy Studies report, which found that white middle-income households own almost eight times as much wealth as black middle-income households, and ten times as much wealth as middle-income Latino households[17]. Recognizing the role institutional discrimination has played in creating vulnerability is crucial when trying to develop and implement new policy to ameliorate that vulnerability.

IV. Who Will Use Toolbox

This Resiliency Planning Toolbox was designed for government planners seeking to incorporate resiliency into their jurisdictional plans. As of June 2019, the Resiliency Planning Toolbox includes language, policies, and actions related to heat resiliency and extreme heat preparedness. The Yolo Resiliency Collaborative plans to add additional resiliency topics into this toolbox over time, and hopes this document will be useful for multiple contexts and purposes, as climate change heat impacts reach across sectors and around the globe.

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[17] Asante-Muhammad, Dedrick., Collins, Chuck., Hoxie, Josh., Nieves, Emanuel., *The Road to Zero Wealth: How the Racial Wealth Divide is Hollowing Out America's Middle Class* (Washington D.C.: Institute for Policy Studies, 2017 ; Washington D.C.: Prosperity Now, 2017), page 5. https://prosperitynow.org/sites/default/files/PDFs/road_to_zero_wealth.pdf (accessed January 11, 2019).

Planning Language

This chapter of the Resiliency Planning Toolbox offers template language that can be inserted into plans. This template language explains the necessity for adaptation, reasons why extreme heat should be addressed, and defines several key terms in heat resiliency planning.

As stated in the Introduction of this Toolbox, the content in this document is primarily a list of suggestions that may or may not be relevant to your location or the plan you're working on. Local planners should add or delete content as necessary, and ensure that plans are tailored to local resources, vulnerabilities, and conditions.

NOTE: The text in red is the draft language. The text in *italics and underlined* is for you to fill in with local information, projects, and/or preferences.

I. Language for why your plan is addressing adaptation

A. Explaining the necessity of adaptation

The world is changing. Climate change is a reality that can no longer be ignored; its consequences are already impacting millions around the globe, and these impacts will only increase in severity. Regardless of the success of mitigation efforts undertaken around the world, current and previous emissions have ensured that global temperatures will rise[18]. Therefore, it is necessary for people and planners to prepare for and adapt to the consequences of climate change.

Adapting to climate change is a challenge that calls for ample research, holistic thinking, and honest conversations. The longer adaptation is delayed, the fewer options will be available to future generations. However, adaptation also offers opportunities to build more resilient and more equitable communities that are also better places to live. Adaptation calls for changes across sectors in our own lives, and while change can challenging, change offers space for creating positive differences in our existing systems and society. Adaptation will build safer communities in the face of climate change, and instigates changes that can create stronger communities.

[18] Intergovernmental Panel on Climate Change, *Special Report: Global Warming of 1.5°C: Summary for Policymakers* (Intergovernmental Panel on Climate Change, 2018). https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/.

B. Explaining legal reasons for adaptation in California[19]

Senate Bill 379 was signed into California law in 2015. This bill mandates that all cities and counties incorporate climate adaptation and resiliency into the safety elements of their General Plans beginning January 1, 2017 and by January 1, 2022.

Jurisdiction has taken steps to comply with this rule by updating the *jurisdiction* General Plan to include relevant policies, and current and future adaptation projects *jurisdiction* is undertaking.

- If addressing heat resiliency in a plan that is not your local jurisdiction's General Plan: *Lead agency* is addressing climate adaptation and resiliency in *plan you are writing or updating* to ensure [consistency between *jurisdiction* plans] {and/or} [concordance with the intent of Senate Bill 379].

SB 1035 (legalized in 2018), clarifies the timeline of SB 379 and mandates that once General Plans include climate adaptation and resiliency, local planning agencies must review and, if necessary, revise the safety element in accordance with each revision of the housing element or local hazard mitigation plan no less than every 8 years[20]. These revisions to the safety element should identify and address new information regarding climate change adaptation and resiliency that was not available during the previous revision to the safety element[21].

Jurisdiction will also comply with this rule and will review and, if necessary, revise the safety element of the General Plan upon each revision of the housing element {or} upon each revision of the local hazard mitigation plan {and/or} no less than every 8 years.

[19] If your jurisdiction is not in California but there are adaptation related laws that encompass your jurisdiction, you can use this general format to discuss the legal requirements in your jurisdiction for addressing adaptation.

[20] SB 1035, Section 65302 (California, 2018), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1035

[21] In addition to climate adaptation and resiliency, SB 1035 also requires that new information regarding flood and fire risk be identified and addressed in the safety element of General Plans or local hazard mitigation plans no less than every 8 years.

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- If addressing heat resiliency in a plan that is not your local jurisdiction's General Plan: *Lead agency* will review and, if necessary, revise *plan you are writing or updating* to ensure [consistency between *jurisdiction* plans] {or} [concordance with the intent of Senate Bill 1035].

II. Why your plan is addressing extreme heat

Jurisdiction/locality is getting hotter. Between 1961-1990, the historical annual mean maximum temperature in *jurisdiction's county* was ___[22]°F and the average number of extreme heat days was ___[5] . Last year, the average annual temperature in *jurisdiction/locality {or} regional entity with average annual maximum temperature data* was *temperature* and *jurisdiction/locality {or} regional entity with extreme heat days data* experienced *number* extreme heat days. By 2061-2090, these numbers are expected to have increased to _____[5]°F and ____[5] days.

Increasing temperatures and extreme heat events influence communities in many ways. Sectors stressed by heat include infrastructure, public health, emergency service provision, and the economy. *Insert information about other ways heat stresses your jurisdiction/locality, or can note heat impacts of particular concern in your jurisdiction/locality.*

Infrastructure: Electricity systems are heavily stressed by heat as demand for air conditioning increases, which increases the risk of prolonged power outages[23]. Building and transportation materials like pavement and asphalt are at increased risk of cracking and rutting as a result of higher temperatures and extreme heat. These heat impacts also increases the risk of railroad track, bridge, and road failures[24].

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[22] These are just suggested metrics, other data about temperature and extreme heat available to your jurisdiction/locality will suffice. For jurisdictions/agencies in California, the information in the ____ spots above, and more, can be found on cal-adapt under "Annual Averages" and "Extreme Heat Days and Warm Nights". Heat data for California jurisdictions/localities can also be found on the California Heat Assessment Tool.

[23] "Adapting to Heat", U.S. Environmental Protection Agency (EPA), accessed January 22, 2019, https://www.epa.gov/heat-islands/adapting-heat.

[24] "What does adaptation look like in the transportation sector?" Alliance of Regional Collaboratives for Climate Adaptation (ARCCA), accessed January 21, 2019, http://arccacalifornia.org/roadmap-to-resilience/.

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Water Resources: Consumer demand for water increases during periods of extreme heat and increased temperatures. Water resources may also be strained by extreme heat events if used to cool metal structures and other infrastructure. Extreme heat events may also cause water temperatures to rise, which can decrease water quality and negatively impact fish populations in rivers and lakes[25].

Public Health: Extreme heat takes a great toll on public health. Heat-related illnesses include heat cramps, heat exhaustion, and heat stroke. Populations most at risk to heat-related illness include children, the elderly, pregnant women, low-income individuals, people with existing health conditions, geographically isolated people, tribal communities, people experiencing homelessness, some communities of color, members of the LGBTQ+ community, prescription drug users, outdoor workers and those active outdoors[26].

Heat-related death and illness is largely preventable, however extreme heat events are the leading cause of weather related deaths in the United States[27]. In 2018, and for the ten-year average and 30-year average between 2009 to 2018, more people died from heat than floods, lightning, tornadoes, hurricanes, cold, or rip currents[28]. According to the CDC, over 600 people in the United States are killed by extreme heat events every year. In 2006, over 650 people died in California from heat-related conditions during one 10-day heat wave alone[29]. Furthermore, the number of heat-related deaths is severely

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[25] Christopher R. Adams, "Impacts of Temperature Extremes," Colorado State University, n.d., accessed January 22, 2019, https://sciencepolicy.colorado.edu/socasp/weather1/adams.html.

[26] California Natural Resources Agency, *Safeguarding California Plan: 2018 Update*. 2018. Web, http://resources.ca.gov/docs/climate/safeguarding/update2018/safeguarding-california-plan-2018-update.pdf (accessed January 11, 2019).

[27] U.S. National Oceanic and Atmospheric Administration, National Weather Service, *Natural Hazard Statistics, Weather Fatalities 2018*, (Silver Springs Maryland, 2019), https://www.nws.noaa.gov/om/hazstats.shtml.

[28] U.S. National Oceanic and Atmospheric Administration, National Weather Service, *Natural Hazard Statistics, Weather Fatalities 2018*.

[29] California Environmental Protection Agency, California Department of Public Health, *Preparing California for Extreme Heat: Guidance and Recommendations*, Heat Adaptation Workgroup, 2013, Web, https://www.climatechange.ca.gov/climate_action_team/reports/Preparing_California_for_Extreme_Heat.pdf (accessed January 21, 2019).

under-reported in the United States, because there is no standardized definition for heat-related death in the US[30].

Emergency Service Provision: During extreme heat events, emergency service workers such as law enforcement officers, firefighters, and EMTs may face increased demand for their services. As public safety and health are compromised by extreme heat, more people may require emergency attention, straining the resources and personnel in emergency service provision.

Economy: The damages to infrastructure, stress on water resources, increased demand on healthcare resources, and increased demand on emergency services provision caused by heat also incur an economic cost. Furthermore, during periods of extreme heat, outdoor workers' safety and productivity are compromised, as well as those of other populations vulnerable to heat.

- For jurisdictions/agencies where agriculture is a prominent facet of the economy: Heat also has serious impacts on agriculture. Livestock and crops are heavily stressed by heat, and agricultural yields may decrease significantly as a result of extreme heat events and higher temperatures during key crop growth stages[31].

III. Definitions

A. Adaptation

Adaptation is the process of changing to accept and be better suited for new circumstances. In discussions and studies of climate change, adaptation is typically used to refer to adapting to climate change.

B. Resiliency

Resiliency is the ability of individuals, communities, and systems to "survive, adapt, and grow" in response to and despite difficulties[32]. In discussions and studies of climate change, these difficulties typically

[30] California EPA, California DPH, *Preparing California for Extreme Heat: Guidance and Recommendations*.

[31] Adams, "Impacts of Temperature Extremes."

[32] Lek Kadeli, "Survive, Adapt, and Grow: EPA, Rockefeller Foundation Team Up for Resilient Cities," *The EPA Blog*, December 22, 2014, https://blog.epa.gov/2014/12/22/survive-adapt-and-grow-epa-rockefeller-foundation-team-up-for-resilient-cities/.

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refer to the chronic stresses, acute shocks, and traumas caused by climate change.

C. Extreme Heat Events

The Centers for Disease Control and Prevention defines extreme heat as "'summertime temperatures that are much hotter and/or humid than average", and "average" depends on location and time of year[33]. In accordance with this definition, many experts recommend using relative temperature indicators rather than an absolute temperature to define extreme heat days[34]. Relative temperature definitions should be adjusted to local conditions, because human bodies gradually acclimatize to the temperatures wherever we live. People living in areas with cooler temperatures are at risk of heat-related illness at lower temperatures than those living in higher temperature areas.

D. Cooling Centers

Cooling centers are publicly available spaces where people can cool off during high heat days[35]. Examples of cooling centers include public libraries, shopping malls, community centers, local government-run senior centers, and parks and recreation centers. {Jurisdictions/agencies} can also work with the private sector to designate private buildings as cooling centers during extreme heat events.

E. Cool/Green Roofs

Both of these roofing techniques reduce temperatures in and around buildings. Cool and green roofs decrease indoor air temperatures, lowering electricity costs and greenhouse gas emissions from air conditioning use, and making the indoors more comfortable in periods

[33] "About Extreme Heat," Centers for Disease Control and Prevention (CDC), accessed January 22, 2019, https://www.cdc.gov/disasters/extremeheat/heat_guide.html.

[34] Cal-Adapt defines extreme heat events using relative temperature, with the preset condition for extreme heat days as above the 98th percentile of daily maximum/minimum temperatures in a location between 1961-1990. Users can redefine extreme heat days as they see fit.

[35] California Emergency Management Agency, California Natural Resources Agency, *California Adaptation Planning Guide: Identifying Adaptation Strategies*. Mather; Sacramento, 2012. Web, http://resources.ca.gov/docs/climate/APG_Identifying_Adaptation_Strategies.pdf (accessed January 24, 2019).

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of extreme heat. Furthermore, cool and green roofs can help decrease the outdoor air temperature in urban areas, mitigating the urban heat island effect.

- Cool roofs are made with materials that reflect more sunlight off of roofs and radiate more absorbed heat than traditional roofs[36]. Cool roofing products can be a variety of materials and range in primarily light-tinted colors.
- Green roofs are partially or completely covered with vegetation planted over a waterproofing membrane. Green roofs can sequester carbon and reduce energy consumption of buildings. Insulation from green roofs keep buildings warmer when temperatures are low, and sunlight absorbed by plants keep buildings cooler when temperatures are high.

F. Urban Greening

Urban greening refers to efforts to increase vegetation in urban areas. These efforts include green roofs, planting trees, and increasing vegetative cover.

G. Weatherization

Weatherization is a process of protecting a home or building from weather events in ways that improve health and safety, reduce energy consumption, and increase energy efficiency. Weatherization services include improving ceiling, wall, and floor insulation, installing caulking, weather-stripping, solar water heating and solar photovaltics, and energy efficient appliances, fans, and lightbulbs, and repairing heating/cooling systems.

H. Social Capital

Social capital is a term to convey that having strong social relationships and networks in a community is an important resource for that community. Factors of social capital include trust, community participation, and social agency[37]. Social capital helps ensure that societies function effectively and healthily.

[36] California Energy Commission (CEC), *California Cool Roofs: 2008 Building Energy Efficiency Standards*. 2012. Web https://www.energy.ca.gov/2012publications/CEC-400-2012-003/CEC-400-2012-003-BR.pdf (accessed January 24, 2019).

[37] Jenny Onyx and Paul Bullen, "Measuring Social Capital in Five Communities," *Journal of Applied Behavioral Science* 36, no. 1 (2000).

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I. Populations Vulnerable to Heat

Resource: California Governor's Office of Planning and Research Vulnerable Populations Guidebook

- See this guide for more information about all of the following populations

Extreme heat impacts all populations, but some populations are particularly vulnerable. These populations include

Populations more physically vulnerable to heat

- Children – anatomic, cognitive, psychologic, and immunologic differences from adults make children and adolescents more vulnerable to heat[38].
- Elderly individuals – elderly individuals do not adjust as well to sudden changes in temperature, and are more likely to have a chronic medical condition and be on prescription medication[39].
- Pregnant women – pregnant women's abilities to thermoregulate are compromised, and temperature extremes may also negatively impact birth outcomes[40].
- People with existing health conditions – chronic and existing health conditions can decrease the body's ability to adjust to environmental and temperature changes[41]. People with existing health conditions may also rely on electrically powered tools, which may be compromised by power shortages during heat events.

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[38] Columbia University's Mailman School of Public Health. "Children are highly vulnerable to health risks of a changing climate." ScienceDaily. www.sciencedaily.com/releases/2018/08/180806151856.htm (accessed June 26, 2019).

[39] "Heat and Older Adults," Centers for Disease Control and Prevention (CDC), accessed June 26, 2019, https://www.cdc.gov/disasters/extremeheat/older-adults-heat.html.

[40] Kuehn, Leeann, and Sabrina McCormick. "Heat exposure and maternal health in the face of climate change." *International journal of environmental research and public health* 14, no. 8 (2017): 853.

[41] Kenny, Glen P., Jane Yardley, Candice Brown, Ronald J. Sigal, and Ollie Jay. "Heat stress in older individuals and patients with common chronic diseases." *Cmaj* 182, no. 10 (2010): 1053-1060.

- Prescription medication users - some prescription drugs can decrease the body's ability to cool itself, so individuals taking prescription drugs may be more vulnerable to extreme heat[42].

Populations more socioeconomically vulnerable to heat[43].

- Outdoor workers - outdoor workers are regularly exposed to heat and temperature extremes, and are often engaged in exertional work, increasing their vulnerability to heat illness[44].
    - Indoor workers in hot conditions are also at risk for heat illness, so indoor workplaces must maintain adequate cooling systems.
- People who are housing-insecure - people who are experiencing housing-insecurity or homelessness are at higher risk of heat illness, as they are more exposed to high temperatures. Pre-existing medical and psychiatric conditions are also more common among people experiencing homelessness, further increasing their risk from extreme heat[45].
- Low-income individuals - individuals with low income may be unable to afford to keep cool and maintain their health during heat events. The cost of air conditioning, medical care, and transportation may all be barriers in the ability of low-income individuals to respond to heat events[46].
- Geographically isolated people - individuals and communities who are geographically isolated may have fewer resources,

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[42] Holliday Moore, "Extreme Heat and Prescription Medications can be a Recipe for Heat Stroke," KJZZ 91.5, August 31, 2017, https://kjzz.org/content/527301/extreme-heat-and-prescription-medications-can-be-recipe-heat-stroke (accessed May 22, 2019).

[43] A person is not inherently vulnerable due to their race, sexual orientation, gender identity, national origin, first language, religion, or zip code. Rather, historic and structural discrimination have constructed systems to create differences and increase the vulnerability of groups of peoples in our world.

[44] "Occupational heat Exposure," Occupational Safety and Health Administration (OSHA), accessed June 26, 2019, https://www.osha.gov/SLTC/heatstress/

[45] Case, Mary. "Homelessness: Programs and the people they serve: Findings of the national survey of homeless assistance providers and clients: Summary," American Planning Association, Journal of the American Planning Association 67, no. 1 (2001): 119.

[46] Gronlund, Carina J. "Racial and socioeconomic disparities in heat-related health effects and their mechanisms: a review." *Current epidemiology reports* 1, no. 3 (2014): 165-173.

including medical resources, easily accessible to them, and face delayed or limited assistance during crises[47].

- Communities of color - historic and structural discrimination in the United States has resulted in people of color being more likely to have low socio-economic status[48]. Language barriers, occupational exposure, and other factors also contribute to increased risks for heat-vulnerability among communities of color[49].
- Tribal communities - Tribal communities often have close cultural, economic, and sustenance ties to the land, and extreme weather such as extreme heat may change the landscape in detrimental ways for Tribal communities, and restricting Tribes to reservation boundaries prevents Tribes from relocating to accommodate climate shifts[50]. Furthermore, high rates of unemployment and poverty on reservations limits Tribes' resources to adapt to changing climate conditions[51].
- Members of the LGBTQ+ community - discrimination against the LGBTQ+ community has led to members of this community having higher rates of poverty, mental illness, and homelessness, all of which may increase climate change and extreme heat risks[52]. Furthermore, older members of the LGBTQ+ community may become more socially isolated as they age, increasing their vulnerability to climate crises such as extreme heat events[53].

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[47] California Governor's Office of Planning and Research, *Executive Order B-30-15 Resiliency Guidebook: Vulnerable Populations*, Technical Advisory Group, n.d., Web, http://opr.ca.gov/docs/20180312-Vulnerable_Communities_Descriptions.pdf (accessed June 26,, 2019).

[48] California Governor's Office of Planning and Research, *Executive Order B-30-15 Resiliency Guidebook: Vulnerable Populations*.

[49] Hansen, Alana, Linda Bi, Arthur Saniotis, and Monika Nitschke. "Vulnerability to extreme heat and climate change: is ethnicity a factor?." *Global health action* 6, no. 1 (2013): 21364.

[50] National Wildlife Federation, *Facing the Storm: Indian Tribes, Climate-Induced Weather Extremes, and the Future for Indian Country* (2011), https://www.nwf.org/~/media/PDFs/Global-Warming/Reports/TribalLands_ExtremeWeather_Report.ashx

[51] National Wildlife Federation, *Facing the Storm: Indian Tribes, Climate-Induced Weather Extremes, and the Future for Indian Country.*

[52] Institute of Medicine (US) Committee on Lesbian, Gay, Bisexual, and Transgender Health Issues and Research Gaps and Opportunities. *The Health of Lesbian, Gay, Bisexual, and Transgender People: Building a Foundation for Better Understanding*. Washington (DC): National Academies Press (US); 2011. 6, Later Adulthood. https://www.ncbi.nlm.nih.gov/books/NBK64800/#ch6.s29 (accessed June 26, 2019).

[53] Institute of Medicine (US) Committee on Lesbian, Gay, Bisexual, and Transgender Health Issues and Research Gaps and Opportunities. *The Health of Lesbian, Gay, Bisexual, and Transgender People: Building a Foundation for Better Understanding*.

Sample Policies and Actions

This chapter of the Resiliency Planning Toolbox lists suggested heat resiliency policies and actions that can be incorporated into jurisdictional plans and undertaken by jurisdictions and agencies. These policies and actions are organized by sector. Not all of these policies and actions may be relevant to your location or plan, and this Toolbox may not contain all the potential heat resiliency policies and actions relevant to your location.

The text in red is the draft policies and actions. The text in *italics and underlined* is for you to fill in with local information, projects, and/or preferences. The text in purple denotes an action's estimated timeframe and budget.

The timeframe in this tool is structured as follows:

- Short term - five years or less
- Medium term - five to 10 years
- Long term - more than 10 years
- Ongoing - a continuous action in all present and future planning

Policies are listed with a capital letter and number, actions are listed with a lowercase letter and number.

I. Agriculture/Habitat

A. Heat Resilient Agriculture

Policy

A.1 Heat and Crops: Recommend farmers plan for increasing and extreme heat and bolster crop resilience. Encourage techniques for building soil resilience, crop diversification, reducing erosion, and increasing water-holding capacity of soil. Provide information and incentives for farmers to practice agro-ecology techniques.

A.2 Heat and Livestock: Recommend ranchers consider heat in caring for livestock. Encourage improving livestock shelters to mitigate heat through cooling mechanisms such as coolers, fans, and sprinklers, adjusting water pH, increasing shade cover on land, and suggest potentially shifting to breed more heat tolerant species[54]. Provide

[54] California Natural Resources Agency, *Safeguarding California Plan: 2018 Update*. 2018. Web, http://resources.ca.gov/docs/climate/safeguarding/update2018/safeguarding-california-plan-2018-update.pdf (accessed January 11, 2019).

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information and incentives for ranchers to practice agro-ecology techniques.

A.3 Protect Farmland: Protect farmland from urban development. Farmland is critical to the *jurisdiction* economy, and serves as both a mitigating and adapting asset in the face of climate change. Farmland acts as a carbon dioxide sink, and offers lower surface and air temperatures compared to urbanized areas[55].

Action

a.1 Create informational and educational materials on agro-ecology and on the necessity and benefits of heat resilient agriculture. Post materials on *jurisdiction/agency* website and distribute materials to farmers and ranchers.

- Timeframe: Short-term
- Budget: Low-cost

a.2 Host a workshop with local farmers and ranchers to discuss challenges they may face in increasing heat resilience on their land, and solutions to those challenges *jurisdiction/agency* can implement.

- Timeframe: Short term for the workshop, and long-term/ongoing for implementing discussed solutions
- Budget: Low-cost for the workshop, and low - high cost for solutions

B. Habitat

Policy

B.1 Foster ecosystem health: Promote ecosystem health to increase ecosystem resilience. Manage land and waterways to reduce stresses, such as water pollution, invasive species, urban and agricultural runoff, and habitat fragmentation[56].

B.2 Facilitate habitat climate change adaptation: Proactively plan for climate change's impacts on local habitats.

B.2a) Waterways: Provide adequate shade along streams and waterways through measures such as planting native trees.

[55] The Earth Observatory, *What's the Value of Land Skin Temperature?*, (NASA, 2012), https://earthobservatory.nasa.gov/features/HottestSpot/page3.php. (Accessed May 24 2019).

[56] National Wildlife Federation, *Wildlife in Hot Water: America's Waterways and Climate Change* (2015), https://www.nwf.org/~/media/PDFs/Water/2015/NWF-Report_Wildlife-In-Hot-Water.pdf

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Manage waterways to provide adequate streamflow, and monitor and protect estuaries[57].

B.2b) Land: Manage land for projected local climate change impacts and risks, such as *projected climate change impacts and risks in your jurisdiction* (which may include increased frequency of drought, wildfire, increased risk of flooding, sea level rise, etc)

Action

b.1 Partner with land-use and water-management planners to ensure waterways and land are managed for heat resiliency.

- Timeframe: Ongoing
- Budget: Low/no cost

II. People/Community

A. Labor

Policy

A.1 Protect outdoor workers: Ensure the safety of outdoor laborers, including migrant and seasonal workers, in severe conditions (extreme heat events, poor air quality, etc). Visit work sites, interview outdoor laborers about their work conditions, and provide information to employees and employers about the risks of severe conditions and training on emergency procedures.

A.2 Bolster engagement with outdoor workers: Conduct outreach to outdoor workers to see how *jurisdiction/agency* can better support them through severe climate conditions.

Action

a.1 Establish routine checks of working conditions, and check that laborers are provided adequate shade, breaks, water, and safety materials, information about risks of severe conditions, and training on emergency procedures.

- Timeframe: Ongoing
- Budget: Low cost

a.2 Create or supply multilingual pamphlets to distribute to outdoor workers and employers with advice for increasing workplace safety in

[57] National Wildlife Federation, *Wildlife in Hot Water: America's Waterways and Climate Change.*

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severe conditions, and increasing personal safety during periods of extreme conditions. Include health and worker support resources in pamphlets.

- Timeframe: Short Term
- Budget: Low-Medium cost

Note: There are many online resources with worker safety information, such as the OSHA outdoor workers heat illness publications. Search online to find which resources could help you create your own pamphlet, or which resources your jurisdiction could use.

a.3 Organize outreach strategies to support and learn from outdoor workers. Meet with outdoor workers from multiple local economic sectors, create anonymous surveys to distribute to workers and ask about their working conditions and resources they need and want, and reach out to employers about resources they need and want to create a safer workplace.

- Timeframe: Ongoing
- Budget: Low Cost

B. Community Relations

Policy

B.1 Community engagement: Actively promote diverse community engagement in creating and implementing jurisdictional plans and projects. Work with stakeholders throughout local communities to increase public participation and understand community issues and opinions.

B.2 Community workshops: Ensure community workshops are accessible to all community members. Meet people in their communities to discuss concerns, ideas, and solutions. Hold community workshops during hours and in locations convenient for community members, provide childcare and food at workshops, and work with community leaders to ensure community advocates play an active role in workshop facilitation. Workshops will also be held in the first language of community members, with translation services available.

B.3 Communication with Public: Maintain clear and consistent communication channels with the public. Ensure *jurisdiction/agency* website is user-friendly and all resources are available on the website. Maintain a social media presence to interact with the public and further

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promulgate emergency alerts and information. Promote accessibility and understandability of *jurisdiction/agency* outreach materials, public resources, and public documents by employing accessible language rather than technical jargon, and publishing them in all primary languages spoken by over 5% of the population.

Action

b.1 Involve community members directly while planning community workshops. Methods for doing so include (YRC recommends doing both of the following):

- Consult at least one community member and advocate (for example, a leader of a CBO) on their recommendations for workshop hours, location, amenities, activities, and format. *Jurisdiction/agency* will compensate consulted community members for their time and advice at a rate similar to rates of consultants currently hired by *jurisdiction/agency.*
    - Timeframe: Ongoing
    - Budget: Low - Medium cost
- Survey community members to ask what times work best for their schedules and what location, amenities, activities, and format they would prefer. Distribute survey by making paper copies for children in community school district to take home to their parents, putting paper copies in community centers, making survey available online, and having jurisdictional staff or volunteers distribute surveys in person in communities.
    - Timeframe: Ongoing
    - Budget: Low - Medium cost

b.2 Eliminate technical jargon from outreach materials, public resources, and public documents. Employ accessible and inclusive language that non-experts can understand.

- Timeframe: Ongoing
- Budget: Low/no cost

b.3 Translate {jurisdiction/agency} outreach materials, public resources, and public documents into all languages spoken by over 5% of the population in *jurisdictional/agency regional entity.*

- Timeframe: Short term/ ongoing
- Budget: Medium cost

C. Social Capital

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Social ties and connections are critical in disaster recovery and relief, and *jurisdiction/agency* will play an active role in promoting these ties. Actions in *plan you are writing or updating* aim to build social cohesion and social capital to create stronger, safer, and more resilient communities.

Policy

C.1 Promote social capital: Create and maintain programs and events to foster social capital and cohesion. Bring people together to foster social networks and connections between community members, representatives, local businesses, and local organizations. These social ties are critical in disaster recovery and relief, and create stronger, safer, more resilient communities.

Action

c.1 Organize and encourage community events and celebrations to bolster interaction and connection between community members and strengthen social networks, and therefore increase social resiliency.

- Timeframe: Long Term/Ongoing
- Budget: Flexible
    - Low cost: Encourage collective neighborhood block parties by asking residents, Neighborhood Watch Liaisons, apartment complexes, etc to host informal potluck gatherings in their neighborhood. For reference, see the San Francisco Neighborfest
    - Medium - High cost: Organize an annual community fair or festival, or work with venues in your community to organize weekly or monthly events such as live music in public spaces

c.2 Design public spaces with social connections and ties in mind - design streets to be pedestrian-friendly, ensure development is multi-use and accommodates for common spaces and social interaction

- Timeframe: Ongoing
- Budget: Low cost

c.2a) Leverage existing funding for development of pedestrian-friendly streets and multi-use spaces, and encourage considering social connection in initial design phases

- Timeframe: Ongoing
- Budget: Low cost

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c.3 Promote community stewardship by providing and publicizing materials designed to help neighborhoods create disaster emergency plans

- Timeframe: Short Term
- Budget: Low cost

c.4 Partner with local community organizations to increase disaster preparedness. Provide support to local non-profits working with populations vulnerable to heat, Neighborhood Watches, community centers, senior centers, and the public at large with disaster resources, such as maps of cooling centers, lists of emergency kits to prepare, etc

- Timeframe: Short Term
- Budget: Low cost

D. Individual Resilience

Policy

D.1 Promote individual resilience: Engage holistically across fields and sectors to promote personal mental, psychological, and spiritual resilience. As the impacts of climate change increase in severity and frequency, individual mental health will be stressed heavily[58]. Proactively work with health, education, welfare, disaster, faith, and social justice professionals to help individuals prepare for and recover from these impacts.

Action

d.1 Create a coalition of health, education, welfare, disaster, faith, and social justice professionals to discuss cross-sectoral programs for increasing individual resilience

- Timeframe: Short Term/Ongoing
- Budget: Low Cost

[58] International Transformational Resilience Coalition, *Preparing People on the West Coast for Climate Change: Recommendations for Making Psychological & Psycho-Social-Spiritual Resilience Education and Skills Training for Climate Adversities Universal in California and the Pacific Northwest by 2025* (2019), http://static1.1.sqspcdn.com/static/f/551504/28051577/1546448956667/Preparing+People+on+the+West+Coast+for+Climate+Change-+Recommenations+from+ITRC+Assessment+for+CA+and+the+PNW+Final+1-8-19.pdf?token=E3Zr3%2FegsenvRvx4XdSHmI8uJeU%3D.

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III. Housing/Building

A. Weatherization and Energy Efficiency

Note: Existing weatherization and energy efficiency programs in your jurisdiction may be run by the federal, state, and/or local government, and/or local utility providers. For example, in the United States, federal programs include the Weatherization Assistance Program.

A.1 Improving efficiency: Encourage weatherization and energy efficiency practices by increasing awareness of existing weatherization and energy efficiency programs through public outreach, particularly with low-income communities. Develop support networks to assist interested applicants in the application process.

a.1 Organize awareness campaign for home/building related heat mitigating and energy saving mechanisms, such as weatherization and cool roofs.

- Timeframe: Medium Term
- Budget: Medium Cost

a.2 Compile list of weatherization resources and programs on *jurisdiction/agency* website

- Timeframe: Short-Term/Ongoing
- Budget: Low Cost

B. Indoor Air Quality

Hotter temperatures contribute to decreased air quality, increased child asthma, and respiratory/heart issues. Increased frequency and severity of wildfires also creates smoke that can detrimentally impact air quality for miles. Therefore, it is imperative that indoor air quality be evaluated, monitored, and improved to protect public health.

Suggested resource: The U.S. Environmental Protection Agency offers helpful guidance and best practices in protecting indoor air quality on their website, with many resources available at https://www.epa.gov/indoor-air-quality-iaq

Policy

B.1 Improve and maintain indoor air quality in public buildings: Ensure indoor air quality in public buildings is safe from both indoor and

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outdoor pollutants. All air quality systems in public buildings, including schools, senior facilities, libraries, and public hospitals should be inspected, assessed, cleaned, and monitored regularly, and replaced when necessary[59]. Filtration and/or air purifier systems will be installed, with priority on schools and designated air quality center buildings.

B.2 Encourage maintenance of indoor air quality in private homes and buildings: Conduct public and private outreach on improving home and building air quality. Connect property owners to resources for improving and maintaining indoor air quality.

Action

b.1 Follow EPA guidance on maintaining indoor air quality. This guidance includes regularly conducting inspections and maintenance on HVAC systems, checks for moisture/mold and pests, systems cleanings, walkthrough inspections, and upgrading energy efficiency and building renovations to improve indoor air quality.

- Timeframe: Ongoing
- Budget: Medium - High Cost

b.2 Install filtration systems and/or air purifiers in public buildings, prioritizing public schools and designated air quality centers.

- Timeframe: Short - Medium Term
- Budget: Medium - High Cost

b.3 Create educational and informational material on maintaining indoor air quality to distribute to community members, particularly homeowners and building owners.

- Timeframe: Short Term
- Budget: Low Cost

C. Cool/Green Roofs

Policy

C.1 Cool/Green roof installation: All new buildings and homes must have either a cool or green roof*. For major renovations and alterations requiring a permit, the *jurisdiction/agency building department* will

[59] U.S. Environmental Protection Agency,*The Indoor Air Quality Tools for Schools Approach: Providing a Framework for Success.* 2018. Web, https://www.epa.gov/sites/production/files/2018-08/documents/iaq_2018_management_framework_success_3page_508_final_2.6.18.pdf (accessed January 31, 2019).

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provide information at the time of permit application regarding cool and green roofs so that building owners are informed about more adaptive and efficient options.

*Note: If your jurisdiction has a policy requiring solar roofs, you may want to include a provision for solar roofs: All new buildings and homes must have either a cool or green roof, with the exception of buildings and homes that have a solar roof.

Action

c.1 Contact planners from jurisdictions where cool/green roof installation has been mandated[60]. Shape policies and programs on the advice from consulted planners advice.

- Timeframe: Short Term
- Budget: Low Cost

c.2 Organize awareness campaign for home/building related heat mitigating and energy saving mechanisms, such as weatherization and cool roofs.

- Timeframe: Medium Term
- Budget: Medium Cost

c.3 Compile information on cool/green roofs for building owners.

- Timeframe: Short Term
- Budget: Low Cost

c.4 Investigate opportunities to create a rebate program to help residents offset the costs of cool/green roof implementation.

- Timeframe: Short Term/Ongoing
- Budget: Low Cost

D. Climate Appropriate Architecture

Policy

D.1 Climate appropriate architecture: New *jurisdiction/agency* buildings will be designed and built to better adapt to present and future climate conditions. *Jurisdiction/agency* will also encourage private companies and home builders to design and build climate appropriate buildings,

[60] For example, the City of Los Angeles. In 2013, the city established a requirement for all new and refurbished homes to have a cool roof.

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and consider climate risks when deciding where to build. *Jurisdiction/agency building department* will provide information at time of building application regarding climate appropriate and climate responsive design so builders are informed about this adaptive and efficient option.

Action

d.1 Consult climate and sustainability focused architects and academics on designing buildings that can best withstand and mitigate local climate change impacts. Compile information for builders and property owners based on architects and academics locality-specific advice, and construct {jurisdiction/agency} buildings following this advice.

- Timeframe: Ongoing
- Budget: Medium-High Cost

IV. Public Health and Safety

A. Cooling/Air Quality Resources

Policy

A.1 Cooling centers: Establish cooling centers at convenient, appropriate, public-transport accessible locations such as local public libraries, jurisdiction-owned Community Centers, jurisdiction-owned Senior Centers, and local parks and recreation areas. Ensure that existing community hubs and focal points, such as churches, pools, and schools, can serve as cooling centers. Partner with private business to offer additional buildings as cooling centers. Investigate potential of repurposing public buses to serve as mobile cooling centers.

Best Practice: People will feel more comfortable and content if a place they already frequent can serve as a cooling center, such as schools, pools, and churches. Ensuring the safety of these places during extreme heat events fosters community building, and helps ensure residents will be willing to leave the comfort of their home to go to a cooling center in the first place.

A.2 Personal cooling resources: Partner with local emergency responders to identify and reach vulnerable populations who may not be able to journey to cooling centers if necessary, and currently do not have personal cooling resources. Work with members of heat vulnerable populations to allow them access to cooling resources, through measures such as discussing utility and government energy

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subsidy programs (such as the Low Income Home Energy Assistance Program) and supporting them through the application process.

A.3 Advice for personal cooling: Promote public awareness of tips for cooling off during hot days.

A.4 Air quality centers: All [indoor] cooling centers will double as air quality centers. Mark these centers as air quality centers on the *jurisdiction/agency* website, create additional flyers to mark each air quality center as accessible to the public during poor air quality periods, and distribute list of air quality centers to local news outlets.

Action

a.1 Identify potential cooling/air-quality centers. Consult staff and administration on how best to ensure those facilities are prepared for extreme heat and poor air quality days. Centers should be accessible to the public, including to individuals with limited mobility and transportation access.

- Timeframe: Short Term/Ongoing
- Budget: Low cost

a.2 Ensure safety of existing community hubs during extreme heat and poor air quality days. Schools, churches, and other community hubs should be equipped with adequate air conditioning and air filtration systems. Consult staff and administration of these buildings on how best to ensure those facilities are prepared for extreme heat and poor air quality days. If building is not owned by jurisdiction, direct staff of that building to opportunities for improving building safety.

- Timeframe: Short Term/Ongoing
- Budget: Low cost

a.3 Create consistent logo to distinguish and mark cooling/air-quality centers as such on identifiable flyers.

- Timeframe: Short Term
- Budget: Low cost

a.4 Create, distribute, and publish resources summarizing critical information about cooling/air-quality centers. Resources will list the hours cooling centers/air-quality centers are operational during emergencies, and list the resources available at those centers. Resources created to identify and communicate locations of cooling

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centers will note that populations most vulnerable to heat should seek air conditioned cooling centers before the outdoor cooling centers.

- Timeframe: Short Term/Ongoing
- Budget: Low cost

a.5 Promote awareness of cooling/air-quality center locations though multiple means. Distribute and post resources summarizing critical information widely, list centers on *jurisdiction/agency* website, mark centers on website map, and inform local news outlets of their location.

- Timeframe: Short Term/Ongoing
- Budget: Low cost

a.6 Work with public transportation officials to improve cooling systems in public transportation vehicles and create plans to eliminate ride fare during extreme heat and poor air quality days.

- Timeframe: Short Term
- Budget: Low cost

a.7 List tips and advice for staying cool on hot days on *jurisdiction/agency* website, and create or print existing flyers with this advice. Post information in cooling centers and around community in advance of extreme heat events. Work with public schools to increase student knowledge of staying cool, and send flyers with cooling advice to parents/guardians throughout school district.

- Timeframe: Short Term/Ongoing
- Budget: Low cost

B. Heat Alert System

Policy

B.1 Improve local heat warning systems: Evaluate efforts to warn residents of heat events. Ensure warnings are reaching the populations most vulnerable to extreme heat, and improve communication efforts based on the feedback of vulnerable populations and local residents as well as technological innovations.

Action

b.1 Conduct community outreach to evaluate the effectiveness of the heat alert system. Ask a wide range of community members (different ages, income levels, abilities, first language, occupation, etc) if they are receiving alerts from current heat alert efforts, and how they could be better forewarned. Meet community members where they are through

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conducting outreach at community events and locations where community members congregate. Focus on learning from populations most vulnerable to heat, including outdoor workers, people who are housing-insecure, elderly individuals, geographically isolated people, and low-income individuals.

- Timeframe: Short Term
- Budget: Low cost

b.2 Create {or} update heat alert system to reflect community feedback, utilize online and offline communication mechanisms, and ensure public is warned about extreme heat events in advance. Alerts will also direct public to *jurisdiction/agency* cooling tips and cooling centers.

- Timeframe: Short Term / Ongoing
- Budget: Low cost

V. Social Equity

Equity, environmental justice, and climate change are intricately tied. Climate change and its impacts on structurally disempowered communities must be considered as well. For jurisdictions in California, addressing environmental justice is mandated by SB 1000, and considering climate change should be integrated into SB 1000 work.

A. Populations Most Vulnerable to Heat

See chapter two, section III, part I for explanations of vulnerability of each of these populations.

Populations more physically vulnerable to heat

- Children
- Elderly individuals
- Pregnant women
- People with existing health conditions
- Prescription medication users

Populations more socioeconomically vulnerable to heat[61].

[61] A person is not inherently vulnerable due to their race, sexual orientation, gender identity, national origin, first language, religion, or zip code. Rather, historic and structural discrimination have constructed systems to create differences and increase the vulnerability of groups of peoples in our world.

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- Outdoor workers
- People who are housing-insecure
- Low-income individuals
- Geographically isolated people
- Communities of color
- Tribal communities
- Members of the LGBTQ+ community

Policy

A.1 Plan for and with populations vulnerable to heat: All plans and policies will prioritize the needs and realities of populations most vulnerable to climate change. Work with communities and individuals to ensure their needs and concerns are adequately met.

Action

a.1 Bolster relationships and partner with community members in the populations most vulnerable to climate change and extreme heat. Work with community members and leaders on creating and implementing *jurisdiction* plans and policies for climate change and extreme heat. Methods for doing so include (YRC recommends doing both of the following):

- Create a task force of community members and who meet with *jurisdiction* planners regularly. Task force members will be compensated for their time and advice.
    - Timeframe: Ongoing
    - Budget: Low cost
- Consult at least one member of and advocate for each of the communities most vulnerable to heat on their recommendations for jurisdictional plans. *Jurisdiction* will compensate consulted community members for their time and advice at a rate similar to rates of consultants currently hired by *jurisdiction.*
    - Timeframe: Ongoing
    - Budget: Low-medium cost

a.2 Ask community members, advocates, and task force members questions to increase *jurisdiction/agency* understanding of policies and plans on vulnerable communities. Questions to ask include[62]:

[62] Race & Social Justice Initiative, *Racial Equity Toolkit to Assess Policies, Initiatives, Programs, and Budget Issues* (Seattle: seattle.gov, 2012), page 5, https://www.seattle.gov/Documents/Departments/RSJI/RacialEquityToolkit_FINAL_August2012.pdf (accessed January 30, 2019).

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1. What do we need to know about this issue?
2. How are you and your community impacted by this issue?
3. How do you think your community would be impacted by this proposed policy/plan/budget/initiative?
4. What are ways to minimize the potential negative impacts that may result? What are ways to increase the benefits that may result?
5. How can we increase equity through this proposed policy/plan/budget/initiative?

- Timeframe: Ongoing
- Budget: Low-cost

B. Addressing Discrimination

Policy

B.1 Recognize historic and institutional discrimination: Practice and promote equity by recognizing historic and institutional discrimination and the impacts of discrimination in our communities and around the globe. *Jurisdiction/agency* employees will receive equity training no less than every five years starting in 2019. *Jurisdiction/agency* website will also list equity based resources and training information and encourage residents and local businesses to review these resources.

Action

b.1 Establish routine equity training protocol for *jurisdiction* staff. Staff will be trained by outside equity experts. Training will take place no less than every five years beginning in 2019.

- Timeframe: Ongoing
- Budget: Low-Medium cost

b.2 Publicize equity resources discussed at equity trainings on *jurisdiction* website for the public to access.

- Timeframe: On-going
- Budget: Low/no cost

C. Senate Bill 1000 - relevant for California jurisdictions

Policy

C.1 Integrate climate considerations when adhering to SB 1000: Consider and address the impacts of climate change on disadvantaged communities when writing the environmental justice element of General Plans and doing other SB 1000 work.

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Action

c.1 Partner with *jurisdiction/agency* staff working on SB 1000 to ensure equity, climate change, environmental justice, and adaptation are successfully integrated into *jurisdiction/agency* plans.

- Timeframe: Ongoing
- Budget: Low cost

VI. Planning/Public Works/Parks

A. Urban Greening

Policy

A.1 Pursue urban greening opportunities: Implement green infrastructure as a cooling strategy in viable public and private spaces. These spaces may include around buildings, along transportation corridors, in parking lots, in schools, in playgrounds, green walls, green roofs, and more[63]. Plant and maintain non-allergenic, heat tolerant, [and if possible to your jurisdiction, native] trees and vegetation. Shade open green spaces. Educate the public on the value of urban greening.

- If jurisdiction/agency has an urban forest management plan, review urban forest management plan and update to accommodate for extreme heat concerns (if not already accounted for)
- If your jurisdiction/agency does not have an urban forest management plan, consider writing such a plan
- Examples of trees with low allergenic potential include fir species, spruce species, walnut, poplar, willow, elm, and maple[64,65]. Research the trees native to your jurisdiction, their allergen potential, and their shade coverage, and consult an arborist about if native trees would be appropriate for your jurisdiction resiliency projects.

A.2 Prioritize greening efforts in communities most vulnerable to and most impacted by heat. Communities that experience higher

[63] Institut national de santé publique du Québec, *Urban Heat Island Mitigation Strategies*, Mélissa Giguère. Gouvernement du Québec, 2012. Web, https://www.inspq.qc.ca/pdf/publications/1513_UrbanHeatIslandMitigationStrategies.pdf (accessed January 31, 2019).

[64] David Beaulieu, "Top Hypoallergenic Trees Varieties," TheSpruce, Dotdash, last updated April 2019, https://www.thespruce.com/what-are-hypoallergenic-trees-3976742.

[65] Institut national de santé publique du Québec, *Urban Heat Island Mitigation Strategies*.

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temperatures and where residents may currently sacrifice basic needs to keep cool will be prioritized.

Action

a.1 Work with arborists to assess potential locations for urban greening and to select climate appropriate, preferably native, vegetation to install.

- Timeframe: Short Term
- Budget: Low - Medium cost

a.2 Establish plan to ensure vegetation is properly cared for and work with arborist to implement plan. Plan will also include educational campaign to explain the value of urban greening to the public.

- Timeframe: Short Term/Ongoing
- Budget: Medium Cost

a.3 Use census and neighborhood level data to determine which communities are most vulnerable to heat, then focus urban greening projects in these communities. Determine communities based on whether or not they have all or some combination of the following characteristics: low vegetation coverage, high surface temperature, high rate of heat deaths/heat-related illnesses, high percentage of residents with lack of A/C, high percentage of low-income residents, high percentage of vacant lots, high rates of cardiovascular and respiratory diseases, language isolation, and other equity-based considerations.

- Timeframe: Short Term/Ongoing
- Budget: Low - Medium Cost

B. Recreation

Policy

B.1 Maintain parks for heat events: Prepare for increased demand for recreation areas during periods of extreme heat, and ensure that recreation areas are safe places for residents during periods of extreme heat. Maintain and prepare parks for increased usage as heat rises. Increase shading at recreational sites to offer further refuge from heat while ensuring sufficient lighting is available at these sites at night. Ensure play equipment is properly shaded. Provide a minimum of 25% shading of parks during peak high heat daylight hours through trees

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and shade structures[66]. Where possible, in meeting this goal seek to plant trees rather than install shade structures, as planting trees and vegetation in parks also has the co-benefit of sequestering greenhouse gases and decreasing the urban heat island effect.

Action

b.1 Partner with *jurisdiction/agency parks department* to develop parks plan that accounts for increased heat and increased usage, particularly by individuals with limited access to air conditioning. Plan for and implement increased shading and maintenance, ensure drinking water in recreation areas is clean, and include nutritious snacks in vending machines.

- Timeframe: Short Term/Ongoing
- Budget: Low - Medium Cost

b.2 Work with arborist to develop shading strategy in parks that will increase refuge from heat while ensuring there is sufficient lighting in recreational areas after dark. Plant necessary vegetation and install necessary lighting.

- Timeframe: Short Term
- Budget: Medium Cost

b.3 Work with Parks Department and arborist to adequately and safely shade play equipment. Plant trees and install shade structures over and near new, existing, and replaced play equipment.

- Timeframe: Short Term/Ongoing
- Budget: Medium Cost

C. Landscape

Policy

C.1 Heat tolerant landscape: Ensure open spaces (including parks, lawns, large medians, etc) are heat tolerant. Consider the current and expected local climate conditions and risks while maintaining, renovating, and improving open spaces. Plant heat resilient trees and vegetation while still ensuring shade is available where necessary.

[66] There are a number of ways to calculate shade, for example, the City of Sunnyvale uses the diameter of tree crown at fifteen years to calculate it's parking lot shade requirements (https://sunnyvale.ca.gov/civicax/filebank/blobdload.aspx?BlobID=23612)

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Action

c.1 Partner with consultants and gardeners to develop and implement heat tolerant landscape plans. Assess open spaces to determine appropriate heat tolerance approaches and landscapes to implement.

- Timeframe: Short Term/Ongoing
- Budget: Medium Cost

D. Transportation

Policy

D.1 Increase shade along transit routes: Increase shade coverage near access points for public and active transportation options. Plant trees along sun-exposed bike paths and, where possible, near bus stops. Install seating with shade structures near bus stops where appropriate.

D.2 If budget allows your jurisdiction to purchase low energy and low carbon cool pavement options. Cool pavements: Investigate cool pavement opportunities, such as installation of sustainable, low carbon cool pavements and cool parking lots to increase albedo in urban areas.

D.3 Expand uses of public buses: Repurpose public buses to serve as mobile cooling centers during extreme heat events[67].

D.4 Ensure consistent access to drinking water: Drinking water must be readily available in public places. Install and maintain water foundations in parks, city/town centers, commercial areas, and along pedestrian pathways.

Action

d.1 Partner with arborist and public transportation officials to determine appropriate and effective locations to increase shading, then install or plant shading options.

- Timeline: Short Term
- Budget: Low- Medium Cost

d.2 Research cool pavement opportunities, and partner with jurisdictional urban planners to determine if cool pavements and cool

[67] Susan Spierre Clark, Mikhail V. Chester, Thomas P. Seager and Daniel A. Eisenberg, "The vulnerability of interdependent urban infrastructure systems to climate change: could Phoenix experience a Katrina of extreme heat?," *Sustainable and Resilient Infrastructure* 4, no.1 (2019): page 30, https://www.tandfonline.com/doi/pdf/10.1080/23789689.2018.1448668?needAccess=true

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parking lots are a good environmental, economic, and social investment, and implement if desired.

- Timeframe: Medium - Long Term
- Budget: Low - High Cost (depending on if cool pavements implemented)

d.3 Consult and partner with public transportation officials and workers to develop strategies to allow public buses to serve as free mobile cooling centers during periods of extreme heat.

- Timeframe: Short - Medium Term
- Budget: Low Cost

d.4 Review current availability and presence of water foundations/drinking stations. Check quality of water from existing foundations and stations, improve if necessary. Install enough water foundations/drinking stations such that pedestrian would not need to travel more than ½ mile to access drinking water.

- Timeframe: Short - Medium Term
- Budget: Low - Medium Cost

VII. Utilities/Infrastructure

A. Water Resources

Policy

A.1 Water supply: Prepare for potential climate change induced water issues. Monitor water supply and quality, improve water storage mechanisms, and create drought preparedness plans.

A.2 Water conservation and reuse: Implement water conservation and reuse programs in jurisdiction operations, and encourage businesses and residents to practice water conservation and reuse.

A.3 Stormwater pollution prevention and reuse: Require construction and development operations to develop a stormwater pollution prevention plan. Fortify water supply by capturing and reusing stormwater.

- Resource: U.S. EPA "Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites" 2007

Action

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a.1 Establish routine monitoring of water supply and quality, including assessment of inflow and infiltration and check for leaks and drainage issues.

- Timeframe: Ongoing
- Budget: Medium Cost

a.2 Assess jurisdiction water usage and implement appropriate water conservation and reuse tactics, including stormwater capture and reuse.

- Timeframe: Short Term/Ongoing
- Budget: Medium Cost

a.3 Organize water conservation and reuse public awareness campaign. Campaign will include social media posts and compiling information on *jurisdiction/agency* website about water conservation and reuse programs and systems, such as greywater reuse.

- Timeframe: Short Term/Ongoing
- Budget: Low-Medium Cost

a.4 Research expected drought conditions in jurisdiction *locality/region*, draft drought preparedness plan based on predicted conditions.

- Timeframe: Short-Medium Term
- Budget: Low Cost

B. Energy

Policy

B.1 Pursue renewable energy opportunities: Renewable energy sources such as solar and wind are more resilient to climate change, less-water intensive, and reduce greenhouse gas emissions. Collaborate with regional entities to discuss opportunities for increasing regional renewable energy options, including community choice aggregation with renewable energy sources.

If it seems like regional renewable energy options are limited or unavailable in the near future:

B.1a) Increase renewable energy sources: Install renewable energy sources in powering jurisdiction buildings and efforts. Encourage residents and business owners to install renewable energy sources. Offer information on benefits of installing

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renewable energy sources, including environmental benefits and financial incentives.

B.2 Promote energy conservation: Promote energy conservation and energy-efficient measures through energy-aware jurisdiction building design and maintenance, and through public outreach.

B.3 Ensure back-up energy sources: Ensure facilities have access to back-up energy generation in the event of power outages due to extreme heat. Facilities and services for communities most vulnerable to extreme heat should be prioritized (hospitals, senior centers, nursing facilities, public schools) as well as designated cooling centers.

Action

b.1 Investigate renewable energy opportunities through partnerships with other regional entities and renewable energy providers, and by researching opportunities to implement renewable energy systems for jurisdiction operations.

- Timeframe: Short Term/Ongoing
- Budget: Low Cost

b.2 Organize renewable energy and energy conservation public awareness campaign. Campaign will include social media posts, providing information about the benefits of renewable energy, energy savings, and energy efficiency on *jurisdiction/agency* website, and the *jurisdiction/agency planning department* directly providing this information to residents and businesses seeking to build or retrofit homes and buildings.

- Timeframe: Short Term/Ongoing
- Budget: Low-Medium Cost

b.3 Establish routine monitoring system of back-up energy sources in {jurisdictional/agency} buildings, public schools, hospitals, senior centers, nursing facilities, and designated cooling centers.

- Timeframe: Ongoing
- Budget: Low-Medium Cost

C. Climate Resilient Infrastructure

Policy

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C.1 Climate resilient infrastructure: Consider current and future climate conditions when planning, constructing, maintaining, and repairing infrastructure.

Action

c.1 Evaluate projected changes from current heat conditions for 2050 and 2100. Heat stresses infrastructure and influences maintenance needs, so *jurisdiction* will prepare for changes in heat and temperature and anticipate future infrastructure needs.

- If infrastructure is located in mountainous regions, evaluate projected changes in snowpack for 2050 and 2100.

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Implementation Strategies

This chapter of the Resiliency Plan Toolbox lists suggested heat resiliency implementation practices and considerations that can be incorporated into jurisdictional plans and undertaken by jurisdictions. Not all of these practices and considerations may be appropriate for feasible for your location or plan, and this Toolbox may not contain all the potential heat resiliency implementation practices or considerations relevant to your location.

I. Overview

A. What is Implementation

Considering and creating implementation measures help ensure plans are put into action, existing beyond paper and into the real world. Implementation measures also help establish guidelines that must be considered when putting plans into action.

There are different overarching strategies for implementation, such as:

- adaptive pathways - an iterative process that lays out multiple options for policies and actions, striving to meet an overall goal rather than a pre-specified final outcome[68]
- trigger policies - pursuing a policy if an event or new information "triggers" that policy
- conventional development pathways - laying out a plan to pursue a pre-specified final outcome
- and more!

Regardless of the overarching strategy pursued, implementation is key to planning, and the purpose of this section is to support jurisdictions in implementation.

B. Questions to Consider in Implementation Planning

Implementation is a challenging process, and the manifestation of these challenges will be different between jurisdictions. California

[68] "What is a pathways approach to adaptation?," CoastAdapt, National Climate Change Adaptation Research Facility, Australian Government Department of the Environment and Energy, last modified May 2017, https://www.coastadapt.com.au/pathways-approach.

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Senate Bill 379 calls for local governments to undertake and plan for climate adaptation and resilience, the bill also requires that a set of implementation measures be created to support that resiliency planning, and that the following must be considered:

> (i) Feasible methods to avoid or minimize climate change impacts associated with new uses of land.
>
> (ii) The location, when feasible, of new essential public facilities outside of at-risk areas, , including, but not limited to, hospitals and health care facilities, emergency shelters, emergency command centers, and emergency communications facilities, or identifying construction methods or other methods to minimize damage if these facilities are located in at-risk areas.
>
> (iii) The designation of adequate and feasible infrastructure located in an at-risk area.
>
> (iv) Guidelines for working cooperatively with relevant local, regional, state, and federal agencies.
>
> (v) The identification of natural infrastructure that may be used in adaptation projects, where feasible. Where feasible, the plan shall use existing natural features and ecosystem processes, or the restoration of natural features and ecosystem processes, when developing alternatives for consideration. For the purposes of this clause, "natural infrastructure" means the preservation or restoration of ecological systems, or utilization of engineered systems that use ecological processes, to increase resiliency to climate change, manage other environmental hazards, or both. This may include, but is not limited to, floodplain and wetlands restoration or preservation, combining levees with restored natural systems to reduce flood risk, and urban tree planting to mitigate high heat days.[69]

These concepts touch on some of the challenges to implementation, and implementation concerns that must be considered.

While the specific context of some of these challenges may be different between regions, addressing the following general questions can help jurisdictions tackle implementation concerns, and should be considered by all jurisdictions when developing an implementation

[69] S.B. Bill 379, Section 65302 (California, 2015), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB379.

strategy. These general questions will also be addressed in other sections of this chapter.

- What are the (expected and potential) barriers to implementing this plan?
    - What social, economic, and policy barriers could stall implementation of this plan?
    - The better you understand these barriers, the better implementation measures you can prepare
- What legal requirements may influence the implementation of this plan or policy?
- Which groups or individuals need to be involved in implementing this plan or policy?
- Who can be partnered with to best implement this plan?
- Who will benefit from implementation of this plan? Who will not benefit from implementation?

C. Equity and Implementation

Implementation of projects must prioritize and seek to increase equity; the benefits from additional resources provided by heat mitigating and heat adapting projects must be equitably shared throughout your jurisdiction. Community factors and social realities should be considered and measured when evaluating how project benefits are being shared, and when evaluating vulnerability to heat. These community factors include, and are not limited to, the following:

- Average and median income
- Language isolation and first languages
- Racial composition
- Rates of diabetes
- Rates of asthma
- Rates of cardiovascular and respiratory diseases
- Metrics for socially isolated elders
- Benefits for multi-family households & single family households
- History of discriminatory policies

Tracking these metrics and factors over time will help jurisdictions determine if their communities are becoming more equitable. The list above is not comprehensive, but considering and measuring these factors as well as other equity concerns will help prevent projects and programs from causing additional harm to structurally disempowered

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communities, and will help ensure that projects and programs support these communities and close existing equity gaps.

D. Implementation Tasks

The California Adaptation Planning Guide recommends the following four tasks in phasing and implementing adaptation strategies:

1. Identify the responsible party
2. Identify funding
3. Establish systems for monitoring and diffusion of information and technology
4. Establish feedback loops[70]

This section of the Resiliency Planning Toolbox touches on each of these four steps, the YRC also advises reviewing the California Adaptation Planning Guide for further information. As of the time of writing this document, a new Adaptation Planning Guide is expected to be published in 2020.

II. Staffing

A. Establishing Responsibility

Identify a specific individual, department, agency, and/or organization as responsible for implementing your resiliency plan, policies, and actions. This way, progress on implementation can be organized and evaluated consistently, and reports on progress are made to a recognized responsible party.

B. Institutionalizing Resiliency

While it is important to identify a specific responsible party, that party cannot implement a resilience or sustainability plan all on their own. To successfully implement plans, policies, and actions, cooperation throughout jurisdiction sectors is necessary. For example, to increase shading along bike paths and at bus stops, the responsible party would also need to cooperation of the Transportation Department. Therefore,

[70] California Emergency Management Agency, California Natural Resources Agency, *California Adaptation Planning Guide: Planning for Adaptive Communities*. Mather; Sacramento, 2012. Web, http://resources.ca.gov/docs/climate/APG_Planning_for_Adaptive_Communities.pdf (accessed January 24, 2019).

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it is imperative to institutionalize resiliency throughout every sector, department, and division of your jurisdiction.

Means for this institutionalization include:

- Education and training on resilience issues your locality and/or region will face. This training should include how each division can make decisions to bolster resilience
- Bolster relationships and partnerships between the responsible party and all other divisions
    - The responsible party should reach out to other divisions in the initial stages of developing a resilience plan. A resilience plan will be stronger with the input of many specializations, and establishing that their input and opinions is valuable will help develop a strong partnership.
    - Resilience is not an issue that can be tackled by one division alone, and other divisions will be more willing to implement a plan they helped create than a plan they have never been consulted about. The first time another division hears from the responsible party should NOT be when being asked to help implement a plan they had no role in shaping!

III. Financing

A. Financing Guidance Resources

There are many approaches for financing and funding resiliency projects, a brief list of some of these approaches and strategies follows:

- Direct new funds from jurisdiction budget to financing project
- Pursue projects concurrently to increase efficiency
- Leverage or direct funds from existing projects - promote resilience and sustainability in existing, already funded projects
- Pursue federal, state, regional, and private grants
- Partner with other local jurisdictions and agencies across your region - climate change has regional impacts that go beyond political boundaries, so regional partnerships to promote resiliency increase effectiveness and efficiency.
- Partner with the State or Federal government

There has also been extensive research into resiliency financing drafted specifically for local governments and private actors that further

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discuss these strategies and more. The YRC recommends the following documents to better understand resiliency financing:

- Climate Adaptation Finance and Investment in California
    - Authored by Jesse M. Keenan and published in 2019, this book is based on a guide prepared for the State of California Governor's Office of Planning and Research (OPR).
    - This guide has been tailored for local governments and private enterprises.
    - While this guide is primarily focused on California, the book also provides broad insight on resilience financing that transcend political borders
- Paying for Climate Adaptation in California
    - Prepared by AECOM for the Resources Legacy Fund and published in October 2018, this report is meant to serve as "a primer for practitioners".
    - This report is also primarily focused on California, but similarly to the Keenan guide, the report also provides recommendations and strategies that are applicable beyond California

Resiliency financing is a growing focus of research, if your jurisdiction is searching for more localized guidance, look into what reports and guides may have been published that are particularly relevant to your jurisdiction.

B. Grant Opportunities

Investment in and commitment to climate resiliency is increasing, and there are many grant programs seeking to support resiliency projects. These programs can be administered by the federal or state government, non-profits, utility companies, and more. The following agencies and organizations often have grant programs that your jurisdiction may be able to access:

- Federal government
    - U. S. Department of Energy
    - U.S. Environmental Protection Agency
    - U.S. Department of Housing and Urban Development
- California State government (if not in California, investigate your State's equivalent agency for opportunities)
    - California Office of Emergency Services

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    - California Energy Commission
    - California Infrastructure and Economic Development Bank
- Utility company
    - Pacific Gas and Electric (if not in Northern California, look into your utility company and see if they have grant programs)

These programs change often, and while some programs end, there are also always new opportunities to pursue. In order to stay up-to-date on relevant programs and opportunities, the YRC recommends subscribing to newsletters that provide consistent, updated information on adaptation resources, events, and funding opportunities.

- Newsletters that may be helpful include
    - ARCCA (Alliance of Regional Collaboratives for Climate Adaptation) News Roundup
        - This listserv was created for resiliency practitioners in California, but also lists funding opportunities outside of California.
        - Only ARCCA members are eligible to receive the bi-weekly News Roundup; information on how to join is available on the ARCCA website
    - Georgetown Climate Center
        - The Georgetown Climate Center offers a variety of email updates, with listservs for daily clips, adaptation news, clean energy news, and transportation news accessible to anyone who provides their email
    - Smart Growth America
        - Smart Growth America focuses on smart urban planning and development and is based in Washington D.C.
        - Member benefits include receiving monthly newsletters. Information about how to join is available on the Smart Growth America website
    - Rezilient
    - Urban Sustainability Directors Network (USDN)
        - The USDN is a network of local government professionals from the United States and Canada

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        - Information about how to join is available on the USDN website
    - California state agency newsletters
        - Office of Planning and Research (OPR), Strategic Growth Council (SGC), California Natural Resources Agency (CNRA), California Department of Public Health (CDPH)
    - U.S. federal agency newsletters
        - Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), USDA, etc
    - Look into your own regional newsletters!
        - Ex/ Sierra Nevada Alliancance, Capital Region Climate Readiness Collaborative (CRC) Bay Area Air Quality Management District (BAAQMD), (and other air districts), various regional Council of Governments

IV. Monitoring

A. Develop Metrics

Metrics are key to tracking the progress of resiliency plans, as well as measuring their impact. In order to create a comprehensive and efficiently implementable resiliency plan, metrics must be included with resiliency policies and actions.

The Safeguarding California Plan 2018 includes a thorough list of climate change metrics in Appendix E, with context and explanations for each metric. The proposed metrics listed in the Safeguarding California Plan are primarily intended for state governments, but many can be employed by local actors as well[71].

Specifically for heat resiliency plans, examples of metrics a plan may include, and are not limited to, the following (categorized by different sectors influenced by heat):

- Agriculture/Habitat
    - Percentage of livestock shelters with heat mitigation systems

[71] California Natural Resources Agency, *Safeguarding California Plan: 2018 Update*. 2018. Web, http://resources.ca.gov/docs/climate/safeguarding/update2018/safeguarding-california-plan-2018-update.pdf (accessed January 11, 2019).

    - Percentage of farmers employing agroecology techniques
    - Presence of non-native vs native species in habitats
- People/Community
    - Percentage of outdoor workers and employers who have received training on extreme heat
    - Attendance at community workshops
    - Number of languages jurisdiction materials are available in
    - Number of organized community events per year
    - Number of resources dedicated to promoting individual resilience
- Housing/Buildings
    - Number of homes participating in weatherization programs
    - Number of months between building air quality inspections
    - Percentage of cool/green roofs in jurisdiction
    - Percentage of buildings constructed with climate appropriate considerations
- Public Health and Safety
    - Cooling Centers
        - Accessibility of cooling centers
            - Maximum distance from cooling center
            - Public transportation routes near cooling centers
            - Parking spaces available near cooling centers
        - Usage of cooling centers
            - Number of community members at cooling centers during extreme heat events
    - Heat-Related Illness
        - Number of heat-related emergency room visits per year
        - Number of heat-related illnesses and deaths by census tract
        - Number of utility calls by census tract
- Social Equity
    - Percentage of residents with access to A/C, overall and by census tract
    - Percentage of residents with cardiovascular or respiratory diseases, overall and by census tract
    - Number of cooling centers per census tract

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    - Number of languages jurisdiction materials are available in
    - Number of heat-related illnesses and deaths by census tract
    - Normalized Difference Vegetation Index (NDVI) Greenness per census tract
    - Attendance at community workshops
    - Number of languages jurisdiction materials are available in

    NOTE: Some of the metrics listed for measuring heat impacts can also be used to measure heat-related equity, and thus are included as Social Equity metrics as well as metrics for other sectors

- Planning/Public Works/Parks
    - Percentage of shade cover in parks
    - Percentage shade cover along transport routes
    - Percentage of shade cover by census tract
    - Number of trees by census tract
    - Presence and health of urban greening installations
    - Consistent access to drinking water - at least every ½ mile
    - NDVI Greenness
- Utilities/Infrastructure
    - Efficiency of water storage mechanisms
    - Quality of jurisdiction water
    - Compliance with stormwater pollution prevention plans
    - Reduction in water usage
    - Percentage of jurisdiction energy generated from renewable sources
    - Reduction in energy use
    - Percentage of facilities with back-up energy generators
    - Percentage of infrastructure constructed with climate appropriate considerations

Ultimately, the metrics employed in a jurisdictional resiliency plan should be tailored to indicators that are important to that jurisdiction. Metrics should be defined by local actors and community members to

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ensure progress is tracked for the indicators most important to communities, and to increase ties between a plan and the public[72].

B. Track Scientific Updates, Tools, and Technology

The field of adaptation research is growing, and as such new tools, information, and technology are becoming available. Existing tools are also updated with new, often more localized, information that may also help jurisdictions understand how climate change will impact a locality and region. Therefore, resiliency plan implementation strategies should include staying up-to-date with these scientific updates and advances[73]. Parties responsible for adaptation should form a team and system for staying informed and updated.

C. Establish Feedback Loops

Adaptation and resiliency call for change and flexibility, as well as accountability. Resiliency plan monitoring must include a process of periodic review, where progress on the plan can be evaluated, metrics reported on, and new tools or information can be integrated into the plan[74]. The party responsible for implementing the resiliency plan should establish and secure a system of review.

V. Collaborating

A. In-Agency Partners

As discussed in the Staffing section of this chapter, implementation of a resiliency plan cannot successfully be carried out with one individual or agency alone. Resiliency is best achieved by breaking through silos and encouraging every sector and department to make decisions promoting resiliency and sustainability.

B. Beyond-Agency Partners

[72] Susannah Fisher and Simon Anderson, "Developing meaningful local metrics for climate adaptation: learning from applying the TAMD framework at local scales," *Adaptation metrics: Perspectives on measuring, aggregating and comparing adaptation results*, (2018): 76, https://resilientcities2018.iclei.org/wp-content/uploads/UDP_Perspectives-Adaptation-Metrics-WEB.pdf.

[73] California Emergency Management Agency, California Natural Resources Agency, *California Adaptation Planning Guide: Planning for Adaptive Communities*.

[74] California Emergency Management Agency, California Natural Resources Agency, *California Adaptation Planning Guide: Planning for Adaptive Communities*.

i. Regional partnerships

Extending beyond political boundaries is also beneficial to resiliency. Climate change has regional impacts tying together localities, and pursuing resiliency through regional partnerships can allow for resource sharing, increase efficiency, and increase the number of constituents and communities benefiting from resiliency efforts[75]. Jurisdictions should consider partnering with local jurisdictions, county level governance, neighboring communities, and other organizations within a jurisdiction's region.

Examples of regional resiliency partnerships include:

- Capital Region Climate Readiness Collaborative (CRC)
- Bay Area Climate Adaptation Network (BayCAN)
- Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC)

ii. State and Federal partnerships

State and/or Federal government agencies may be able to provide support and resources in implementing resiliency plans. These agencies may be able to offer funding, additional technical expertise, and connect jurisdictions to others facing similar issues.

iii. Private partnerships

Private actors are another potential partner in implementation. They can provide funding, additional expertise, and connections, and may help persuade other private actors to support resiliency efforts as well.

VI. Summary

A. Implementation Considerations

The first considerations a jurisdiction should make in implementing a policy are:

- What are the (expected and potential) barriers to implementing this plan?
    - What social, economic, and policy barriers could stall implementation of this plan?

[75] California Emergency Management Agency, California Natural Resources Agency, *California Adaptation Planning Guide: Planning for Adaptive Communities*.

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- What legal requirements may influence the implementation of this plan or policy?

After answering these high-level questions, jurisdictions must consider the specifics of a plan's implementation in their localities. Table X. offers a summary of these more specific implementation considerations that jurisdictions may use to prepare implementation plans. Before beginning on the process of filling out this table, jurisdictions also should have considered the following questions:

- Which groups or individuals need to be involved in implementing this plan or policy?
- Who can be partnered with to best implement this plan?
- Who will benefit from implementation of this plan? Who will not benefit from implementation?

Answering these questions will help jurisdictions fill out Table X.

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*Italicized headlines pull specifically from California's SB 379 regulations

Heat Resiliency Policy or Action	Responsible Party	In-agency partners in implementation	External partners in implementation	Financing	Metric and feedback system	Methods to increase and advance equity	*Methods to avoid or minimize climate change impacts from new uses of land**	*Location of new essential public facilities or construction methods to minimize damage if facilities currently located in at-risk areas*	*Designation of adequate and feasible infrastructure in at-risk areas*	*Guidelines for working with relevant local, regional, state, and federal agencies*	*Identification of natural infrastructure that may be used in adaptation projects*

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B. Hypothetical Case Study

The following hypothetical works with the table provided to demonstrate how a local government may prepare for resiliency plan implementation.

The City of Sunshine (CoS), located in Soleil County, created a Heat Resiliency Plan that they integrated into their General Plan and Climate Action Plan. They have reached the implementation stage, and want to ensure they are planning comprehensively and meeting the requirements of California SB 379. The primary climate change risk in the City of Sunshine, as determined by the vulnerability assessment conducted by the City of Sunshine, is a significant increase in heat and extreme heat events.

One of the resiliency policies the CoS plans to implement stipulates requirements for installing cool/green roofs. The policy is: Cool/Green roof installation: All new buildings and homes must have either a cool or green roof, with the exception of buildings and homes that have a solar roof. For major renovations and alterations requiring a permit, the *City of Sunshine Building Department* will provide information at the time of permit application regarding cool and green roofs so that building owners are informed about more adaptive and efficient options.

While drafting this policy and planning for its implementation, the CoS Sustainability Coordinator and her team considered the following questions:

High level questions

- What are the (expected and potential) barriers to implementing this plan? What social, economic, and policy barriers could stall implementation of this plan?
    - *Social: resistance to building requirements, especially if they increase the builders costs*
    - *Economic: ability of CoS to help fund installation of cool/green roofs, budget constraints that would divert money elsewhere*
    - *Policy: CoS City Council may seek to allocate CoS budget to prioritize other projects*
- *What legal requirements may influence the implementation of this plan or policy?*

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- *City of Sunshine General Plan - requires new buildings to have cool or green roof*
- *City of Sunshine Climate Action Plan - requires new buildings and homes to have either a cool or green roof, or a solar roof*
- *California Energy Commission - starting 2020, new homes, condos, and apartment buildings will be required to have a solar roof, with exceptions (such as for homes in the shade)*
  → This policy is meant for homes, so buildings will focus on having either cool/green roof or solar roof. Homes in the shade may also be built with a cool/green roof

Implementation specifics

- Which groups or individuals need to be involved in implementing this plan or policy?
  - *CoS housing and building staff, CoS Finance Department, Sunshine homeowners, landlords, renters representatives, housing authorities, and construction industry groups (including the Sunshine Chamber of Commerce and the Sunshine Builders' Exchange) companies*
- Who can be partnered with to best implement this plan?
  - *CoS Departments of Community Services, Public Works, and Finance.*
  - *Soleil County, Sunshine Building and Construction Inc, Soleil County Housing, Sunshine Homeowners Association, Sunshine Neighborhood Associations, Soleil Renters Association*
- Who will benefit from implementation of this plan? Who will not benefit from implementation?
  - *Benefit*
    (1) Homeowners, building owners, and building tenants who will be able to save money on energy and/or enjoy more comfortable indoor temperatures
    (2) Construction companies could benefit from requirements that may allow them to increase profit
  - *Not benefit:*
    (1) if cool/green roofs significantly increase cost of homes and buildings, some interested

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homeowners may not be able to afford to live in the City of Sunshine

(2) Construction companies could also not benefit from requirement if they do not currently have the expertise or materials to install cool/green roofs

Now fully in the implementation stage, the City of Sunshine is outlining it's full implementation plan. Table Y. overviews the City of Sunshine's implementation plan for their cool/green roof policy.

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Heat Resiliency Policy or Action	Responsible Party	In-agency partners in implementation	External partners in implementation	Financing	Metric and review system	Methods to increase and advance equity	*Methods to avoid or minimize climate change impacts from new uses of land*	*Location of new essential public facilities or construction methods to minimize damage if facilities currently located in at-risk areas*	*Designation of adequate and feasible infrastructure in at-risk areas*	*Guidelines for working with relevant local, regional, state, and federal agencies*	*Identification of natural infrastructure that may be used in adaptation projects*
Cool/green roof installation	CoS Sustainability Coordinator	CoS Department of Community Services CoS Department of Public Works CoS Department of Finance	Sunshine Building and Construction Inc. Sunshine Chamber of Commerce Sunshine Builders' Exchange Soleil County Sunshine Homeowners Association Sunshine Neighborhood Associations Soleil County Housing Soleil Renters	CoS will set aside __% of budget to help fund construction CoS will apply for grants from California HCD, US HUD to add to support this fund	Percentage of roofs in Davis that are cool or green; assessed every three years Track prices of new homes, determine if more expensive than would be without cool/green roof	CoS fund priority given to cool/green roof installation for low-income housing	Construction of new buildings and homes should be limited to existing commercial or residential zones, respectfully. If CoS growth demands construction beyond those zones, regulate construction to minimize disruption to natural ecosystems	Renovate roofs of essential public facilities with cool/green roofs to improve indoor comfort and decrease air conditioning needs	Infrastructure throughout CoS is currently adequate to sustain heat, but preventative measures will be taken to maintain adequacy	CoS will update other cities in Soleil County, Soleil County staff, and California HCD on effectiveness of policy at least every three years CoS will stay up to date on California HCD and US HUD programs that could support policy	Plant and/or maintain street trees to increase shading and further mitigate heat

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Conclusion

The purpose of this Toolbox is to streamline heat resiliency planning throughout Yolo County, California, and beyond. The Toolbox contains planning language, sample policies, sample actions, and implementation guidance. This content can be copied, pasted, and applied to jurisdictional plans such as General Plans, Climate Action Plans, Resiliency Plans, and/or any other resiliency-related plan. The Toolbox was created for local governments, but the YRC hopes that the Toolbox will be useful to agencies and organizations beyond local governments as well.

No matter the context of this Toolbox's application, it is imperative that equity and community engagement are integrated into its application. Extreme heat, like all impacts of climate change, will affect some people and communities more acutely than others. Our age, health, race, location, income, and occupation all influence our susceptibility to heat. These factors are either entirely out of an individual's control or difficult to change. Communities most impacted by and vulnerable to climate change impacts must be empowered in resiliency decision-making; their voices, concerns, and ideas need to be heard and considered to ensure steps taken are adequate and appropriate. Furthermore, promoting equity and community engagement allows us to create neighborhoods, communities, and societies that are better than ever, despite climate crises.

Climate change is an incredibly daunting reality of our present and future; however, we can prepare ourselves and our communities for this reality. The dozens of policies and actions in this Toolbox demonstrate that we need not stand idly by, we can face climate challenges head on, and create a more resilient, sustainable, equitable, and livable community in the process.

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