CALIFORNIA'S FIFTH CLIMATE CHANGE ASSESSMENT

EISI for Extreme Heat Online: Interactive Exposures, Impacts, and Strategies Inventory Tool for Extreme Heat Project

An Original Research Report for:

California's Fifth Climate Change Assessment

Prepared By:
Pala Band of Mission Indians
Prosper Sustainably
Public Health Alliance of Southern California

PALA BAND OF MISSION INDIANS

CALIFORNIA ENERGY COMMISSION

Public Health Alliance OF SOUTHERN CALIFORNIA

Prosper Sustainably

Primary Author(s)

Shasta Gaughen
Executive Director of the Pala Environmental Department (PED)
Pala Band of Mission Indians

Angie Hacker
CEO, Principal Consultant
Prosper Sustainably

Coline Bodenreider
Climate Change and Health Data Lead
Public Health Alliance of Southern California

Laurie Monserrat
Project Coordinator
Prosper Sustainably

Sarina Vega
Project Support
Prosper Sustainably

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- John Gomez, Ramona Band of Cahuilla
- Curtis Lee, Cold Springs Rancheria of Mono Indians of California
- Ashley Pomona, North Fork Rancheria of Mono Indians of California
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- Rob Roy, La Jolla Band of Luiseño Indians
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Axis Maps designed and built the EISI for Extreme Heat Online tool.

About California's Fifth Climate Change Assessment

California's Climate Change Assessments are the state's scientific foundation for understanding future climate-related vulnerability across California's regions and systems. Senate Bill 1320 (Stern, 2020) requires the State to report the impacts and risks of climate change across California at least every five years, beginning with California's Fifth Climate Change Assessment (Fifth Assessment). Building on decades of climate research and previous Assessments, the Fifth Assessment presents new findings about California's climate future, with a dedicated focus on Tribal partnerships, public engagement, and communities most vulnerable to climate impacts.

The Fifth Assessment's research and tools are designed to fill knowledge gaps about California's climate future, inspire strategic climate actions, and shape planning, investments, and policies at the state, regional, and local scales. Guided by research priorities identified by state, Tribal, and local leaders, community representatives, and subject matter experts, its findings are designed to help illuminate potential climate futures, the challenges they may present, and the opportunities to build resilience through adaptation pathways.

For the full suite of Fifth Assessment research products, please visit: www.ClimateAssessment.ca.gov.

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Abstract

The Pala Band of Mission Indians developed an interactive, web-based platform called the Exposures Impacts Strategies Inventory for Extreme Heat (EISI for Extreme Heat Online) for Tribes to better assess their extreme heat exposure, impacts and prioritize community assets and facilities. This project was supported by the Tribal Climate Health Project, Prosper Sustainably and the Public Health Alliance of Southern California.

Keywords: Extreme heat, vulnerability, California Native American Tribes, Tribal, data, exposures, risks, impacts, Pala Band of Mission Indians, interactive, platform

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Executive Summary

This grant is the first of two awarded to the Pala Band of Mission Indians through California's Fifth Climate Change Assessment and Tribal Research Grant Program administered by the California Energy Commission (CEC), which developed the Exposures, Impacts, and Strategies Inventory (EISI) for Extreme Heat Project. This is a pilot project designed to provide actionable climate, health, and community condition data to Pala. This tool was created to fill data gaps and meet the needs of Tribes in California, some of whom are already experiencing the increasing impacts of climate-driven extreme heat but have constrained capacity to compile and analyze all data needed to inform action.

The Pala Band of Mission Indians collaborated with the Public Health Alliance of Southern California, Prosper Sustainably, Tribal Climate Health Project, and nine Tribal Advisors to develop the interactive EISI for Extreme Heat Online Tool. This collaboration resulted in an online platform that allows Tribes to learn about extreme heat exposures, risks, and impacts with data from Cal-Adapt, CalEnviroScreen 4.0 and the Healthy Places Index. The EISI for Extreme Heat Online tool is designed to make it easier for California Tribes to assess, prioritize, and address extreme heat vulnerabilities that impact health and other important community assets.

The second Fifth Climate Change Assessment and Tribal Research Grant Program grant allowed the Tribal Climate Health Project and the Pala Band of Mission Indians, aided by the Public Health Alliance of Southern California, to begin developing a robust, fully customizable vulnerability assessment report feature within the EISI for Extreme Heat Online tool to further enable Tribes to understand their specific heat risks and impacts and inform effective adaptation strategies. Beyond the pilot phase, we aim to expand the EISI for Extreme Heat Online Tool to incorporate additional climate exposures, such as drought, wildfire, and sea-level rise.

Chapter 1: Introduction

The Interactive Exposures, Impacts, and Strategies Inventory (EISI) Tool for Extreme Heat (EISI for Extreme Heat Online) Project is a collaborative pilot initiative led by the Pala Band of Mission Indians (Pala), Prosper Sustainably, and the Public Health Alliance of Southern California. While tribes have a deep and long-standing understanding of how their climate and lands are changing, there are gaps in information that can make it difficult for Tribes to safeguard their communities from climate risks. Navigating the thousands of available datasets can also require more time and capacity than is available.

This project centers around the modification and integration of the Exposures, Impacts, and Strategies Inventory (EISI Core) tool, a well-established mechanism for assessing climate-related risks, into an interactive and easily accessible web-based tool that utilizes data from the existing California Healthy Places Index: Extreme Heat Edition (HPI: Extreme Heat Edition) map platform.

The existing EISI tool is a spreadsheet-based tool that helps tribes braid both Indigenous or local knowledge with publicly accessible, and "community-ready" science to identify and evaluate:

- Exposure to various climate conditions (primary conditions, as well as secondary climate conditions that occur as a result of the primary condition).
- Potential impacts these exposures have on health and social, natural, and built environments, including highly valued tribal community assets.
- Community characteristics that influence a tribe's sensitivity or adaptive capacity.

However, the tool requires tribes to search for, interpret, and input data points on climate change and community vulnerability, consuming valuable and limited tribal staff time.

The EISI for Extreme Heat Online platform translates the EISI Core framework into a user-friendly web application that offers centralized access to data on extreme heat, health, and community conditions directly within the tool. This platform was designed to support Tribal government staff and administrators in creating their vulnerability assessments, adaptation plans, emergency management plans, and hazard mitigation plans.

This project represents a crucial step towards helping California Native American tribes readily access and use available scientific information and tribal ways of knowing, to assist their climate change resilience efforts. The project provides

actionable extreme heat, health, and community condition data to California Tribes as a pilot project that can then be leveraged and expanded to include other climate hazards, enabling tribes in California to bolster resilience to the ongoing and increasing impacts of climate change.

Chapter 2: Development Process and Tribal Outreach

The EISI for Extreme Heat Online tool was developed by the Pala Band of Mission Indians, Prosper Sustainably, the Public Health Alliance of Southern California, and Axis Maps, with review and input from a group of Tribal Advisors. Development of the EISI for Extreme Heat Online tool platform and data are described in detail in the sections below.

Tribal Advisors were a crucial component of the development process and were involved throughout. Pala Band of Mission Indians and Prosper Sustainably, through the Tribal Climate Health Project, convened Tribal Advisors from federally recognized Tribes throughout California to help evaluate and provide input on the development of the EISI for Extreme Heat tool.

Advisors were provided with:

- Custom vulnerability data and information to inform and/or update adaptation plans
- Beta access to the EISI for Extreme Heat platform

Tribal Advisors, with their own respective expertise in climate adaptation tools and best practices for using data for tribal planning, tracking, and decision-making, helped identify climate adaptation data and evaluate data gaps for this project. Additionally, Tribal Advisors gave advice to enhance user experience and functionality. Input and feedback on the EISI for Extreme Heat Online tool was facilitated by Prosper Sustainably, the Tribal Climate Health Project, and the Public Health Alliance of Southern California. Tribal Advisors met five times over the course of the project, and their input and feedback were documented and incorporated into the final EISI for Extreme Heat tool. A summary of meeting dates and topics are provided in Table 1.

Table 1: Tribal Advisor Meetings for EISI for Extreme Heat Online

Meeting	Date	Topics
Tribal Advisor Meeting #1	August 2024	• Kickoff meeting for Tribal Advisors • EISI for Extreme Heat Online tool concept discussion • Solicited information for other Extreme Heat databases and needs
Tribal Advisor Meeting #2	April 2025	• Initial review of the EISI for Extreme Heat Online tool • Wireframe, Tribal climate data needs, and data sovereignty discussed
Tribal Advisor Meeting #3	May 2025	• Adaptation strategies feedback session • Review, revision, and paring down list of adaptation strategies for inclusion in the tool
Tribal Advisor Meeting #4	August 2025	• Second review for the EISI for Extreme Heat Online tool (beta version) • Feedback on beta version and future report feature discussed
Tribal Advisor Meeting #5	February 2026	• Demonstration of the final EISI for Extreme Heat Online tool for Tribal Advisors • Minor bug fixes and enhancements discussed

Source: Tribal Climate Health Project

Platform Development Process

To develop the platform, regular discussions were held between Axis Maps, Public Health Alliance of Southern California, Pala Band of Mission Indians, and Prosper Sustainably (the internal project team).

To begin the development process, the Public Health Alliance developed design specifications for the EISI for Extreme Heat Online platform, outlining each step of the tool and its required functionality. The design specifications were based on an established Tribal climate adaptation framework used in the original Exposures,

Impacts, and Strategies Inventory tool, which was developed by the Tribal Climate Health Project. The internal project team reviewed, revised, and approved the design specifications.

Based on these design specifications, Axis Maps developed wireframe designs that were reviewed, revised, and approved by the internal project team. A beta version of the interactive web platform was developed by Axis Maps based on the wireframe designs and design specifications, and was refined through an iterative feedback process with the internal project team. The wireframe designs were presented to Tribal Advisors in April 2025.

A demonstration of the refined beta version of the EISI for Extreme Heat Online tool was then presented to the Tribal Advisors in August 2025 for review and feedback. Feedback received from the Tribal Advisors included changes to make the user interface more intuitive, adding visual and text data interpretation aides, improving instructions for the tool, and creating an option for users to add custom community assets. Improvements to the tool were made in response to feedback from Tribal Advisors, leading to the final version of the tool. The final version of the tool was presented to Tribal Advisors in February 2026.

Data Development

Data from the Healthy Places Index: Extreme Heat Edition (developed by the Public Health Alliance of Southern California) was used as the basis for the data included in the EISI for Extreme Heat Online tool. The Tribal Research Grant Program Round 1 funded the development of 20 additional extreme heat and extreme heat vulnerability datasets. (For a complete list of data layers included in the EISI for Extreme Heat Online tool, see Appendix B). In order to decide which additional data layers to develop and add to the tool, we met with Tribal Advisors (Tribal Advisor Meeting #2) and conducted a series of Mentimeter polls around three main types of data included in the EISI for Extreme Heat Online tool (extreme heat, secondary exposures, and impacts). Data layers to be added to the tool were selected based on preference indicated from results of the Mentimeter polls and discussion with Tribal Advisors.

Chapter 3: The EISI for Extreme Heat Online Tool

Key Features and Capabilities

The EISI for Extreme Heat Online tool provides tribes with the platform, framework, and data to conduct an extreme heat vulnerability assessment. It takes users through a seven-step process, described in detail below.

Key features and functions of the EISI for Extreme Heat Online tool include:

- The ability to access data on extreme heat, secondary exposures related to extreme heat (like air quality), extreme heat impacts, and measures of population sensitivity and adaptive capacity all in one place.
- Data visualizations for each indicator (e.g., trendlines, percentile color bars) for easier communication and interpretation of complex data.
- Integration of local tribal knowledge, lived experience, and tribal priorities through asset evaluation.
- Flexibility in selecting tribal areas. Tribal areas can be modified to reflect ancestral lands or additional tribe tracts/parcels. Tribes do not have to be federally- or state- recognized to create or select a tribal area.
- A summary of relevant extreme heat, secondary exposure, and impact data, as well as prioritized assets and selected risk levels for each exposure and impact.

Step 1: Find your area

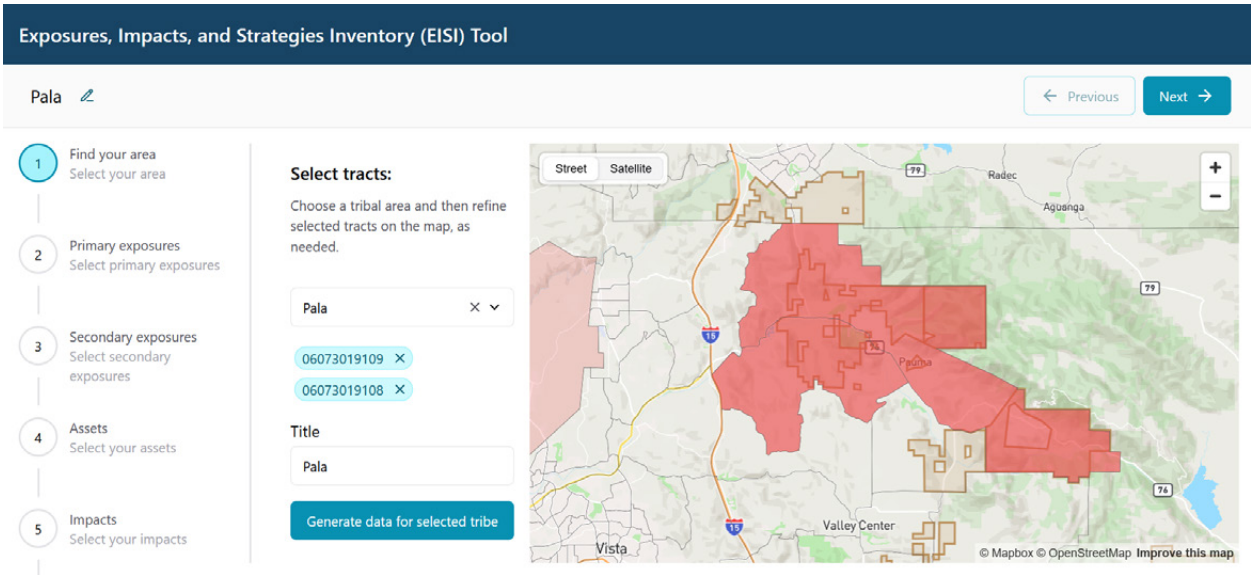
The first step in the tool is to select the geographic area that represents a tribe. The selected area determines the data shown in later parts of the tool, including information on extreme heat, health, and demographics.

Tribal areas are defined using census tracts as a base geographic unit.

There are two ways to select an area: 1) By choosing a tribe from the dropdown list to automatically select census tracts associated with tribal boundaries, or 2) by manually selecting or adjusting census tracts directly on the map. The selected census tracts will show up as red boundaries. Federally recognized Tribal tracts, courtesy of BIA, were added to the map as reference.

After confirming the selection, users click on a button that generates the data for the chosen area and takes them to the next step.

Figure 1: Step 1 of the EISI for Extreme Heat Online Tool - Find Your Area



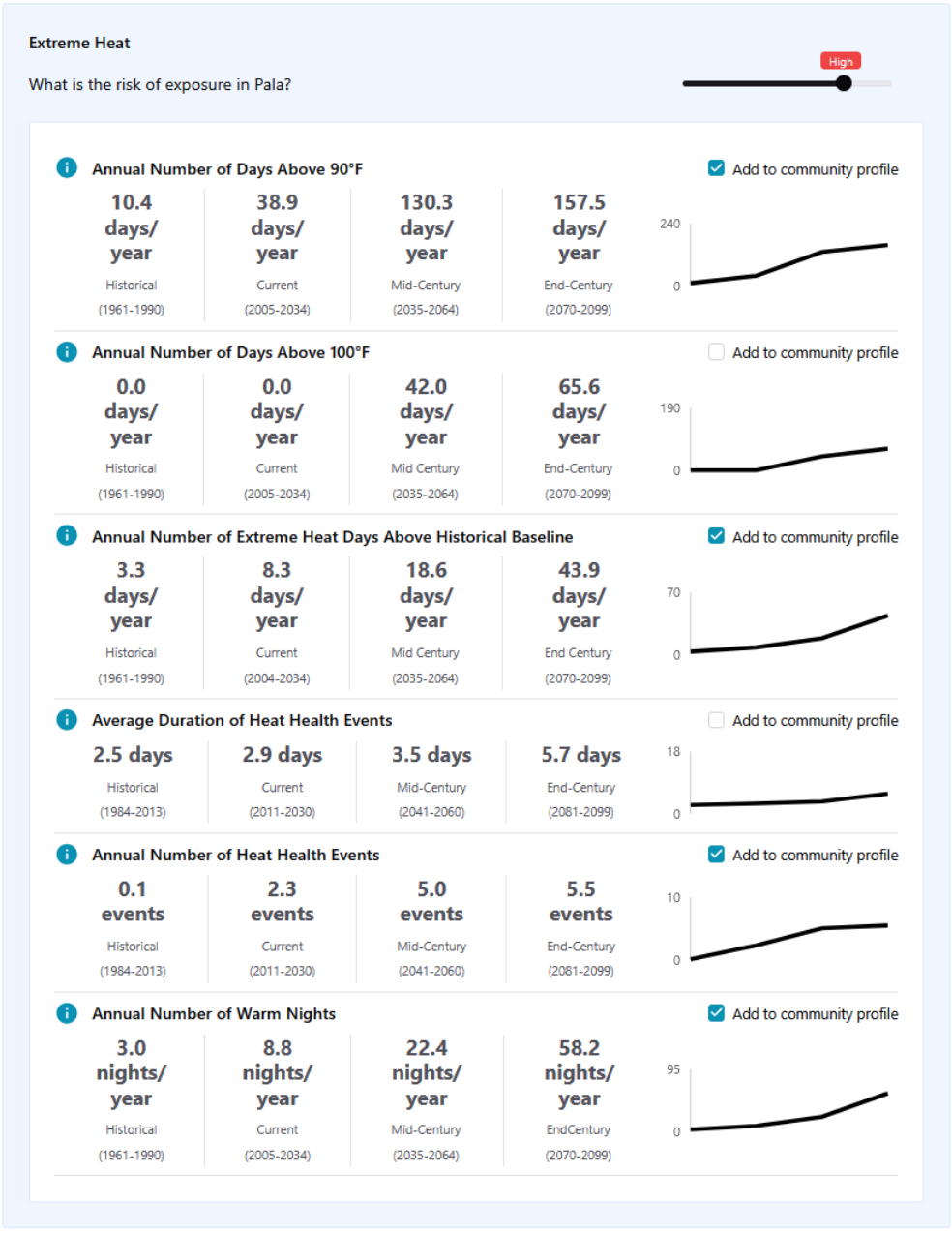
This step allows users to select a tribal area, either via the dropdown list to the left of the map or by clicking directly on the map.

Step 2: Primary Exposures

In this step, users review data on historical, current, and projected extreme heat exposure for the selected tribal area. Users then assign a qualitative risk rating (None, Very Low, Low, Medium, High, or Very High) to indicate the risk that extreme heat poses to their community. This rating is informed by both the quantitative data provided and contextual knowledge, such as community feedback, local observations, and existing tribal reports.

This step presents users with extreme heat exposure data from the Fifth Assessment and heat-health events data from the California Heat Assessment (CHAT) tool. When clicked, an information icon next to each indicator reveals its definition and data sources. Users can select specific indicators to include in a generated community profile, typically based on observed trends or relevance to community concerns. Each indicator also includes a trendline that visualizes changes over time across four periods: historical, current, mid-century, and end-of-century. Corresponding numerical values are displayed alongside the trendline to support interpretation of temporal trends.

Figure 2: Step 2 of the EISI for Extreme Heat Online Tool - Primary Exposures



This step allows users to view data on past, present, and future extreme heat exposures in their community and assign a qualitative risk ranking.

Step 3: Secondary Exposures

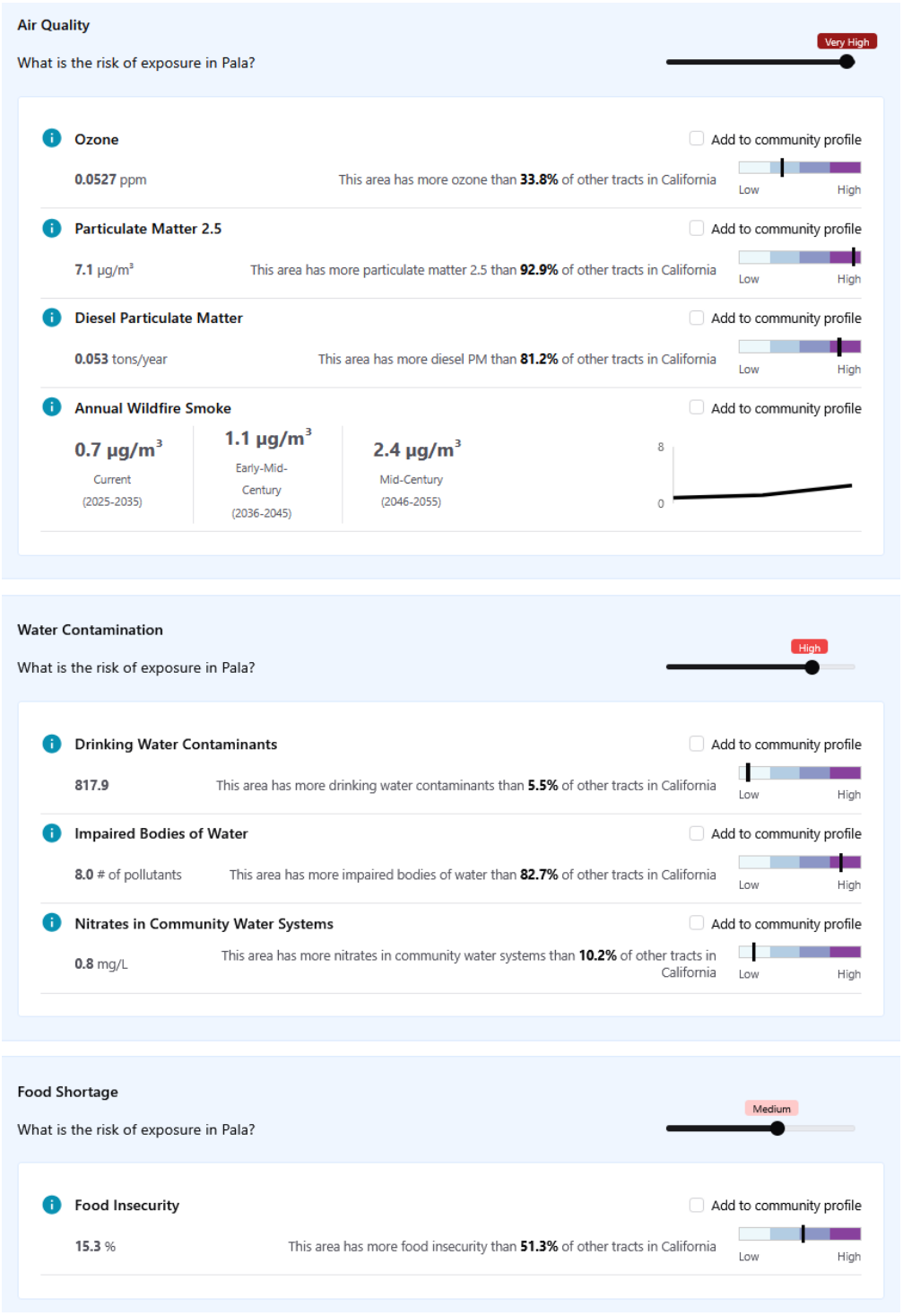
This step presents users with data on secondary exposures in their tribal area. Secondary exposures are exposures that are influenced or intensified by extreme heat (air quality, water contamination, and food shortage). After reviewing the data, users assign a risk level to each secondary exposure.

As in the previous step, users can:

- Access indicator definitions and data sources by clicking on the blue information icon next to each indicator.
- Select relevant data to include in a community profile, particularly where exposures are elevated relative to other areas or are of specific concern.
- Assign each secondary exposure a risk level using a standardized scale (None, Very Low, Low, Medium, High, or Very High), informed by both the provided data and contextual knowledge, including community input, local observations, and existing reports.

The data display for secondary exposure indicators includes three things: 1) the measured value for the area, 2) a percentile ranking with interpretation, comparing the area to other census tracts in California, and 3) a color-coded bar that visually represents this ranking from low to high.

Figure 3: Step 3 of the EISI for Extreme Heat Online Tool - Secondary Exposures



This step allows users to view data on secondary exposures (air quality, water contamination, and food storage) in their community and assign a qualitative risk ranking to each exposure.

Step 4: Select Community Assets

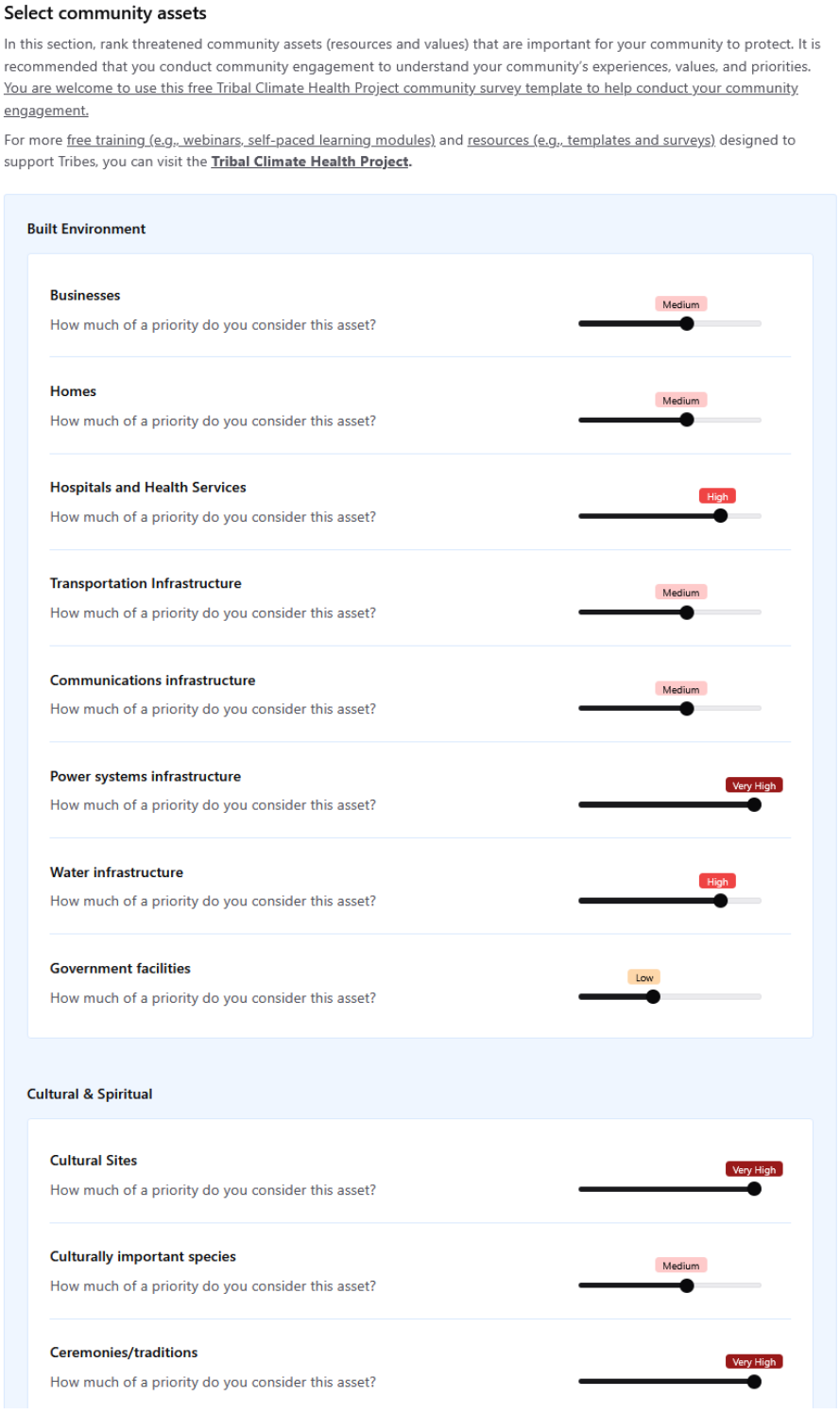
In Step 4, users identify and rank community assets (e.g., key resources and values) to determine their relative importance for protection against extreme heat. This process supports subsequent analysis of how extreme heat may impact high-priority assets.

Assets are grouped into categories, such as built environment (e.g., transportation infrastructure, businesses), cultural and spiritual (e.g., ceremonies/traditions, traditional knowledge and practices), health (e.g., physical and mental health), and natural resources (e.g., water resources, wildlife). Users can also add and rank custom assets not included in the predefined list.

Users are encouraged to conduct a community climate priorities survey prior to this step in order to better understand which assets are most important to their tribe in the face of extreme heat and climate change. The tool points users to guidance and a template community survey developed by the Tribal Climate Health Project to help them in this process.

Based on the community survey results or the user's understanding of community priorities, the user prioritizes each asset from a scale of None to Very High.

Figure 4: Step 4 of the EISI for Extreme Heat Online Tool - Select Community Assets



This step allows users to rank community assets from a predetermined list, as well as add and rank custom assets. Note: The figure depicts a truncated list of assets, as the full list of assets are too long to be shown in a single figure.

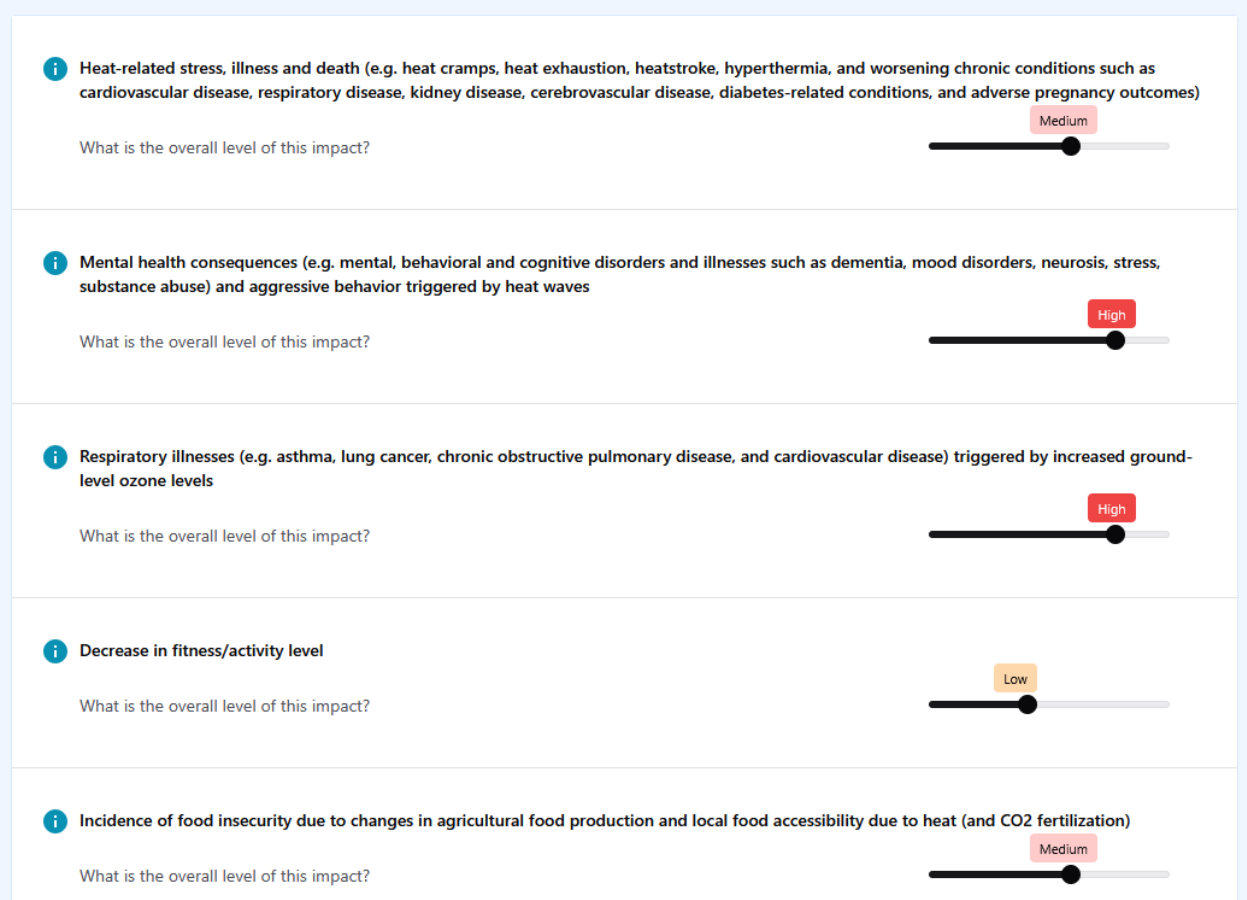
Step 5: Rank Impacts

This allows users to evaluate and assign risk levels to specific extreme heat impacts affecting the tribal area. The assessment integrates multiple factors, including impact data, community characteristics, and the priority of affected community assets.

Each impact is explored through three components:

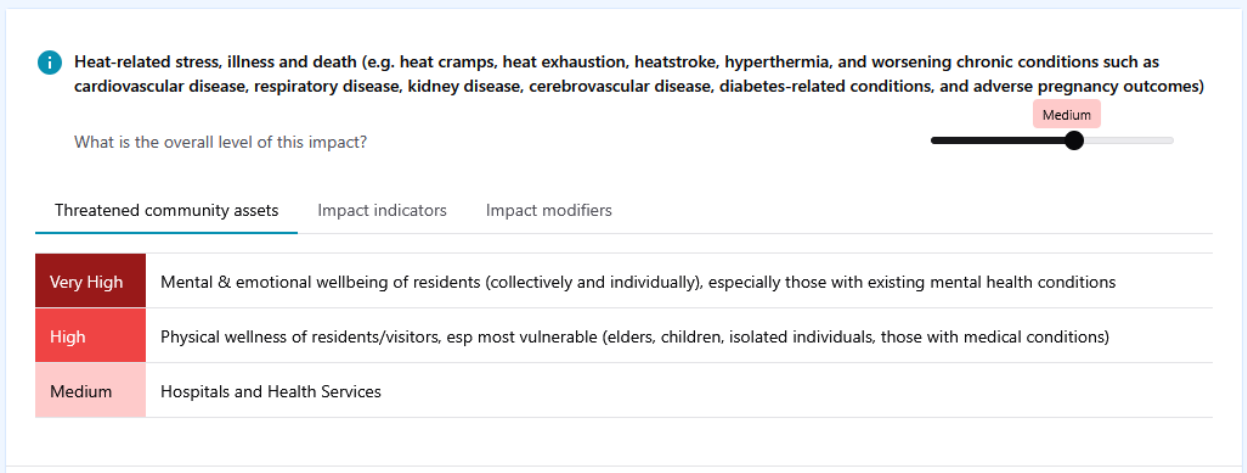
1. **Threatened community assets**, which reflect priority rankings assigned in Step 3
2. **Impact indicators**, which quantify the magnitude of the impact (e.g., heat-related emergency department visits)
3. **Impact modifiers**, which describe community characteristics that influence vulnerability or adaptive capacity.

Figure 5: Step 5 of the EISI for Extreme Heat Online Tool - Review and Rank Impacts



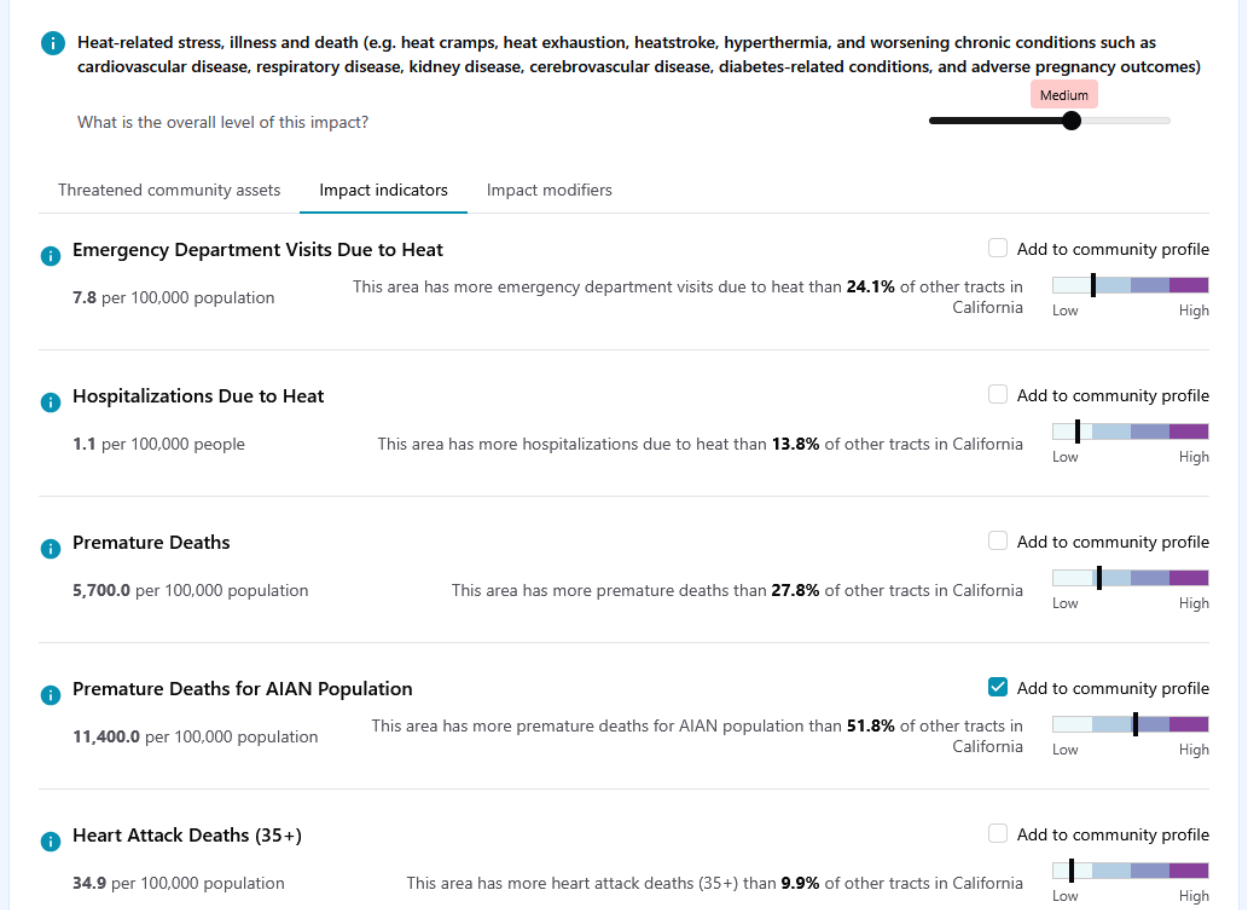
This step allows users to review the different extreme heat-related impacts and rank them.

Figure 6: Step 5.1 of the EISI for Extreme Heat Online Tool - Threatened Community Assets



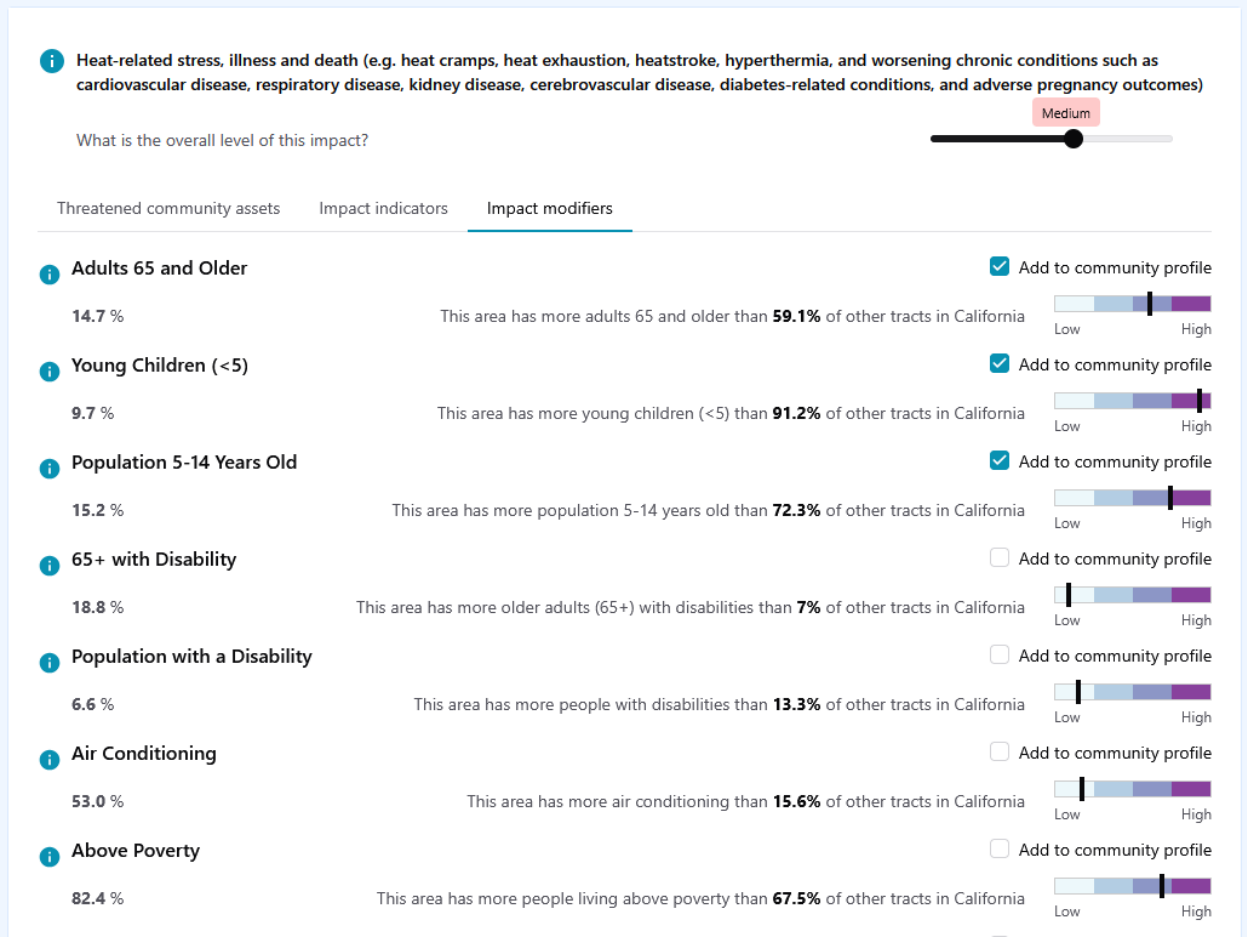
This step allows users to review related threatened community assets from Step 3.

Figure 7: Step 5.2 of the EISI for Extreme Heat Online Tool - Impact Indicators



This step allows users to select impact indicators for heat-related stress.

Figure 8: Step 5.3 of the EISI for Extreme Heat Online Tool - Impact Modifiers



This step allows users to select impact modifiers for heat-related stress.

Impact modifiers include factors such as sensitive populations (e.g., older adults, children), highly exposed groups (e.g., outdoor workers, unhoused individuals), and environmental conditions (e.g., tree canopy, impervious surfaces) that can increase or decrease risk.

Users assign a qualitative risk level (None to Very High) for each impact based on these combined inputs and may select specific indicators for inclusion in the community profile.

The data display for impact indicators and impact modifiers is the same as the one used to display data for secondary exposures in the second step. It describes the indicator value, percentile, and percentile interpretation, and provides a color bar to visualize the percentile from low to high.

List of extreme heat impacts:

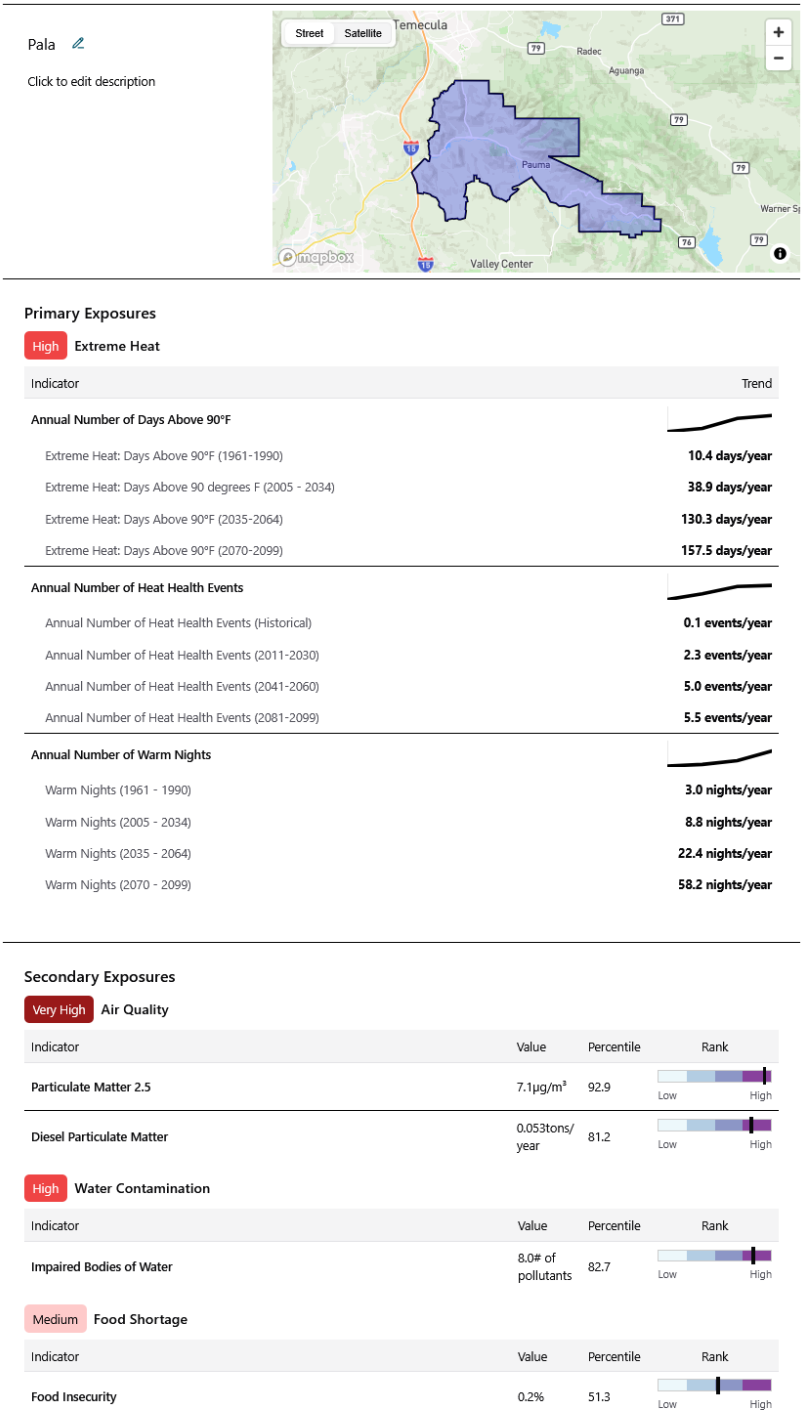
- Heat-related stress, illness, and death (e.g., heat cramps, heat exhaustion, heatstroke, hyperthermia, and worsening chronic conditions such as cardiovascular disease, respiratory disease, kidney disease, cerebrovascular disease, diabetes-related conditions, and adverse pregnancy outcomes)
- Mental health consequences (e.g., mental, behavioral, and cognitive disorders and illnesses such as dementia, mood disorders, neurosis, stress, substance abuse) and aggressive behavior triggered by heat waves
- Respiratory illnesses (e.g., asthma, lung cancer, chronic obstructive pulmonary disease, and cardiovascular disease) triggered by increased ground-level ozone levels
- Decrease in fitness/activity level
- Incidence of food insecurity due to changes in agricultural food production and local food accessibility due to heat (and CO2 fertilization)
- Infections due to contact with or ingestion of pathogens such as bacteria, viruses, and protozoa, or other toxins

Step 6: Community Profile

The final step is a community profile, which summarizes all the extreme heat, secondary exposure, and impact data that were chosen to be added to the community profile in the previous steps. It also shows the risk level selections for extreme heat, each secondary exposure, and each impact. Community assets are listed in a table organized by priority level.

At the end of the community profile is a list of adaptation strategies Tribes may consider to increase their resilience to future extreme heat. Users may find this community profile helpful as a reference when developing grant applications, drafting climate change assessments, or as a source of data for communications on future extreme heat threats.

Figure 9a: Step 6 of the EISI for Extreme Heat Online Tool - Community Profile - Exposure Summary



Pala

Click to edit description

Primary Exposures

High **Extreme Heat**

Indicator	Trend
Annual Number of Days Above 90°F	
Extreme Heat: Days Above 90°F (1961-1990)	**10.4 days/year**
Extreme Heat: Days Above 90 degrees F (2005 - 2034)	**38.9 days/year**
Extreme Heat: Days Above 90°F (2035-2064)	**130.3 days/year**
Extreme Heat: Days Above 90°F (2070-2099)	**157.5 days/year**
Annual Number of Heat Health Events	
Annual Number of Heat Health Events (Historical)	**0.1 events/year**
Annual Number of Heat Health Events (2011-2030)	**2.3 events/year**
Annual Number of Heat Health Events (2041-2060)	**5.0 events/year**
Annual Number of Heat Health Events (2081-2099)	**5.5 events/year**
Annual Number of Warm Nights	
Warm Nights (1961 - 1990)	**3.0 nights/year**
Warm Nights (2005 - 2034)	**8.8 nights/year**
Warm Nights (2035 - 2064)	**22.4 nights/year**
Warm Nights (2070 - 2099)	**58.2 nights/year**

Secondary Exposures

Very High **Air Quality**

Indicator	Value	Percentile	Rank
Particulate Matter 2.5	7.1µg/m³	92.9	Low High
Diesel Particulate Matter	0.053tons/ year	81.2	Low High

High **Water Contamination**

Indicator	Value	Percentile	Rank
Impaired Bodies of Water	8.0# of pollutants	82.7	Low High

Medium **Food Shortage**

Indicator	Value	Percentile	Rank
Food Insecurity	0.2%	51.3	Low High

The community profile displays a summary of exposure and rankings selected by the user over the course of the tool.

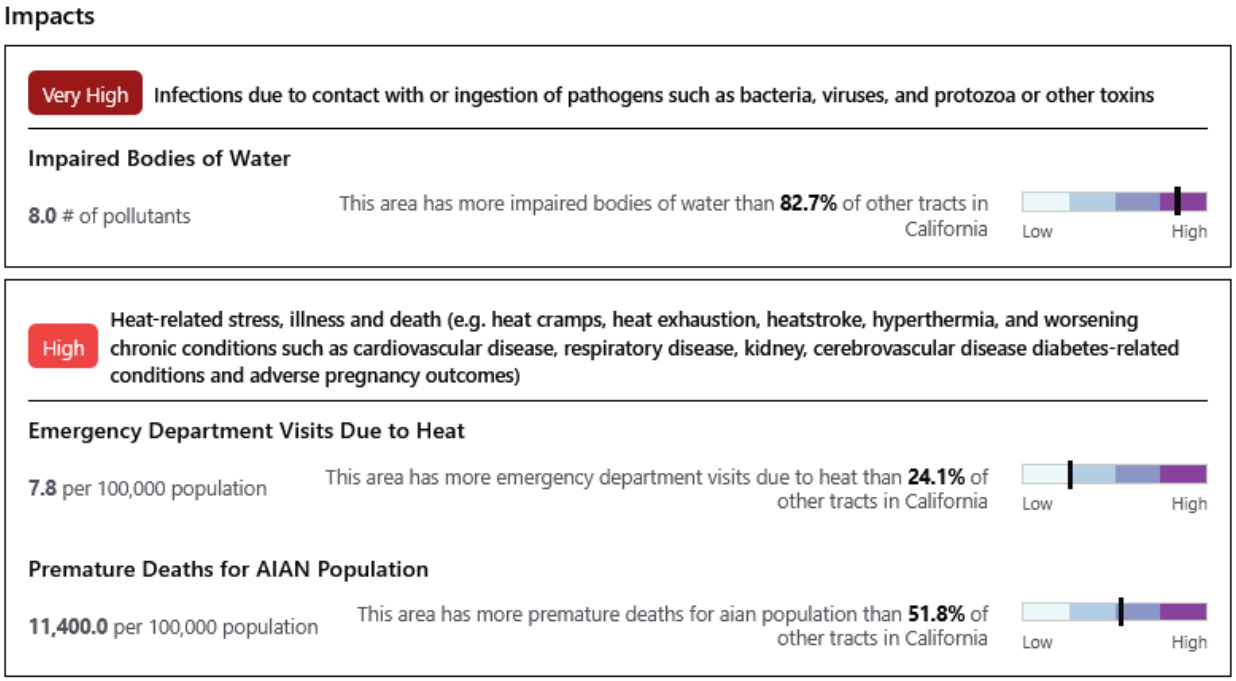
Figure 9b: Step 6 of the EISI for Extreme Heat Online Tool - Community Profile - Asset Summary

Community Assets

Very High	Mental & emotional wellbeing of residents (collectively and individually), especially those with existing mental health conditions
	Cultural Sites
	Community Cohesion
	Ceremonies/traditions
	Tribal Sovereignty/Self Determination & Cultural Identity
	Traditional Knowledge and Practices
	Power systems infrastructure
High	Physical wellness of residents/visitors, esp most vulnerable (elders, children, isolated individuals, those with medical conditions)
	Habitats and ecosystems
	Water Resources
	Hospitals and Health Services
	Water infrastructure
	JIVOC Seed Bank
	JIV Childcare Facility
Medium	Culturally important species
	Educational opportunity
	Economic opportunity
	Wildlife
	Plants, trees and forests
	Air
	Businesses
	Homes
	Transportation Infrastructure
	Communications infrastructure
Low	Government facilities
Very Low	Agriculture

The community profile displays a summary of community assets and their rankings selected by the user in Step 4.

Figure 9c: Step 6 of the EISI for Extreme Heat Online Tool - Community Profile - Impact Summary



The community profile displays a summary of impacts and their rankings selected by the user in Step 5.

Figure 9d: Step 6 of the EISI for Extreme Heat Online Tool - Community Profile - Adaptation Strategies

Strategies to Consider

Review Tribal Climate Health and Adaptation Assistance Providers for no cost assistance (access document here).

Develop an emergency, disaster response, and/or health management plan to anticipate and prepare public services for exposure risks. Identify existing community assets (e.g., fire stations, businesses, faith-based organizations) that can contribute to extreme heat preparedness and recovery

Update short and long-term planning efforts (e.g., comprehensive plans) to add climate change strategies that address exposure (e.g., green or cool roofs, cool pavements, increased vegetation, trees, and tree canopies)

Other Strategies

Conduct an annual assessment of population health vulnerabilities

Monitor relationships between tributary productivity and fire, smoke, and river temperatures, fish diseases and pathogens, and interactions with invasive species

Monitor for indicators of impending fish die-off events (i.e. rapid temperature changes, low dissolved oxygen levels)

Retrofit critical facilities like hospitals and health care buildings are constructed to resist exposure events and reduce the incidence of damage and service interruptions

Preserve threatened resources to ensure that traditional crafts, medicines, and relationships can continue in a changing environment

Pursue water source protection efforts and litigation to reinstate water flow to Tribes

Establish local tree canopy cover goals (e.g., increasing tree canopy coverage to 20 percent of urban areas by 2030) and identify optimal locations for tree canopy development

Be aware of how climate change may affect the timing of cultural indicators in order to ensure the harvest of (living and non-living) beings in a sustainable way

Mapping, conservation, and protection of wildlife connectivity and movement corridors (land and aquatic), as a way to protect the dispersal ability of one or more species of conservation interest

Restore communal ownership of land by developing a land purchasing and consolidation program

Plant larger individuals (saplings versus seedlings, or containerized versus bareroot stock) to help increase survival in sites where dry conditions are expected

The community profile displays a list of suggested adaptation strategies for tribes.

Chapter 4: Limitations

We encountered several limitations during the development of the EISI for Extreme Heat Online platform, including a lack of Tribal-tract specific data coverage and Tribal data sovereignty considerations that were not part of the scope of this project to explore.

Location-specificity and Resolution

Often, health and exposure data exist at the census tract level, which do not adhere to Tribal boundaries. As demonstrated in Figure 1, the Pala Band of Mission Indians tract (in brown; provided by the BIA) exists across two census tracts (in red; 06073019108, 06073019109) and the data is averaged at the census tract level. As a result, census tract data may include information on populations or conditions outside of the Tribal boundary.

Data Analysis and Tribal Data Sovereignty

Indian Health Center data from the California Tribal Epidemiology Center (CTEC) is not included as part due to data access limitations that would require Tribal data sovereignty agreements with each Tribe and participating organizations on this project. As the scope of this project was to reduce burden on Tribes and use publicly accessible data, the specific American Indian Alaska Native (AIAN) representation in the EISI for Extreme Heat Online datasets varies by each source.

Knowledge and Capacity

This tool requires a Tribal government official or staff person to assess and understand Tribal priorities and needs (e.g., where Tribal members live, where the Tribe aims to develop, internal health concerns to the Tribe) and requires a lengthy amount of time to fill out and investigate each indicator. The Assets section is customizable and may be based on community engagement findings (templates provided by the Tribal Climate Health Project), which adds an extra step to this process.

Chapter 5: Conclusions and Future Directions

The EISI for Extreme Heat Online platform was created to alleviate the burden of compiling datasets and using credible, publicly accessible, and "community-ready" science to identify and evaluate extreme heat exposures and impacts for Tribal communities. This platform was designed to support Tribal government staff and administrators in creating their vulnerability assessments, adaptation plans, emergency management plans, and hazard mitigation plans. After hearing from Tribal Advisors, it is apparent that this platform will decrease the time spent organizing exposures and impacts on extreme heat, and the project team looks forward to next steps for this project and opportunities to expand this platform.

> *"I can see that this will require our environmental director to dedicate time out of her other responsibilities to fill this out. However, the long-term saving of time will be incredible for the department and looks like it will require minimal 'maintenance' in terms of updating. I like the ease of use. I do think parts of it feel subjective like community assets, but those don't have a way of being measured outside of opinion."*
>
> *– EISI for EH Online Tool User Feedback from California Tribal Member*

Moving into the second grant within the Tribal Research Grant Program, the EISI for Extreme Heat Online platform will boast an Extreme Heat Vulnerability Assessment Report Feature, which will be generated at the final step of the platform (Step 7). The information on the EISI for Extreme Heat Online web-based platform will translate into the narrative report feature, which will be directly editable and will provide detailed instructions on how to customize for each Tribe's specific use case. In the future, the EISI for Extreme Heat Online platform can eventually be expanded to include additional exposure indicators such as sea level rise, wildfire, and drought. It could also add and improve steps around adaptation planning, to allow tribes to select and plan various adaptation strategies for their Tribe.

Appendix A: California Fifth Climate Assessment Data

The following extreme heat data from California's Fifth Climate Assessment were included in the EISI for Extreme Heat Online tool. The data are sourced from the Cal-Adapt Analytics Engine and produced by Eagle Rock Analytics. To show the change of extreme heat over time, each extreme heat indicator features data across four time points: Historical (1961–1990), Current (2005–2034), Mid-Century (2035–2064), and End-Century (2070–2099).

Annual Number of Days Above 90˚F
Definition: Average annual number of days above 90˚F, modeled under a high greenhouse gas emissions scenario (SSP 5-8.5)

Annual Number of Days Above 100˚F
Definition: Average annual number of days above 100˚F, modeled under a high greenhouse gas emissions scenario (SSP 5-8.5)

Annual Number of Extreme Heat Days Above Historical Baseline
Definition: Projected number of extreme heat days exceeding the 98th percentile historical temperature threshold, modeled under a high greenhouse gas emissions scenario (SSP 5-8.5). Historical temperature thresholds are based on data between 1981–2010.

Annual Number of Warm Nights
Definition: Annual average number of warm nights, modeled under the SSP 5-8.5 (high greenhouse gas emissions) scenario. A warm night is defined as a night during which the minimum temperature does not fall below the 98th percentile of historical (1981–2010) overnight minimum temperatures for a place.

Appendix B: Key Extreme Heat Data Layers for EISI for Extreme Heat Online

The following data layers are included in the EISI for Extreme Heat Online tool. There are 63 unique data layers. Data layers that fall in more than one category are repeated in the table, denoted by an asterisk.

Table 2: Data Layers Included in the EISI for Extreme Heat Online Tool

Primary Exposure - Extreme Heat			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Annual Number of Days Above 90°F • Historical (1961–1990) • Current (2005–2034) • Mid-Century (2035–2064) • End-Century (2070–2099)	Average annual number of days above 90 degrees F, modeled under a high greenhouse gas emissions scenario (SSP 5-8.5).	Cal-Adapt (5th Assessment)	2023
Annual Number of Days Above 100°F • Historical (1961–1990) • Current (2005–2034) • Mid-Century (2035–2064) • End-Century (2070–2099)	Average annual number of days above 100 degrees F, modeled under a high greenhouse gas emissions scenario (SSP 5-8.5).	Cal-Adapt (5th Assessment)	2023

Primary Exposure - Extreme Heat			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Annual Number of Extreme Heat Days Above Historical Baseline • Historical (1961–1990) • Current (2005–2034) • Mid-Century (2035–2064) • End-Century (2070–2099)	Projected number of extreme heat days exceeding the 98th percentile historical temperature threshold, modeled under a high greenhouse gas emissions scenario (SSP 5-8.5). Historical temperature thresholds are based on data between 1981–2010.	Cal-Adapt (5th Assessment)	2023
Annual Number of Heat Health Events • Historical (1984–2013) • Current (2011–2030) • Mid-Century (2041–2060) • End-Century (2081–2099)	The annual average number of heat health events expected to occur. A heat health event is any heat event that generates public health impacts, regardless of the absolute temperature.	California Heat Assessment Tool	2018
Average Duration of Heat Health Events • Historical (1984–2013) • Current (2011–2030) • Mid-Century (2041–2060) • End-Century (2081–2099)	The average length (days) of future heat health events. A heat health event is any heat event that generates public health impacts, regardless of the absolute temperature.	California Heat Assessment Tool	2018

Primary Exposure - Extreme Heat			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Annual Number of Warm Nights • Historical (1961–1990) • Current (2005–2034) • Mid-Century (2035–2064) • End-Century (2070–2099)	Annual average number of warm nights, modeled under the SSP 5-8.5 (high greenhouse gas emissions) scenario. A warm night is defined as a night during which the minimum temperature does not fall below the 98th percentile of historical (1981–2010) overnight minimum temperatures for a place.	Cal-Adapt (5th Assessment)	2023

Secondary Exposure - Air Quality			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Ozone*	Average amount of ozone in the air during the most polluted 8 hours of summer days, measured in parts per million (ppm). For reference, the National Ambient Air Quality Standard for 8-hour ozone exposure is 0.070 ppm.	CalEnviroScreen 5.0	2025

Secondary Exposure - Air Quality			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Particulate Matter 2.5	Yearly average of fine particulate matter concentration (very small particles from vehicle tailpipes, tires and brakes, powerplants, factories, burning wood, construction dust, and many other sources), measured in micrograms/meter^3. Excludes wildfire smoke days.	CalEnviroScreen 5.0	2025
Diesel Particulate Matter	Average daily amount of particulate pollution (very small particles) from diesel sources, measured in tons per year	CalEnviroScreen 5.0	2025
Annual Wildfire Smoke • Current (2025–2035) • Early-Mid-Century (2036–2045) • Mid-Century (2046–2055)	Projected annual smoke particulate matter 2.5 (fine particulates) concentrations (ug/m^3) under a high greenhouse gas emissions scenario (SSP3-7.0).	Qiu et al., (2025)	2025

Secondary Exposure - Air Quality			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Drinking Water Contaminants	Index score combining information about 13 contaminants and 2 types of water quality violations that are sometimes found when drinking water samples are tested. Higher index values indicate more drinking water contamination.	CalEnviroScreen 4.0	2021
Impaired Bodies of Water*	Sum of the number of pollutants counted in lakes, streams and rivers, and coastal waters that do not meet water quality standards (also known as impaired water bodies).	CalEnviroScreen 4.0	2021
Nitrates in Community Water Systems	Annual mean concentration of nitrate (mg/L) in community water systems. For reference, the Maximum Contaminant Level for Nitrate is 10 ppm (or 10 mg/L).	CDC National Environmental Public Health Tracking Network	2019
Food Insecurity*	Percent of adults who reported that the food that they bought did not last, and they didn't have money to get more.	CDC PLACES	2024

Impact *modifier* - Heat-related stress, illness, and death			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Adults 65 and Older	Percent of people aged 65 or older.	American Community Survey	2021
Young Children (<5)	Percent of population who are young children.	American Community Survey	2021
Above Poverty	Percent of people earning more than 200% of federal poverty level.	American Community Survey	2024
Population 5–14 Years Old	Percent of population who are young children.	American Community Survey	2021
65+ with Disability	Percent of people 65 years and older with disabilities.	American Community Survey	2021
Population with a Disability	Percent of people who have a disability.	American Community Survey	2021
Air Conditioning*	Percent of households with air conditioning.	Residential Appliance Saturation Study	2009
Impervious Surface Cover*	Percent impervious surface cover.	National Land Cover Database	2011
Low-Income Homeowner Severe Housing Cost Burden	Percent of owner-occupied households that are low-income and have housing costs exceeding 50% of income.	HUD CHAS	2024

Impact *modifier* - Heat-related stress, illness, and death			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Low-Income Renter Severe Housing Cost Burden	Percent of renter-occupied households that are low-income and have housing costs exceeding 50% of income.	HUD CHAS	2024
Tree Canopy*	Percent of land with tree canopy (weighted by number of people per acre).	National Land Cover Database	2011
Projected Population Aged 5–14 in 2050	Projected percent of people aged between 5 to 14 in 2050.	CA Department of Finance	2020
Projected Population Aged 65+ in 2050	Projected percent of people aged 65 and older in 2050.	CA Department of Finance	2020
Projected Population Aged Under 5 in 2050	Projected percent of people under 5 in 2050.	CA Department of Finance	2020
Projected Workers Experiencing High Environmental Exposure in 2026	Percent of workers who spend over half of their time in a place that is not indoors and air-conditioned.	CA Employment Development Department	2020
Homes Built Before 1940	Percent of homes built before 1940.	American Community Survey	2021
Households in Mobile Homes	Percent of households living in mobile homes.	American Community Survey	2021

Impact *modifier* - Heat-related stress, illness, and death			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Housing Habitability	Percent of households with basic kitchen facilities and plumbing.	HUD CHAS	2024
Urban Heat Island Index	Index measuring urban-rural heat difference. Higher index values indicate higher warming in urban areas compared to rural areas.	CalEPA	2015
Workers Experiencing High Environmental Exposure	Percent of workers who spend over half of their time in a place that is not indoors and air-conditioned.	California Employment Development Department / US Department of Labor	2016

Impact *indicator* - Mental health consequences			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Crime	Number of violent crimes per 1,000 people.	FBI UCR	2021
Violent Crimes (Homicides)	Number of deaths due to homicide per 100,000 population.	County Health Rankings	2025

Impact *indicator* - Mental health consequences			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Poor Mental Health Days	Average number of mentally unhealthy days reported in past 30 days.	County Health Rankings	2022
Mental Health Not Good	Percentage of adults who felt their mental health was not good during 2 or more weeks of the previous month.	CDC PLACES	2024

Impact *modifier* - Mental health consequences			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Air Conditioning*	Percent of households with air conditioning.	Residential Appliance Saturation Study	2009
Park Access	Percent of people living within walkable distance (half-mile) of a park, beach, or open space.	California Protected Areas Database	2024
Tree Canopy*	Percent of land with tree canopy (weighted by number of people per acre).	National Land Cover Database	2011
Impervious Surface Cover*	Percent impervious surface cover.	National Land Cover Database	2011

Impact *modifier* - Mental health consequences			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
No Leisure Time Physical Activity*	Percent of people who do not exercise or participate in physical activities (outside of their regular job).	CDC PLACES	2024
65+ Living Alone	Percent of people 65 years and older living alone.	American Community Survey	2021

Impact *indicator* - Respiratory Illness			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Asthma	Percent of adults who report having ever been told by a doctor, nurse, or other health professional that they have asthma, AND still have asthma.	CDC PLACES	2024
Asthma ER Admissions	Rate of emergency room visits for asthma (per 10,000 ER visits).	CalEnviroScreen 3.0	2017
Asthma Emergency Room Visits for Youth	Asthma emergency department visits among 0–17 year olds (per 10,000 residents).	California Department of Health Care Access and Information	2017

Impact *indicator* - Respiratory Illness			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Ozone	Average amount of ozone in the air during the most polluted 8 hours of summer days, measured in parts per million. For reference, the National Ambient Air Quality Standard for 8-hour ozone exposure is 0.070 ppm.	CalEnviroScreen 5.0	2025

Impact *modifier* - Respiratory Illness			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Adults 65 and Older*	Percent of people aged 65 or older.	American Community Survey	2021
Adults 75 and Older	Percent of people aged 75 or older.	American Community Survey	2019
Air Conditioning*	Percent of households with air conditioning.	Residential Appliance Saturation Study	2009

Impact *indicator* - Decrease in fitness/ activity			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Active Commuting	Percentage of workers (16 years and older) who commute to work by transit, walking, or cycling.	American Community Survey	2024
Obesity	Percent of adults with obesity (a BMI of at least 30.0 kg/m²).	CDC PLACES	2024
No Leisure Time Physical Activity*	Percent of people who do not exercise or participate in physical activities (outside of their regular job).	CDC PLACES	2024

Impact *modifier* - Decrease in fitness/ activity			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Park Access*	Percent of people living within walkable distance (half-mile) of a park, beach, or open space.	California Protected Areas Database	2024
Automobile Access	Percent of households with access to an automobile.	American Community Survey	2024

Impact *modifier* - Decrease in fitness/ activity			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Tree Canopy*	Percent of land with tree canopy (weighted by number of people per acre).	National Land Cover Database	2011

Impact *indicator* - Incidence of food insecurity			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Food Insecurity*	Percent of adults who reported that the food that they bought did not last, and they didn't have money to get more.	CDC PLACES	2024
Students Eligible for Free and Reduced Meal Program	Percent of K–12 students who are eligible to participate in the Free & Reduced Meal Program.	CA Department of Education	2026

Impact *modifier* - Incidence of food insecurity			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Above Poverty	Percent of people earning more than 200% of federal poverty level.	American Community Survey	2024

Impact *indicator* - Infections due to contact with of ingestion of pathogens			
EISI for Extreme Heat Grouping/Data Layer	**Definition**	**Data Source**	**Year**
Impaired Bodies of Water	Sum of the number of pollutants counted in lakes, streams and rivers, and coastal waters that do not meet water quality standards (also known as impaired water bodies).	CalEnviroScreen 4.0	2021