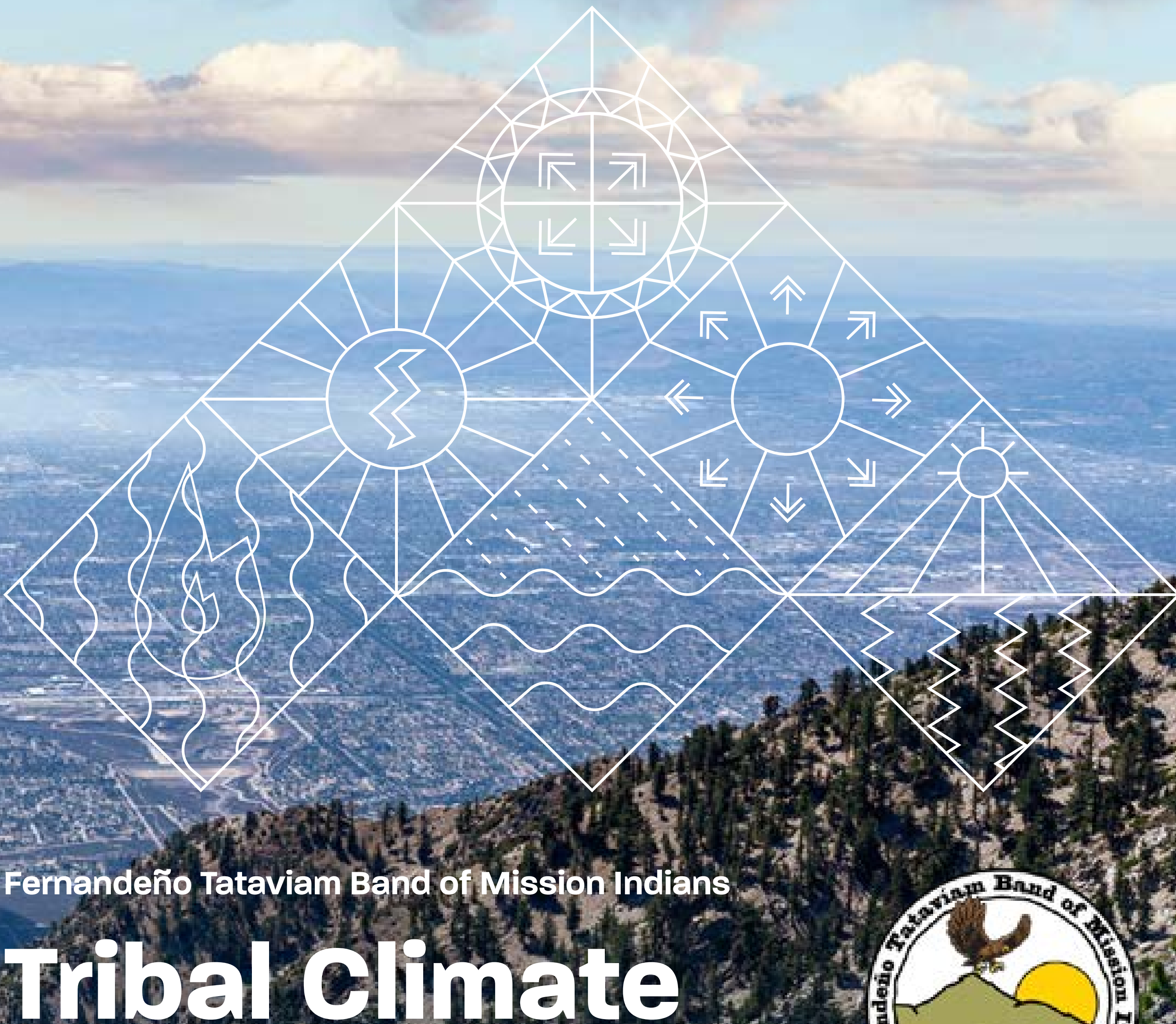

Fernandeño Tataviam Band of Mission Indians

Tribal Climate Resiliency Plan

JANUARY 2024

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Fernandeño Tataviam Band of Mission Indians

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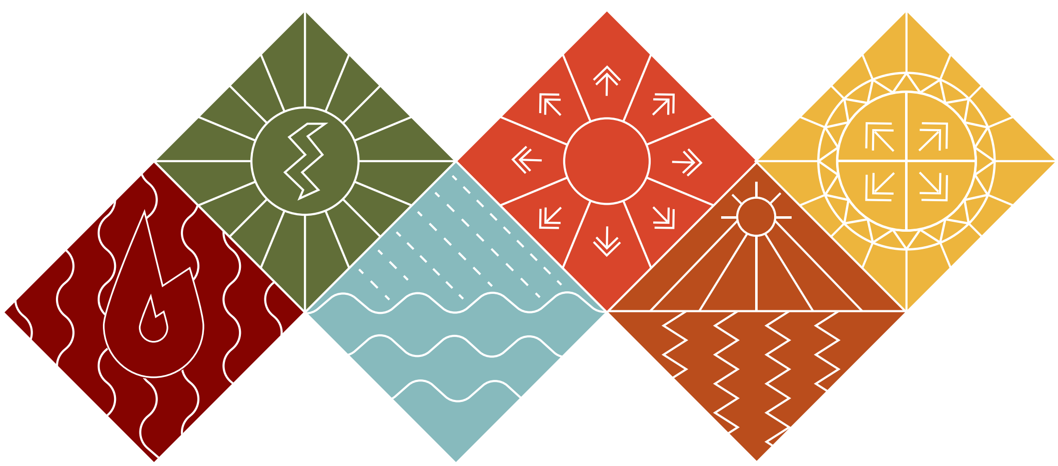

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UCR CE-CERT

Climate Resolve

Message
FROM THE PRESIDENT

My Tribe, Fernandeño Tataviam Band of Mission Indians, carries the wisdom of our ancestors in our hearts and the future of our descendants in our hands. Addressing the impacts of climate change in our territory is essential to the future of our people. The development of a Climate Resilience Plan reflects our commitment to our sacred stewardship of the Earth, acknowledging our sovereignty and embracing the promise of a sustainable and resilient future for the health and prosperity of our people.

As global temperatures rise and the damage to land, water and life continues to threaten self-determination, traditional ways of life and practices, we will use Traditional Ecological Knowledge and science to address climate-related hazards. The Climate Resiliency Plan is our roadmap for how we can begin the healing process within our ancestral lands.

Our vision is that Tribal citizens and leaders in partnership with allies can work collaboratively to stabilize our lands towards restoration and vibrant communities where we can nurture our children in a land that has abundant clean water, thriving forests, clean air, urban communities cooled by trees and open green space, and restored rivers and tributaries. The recommendations in this report seek to strengthen our cultural identity, promote our economic prosperity, while honoring our ancestors as we forge a path towards a climate-resilient future by applying our traditional ecological knowledge and history combined with new data and modern science for solutions across our tribal lands and the region.

Exercising our sovereign leadership, we will implement strategies and policies found in the Plan that fortify our resilience in the face of climate change. Further, with unity at the heart of our approach, we extend an invitation for collaboration to local, state, national, and global allies who honor our sovereign rights and align with our vision of a resilient, sustainable future. Together, we are determined to convert the challenges of climate change into opportunities for growth, healing, and the fortification of our community.

I want to thank California Resilience Challenge for funding the development of this plan and our partners for their dedication in working with us throughout the process. While there is still much to be done for implementation of the Plan, we now have the strategies and priorities identified in this Plan to ensure that we are well prepared for the future.

Sincerely,

Tribal President, Rudy J. Ortega, Jr.

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Vision

As global temperatures rise and the damage to land, water, and life continues to threaten self-determination, traditional ways of life and practices, the Fernandeño Tataviam Band of Mission Indians (Tribe) is using traditional ecological knowledge and science to address climate-related hazards.

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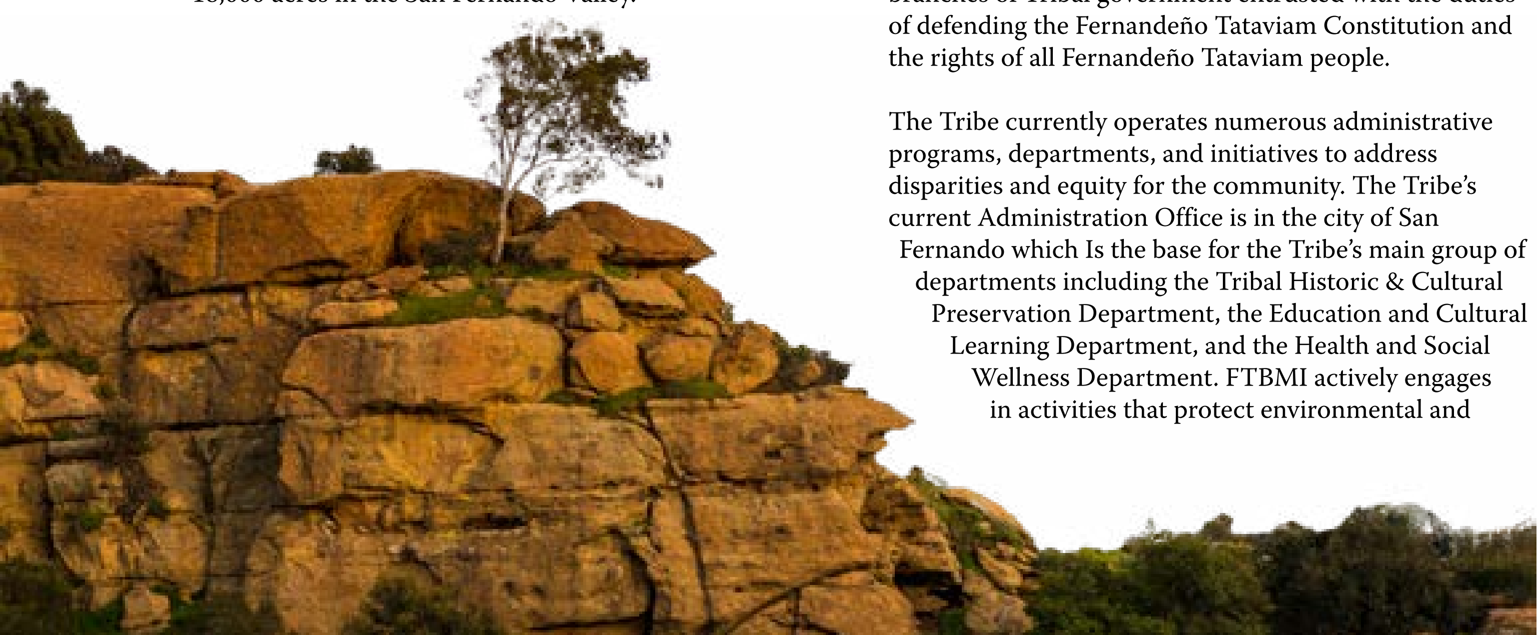
The Fernandeño Tataviam Band of Mission Indians

HISTORY OF THE TRIBE AND THEIR LAND

The Fernandeño Tataviam Band of Mission Indians (FTBMI or Tribe) is a native sovereign nation located in Los Angeles County and eastern Ventura County in the State of California. The citizens of the FTBMI are the people of northern Los Angeles County. After thousands of years, foreign powers began colonization in the late 1770s with the arrival of the Spanish followed by the establishment of Mexico and the United States. Despite settler colonization, the Tribe continues to operate as a Tribal community. The Fernandeño Tataviam community originates in the lineages, villages, and cultures of the Simi, San Fernando, Santa Clarita, and Antelope Valleys (Figure 1) and in the period that came before the establishment of Mission San Fernando in 1797, from which their ancestors received the name *Fernandeño* during enslavement by the Spanish.

Enslavement at Mission San Fernando by the Spanish drastically changed the daily lives of the Fernandeños. Families were separated, children were married off, sacred sites were demolished, culture was suppressed, traditional ways of life were destroyed, food sources were removed by environmental degradation from invasive species, and the Fernandeños were massacred through Spanish-brought disease, hunger, violence, and slavery. In 1821, Mexico gained independence from Spain and California fell under the jurisdiction of the First Mexican Empire. After the Missions were secularized by Mexico, approximately 50 surviving members of the Fernandeño leaders negotiated for and received several land grants amounting to over 18,000 acres in the San Fernando Valley.



Throughout the 1800's, the United States was on a mission to eradicate Indigenous nations. In the era of California's State and Federally funded Genocide and campaign to exterminate California Native American people, Fernandeños lacked U.S. citizenship and yet, fought to defend their lands in local state courts for several decades to no avail. In the first years of its statehood, California also passed the 1851 Land Claims Act, which would pass lands into public domain that was not filed within a two-year period. Land in northern Los Angeles County, particularly areas with natural water sources such as the Native-owned land grants, became extraordinarily valuable. The Fernandeño ancestors, who could not read or write English, lost their lands within this two-year period to encroaching settlers. Several Fernandeños had cases heard in the Los Angeles Superior Court [for example, see *Porter et al v. Cota et al.*] but the local state courts were against the Fernandeño ancestors' claims to the land, which made it impossible for the San Fernando Mission Indian defendants to affirm rights to land that would have formed the foundation for a reservation.

By 1900, the Tribe was evicted from its homelands and members were left as refugees in Los Angeles County. Of the thousands of ancestors that were enslaved at the mission, only 5 families of the Fernandeño historical Tribe survived to see the 20th Century. Today, the FTBMI consists of 900+ Tribal Citizens that descend from the Fernandeño historical Tribe. The Tribe governed by two branches of Tribal government entrusted with the duties of defending the Fernandeño Tataviam Constitution and the rights of all Fernandeño Tataviam people.

The Tribe currently operates numerous administrative programs, departments, and initiatives to address disparities and equity for the community. The Tribe's current Administration Office is in the city of San Fernando which Is the base for the Tribe's main group of departments including the Tribal Historic & Cultural Preservation Department, the Education and Cultural Learning Department, and the Health and Social Wellness Department. FTBMI actively engages in activities that protect environmental and

cultural values of its traditional territory. Currently, the Tribe carries out these critically important activities through the Environmental Protection Division and other divisions within the Tribal Historic and Cultural Preservation Department.

The Tribe's long-term goal is to ensure a thriving Tribal community. However, the current community condition includes negative economic impacts as a result of the COVID-19 pandemic, historical trauma, and systemic inequities including environmental justice issues. For the last four decades, the Tribe has actively consulted with local governments on environmental protection under the California Environmental Quality Act (1970). Through Assembly Bill 52 (Gatto 2014), the Tribe consults on a government-to- government level with the County of Los Angeles and cities throughout the region to mitigate impacts to cultural resources by projects breaking ground within the San Fernando, Simi, Santa Clarita, and Antelope Valleys. Under AB52, the Tribe receives over 300 notices annually of impending land development with potential threats to environmental and cultural resources.

FTBMI has numerous generations worth of experience in preserving and enriching its deep-rooted traditional knowledge that still guides their daily lives. The Tribe has a long history of teaching ethnobotany via a Tribal Ecological Knowledge lens with Indigenous Knowledge Keepers (i.e., tribal elders and cultural practitioners) to address environmental issues and embracing its community roots by implementing cultural and environmental programming that uplifts the knowledge on tribal practices, land stewardship, and urban forestry which was largely disrupted and prohibited by the settler governments beginning in the 1700s.

Historic land dispossession that began in 1797 created Systemic Barriers for the Fernandeño Tataviam people that are still impacting the Tribe today. Thus, beginning in the 1900s, FTBMI began establishing mechanisms to overcome these barriers, such as Pukúu Cultural Community Services, a social services nonprofit to provide emergency services and scholarships to the community, Tataviam Land Conservancy, a Tribally-centered land conservancy whose mission is to conserve land in perpetuity for cultural needs and healing, and more. In June 2022, FTBMI launched the "Tiüvac'a'ai Tribal Conservation Corps", a multi-beneficial hands-on training program that will work with Native youth and young adults to promote and restore the cultural values of the Indigenous Peoples through the practice and application of Traditional Ecological Knowledge in the protection, restoration, and development of tribal cultural and natural landscapes.

Figure 1.
Tribal boundary depicted is based on the villages from which registered Fernandeño Tataviam Band of Mission Indians' (FTBMI) tribal citizens descend. Due to the complex kinship and social exchange networks of our ancestors, the tribal boundary does not include all of the abundant locations associated with our peoples. The yellow shaded area depicts tribal lands that are sig-nificant to the FTBMI but are culturally shared with neighboring Tribal governments, due to the natural mobility of ancestral and contemporary FTBMI people.

Executive Summary

Report Goals

FTBMI seeks to convene Tribal Citizens, neighboring tribes, and community at large to identify multiple benefit projects for implementation, develop new partnerships between the Tribe and other stakeholders, and plan for multi-benefit adaptation projects in the region to holistically address climate change impacts and allow tribal communities to adapt and thrive, even under challenging conditions.

Our goals include:

- **Building local climate resilience for the Tataviam Tribe**
- **Collaborating with the Ventureño and Gabrielino Tribal Nations to respond to climate related hazards on a regional scale**
- **Collaborating with climate scientists, governmental, and non-profit organizations on the use of local-and regional scale climate information and tools**
- **Adaptation planning, vulnerability assessments, and professional development to increase the skills and capacity of tribal staff and management**
- **Developing a resilience framework that can be effectively integrated into regional and statewide climate adaptation and resilience planning efforts on a long term**

The tribal resilience planning will improve local and regional resilience to multiple climate impacts including droughts, flooding, extreme heat, and wildfires.

Climate Hazard Identification

The Climate Hazard Identification task began with an in-depth review of the County of Los Angeles' Climate Vulnerability Assessment (LA County CVA). The LA County CVA was developed by the County of Los Angeles' Chief Sustainability Office in 2021 and builds on a solid foundation of climate research to analyze vulnerability in LA County—examining climate risks to the County's diverse people and places, including populations with heightened susceptibility to climate impacts.

The LA County CVA uses a combination of existing research, climate change projections, census data, stakeholder feedback, and community input to inform its findings. The geographical scope of the CVA overlaps with the FTBMI land boundary and provides an initial look into climate change impacts across Tribal territory, specifically heat, flooding, drought, and wildfire.

Key climate hazard takeaways gathered from the LA County CVA are:

- **HEAT – The county-wide max temperature will increase by an average of 5.4°F to a mid-century average of 98.6°F.**
- **FLOODING – Extreme precipitation is projected to get more severe with periods of high-volume rainfall and inland flooding.**
- **DROUGHT – Over the Southwest United States, climate models project more than 65% increase of severe drought conditions between mid and end of century.**
- **WILDFIRE – An additional 2.2 hectares of LA County land is projected to burn each year by mid-century.**

The findings of the CVA are foundational in mapping the projected climate hazard impacts in the FTBMI Land Boundary Climate Vulnerability Assessment. Our Vulnerability Assessment used a similar approach as the LA County CVA and assesses climate hazard distribution specifically across the FTBMI Land Boundary now and through the end of the century. Key findings from the Vulnerability Assessment will guide community engagement activities and policy recommendations to increase FTBMI's ability to adapt to hazards and meet the needs of its vulnerable communities.

The project team conducted a scan of available datasets that determined the degree of severity of specific climate hazards (extreme heat, wildfire, drought, and flooding) resulting from climate change in the coming decades. Each analysis was conducted across the FTBMI Land Boundary and findings will assist Tribal leaders to develop adaptation and resiliency strategies to reduce risk and loss.

Takeaways

The FTBMI Land Boundary Existing Conditions, Climate Impacts, and Environmental Hazards Desktop Review synthesizes existing and predicted data of climate and hazard impacts on the FTBMI Land Boundary. For the FTBMI Land Boundary to adapt to climate change hazards, it is important to understand how climate change will affect the 800+ FTBMI citizens living across the FTBMI Land Boundary, and then help equip stakeholders and policymakers to develop strategies to reduce risk and loss.

Our analysis evaluates hazards present in and around (1-mile radius) the FTBMI Land Boundary:

Extreme Heat

- **The FTBMI ancestral territory Land Boundary will continue to warm. Annual average maximum temperatures are projected to increase around 3 – 4°F by mid-century, and 4 – 7°F by end-of-century.**
- **Temperature extremes are also expected to increase. For the FTBMI area, the extreme heat day threshold is 100°F. The projected maximum number of extreme heat days is expected to increase by 9 – 12 days by mid-century and 13 – 38 days by end-of-century.**
- **Nighttime temperatures will increase, which has a direct public health impact as the body needs time to recover from heat. The likely number of warm nights is expected to increase by 32 – 44 days by mid-century and 46 – 103 days by end-of-century.**

Drought

- **Communities within the FTBMI ancestral territory land boundary will experience an increased severity of drought due to global climate change. Future droughts are predicted to coincide with more extreme heat days, record low snowpack, soil drying, and forest die-offs.**
- **Within the FTBMI ancestral territory land boundary, the water systems that are most physically vulnerable to drought related water outages serve communities in the Antelope Valley and they include, among others, Baxter Mutual Water Company, Aqua J Mutual Water Company, Tierra Bonita Mutual Water Company, and several water systems that serve mobile home parks.**
- **Water affordability may be a concern during drought. FTBMI Tribal citizens that will be subjected to the worst affordability ratios are served by small water systems that serve the Antelope Valley including, among others, Reesedale Mutual, Aqua J Mutual Water Company, California Water Service Company, Westside Park Mutual.**

Flood

- **Within the FTBMI ancestral territory boundary, climate change will increase the likelihood of extreme precipitation events and the occurrence of severe floods due to stronger atmospheric rivers, as well as extend the flood hazard season.**
- **Flood hazard modeling by UCI and FEMA maps show flooding in many urban areas with deep levels of flooding near overtopped channels, dams, and along channelized sections of tributaries. FTBMI tribal citizens face high flooding risks along the Tujunga Wash, near Sepulveda Dam, and in the cities of Palmdale and Northeast Lancaster.**
- **Flash floods are more likely following intense rainfall in areas that have recently burned. Climate change will increase the frequency of post-fire flood and debris flows. Tribal communities living within the FTBMI ancestral territory land boundary are vulnerable to debris flows, particularly along ravines, canyons, and the mouth of canyons below recent burn areas.**

Wildfire

- **Prolonged drought, extreme heat, and increased vapor pressure deficit will continue to increase the aridity of fuels and the frequency of large fires within the FTBMI ancestral territory. Burn areas in natural lands within the FTBMI boundary, like the San Gabriel Mountains, are expected to increase by 40% by mid-century.**
- **Wildfire risks are the greatest to FTBMI communities adjacent to natural areas. These communities include Santa Clarita, Simi Valley, Palmdale, Sylmar, San Fernando, and Acton. There are also broader public health concerns due to poor air quality and water quality downwind and downstream of burn areas.**
- **Increased frequency or intensity of fires to plant communities within the FTBMI ancestral territory land boundary will lead to altered species distributions, biodiversity and species loss.**

Policy Recommendations

The recommendations listed below are a high priority for the Fernandeño Tataviam Band of Mission Indians (FTBMI) tribal citizens as reported during a survey, in focus groups and through input from Tribal Elders and elected Administration of the tribe. Historic decimation of lands, native peoples and disruption of tribal ecological practices have critically impacted generational knowledge and practices between native people and care for the land and natural resources. Therefore, it is critical that the recommendations in this summary be prioritized through funded actions which would benefit tribal members.

Across all the recommendations it is imperative that FTBMI be an equitable partner in the planning, development, and implementation of climate adaptation projects and programs.

Cross Cutting Climate Hazards Recommendations

- **Create cooling centers/other places with air conditioning and resilience hubs where residents can get support, coordinate communication, find resources, and reduce carbon pollution while enhancing quality of life.**
- **Support urban river conservation and restoration efforts to enhance threatened plant and animal habitat and create community benefits (water capture, urban cooling, green space access).**
- **Portable back-up power for critical residential loads to allow for residential cooling during extreme heat events. (Battery electric power station is recommended over gas/diesel generators)**

Extreme Heat Recommendations

- **Expand access to at-home heat adaptation resources like air conditioning and insulation retrofits f or homes.**
- **Install shade and water structures in high use areas that protect pedestrians from heat on streets and in other public places.**
- **Increase street, park, and private property tree canopy coverage in neighborhoods and other high traffic areas.**

Flooding/Drought Recommendations

- **Enhance floodplains to allow local streams and rivers to accommodate flows during storm events and capture stormwater for groundwater replenishment.**
- **Facilitate nature-based stormwater infrastructure that slow, spread, and sink rainfall during storm events.**
- **Encourage water conservation and the diversification of water resources such as graywater and water recycling. Conservation and water reuse are a cost-effective method for reducing negative impacts on aquatic ecosystems.**
- **Supplementary water sources will be required to meet water needs in the region. Recycled water has great potential to meet this need given its year-round availability.**
- **Local capture of stormwater through nature-based solutions to enhance local water supply, reduce stress on aquatic ecosystems, and provide supplementary benefits like shading, cooling, and habitat.**

Natural Resources Recommendations

- **Establish and expand protected areas to conserve biodiversity, particularly for species that are culturally important, have limited ranges, and are threatened by development or other pressures.**
- **Assess tribal territory to identify, prioritize : , establish and expand protected areas that conserve vulnerable land with high cultural value to the tribe.**
- **Develop preservation and conservation priorities from a tribal perspective by joining those agency and district boards and commissions involved in land conservation and natural resource management.**

Wildfire Recommendations

- **Support and facilitate the eradication of invasive species in natural lands, particularly in fire prone areas like the wildland urban interface, recreational areas, and highways along the forest (also a top recommendation for natural resources).**

- **Engage with County Fire Forestry Division to inform culturally sensitive design guidelines and practices and include as part of Tribal Conservation Corps training. Engage and educate community members about building codes and landscaping to create and support defensible space to reduce fire risks.**
- **Enhance community engagement around wildfire risks, prevention, and evacuation, as well as grants and other programs and resources available to communities in High Fire Hazard Severity Zones.**

Energy Recommendations

- **Uninterruptible backup power or microgrid deployment for resilience hubs.**
- **Stationary energy storage back-up power system capable of providing power to entire residence in the event of power outage.**
- **Solar PV and/or community solar system in combination with stationary energy storage for microgrid implementation, capable of providing back-up power to entire residences for prolonged periods.**

Approach

The Fernandeño Tataviam Band of Mission Indians (FTBMI) is taking the lead on the implementation of the 2021 California Resilience Challenge grant project and centering the voices and knowledge of the tribe every step of the way. To get started it is first and foremost important to know about the Fernandeño Tataviam Band of Mission Indians community themselves in order to begin the planning process.

The population of the Tribe is 800+ citizens. 30% of FTBMI's approximately 800 citizens live close to or below the Federal poverty threshold. One out of every two FTBMI families does not reach the 2021 median family income for Los Angeles County of $80,000 and cannot afford to live within their traditional territory of Los Angeles County. 35% percent of FTBMI families spend more than 1/3 of their income on rent. Approximately one in every 15 Tribal Citizens has been homeless within the last 10 years. Approximately 1% of FTBMI Citizens have no income.

Furthermore, tribal nations are particularly susceptible to and disproportionately affected by climate change due to their close ties to the land and its resources (Billiot et al. 2019). Moreover, according to California's Fourth Climate Change Assessment, tribal lands are burdened by climate change impacts to critical infrastructure and lifeline sectors (like energy, water, food, communications, and transportation), and increasing resilience within these sectors is a vital tribal strategy for climate adaptation. Also, it is well documented that the highly dense communities in Greater LA suffer from a lack of open space, exposure to toxic hazards, urban heat, poor air quality, localized flooding, and poor air and water quality. These existing social and physical vulnerabilities as well as existing needs can be met through investments in climate resilience and adaptation measures.

30%

of FTBMI's population live close to or below the Federal poverty threshold

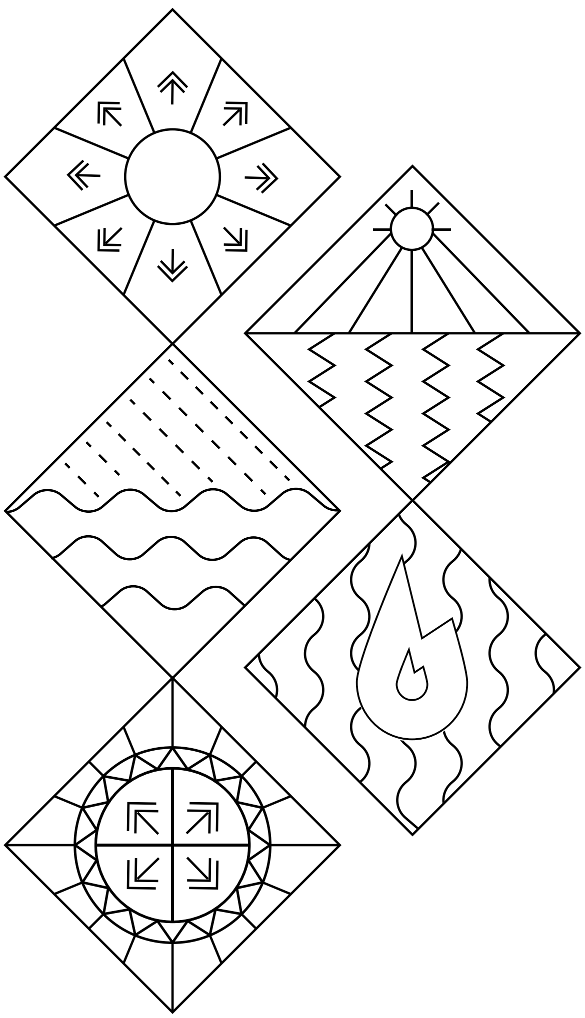
The preceding map (on pg. 11) showing the tribal land boundary depicts where the Tribal Climate Resilience Framework plan project will be implemented. This collaborative between Fernandeño Tataviam Band of Mission Indians, and project partner institutions like Climate Resolve, Council for Watershed Health, and University of California, Riverside, College of Engineering Center for Environmental Research and Technology (UCR CE-CERT), has chosen to undertake this project because of the important and urgent need for local and regional climate resilience efforts that center the experience and situated knowledge of indigenous peoples in this era of climate change.

The approach includes

- **Outreach Plan**
- **Extreme Heat Resilience Plan**
- **Drought, Wildfire, and Flooding Resilience Plan**
- **Energy Resilience Plan**
- **Resilience Strategies**

Outreach Framework Plan Overview

The Outreach Framework Plan (Plan) was developed to facilitate the input of interested parties, tribal and non-tribal community members for the Fernandeño Tataviam Band of Mission Indians (FTBMI) Climate Resiliency Plan (CRP). The framework includes Outreach & Engagement Goals and Outcomes, Strategies and Methods of Engagement, Priority Outreach Entities and Populations, and Outreach Timeline, Tools, and Materials. The Outreach Plan was developed using best practices in community engagement with a goal of prioritizing community input in all decision making. At the core of this effort was the deep engagement of FTBMI tribal members from the President, Executives, the Senate, Elders and tribal members themselves. The Outreach Plan implementation was led by FTBMI staff with the support of the CRP Team: Climate Resolve, Council for Watershed Health, and UCR-CE-CERT.



Outreach and Engagement Goals and Outcomes

- **Cultivate an interested parties list, build and maintain vertical relationships and receive feedback.**
- **Event attendance & participation within the tribal territory**
- **Survey participation from general public and specifically tribal members**
- **Achieve equity in the participation of systemically minoritized/marginalized communities.**
- **Create a liaison between climate issues/resilience, education, and community.**
- **Ensure community feedback influences the direction and process of the project, assessment & final plan.**

Strategies and Methods of Engagement

The following section highlights the CRP Team's focus areas and outreach action items. In addition, this section highlights the responsibility and timeline associated with the action item.

Focus Areas

01. Engaging Interested parties Through Community Convening

02. Regional Data Digital Collection Through Surveys

03. Hosting and Leveraging Events

04. Prioritizing TEK, Tribal Citizens, and Non-Traditional Groups

05. Social Media and Marketing

Focus Areas

01.

Engagement of Interested Parties Through Community Convening

Over the course of the project the CRP Team identified and prioritized a list of interested parties according to target audiences, region, and non- traditional audiences. This task was initiated in August of 2022 and updated as necessary throughout the planning process. A total of over 275 individuals were identified in this process. The spreadsheet of interested parties included: local tribal nations, NGOs, elected officials, local, state, and federal entities, regional entities, water agencies, schools, and universities. The response to meeting requests was highest among local governments, followed by NGOs, and other entities. Over 50 individual meetings were conducted, primarily virtual, and were highly successful in establishing a framework for continued collaboration on climate resiliency.

In a concurrent timeline outreach materials were developed by the team including: meeting agenda, background information on the tribe, a one-page flyer outlining the goals of the CRP, sample heat maps, the tribal map and the survey developed to solicit input on climate priorities in an accessible hub using a tiny URL link to share the documents. These resources were shared prior to individual meetings and proved to be very useful in establishing a collaborative relationship for future programs/projects. For those entities where meetings could not be scheduled for a variety of reasons the materials were provided to over 200 entities. This action did generate interest in maintaining contact about the progress of the CRP.

The call to action for each interested party was to share the survey with their constituency group. At least 5 cities and over 10 NGOs shared the survey on their website. Spanish versions of the survey were also provided to facilitate non-English speakers. During these meetings information was shared about events in their respective communities which could generate direct engagement with community members, and involvement with the community. Another call to action in these meetings was the opportunity for future collaboration on climate resiliency projects/programs in jurisdictions. The intent is to use the contacts developed in this process to share the final CRP with participants and follow up on opportunities.

02.

Regional Data Digital Collection Through Surveys

To reach the maximum number of community members the outreach plan prioritized the collection of information relative to climate through surveys. The surveys were developed using examples from other efforts as guideposts together with the experience of team members involved in similar efforts over the last several years, particularly during the years of the pandemic where group events were at a standstill and just coming back online during this program. As an incentive for completion of the survey a $100 raffle was announced via the flyer and all social media posts to seek respondents.

The survey pilot was launched at an in-person event with over 52 questions, and it was evident that many respondents did not complete the survey due to the large number of questions and the time it took to answer the questions. Therefore, the survey was revised to capture the most relevant information and reduced to 22 questions. To customize and distinguish the input desired from tribal and non-tribal individuals two surveys were developed and a version of the general survey was

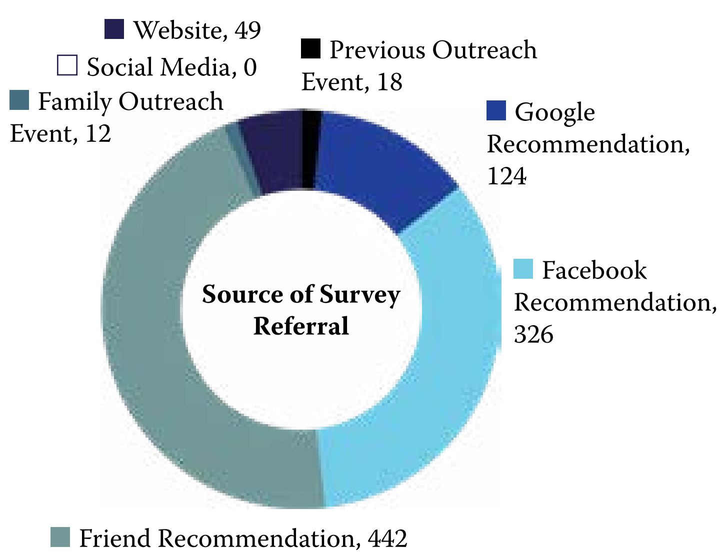


Figure 1: Source of Survey Referral – General Survey

provided in Spanish. Detailed information on both the survey content and results are included in an appendix to this report. Summarized below are the general questions and responses collected during this process.

The broad reach of the survey tool due to city/NGO collaborations was phenomenal. It worked so well that over 1,750 responses were captured. However, since the reach of several of the entities extended outside of tribal boundaries only 322 respondents lived in zip codes within FTBMI's territory. The FTBMI territory roughly covers northern Los Angeles County, including much of the San Fernando, Santa Clarita, Simi, and Antelope Valleys. The tribal survey was developed and tested by the Tribal Senate and subsequently distributed via the Tribe's Family Facebook page as recommended by tribal leadership. There are 488 on the members page and 38 responses were received.

The findings from the survey were analyzed by each team member to develop research and recommendations related to each topic of the CRP. A few of the major findings from the survey are shown in the adjacent graphs.

Most of the results indicated that recommendations from friends were the predominant source of referral. However, when combining social media platforms like Facebook and Google with general media sources, they slightly exceeded recommendations from friends. This finding confirms that friend recommendations are a highly effective source, but social media and general media also play a significant role. This insight will be instrumental in guiding our strategies for future outreach efforts.

The response to the question of the most pressing climate change concerns was enlightening with respect to Air Quality. Based on these results FTBMI will be seeking to conduct further analysis of this issue as it relates to Climate Resiliency. The other major concerns related to Extreme Heat, Drought and Wildfire were consistent with the anticipated concerns, however the fact that earthquake was more of a concern than flooding is likely related to whether the respondent is in a flood zone or not.

The question of what climate resilience means to you sheds light on the need for more education about the elements of climate resiliency and adapting our vernacular about these issues so that the general public understands the issues.

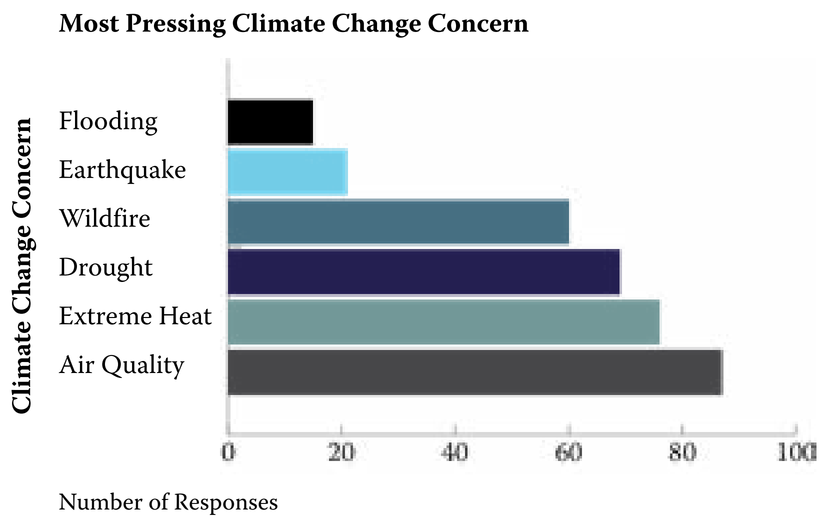


Figure 2: Most Pressing Climate Change Concern – for respondents within Tribal Territory

03.

Hosting and Leveraging Events

The initial task of the CRP Team was to develop a protocol for hosting and participating in events within the priority areas. It was important to include activities that highlighted tribal members and incorporated arts, healing, etc. with climate issues, Traditional Ecological Knowledge (TEK), and nature-based solutions to ensure an intentional and holistic approach to hosting community events. To develop the protocols, meetings were conducted with FTBMI staff, FTBMI senate, FTBMI elders, and tribal knowledge keepers. Based on their input, three events were hosted in the City of San Fernando. One of the best incentives to increase interest and participation was a giveaway program of native plants combined with access to tribal information through brochures and a map highlighting historic tribal villages in the territory.

In addition to hosting events, staff gathered information about upcoming events conducted by cities, NGO's, and CBO's. The materials developed for meetings with interested parties were used as handouts. Due to the slow start of larger scale events only 3 opportunities to leverage external events occurred during this time period. It is estimated that about 250 persons engaged with staff, and about 10% of those individuals took the survey. For both hosted and external events materials such as photos, surveys, cold quotes and contact information, were collected for our records.

04.

Prioritizing TEK, Tribal Citizens, & Non-Traditional Groups

An early component of this process was to meet FTBMI staff, FTBMI senate, FTBMI elders, and Tribal Knowledge Keepers to inform the direction of outreach and to establish the best process for engagement with FTBMI citizens and other tribes in the area, in particular the Ventureño and Gabrieleño and the City/County Native American Indian Commission. A protocol was established by the Tribal President which included direct introductions to their tribal leaders and an invitation to participate in this process. The connection to the Native American Indian Commission yielded a fair amount of engagement, particularly in providing input through the survey.

The team adapted language and terminology to ensure comprehension, accessibility, and inclusivity across communities of varying backgrounds, identities, and concerns. Language in external documents was tailored to ensure accessibility among people without backgrounds in environmental science and climate adaptation; Appropriate language was used to refer to tribal citizens, traditions, and activities; language was adapted for gender inclusivity; materials developed were multilingual to reduce language barriers.

05.

Social Media and Marketing

A social media and marketing calendar was established to include content creation, and scheduled social media posts, along with an approval process for the CRP team and Tribal leadership. The method selected for distribution of information was customized to each target group. For purposes of engagement with interested parties this was done through sharing a URL with materials. Within Tribal membership the best medium for communication is the Family Facebook page. NGO partners used their social media accounts, either Instagram or Facebook, to share materials while municipalities used their websites to share announcements such as the survey. During events, photos were captured for social media, newsletters, etc.

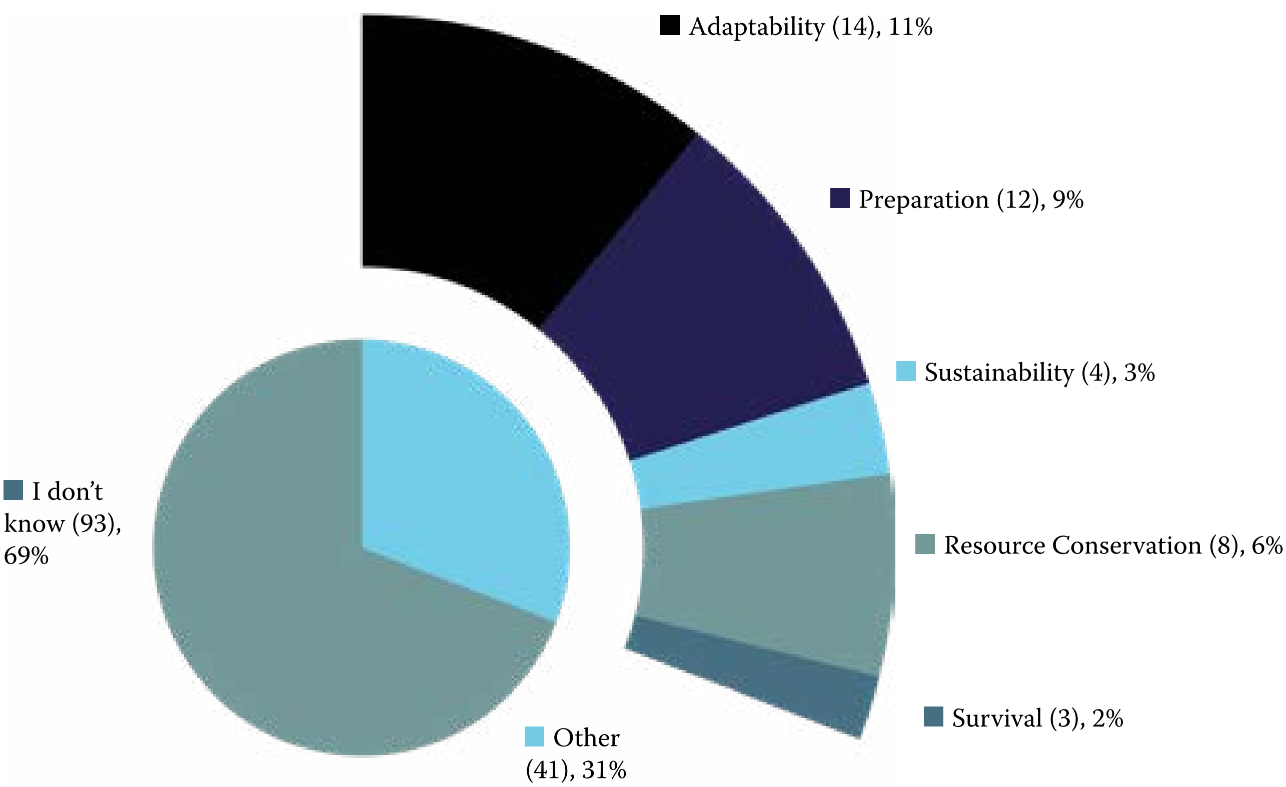


Figure 3: Responses to "What does 'Climate Resiliency' mean to you?" – For respondents within Tribal Territory

Climate Resiliency Reports

Extreme Heat Resilience Planning Report

Drought, Wildfires, and Flooding Resilience Planning Report

Energy Resilience Planning Report

Extreme Heat Resilience Planning Report

CH.01 | Extreme Heat Resilience Planning

1.1 Extreme Heat Impacts

Climate change is expected to increase overall global temperatures. Observations over the past century indicate that temperature has increased at the FTBMI Land Boundary. Based on the four climate models recommended by the Fourth Climate Change Assessment, there will be significant upward trends in annual maximum temperatures by mid-century (2035 - 2064) and end-of-century (2070 - 2099).

Projected future climate from these models can be described as producing:

- **A warm/dry simulation (HadGEM2-ES)**
- **A cooler/wetter simulation (CNRM-CM5)**
- **An average simulation (CanESM2)**
- **A model simulation that couples the atmosphere and ocean climate models together with the land and sea ice modules (MIROC5)**

To calculate temperature for the FTBMI Land Boundary, an average of the four recommended climate models from CalAdapt were used. These projections are an average of the data from the four Localized Constructed Analogs (LOCA) that overlap with the FTBMI Land Boundary.

As shown in Table 1, annual average maximum temperatures are projected to increase around 4.6°F by mid-century, and around 6.21°F by end-of-century using a RCP4.5 scenario. This means that within a RCP4.5 scenario, where our GHG emissions peak around 2040 but then continue to decline, we can expect to see an increase in annual average maximum temperature by 4.6°F in the years 2035 to 2064 and 6.21°F in the years 2070 to 2099.

Annual average maximum temperatures are projected to increase around 5.8°F by mid-century, and around 8.98°F by end-of-century using a RCP8.5 scenario. This means that within a RCP8.5 scenario, where greenhouse gasses (GHG) emissions continue to rise strongly through 2050 and begin to plateau around 2100, we can expect to see an increase in annual average maximum temperature by 5.8°F in the years 2035 to 2064 and 8.98°F in the years 2070 to 2099. Figure 1 depicts an upward trend in annual maximum temperature in the FTBMI land boundary that is consistent for all four LOCA models within both RCP4.5 and RCP8.5 scenarios.

Model	Years	Change from Baseline	30yr Avg.
Historical Baseline	1961 – 1990	N/A	72.78007
Medium Emissions (RCP 4.5) Mid-Century	2035 – 2064	+4.66	77.44
High Emissions (RCP 8.5) Mid-Century	2035 – 2064	+5.8	78.59
Medium Emissions (RCP 4.5) End-of-Century	2070 – 2099	+6.21	79
High Emissions (RCP 8.5) End-of-Century	2070 – 2099	+8.98	81.76

Table 1: Annual Maximum Temperature for FTBMI Land Boundary, *Source: CalAdapt*

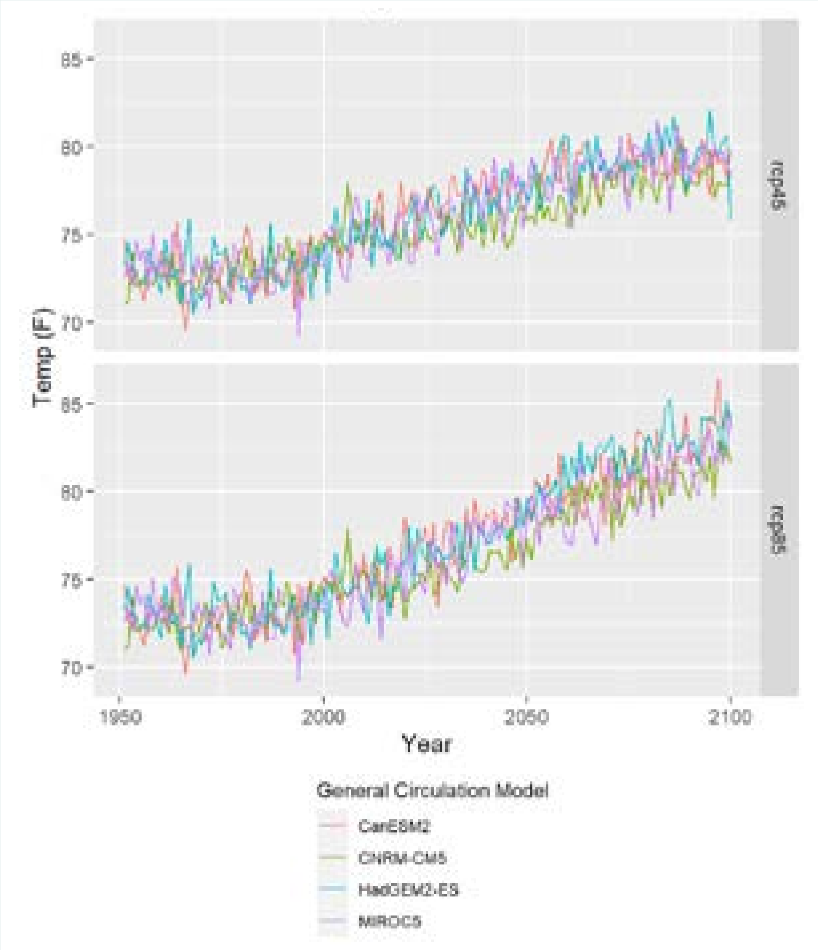


Figure 1: Annual Maximum Temperature for FTBMI Land Boundary, *Source: CalAdapt*

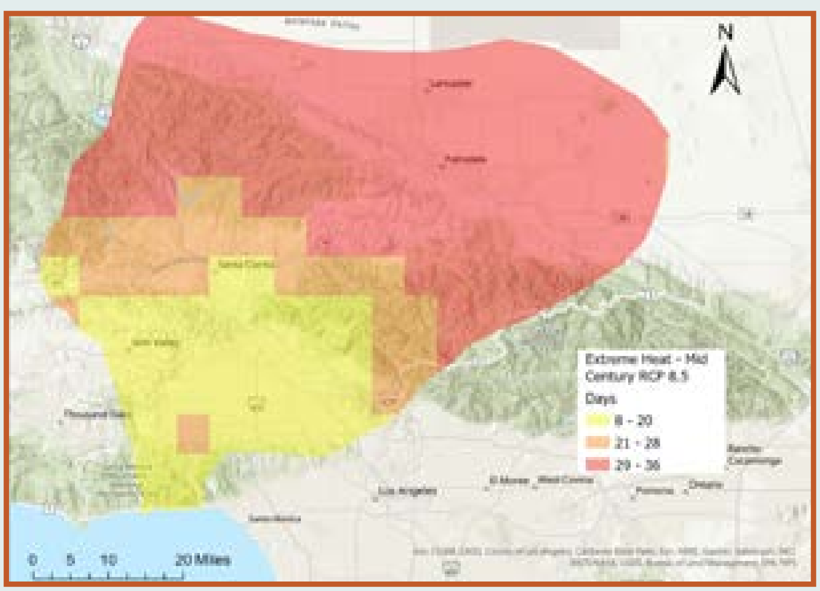


Figure 2: Extreme Heat Days for FTBMI Land Boundary - Mid Century RCP8.5, *Source: CalAdapt*

As temperatures rise, the duration of heat waves will increase as well. Heat waves can have an impact on the environment, including habitat, and public health. Research and studies have provided evidence that consecutive warm nights have an increased negative effect on morbidity and mortality. In addition, the impacts of heat waves are geographically variable in nature as local populations adapt to the prevailing climate via physiological, behavioral, cultural, and technological adaptations. Low-income populations and communities of color tend to feel the burden of heat waves more often because of barriers to adaptation (e.g. no AC in housing units, less tree canopy or park space, and potential high cost of energy/water utilized to cool down).

For this analysis, an extreme heat day is defined as a day "when the maximum temperature exceeds the 98th historical percentile of maximum temperatures based on daily temperature maximum data between 1961 and 1990 during the months of April to October." To calculate the maximum number of extreme heat days for the FTBMI Land Boundary, an average of 32 climate models from CalAdapt were used.

For the FTBMI Land Boundary, the extreme heat day threshold is 100°F. Threshold temperatures are defined as the 98th percentile value of historical daily maximum/minimum temperatures (from 1961–1990, between April and October) observed at the FTBMI Land Boundary. Daily temperature that exceeds 100°F is considered an extreme heat day.

It is important to note that the extreme heat day threshold of 100°F is based on modeled data. Individuals can experience discomfort and heat related illnesses such as heat cramps and heat exhaustion at lower temperature thresholds. Qualitatively, individuals may experience heat-related illnesses and exhaustion at lower temperatures (e.g. 80 degrees), especially if humidity is high.

Under a RCP8.5 scenario, using an average of 32 climate models, the projected maximum number of extreme heat days is projected to increase to 8-20 days across the southern portion of the Land Boundary, and 29-36 days across the northern portion of the land boundary. Considering these projections for extreme heat day increases within the FTBMI land boundary, mapping out the most impacted and vulnerable communities will help target extreme heat resilience strategies to reduce negative socioeconomic and health impacts.

Another metric for heat, the California Heat Assessment Tool (CHAT) was developed by Four Twenty Seven and sponsored by the California Natural Resources Agency under the 2018 California Fourth Climate Change Assessment. The Heat Health Action Index is a statistically weighted result of the indicators below and is intended to represent overall heat vulnerability. It ranges from 0 to 100, with lower scores representing less heat vulnerability.

In Figure 3, CHAT identifies heat vulnerability using the Heat Health Action Index score, with higher scoring census tracts being more vulnerable than lower scoring census tracts. The composite score takes into account multiple indicators relevant to heat vulnerabilities such as tree canopy, ozone and PM2.5 concentration, asthma, percentage of outdoor workers, and cardiovascular disease. Across the land boundary, 20% of census tracts score at or above the 50th percentile.

Figure 3 also shows that heat-vulnerable census tracts are clustered in the San Fernando Valley and across northern Palmdale and Lancaster, with indicators such as lower tree canopy, poorer air quality, and local health metrics calculated and contributing to a higher vulnerability score.

Furthermore, NASA's Jet Propulsion Laboratory (JPL) ECOSTRESS dataset measures the earth's land surface temperature. ECOSTRESS high-resolution images serve as a powerful tool for understanding aspects of the weather event that might be overlooked by traditional observation networks, and is useful for documenting key heat-related phenomena, like patterns of heat absorption and retention. Figure 4 shows the mean land surface temperature between the summer months of June 2022 through September 2022. The ECOSTRESS data captured across the land boundary shows an average of 105°F, which is greater than the average of cities and neighborhoods neighboring the FTBMI land boundary.

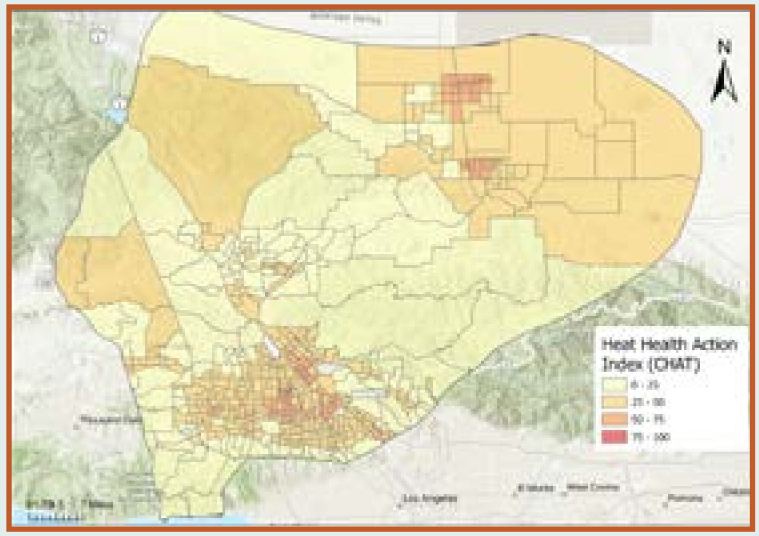


Figure 3: California Heat Assessment Tool (CHAT),
Source: Four Twenty Seven, California Heat Assessment Tool

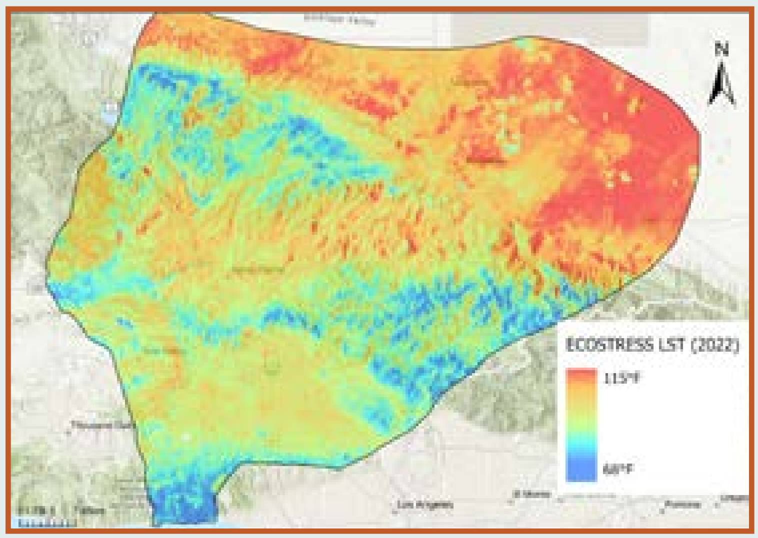


Figure 4: NASA/JPL ECOSTRESS (2022),
Source: NASA/JPL ECOSTRESS

CH.02 | Socioeconomic, Pollution, and Health Impacts

2.1 Socioeconomic Conditions

Extreme heat's impact is not distributed evenly. Low-income communities and individuals living in older homes are disproportionately affected by extreme heat events. The intersection of extreme heat impacts and socioeconomic conditions can exacerbate health and economic consequences, making it crucial to address this issue.

Older homes, especially those built before modern insulation and cooling systems, are more likely to trap heat, leading to higher indoor temperatures. This effect is compounded by low-income households, which may not have access to adequate insulation or air conditioning. As a result, these households may experience heat-related illnesses, such as dehydration, heat exhaustion, or heat stroke, which can be life-threatening, especially for vulnerable populations, such as the elderly or those with preexisting medical conditions. Furthermore, heat also compounds to increase rates of asthma and cardiovascular disease.

Low-income households may also have limited access to healthcare, which can further compound the health consequences of extreme heat. High temperatures can exacerbate preexisting medical conditions, such as respiratory or cardiovascular diseases, leading to more hospitalizations and healthcare costs. The lack of health insurance often leads to financial strain, exacerbating existing socioeconomic conditions.

Additionally, extreme heat can impact economic conditions. Workers in outdoor occupations, such as construction or agriculture, may be forced to take time off work due to heat exhaustion or heat stroke, leading to lost wages. This can be particularly devastating for low-income households, which may have limited savings and may not have access to paid time off.

Approximately 33% of the census tracts in the FTBMI land boundary contain socioeconomic conditions in the 75th percentile of "disadvantaged" category, according to CalEnviroScreen 4.0 (Figure 5).

Figure 5 below shows that there is a particularly large concentration of "disadvantaged" census tracts in the Eastern San Fernando Valley and Central Antelope Valley. Furthermore, there are census tracts in central Lancaster and throughout the San Fernando Valley that are considered both "disadvantaged communities" as well as particularly high heat-vulnerable shown in red and orange striping in Figure 5. These communities deal with poor socioeconomic conditions as well as high heat vulnerability and should be particular priorities for extreme heat resilience planning in the FTBMI land boundary.

2.2 Air Pollution Compounding Impacts

Extreme heat and increasing temperatures can have a significant impact on ozone levels. Ozone is formed when nitrogen oxides (NOx) and volatile organic compounds (VOCs) react in the presence of sunlight. As temperatures rise, the chemical reactions that create ozone occur more quickly, resulting in higher levels of ozone. Increased ozone levels can have serious health impacts, especially for vulnerable populations such as children, the elderly, and people with respiratory or cardiovascular conditions. Ozone can cause shortness of breath, chest pain, coughing, and lung inflammation. It can also exacerbate asthma and other respiratory diseases, leading to hospitalizations and even premature death. As global temperatures continue to rise due to climate change, it is crucial to take steps to reduce emissions of NOx and VOCs to prevent further damage to our environment and public health.

Moreover, wildfires that occur as a result of extreme heat and droughts can release particulate matter and other

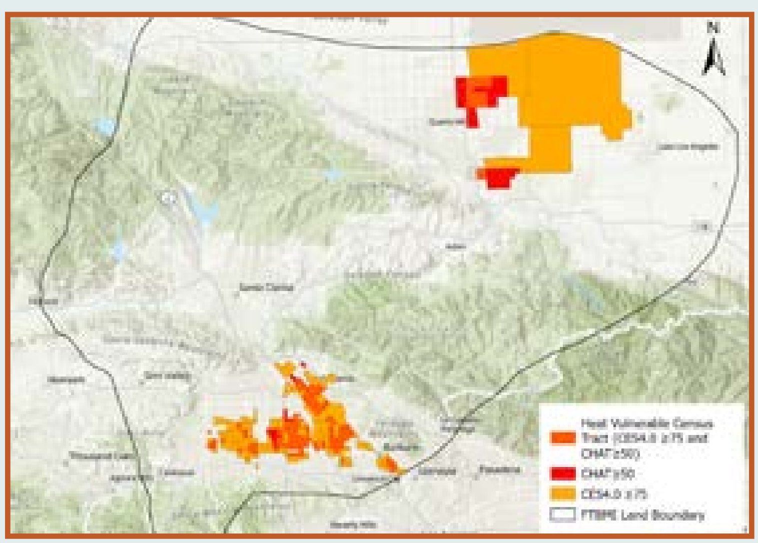


Figure 5: Disadvantaged Communities and Heat Vulnerable Communities, *Source: CalEPA, CalEnviroScreen 4.0 and Four Twenty Seven, California Heat Assessment Tool*

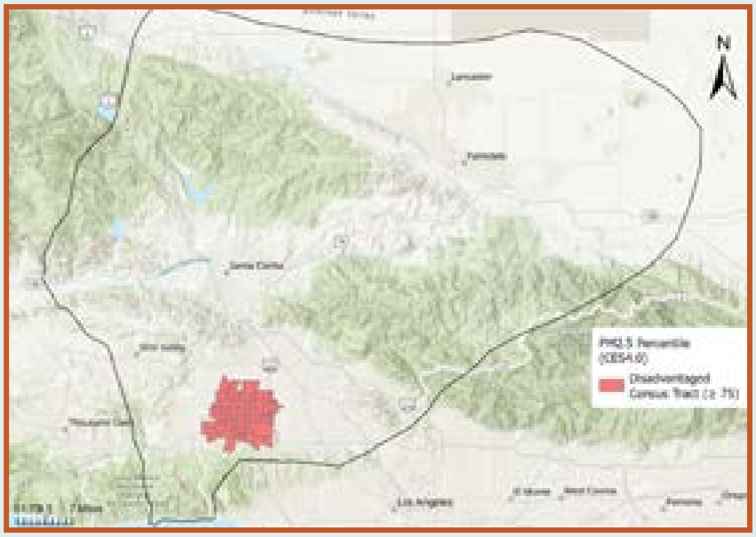


Figure 6: PM2.5 - CalEnviroScreen (4.0), *Source: CalEPA, CalEnviroScreen 4.0*

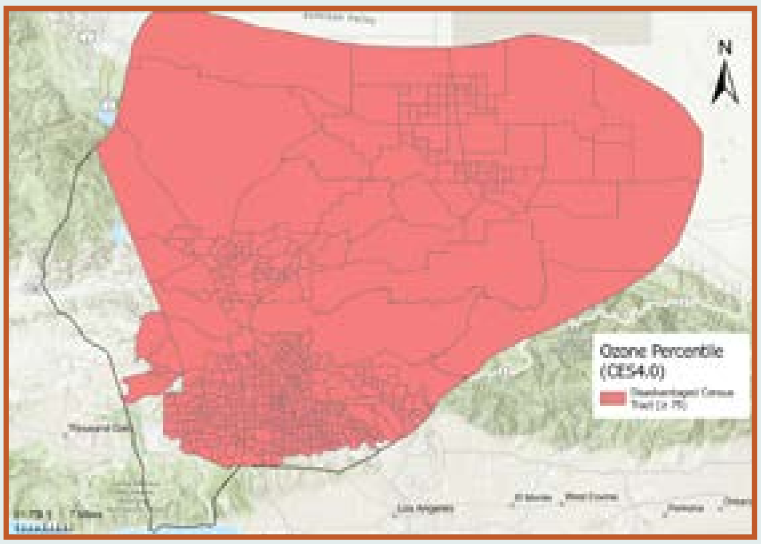


Figure 7: Ozone Percentile in the FTBMI Land Boundary, *Source: CalEPA, CalEnviroScreen 4.0*

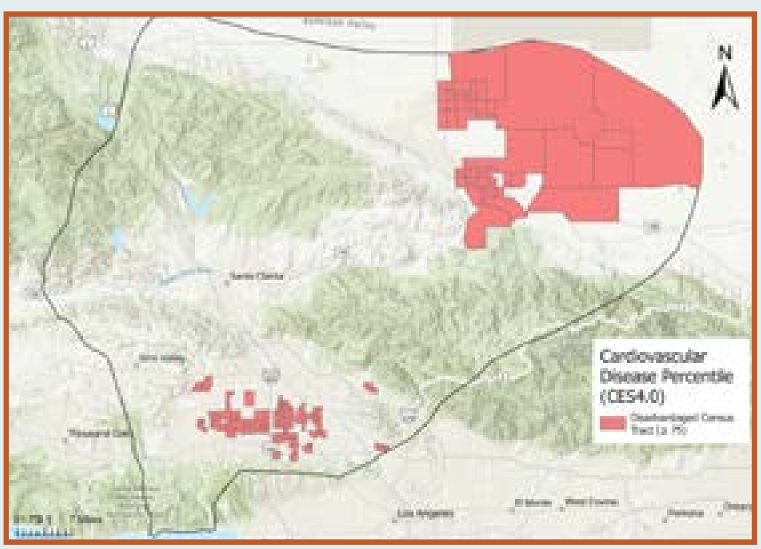


Figure 8: Cardiovascular Disease – CalEnviroScreen (4.0) *Source: CalEPA, CalEnviroScreen 4.0*

types of pollutants into the air, which can have significant health impacts. Higher air temperatures can lead to weather conditions that cause stagnation, trapping these pollutants in the lower atmosphere where people live and breathe. Therefore, it is essential to address the impact of extreme heat and increasing temperatures on droughts to protect public health and ensure air quality is not severely compromised.

Tribes experience disproportionate impacts from poor air quality, including smoke/fine particulates, heat, and humidity, all of which can be connected to climate change, according to the 2021 Status of Tribes report. In the FTBMI land boundary, 12% of the census tracts (75/621 census tracts) within the boundary have particulate matter, specifically PM 2.5, levels within the top 25th percentile, which can be worsened by extreme heat (Figure 6). The majority of these census tracts are in the Western region of the San Fernando Valley, which also experiences many extreme heat days. Furthermore, within the FTBMI land boundary, over 89% of the census tracts (557/621 census tracts) within the boundary have Ozone levels within the top 25th percentile, which can also be worsened by extreme heat (Figure 7). These census tracts are dispersed within the FTBMI land boundary except the Western most areas within the Santa Monica Mountains and Lake Piru areas.

2.3 Public Health

Southern California is known for its warm and sunny weather, but the rise in temperature due to climate change can have severe consequences on public health. The increase in extreme heat can lead to a surge in cardiovascular diseases such as heart attacks and strokes. The high temperature can cause the body to work harder to maintain a normal temperature, leading to increased heart rate and blood pressure, which can further strain the cardiovascular system. Figure 8 below illustrates that around 24% of the census tracts (152/621 census tracts) in the FTBMI land boundary contain particularly high rates of cardiovascular disease, according to CalEnviroScreen 4.0

Additionally, the high temperatures can worsen respiratory illnesses such as asthma by triggering inflammation of the airways and inducing breathing difficulties. Figure 9 illustrates that around 28% of the census tracts (175/621 census tracts) in the FTBMI land boundary that contain particularly high rates of asthma according to CalEnviroScreen 4.0. Vulnerable populations in Southern California, such as the elderly and those with pre-existing medical conditions, are particularly susceptible to the adverse health effects of extreme heat.

Furthermore, the risk and occurrence of heat-related illnesses (HRIs), hospitalizations, and deaths increases with worsened extreme heat conditions. On an average extreme heat day with temperatures above 90 degrees, there are over 1,500 excess emergency room (ER) visits in Los Angeles County due to HRIs, which is expected to have led to over 660,000 additional ER visits for Los Angeles County residents between 2009 and 2018 (Eisenman et al. 2022). Within the FTBMI land boundary the zip code areas in northeast San Fernando Valley and central Lancaster and Palmdale experience the most excess ER visits on extreme heat days within the boundary (Figure 10).

2.4 Built Environment across FTBMI Land Boundary

Albedo, which represents the fraction of the incoming radiation that is reflected by a surface, plays a significant role in land surface temperatures. The NASA LANDSAT Albedo map shown in Figure 11 is a measurement of albedo by the National Aeronautics and Space Administration that shows the range of albedo across the land boundary from around 0 to 0.70. In particular, the albedo levels in the San Fernando Valley, Santa Clarita Valley, and Simi Valley are lower than the albedo levels in the Antelope Valley. There are opportunities in increasing the levels of albedo in the Southern portions of the FTBMI land boundary.

Additionally, the FTBMI land boundary is impacted by an urban heat island (UHI) effect due to its built environment's characteristic of low albedo. UHI is a term used to describe the increased temperature of city centers compared to rural surroundings. UHI is a result of high anthropogenic activity in densely populated areas. UHI is caused by an increase in impervious surfaces like asphalt, concrete, and buildings which have replaced the natural landscape and vegetation. During the daytime, built surfaces absorb heat, causing the surface temperature to increase. Typically, built surfaces have low heat emittance, therefore during nighttime heat is released, causing not only an increase in day temperatures but at night as well.

2.5 Green Spaces

Figure 12 shows the possible percent canopy cover as measured using LA County LiDAR tree data. Across the FTBMI land boundary, the possible percent of tree canopy cover varies, with the northern portion of the area having a greater possible percent of trees planted than the southern portion. Additionally, this data can guide future tree planting activities in the most disadvantaged census tracts across the land boundary in an equitable manner. The unequal distribution of street trees is significant because trees bring many direct and indirect benefits, including everything from cleaner air, water capture, biodiversity habitat, beautification, shade/cooling benefits, energy savings, and carbon sequestration to better public health/mental health outcomes and safer streets. Urban trees also help offset the urban heat island effect, and in doing so, can reduce the impact of extreme heat on vulnerable communities.

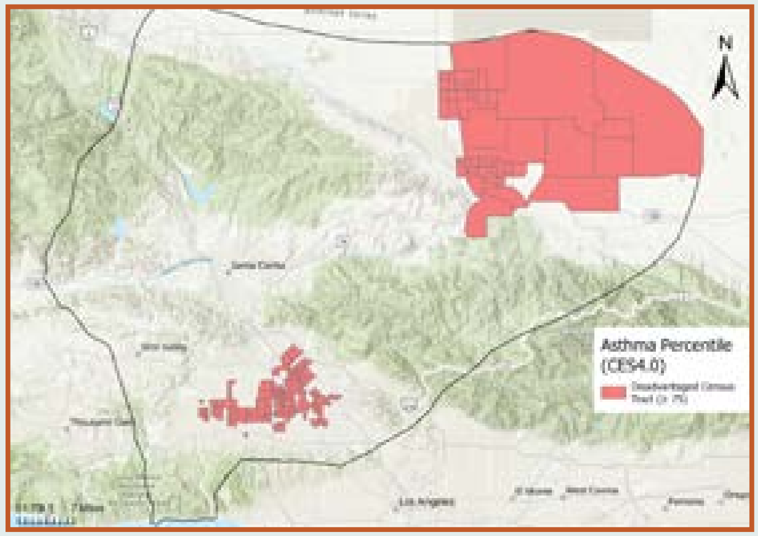


Figure 9: Asthma - CalEnviroScreen (4.0)
Source: CalEPA, CalEnviroScreen 4.0

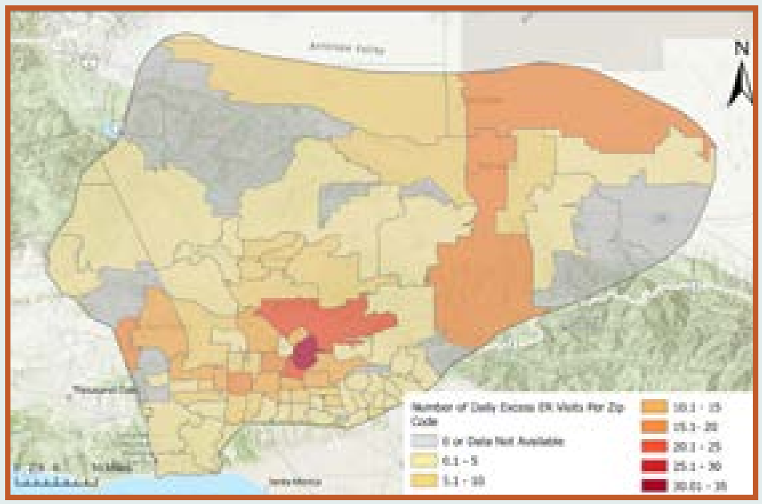


Figure 10: Number of Daily Excess ER Visits Per Zip Code - CalEnviroScreen (4.0), *Source: Eisenman et al. 2022, UCLA Heat Maps*

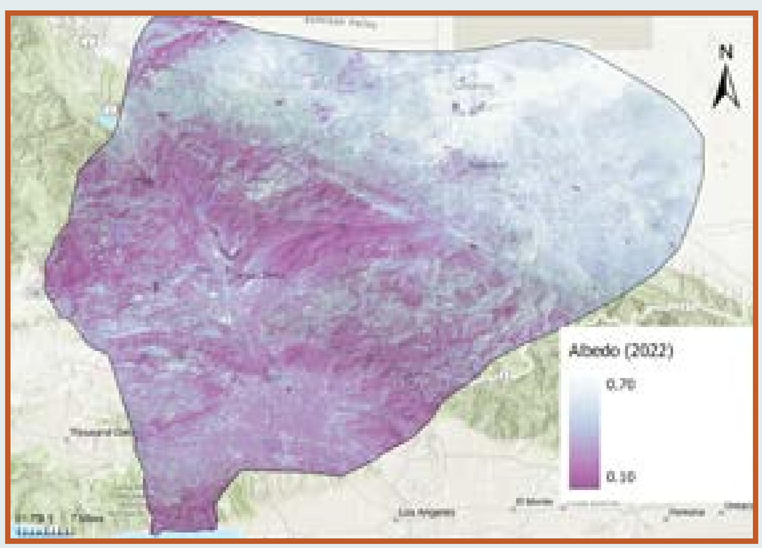


Figure 11: NASA LANDSAT Albedo
Source: NASA LANDSAT

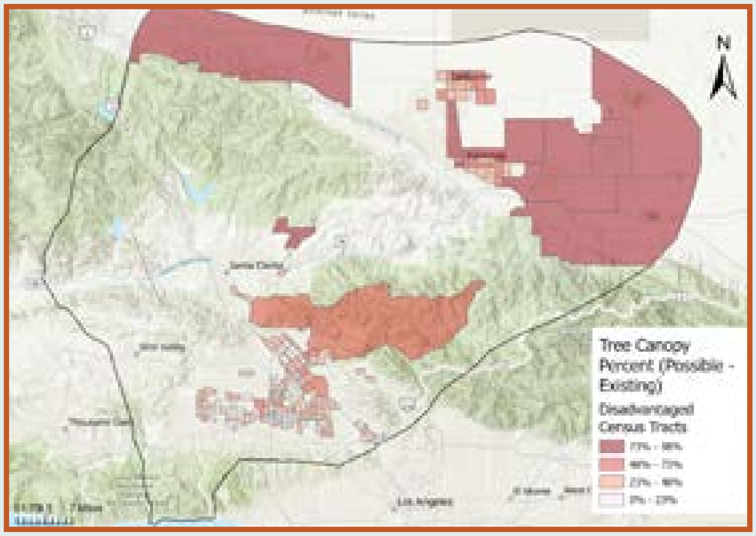


Figure 12: Tree Canopy Map, *Source: LA County LiDAR Tree Data, CalEPA, CalEnviroScreen 4.0 and Four Twenty Seven, California Heat Assessment Tool*

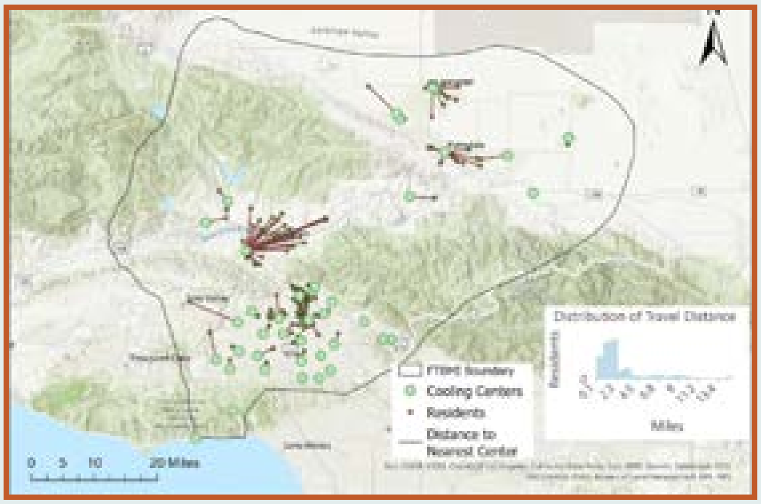


Figure 13: Cooling Center Locations and Distance from FTBMI Citizen Residence to Nearest Center, *Source: Los Angeles County Office of Emergency Management*

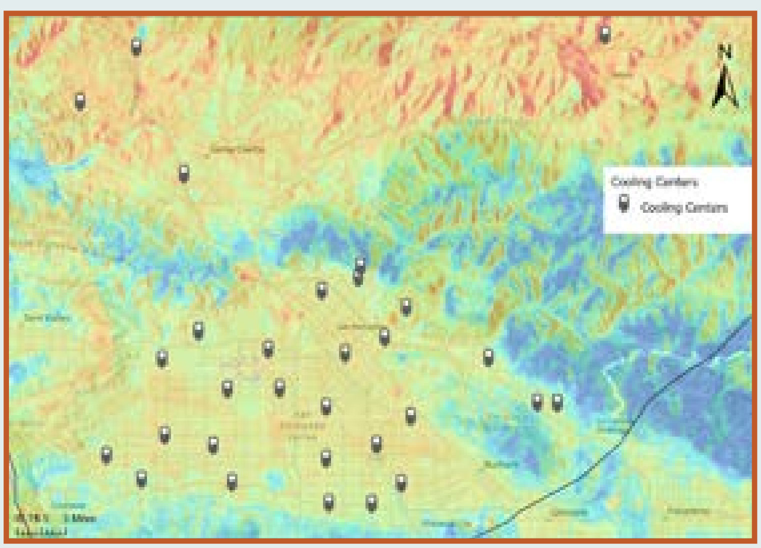


Figure 14: Cooling Center Locations with Land Surface Temperature in San Fernando Valley Region of the FTBMI Land Boundary, *Source: Los Angeles County Office of Emergency Management, NASA/JPL ECOSTRESS*

2.6 Cooling Centers

Figure 13 shows that in total, there are forty identified cooling centers across the FTBMI land boundary. Cooling centers can provide FTBMI residents with resilience during extreme heat events, as these buildings are equipped with air-conditioning, and they often distribute water bottles to prevent dehydration in those exposed to high temperatures. There is currently a lack of data on the amount of individuals who use cooling centers during extreme events and if there are barriers in traveling to these locations. Future cooling center locations should take into account the spatial distribution of populations at highest risk of heat illness during extreme heat events and multimodal (e.g. microtransit, public transportation) transportation to cooling centers. Analysis of driving distance to the nearest colling center from the residences of FTBMI residents, indicates that the majority of them have a cooling center within 5 miles of their home. While the longest distance is over 14 miles. In addition, Figures 14 and 15 show the locations of the cooling centers in the FTBMI boundary in relation to FTBMI citizen residences and ECOSTRESS heat data for the San Fernando Valley and the Antelope Valley regions, respectively.

2.7 Community Survey Responses Related to Heat

The general and tribal surveys conducted as part of the project's efforts to assess vulnerabilities and areas of concern with respect to climate change included questions related to extreme heat. The responses to those questions are summarized in Figure 16 through Figure 23.

Based on survey results from the Climate Resilience Plan Tribal Member Survey, the single most pressing climate change concern for indigenous survey respondents is very clearly air quality. Furthermore, the next most pressing concerns for indigenous survey respondents, in order, includes drought, extreme heat, and wildfire. This response highlights the air pollution issue that is the primary concern for indigenous survey respondents and informs the need for climate resilience strategies that address air pollution through multiple avenues such as extreme heat interactions and wildfire smoke impacts. In comparison, the single most pressing climate change concern for general survey respondents is also air quality, but extreme heat and then drought are a close second then third most pressing concern.

The level of concern about the impacts of extreme heat specifically on tribal ecological knowledge and practices was particularly high, with an average level of concern at 4.6 out of 5 for indigenous survey respondents, as shown in Figure 18. Furthermore, indigenous survey respondents shared that after extreme heat, wildfire, drought, then floods were the next most concerning climate impacts for specifically affecting tribal ecological knowledge and practices (shown in Figure 19). These survey results can inform the prioritization of recommendations for FTBMI, and the survey results informed the report's choice of multi hazard recommendations.

Survey results showed that on average 55% of indigenous survey respondents disagree that there are enough trees in their neighborhoods to provide adequate shade for walking on a hot sunny day (Figure 20). These survey results emphasized the need for shade infrastructure of different types (trees and man-made structures) within the FTBMI boundary that informed our extreme heat recommendations. In comparison, on average 45% of the general survey respondents from within the FTBMI boundary (Figure 21), disagree that there are enough trees in their neighborhoods to provide adequate shade for walking on a hot sunny day.

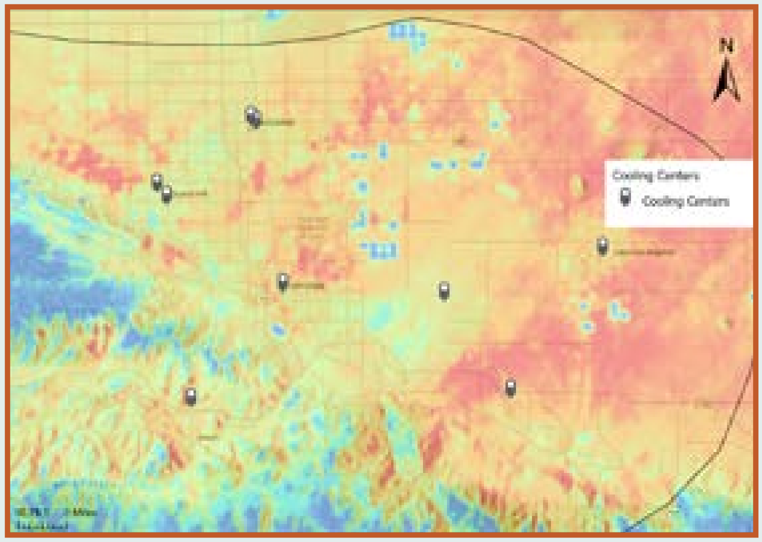


Figure 15: Cooling Center Locations with Land Surface Temperature in Antelope Valley Region of the FTBMI Land Boundary, *Source: Los Angeles County Office of Emergency Management, NASA/JPL ECOSTRESS*

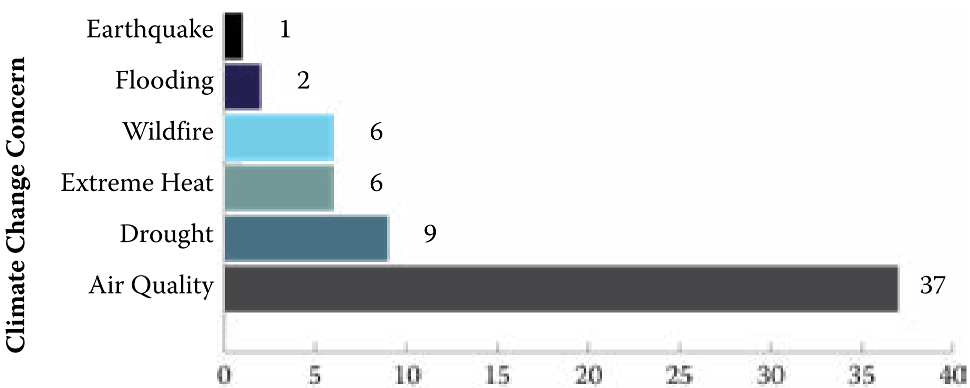


Figure 16: Single Most Pressing Climate Change Concern – Tribal Member Survey

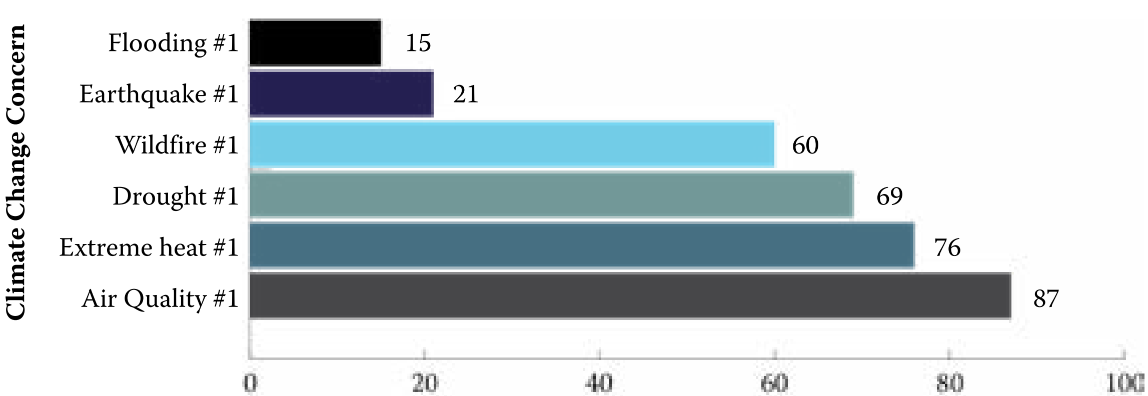


Figure 17: Most Pressing Climate Change Concern – General Survey respondents within tribal territory

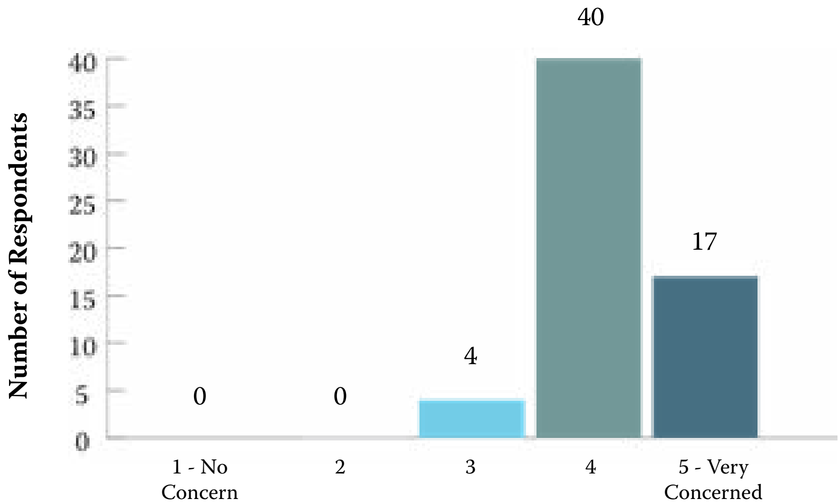


Figure 18: Level of Concern About the Impacts of Extreme Heat on Tribal Practices (from 1-5)– Tribal Member Survey

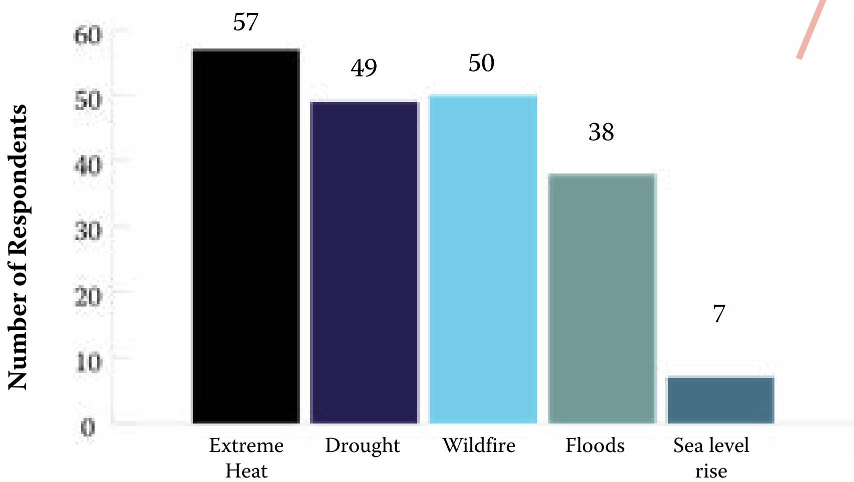


Figure 19: Climate Impacts that Respondents are Most Concerned Will Impact Ecological Knowledge and Practices – Tribal Member Survey

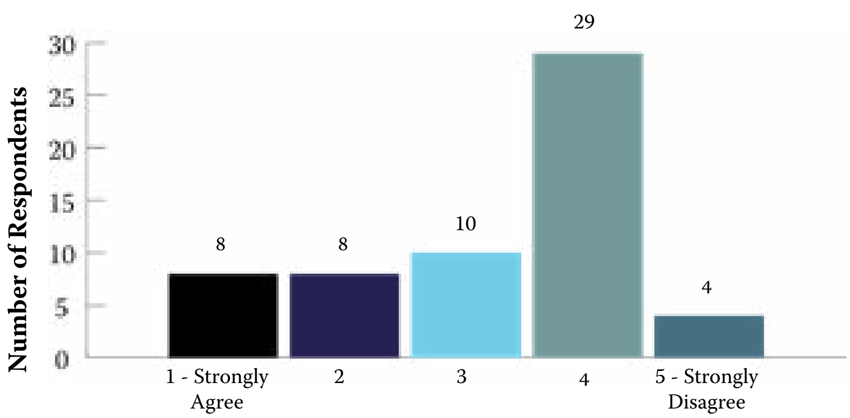


Figure 20: How strongly tribal members agree or disagree, on a scale from 1 to 5, that their neighborhood has enough trees to provide adequate shade for walking on a hot sunny day – Tribal Member Survey

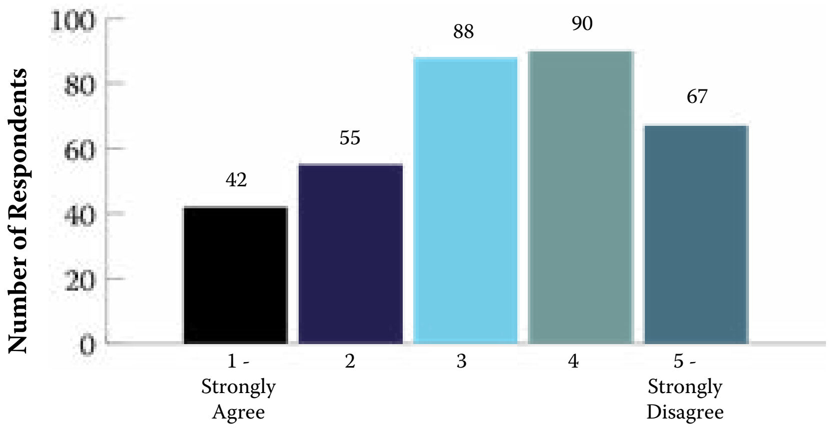


Figure 21: How strongly general survey respondents agree or disagree, on a scale from 1 to 5, that their neighborhood has enough trees to provide adequate shade for walking on a hot sunny day – General Survey respondents within tribal territory

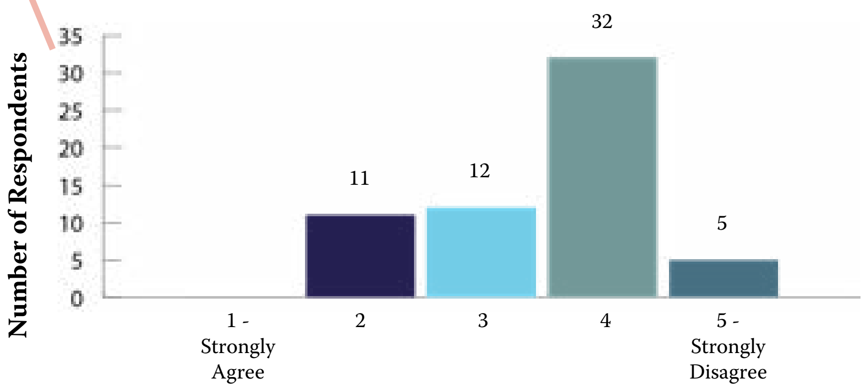


Figure 22: How strongly tribal members agree or disagree, on a scale from 1 to 5, with their neighborhood possessing services and programs to help people during and after a heatwave or disaster – Tribal Member Survey

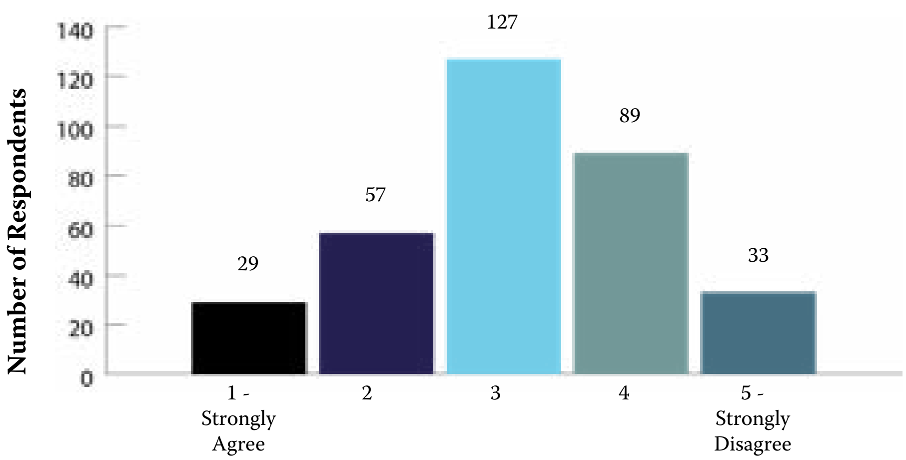


Figure 23: How strongly general survey respondents agree or disagree, on a scale from 1 to 5, with their neighborhood possessing services and programs to help people during and after a heatwave or disaster – General Survey respondents within tribal territory

Drought, Wildfires, and Flooding Resilience Planning Report

CH.01 | Drought, Wildfires, and Flooding Resilience Plan

1.1 Overview

Climate change impacts are interrelated and can reinforce each other from one season to the next, exacerbating change in the landscape. Drought, for example, can increase the risk of more severe fires, which clear large swaths of vegetation that consequently increases soil exposure and alters erosion potential while encouraging invasive plants, which fundamentally alter fire regimes and add fuel loads for the next fire. This cycle can lead to increased fire frequency and runoff, thus compounding risks of dangerous debris flows and flooding downstream during the wet winter months.

The Drought, Wildfires, and Flooding Resilience Plan provides an overview of existing conditions and projected impacts of climate change to FTBMI's natural and built environment. The plan reviews the factors that influence vulnerability to drought, wildfire, and flooding, such as rainfall intensity and frequency, fuel loads, invasive species dominance, and aging infrastructure. The plan also reviews relevant community survey questions to help identify/prioritize concerns and then concludes with a set of recommendations that are aimed to improve tribal citizens' adaptive capacity against climate impacts. While the sections below describe each impact individually, as noted above, natural disasters like drought, extreme heat, wildfires, and flooding can be linked and exacerbate the severity of the next disaster.

CH.02 | Drought Impacts

2.1 Drought Impacts

Drought is a natural phenomenon that occurs within the FTBMI land boundary. There is a long history of extended periods of drought (MacDonald, 2007); however, recent droughts are unprecedented in their scale (Robeson, 2015). Figure 1 shows precipitation in the FTBMI land boundary and captures periods of drought over the last 42 years, including the historically severe drought period that spanned from 2012-2017. Global climate change has and will increase the severity of drought and will result in drastically reduced snowpack due to increased probabilities that warm and dry years coincide. Global change models under the assumptions of RCP8.5 (the "business as usual" scenario) predict drier soils over the Southwest and an 80% chance of a multi-decadal drought the second half of the century (Cook et al., 2015, 2018). At high elevations, snowpack is expected to diminish in the future (even with significant reductions in emissions) with declines ranging from 60-85% (Berg & Hall, 2017). Snowpack is an important water reservoir, and its loss will further complicate already challenging water management scenarios that are stressed for solutions that balance the water needs of municipal users, agriculture, and ecological needs (Berg & Hall, 2017). Climate simulations that make use of recent data that capture these new extremes, e.g. the 2012-2016 record-breaking drought, find that future droughts are predicted to coincide with more extreme heat days, record low snowpack, soil drying, and forest die-offs (Ullrich et al., 2018). The impacts of drought to human and natural systems are cross-cutting. Drought and current responses to drought lead to heightened wildfire risks and shortages of water that reduce flows in aquatic ecosystems, overdraft groundwater basins, and create stress on agricultural regions.

Water Supply and Affordability

Drought impacts water supply, particularly for small, public water systems. While there is no comprehensive dataset on reported water shortages during previous droughts, shortages were reported in the majority of counties across the state (Feinstein et al., 2017). Water shortages were most heavily associated with small water systems (those with less than 1000 connections), which tend to overlap with economically disadvantaged or burdened communities (Feinstein et al., 2017). Within the FTBMI boundary, there are few small water systems that are physically vulnerable to water outages because of the water source and listed emergency water supplies. The most vulnerable water systems serve communities in the Antelope Valley, and they include, among others, Baxter Mutual Water Company, Aqua J Mutual Water Company, Tierra Bonita Mutual Water Company, and several water systems that serve mobile home parks.

Water affordability for the FTBMI community may be a concern during drought as utilities implement fixed

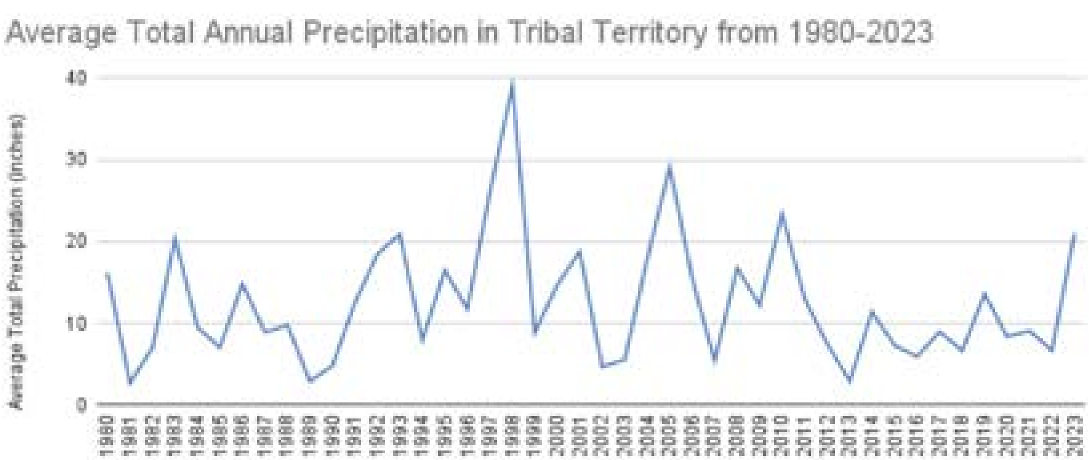


Figure 1. Average Total Annual Precipitation Within the FTBMI Land Boundary (1980-2023). Total annual precipitation for each station was compiled and averaged on an annual basis. Data was sourced from the California Data Exchange Center: California Department of Water Resources Historical Data Query Tools (https://cdec.water.ca.gov/).The selection of stations within the tribal territory was selected based on data availability. Stations included: Acton Escondido Canyon, Cheeseboro, Del Valle, El Mirage Field, Fairmont Reservoir, Lancaster FSS FAA, Lake Palmdale, Piru, and Saugus Power Plant 1. Note that the datasets may exhibit some inconsistencies in year-to-year coverage.

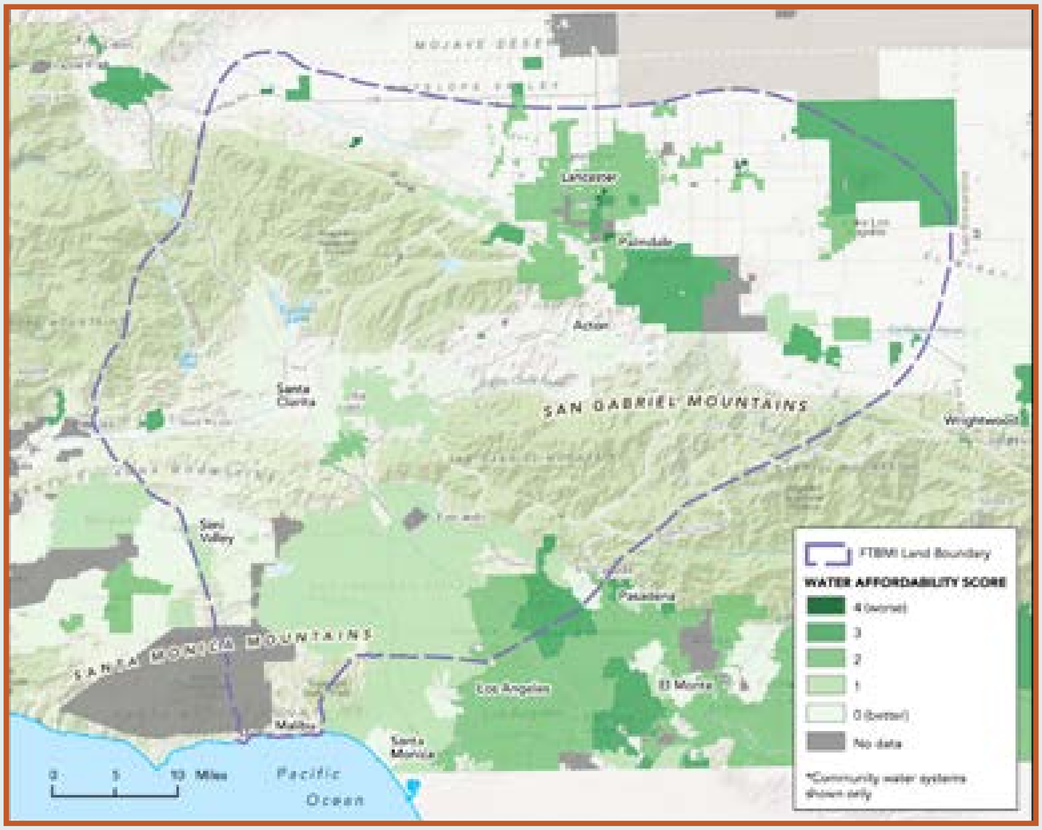


Figure 2. Water Affordability Composite Score for community water systems. This score ranges from 0 to 4, with higher scores indicating worse outcomes. The composite is based on a household-weighted average of three affordability ratios: Median Household Income, County Poverty Threshold, and Deep Poverty Threshold. *Source: Human Right To Water Data Tool - Office of Environmental Health Hazard Assessment (OEHHA).*

drought charges to cover costs when use declines, purchase more expensive supplies of water, or incur cost from the treatment of lower quality waters. The impact of drought on drinking water quality is still poorly studied. However, the effects of future droughts on water affordability will be most acutely felt by Tribal citizens served by small water systems and by water systems that are already unaffordable and serving low-income areas (Feinstein et al., 2017). From a water affordability perspective, FTBMI Tribal citizens that will be subjected to the worst affordability ratios, based on median household income, county poverty, and deep poverty thresholds, are served by small water systems that serve the Antelope Valley including, among others, Reesedale Mutual, Aqua J Mutual Water Company, California Water Service Company, Westside Park Mutual (OEHHA, 2023) (Figure 2).

2.2 Wildfire Impacts

Fire is a natural force in the landscapes of the FTBMI land boundary due to the warm, dry climate and the presence of a main driver of fire, the Santa Ana Winds. Historically, ecosystems in the tribal territory ignited as a result of lightning, Santa Ana Winds, or were intentionally set by Indigenous people. Within the FTBMI land boundary, which is largely composed of shrubland vegetation, the historical fire regime is altered due to an increased number of ignitions and more frequent fires (Figure 3). This is different from the fire suppression that is predominant in plant communities that occur at higher elevations within the FTBMI boundary, like the small pockets of mixed conifer forests, and is common in other parts of the state. In addition to human development patterns, warming, drought, and invasive species are exacerbating fire. Since the 1970's, wildfire extent in California has increased fivefold (Williams & Abatzoglou, 2016). The communities within FTBMI land boundary have already experienced several devastating fires. These include the Thomas Fire, which impacted Ventura and Los Angeles Counties in December 2017, and the Woolsey Fire in November 2018. These fires caused loss of life, billions in damages, and irreparable change to ecosystems.

Prolonged drought, extreme heat, and increased vapor pressure deficit has and will continue to increase the aridity of fuels and the frequency of large fires (Abatzoglou and Williams, 2016). Large wildfires (>400 HA) are already more frequent, of longer duration, and wildfire seasons are longer than in the mid-1980s in the American Southwest (Westerling et al., 2006). Under Global Climate Change, burn areas in natural lands within the FTBMI boundary, like the San Gabriel Mountains, are expected to increase by 40% by mid-century, impacting those along the wildland urban interface the most (LA County Climate Vulnerability Assessment). These changes, in part, are positively associated with higher spring and summer temperatures and earlier snowmelt. These cycles of wet and extended dry periods promote the growth and then desiccation of plant biomass (Westerling et al., 2011).

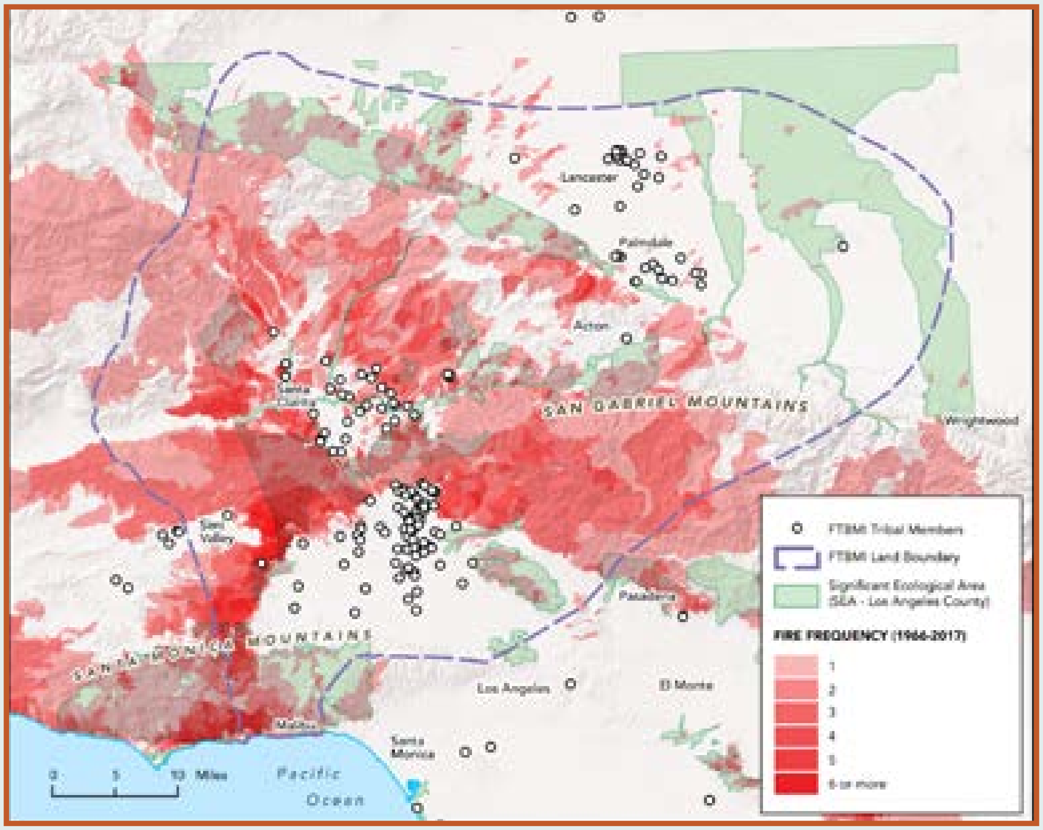


Figure 3. Fire frequencies in lands within the FTBMI land boundary from 1966 to 2017. The natural fire return interval for shrublands and chaparral, the dominant plant communities within the FTBMI, are 20-120 years (M=76) for shrublands and 30-90 (M=55) years for chaparral. Frequent wildfires can eliminate these habitats by reducing biodiversity through the loss of fire-sensitive species, then by type-conversion to non-native invasive plants that produce monocultures.
Source: CalFire.

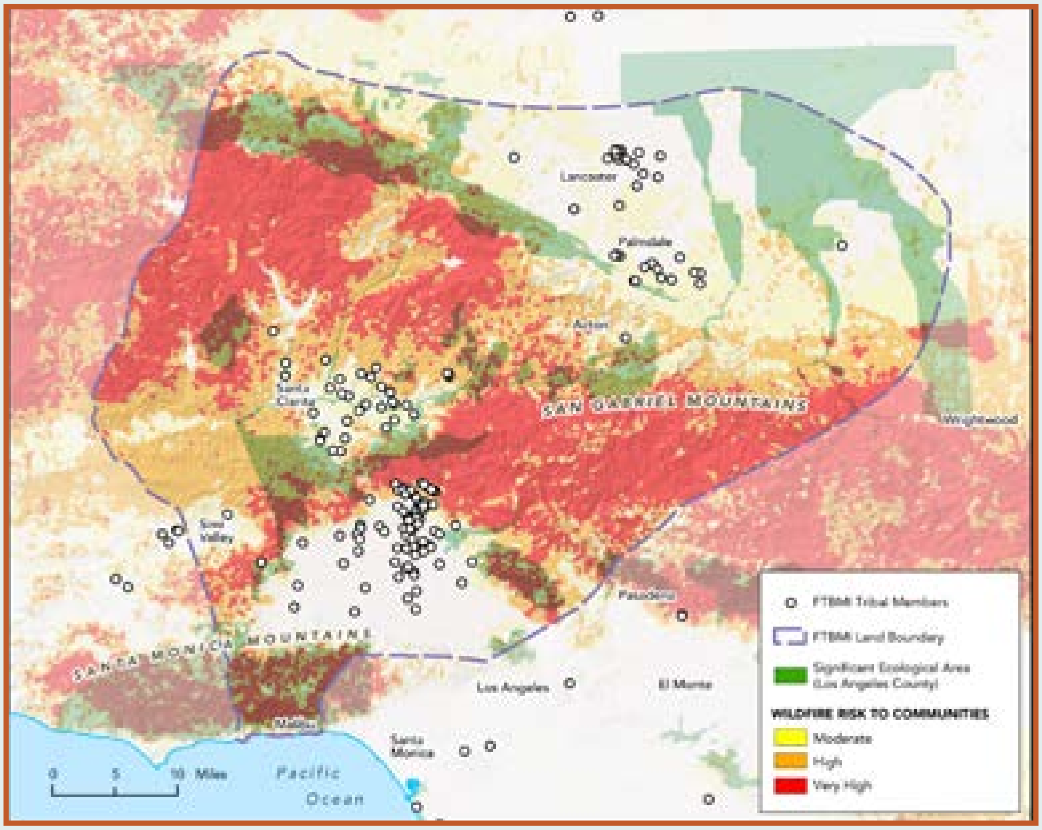


Figure 4. Areas most susceptible to burn within the FTBMI land boundary. The significant ecological areas (SEAs) are County designated areas that represent spaces with irreplaceable biological resources and are prioritized for preservation through goals and policies of the County's General Plan since the 1970s. SEAs are qualified by habitat of rare, endangered, or threatened plant or animal species as well as those biotic communities with limited distribution regionally.

Wildfire related risks are the greatest in those FTBMI communities adjacent to natural areas such as the Santa Monica, San Gabriel, Santa Susana, and Verdugo Mountain Ranges. These communities include Santa Clarita, Simi Valley, Palmdale, Sylmar, San Fernando, and Acton. Additionally, the County-designated Significant Ecological Areas (SEAs) containing irreplaceable biological resources thread throughout the high and very high fire risk areas within the FTBMI (Figure 4).

Flora

The following section briefly outlines the fire regime and impact to select high risk, natural vegetation types within the FTBMI boundary (Figure 5).

Shrublands

Fires in shrublands were historically localized with periodic large fires that consumed much of the landscape (Keeley and Fotheringham, 2001). Currently, fire regimes in shrublands are similar to historical fire regimes in size and intensity, with the exception of an increased fire frequency, particularly in areas of high population density (Keeley et al., 1999). Large fires in shrublands are coincident with severe weather during time of ignition (Keeley et al., 1999). An increased frequency of fires in shrublands can alter species distributions, dominance, and overall biodiversity. Specifically, species with fire dependent germination lose cover while nonnative annual grasses and resprouting shrubs have observable increases in cover post-fire (A. D. Syphard et al., 2006).

Mixed Conifer Forests

The mixed-conifer forests of the Transverse ranges historically ignited every 10-15 years in a frequent but low-intensity fire regime that would preserve mature trees and reduce competition (Keeley and Fotheringham, 2001). In the pockets of mixed conifer forest within the FTBMI land boundary, fire suppression has led to the accumulation of fuels and a decreased fire frequency that has resulted in more severe fires (Nigro & Molinari, 2019). High intensity and increased frequency of fires kill mature trees in mixed conifer ecosystems.

Historically, due to low-lying topography and increased moisture, riparian areas acted as a barrier to fire (Pettit & Naiman, 2007). Urbanization has amplified the frequency of fires due to human ignition and an invasive grass plant fire regime (Coffman et al., 2010). Invasive plant species, like Arundo donax and tamarisk, are highly flammable, aggressive in their spread, and recover quickly from fire. Under an invasive plant regime and conditions projected under future climate change scenarios, fire will become a more frequent occurrence in riparian areas. This is due to climate change favoring the spread of nonnative species, an altered seasonality of flood and the resulting reduced reproductive success of flood dependent species, and drying of fuels as a result of drought (Falk & Finch, 2019). Fire regime in riparian areas will also depend on the

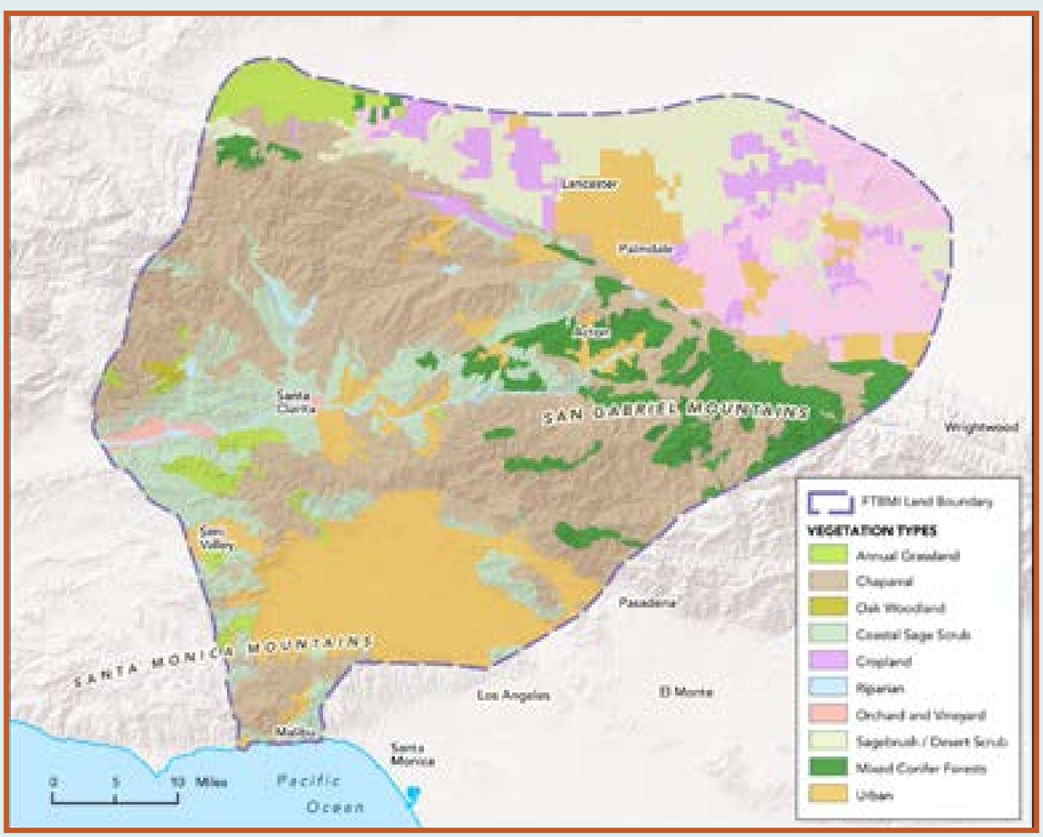


Figure 5. Vegetation types within the FTBMI land boundary. *Source: California Gap Analysis Project, CDFW.*

landscape and local fire history. For example, if climate change reduces fuel density, then fire can become less frequent opposed to dense forests than have undergone fire suppression and fuel accumulation. In this latter instance, riparian areas may become highways for wildfire to extend into the landscape (Van de Water and North, 2011). Areas with a natural flooding regime have reduced fire frequency because floods scour litter, woody debris, and understory vegetation that would otherwise ignite (Falk & Finch, 2019). A natural flow regime also reduces invasion by species that establish an invasive plant fire regime (Falk & Finch, 2019).

Riparian Forests

While riparian species can recover quickly from low intensity fire events, many may experience high rates of mortality leading to altered plant community structure (Falk & Finch, 2019). In the FTBMI land boundary, which includes the Transverse Ranges, species like mule-fat and red willow may gain abundance compared to cottonwood and white alder as a result of fire (Bendix, 1994). When invasive species are present, however, invasive recovery outpaces those of natives. For example, Arundo donax thrives following fire and regrows in monoculture, outcompetes natives, and contributes to the aridification of riparian systems through exhaustive use of water resources (Coffman, 2007). The combination of drought and fire can result in high mortality of non-fire and drought adapted riparian species, particularly species that depend on a high water table during early life stages (Smith et al., 2009).

Air Quality

Wildfire results in the emission of large amounts of ash and particulate matter that exacerbates poor air quality (Figure 6). Smoke plumes from a wildfire can travel long distances (Teakles et al., 2017 for example describe air quality impacts in the Pacific Northwest from a Siberian Fire). The pollutants that are emitted from fires vary depending on fire intensity and the materials that are burned. These can include particulate matter, nitrous oxides, volatile organic compounds, carbon monoxide, and methane, but many pollutants, particularly those that are not priority pollutants under the Clean Air Act, are poorly characterized (Prichard et al., 2020). Nevertheless, poor air quality resulting from wildfire impacts public health (Fowler, 2003; Reid et al., 2016). Health outcomes like worsened asthma, bronchitis, chronic obstructive pulmonary disease, respiratory illness, cardiac arrests, adverse birth outcomes, and premature mortality are associated with exposure to wildfire smoke (Hill et al., 2020).

Recent fires, like the September 2020 Bobcat Fire, have resulted in unhealthy air quality throughout the FTBMI boundary and hazardous air quality in the areas closest to the active fire. However, it is important to note that air quality can be dependent on atmospheric conditions and downwind distance. Tribal citizens are at risk of exposure to very unhealthy and hazardous levels of air quality due to predictions of increased burn areas and fire frequencies within the FTBMI boundary under climate change.

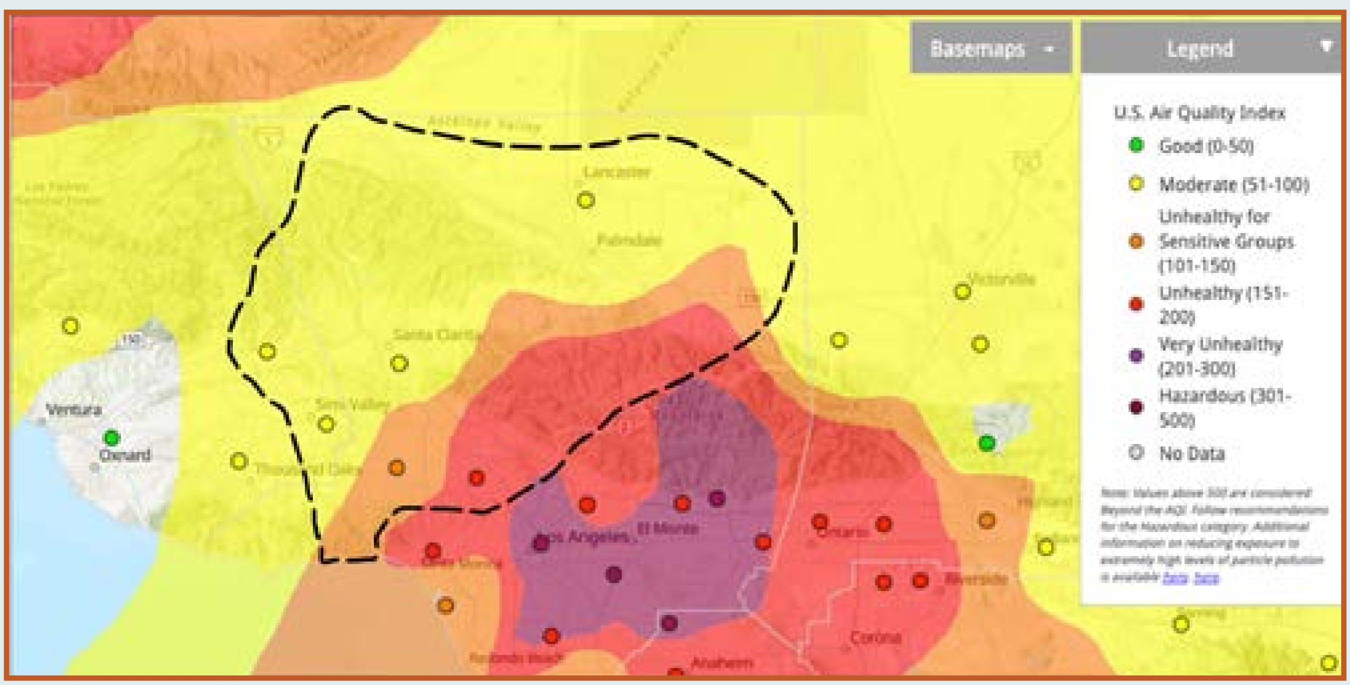


Figure 6. Air quality in parts of Los Angeles and Ventura County. Map is colored by categories of the US Air Quality Index for ozone. Image shows air quality on September 6, 2020, during the Bobcat Fire. Based on the air quality index, green = good, yellow = moderate, red = unhealthy, purple = very unhealthy, dark purple = hazardous. *Image from AirNow's interactive map of air quality.*

Water Quality

Fire affects stream surface water quality, often with effects that linger many years post-fire. The increased loading of contaminants and increased temperature that result from canopy loss can result in increased sedimentation, reduced dissolved oxygen, and elevated nutrient levels that negatively impact aquatic life and create conditions conducive to harmful algal blooms in nearby streams (Chow et al., 2021). Contaminants that are found in elevated concentrations post-fire include polycyclic aromatic hydrocarbons, heavy metals, total suspended solids, dissolved organic matter, and dissolved organic nitrogen (Raoelison et al., 2023). The peaks for each of these contaminants vary and are also sensitive to area burned, time sampled, and stream discharge rate (Raoelison et al., 2023).

Fire threatens drinking water sources. Wildfire results in increased loading of dissolved organic matter, which creates toxic disinfection byproducts when water sources undergo processes used for drinking water treatment (Hohner et al., 2019). Contaminants that are elevated as a result of wildfire require more intensive water treatment and often necessitate interim and alternative safe drinking water sources (Pierce et al., n.d.). When water infrastructure is burned or melted, the contaminants that are released also pose a threat to drinking water. Flames damage and melt storage tanks, pipes, meters, and well infrastructure which can be made of cross-linked polyethylene (PEX) and polyvinyl chloride (PVC) (Proctor et al., 2020). These materials release dangerous VOCs (such as benzene) into drinking water supplies when burned or melted that then impact the water infrastructure network, including connected and undamaged sections of the water conveyance network. Furthermore, the damaged and depressurized sections can allow for the introduction of bacteria and VOCs. These contaminants can linger in the water system for an extended period of time, necessitating prolonged monitoring and delivery of alternative clean drinking water to impacted households, and it highlights the need for effective government communication and monitoring strategies following natural disasters (Proctor et al., 2020).

The impact of fire on drinking water quality within the FTBMI land boundary is convoluted by varying effects on drinking water quality based on fire area, water sources that vary by municipality, and highly fragmented water governance. As far as the authors are aware, there are no tools that convey drinking water risks due to wildfire. However, treatment costs may increase to minimize exposure to pollutants, which will stress communities that are served by small water systems and already burdened by poor water affordability (See Water Supply and Affordability section).

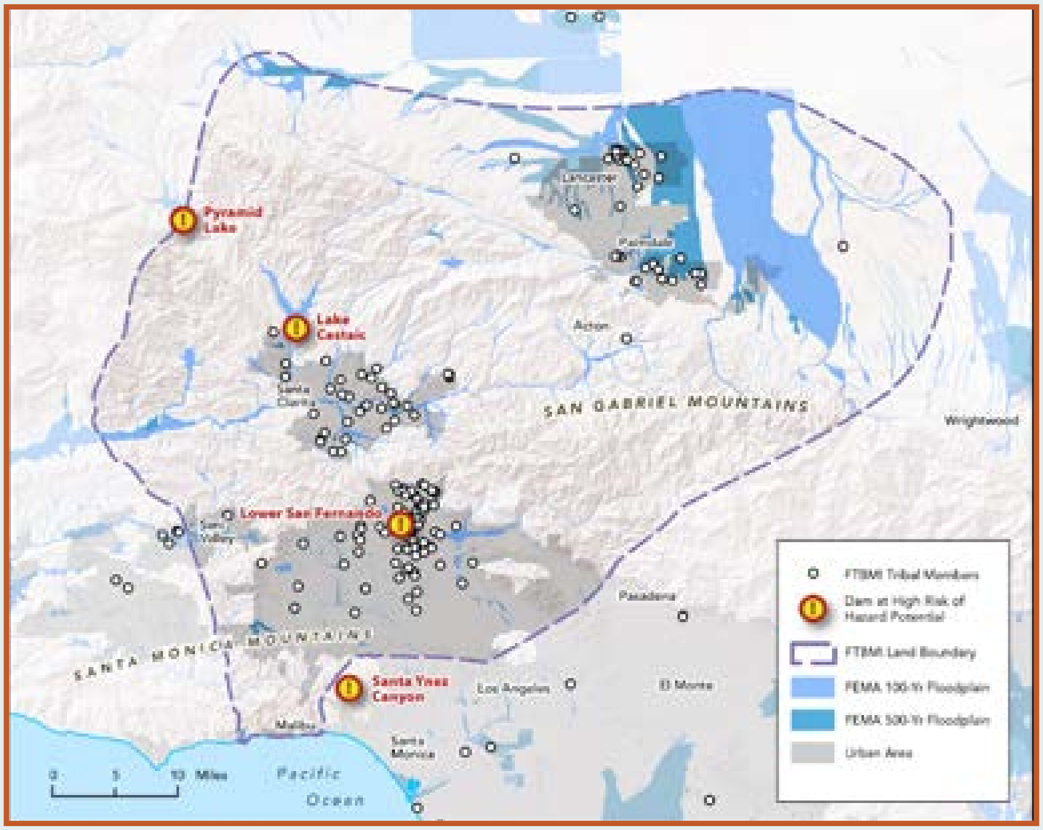
2.3 Flood Impacts

Catastrophic floods, such as the floods of 1862 and 1938, have taken place in California's recent history. These types of deluges are delivered to the region via atmospheric rivers. Atmospheric rivers are regions of high-water vapor transported from the tropics. In normal conditions, about 5 atmospheric rivers are responsible for the majority of the precipitation in a given year. For example, the 3-day storm precipitation total from an atmospheric river is comparable to those in the hurricane belt (Dettinger, 2011). As such, these meteorological events are responsible for breaking previous droughts. While the total amount of precipitation is not expected to shift considerably under future climate change scenarios, there will be more wet and dry extremes. A repeat of the Great Flood of 1862 is 3 times more likely under global climate change (Huang & Swain, 2022; Swain et al., 2018). Thus, climate change will increase the likelihood of extreme precipitation events, years with many atmospheric rivers, the occurrence of severe floods due to stronger atmospheric rivers, and extend the flood hazard season (Dettinger, 2011; Payne et al., 2020).

When extreme precipitation falls upon a highly urbanized and paved landscape, in which precipitation rapidly sheds from impermeable surfaces or stream and debris flow overtops flood control channels, extreme flood risks result. In highly populated and developed flood plains, flooding poses serious harm to communities and can result in considerable losses and damage to property and infrastructure. While considerable investment has been made to protect communities from catastrophic floods, research by the USGS has shown that if a Great Flood, like that of 1861-1862, occurred in California again, flood infrastructure would be ineffective in preventing the human and economic loss due to undersized infrastructure. Both flooding and landslides would damage homes and highways and critical power, water, and sewer infrastructure (Porter et al., 2011).

Federal Emergency Management Agency (FEMA) maps show a small area within the FTBMI land boundary that

Figure 7. FEMA flood risks within the FTBMI land boundary: 1% annual chance (100-yr flood) and 0.2% annual chance (500-yr flood). The map also highlights dams at potential high risk of failure. *Sources: FEMA, Los Angeles All Hazards Mitigation Plan.*



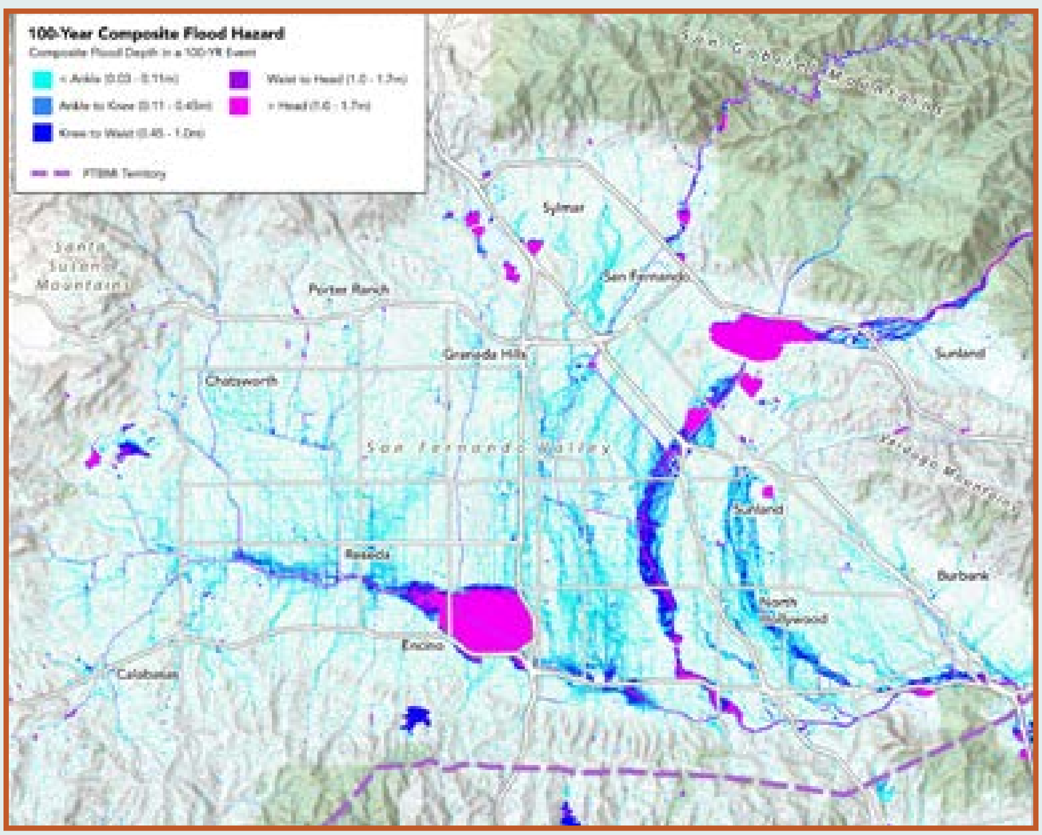


Figure 8. Simulated flooding and flooding depth within the portion of FTBMI land boundary for which data is available. The map illustrates modeled conditions from a 100-year flood hazard. *Source: Sanders et al. (2022).*

would be impacted by a 1% annual flood hazard (Figure 7). These areas at high risk of flood are downstream of dams, along watercourses, and in locations where mountainous flows reach the valley floor or foothills and include Little Rock and Big Rock Washes, Antelope Valley, and the Foothills of Santa Clarita (2020 County of Los Angeles All Hazards Mitigation Plan, 2020). In Ventura County, these areas are along the Santa Clara River and the Arroyo Simi in cities such as Simi Valley and Piru. However, FEMA hazard maps do not take into account pluvial flooding (flooding that results from rainfall exceeding infiltration capacity), only coastal and fluvial flooding (flooding caused by water levels that exceed bank heights in river channels). As a result, these maps can underestimate flooding risk, particularly with growing development and impervious areas (Sanders et al., 2023).

Recent assessments have also identified high hazard flood infrastructure, infrastructure that is at risk of failure or unable to contain flows from a 100-year storm (2020 County of Los Angeles All Hazards Mitigation Plan, 2020; Sanders et al., 2023)(Figure). This includes the Los Angeles River and several dams at high risk of hazard potential. They include Pyramid Lake, Lake Castaic, Lower San Fernando, and Santa Ynez Canyon (2020 County of Los Angeles All Hazards Mitigation Plan, 2020).

Recent high resolution compound flood hazard modeling of Los Angeles County completed by UCI estimates that between 197,000-874,000 people would be exposed to flooding by a 100-year event, with estimates of $36-$108 billion in property damage (Sanders et al., 2023).

According to this modeling, flooding will be deepest in areas nearest overtopped channels, near dams, and along channelized sections of tributaries, such as the Tujunga Wash (Figure 8).

Fire, Flood, and Debris Flow Connections

Floods and debris flows are influenced by previous cycles of fire in the landscape. Flash floods are more likely to occur following intense rainfall in areas that have recently burned (Liu et al., 2022). This is because fire denudes the landscape, weakens the strength of roots that hold soil in place, and alters the physical and chemical characteristics of soil so as to reduce infiltration and increase the susceptibility of soils to erosion. Together these fire mediated changes to the landscape contribute volume to runoff, particularly along steep terrains (Oakley et al., 2021). Climate change will increase the frequency of post-fire flood and debris flows. However, understanding of flash floods and debris flows is still too coarse to inform planning and management (Oakley, 2021). The FTBMI land boundary is vulnerable to debris flows and many events have already occurred in Ventura and Los Angeles County (2020 County of Los Angeles All Hazards Mitigation Plan, 2020; Ventura County Multi Jurisdictional Hazard Mitigation Plan, 2022). Locations along ravines, canyons, and the mouth of canyons below recent burn areas are the most susceptible (Figure 9) (2020 County of Los Angeles All Hazards Mitigation Plan, 2020; Ventura County Multi-Hazard Mitigation Plan, 2015).

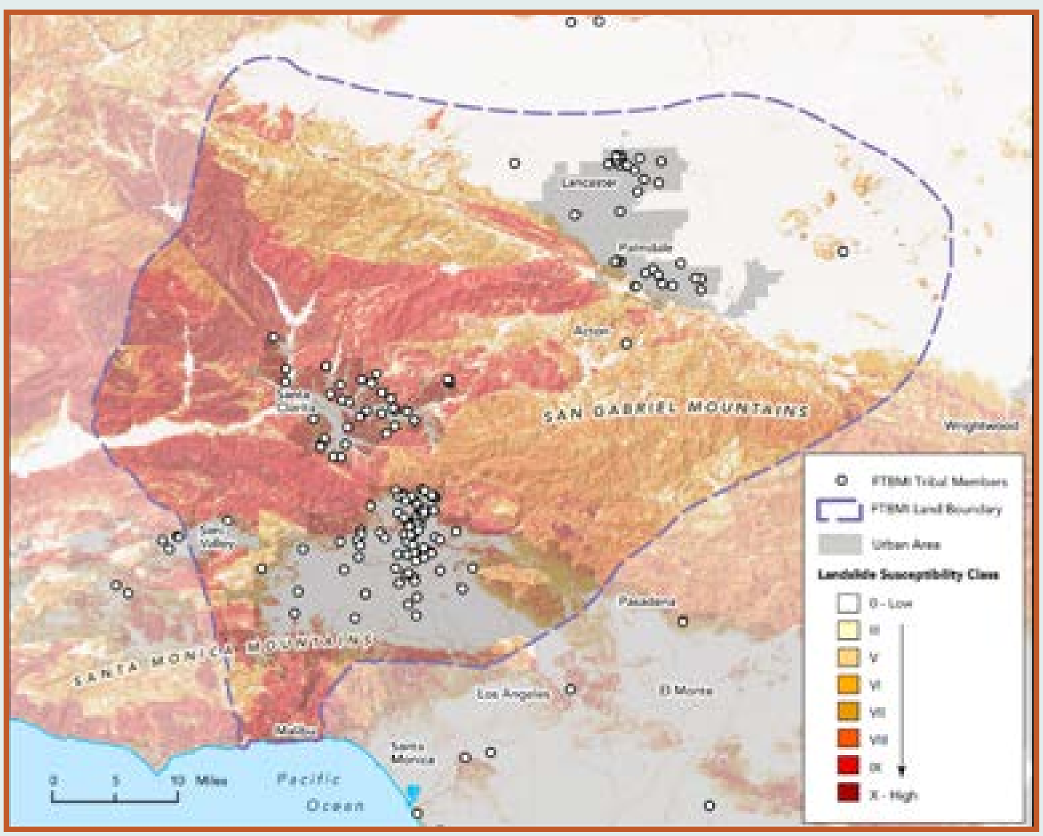


Figure 9. Landslide susceptibility potential within the FTBMI land boundary. *Source: California Department of Conservation.*

Sea Level Rise

There are several reasons for increased sea level rise (SLR). Thermal expansion and waters from melting glaciers, ice caps, and ice sheets contribute to SLR. King tides and storm surges also periodically exacerbate the water levels along coastal communities. In the 4th climate change assessment, predictions for SLR for 5th, 50th, and 95th percentiles sea levels for 2050 are 2.3, 7.3, 13.3 inches under RCP8.5 ("business as usual") and by 2100 are 24.8, 50.1, and 90.9 (Hall et al., 2018). The differences between emission scenarios are particularly notable by 2050 and there is a large amount of variability depending on the dataset and the extent of ice loss from the West Antarctic Ice Sheet (What Threat Does Sea-Level Rise Pose to California? 2020 and references therein). A 3-6 ft increase in sea level would erode two-thirds of Southern California beaches by 2100 and pose a threat to infrastructure, housing, commerce, and natural resources (What Threat Does Sea-Level Rise Pose to California? 2020). Critical infrastructure that is at risk due to SLR includes water treatment plants (sewage leaks would pose threats to aquatic and public health), roads and highways, railways, and piers and marinas. Additionally, SLR will erode cliffs, walls, and beaches, and threaten the loss of already few and vital coastal ecosystems (Heady et al., 2018). The facilities that have been identified by Los Angeles County as most at risk from 3 to 6 ft of SLR are Public Works facilities (2020 County of Los Angeles All Hazards Mitigation Plan, 2020). Within the FTBMI land boundary, the Santa Monica Mountains and coastal areas near Malibu are located within a SLR hazard area (Figure 10).

Water Resources

Sea level rise also poses a threat to public health and to valuable water resources within the FTBMI land boundary (What Threat Does Sea-Level Rise Pose to California? 2020). Rising seas can contaminate fresh drinking water with seawater, disrupt wastewater infrastructure, and allow for the mobilization of contaminants at hazardous sites throughout the state (What Threat Does Sea-Level Rise Pose to California? 2020). As sea water intrudes, it pushes up shallow water tables, resulting in flooding that can damage sewage pipes and cause sewage leaks in homes and neighborhoods. SLR can also cause rising water tables to contact and distribute contaminants from storage tanks, waste pits, landfills, brownfields, and other contaminated sites. Sea water intrusion from SLR also threatens freshwater aquifers, a drinking water source for communities in coastal Los Angeles (Jasechko et al., 2020; What Threat Does Sea-Level Rise Pose to California? 2020). The Bay Delta, a source of drinking water for 27 million people including Southern California, is dependent on highly fragile levees that support the delivery of freshwater resources to Southern California. While the Bay Delta is not within the FTBMI land boundary, the integrity of these levees is threatened by SLR and would reduce and threaten freshwater supplies in the FTBMI land boundary (What Threat Does Sea-Level

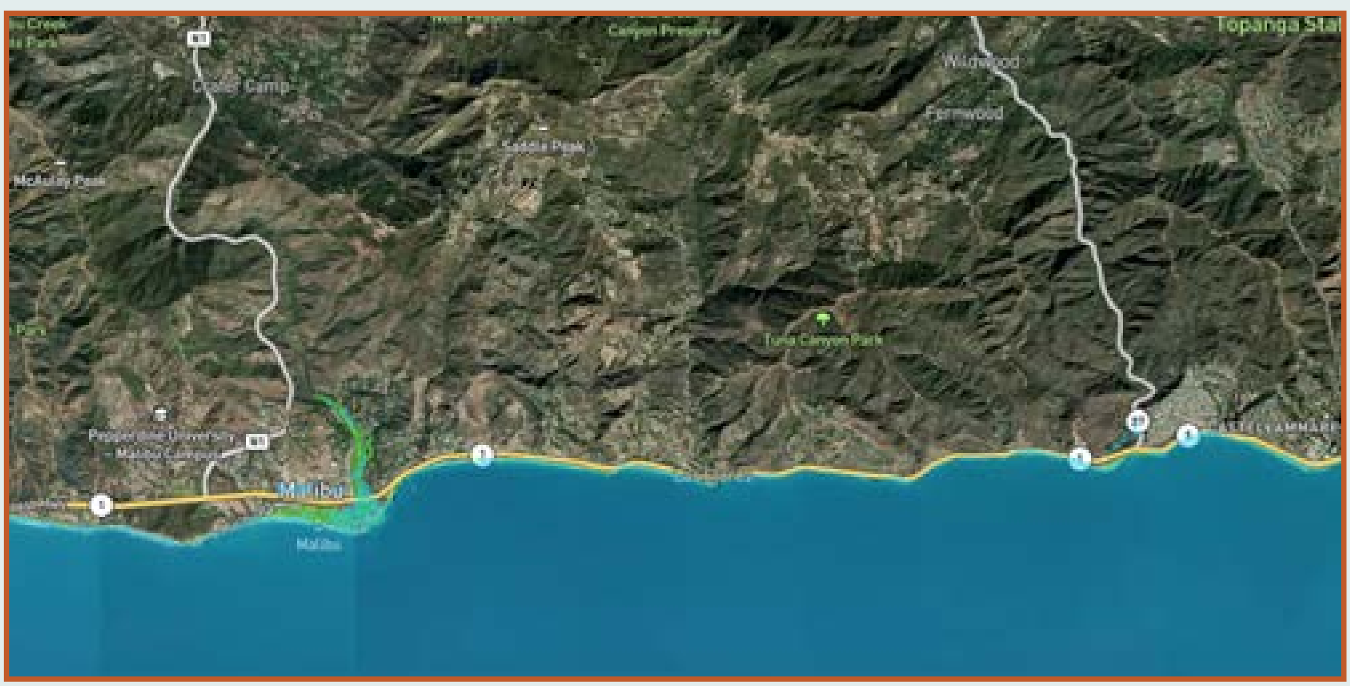


Figure 10. Median projected water levels associated with a 100-year storm and SLR from 2080 to 2100 for the coastal portion of the FTBMI land boundary. *SLR extent is based on CoSMoS and CalFloD-TFS (50m). Image and data are from cal-adapt.org.*

Rise Pose to California? 2020).

2.4 Agriculture and Natural Resources in the Face of Climate Change

Agriculture

California is a significant producer of vegetables, fruits, and nuts with $41.1 billion in revenue from crops and livestock. The agriculture sector is vulnerable to changes in climate. During the most recent drought spanning from 2012-2016, agricultural regions faced water shortages that led to land fallowing and additional groundwater pumping (Medellín-Azuara et al., 2016). While many studies examining the impact of climate change in California have focused almost exclusively on the Central Valley, some lessons can be applied to the FTBMI land boundary. The impact of climate change on produce will be crop dependent. Studies have found that temperature variations of 2 °C result in reduced yields of almonds, wine and table grapes, strawberries, hay, walnuts, peaches, and cherries (Pathak et al., 2018). Summer heat waves, for example, are expected to reduce yields of maize, rice, sunflower, and tomato by 1-10%, while alfalfa will have higher yields (Pathak et al., 2018). Crops that depend on long winter chill conditions, such as walnuts, may decline in the future. Generally, horticultural crops will be more sensitive to climate change than grain or oilseed crops (Backlund et al., 2008). Table 1 presents optimal temperatures for yield and germination for a subset of important crops. Apart from the impact of climate on plant growth and reproduction, plant diseases, insects, and invasive weeds will become more prevalent in a warming climate (Pathak et al., 2018) and increased temperatures will result in more frequent crop failures.

Reports of agricultural production in the region are coarse and only available for Los Angeles and Ventura counties, complicating assessments of agricultural production within the FTBMI land boundary. Crops that have high gross value include root vegetables, for Los Angeles County, and strawberries and lemons, for Ventura County. Descriptions of the ongoing impacts of climate change to agriculture within the FTBMI land boundary are few, except losses to avocado and grape acreage following the Woolsey Fire (Crop and Livestock Report, 2019, Crop and Livestock Report, 2021). However, drought, as well as increased heat and floods, will reduce yields and acreage for economically important crop species.

Salmonoids and other Aquatic Ecosystems

The health of freshwater aquatic species is impacted by climate change. Loss of flow, due both to lack of precipitation and human pressure on remaining flows,

Climate Classification	Crop	Acceptable Temp (ºC) for Germination	Optimal Temp (ºC) for Yield	Acceptable Temp(ºC) Growth Range
Hot	Watermelon	21-35	25-27	18-35
	Okra	21-35	25-27	18-35
	Melon	21-32	25-27	18-35
	Sweet Potato	21-32	25-27	18-35
Warm	Cucumber	16-35	20-25	12-30 (35)
	Pepper	16-35	20-25	12-30 (35)
	Sweet Corn	16-35	20-25	12-30 (35)
	Snap Bean	16-30	20-25	12-30 (35)
	Tomato	16-30	20-25	12-30 (35)
Cool-Warm	Onion	10-30	20-25	7-30
	Garlic	7-25	20-25	7-30
	Turnip	10-35	18-25	5-25
	Pea	10-30	18-25	5-25
Cool	Potato	7-26	16-25	5-25 (30)
	Lettuce	5-26	16-25	5-25 (30)
	Cabbage	10-30	16-18 (25)	5-25
	Broccoli	10-30	16-18 (25)	5-25
	Spinach	4-16	16-18 (25)	5-25

Table 1. Summary of optimal growing temperatures for a subset of crop species. Table is reproduced from Backlund et al., (2008).
Source: Scripps Institution of Oceanography: LOCA Downscaled Projections

alters the availability and quality of physical habitat. As a result, fish and invertebrate community diversity shifts to populations that can withstand harsh conditions (Chang & Bonnette, 2016 and references therein). In some species, climate related environmental stressors and habitat alterations can lead to the loss of genetic and phenotypic (e.g., morphological, behavioral, and physiological) diversity (Herbold et al., 2018). Reduced flows also result in increased water temperatures that shift fish community composition (Lynch et al., 2016) and intensify predation by warm-adapted (often non-native) species on cold-water, native species such as salmonids (Mantua et al., 2010). Depending on the magnitude of change, some species (e.g., salmonids) can adapt to a shift in local environmental conditions, though there are species-specific physiological limits on the ability to adapt to higher temperature (Crozier et al., 2008; Muñoz et al., 2015), which can lead sensitive species to undergo range contraction in response to warmer water temperatures (Eby et al., 2014). The impact of increased temperature and reduced flow on aquatic species distributions is species dependent, particularly impacting cold water species like the anadromous steelhead trout (Crozier et al., 2019; Sloat & Osterback, 2013). The most vulnerable species in the South Coast region are those with small niches and species that occur in high elevation streams, like the Santa Ana sucker and rainbow trout (Rogers et al., 2020).

The climate forces that impact aquatic biota are many. Drought can impact water quality since the first flush after prolonged drought can result in elevated concentrations of pollutants, increased conductivity, and reduced dissolved oxygen (Mosley, 2015). Changes in streamflow (shifts in low and peak flow) can function as a physical barrier to fish passage which can lead to migration delays, and reduced fish survival. Increased temperatures have physiological, developmental, and behavioral impacts (Whitney et al., 2016). For example, increased water temperatures can expedite egg development and favor earlier emergence (Crozier et al., 2008), reducing the survival of both adults and juvenile salmonids (Israel et al., 2015; Murauskas et al., 2021). Higher water temperatures also favor disease conditions in fish as parasitic and bacterial diseases tend to become more virulent with warmer water conditions (McCullough, 1999). In adult salmonids, an increase in the frequency of mortality is found when there is a compounding effect of low flow, apparent lack of migration cues, warm water temperatures, and parasitic and bacterial disease outbreaks (Belchik et al., 2004; Crozier et al., 2011). Hence, as both mean and peak summer water temperatures will rise in the future, migration delays and mortality events in salmonids may become more frequent. Salmonoids within the FTBMI land boundary are threatened by habitat fragmentation, barriers to fish passage, sedimentation, poor water quality, drought, and fire. However, streams within the FTBMI land boundary are important for the viability of salmonids like steelhead trout. The Santa Clara River and Big Tujunga Creek, for example, have high quality spawning, rearing, or refugia habitat. Improved connectivity to high quality habitat would bolster the viability of steelhead trout populations. Barriers for fish passage that, if remedied, could improve diversity and viability of steelhead trout within the FTBMI land boundary includes the Santa Felicia Dam. In the Los Angeles River Watershed, the viability of steelhead populations could be further bolstered by improved connectivity to Big Tujunga Creek. However, Steelhead within FTBMI are extremely vulnerable to extinction and, in most recent assessments, did not meet population density viability criterion (National Marine and Fisheries Service, 2023).

Native Habitat

The resilience of floristic cultural resources in the FTBMI land boundary is affected by drought, fire, invasive species, the timing of precipitation and flood events, and factors not related to climate change, like land use change. Studies of the impact of climate change to California's vegetation, overall, have found that 63-69% of the Los Angeles region's vegetation will be stressed by climate change by the end of the century under a business-as-usual trajectory with substantial reductions in the area that is stressed if Paris Agreement goal of 2° C are achieved (Thorne et al., 2016). Plant species that are rare (small number of patches and found within a small area) and threatened by land use change will be the most threatened under climate change (Rose et al., 2023).

There are few studies that predict the effect of climate change to individual species of interest within the FTBMI land boundary. Those that do exist statewide, are highlighted within the text. As a result, this section focuses on the impacts of climate change on plant communities that contain the majority of culturally significant species (Table 2). Climate change vulnerability assessments by the California Department of Fish and Wildlife (Thorne 2016) analyzed biological traits of the dominant species of plant communities throughout California to estimate sensitivity to changes in climate and the ability for those plants to adapt, along with the exposure to changing climate, and the required migration plants will require to adapt. These scores are combined to provide vulnerability rankings for vegetation classifications and are included within each type below.

Mixed Conifer Forests are present within the higher elevations (primarily in the Angeles National Forest) of the FTBMI land boundary and are islands of habitat, separated by shrubland communities. Tree species found in Mixed Conifer Forests include a mix of conifers (pines, firs, and cedar) and oak species. Amongst many other plants, pines (Pinus spp.) provide many food and other cultural uses for the FTBMI. Local fire suppression has caused canopies to close in many of these mixed conifer

Vegetation Type	Area (SQ MI)	% Area
Annual Grassland	7.49	3.39%
Oak Woodland	0.33	0.15%
Costal		
Sage Scrub	26.87	12.17%
Riparian	2.01	0.91%
Chaparral	38.49	17.44%
Mixed Conifer	57.95	26.25%
Sagebrush – Desert Scrub	37.73	17.09%
Cropland	8.38	3.79%
Orchard & Vineyard	1.01	0.46%
Urban	40.48	18.34%
Total	220.75	100%

Table 2. Percent land cover classifications within the FTBMI land boundary.
Source: California Gap Analysis Project, CDFW.

forests; moderate fire frequencies (every 15-30 years) create a more open forest and higher diversity. (Barbour, M.G., 1988). Mixed conifer forests sequester carbon and provide habitat and wildlife corridors; they are essential for recreation and respite for many in neighboring urban areas.

These forests are under threat from a suite of rapidly intensifying stressors and disturbances, including many that have strong climate connections. Specific threats include the most rapid climate warming in the US; one of the most variable precipitation regimes in the US; persistent, long-term droughts; the highest ozone pollution levels in the nation; increasingly large and severe wildfires; massive levels of habitat loss due to urban and suburban expansion; and an expanding list of damaging invasive species." (Climate Science Alliance, 2023). Under warmer and drier conditions with fires that eliminate seed banks within these islands, mixed conifer ecosystems may be replaced by oak, chaparral, and grassland plant communities (White & Long, 2019). The California Department of Fish and Wildlife's "A Climate Change Vulnerability Assessment of California's Vegetation" study ranked Mixed Conifer Forests vulnerability as Moderate vulnerability to projected climate change (CDFW, 2016).

Oak Woodlands cover over 8 million acres in California's Coast, Transverse, and Peninsular Mountain Ranges at elevations up to 9000 feet; about 10% of California are covered by oak woodlands. (California Institute for Biodiversity & Rancho Santa Ana Botanic Garden, 2008). Oaks are also keystone species of woodland areas providing food, cover, nesting places and other habitat to hundreds of insects and other animal species. Oak woodlands in California are home to over 5,000 species of insects and 330 amphibians, reptiles, birds, and mammals (Atlas of the Biodiversity of California, 2023). More than 1,500 species of plants are associated with Oaks in California. Amongst many other plants, oak species (Quercus spp.) provide many food and cultural uses for the FTBMI. Acorns and the many oak woodland plant and animal species were long a source of sustenance for native and indigenous people.

While oak trees often succumb to long-term drought, the evergreen leaves of healthy oaks stay rigid and do not dry out during prolonged summer dry seasons. Deciduous valley oaks, with thinner leaves, can have remarkably deep roots that protect trees during drought periods. In recent decades, historic droughts, invasive species, and grazing have led to less recruitment of native oak seedlings. Fires can also clear shrubs and other low growing plants in oak woodlands favoring annual exotic grasses and the high severity fires they precipitate. High severity fires can kill oak trees. Low severity fires like those used by tribes on the other hand, likely benefited recruitment of oak saplings (Pavlik et al, 1991). Land use change, nitrogen deposition, and invasive species are all expected to have negative impacts on acorn recruitment and oak woodland health. The California Department of Fish and Wildlife's "A Climate Change Vulnerability Assessment of California's Vegetation" study ranked Oak woodlands as Moderate vulnerability to projected climate change (CDFW, 2016).

Coastal Sage Scrub (CSS) is a unique plant community found along the coastal areas of the FTBMI land boundary that consists of drought deciduous shrubs, forbs, and grasses. Amongst many other plants, sages (Salvia spp.) in CSS provide many cultural uses for the tribe. The plant community has been highly reduced and threatened due to urban encroachment, invasive species, frequent fire, and habitat loss (A. Syphard et al., 2018). Climate change will further compound losses of this threatened ecosystem. Fire is predicted to increase in frequency and severity due to climate change, resulting in loss of biodiversity, change in plant cover, and altering plant species dynamics (Keeley and Syphard, 2016). Furthermore, extreme drought following fire facilitates type conversion of CSS to invasive annual grassland. Type conversion in CSS is exacerbated by nitrogen deposition (Kimball et al., 2014). Altered rainfall patterns may also shift competitive dynamics between native vegetation and invasive grasses in which invasive grasses may flourish under drought conditions (Goldstein & Suding, 2014). In the broader region surrounding the tribal territory, projected land use change is also a threat to CSS and will compound loss of CSS as a result of climate change (Riordan & Rundel, 2014). Under assumptions that

include projected land use change, unlimited dispersal of species, and a warmer, wetter future, 82.6% loss of CSS is expected in the South Coast by 2080 (Riordan & Rundel, 2014). The California Department of Fish and Wildlife's "A Climate Change Vulnerability Assessment of California's Vegetation" study ranked Coastal Sage Scrub as Mid-High vulnerability to projected climate change.

While many plant species found in the Coastal Sage Scrub plant community are also found in chaparral, chaparral is a denser shrub-dominated plant community found farther inland and generally adapted to drier, hotter conditions. Climate change, frequent fires, nitrogen deposition, and drought threaten the resilience of this plant community through type conversion to invasive herbaceous cover (Park et al., 2018; A. D. Syphard et al., 2019). Under increased fire intervals (particularly those that occur in or adjacent to highly urbanized areas) and extreme drought, chaparral plant community structure will be altered, favoring those species whose seeds germinate only after fire (facultative) over non facultative species, and chaparral density will be reduced (Lucas et al., 2017). California Department of Fish and Wildlife's "A Climate Change Vulnerability Assessment of California's Vegetation" study ranked Chaparral as Moderate vulnerability to projected climate change (CDFW, 2016).

Wetlands and riparian woodlands in the tribal territory vary widely from seasonal wet vernal pools to streams, creeks and coastal wetlands that can be wet year-round. Riparian areas may dry by summer but high water tables often keep trees like cottonwoods, sycamores, alders, and willows thriving throughout the dry months. Throughout much of urban and suburban Southern California, riparian vegetation has been removed for flood control channels and culverts and agricultural, commercial, industrial, and residential uses have depleted once plentiful groundwater sources and the plants and animals dependent on that water. (Atlas of the Biodiversity of California, 2023). Riparian wetlands locally were once breeding grounds for anadromous fish such as steelhead trout that returned to our rivers from the ocean to breed. Estimates of the loss of wetland and riparian woodlands in California are estimated to be over 90 percent since European Colonization. Wetlands in California will be further impacted by climate change. A study in the Santa Clara River Watershed observed increased riparian woodland mortality as a result of the 2012-2019 drought period and the declining groundwater levels (Kibler et al., 2021). A 2018 study from UCLA found that due to climate change, many coastal California wetlands could be destroyed due to development, pollution, and climate change related sea-level rise in the next 75 years (Thorne, et al., 2018). The California Department of Fish and Wildlife's "A Climate Change Vulnerability Assessment of California's Vegetation" study rated Riparian plant communities as Mid-High vulnerability to projected climate change (CDFW, 2016).

CH.03 | FTBMI Community Concerns Across the FTBMI Land Boundary

3.0 Overview

As part of FTBMI's Climate Resiliency Framework, FTBMI surveyed residents within the tribal territory to gather public opinion regarding the impacts of climate change. The survey was distributed primarily at tribal events and gathered over 1,750 responses, of which 322 respondents lived within the FTBMI Tribal Territory. The study invited participation from both the general public and tribal members. A full analysis of the survey results can be found in Chapter 2 - Public Engagement Overview and Survey Results. Although the survey touched on various climate change-related topics, this section hones in on the specific findings regarding drought, wildfire, and flooding.

In the survey, respondents were requested to rank these concerns based on their level of concern, and Figure 11 illustrates the number of respondents who ranked each concern as their top priority (#1). It is evident that wildfire and drought were frequently identified as a pressing climate change concern. In contrast, flooding received the least number of high rankings suggesting it is of less concern to the respondents. This discrepancy in concern levels may be attributed to the region's historical experience with droughts and wildfires, which has drawn more attention and resources in recent years, while flooding events have been less prevalent.

Respondents were also prompted to identify climate change concerns that had significant impacts on tribal ecological knowledge and practices. Figure 12 illustrates that the perceived impact of wildfire (n = 50) and drought were closely tied (n = 49), with floods following closely behind but still registering a substantial number of responses (n = 38). Possible explanations for this difference include that both wildfire and drought can lead to the loss of culturally significant native habitat, underscoring their shared impact on tribal practices and ecological understanding. Wildfires in particular receive a lot of media attention and leave a highly visible scar on the landscape, which may contribute to their higher perceived impact. However, floods, while also concerning, may not have the same direct and immediate effect on these cultural and ecological aspects.

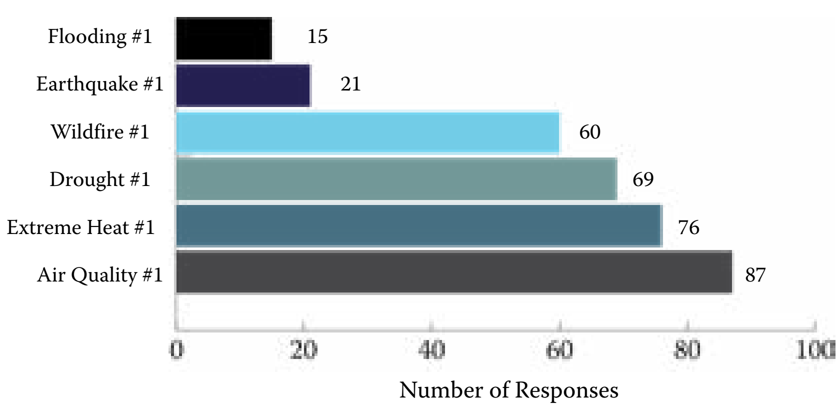


Figure 11. Most Pressing Climate Change Concerns

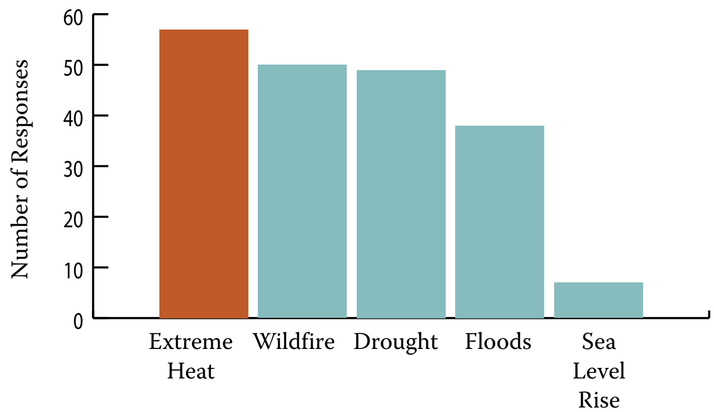


Figure 12. Climate Impacts of Concern: Tribal Ecological Knowledge and Practices.

3.1 Drought Concerns

To gain insight on the community's priorities in the topic of drought, respondents were asked to rank eight pre-selected drought-related concerns within the local community on a scale of 1 to 8, with 1 indicating the highest concern and 8 the lowest. The resulting rankings are depicted in Figure 13. These findings reflect the nuanced perspectives of the community, shedding light on the varying levels of importance placed on different aspects related to drought in the local area.

Notably, "Drinking Water Availability" emerged as a primary concern with an average ranking of 2.9. Nearly a third of respondents ranked it as their top concern (33%, n = 106). This highlights the critical significance of accessible drinking water during drought periods. "Water for food production," with an average rank of 3.1, and "Water for wildfire suppression," with an average rank of 3.2, closely followed as the second and third priorities, respectively. These rankings underscore a notable degree of concern within the community for actions aimed at mitigating the heightened wildfire risk during drought conditions.

In contrast, "Water Recreation" (average ranking of 7.0) and "Regulations Impacting Access to Water" (average ranking of 6.3) were consistently positioned as the least concerning drought-related topics. This is highlighted by the substantial 44% of respondents (n = 144) who designated "Regulations Impacting Access to Water" as their lowest concern. This finding suggests that, within the context of this community's drought-related concerns, recreation and regulations affecting water access are not a primary focus of apprehension for residents. It implies that other aspects of drought, such as securing drinking water or addressing wildfire risks, take precedence in their considerations.

Respondents (n=61) were asked about their level of concern regarding the impact of drought on tribal practices (Figure 14). They were asked to rate this concern on a scale from 1 to 5, with 1 indicating the least concern and 5 signifying the highest level of apprehension. On average, respondents expressed a substantial level of concern, with an average score of 4.3. This high average score underscores the significant impact that drought is perceived to have on tribal practices, reflecting a shared sentiment among the community members regarding the importance of addressing this challenge effectively.

3.2 Wildfire Concerns

Likewise, respondents (n=61) were inquired about their level of concern related to the influence of wildfires on important tribal places. On average, respondents indicated a considerable level of concern, with an average score of 4.2 (Figure 15). This elevated average score highlights the significant impact that wildfires are believed to exert on tribal practices. This elevated average score serves as a meaningful indicator of the widespread recognition within the community of the critical importance of addressing the challenges presented by wildfires. It underscores the urgency of safeguarding important tribal places from the adverse effects of these natural disasters and signals a collective determination to protect the cultural and ecological heritage deeply rooted in these locations.

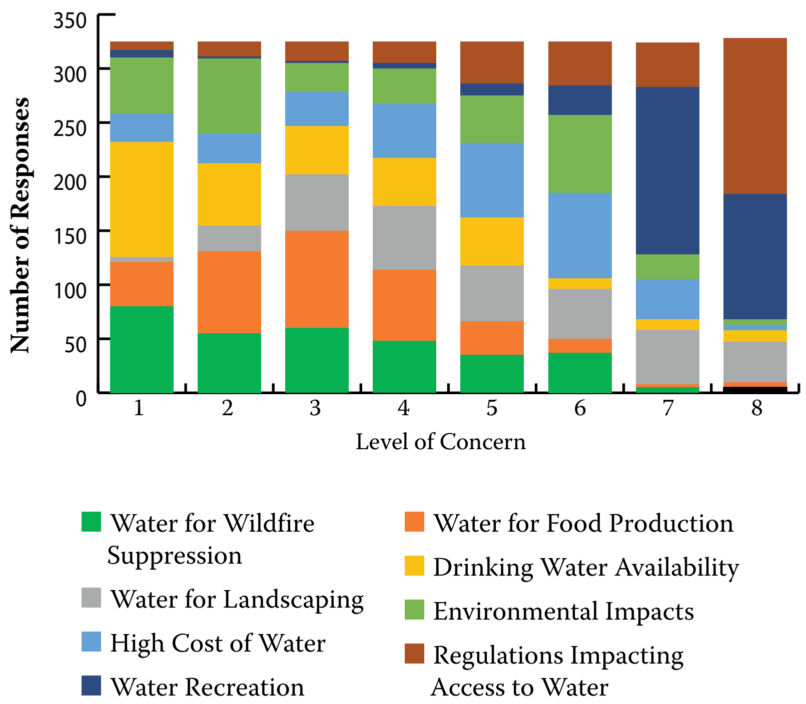


Figure 13. Greatest drought-related concerns in the local community.

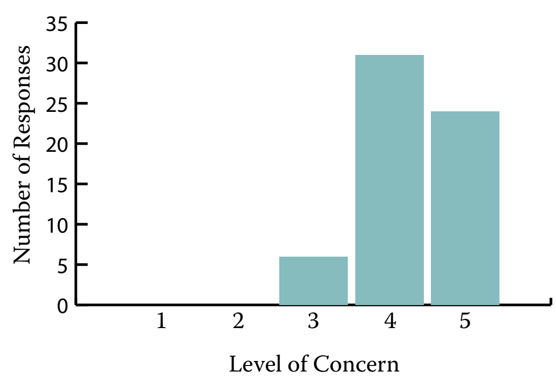


Figure 14. Level of concern of drought conditions on tribal practices.

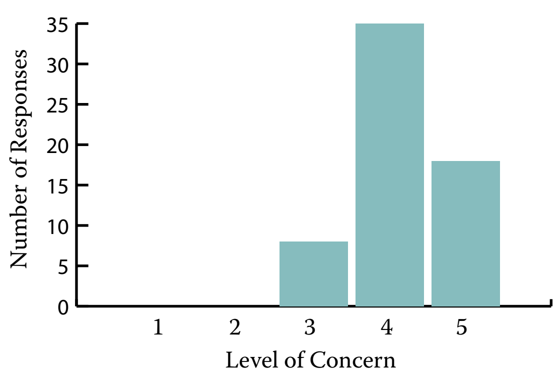


Figure 15. Level of concern of wildfires on important tribal places.

Energy Resilience Planning Report

CH.01 | Energy Resilience Plan

1.1 Overview

The primary sources of energy used by households in the U.S. include electricity, natural gas or propane, and gasoline or diesel fuels derived from petroleum. Natural gas is primarily used for heating and cooking, while petroleum products are mostly used for transportation. These types of energy derived from fossil fuels are some of the primary emissions sources of GHG's, which have been identified as leading causes of climate change. Despite their contribution to climate change, fossil fuels remain integral to the U.S. economy. They are especially vital for transportation, heating, and back-up power generation. As the costs of emerging technologies like electric energy storage systems, electric vehicles, and heat pumps continue to decrease, both households and industrial sectors are likely to shift towards greater reliance on electric energy, reducing the demand for fossil fuels. This energy resilience plan prioritizes electricity due to its critical importance across various industry sectors. In households, electricity is essential for cooling, heating, lighting, communications, electronics, medical equipment, and certain forms of transportation. Furthermore, electricity is unique in that it incorporates a significant share of renewable sources, such as hydro, solar, and wind energy.

1.2 Electric Generation Transmission and Distribution System

The electrical energy infrastructure system starts with power-generating plants powered by coal, natural gas, hydro, nuclear, geothermal, solar, and wind energy sources. High-voltage electric power is transmitted from the generation source to nearby electric substations. Figure 1 shows the electric transmission system and substations within the FTBMI land boundary. From the substations, power is transmitted to end-users via the distribution network at lower voltages. Figure 2 shows the distribution circuit system on Southern California Edison's (SCE) service territory within the FTBMI land boundary.

An increasing number of utility customers with solar PV installations are becoming power generators within the distribution system by feeding unused solar energy back into the grid. Figure 2 also illustrates the varying capacities for solar PV integration on each circuit, available to residential and commercial customers in SCE's service territory.

1.3 Electric Utility Service Territories

The majority of residents living within the FTBMI land boundary receive their electric service from SCE or Los Angeles Department of Water and Power (LADWP). Figure 3 shows all five electric utilities providing service within the region. SCE is a privately owned and operated utility, while LADWP is a publicly owned utility, thus the electric tariffs may be different between the two. These differences include energy and service rates, rebates, discounts, solar PV installation and interconnection rules, etc. Increased amount of renewable energy in the grid power mix, not only results in less GHG emissions, but greater resilience as well, due to the fact that much of the renewable energy generation is geographically distributed rather than centralized, and more diverse in terms of generation technologies.

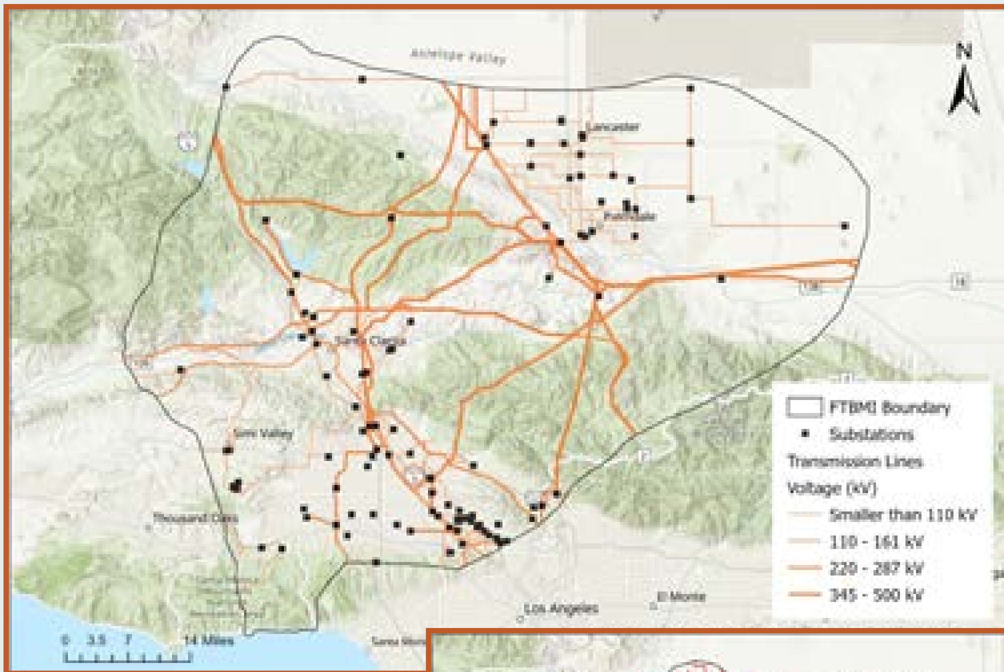


Figure 1: Electric transmission lines and substations on FTBMI land boundary
Source: California Energy Commission

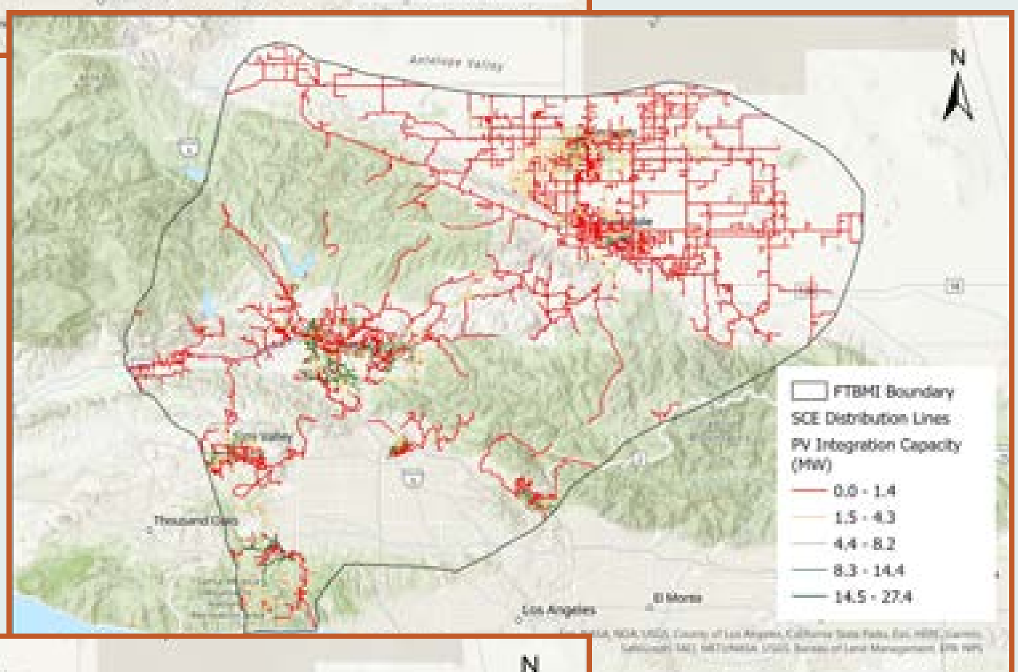


Figure 2: Southern California Edison electric distribution system on FTBMI land boundary
Source: Southern California Edison

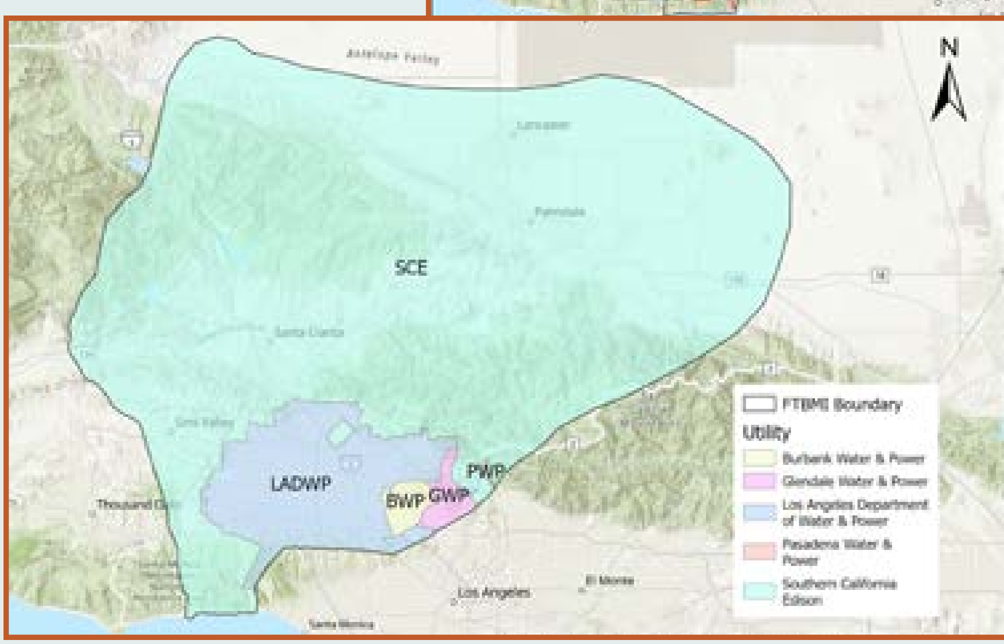


Figure 3: Electric utility companies providing service on FTBMI land boundary
Source: California Energy Commission

CH.02 | Vulnerability Assessment of Energy Infrastructure within FTBMI Land Boundary

2.1 Climate Change Outlook

According to California's Fourth Climate Change Assessment for the Los Angeles region in California, the area will experience further warming in the future, with average maximum temperatures anticipated to rise by approximately 4-5 degrees Fahrenheit by mid-century. Additionally, the assessment predicts an increase in extreme temperatures and a rise in the number of extremely hot days across the region, as well as an increase of wildfire events (Hall et al., 2018). According to the LA County Climate Vulnerability Assessment Report there will be a rise in the frequency, severity, and length of extreme heat, and heat waves, with Santa Clarita and San Fernando Valleys experiencing the largest increases in extreme heat. Wildfires will become more frequent, more extensive, and more damaging, particularly in the San Gabriel Mountains, where the wildfire burn area may increase by as much as 40% by mid-century. Rainfall patterns will be altered; increased concentrations of rainfall over shorter durations will heighten the risk of inland flooding, and this may cause subsequent landslides and mudslides (County of Los Angeles, 2021).

Figure 4 (left) shows the annual average daily maximum temperature baseline (from 1961 to 1990) for FTBMI land boundary region, compared to mid-century (from 2035 to 2064) projections (right), under high GHG emissions scenario (RCP 8.5). The data represents the average of four climate models (HadGEM2-ES, CNRM-CM5, CanESM2, MIROC5). The mean baseline temperature for the region is 73.2 degrees F, while the projected mean mid-century is 79.2 degrees F, resulting in an increase of 6 degrees F by mid-century from baseline.

2.2 Extreme Heat

The FTBMI land area is already experiencing extreme heat events with accompanying consequences. The impacts of extreme heat on infrastructure and facilities are diverse and widespread. During heat events, increased electricity demand for air-conditioning can lead to electric power outages due to inadequate energy supply, leading to service disruptions and a chain of subsequent events. Among the electric energy infrastructure that is most susceptible to extreme heat are transmission lines and power plants. Heat can cause transmission lines to lose carrying capacity by sagging, while substations can lose operating capacity and overload due to the extreme heat and increased demand. Extreme temperatures can also decrease the efficiency and output of natural gas-fired and solar PV power plants. Extreme heat events lead to

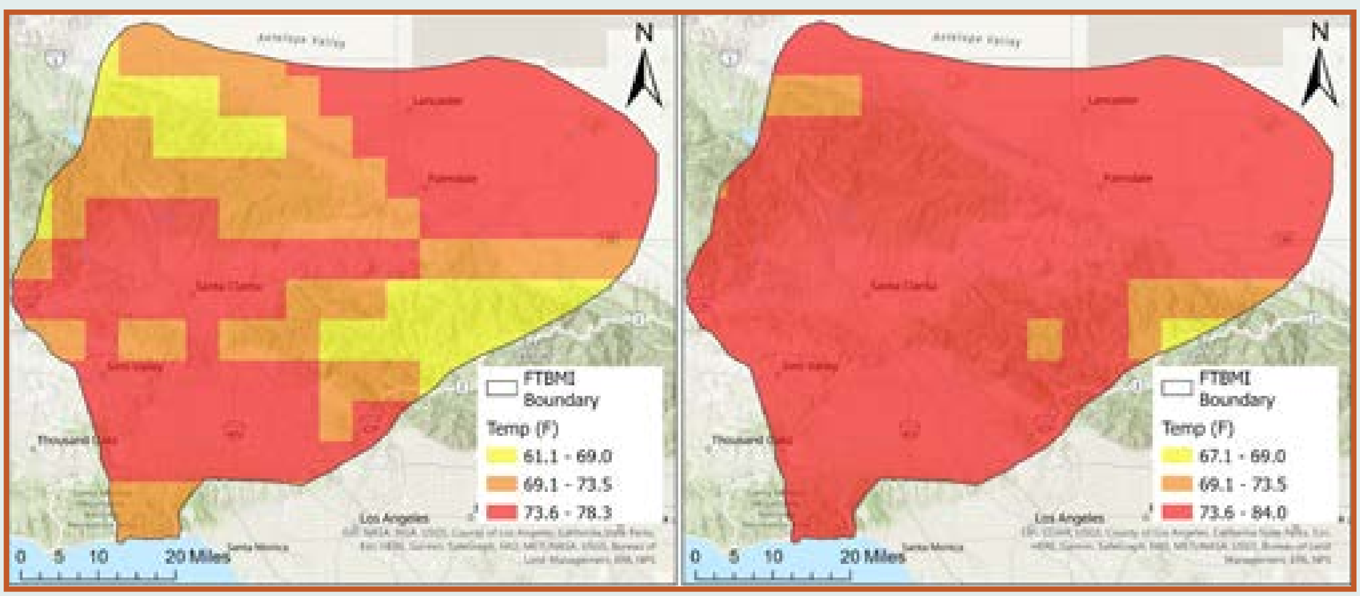


Figure 4: Average maximum daily temperature, historic (left) vs mid-century RCP 8.5 (right)
Source: Cal-Adapt, Scripps Institution of Oceanography – University of California San Diego

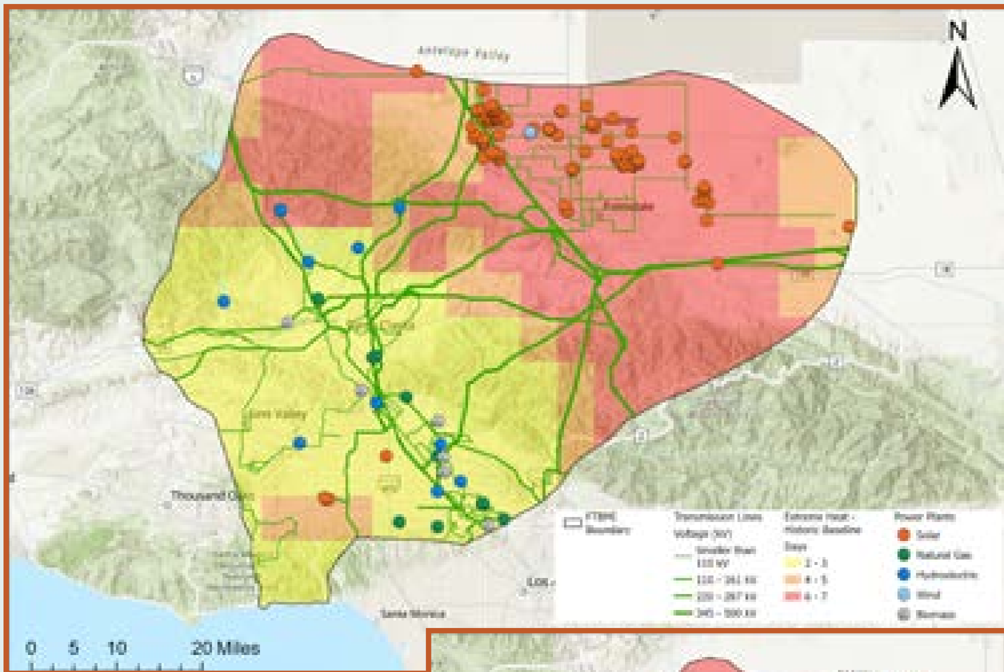


Figure 5: Energy infrastructure and extreme heat days per year, baseline (1961-1990)
Source: Cal-Adapt, Scripps Institution of Oceanography – University of California San Diego

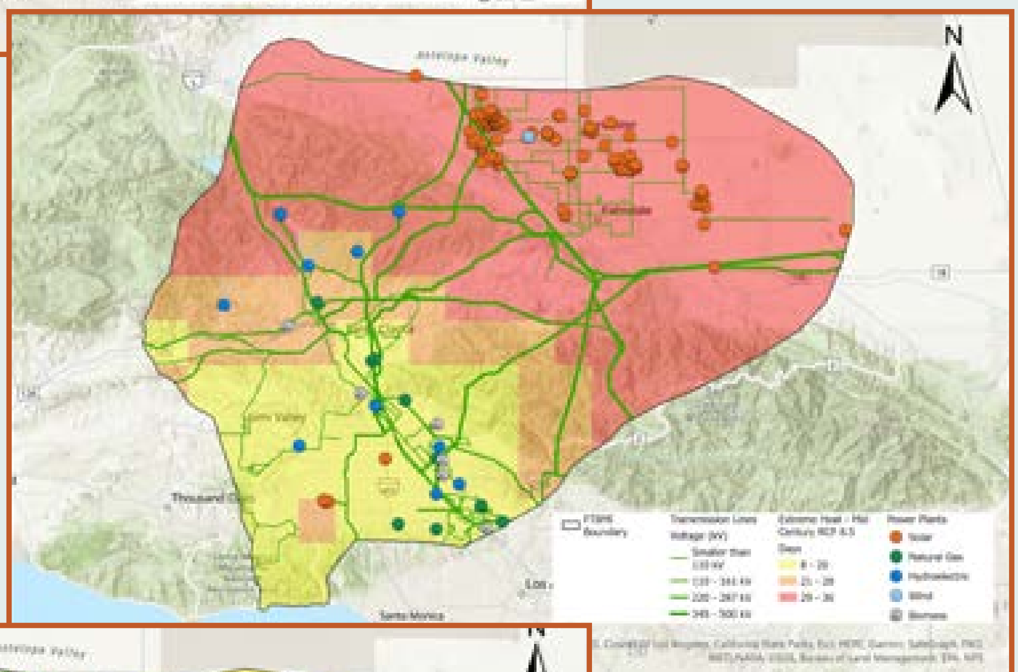


Figure 6: Energy infrastructure and extreme heat days per year, mid-century RCP 8.5
Source: Cal-Adapt, Geospatial Innovation Facility

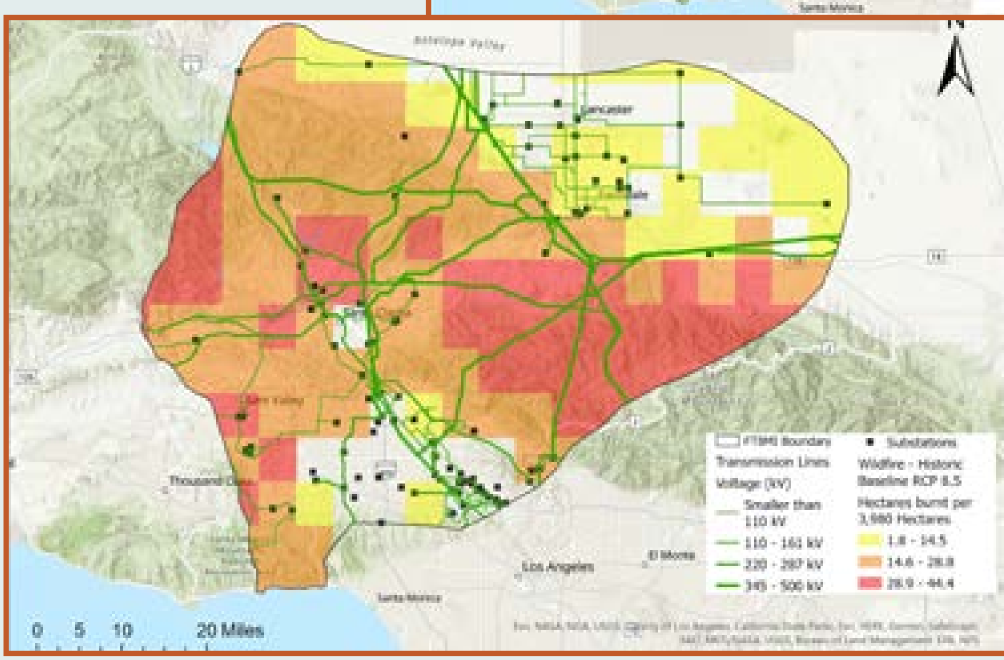


Figure 7: Energy infrastructure and wildfire, historic baseline (1961-1990)
Source: Cal-Adapt, University of California Merced

an electric energy supply-demand imbalance due to the reduced electric energy generation efficiency of plants and increased demand of energy needed for air-conditioning.

Figure 5 shows the baseline number of extreme heat days per year for the FTBMI land boundary, based on the average of 32 climate models. An extreme heat day is defined as a day when the maximum temperature exceeded the 98th percentile of daily maximum temperatures for years between 1961 and 1990 and the months of April through October.

Figure 6 shows the projected number of extreme heat days per year for mid-century under RCP 8.5 scenario. There is a notable increase in the number of extreme heat days per year in the Santa Clarita, San Fernando and Antelope Valleys, where major transmission lines could be impacted.

2.3 Wildfire

A large area within the FTBMI land boundary is highly vulnerable to wildfires, which can have severe

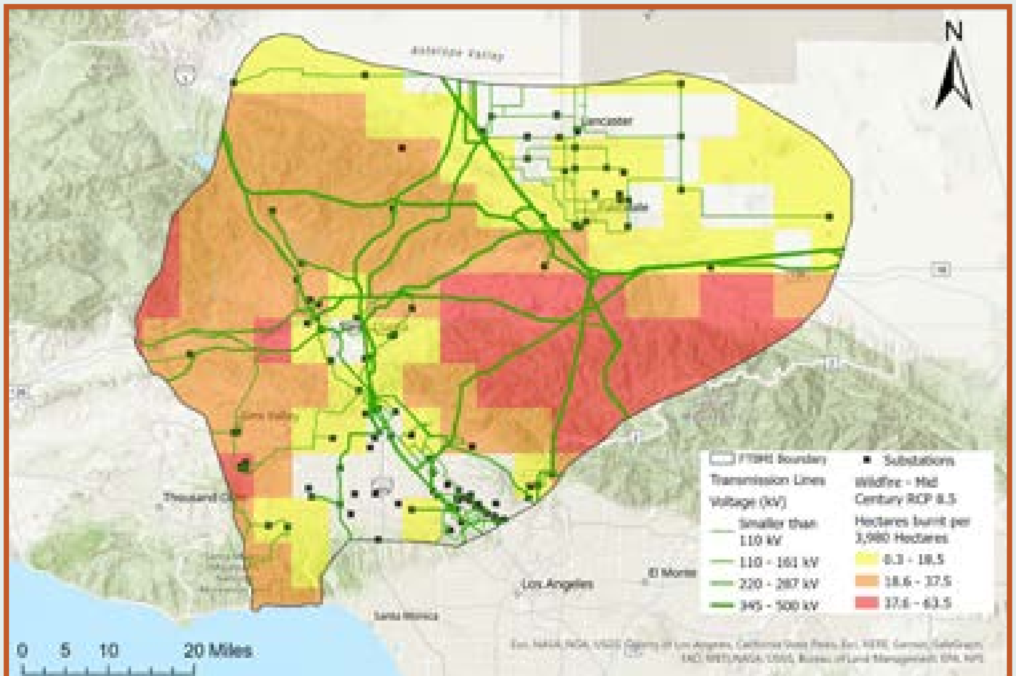


Figure 8: Energy infrastructure and wildfire, mid-century RCP 8.5-high population growth scenario
Source: Cal-Adapt, University of California Merced

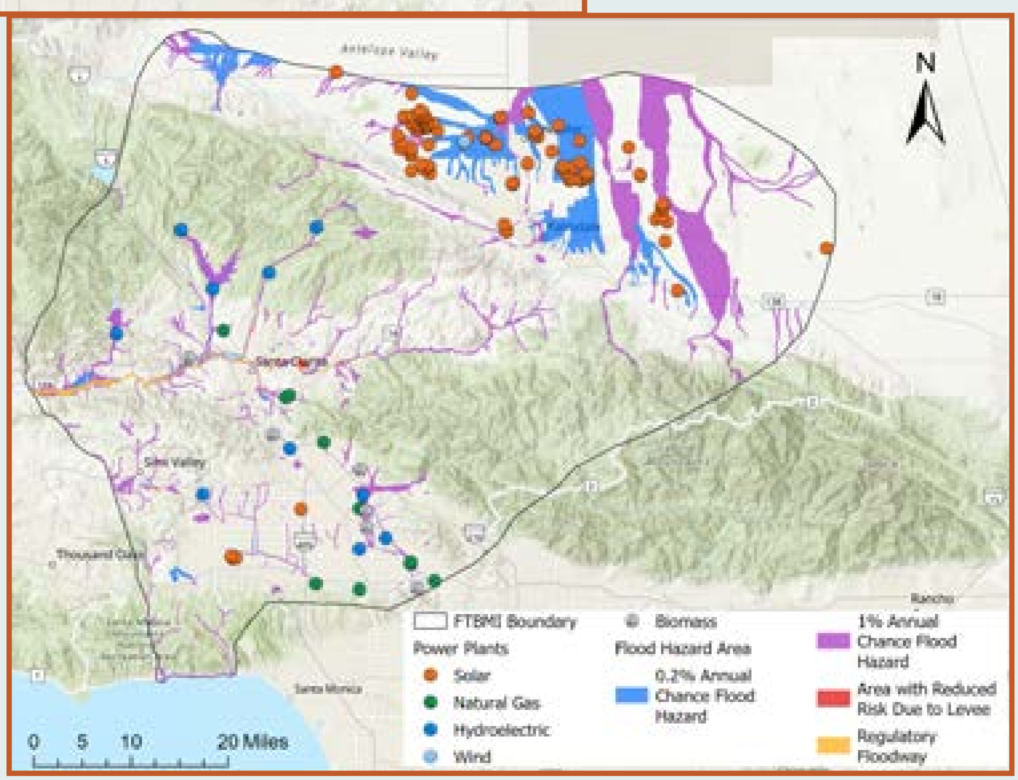


Figure 9: Power plants and FEMA flood hazard map for FTBMI land boundary
Source: Cal-Adapt, University of California Merced

consequences by harming physical structures and disrupting essential services, leading to power loss and communication breakdowns during and after a wildfire occurrence. When a wildfire breaks out, trees and other plants can collapse on power lines, damaging or snapping them, and the heat from the fire can cause power lines and transformers to fail. These events can cause significant harm to electrical infrastructure, resulting in safety hazards, power failures, and expensive repairs. It is crucial for utility companies to take preventive measures to reduce wildfire risks, such as inspecting and maintaining electrical equipment regularly and implementing strategies to prevent vegetation from growing near power lines.

The Los Angeles and Ventura counties have experienced large wildfires in the past with devastating effects. Furthermore, the frequency and extent of wildfires are expected to increase in the future due to extreme heat and drought events. Figure 7 shows the number of hectares burned annually per 3,980-hectare area for the historic baseline of 1961 to 1990. Figure 8 shows the number of hectares burned annually per 3,980 hectares under the mid-century RCP 8.5, high population growth scenario.

2.4 Inland Flooding

Equipment damage to electricity generation and distribution systems can occur due to flooding in inland areas. Such flooding can severely impact infrastructure, and power plants may be unable to function during these events because of structural or equipment damage, or the loss of fuel or water, which can hinder their operations. Furthermore, heavy rainfall and flooding can transport debris into power plants, leading to more damage. When a power plant becomes inoperable, it can have ripple effects throughout the broader energy system.

The flood hazard map, shown in Figure 9, is used by FEMA to identify areas that are at risk of flooding. The map indicates the likelihood of flooding based on factors such as elevation, topography, and historical flood data. The map is used to determine flood insurance requirements and to guide land use planning and development decisions. Figure 9 indicates that there are several power generating plants within the FTBMI land boundary which are on or near areas with elevated risk of flooding.

CH.03 | Impacts to FTBMI Population

3.1 Electric Service Reliability

Electric utilities use two common metrics to assess power reliability to their customers – the System Average Interruption Frequency Index (SAIFI) measures the average number of power outages in a year per customer, and the System Average Interruption Duration Index (SAIDI) measures the average total duration of power outages in a year measured in minutes.

Data in Table 1 represent the SAIFI and SAIDI indices for SCE service areas for the cities of Lancaster, Palmdale, Santa Clarita, San Fernando, and Simi Valley, respectively. These locations experienced roughly one power interruption on average in 2021, except for the Simi Valley which experienced between two and three power interruptions on average. The total duration of power outages in 2021, for these locations was between 2 and 18 hours, as indicated by SAIDI indices. Table 2 shows SAIFI and SAIDI indices for the entire service territory of LADWP, for the period from July 2021 and July 2022. LADWP customers experienced on average 1 power interruption, lasting roughly 2 hours.

3.2 Public Safety Power Shutoff

The Public Safety Power Shutoff (PSPS) is a preventative measure implemented in California to reduce the risk of wildfire caused by electrical power equipment owned and operated by electric utility companies. During extreme weather or wildfire conditions, utilities may temporarily shut off power to specific areas to prevent their electrical equipment from sparking fires. This is done as a last resort when there is a significant threat to public safety due to weather conditions, such as high winds, low humidity, and dry vegetation. Electric utility companies in California, in the

Service Area	SAIFI	SAIDI (min)
Lancaster	1.2	122
Palmdale	1.1	154
Santa Clarita	1.3	432
San Fernando	0.9	329
Simi Valley	2.5	1,093

Table 1: Reliability for 2021

Service Area	SAIFI	SAIDI (min)
LADWP	0.8	115

Table 2: LADWP Reliability for 2021-2022

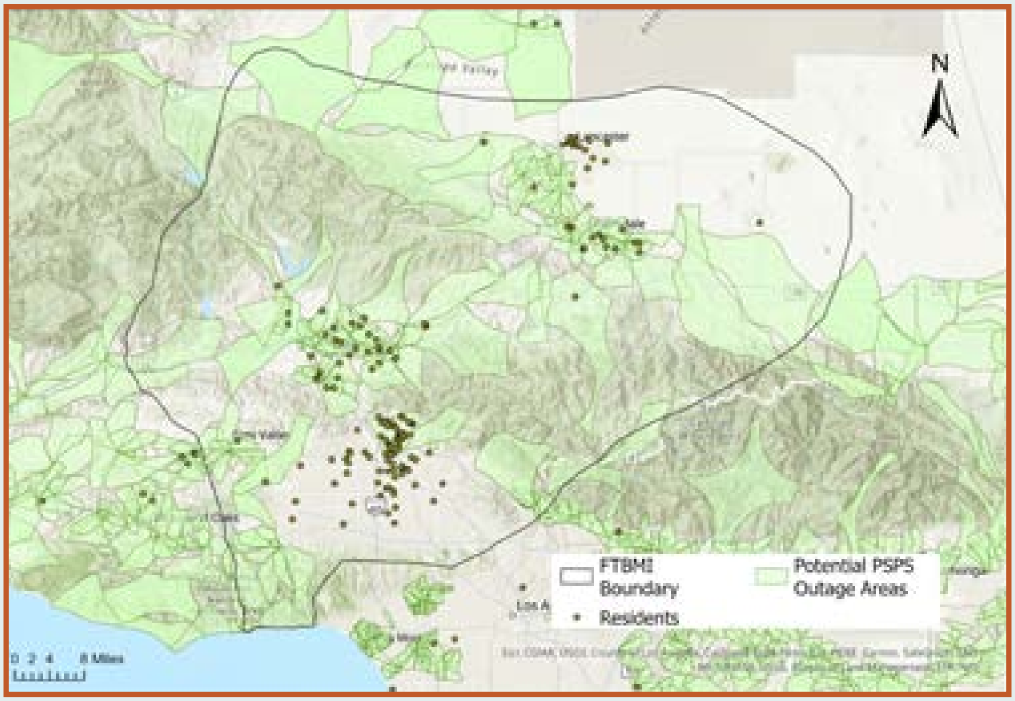


Figure 10: Areas potentially impacted by public safety power shutoffs
Source: CalOES

past several years, have been taking additional measures to reduce the risk of wildfires and the frequency of PSPS events. Some of these measures include grid hardening, infrastructure upgrades, vegetation management, weather monitoring and forecasting, and remote monitoring and operation of grid equipment.

Figure 10 shows areas within the FTBMI boundary, which are identified as potential PSPS outage areas. FTBMI residents in Palmdale, Santa Clarita and San Fernando areas can potentially be impacted by scheduled power outage events initiated by utilities.

3.3 Survey Responses to Questions Related to Electric Power

The general and tribal surveys conducted as part of the project's efforts to assess vulnerabilities and areas of concern with respect to climate change, included questions related to electric power. The responses to those questions are summarized in Figure 11 through Figure 16.

On the question of electric power issues experienced in the past year (Figure 11 and Figure 12), 731 respondents of the general survey and 159 respondents of the tribal survey indicated experiencing power outage. Additionally, 1,008 and 139 of respondents in the respective surveys experienced brownout events. The power outage events are documented and reported by utility companies, as shown in the previous section. However, brownout events, caused by transient voltage drops, are often not reported by utilities. While, in many brownout cases, they do not cause significant power equipment operation disturbances, in some cases they could result in equipment damage. Electrical appliances using motors and sensitive electronic equipment are most susceptible to damage by voltage sags or swells. Fluctuations in voltage such as brownouts on the grid may be caused by increased power demand during extreme heat events, faults and failure in the distribution and transmission grid, and loss of power generation capacity.

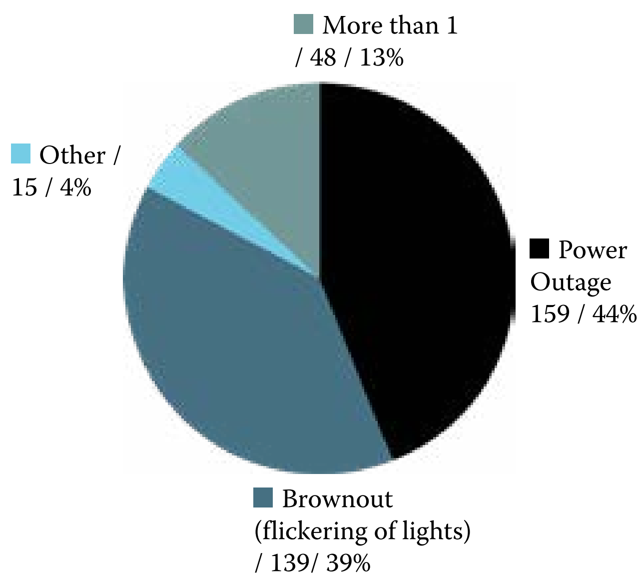


Figure 11: Electric power issues experienced in last year – for respondents within tribal territory

Figure 13 lists specific electrical appliances or equipment, which respondents to the tribal survey would like to be able to power in the event of grid power outage. Among those, the fridge ranks highest, followed by cooling and heating, electronics, internet, cooking, and medical equipment.

Figure 14 shows how strongly respondents to the general survey are concerned about power reliability at their place of residence. While Figure 15 shows how many are concerned about power reliability at their place of residence, among respondents to the tribal survey.

On the question related to response to power outages by the tribal survey respondents (Figure 16), 101 of respondents indicated they have their own back power source, such as a back generator or solar and battery storage system. 217 of respondents indicated they wait at home until grid power is restored.

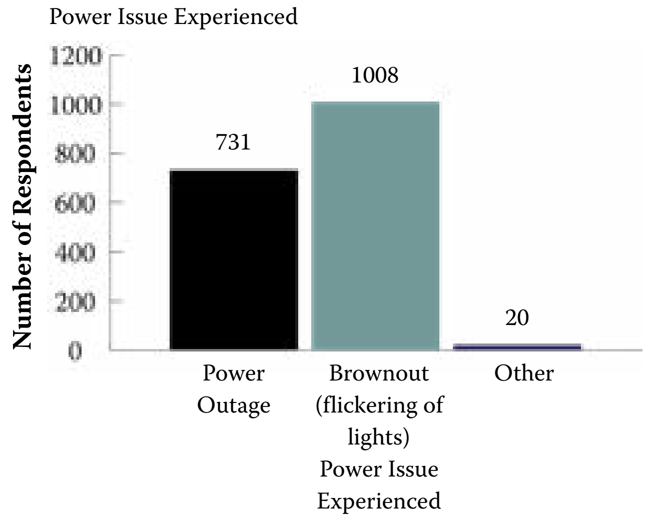


Figure 12: Electric power issues experienced in last year – for respondents within tribal territory

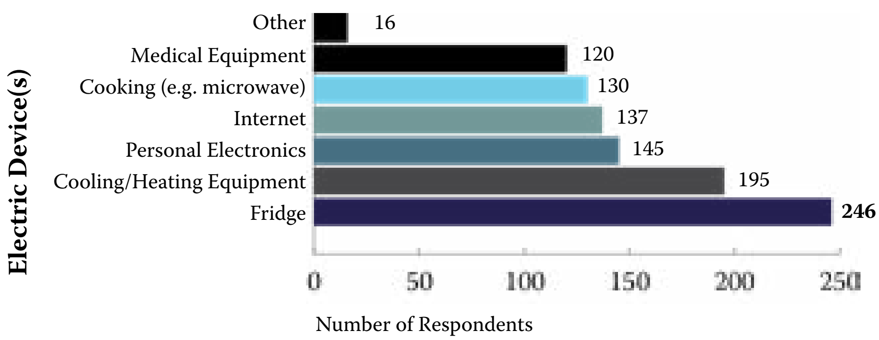


Figure 13: Concerned about not being able to power specific electrical equipment during power – for respondents within tribal territory

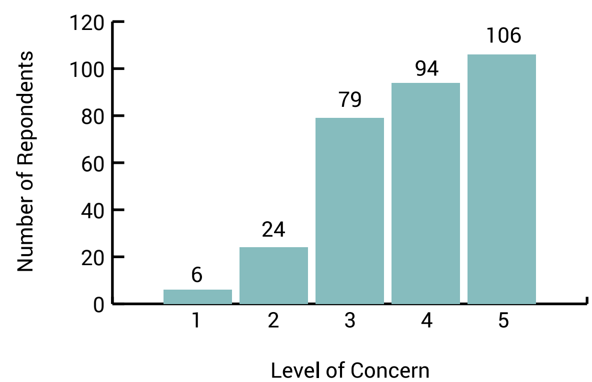


Figure 14: Concern about electric power reliability on scale from 1 to 5 – for respondents within tribal territory

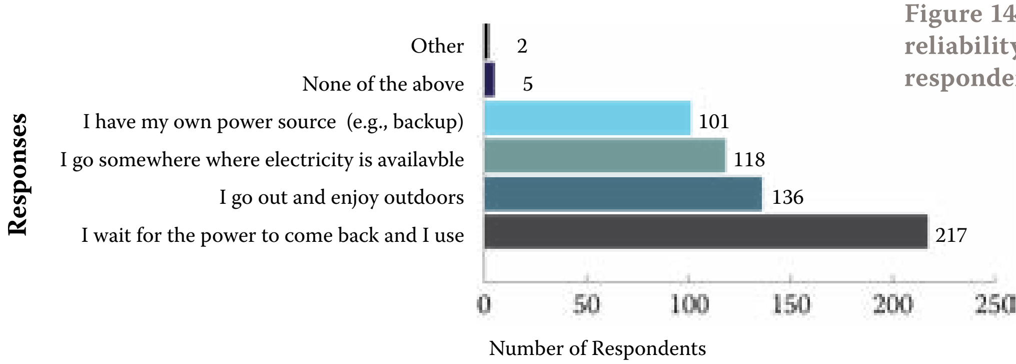


Figure 16: Response to power grid outages lasting longer than 30minutes – for respondents within tribal territory

Resiliency Strategies

Extreme Heat Resilience Strategies

Both the City of Los Angeles' Resilient Los Angeles report and Los Angeles County's Safety Element recommend similar strategies and policies for Tribes responding to extreme heat. One such strategy is the development of a heat emergency response plan that includes identifying heat-vulnerable populations and coordinating with local emergency management agencies. Another strategy is to enhance public awareness and outreach for heat safety through community engagement and educational campaigns. Both reports also recommend the use of green infrastructure, such as urban greening and the creation of green spaces, to mitigate the urban heat island effect. Finally, the reports emphasize the need for partnerships and collaboration between government agencies, Tribes, and other stakeholders to develop and implement effective extreme heat resilience plans.

At the local city level, with the establishment of the Climate Emergency Mobilization Office (CEMO), extreme heat is a major priority for the City of Los Angeles. In 2022, the City of Los Angeles' CEMO spearheaded an innovative community engagement process with hundreds of stakeholders asking, "What are you most worried about regarding climate change impacts?" and the clear answer was extreme heat. Furthermore, CEMO recently undertook community engagement for Los Angeles' first dedicated Heat Action Plan and a Climate Vulnerability Assessment, to which FTBMI was a part of the involved focus groups.

At the state-level, California's 2022 Final Extreme Heat Action Plan is a comprehensive strategy to mitigate the impact of extreme heat events, which are becoming more frequent due to climate change. The plan recognizes the unique vulnerabilities of tribal communities and their reliance on traditional ecological knowledge to adapt to changing environmental conditions.

To engage tribal nations, the plan includes a dedicated section on tribal engagement and consultation, outlining the steps the state will take to consult with tribes and incorporate their perspectives and expertise. Additionally, the plan emphasizes the need to integrate traditional ecological knowledge into heat adaptation strategies, recognizing that indigenous communities have a deep understanding of their environment and its dynamics.

The plan outlines various strategies to address extreme heat events, including expanding cooling centers, increasing tree cover and green infrastructure, improving building codes and standards, and enhancing public outreach and education. For tribal communities, the plan also includes strategies to promote nature-based cooling solutions and address infrastructure needs, such as upgrading housing and improving access to safe water. Overall, the plan emphasizes the importance of collaborative and inclusive approaches to address extreme heat events, recognizing the unique needs and perspectives of different communities, including Tribes. Thus, all of the following recommendations must be considered with incorporated feedback and prioritization by FTBMI's Tribal Elders and Citizens.

Increase tree canopy cover in your community (residents provide water)

Increasing tree canopy coverage within the FTBMI land boundary will help reduce the urban heat island effect in their urban communities, which will not only reduce local temperature but also provide shade for thermal comfort while outside. Residents will tend to and provide water for the trees, but the goal through this recommendation is to provide low-cost or no-cost trees to increase tree canopy coverage in the FTBMI land boundary. Trees offer numerous benefits, including energy savings through shading buildings and reducing ambient temperatures, as well as air pollutant removal, absorption of polluted runoff, and aesthetic enhancements.

The following GIS analysis in Figure 1 and Figure 2, uses a tree coverage tool (LARIAC LIDAR) to show high priority census tracts for increased trees that are also federal Climate & Economic Justice Screening Tool (CEJST) disadvantaged communities census tracts, as well as the approximate locations of Tribal citizen residences, all overlaid on ECOSTRESS land surface temperature data

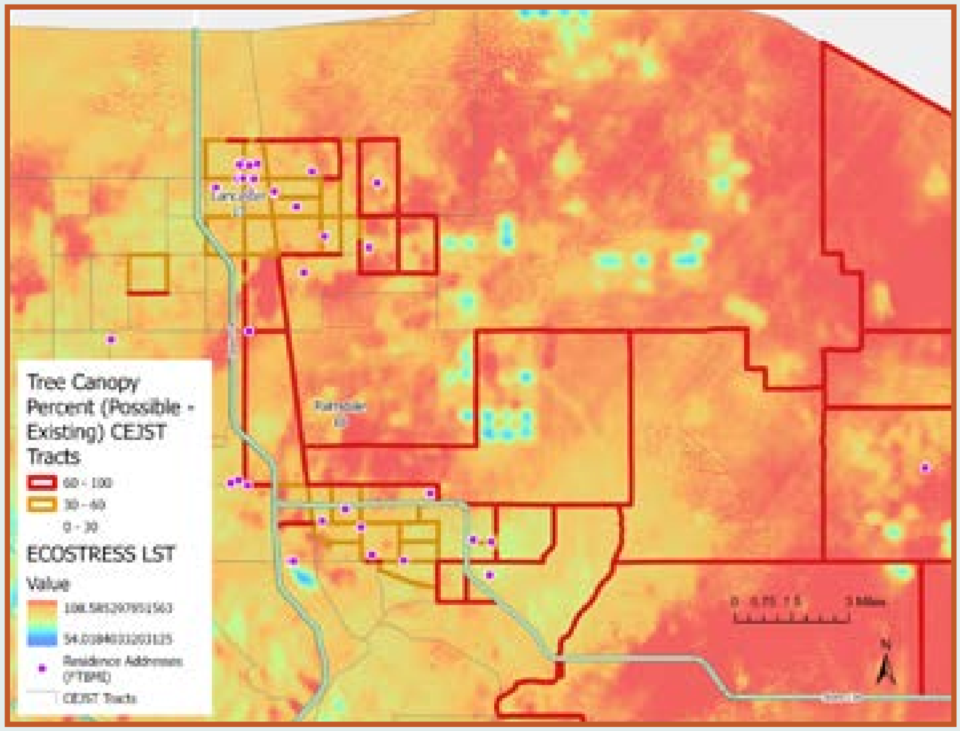


Figure 1: Possible Tree Canopy Prioritization Locations with Land Surface Temperature in Antelope Valley Region of the FTBMI Land Boundary
Source: LA County LiDAR Tree Data, CalEPA, CalEnviroScreen 4.0 and Four Twenty Seven, California Heat Assessment Tool, Council on Environmental Quality Climate and Economic Justice Screening Tool

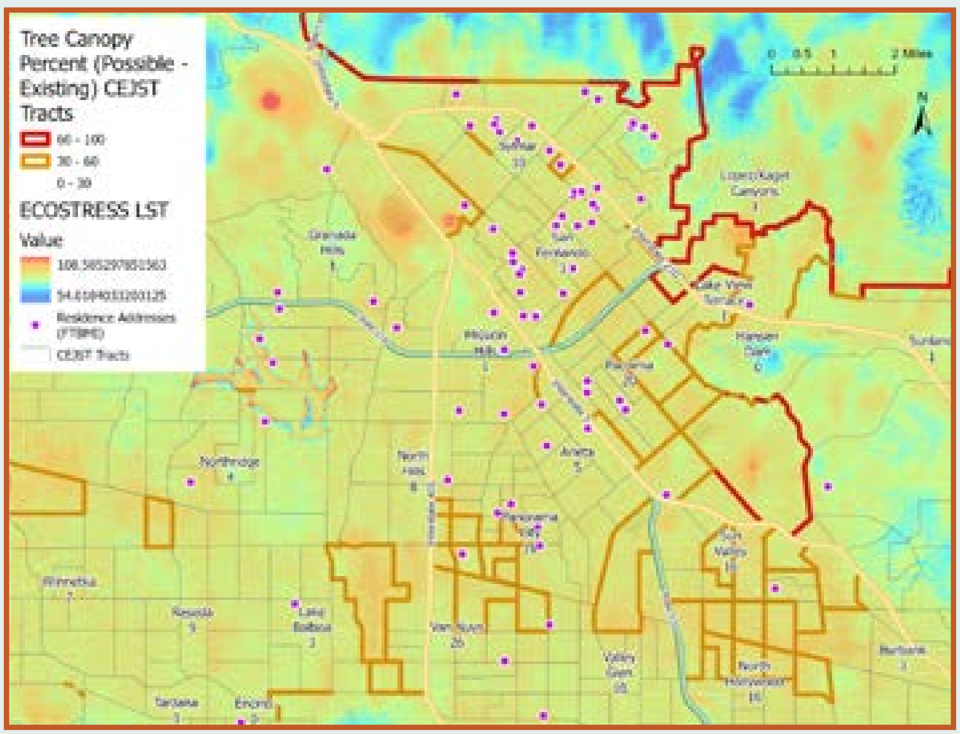


Figure 2: Possible Tree Canopy Prioritization Locations with Land Surface Temperature in San Fernando Valley Region of the FTBMI Land Boundary
Source: LA County LiDAR Tree Data, CalEPA, CalEnviroScreen 4.0 and Four Twenty Seven, California Heat Assessment Tool, Council on Environmental Quality Climate and Economic Justice Screening Tool

which could be used to prioritize areas where additional tree canopy coverage should be prioritized for the Tribe's land boundary and citizens. Some priority areas include Lancaster/Palmdale area first and foremost, as well as Sylmar/San Fernando area, Sun Valley/North Hollywood area, and Panorama City/Van Nuys area.

Different government and private grants could be accessed to fund these tree planting efforts. For example, some recent government grants include the USDA U.S. Forest Service's Urban and Community Forestry Grant and CALFIRE's Urban and Community Forestry Grants. Some recent private grants include ReLeaf's Arbor Week's 2023 Grant.

LADWP offers numerous local programs for customers to reduce the urban heat island and increase shade; and one in particular directly distributes free trees like the City of Los Angeles' City Plants. LADWP has partnered with the Los Angeles City Plants program to fund the planting of 40,000 trees across the city over the next two years. This initiative aims to address the city's low tree canopy cover, which currently averages 21%, well below the national average of 27%. The trees planted under this new agreement will be especially valuable during droughts, as City Plants offers water-efficient shade trees with care recommendations to minimize water consumption.

FTBMI's Tiüvac'a'ai Tribal Conservation Corps can be activated to assist in these urban tree plantings. Given the available tree planting site priority selection mapping analysis, the timeline for the implementation of this recommendation can be short-term, ranging from 6 months to 2 years for actual tree plantings throughout the FTBMI land boundary, although the benefits of the trees may be more long-term given the time it takes for trees to grow to maturity.

Resilience Hubs and other places with air conditioning

Physical infrastructure is important but research has shown that cooling centers, particularly centers that are established for AC during heatwaves, are not a fool-proof model due to low attendance of community members and social cohesion. Moreover, resilience hubs are a new concept of a trusted, community-run space with added physical amenities and programming to help the community survive the brutal shocks of heat waves, earthquakes, and chronic stressors. Resilience hubs/centers are an ideal and innovative replacement for cooling centers as the hub would be at a preexisting gathering place with the community actively engaged in the co-development and operation. Furthermore, with worsening climate change impacts expected in the future, these community-designed improvements to cooling centers and hubs in neighborhoods within the FTBMI land boundary will be vital for the maintenance of community health and bolstering of community resilience especially for those communities that face high temperature days and are socially vulnerable.

The City of Los Angeles CEMO's Heat Action Plan will include a plan to increase resilience hubs/cooling centers in disadvantaged communities, emphasizing the importance of social cohesion in these spaces, fostered by ongoing services and programs for the community. CEMO highlights the City's Recreation and Parks facilities and Libraries as effective channels of communication and outreach to create programming and social cohesion as a priority. CEMO emphasizes the importance of both agency and community-based organizations (CBO) owned and operated hubs, with a need for established trust in potential resilience hub locations, with an emphasis of funding for the communities that are historically disinvested. Using this similar framework, FTBMI can work towards creating co-managed resilience centers with local cities and counties within the FTBMI land boundary as well as acquiring their own land and property for fully Tribe-managed resilience centers.

The following GIS analysis in Figure 3, uses a heat indicator tool (CHAT) to show high priority census tracts for heat that are also CalEnviroScreen (CES) 4.0 disadvantaged communities census tracts, as well as the approximate locations of Tribal citizen residences where resilience centers should be prioritized. Some priority areas include Lancaster/Palmdale area first and foremost, as well as Sylmar/San Fernando and Panorama City/ Van Nuys area. Ultimately the actual site of a resilience center should be an already well-known and well-used

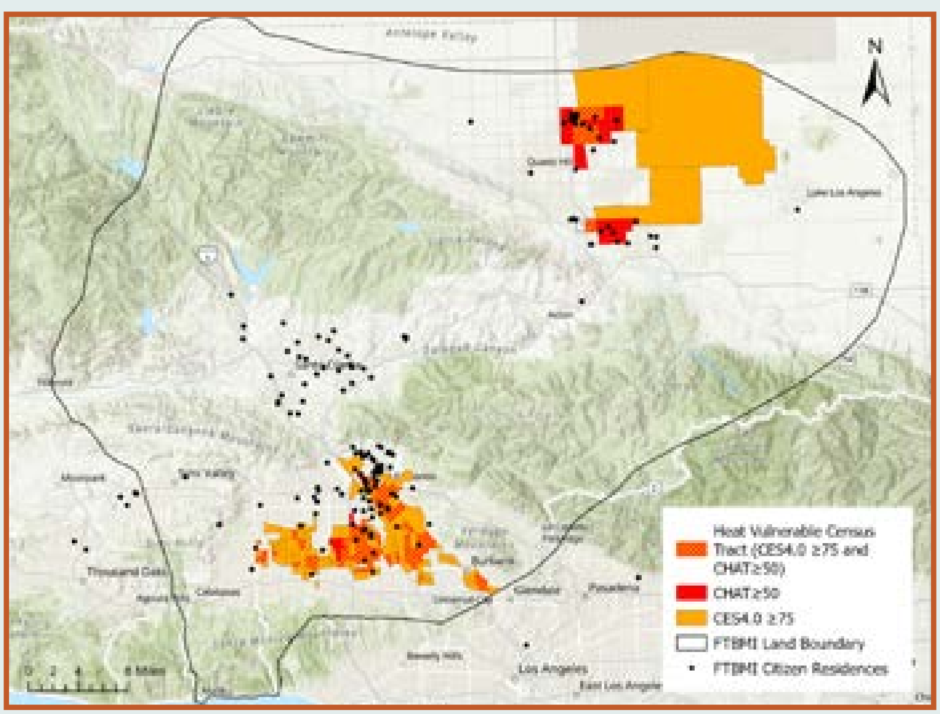


Figure 3: Possible Resilience Hub Prioritization Locations with Heat Vulnerable Census Tracts and FTBMI Citizen Residences in the FTBMI Land Boundary
Source: CalEPA, CalEnviroScreen 4.0 and Four Twenty Seven, California Heat Assessment Tool

community space, which can be bolstered with resilience infrastructure and programming. In addition, while some community sites may be prepared for the implementation of resilience improvements, others may require some pre-implementation planning steps like community engagement, feasibility studies, and site assessments.

Various government and private grants could be accessed to fund these resilience centers. For example, some recent government grants include the EPA Environmental Justice Government-to-Government Program, EPA Environmental Justice Collaborative Problem-Solving Cooperative Agreement Program, and other state programs that directly address resilience upgrades like the Strategic Growth Council's Community Resilience Centers Grant Program and Office of Planning and Research (OPR) ICARP Extreme Heat and Community Resilience Grant Program. Some recent private grants that could supplement these funds through planning include Bay Area Council's California Resilience Challenge.

Since resilience centers would implement multi-climate hazard resilience infrastructure upgrades and programming, it is recommended that various departments of the FTBMI are incorporated into the management and involvement of the center. For example, the Environmental Protections Division can plan and co-manage the utilization of the center, the Tiüvac'a'ai Tribal Conservation Corps can be integrated into workforce development and urban greening, the Paseki Corporation can help with energy infrastructure installations, and the Fernandeno Tataviam Education and Cultural Learning Department (ECLD) can inform and provide programming at the centers. Given the various resilience components that can be incorporated into resilience centers as well as the need for appropriate community engagement in the implementation phase, the timeline for the implementation of this recommendation would likely be middle to long-term (2-5 years) for completion, throughout the FTBMI land boundary, although less-resourced areas may require more time to set up an operational resilience center (5-10 years).

Coordinate and partner with local public agencies to retrofit and upgrade cooling features in public places, streets, and transit services

Coordinating and partnering with local public agencies to retrofit and upgrade cooling features in public spaces is a crucial aspect of enhancing extreme heat resilience within the FTBMI land boundary. By establishing collaborative efforts, tribes can tap into the expertise and resources of public agencies to implement effective strategies given there are various jurisdictions existing within the FTBMI land boundary. There are many avenues for this recommendation, a few of which we discuss below.

Firstly, tribes can initiate communication with relevant local public agencies responsible for urban planning, transportation, and environmental initiatives. This can involve forming working groups or task forces dedicated to extreme heat resilience. These collaborative platforms allow for the exchange of knowledge, needs, and ideas, fostering a comprehensive approach to cooling feature retrofitting. Collaborative design processes that incorporate indigenous knowledge and cultural values ensure that these features are both functional and culturally appropriate. In terms of specific initiatives, partnering with public agencies like local parks and recreation departments or public works departments to install shade structures on streets or shaded bus shelters at bus stops, along with shade structures at parks like shade sails over playgrounds or structures over benches and picnic areas, as well as hydration stations and splash pads at parks and public areas, can significantly alleviate heat stress for the public.

Additionally, another avenue is working with local transit agencies to establish demand-response or paratransit transit services that facilitate access to cooling spaces on extreme heat days. This could involve creating a network of accessible transit options leading to designated spaces of refuge, such as community resilience centers or cooling shelters.

In terms of funding, tribes can leverage various state and federal grants to support these initiatives. For example, some new state grants like the Strategic Growth Council's Community Resilience Centers Grant Program and Office of Planning and Research (OPR) ICARP Extreme Heat and Community Resilience Grant Program can provide funding for infrastructure upgrades and extreme heat resilience projects.

At the federal level, the Environmental Protection Agency (EPA) offers grants through programs such as the EPA Environmental Justice Government-to-Government Program, which aids tribal governments and other local governments in implementing climate resilience feature retrofits with an equity-focused approach. Another federal grant, the Federal Emergency Management Agency's (FEMA's) Hazard Mitigation Assistance (HMA) grants provide funding for projects that reduce disaster risk, which now includes enhancing extreme heat resilience. The Department of Transportation (DOT) also offers grants like the Federal Transit Administration's (FTA) Enhanced Mobility of Seniors and Individuals with Disabilities Program, supporting the development of demand-response and paratransit services, which could be pursued to upgrade accessible transit services in these extreme heat scenarios.

FTBMI can effectively enhance extreme heat resilience by partnering with local public agencies to retrofit and upgrade cooling features in public places and within offered services. Since partnering with local public agencies will require long-term relationship-building as well as engagement with local community to decide the best placement and design of cooling features in public spaces and heat response transit services, this recommendation will include multiple phases with various public agencies throughout a long-term period of 5-10 years, although individual project components like hydration stations and splash pads at parks can be accomplished in a middle to long-term (2-5 year) period. FTBMI's Environmental Protections Division can coordinate and lead these partnerships with local governments and agencies to pursue grant applications together and co-create resilience infrastructure. Other departments of FTBMI can be employed for part of the infrastructure upgrades like the Tiüvac'a'ai Tribal Conservation Corps and the Paseki Corporation. Collaborative efforts enable the integration of indigenous wisdom, cultural significance, and local knowledge into these initiatives. By tapping into a variety of state and federal grants, tribes can secure the necessary funding to implement these projects and create safer, more resilient communities in the face of extreme heat events.

Expand access to at-home heat adaptation resources, like air conditioning and insulation retrofits for homes

Promoting greater awareness of the impacts of extreme heat exposure on vulnerable populations is a crucial component of effective extreme heat resilience planning for FTBMI. FTBMI can implement a multi-faceted approach that combines education, community engagement, cultural events, public health, and partnerships.

Firstly, FTBMI can lead and organize educational campaigns to inform their communities about the dangers of extreme heat and its disproportionate effects on vulnerable groups, like seniors, outdoor workers, Tribal citizens, and those living in poverty or with chronic health conditions. These campaigns could include workshops, seminars, and informational materials that highlight the risks and provide practical tips for staying safe during heatwaves. Collaborations with local health organizations, community centers, and schools can help spread the message effectively.

Community engagement plays a vital role in raising awareness and fostering a culture of preparedness. FTBMI can facilitate discussions and town hall meetings to gather insights from community members, with particular attention to vulnerable groups and Tribal citizens. This community feedback can guide the development of tailored strategies that address the unique challenges these populations face during extreme heat events and ensure that any implemented heat resilience strategies are culturally and socially informed by the experiences of community members.

Leveraging grants will be instrumental in funding the community engagement required for implementing comprehensive resilience plans, such as this one. FTBMI, in partnership with local government and nonprofit organizations, can tap into resources like the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Grant Program or the Office of Planning and Research (OPR) ICARP Extreme Heat and Community Resilience Grant Program. These funds can be used to develop heat action plans, enhance public awareness campaigns, establish community resilience centers, and improve infrastructure that benefits vulnerable populations. Collaboration is key in securing these grants and implementing effective strategies. Tribes can partner with local governments, non-profit organizations, and academic institutions to pool resources, share expertise, and broaden the reach of their initiatives.

Since these awareness campaigns and engagement initiatives are highly community-focused and may require one-on-one interactions, outreach and engagement can be conducted by the Environmental Protections Division and the Fernandeno Tataviam Education and Cultural Learning Department (ECLD) but should ultimately emerge from partnerships.

Encourage the use of cooling methods to reduce the heat retention of pavement and surfaces

One approach to mitigating the urban heat island effect and creating more comfortable environments for their communities, is the use of cool or reflective pavement, surface, and roofing materials. Cool pavements, designed to reflect more solar energy and absorb less heat, help to lower ambient temperatures, reduce heat stress on nearby greenery and trees, enhance thermal comfort, and reduce the energy demand for cooling buildings. This can result in decreased reliance on air conditioning, leading to lower greenhouse gas emissions and reduced energy consumption. By creating cooler and more livable urban environments, cool pavements contribute to improved public health, reduced heat-related illnesses, and enhanced quality of life for residents.

FTBMI can initiate public awareness campaigns to educate residents, businesses, and local authorities about the benefits of adopting cooling technologies, like cool pavements, surfaces, and roofs. Furthermore, pilot projects, workshops, seminars, and demonstration projects within some of the hottest neighborhoods in the FTBMI land boundary (like Sylmar, San Fernando, Lancaster, and Palmdale) can showcase the practical advantages of implementing such measures, including energy savings, improved air quality, and enhanced community well-being.

In terms of financial support, FTBMI can explore available state and federal grants to fund cooling initiatives. The U.S. Environmental Protection Agency (EPA) offers grants such as the Environmental Justice Government-to-Government Program, which supports projects that lead to measurable environmental or public health impacts in communities disproportionately burdened by environmental harms, as well as reduce greenhouse gas emissions. Additionally, state grants like the Office of Planning and Research (OPR) ICARP Extreme Heat and Community Resilience Grant Program and Office of Planning and Research (OPR) Regional Resilience Planning and Implementation Grant Program can fund the implementation of these cooling technologies. Collaboration with local governments, academic institutions, non-profit organizations, and private corporations is crucial to successfully spreading awareness and encouraging implementation of these cooling technologies. By pooling resources and expertise, FTBMI can establish a holistic approach to heat mitigation and create resilient communities that are better prepared to tackle extreme heat challenges while ensuring the comfort and safety of their residents, especially the vulnerable populations.

FTBMI could employ their Environmental Protections Division to plan and co-manage cool material implementation throughout the FTBMI boundary, with educational and community engagement support from the Education and Cultural Learning Department (ECLD). While the application of the cool surfaces technology itself can be rather quick depending on the technology type (reflective sealant paint versus reflective roofing), the need for community engagement throughout the planning and implementation stages in local communities throughout the FTBMI boundary would likely be middle to long-term (2-5 years) for completion.

Drought, Wildfires, and Flooding Resilience Strategies

Climate change presents an increasingly urgent challenge for communities worldwide, necessitating comprehensive strategies for adaptation and resilience. As the impact of climate change becomes more pronounced and evident in our everyday lives, the need for proactive measures to safeguard vital resources and ecosystems has become critical. These strategies address the imperative of climate resiliency and outline a series of tactics aimed at enhancing water resources, habitat, flood, and fire resilience within the FTBMI boundary, emphasizing the distinct challenges and opportunities faced by this area. The strategies proposed in this report are prioritized based on tribal citizen survey responses and are aligned with the overarching goal of bolstering FTBMI tribal citizens' ability to withstand the adverse effects of climate change, and to protect communities, ecosystems and cultural resources and practices. In evaluating these strategies, the report also highlights the unique aspects of the region and underscores the necessity of tailored approaches that account for the region's specific vulnerabilities and opportunities.

The report also underscores the need for collaboration with various agencies, communities, and organizations to implement comprehensive and sustainable solutions, communicate climate risks and preparedness to vulnerable communities, but also to ensure FTBMI tribal leaders prioritize board membership and advocacy as an important venue for crafting policies and programs that are responsive to the needs, priorities, and cultural practices of the FTBMI. As much as possible, this report prioritizes nature-based solutions and strategies that are multi-benefit because they maximize investment by addressing multiple concerns within the FTBMI boundary. As a result, many of the recommendations overlap across topic areas.

Water Resources Strategies

> *Encourage water conservation and the diversification of water resources such as greywater and water recycling*

Municipalities reliant on a small diversity of water sources are most at risk from natural catastrophe and the impacts of climate change. Conservation, particularly the reduction of non-essential water use for lawns and ornamental landscaping, can reduce water demand and stress to aquatic ecosystems. Supplementary water sources will be required to meet Southern California's water needs. Sustainable sources of water include recycled water and stormwater. Recycled water, in particular, has great potential given its year-round availability. Additionally, the protection of natural lands and stormwater capture using nature-based solutions, for example, can enhance local water supply, improve water quality, reduce stress on aquatic ecosystems, and provide supplementary benefits like shading, cooling, and habitat.

These strategies can be implemented at multiple scales including individual, community, and regional. At the individual level, greywater, or non-potable water from washing machines, bathroom sinks, and showers can be collected for reuse in landscaping and to support groundwater recharge, while features like native plant landscaping and rain gardens, bioswales, and berms and impressions can enhance stormwater capture at the individual parcel level. There are rebates available to various property types through the Metropolitan Water District and the Los Angeles Department of Water and Power (www.socalwatersmart.com).

At the community and regional level, green infrastructure projects are identified by communities, cities, and municipalities, and funding from the Safe Clean Water Program as well as agencies including California Natural Resource Agency, the California State Water Resources

Control Board, the Department of Water Resources, the California Environmental Protection Agency support the design and implementation of multi-benefit green infrastructure projects that enhance water capture and water quality. The State Water Resources Control Board maintains a Tribal Affairs website with resources and funding opportunities (www.waterboards.ca.gov/tribal_affairs) for water resource projects. Local wholesale and retail Water Districts are another place to identify partnerships and grant programs for water resource projects. Metropolitan Water District's website often has up to date information on their current grant opportunities (www.mwdh2o.com/planning-for-tomorrow/funding-opportunities)

State and federal funding programs can be identified at grants.gov, and grants specifically designed for tribes can be found by entering "Native American Tribal Governments" in the eligibility section of the grants.gov search tool. ReDesignLA is a local resource for current governmental and non-governmental water resource funding opportunities (www.redesign.la). Other specific grant programs for tribes are referenced elsewhere in this report.

Support nature-based solutions that capture and clean stormwater and recharge aquifers.

Local capture of stormwater through nature-based solutions can enhance local water supply, groundwater recharge, reduce stress on aquatic ecosystems, and provide supplementary benefits like shading, cooling, and habitat. Conservation and restoration of natural lands, particularly lands that provide water sources for cities, is an important nature-based solution. The protection of source water is an intuitive multiple barrier strategy toward water resource sustainability, particularly since studies have shown that watershed degradation negatively impacts water quality and water treatment costs and source water protection has multiple environmental, economic, and community benefits (McDonald et al., 2016; Abell et al., 2017). Programs focused on source water protection and sustainable land management are often centered around the Sierra Nevadas, Central Valley (and agricultural lands), and the Bay Delta, or do not explicitly recognize water resource benefits of conservation and restoration. Los Angeles County's Safe Clean Water Program, for example, has no funding for habitat conservation or restoration where there isn't a constructed stormwater best management practice. Programs and funding sources that can enhance water resource benefits through conservation or restoration, whether explicitly within the language of the program or implied, include the Department of Water Resources: Integrated Regional Water Management Program, the California Department of Food and Agriculture Healthy Soils Program, the Sustainable Agricultural Land Conservation Program, the California Farmland Conservancy Program, and various efforts of land conservancies and conservation districts.

Other water resource recommendations:

- **Support tools, the creation of culturally competent risk communication, and emergency supplies for communities that face increased fire risks, recognizing the need for emergency water supplies in the event of fire (e.g., damage to water infrastructure or degradation of drinking water quality).**
- **Through board membership and advocacy, support equitable access to affordable and clean drinking water.**

Habitat Resilience Strategies

Establish, restore, and expand habitat and protected areas to conserve biodiversity, particularly for species that are culturally important, have limited ranges, and are threatened by development or other pressures.

The habitats of the FTBMI land boundary face multiple stressors including urban development, invasive species, nutrient deposition, and the multiple threats mounted by a changing climate. Plant communities can shift their distributions toward more suitable areas as a response to climate change. For some plant communities, urban development can preclude movement and thus the survival of sensitive and range limited plant species. An important strategy to combat habitat loss is to establish, restore, and expand habitat and protected areas. That process can be better informed through the collaboration with researchers, government agencies, and other knowledgeable partners to develop a process that identifies and prioritizes plant species, and the critical habitat areas where they occur, that are most threatened within the tribal boundary so as to better inform conservation and restoration activities. One such effort is the Climate Science Alliance's Resilient Restoration effort. Specifically, the effort seeks to develop knowledge and supporting actions to enhance the preservation of ecosystems and plant communities important to tribal communities. It is important to note, that many of the most threatened plant communities occur in the highly developed coastal plain and thus efforts to conserve these species cannot solely rely on large open spaces, like the national forests. Homes, parks, and other community spaces can and should be identified as an accessible and important avenue to create habitats and habitat corridors that sustain cherished plant species and ecosystems.

Acquire land for the FTBMI to conserve and manage in perpetuity or, when land back is not possible, pursue co-management opportunities with land agencies.

FTBMI knowledge, priorities in habitat conservation, land management and cultural practices can be best implemented through land ownership. Tribal ownership of land would provide unobstructed access to habitats for restoration, conservation, and management without delays from permitting processes and jurisdictional challenges. It is through land ownership that culturally attuned management can best be implemented.

The Trust for Public Land often partners with tribes to identify available land and to support the purchase of those lands for their conservation (www.tpl.org/our-mission/tribal-lands). The Indian Lands Conservation Alliance is also working with tribes throughout the Country to support land-back and conservation efforts (www.inca-tcd.org). Finally, the California Council of Land Trusts and the Land Trust Alliance are two other groups working to support land conservancies.

Join the boards and advisory committees of natural resource agencies such as Resource Conservation Districts involved in preservation and natural resource management.

Board and advisory committees are charged with informing priorities and setting preservation and conservation practices. FTBMI involvement can help establish guidelines and oversight ensuring tribal perspectives and voices are considered in all resource management decisions.

Other habitat resilience recommendations:

- **Support urban green infrastructure river restoration given the opportunity to capture stormwater, restore floodplains and enhance biodiversity by conserving and restoring threatened plant and animal communities in urban environments.**
- **Establish native nursery to provide green jobs and plant material for urban forestry and habitat restoration.**
- **Engage with groups like the Theodore Payne Foundation and the California Native Plant Society, both of whom have knowledge and experience to share but also are committed to constantly engaging with tribes to better understand and support "ecocultural restoration" goals (Long, J., et al. 2020).**
- **Provide a training site and workforce development opportunities in green infrastructure, landscape design, maintenance, arboriculture, and horticulture.**
- **Develop trainings on habitat restoration, including invasive species management, and leverage the Tribal Conservation Corps.**
- **Further develop field crews to work on FTBMI and neighboring lands.**
- **Support river restoration to support critically threatened plant and animal communities and the services healthy rivers provide to neighboring communities.**

Flood Resilience and Sea Level Rise Strategies

Support enhanced natural floodplains or multi-benefit flow bypass systems to allow local streams and rivers to swell and accommodate flows during strong storm events and to expand the area that can capture stormwater for groundwater replenishment.

To manage the risk of catastrophic flood, concretized channels, taller levee walls, and other engineered solutions have been implemented. While these strategies have largely protected the FTBMI land boundary from extreme flooding and casualties, extreme flooding is more probable under climate change. Purely engineered solutions to flooding, however, do not provide the multiple benefits that restored and connected floodplains or natural bypass channels can provide. Enhanced natural floodplains and natural flow bypass systems can keep rivers from breaching levee walls, thus reducing flood risks and providing seasonally flooded wetland habitats. These types of strategies have already been implemented in the Sacramento and Mississippi Rivers and provide seasonally flooded habitat for migratory birds and native fish habitat on top of flood management. These strategies and their ecological benefits, however, are limited by the amount of land that is available and the cost of land that abuts rivers. As a result, they have been more frequently implemented in agricultural areas instead of heavily urbanized areas. However, raising levees alone in hopes of reducing flood risks under a changing climate can expose communities in the FTBMI to flood risks. Mitigating those risks will require a wide range of strategies, including the integration of nature based, multi-benefit solutions (Serra-Llobet et al., 2022). The feasibility and costs of these strategies within the FTBMI boundary, as far as the authors know, are largely unexplored. One exception is the Santa Clara River, where enhancement and restoration plans aim to restore riparian habitat, acquire agricultural land for conversion to riparian habitat, and to maintain agricultural land along the river with practices that are ecologically compatible (The Nature Conservancy, 2020; Santa Clara River Enhancement and Management Plan, 2005). NOAA currently has the Transformational Habitat Restoration and Coastal Resilience Grant Program under the Bipartisan Infrastructure Law and Inflation Reduction Act to help fund restoration and coastal resilience strategies discussed above.

Support the implementation of green infrastructure and nature-based solutions that soak up stormwater flows and better manage stormwater during storm events.

Stormwater flows fall on impervious and developed landscapes within the FTBMI boundary and instead of percolating into the soil and being slowed by the tree canopy and other vegetation, rain quickly flows along streets and ultimately into streams, rivers, and the ocean. The flows that quickly shed from impervious surfaces increase flood risks. Green infrastructure, and other nature-based solutions, can slow and capture stormwater flows so as to reduce urban flooding, particularly nuisance flooding during the 85th percentile storms. These strategies are most effective in reducing flood risks and providing benefits to communities when they are distributed throughout the landscape and are effectively coupled with blue infrastructure, such as watercourses, ponds, and wetlands, and more heavily engineered solutions.

Prioritization tools for the Los Angeles region have been developed and through collaboration can be expanded to the FTBMI area. Those prioritization tools, however, do not take urban flooding into consideration. They do, however, identify other benefits and a need for green infrastructure including biodiversity, social and public health, and pollutant loading (Jessup et al., 2021). Local programs like the LA/Ventura Integrated Water Resources Program (IRWM) and the County of Los Angeles Safe Clean Water Program (SCWP) should be working more closely with tribal members on green infrastructure solutions in the highly urbanized areas across the greater land boundary.

Advocate for zoning and policies that discourage development in areas prone to flooding, including setbacks that maintain natural buffers to coastal and other flood hazards.

Flooding is a significant hazard for the communities within the FTBMI boundary. Despite most risk communication emphasizing other natural hazards in the area, climate change increases the probability of severe storm events and mega-floods. Flooding risks can be mitigated through development patterns and zoning that does not exacerbate flooding risks and exposure. This includes traditional tools such as zoning, coastal and levee setbacks, and the use of natural buffers that protect communities and critical infrastructure. This strategy is particularly critical given that the National Flood Insurance Program, available to homes and businesses within the 100-year floodplain, is nearing insolvency and has an uncertain future.

Assess tribal lands for flood risk and create a flood hazard mitigation plan.

Risk assessment and mapping resources can be found through the California Department of Water Resources Flood Management website (water.ca.gov/Programs/Flood-Management). Hazard mitigation plans are often required to apply for flood risk mitigation funding through FEMA's Flood Mitigation Assistance grant program (www.fema.gov/grants/mitigation). Additional flood preparedness resources are available locally through both Counties:

Los Angeles - https://ready.lacounty.gov/flooding/

Ventura - https://www.vcpublicworks.org/wp/floodpreparedness/

Other flood resilience recommendations:

- **Enhance communication about flooding risk and emergency preparedness.**
- **Support nature-based solutions such as beach nourishment, living shoreline, dune restoration, and wetland preservation that can enhance natural buffers and allow for the landward migration of valued coastal ecosystems.**
- **When armoring the coast is necessary to prevent catastrophic flooding, advocate for seawalls and levees that create heterogenous and complex environments that can enhance coastal biodiversity.**
- **Support policies and funding that facilitate managed retreat and the relocation of threatened communities and infrastructure.**
- **Upgrade critical infrastructure and design standards to reflect growing flood risks in the FTBMI boundary.**

Fire Resilience Strategies

Support the eradication of invasive species in natural lands, particularly in fire prone areas like the wildland urban interface, recreational areas, and highways along the forest.

Invasive species are most numerous and have highest coverage at lower elevations. Invasive species increase fire risks and recover more quickly following a fire, outcompeting native species. This positive feedback loop translates to higher frequencies of fires at low elevation that fundamentally alter native plant communities so that invasive species can thrive. Species that are commonly found in urban and disturbed areas include giant reed, mustard, annual grasses, and eucalyptus. Invasive species also alter the nature of fire, its intensity, severity, and how quickly it can move through a landscape. Controlling invasive species will be an integral strategy to reducing fire risks in the FTBMI boundary with benefits to wildlife and already threatened plant communities. The California Invasive Plant Council can support education and provide technical assistance to invasive management efforts (www.cal-ipc.org). CAL-IPC also provides resources that can help support invasive species management.

Enhance community engagement around wildfire risks, prevention, and evacuation, as well as grants and other programs and resources available to communities in High Fire Hazard Severity Zones.

Community engagement is foundational to reducing fires within the FTBMI boundary as well as reducing exposure to fire related risks. The increased fire frequencies within the FTBMI boundary are largely caused by human ignition. Engagement with communities that live in the urban wildland interface and who frequently visit sites in the Angeles National Forest can benefit from increased engagement around fire safe practices at home and while visiting natural areas. Communities in close proximity to fire-prone areas face increased fire risks and exposure to poor air quality. These communities would benefit from critical resources related to evacuation, fire-proofing design guidelines, and mitigating exposure to poor air quality during fire. The Disaster Help Center lists programs and grants that provide food, housing, and unemployment services to community members impacted by California wildfires (www.cdss.ca.gov/disaster-help-center). The Fire Safe Councils are an important resource to communities to assist in wildfire preparedness, education, and mitigation to build fire-adapted communities throughout the FTBMI land boundary. (www.cafiresafecouncil.org)

Other fire resilience recommendations:

- **Educate and train Tribal Conservation Corps to design and maintain landscapes in fire-prone areas to create defensible space and reduce fire risks. US Green Building Council Los Angeles has a number of resources available (www.usgbc-la.org/programs/wildfire-defense-education-and-tours).**
- **Encourage Tribal leadership on City Planning Commissions to address fire management strategies, including brush clearance, etc.**
- **Join the Fire Science Alliance, Climate Science Alliance Tribal Working Group (www.climatesciencealliance.org) and the Indigenous Peoples Burning Network (IPBN) to support a network among Native American communities that are revitalizing their traditional fire practices in a contemporary context.**
- **Engage with County Fire Forestry Division staff to inform culturally sensitive design guidelines and practices and include as part of Tribal Conservation Corps training.**
- **Engage community members about building codes and landscaping to create defensible space to reduce fire risks. A list of CalFire regional foresters can be found on their website (www.fire.ca.gov).**

Energy Resilience Strategies

Reducing Energy Demand and Carbon Footprint

Electric grid reliability and electric energy resilience are essential at the time when many sectors of the economy are undergoing decarbonization and transition from fossil energy powered equipment to electric powered equipment. The increasing electric power demand and extreme weather events exacerbated by climate change, pose significant challenges to electric utilities in maintaining high degree of reliability and resilience in the electric grid to failures and extreme weather events.

At utility scale, increasing the use of diverse and locally available renewable energy sources, such as solar, wind, and hydro power, to reduce dependence on single energy sources and enhance system flexibility, can increase resilience of the electric grid infrastructure. Other utility efforts involve grid hardening and equipment and technology upgrades. Besides utility-scale renewable energy systems that contribute to the broader grid infrastructure, more compact distributed power sources, such as microgrids powered by renewables, can enhance community-level energy resilience on the customer's side of the meter. Microgrids can boost energy dependability by managing local energy supply and demand and operating independently from the main grid when necessary. Furthermore, microgrids equipped with smart energy management systems can optimize renewable energy utilization by optimizing energy dispatch among the various energy resources and minimize peak power demand by optimizing load operation. Integrating microgrids and distributed energy resources, wherever possible, which can operate independently from the main grid during emergencies and help maintain power supply in affected areas, offers the highest level of energy resilience for the owners of the microgrid system.

Local renewable energy generation through solar PV systems not only generates electricity bill savings and contributes to the overall reduction of GHG emissions, but also serves as an integral part of microgrids. Solar PV alone can rarely function as a microgrid due to the intermittent nature of solar energy resources. However, when paired with a battery energy storage system, capable of operating in islanded mode, solar PV provides vital energy needed to charge the battery storage system and power the electric loads in the microgrid.

The feasibility and cost-benefit analysis of the installation of residential solar PV battery energy storage systems, or equipment efficiency upgrades, or smart energy management systems, needs to be evaluated on a case-by-case basis as the requirements for these are unique for each individual case. Various factors to be considered include location, physical site constraints, electric load profile, electric tariffs, structural integrity, local ordinances, rebates and incentives, among others.

Under most circumstances, single family homeowners in southern California could install solar PV and/or energy storage at their homes. Various financial incentive programs (more on this on pg. 83) and financing options are available for residential solar PV. For renters and residents of multi-family housing, there are programs like California's Solar on Multifamily Affordable Housing (SOMAH), providing financial support for community solar PV installations.

GRID Alternatives is a non-profit organization that focuses on providing access to clean, renewable energy and job training in the solar industry for low-income communities and underrepresented groups. The organization operates through a community-based model, partnering with local organizations, municipalities, and utilities to identify and engage with eligible households. More information on the application process and qualification criteria could be found on their site (https://gridalternatives.org/).

Securing Back-Up Power for Critical Loads

A back-up power system is critical, if not the most important component, in any energy resilience plan. Back-up power directly addresses the issue of a central grid power outage. Back-up resources may be designed to power critical loads only, or entire building loads, as is the case with a microgrid. Back-up power resource installations may be permanent and stationary or temporary and mobile in nature. Back-power systems can utilize uninterrupted power supply (UPS), or delayed back-up power supply systems. UPS systems are expensive and often used to power critical loads in information and communication sectors. In contrast, back-up power generators can restore power within 30 seconds from power outage.

Back-up power generators have traditionally been powered by fossil fuels like gasoline, diesel, and natural gas. More recently, electric battery energy storage systems are utilized as back-up power generators. Lead-acid battery technology has been used in UPSs and energy storage systems for decades, however, newer lithium-ion and lithium iron phosphate-based batteries offer higher efficiency, longer life, and overall safer operation.

In order to achieve the highest level of energy resilience to power disruptions, the installation of a stationary energy storage system as part of a microgrid should be pursued where technically and economically feasible. Electric battery energy storage system paired with solar PV system is preferred due to GHG reductions, renewable energy generation, lower energy costs, and independence of fossil fuels.

Where the construction of microgrids and installation of permanent stationary energy storage systems is not feasible, smaller portable back-up power generators can be used to power selected critical home loads during power outages. Battery powered mobile generators can be used indoors to power medical equipment and other critical loads. SCE provides a list of portable battery electric power stations at https://marketplace.sce.com/portable-power-stations/, many of which are eligible for rebates.

Utilizing energy incentives and rebate programs

There are numerous rebates and incentives offered by various entities, including utility companies, local governments, and state agencies for renewable energy generation systems, energy efficiency upgrades, energy storage system, energy management, and others. However, it should be noted that eligibility requirements and funding availability for many programs change over time. Some examples of rebate programs in California specific to SCE and LADWP service territory are listed below. It is essential to consult the websites of the local utility company, city, or county, and state agencies like the California Energy Commission for the most up-to-date information on available rebates and incentives.

SCE offers numerous incentive programs for residential and commercial customers to promote energy efficiency and renewable energy and offer support to low-income customers. Some of these programs are listed below.

Energy Savings Assistance Program: The program offers new energy efficient appliances and installation at low or no cost to low-income SCE customers who qualify for the program, based on income level.

Back-up Power Equipment Rebates: SCE offers rebates on portable power generator equipment, portable power stations and whole house generator solutions.

California Solar Initiative: This statewide program provides financial incentives for customers who install solar photovoltaic systems on their homes or businesses. SCE customers can benefit from these incentives, which can help offset the costs of solar installations and encourage the adoption of renewable energy.

Demand Response Programs: SCE offers various demand response programs that provide financial incentives to customers who reduce their energy usage during periods of high demand. These programs can include time-of-use pricing, critical peak pricing, and demand bidding.

Electric Vehicle (EV) Rebates and Incentives: SCE may provide rebates and incentives for customers who purchase or lease qualifying electric vehicles or install EV charging infrastructure. In some cases, SCE may also offer special rates for EV charging.

Self-Generation Incentive Program (SGIP): This program provides financial incentives for customers who install eligible distributed energy resources, such as battery energy storage systems, fuel cells, and combined heat and power systems. The incentives can help offset the costs of these installations and encourage the adoption of clean, distributed energy technologies.

Critical Care Backup Battery Program: An initiative offered by SCE, which aims to provide backup battery systems to eligible customers who depend on life-support equipment or have other critical medical needs that require a continuous power supply. It aims to enhance the safety and reliability of power for customers with critical medical needs, especially during Public Safety Power Shutoff events or other power outages.

Golden State Rebates Program: A statewide program which offers instant rebates and coupons for electric and gas water heaters, thermostats, and room air conditioning units.

LADWP also offers various incentive programs for residential and commercial customers to promote energy efficiency and renewable energy. Some of these programs include:

Energy Efficiency Rebates: LADWP provides rebates for customers who install energy-efficient appliances, lighting, and heating and cooling systems. By upgrading to energy-efficient products, customers can reduce their energy consumption and save on utility bills.

Consumer Rebate Program: The program offers rebates to LADWP residential customers on the purchase of energy efficient appliances such as variable motor pool pumps, HVAC units, cool roofs, and whole house fan systems.

Solar Rooftops Program: LADWP can use the house roof of eligible customers to install solar PV, customers would receive fixed roof lease payments from the LADWP between $240 and $600 per year. The installation of solar systems will not impact customers' electricity bills.

Shared Solar Program: The program provides LADWP customers living in multifamily homes with the option to subscribe for the purchase of solar PV energy, either the minimum of 50 kWh or the maximum of 100 kWh of energy on a monthly basis. The renewable solar electricity is supplied by new solar power plants constructed in or near the LA basin and is billed at a fixed Shared Solar Program rate.

Electric Vehicle (EV) Charger Rebate Program: LADWP offers rebates for residential and commercial customers who install Level 2 EV chargers at their properties. This program aims to promote the adoption of electric vehicles and expand the charging infrastructure in the area.

Utilizing cooling centers and other community centers

Figure 4 shows the location of cooling centers available in Los Angeles County within the FTBMI boundary. Analysis of driving distance to the nearest cooling center from the places of residence of FTBMI residents indicates that the majority of FTBMI residents have a cooling center within 5 miles of their home, while the longest distance is over 14 miles.

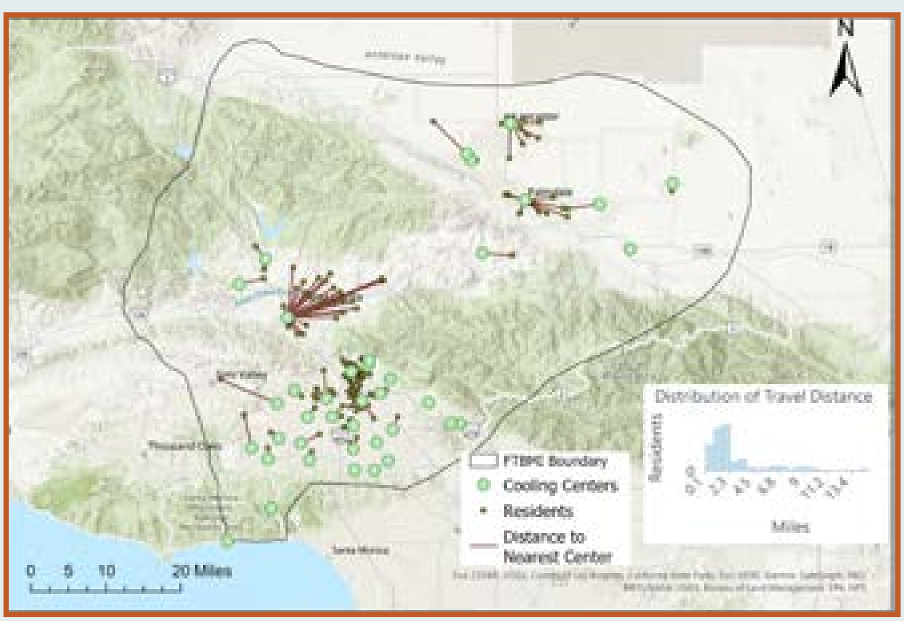


Figure 4: Cooling centers within the FTBMI land region and Distance to Nearest Center for FTBMI Citizens

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