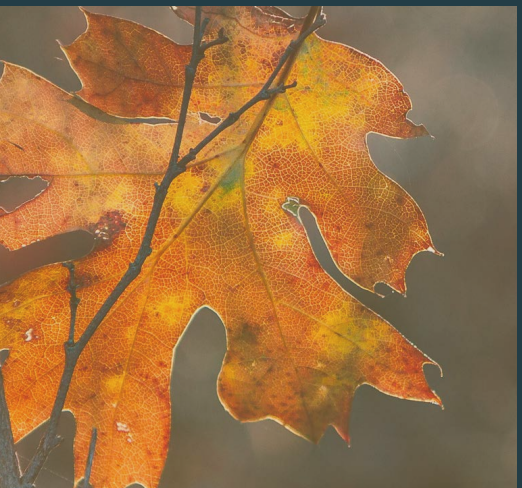
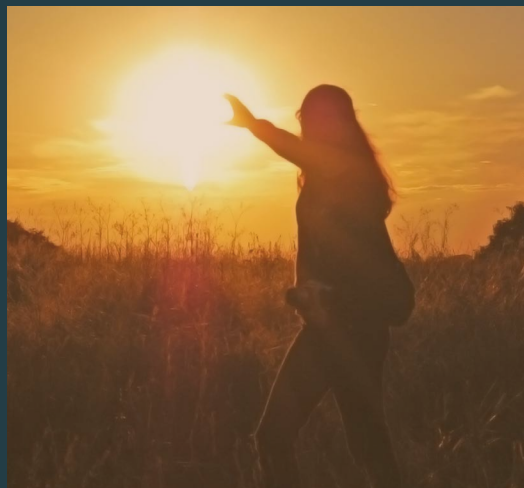
LA JOLLA BAND OF LUISEÑO INDIANS

Adaptation Plan

2019 LIVING DOCUMENT





The La Jolla Adaptation Plan is a living document that may evolve through successive updates, be expanded as needed, and serve different purposes over time as deemed appropriate by the La Jolla Band of Luiseño Indians.

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"Climate change is an important topic everywhere, causing consequences for people around the world. These changes disproportionately impact native peoples as they compound existing stressors and threats in our communities. We are experiencing climate related changes here on the La Jolla Reservation with more severe and intense wildfires, flooding, and heat waves that impact our people and our lands. We are seeing changes to local ecosystems including pests that are harming culturally important plants and animals. As a community we are taking steps to reduce these risks and this plan is one part of this effort.

Our tribe has always been resilient, and we will continue to adapt to the challenges and changes that are coming. No one knows our history better than us. Our climate adaptation plan is focused on our community, on our youth, and learning from our elders. The knowledge and memories, the different ways of knowing - these are the foundations of our resilience. If we don't hold on to our stories, are unfamiliar with our sense of place, and don't take care of our land, it is a loss to our youth, to our people, to our history. The ideas and strategies laid out in this plan will help us continue to be resilient in the face of change.

As a tribal council we approve and support this climate change adaptation plan and are committed to supporting actions that build resilience in our community. Planning for climate change will be an ongoing process but we are committed to this path and our investment in our youth, our community, and our traditions. When the land is healthy, the people are healthy. The La Jolla Tribe is and always will be resilient and we will utilize our knowledge and actions to safeguard our past, present, and future."

FRED NELSON, JR.
TRIBAL CHAIRMAN
La Jolla Band of Luiseño Indians

"Addressing the challenges of climate change, addressing the impacts to our land, resilience comes from learning from each other, letting the elders school us young ones on the changes they have seen in their lifetime so we can learn from them. This adaptation plan is an opportunity to bring us together, to bring our community together, to be resilient together. We dedicate this to our youth so they always know where they come from and who they are."

- LA JOLLA TRIBAL MEMBER

PART I

Introduction

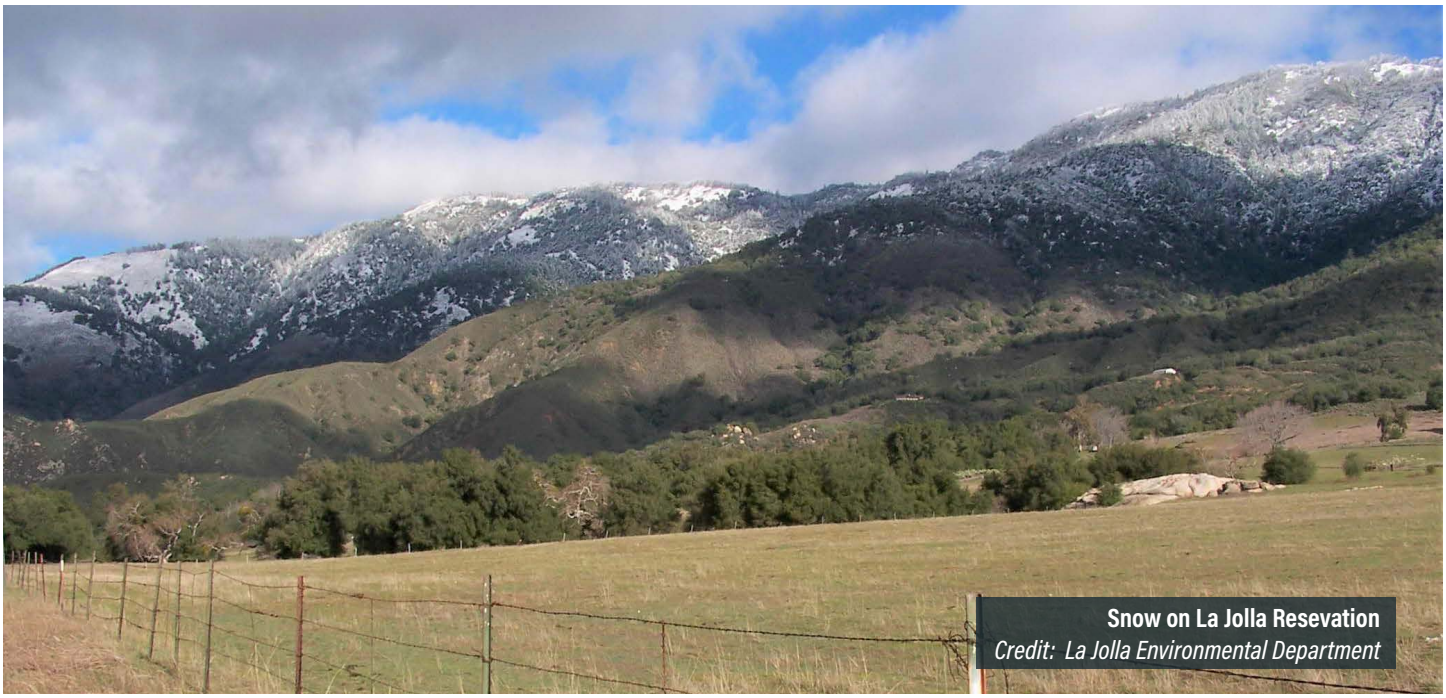
Background

"I am fortunate, blessed to have my grandpa because I have heard a lot of stories of La Jolla. Hearing stories from the time he was young, different things he has seen, things that grew here that are gone, how life was."

- LA JOLLA TRIBAL MEMBER

The Luiseño people, known as Payómkawichum, the "People of the West", have inhabited the coastal area of southern California throughout time. There are now six federally recognized tribes and one-non federally recognized Tribe of Luiseño bands with reservations in southern California. The Luiseños are part of the Shoshonean linguistic family, which includes Native Americans that historically occupied the coast of California from the mouth of Agua Hedionda creek to Point Duma, and the islands of San Nicolas, and Santa Catalina (Sparkman, 1908). While the La Jolla Reservation currently occupies an area between Palomar Mountain and San Luis Rey Valley, the La Jolla people's historical territory extended from Agua Hedionda Creek to the eastern side of the Elsinore Fault Valley and Palomar Mountain, the southern slope above San Jose Valley, and most of the drainage of the San Luis Rey River (Sparkman, 1908). The La Jolla Band of Luiseño Indians' oral history and traditional stories illustrate that the Luiseño people have existed in this region throughout time. The people have always had a close tie with this land, trekking seasonally to gather food, collect acorns, and hunting across a territory of 1,500 square miles along Palomar Mountain, San Luis Rey River Valley, and the coast (Sparkman, 1908). The La Jolla Tribe is the most southwesterly of the Shoshonean family (Sparkman, 1908). The La Jolla people traditionally speak the Cham'teela language and have a philosophical and social structure historically distinct from other Takic-speaking Tribes. The Luiseño embrace a rich culture that includes gathering, traditional practices, unique arts, native food and medicines, and sacred places (La Jolla Band of Luiseño Indians Environmental Department, 2007). Culture and traditions are guided by the religion of ancestors, embodying a strong relationship between spiritual connectedness, the land, and the community. Today, a majority of the 700 enrolled Tribal members live on the La Jolla Reservation (La Jolla Band of Luiseño Indians, Rural Community Assistance Corporation, 2011).

Riparian environment on the La Jolla Reservation
Credit: La Jolla Environmental Department



Snow on La Jolla Resevation
Credit: La Jolla Environmental Department

Historical and Contemporary Challenges

The La Jolla Indians, along with many other native communities across the region, have a complex history, undergoing many challenges and events that have threatened their traditional ways of life, culture, land, and ultimately, their survival. The centuries-long struggle of Tribal nations to maintain cultural identity and sovereignty has greatly contributed to the historical legacy of these communities. Nevertheless, Tribal communities, including the La Jolla Tribe, have persisted, their knowledge and traditions living on through the generations.

"In the snow we would toboggan on cardboard on this hill right behind us."

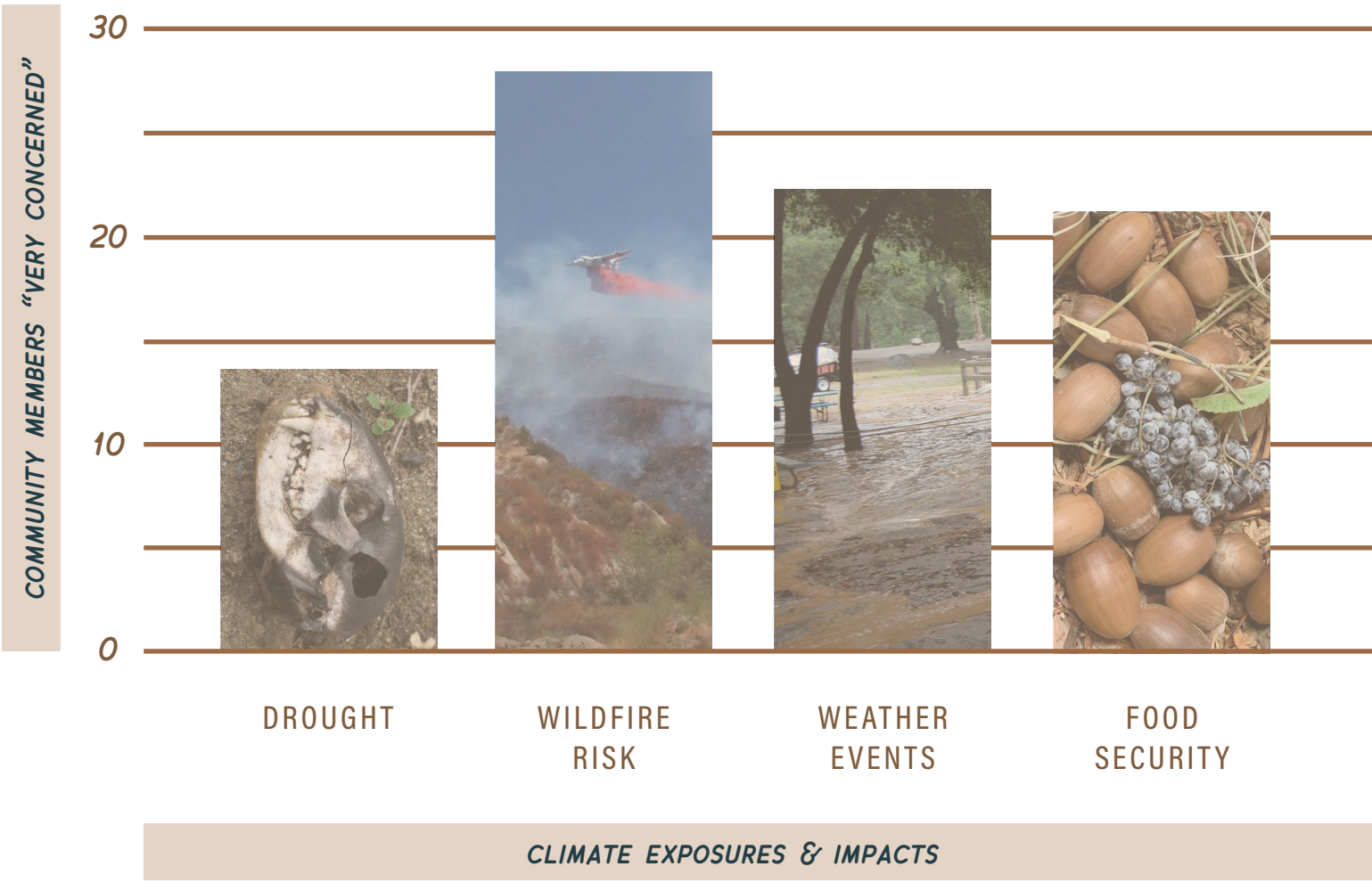
- LA JOLLA TRIBAL ELDER

As one of the greatest contemporary issues globally, climate change has and will continue to present challenges for Tribal communities. The changing climate brings new stressors that can compound the impacts of their historical legacy and the persistent socio-economic problems that many Tribes face (Bennett et al., 2014). The cultural, social, economic, historic, and geographic context of each of the region's Tribal communities is unique and the impacts felt in one community might differ from the next. However, Native American Tribes have adapted throughout time, remaining resilient in the face of ongoing challenges and will continue to do so, bringing knowledge and wisdom acquired through generations of practices and beliefs (National Congress of American Indians, 2019).

La Jolla Tribal community members have expressed their concerns about climate change and the impacts it will have for the community now and in the future. In a climate survey distributed to Tribal community members in spring and summer 2019, a majority of the 29 survey respondents expressed concern about climate change with 60% of respondents indicating they are "moderately" and/or "very" concerned about climate change. Survey respondents also showed

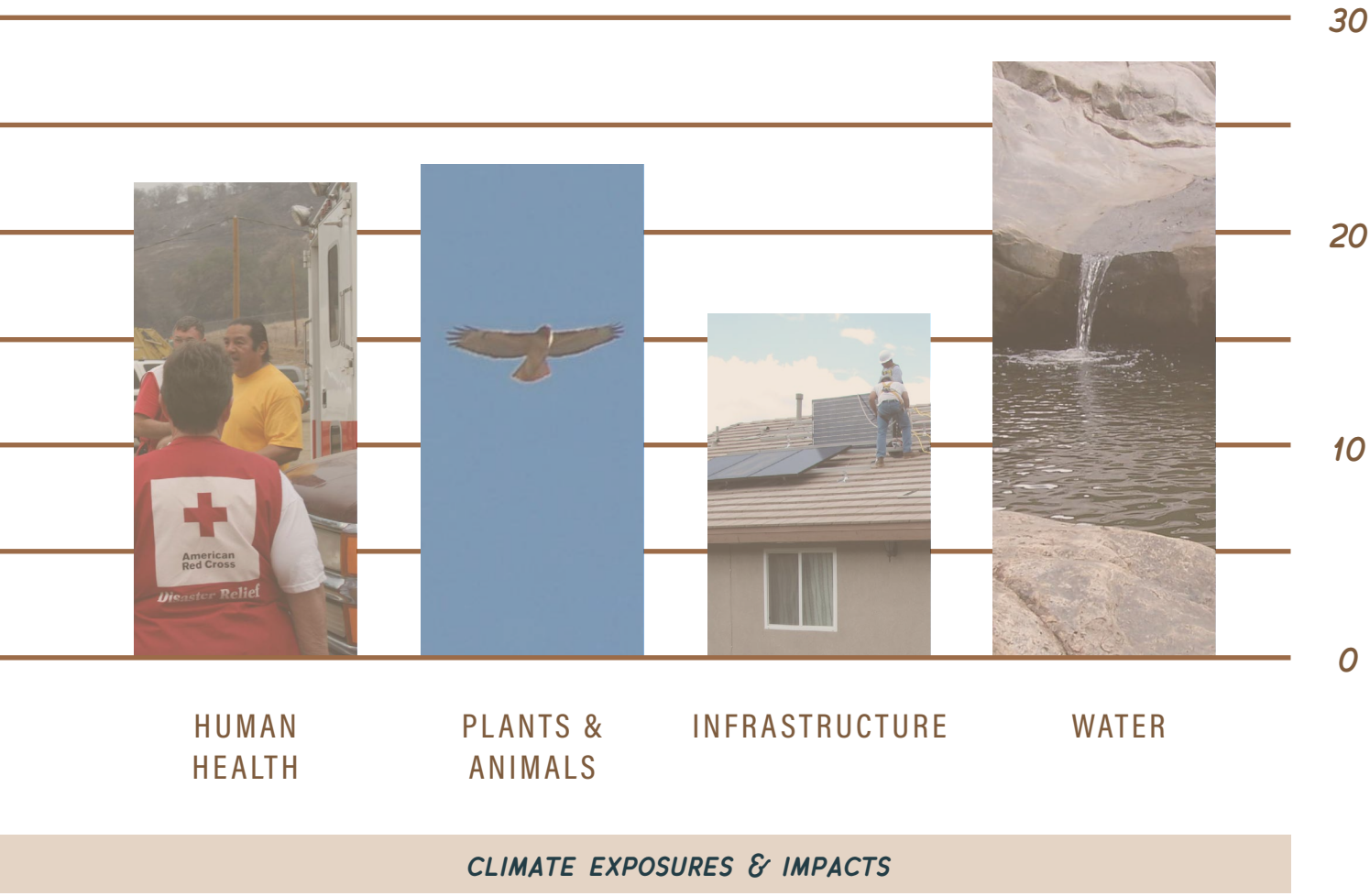
significant concern over the impacts of climate change in the years to come, with 75% of respondents expressing concern for future generations. Community respondents overall were "very concerned" about climate impacts on drought, wildfire risk, weather events, food security, human health, plants and animals, infrastructure, and water (Figure 1). Comments collected in the survey indicate that La Jolla Tribal community members have already begun to observe climate change impacts and feel they are directly experiencing the impacts of these changes in the form of more intense and frequent extreme events. Over 90% of respondents indicated that they have already noticed changes in the region's climate and weather with resulting impacts on people and places.

Figure 1: COMMUNITY CONCERN FOR CLIMATE EXPOSURES & IMPACTS



"When our earth is struggling we struggle. But we have strength, knowledge, and can call on the memory of what our parents and grandparents saw to learn from and use this insight to make our community resilient and strong."

- LA JOLLA TRIBAL MEMBER



CLIMATE EXPOSURES & IMPACTS

"Our ways are not lost, some may be dormant but not lost."

- LA JOLLA TRIBAL MEMBER

Taking Actions to Increase Tribal Resilience

The majority of the 700 enrolled members of the La Jolla Reservation live within the reservation boundaries. The population of the community has grown over the last 20 years and the majority of the population is between 18-60 years of age with elders making up 13%. Since most of La Jolla's Tribal population lives on the reservation any climate change related impacts could be detrimental to the survival of future generations. Increasing the resilience of the community and the environment to future climate change is especially critical for the La Jolla people if they do not have the economic and/or physical ability to relocate.

The La Jolla Tribal community is already taking steps to adapt to climate change related impacts and enhance community resilience. These include community based planning efforts, outreach, and education programs including Intertribal Earth Day events, elder activities, youth educational programs, and initiating a community garden. These kinds of actions help raise awareness of changing conditions and actions that individuals can take to reduce risks. Additionally, Tribal leadership has supported the creation and implementation of planning efforts and programs that incorporate, or are primed to consider, climate change related impacts. These include hazard mitigation planning, waste water resource management and planning, an Integrated Solid Waste Assessment Plan, a Household Hazardous Waste and E-Waste collection program, Source Waste Assessment Planning that protects the environment and local water resources, and a FEMA Pre-Disaster Mitigation Plan updated in 2019. The La Jolla Tribe was the first Tribe in California to have an approved Drought Mitigation Plan. The La Jolla Tribe also maintains cultural and educational programs and supports an Environmental Department that can continue to play strong roles in building community resilience.

La Jolla's resilience will be measured by the people's ability to come together and preserve the culture, traditions, elements, and stories of the *Payómkawichum* that have endured throughout generations. Through the creation of the Tribe's climate adaptation plan the community is laying the foundation to prepare for and reduce the risks climate change poses to their way of life. The collaborative process undertaken to create this plan provided opportunities to bring awareness about anticipated climate change impacts on La Jolla's Tribal land, introduce ideas for adapting to change, and served as a valuable platform to bring the community together to hear stories, suggestions, and ideas from elders and community members that inspire actions for years to come.

"There is a lot of value in implementing community programs that can help bring together youth, elders, and the entire community."

- LA JOLLA TRIBAL MEMBER

Sunflower in the Community Garden. *Credit: La Jolla Environmental Department*

Regional Context

"The river used to have a lot of willows and vegetation cover, just like you see in Oceanside and Bonsall. There used to be a lot of water, too."

- LA JOLLA TRIBAL ELDER

Water Resources

The reservation is included in the La Jolla Amago groundwater Basin within the San Luis Rey Hydrologic Unit (Barker et al., 1994), and has a normal seasonal rainfall of 24 inches. Local La Jolla Amago rain gauges indicate a high degree of annual and inter-annual variability within the subbasin, ranging from seasonal totals of 42 inches in water year 2004-2005, to as low as 8.62 in water 2001-2002 (La Jolla Band of Luiseño Indians Environmental Department, 2005).

There are a total of 36 miles of waterways, 20 acres of wetlands, and three springs (EPA, 2011). The La Jolla Amago Basin is 11,907 acres, with a modeled maximum groundwater in storage of 2,075 (Acre-Feet), and a modeled average groundwater recharge of 2,399 (Acre-Feet Per Year) (County of San Diego, Department of Planning and Land Use, 2010b). The Reservation's aquifer is classified as varying from slightly to moderately fractured crystalline rock by the City of San Diego Department of Planning and Land Use (County of San Diego, Department of Planning and Land Use, 2010a). According to U.S. Geological Survey historical records, the La Jolla Reservation also includes area of talus (angular blocks of bedrock broken down by weathering) which have fallen down steep mountain slopes, creating water sources such as the Agua Tibia Mountains escarpment on the reservation (Bureau of Indian Affairs, 1953).

As with many Tribal communities in the region, the La Jolla Reservation is located on lands excluded from San Diego Water Authority Services and imported water (Regional Water Management Group and Regional Advisory Committee, 2019), and is thus dependent on local groundwater and well systems. The community's drinking water is drawn from wells that are replenished by rain and snowfall (Weiser, 2016). La Jolla, in addition to Pala, Pauma, Rincon, and San Pasqual Bands, have together created the San Luis Rey Indian Water Authority (SLRIWA). SLRIWA is a sovereign tribal entity that has unified Bands and aimed to protect and manage their people's water resources since 1988 (San Luis Rey Indian Water Authority, 2019).

Riparian environment on the La Jolla Reservation
Credit: La Jolla Environmental Department

"My grandpa used to tell me how much water we had, and it was good water. You could drink out of any stream or even the watering troughs when he was a kid. The water was good – it was safe."

- LA JOLLA TRIBAL MEMBER

Location

The La Jolla Indian Reservation is located within traditional Luiseño territory, which covers approximately 1,500 miles of southern California and most of the San Luis Rey and Santa Margarita drainages (Southern California Tribal Chairmen's Association, 2019). The Reservation now spans approximately 9,000 acres across North Eastern San Diego, at the base of Palomar Mountain State Park (La Jolla Band of Luiseño Indians, Rural Community Assistance Program, 2011). At the base of the southern slopes of Palomar Mountain, the La Jolla Reservation ranges from 800 to 5,200 ft in elevation and encompasses foothills, cool forests, and steep, rugged, mountainous terrain (Environmental Protection Agency, 2019). Proximity to the Palomar Mountain Range results in distinct and variable weather patterns, including higher annual precipitation rates than many surrounding areas. Specifically, Palomar Mountain experiences triple the annual average rainfall amount, ranging from 25-45 inches (Barker et al., 1994), compared to San Diego, which averages only 10.5 inches (U.S. Climate Data, 2019). Rainfall primarily drains into and through the 55 mile long San Luis Rey River, where it eventually discharges into the ocean near Oceanside (Project Clean Water, 2018).

La Jolla Indian Campground
Credit: La Jolla Environmental Department

"It was a pretty good running river (San Luis Rey River) and Escondido benefited from our water. They took our water and then hired us back to build the flume to carry it away."

- LA JOLLA TRIBAL ELDER

Lake Henshaw. *Credit: Virgina Hill on Flickr.*

"Different species of oaks have different acorn cycles.

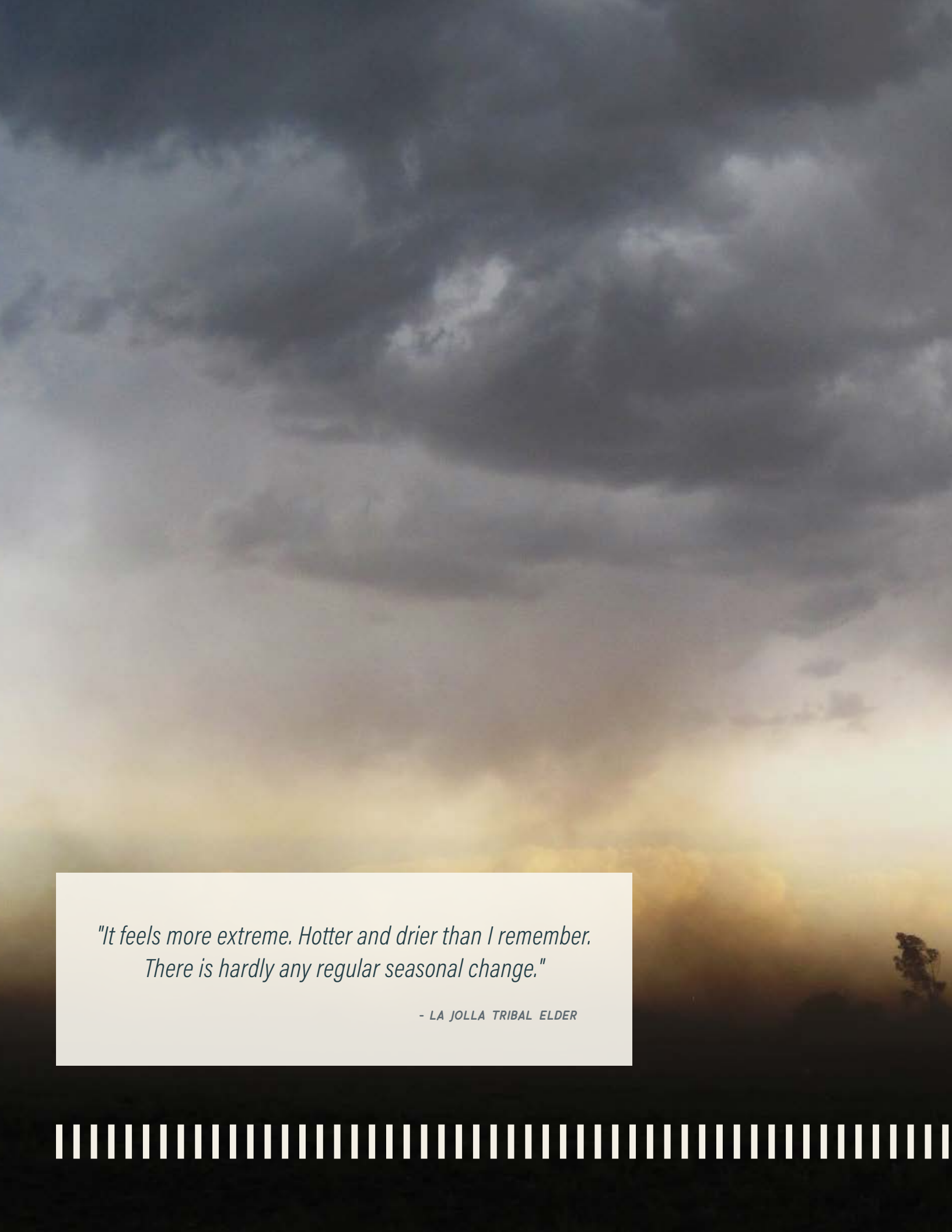
This was known by all people."

- LA JOLLA TRIBAL ELDER

Habitat and Species

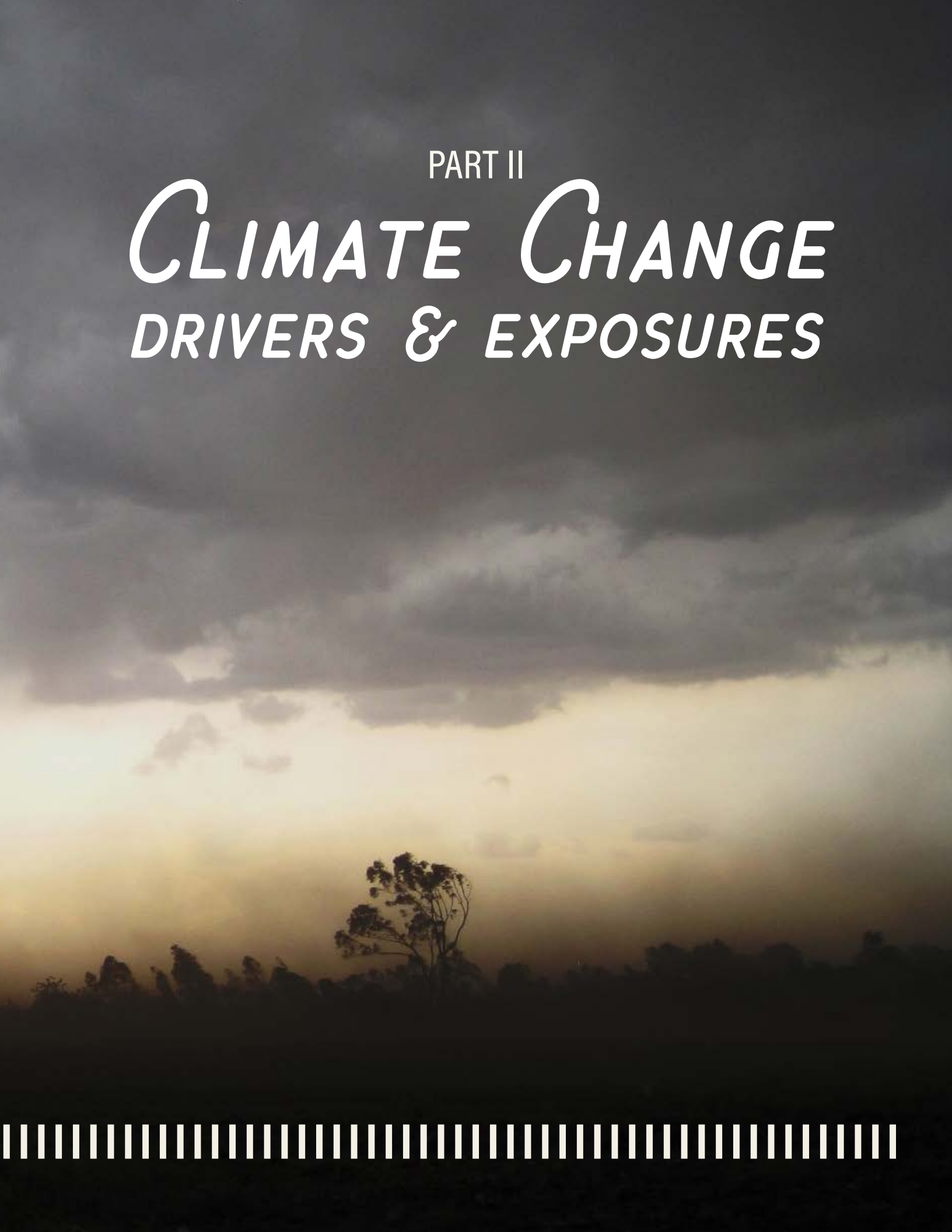
The Tribe's historical territory covered habitat that included every ecological zone from the ocean, beaches, shallow inlets, marshes, coastal chaparral, interior grassy valley, oak groves, pines, and cedars (La Jolla Band of Luiseño Indians Environmental Department, 2007). The ecoregion continues to be one of the world's most biodiverse locations, with various vegetation communities (Jennings et al., 2018) being home to many of the Tribe's culturally significant species. When the Luiseño first came into Southern California, the environment was dominated by scrub plant communities, including: coastal sage scrub, lower chaparral, upper chaparral, and desert chaparral. These communities supported plants and animals that the Luiseños used for food, medicine, religious traditions, and shelter (Sparkman, 1908). There are now over 200 plant and animal species in the County listed as endangered, threatened, rare, or are candidates for listing (US Fish and Wildlife Service and California Department of Fish and Wildlife, 1998). The San Luis Rey Watershed area is home to several protected and/or special-status species and vegetation communities (Regional Water Management Group and Regional Advisory Committee, 2019).

Acorns of deciduous and perennial oak tree species are some of the most important plant resources to the Luiseños, used to make "*wìiwish*", a staple food of ground acorn mush that has sustained the people for thousands of years. Additionally, the Tribe has traditionally used seeds, greens, roots, bulbs, corms, and berries/fruit for food, as well as over 17 species of native grasses for basket and mat making which remains an important cultural practice and form of art. Luiseño women would gather seeds, roots, wild berries, acorns, strawberries, and prickly pear in these baskets woven with grasses, and men would hunt a variety of animals, such as deer, antelope, rabbits, wood rats, ducks, quail, seafood, and insects (Pauma Band of Luiseño Indians, 2019). Tribal members also used horned lizards (*chaláka*; horny toads), milkweed (gum trees), cascera, and castor oil for food, materials, and/or medicine. Many of these resources continue to be used and remain central to the cultural identity and traditions of the Tribe.



"It feels more extreme. Hotter and drier than I remember. There is hardly any regular seasonal change."

- LA JOLLA TRIBAL ELDER



PART II

Climate Change
drivers & exposures

Drivers of Climate Change

CLIMATE CHANGE ON A GLOBAL & NATIONAL SCALE

"I am very concerned for the future of my grandchildren and their children. What will happen with the effects of climate change?"

- LA JOLLA TRIBAL ELDER

Throughout time, the Earth's climate has undergone many periods of change. Slight fluctuations in the Earth's orbit have contributed to natural variations in climate that have resulted in cycles of glacial advance and glacial retreat (National Aeronautics and Space Administration, 2019). However, climate records from the past millenia reveal that our global climate is changing rapidly in contrast to the Earth's history of natural climate variations (US Global Change Research Program, 2017). Global average temperatures in our time period are, in general, the highest, and rising the fastest, than any period in at least 1,700 years (US Global Change Research Program, 2017). Since the late 19th century, the planet's average surface temperature has risen 1.62 °Fahrenheit (F) (0.9° Celsius (C)). Changing trends in climate variables can provide evidence for climate change, including increasing global average temperatures, melting land ice, glacial retreat, warming ocean temperatures, extreme temperature and rainfall events, and ocean acidification (NASA, 2019). The extent and impacts of climate change in future years will greatly depend on greenhouse gas (GHG) emissions, land use changes, and the sensitivity and timing of these climate variables.

Clouds rolling over Palomar Mountain
Credit: Chris Hunkeler on Flickr.

Changing temperatures depend on the amount of carbon dioxide (CO2) and GHGs that accumulate in the atmosphere as a consequence of human activities (Bedsworth et al., 2018). Future global GHG concentrations can follow various predictions or pathways depending on socio-economic effects, population growth, international and domestic policy, and technology, that alter GHG emission quantities (Lafakis et al., 2019). Scientists use Representative Concentration Pathways (RCPs) to project a range of pathways for future climate conditions. Four finalized trajectories included in the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report, including RCP 2.6, RCP 4.5, RCP 6.0, and RCP 8.5, represent different values of radiative forcing (the balance of incoming and outgoing energy between the Earth and atmosphere) due to human GHG emissions. Many climate assessments, including California's Fourth Climate Change Assessment, use RCP 4.5 and RCP 8.5 (Bedsworth et al., 2018).

RCP 8.5 represents a higher emissions pathway with atmospheric levels of CO2 exceeding 900 parts per million (ppm) by 2100, while RCP 4.5 represents a moderate GHG concentration pathway in which GHG emissions rise until mid-century and then decline by the end of the century (van Vuuren et al., 2011); (Bedsworth et al., 2018). Figure 2 shows projected increases in temperature under these two RCP scenarios for California by mid-century and late-century (Figure 2) (Bedsworth et al., 2018). The business-as-usual emissions trajectory is considered somewhere between RCP 8.5 and RCP 4.5, and thus, national and California state-wide assessments most commonly compare these two scenarios to understand mean global temperature increase (Lafakis et al., 2019).

Climate researchers use various climate models that incorporate these emissions pathways to provide temperature trajectories. There is often model disagreement for temperature projections even under the same RCP scenario, creating a need for model comparison amongst the scientific community. The Coupled Model Intercomparison Project (CMIP) began in 1995 to provide a framework for studying model outputs, including model intercomparison data and assessment of strengths and weaknesses for the IPCC Assessment Reports (National Center for Atmospheric Research, 2016). A suite of CMIP models and RCP scenarios are utilized in California's Fourth Climate Change Assessment, including the San Diego Regional Report, for generating projections of temperature, precipitation, soil moisture, snowpack and other variables (Bedsworth et al., 2018).

Figure 2. Projected increases in annual average maximum daily temperatures for California under RCP 4.5 (intermediate emissions) and RCP 8.5 (high emissions) scenarios by mid century (2040-2069) and late century (2070-2100) (Bedsworth et al., 2018).

Recently updated climate models project increased temperatures for California of:

$4.4^{\circ}F - 5.6^{\circ}F$ *or* $5.8^{\circ}F - 8.8^{\circ}F$

RCP 4.5
INTERMEDIATE EMISSIONS
// Consistent with future intensive efforts to reduce emissions

RCP 8.5
HIGH EMISSIONS
// Consistent with no future policy changes to reduce emissions

REGIONAL CLIMATE CONTEXT: SAN DIEGO COUNTY

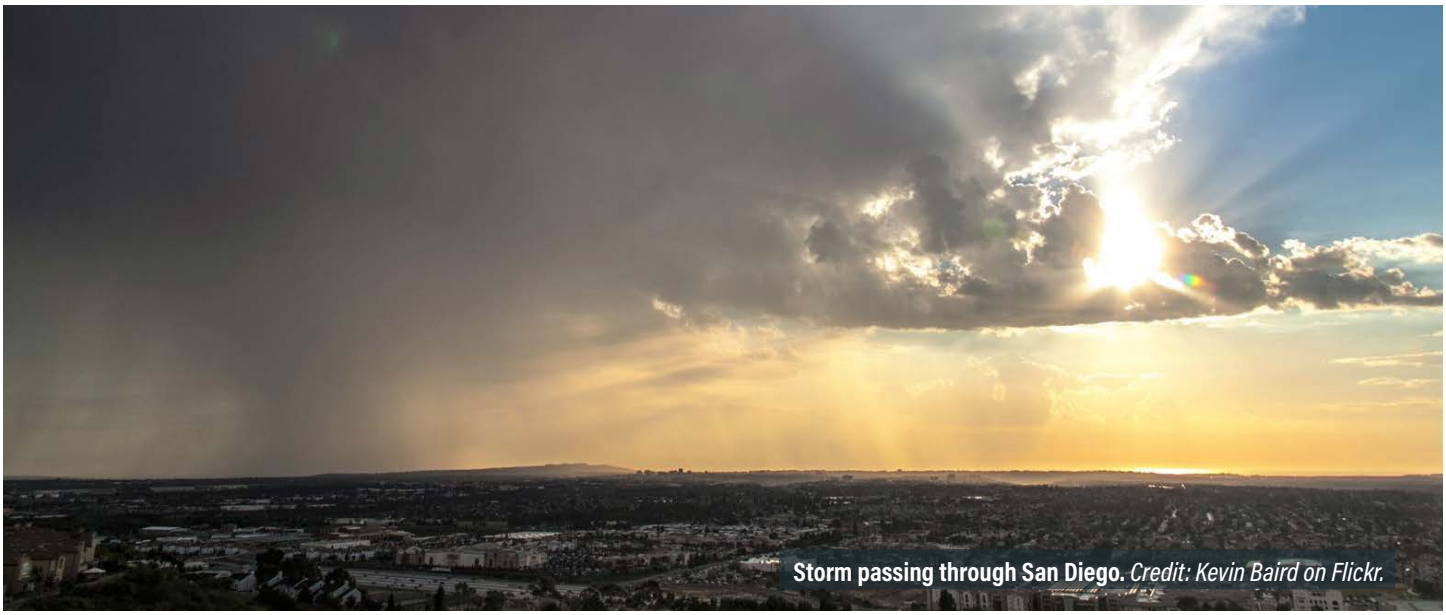
"We can't depend on the weather now."

- LA JOLLA TRIBAL ELDER

Situated in the heart of the subtropical climate zone, San Diego County is positioned uniquely within the coastal zone of the Pacific Ocean to the west, and interior mountains to the east. Like most areas in California, the region is known for its Mediterranean climate in which it experiences hot, dry summers, and mild winters (Kalansky et al., 2018). The combination of complex topography and wide altitudinal ranges coupled with the features of a semi-arid Mediterranean climate, results in a range of diverse microclimates throughout the region (Western Regional Climate Center, 2019). These factors produce variability in monthly precipitation during the winter months. Additionally, the region of southern California experiences the largest yearly variations in precipitation compared to any other region in the U.S (Kalansky et al., 2018). The region's semi-arid Mediterranean features create recurring patterns of prolonged drought and extreme precipitation events. San Diego County has an average annual rainfall amount of 10.5 inches (US Climate Data, 2019), however, this can vary greatly from year to year.

Wildfire is another important component of San Diego's Mediterranean climate, acting as a naturally occurring ecosystem process that shapes the structure and distribution of plant communities (Jennings et al., 2018). Wildfire ignitions largely occur from human sources but are escalated in part as a result of Santa Ana winds that pass through the region (Kalansky et al., 2018). In southern California's west and south-westward sloping terrain, Santa Ana winds fuel the region's most catastrophic wildfires (Kalansky et al., 2018). Santa Ana winds originate from the Great Basin, channeling through low gaps in the mountains and into corridors of San Diego. These winds contribute to some of the region's hottest temperatures and highest wind speeds in which the region's largest fires occur (Kalansky et al., 2018).

Coastal low clouds and fog (CLCF) migrate along the West Coast and are a distinct component of San Diego's climate. CLCF fluctuate on annual and decadal scales, resulting from a combination of naturally occurring climate and weather patterns (Kalansky et al., 2018). Offering relief from the consistently hot, dry, drought conditions of summer, CLCF play an important role in the hydrological regime and ambient temperature, especially for the county's coastal ecosystems (Jennings et al., 2018).



Storm passing through San Diego. *Credit: Kevin Baird on Flickr.*

CLIMATE CHANGE DRIVERS IN SAN DIEGO COUNTY

Two of the major climate change drivers for the San Diego region are temperature and precipitation. It is expected that San Diego's semi-arid Mediterranean features will intensify as the climate changes, meaning enhanced warm and dry periods intermittent with a concentrated wet season of precipitation events (Kalansky et al., 2018).

Temperature

One of the major climate drivers for the San Diego region is changing temperature. The region is expected to see significant temperature increases in both annual minimum (Tmin) and maximum temperature (Tmax) of 4˚ F to 10˚ F by the end of the century. Figure 3 shows the projected shifts in annual cycle Tmax and Tmin for 2006-2039 (dotted blue line), 2040-2069 (brown dashed line) and 2070-2100 (solid red line) under both RCP 4.5 and RCP 8.5 (Kalansky et al., 2018).

Seasonal temperatures are projected to shift with higher average temperatures for both winter and

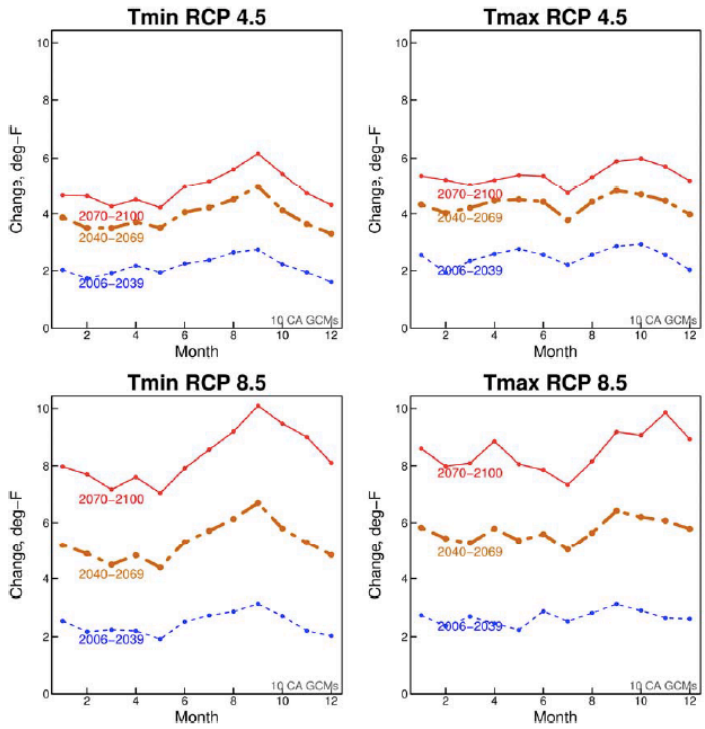


Figure 3. Projected shifts in Tmax and Tmin under RCP 4.5 and RCP 8.5 for 2006-2039 (dotted blue line), 2040-2069 (brown dashed line) and 2070-2100 (solid red line).

spring months. It is estimated that by the end of the century, San Diego will experience a 5˚ F - 6˚ F average temperature increase in January and a 5˚F - 10˚F average temperature increase in July. As a region already prone to heat waves, it is projected that background climate warming will increase the frequency, duration, and intensity of heat waves compared to historical thresholds (Kalansky et al., 2018). The region will face varying changes in the average hottest day per year, daily maximum temperature (Tmax) and daily minimum temperature (Tmin) because of the region's diverse topography and distinct microclimates.

Flooding on La Jolla Reservation in 2008. *Credit: La Jolla Environmental Department*

Precipitation

Another key climate change driver for the region is precipitation. As the global climate warms, climate models indicate that the variability of precipitation in Southern California will continue to increase but will change in character and timing. As a result, the region will likely experience wetter and more concentrated winters, yet longer drier periods beginning earlier in the spring and lasting longer through autumn (Kalansky et al., 2018). While precipitation will likely become less frequent, extreme precipitation events, defined as days with precipitation at or exceeding the 95th percentile, will continue to intensify. Because these events account for 80% of the inter-annual variability, as these events intensify, so too will the region's overall precipitation variability. By the end of the century, the average wettest day for every five years in San Diego is estimated to increase by 10-25% under RCP 4.5 and 15-30% under RCP 8.5 compared to that of the historical period (1976-2005) (Kalansky et al., 2018).

"It use to rain a lot more during the summers and the water from the streams would run all summer. Now they only run when there is heavy rain."

- LA JOLLA TRIBAL ELDER

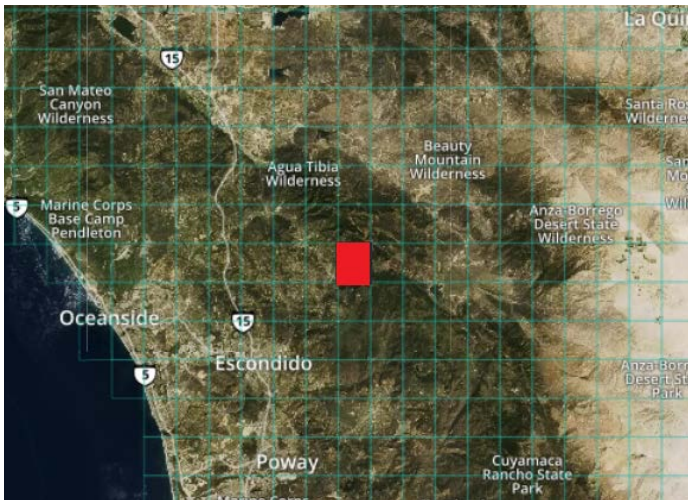
LOCAL CLIMATE CONTEXT: LA JOLLA RESERVATION

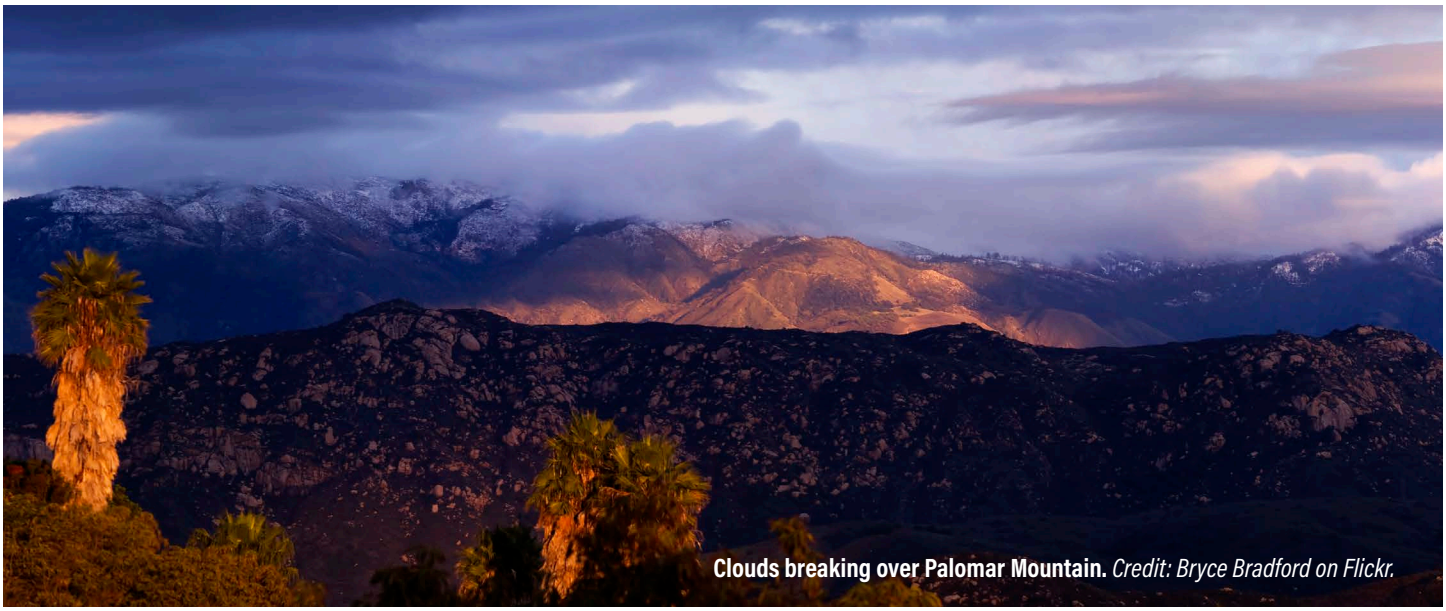
"Just looking around the reservation, you can see the change to the land. Things aren't as green."

- LA JOLLA TRIBAL ELDER

Both annual precipitation and inter-annual variability in precipitation in most areas of California are primarily tied to the number of extreme precipitation events. Thus, these events play a large role in dictating wet years versus dry years . It is also important to note that while much of San Diego County experiences the marine cooling effects of coastal low clouds and fog (CLCF) on the coastal zone, it is not very common for CLCF to penetrate inland into the La Jolla Reservation location (Figure 5). However, there is a significant amount of variability from year-to-year. Satellite records show that the long term mean for May through September 1996-2017 is approximately 11%. These records also show that May - September of 1998 was the cloudiest recorded period for the Reservation, with

Figure 4. La Jolla Reservation grid cell (33.28125, -116.90625)





Clouds breaking over Palomar Mountain. *Credit: Bryce Bradford on Flickr.*

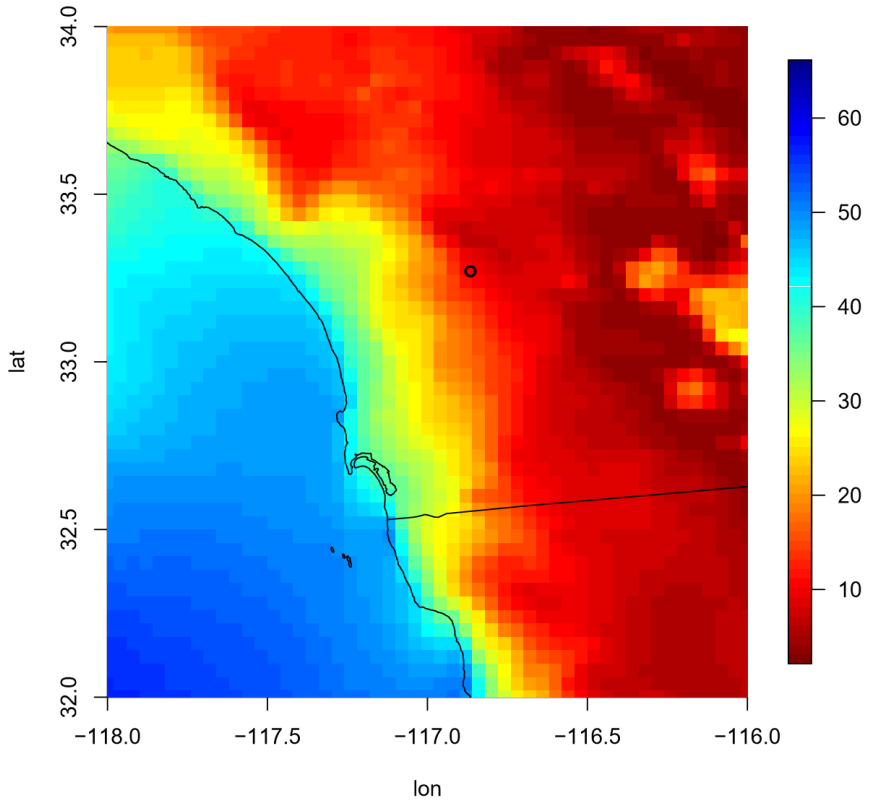


Figure 5. The mean summertime coastal low cloudiness (CLC) for the 1996-2017 period across the San Diego region. The color bar indicates propagation of CLCF across San Diego, and the black circle represents the La Jolla Reservation.

an average of 23% low level cloud cover, while the May - September of 2001 was the clearest recorded period, with an average of 6.9% low level cloud cover. As depicted in Figure 5, west of the La Jolla Reservation, towards the coastal zone, is prone to having more CLCF compared to more inland areas. Thus, while the La Jolla Reservation is generally not a cloudy or foggy location comparatively, it is not far from the cooling influence of these marine layer clouds (Clemesha et al., 2016).

The La Jolla Reservation experiences powerful wind events, including the Santa Ana winds, that result in dry, hot gusty conditions. Tribal members note that the wind moves through the region like a tunnel (Kelly, 2007). These Santa Ana winds have triggered catastrophic wildfires in the Palomar area in recent years and throughout history. During the 2007 Poomacha Wildfires, winds moved with speed and intensity. Low humidity coupled with Santa Ana winds of over 90 miles per hour (mph) fueled the flames that persisted for several days (Interagency Burned Area Emergency Response Team, 2007a). The Poomacha Wildfire directly impacted the La Jolla community, resulting in significant losses in buildings, infrastructure, and natural resources throughout the Reservation. The fire began on the La Jolla Reservation, burning 94 percent of the Reservation, including nearly 60 homes, historic artifacts, and a thick forest of live oak that provided valuable resources for the community, including acorns and shade trees (Kelly, 2007).

CLIMATE CHANGE DRIVERS ON THE LA JOLLA RESERVATION

Fire on La Jolla Reservation in 2003. *Credit: La Jolla Environmental Department*

Temperature

The La Jolla Reservation is prone to higher temperatures than many areas in San Diego County, especially coastal communities. Thus, as climate change continues to affect the region, the La Jolla community could experience further increases in temperature. Under RCP 4.5 emissions scenario, where emissions peak around 2040 then decline, it is projected that the annual mean Tmax for the La Jolla Reservation area will increase by around 5.5˚ F, from the historical mean (1950-2005) of 75.7 F, to a modeled projected annual mean of 81.2˚ F by the end of the century (2070-2099) (GIF, UC Berkeley, 2019). Under RCP 8.5 emissions scenario, where emissions continue to rise strongly through 2050 and plateau in 2100, the projected annual Tmax mean will increase by around 8.4˚ F on the Reservation, from the historical mean of 75.7˚ F (1950-2005) to a modeled projected annual mean of 84˚ F by the end of the century (Figure 6) (GIF, UC Berkeley, 2019). As shown in Figure 7, models project the region will likely experience more extreme heat days under both RCP scenarios by the end of the century (Figure 7) (GIF, UC Berkeley, 2019).

Cham'teela:

Rain - 'axilax

Snow - yúuyit

Fire - kút

Smoke - kúumit

River - wanícha

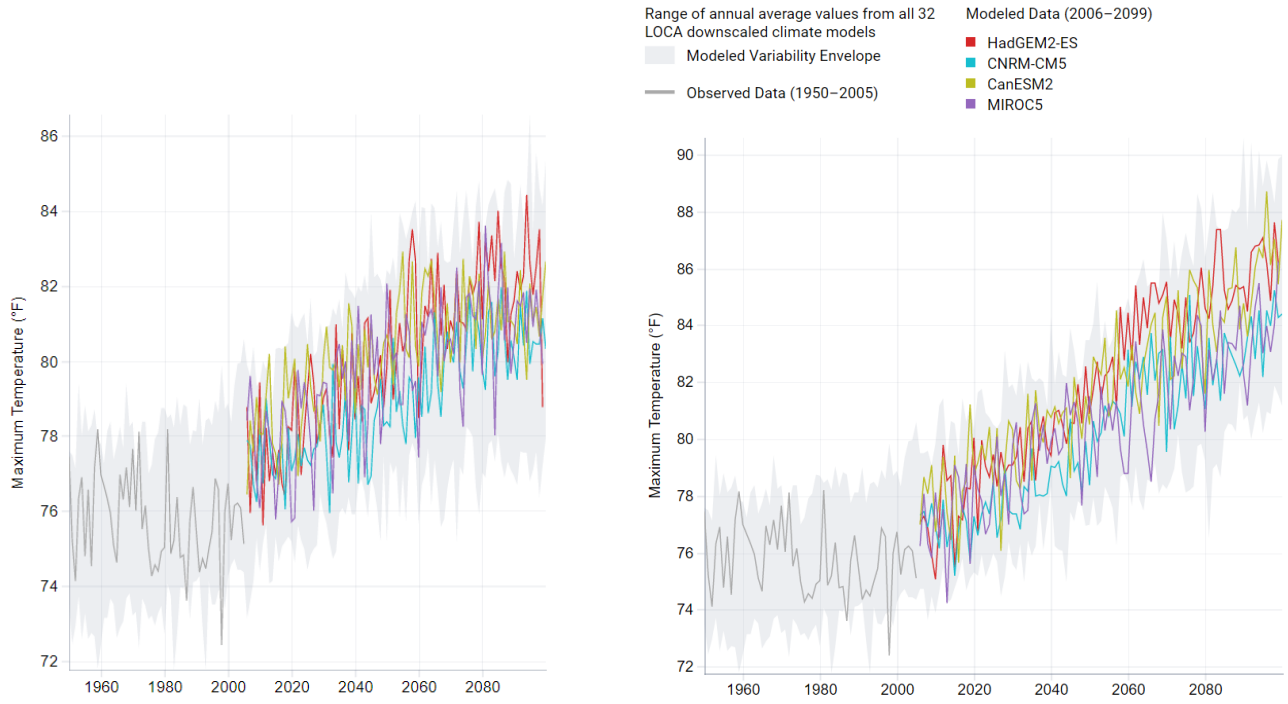


Figure 6. Projected annual mean Tmax for 2070-2099 for La Jolla Reservation grid cell under RCP 4.5 (left) and RCP 8.5 (right).

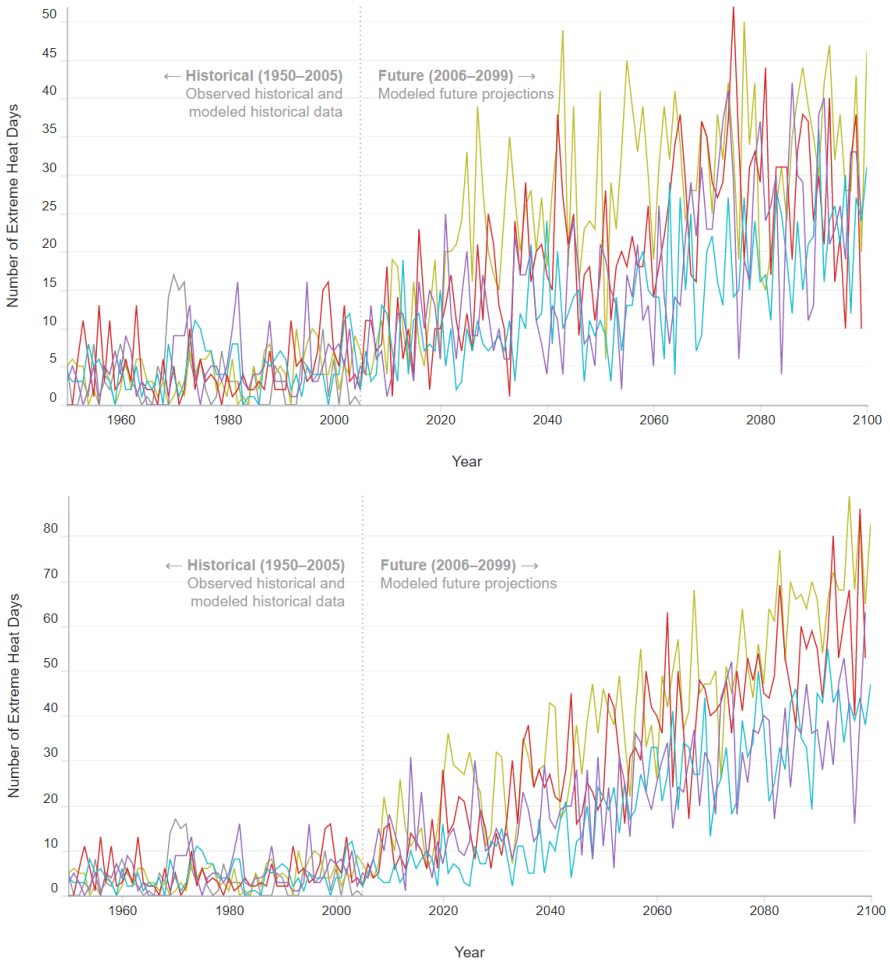


Figure 7. The average number of days in a year in which Tmax exceeds the extreme threshold of 100.3 °F within the La Jolla Reservation grid cell area. Models project that the region will experience an average of 27 extreme heat days under RCP 4.5 (top) and 46 extreme heat days under RCP 8.5 (bottom) by the end of the century.

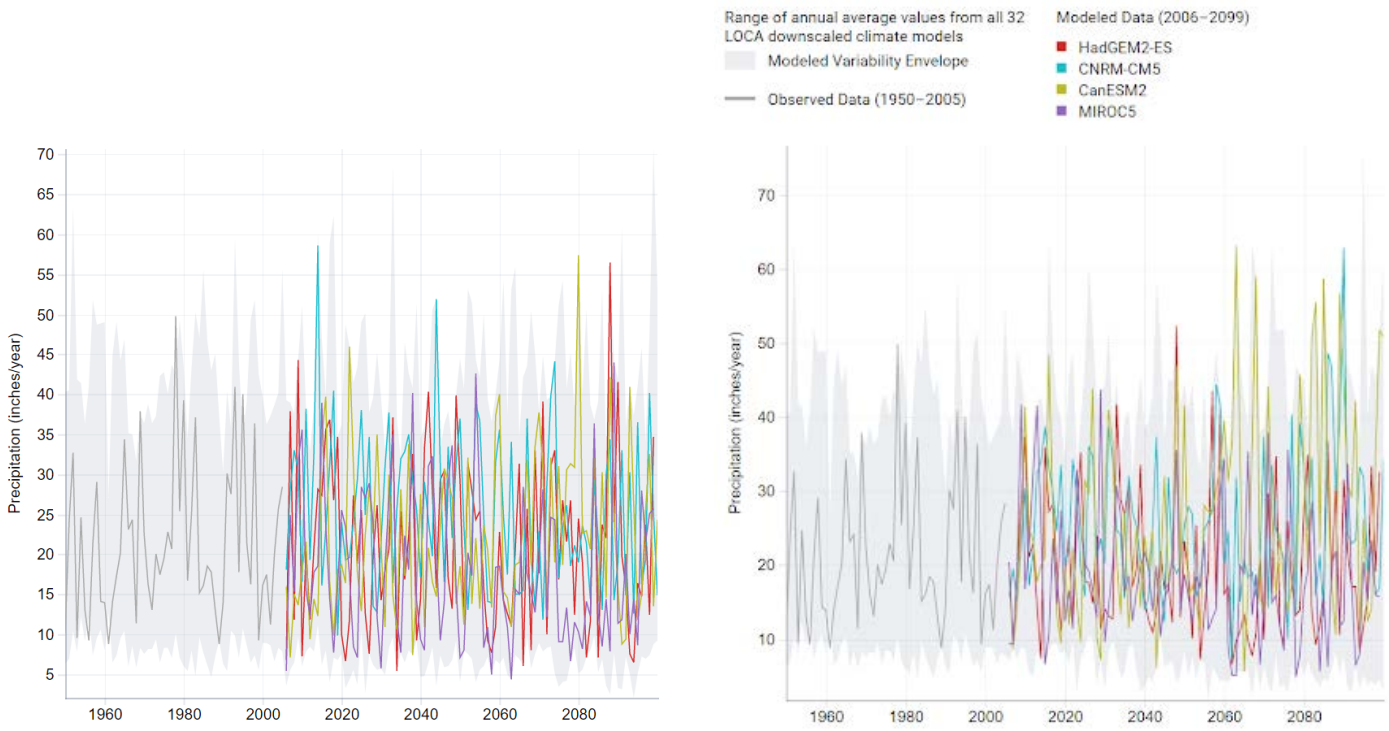


Figure 8. Projected annual average precipitation values under RCP 4.5 (left) and RCP 8.5 (right) for the La Jolla Reservation grid cell.

Precipitation

The Reservation's geographic location at the steep basin of Palomar Mountain, and geologic character of naturally erodible soils, make the region prone to higher annual precipitation and a higher number of extreme precipitation events than many other regions in San Diego County (Interagency BAER Team, 2007a). The Palomar ridgeline creates an orographic effect that causes storms to stall over the region and yield large amounts of rain, especially for southwest-facing and west-facing slopes such as the La Jolla Reservation (Interagency BAER Team, 2007a). As temperatures continue to warm, it is projected that the intensity of these extreme precipitation events will increase.

Figure 8 shows the estimated intensity of extreme precipitation events for the La Jolla Reservation and how intensity changes in a warming climate over historical, mid-century, and late-century time periods. Extreme precipitation events are days during a water year (October through September) with two-day rainfall totals above an extreme threshold of 1.65 inches (GIF, UC Berkeley, 2019). The models range from estimated intensities of 6.4 to 8.33 inches of precipitation under RCP 4.5 and 5.8 to 9.2 inches inches of precipitation under RCP 8.5. The average model (CanESM2) estimates 6.4 inches of precipitation under RCP 4.5 and 9 inches of precipitation under RCP 8.5 by the end of the century. Annual mean precipitation specifically for the Reservation grid cell is projected to increase from the observed historical annual mean (1950-1990) of 20.5 inches to 23.7 inches by the end of the century under RCP 8.5, as shown in Figure 8 (GIF, UC Berkeley, 2019).

"The campground water was high – when we were kids, we would put 4, 5, 6 tubes together to make a raft, that's how big the water was. Now you can barely get down it."

- LA JOLLA TRIBAL ELDER

Visitors to the La Jolla Indian Campground tubing in 2008. *Credit: jclamb on Flickr*

CLIMATE CHANGE EXPOSURES TO THE LA JOLLA RESERVATION

"The weather cycle is far different now compared to my youth."

- LA JOLLA TRIBAL ELDER

The La Jolla community is naturally prone to unique weather and climate patterns given its geographic location. However, these projections show that the La Jolla region will continue to experience further variability of weather and climate patterns as temperatures rise, triggering more frequent and intensified extremes. These climate drivers, coupled with the Reservation's location and social context, make the region especially vulnerable to climate stressors such as extreme heat and heat events, drought, wildfire, and extreme precipitation and flooding.

Drought and Wildfire

Despite intensified extreme precipitation events, it is likely that droughts will increase in both frequency and intensity (Jennings et al., 2018). The expansion of the subtropical zone will lead to a decrease in the number of wet days. More dry days will intensify already depleting soil moisture content and moisture deficit. Figure 9 shows the projected percent change yearly in moisture deficit by mid-century from the historical period (Kalasky, 2018). The average potential evapotranspiration in the La Jolla Reservation area is projected to exceed the historical average by 4.49% over the next 30 years and 8.75% over the 30 years after that (Conservation Biology Institute, 2018), indicating an increase in moisture deficit for the area.

Furthermore, Figure 10 shows the projected change in climatic water deficit (CWD) for 2070-2099 from the historical period (1981-2010) using the MIROC RCP 8.5 model, specifically for the La Jolla Reservation area and surrounding region (Conservation Biology Institute, 2019). The map indicates that by the end of the century, many regions within the Reservation and surrounding the area could experience a significant increase in CWD. Together, both Figures 9 and 10 illustrate that many areas of San Diego County, specifically the La Jolla Reservation and surrounding region, could experience increased drying of the landscape.

Fire damage on La Jolla Reservation.
Credit: La Jolla Environmental Department

Precipitation in the spring and autumn is projected to decrease by up to 20% for San Diego County. This will cause earlier spring soil drying and extended drying through the late fall into winter, thus elongating seasonal dryness in California (Kalansky et al., 2018). The combination of longer periods of dryness, expanding subtropical zones, and warming temperatures, results in more dry years for San Diego county. It

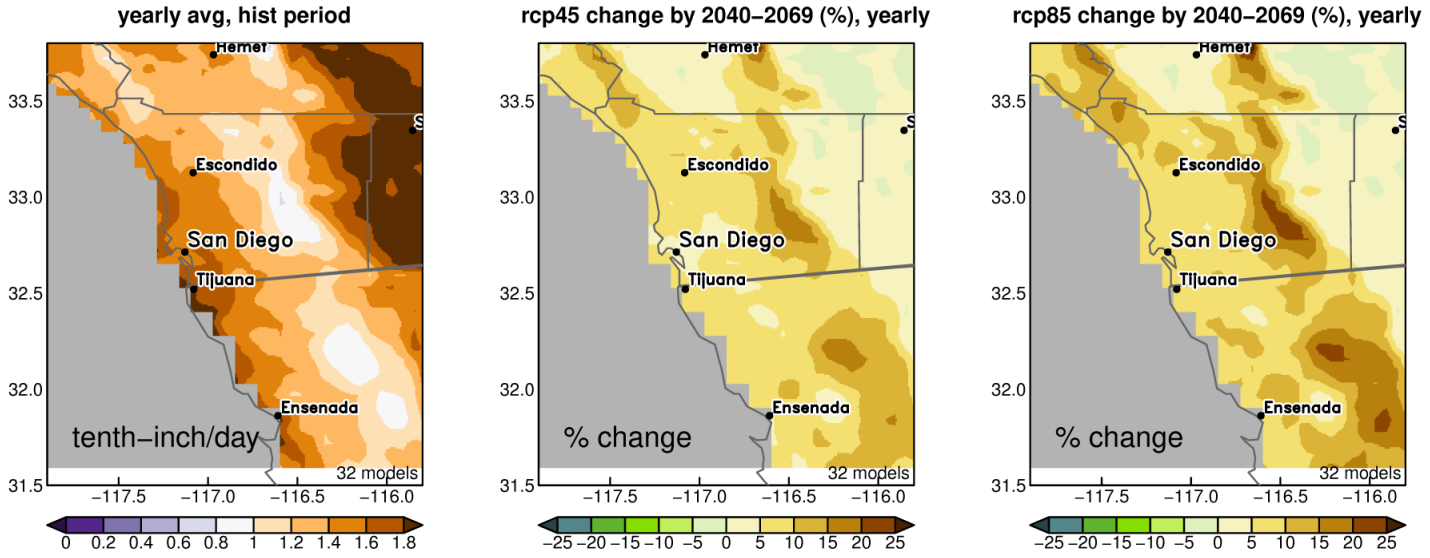
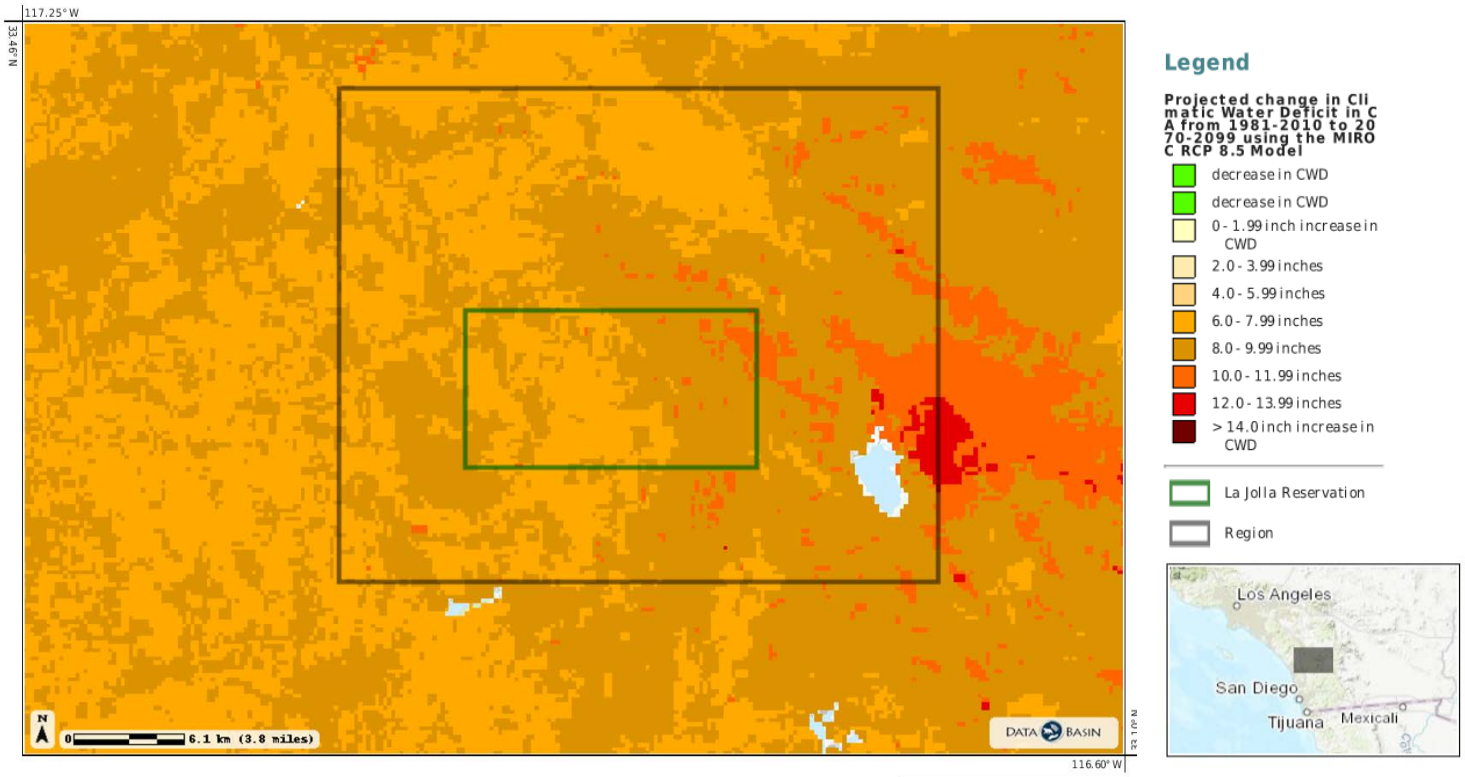


Figure 9. Moisture deficit (the evaporative demand not met by available water) for historical years (left) and the percent change for mid-century (2040-2069) under RCP 4.5 (middle) and RCP 8.5 (right). Positive values indicate increased drying of the landscape.

Figure 10. Projected change in climatic water deficit for 2070-2099 under RCP 8.5 compared to historical (1981-2010).



The Poomacha Fire in 2008. *Credit: La Jolla Environmental Department*

is projected that future droughts will increase in duration, severity, and frequency, due to more dry years and dry antecedent conditions, which will continue to intensify the relative impacts of drought.

While wildfire is a naturally occurring process in San Diego's ecosystems, changes in its occurrence and distribution over time have altered the region's overall ecology and increased societal impacts. Figure 11 outlines fire hazard zones for the La Jolla Reservation and surrounding areas based on fuels, terrain, weather, and other relevant factors (California Department of Forestry and Fire Protection, 2019). Areas of red represent zones designated as very high risk of fire hazard. The map illustrates that many areas (85%) of the La Jolla Reservation boundary are designated as a "very high" risk zone for fire hazard.

One of the major factors that will continue to contribute to wildfire risk is the shift in timing of precipitation regime. As wet seasons become more concentrated, there will be less precipitation in fall months and thus drier conditions directly before the peak Santa Ana wind season (Kalansky et al., 2018). Intense wildfire seasons in the western U.S. generally occur after prolonged or severe drought. The 2007 wildfire season was exacerbated by ongoing drought conditions statewide (Conservation Biology Institute, 2019). As droughts become more intense and frequent, and shoulder seasons (fall and spring) become drier, these conditions coupled with Santa Ana winds could heighten the risk of wildfire on the Reservation area. Figure 12 shows the 2007 California wildfire perimeters and the prevailing winds, including the Santa Anas. These winds help spread fire across larger areas while transporting ember and ash across the surrounding landscape (Grossi, 2008). While projections for future wildfires require better long-term observations for reliable estimates (Kalansky et al., 2018), the 2007 Poomacha Fire forewarns of the devastating impacts that these winds and dry, hot conditions can have across the region's landscape.

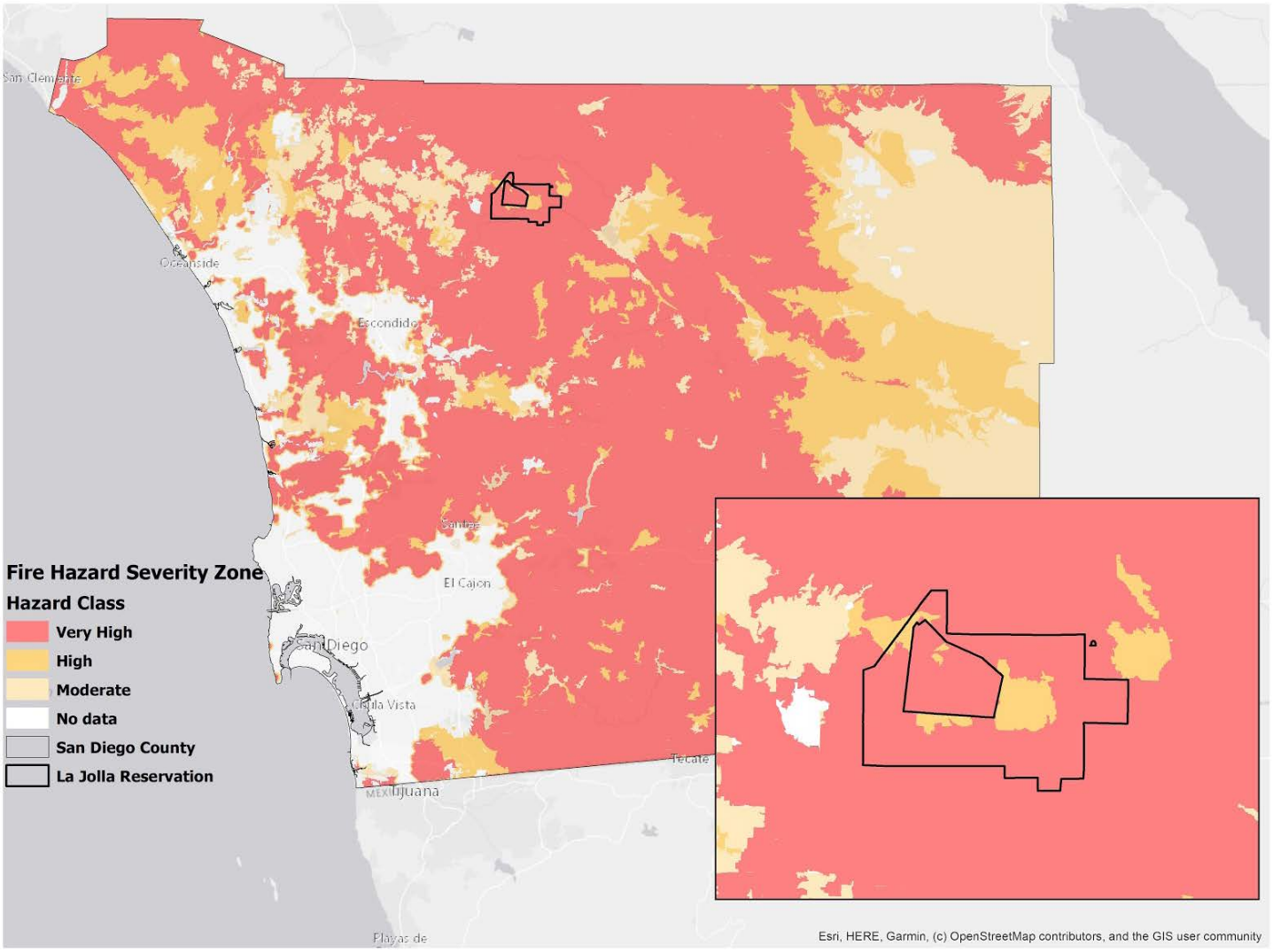
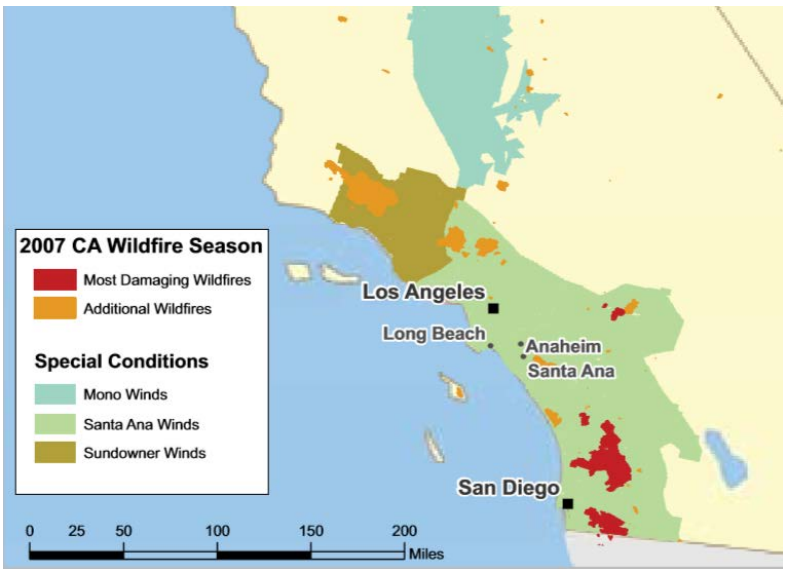


Figure 11. Fire Hazard Severity Zones for San Diego County and the La Jolla Reservation.

Figure 12. Prevailing winds of the 2007 Southern California wildfires.



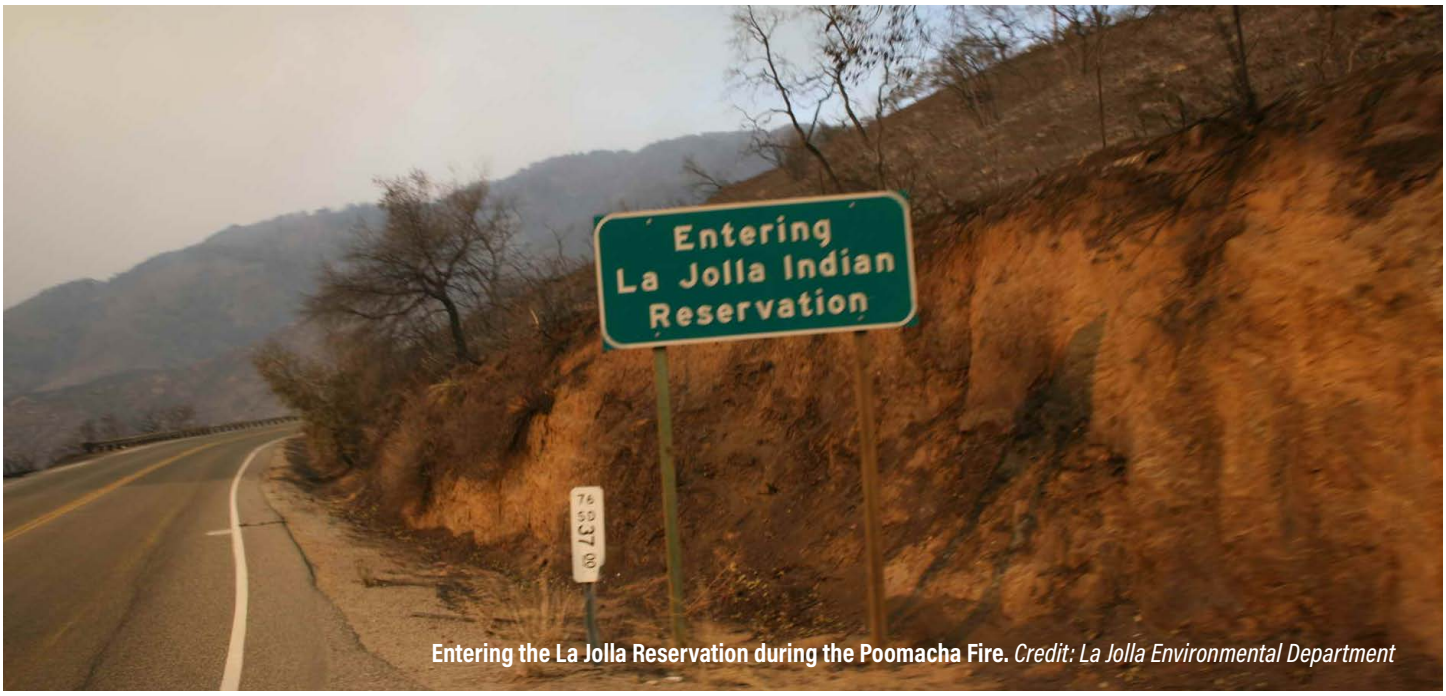
Hotter Temperatures and Extreme Heat Events

As a region already prone to extreme heat, it is projected that background climate warming will increase the frequency, duration, and intensity of heat waves compared to historical thresholds. San Diego County and neighboring areas will face varying changes in temperatures given the region's diverse topography and distinct microclimates, with climate warming trends varying in coastal versus inland areas. Figure 13 shows the climate warming (°F) of summer maximum temperature (June - August) across coastal to inland San Diego County, by early, mid, and late 21st century (Kalansky et al., 2018).

Figure 13 illustrates that maximum temperature during summer months could increase with distance from the coast. This is in part due to the cooling effect of CLCF that modulates the activity of heat waves and buffers the impacts of these events at the coast. In general, higher amounts of warming are expected in inland areas that generally do not benefit from the modulating effects of CLCF. Figure 14 shows the average number of days in a year in which Tmax exceeds the extreme threshold of 100.3 °F within the La Jolla Reservation grid cell area. Models project that the region will experience an average of 27 extreme heat days under RCP 4.5 and 46 extreme heat days under RCP 8.5 by the end of the century (GIF, UC Berkeley, 2019).

> *"The heat waves are longer."*
>
> - LA JOLLA TRIBAL ELDER

With the Reservation's inland location 40 miles north-northeast of the city of San Diego, the buffering effects of CLCF are diminished, making the community prone to hotter temperatures than many coastal communities (Clemesha et al., 2016). However, CLCF rely on highly variable, complex factors, and thus projections for the net effect of climate change on CLCF remains uncertain (Kalansky et al., 2018), especially for areas like the La Jolla Reservation that is situated between inland dry areas and moist, coastal areas prone to CLCF.



Entering the La Jolla Reservation during the Poomacha Fire. *Credit: La Jolla Environmental Department*

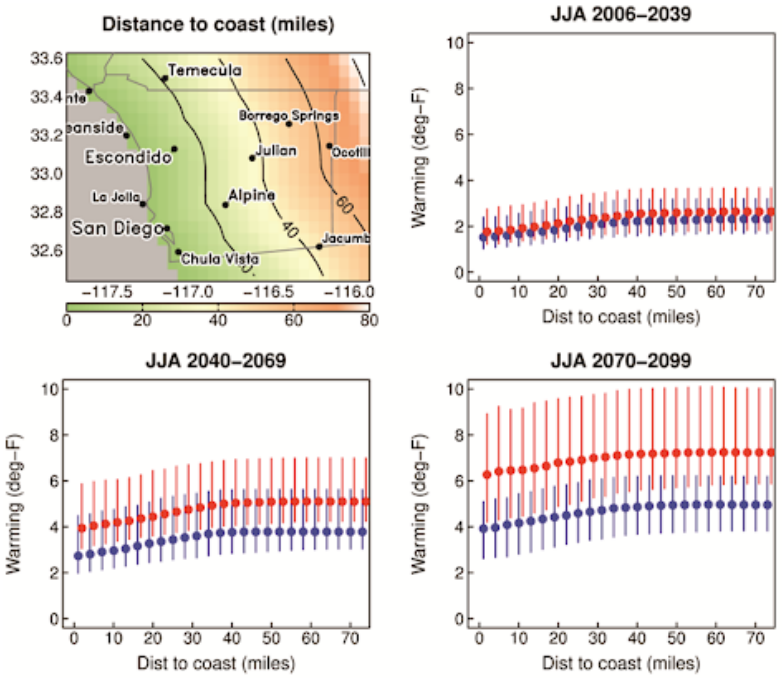
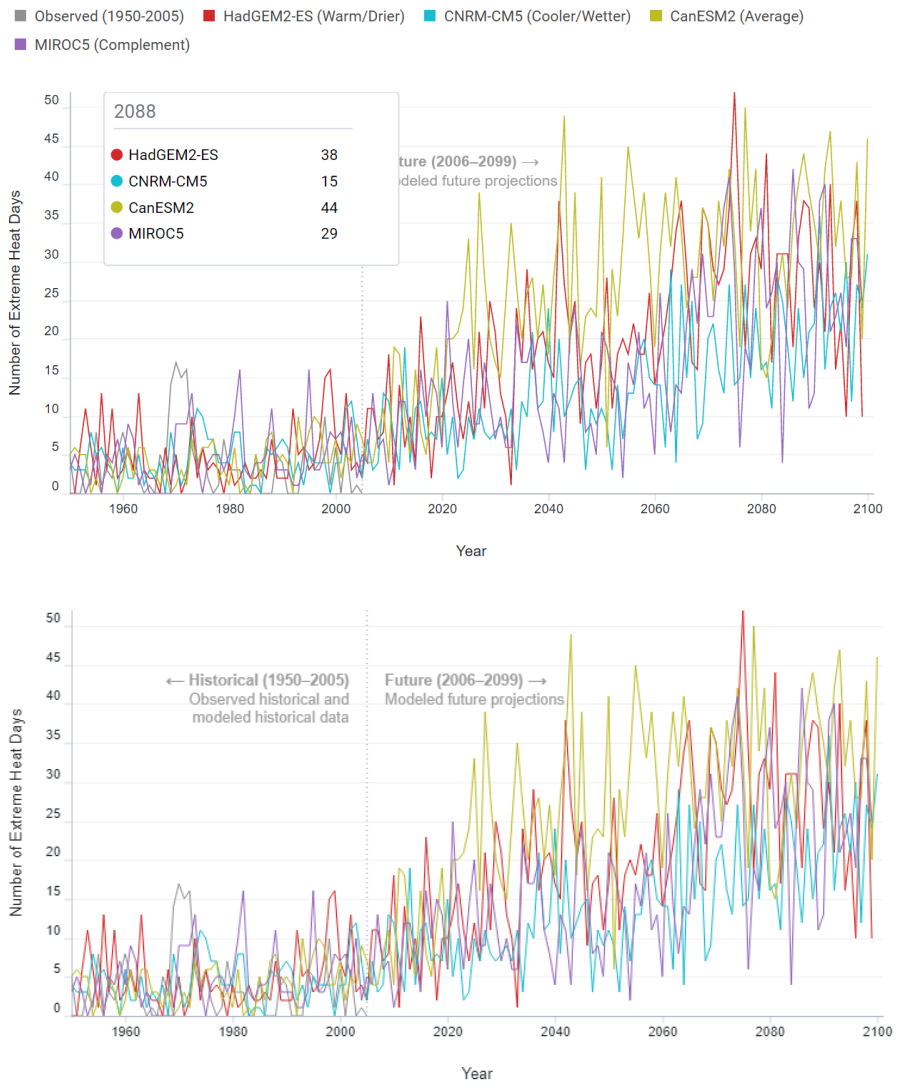


Figure 13. Climate warming (°F) of summer maximum temperature (June - August) across coastal to inland San Diego County by early (2006-2039), mid (2040-2069), and late century (2070-2099) under RCP 4.5 (blue) and RCP 8.5 (red).

Figure 14. Projected average number of extreme heat days per year by the end of century under RCP 4.5 (top) and RCP 8.5 (bottom).



Storms and Flooding

The frequency and intensity of extreme precipitation events will likely increase. Extreme events are defined as the number of days in a water year when two-day rainfall totals are above the extreme threshold. Model projections estimate an average of seven extreme precipitation events per wet season by the end of the century for the La Jolla Reservation. The models representing cooler and wetter future conditions estimate ten extreme precipitation events by the end of century under RCP 8.5 (GIF, UC Berkeley, 2019). While for most Mediterranean climate regions around the world, models consistently indicate drier futures, projections of changes in annual precipitation for California differ (Polade et al., 2017). Other Mediterranean climate regions are expected to experience decreased frequency of winter precipitation, while models project increases in extreme precipitation over California, where there is higher projected warming. Thus, it is important to note that because projections for precipitation and storms in California are highly variable, models in general show more uncertainty in estimates than most other Mediterranean climates across the globe (Polade et al., 2017).

"We had to walk down the grade to catch the bus because it was snowing so much. This doesn't happen anymore."

- LA JOLLA TRIBAL ELDER

In February 2019, an intense storm system led to record breaking rainfall at Palomar Mountain, where 10.1 inches of rain were recorded during one day, making it the most rainfall ever recorded in one day for San Diego County (Bravo, 2019). These intense, short duration storms have implications for increased flood risk, especially for the La Jolla Tribe and its proximity to the river. The region is prone to sporadic extreme hydrologic events that predominantly determine mean streamflow (Regional Water Management Group and

Flooding in the La Jolla Campground as a result of a storm in January of 2008, following the Poomacha Fire in 2007.
Credit: La Jolla Environmental Department

Regional Advisory Committee, 2019). However, as these rainstorms become more frequent and intense, flood risk and damage for the region could increase.

The unconsolidated, deep, coarse soils below Palomar Mountain are known as unstable and inherently susceptible to debris flows during intense rainfalls. These high-risk debris flow areas show evidence of past large-scale events and coincide with areas that include the La Jolla Reservation (Interagency BAER Team, 2007a). Wildfires increase the watershed's responsiveness to precipitation events, as burned areas generally respond quickly and intensely to local storm events (Interagency BAER Team, 2007a). Fires have in the past coincided with these high risk areas and caused debris flows, weakening the stability of soils, and thus, increasing erosion (Regional Water Management Group and Regional Advisory Committee, 2019). Fire increases the risk of debris flow on these slopes and the sub-basins in the Poomacha fire area have a high post-fire debris flow hazard (Interagency BAER Team, 2007a). In a study of regional basins and their ratings of likelihood and volume for a 2-year, 3-hour storm event and a 10-year, 3-hour storm event, Amago East sub-basins where the La Jolla Reservation is located has a high probability of occurrence (60-80% probability) with a volume range of 10,000 and 100,000 cubic meters (Interagency BAER Team, 2007a). The Cedar Creek watershed, above the La Jolla campground, has a high probability of flooding under the 10-year storm event.

"There is more flooding now."

- LA JOLLA TRIBAL ELDER

Flood damage as a result of a storm in January of 2008, following the Poomacha Fire in 2007.
Credit: La Jolla Environmental Department

"Climate change for native people is reconnecting to the land, we don't call it climate change. It is a disturbance with our relationship with the land. We can connect with the land as a way to heal the sickness."

- LA JOLLA TRIBAL MEMBER

PART III

Climate Change Impacts to the Reservation and its People

Climate Change Impacts

It is clear that these climate drivers and climate stressors are complicated, variable, and in many ways interlinked. The impacts will be felt across the Reservation's human, natural, and built environments, with specific impacts for natural and cultural resources, community and traditions, built environment and economy, and human health and wellness. Identifying the impacts and risks posed by climate change and extreme events can help identify the La Jolla Tribe's vulnerabilities, opportunities for adaptation, and steps forward to enhance overall tribal resilience.

La Jolla Tribal Youth on a Climate Kids Field Trip
Credit: Climate Science Alliance

CLIMATE DRIVERS, EXPOSURES, AND IMPACTS TO THE *La Jolla Band of Luiseño Indians*

DRIVERS

INCREASING TEMPERATURES

VARIABLE & EXTREME PRECIPITATION

VISIT PAGE 21 TO LEARN ABOUT THE DRIVERS OF CLIMATE CHANGE

EXPOSURES

FIRE

HEAT

DROUGHT

FLOOD

VISIT PAGE 30 TO LEARN ABOUT WHAT CLIMATE CHANGE LOOKS LIKE ON DIFFERENT SCALES

IMPACTS

NATURAL & CULTURAL RESOURCES

COMMUNITY & TRADITIONS

HEALTH & WELLNESS

INFRASTRUCTURE & ECONOMY

GO ON TO THE NEXT PAGE TO LEARN ABOUT HOW THE LA JOLLA TRIBAL COMMUNITY IS IMPACTED

2019 CLIMATE ADAPTATION PLAN

Summary Table

of Climate Change Impacts

Drought

Natural Resources

- Changes in water availability for wildlife, plants, and people
- Shifts in seasonal life cycles and abundance of plants & animals
- Spread of invasive species that weaken, outcompete, and cause declines in native plants
- Dead and dry vegetation increases the risk of fire

Infrastructure & Economy

- Increased stress on groundwater supply/surface water resources
- Increased risk of fire ignition on dry vegetation
- Weakening and/or death of trees that provide shade in the La Jolla Campground, resulting in fewer visitors and less revenue
- Water scarcity resulting in increased costs for household use

Health & Wellness

- Higher dust levels leading to greater risk of air-borne illnesses
- Increases in vector-borne disease as species establish new areas of breeding grounds
- Water scarcity causing economic stress/impacts on mental health
- Lower water levels/pressure resulting in backflow and growth of bacteria in water infrastructure

Community & Traditions

- Loss of culturally-significant plants and animals can inhibit the ability to engage in traditional ways of life & maintaining language
- Shifts in seasonal life cycles, abundance, and geographic range of culturally-significant resources could alter the community's traditional gathering locations, methods, and food sources

FIRE

- Direct impact to wildlife and plants
- Increased soil erosion after fire can reduce the ability to retain moisture and regenerate the landscape
- Frequent/intense fire can devastate culturally-significant plants & animals
- Altered water resources, habitat, migration of wildlife, and distribution of plants

- Damage/destruction of facilities, homes, and infrastructure
- Disruption to power, telephones, and other public services
- Closures of schools and businesses that impact youth and result in economic losses
- Increased soil erosion after a fire can cause road closures during storm events

- Injury and/or mortality directly from wildfire
- Reduced air and water quality causing illness, disease, and infection, and/or exacerbating pre-existing conditions like asthma
- Fire-induced isolation/relocation can have financial and emotional impacts resulting from financial stress, inability to be outdoors, and attend work/school

- Loss of culturally-significant plants and animals can inhibit the ability to engage in traditional ways of life
- Road closures can cause isolation and relocation of individuals and families
- Damage/destruction of critical community/Tribal buildings and cultural sites could inhibit the ability of community members to gather in these spaces

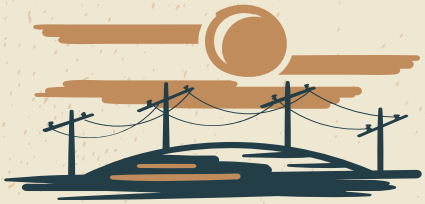
STORMS

- Damage/impair access to culturally-significant sites
- Increased soil erosion enhances risk of mudslides, flooding, and debris-flow
- Short, high intensity rainfall may not be able to replenish groundwater and/or surface water
- Reduced water quality from heavy rainfall, flooding, and mudslides

- Damage/destruction of important community facilities and homes, resulting in expensive maintenance costs
- Flooding of the La Jolla Indian Campground resulting in reduction of visitors and higher maintenance costs
- Flooding can cause damage and closures of roads, power lines, and water infrastructure

- Severe storms causing flooding and debris-flow that can result in severe injury and/or mortality
- Reduced water quality
- Increased mold infestation and the spread of insects that host/ transmit diseases
- Damage/destruction of infrastructure and cultural sites can impact mental health/wellness

- Storms/flooding cause hazardous conditions that isolate community members and impact the ability to access community resources and attend work/school
- Inability to access culturally-significant sites and resources
- Damage/destruction to critical infrastructure such as homes, businesses, and emergency centers



HEAT

- Higher temperatures impact surface water quality & availability
- Shifts in seasonal cues can disrupt the life cycle timing for important plants and animals
- Warming and evaporation alter habitat and migration of aquatic species

- Increased energy demand to use AC, resulting in increased costs for families and the community
- Stress on infrastructure and higher maintenance costs for roads and buildings
- Heat stress & poor air quality can result in more emergency room visits and increased costs for individuals/families

- Reduced night time cooling and less relief from daytime heat causing impacts for mental and physical health, especially for elders, children, and/or disabled
- Unsafe working conditions, especially for those working outdoors
- Unsafe heat conditions resulting in heat stroke, exhaustion, dehydration, and illnesses

- Higher temperatures, more humidity, and less night time cooling can have direct impacts on health and well-being
- Impaired access to culturally-significant sites and resources, resulting in the inability to engage in traditional ways of life

"My uncle was a hunter, he was a good shot and I use to go hunting with him but he couldn't hear well — he was kind of deaf so I would go with him — I would be his ears. We had rabbit, quail, turkey, and lot of deer, there was always a lot of food. We would see 15-16 deer at a time drinking up at Poomacha. Back then you could get what you needed but you don't see that anymore."

- LA JOLLA TRIBAL MEMBER

Wild Turkeys. *Credit: Chris Jerpsen on Flickr*

NATURAL & CULTURAL RESOURCES

Background and Existing Challenges:

The region's unique landscapes and vegetation communities are home to many natural resources that are also sacred to the La Jolla community. Natural resources and landscapes have been used by the Luiseño people for over 10,000 years (Regional Water Management Group and Regional Advisory Committee, 2019) and are thus central to the culture, traditions, and community cohesion of the Tribe. Some of these natural resources include the community's waterways and sources of water, aquatic species, terrestrial animals, and native plant communities.

California has the highest number of native and endemic plant species of any U.S. state, recognized as a biodiversity hotspot globally (California Department of Fish & Game, 2003). The South Coast Province, where the La Jolla Reservation is located, is recognized as the most-threatened, biologically diverse area in the U.S. (California Natural Resources Agency, 2018), home to approximately 200 taxa of plants and animals at risk with future changes (Kalansky et al., 2018). The Tribe has thrived off of the region's natural landscape for thousands of years, providing resources for medicine, food, structures, and more. Community members recall how people sustained themselves off of the abundance of the land, staying synced with the seasonal cycles of plants, animals, water, and harvest/hunting time throughout the region.

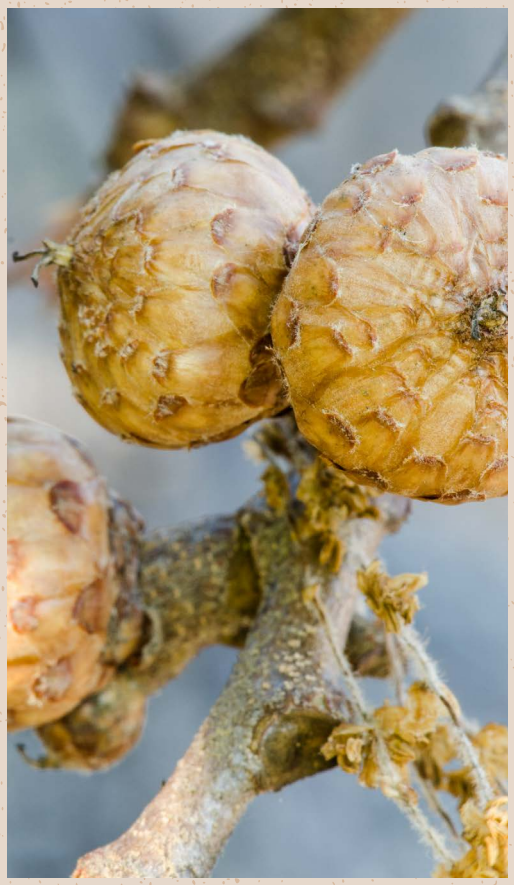
There are many plant and animal species local to the South Coast Province and San Diego County region that are considered sensitive, threatened, and/or endangered (California Department of Fish and Wildlife, 2015). Several plant and animal species listed as threatened or endangered by the U.S. Fish and Wildlife Service have been reported as potentially occurring on the La Jolla Reservation, including Quino Checkerspot butterfly (*Euphydryas editha quino*), Laguna Mountain Skipper (*Pyrgus ruralis lagunae*), Nevin's barberry (*Berberis nevinii*), San Bernardino bluegrass (*Poa atropurpurea*), and many others (Fege et al., 2007). Oak communities across California, including Southern California, are facing detrimental natural and human threats, including encroachment from human development, urban land conversion, and pests and pathogens. The California Fourth Climate Change Assessment Sierra Nevada Region Report estimates that by the late 21st century, some oak-woodland communities are likely to decline to less than 60% of their former range, and shift upwards in range due to climate change and human development (Dettinger et al., 2018). Oak woodland development percentages are higher in the Southern region of California than in any other region in the state (Gaman & Firman, 2006).

While the region's diverse ecosystems and species have adapted to the region's highly variable climate, precipitation regime, and local climate impacts such as increasing temperature, variability, and intensity of events, will perpetuate and accelerate existing challenges (Jennings et al., 2018). Although these species have withstood many weather and climate stressors, climate change poses new and intensified chal-

lenges that threaten their ability to adapt and survive in the years to come. Rapidly changing landscape conditions are significant, and in some cases, may permanently impact many species and ecosystems.

Similar to many areas across California, the South Coast province faces invasive species problems (CDFW, 2015). The large presence of non-native plant species is the main characteristic that differentiates disturbed southern mixed chaparral from undisturbed southern mixed chaparral (La Jolla Band of Luiseño Indians Environmental Department, 2019). A majority of the disturbed areas are found in close proximity to developed areas, and are prone to constant disturbance which enhances the potential for invasive species to establish and thrive (La Jolla Band of Luiseño Indians Environmental Department, 2019). A study completed for the San Luis Rey River Park, in proximity to the La Jolla Reservation, found non-native grasses to be one of the major vegetation communities (County of San Diego, Department of Parks and Recreation, 2011). Additionally, invasive Giant reed (*Arundo donax*) and salt cedar (*Tamarisk spp.*) were identified in the region (County of San Diego, Department of Parks and Recreation, 2011). Infestations of non-native species, such as *Arundo donax*, have lowered habitat quality along several stretches of the river (Southern California Wetlands Recovery Proj-

Native plants and animals are important to the culture of the Luiseño people. These resources include various oak trees, such as Black Oak (*Quercus Californica; kwiila*), Coast Live Oak (*Quercus agrifolia; wi'áaal*), and Canyon Live Oak (*Quercus chrysolepis; wi'át*), and their acorns for acorn pudding (*wiiwish*). In addition to providing a major source of nutrients, the oaks are symbolic and treasured by the people. The practice of basket-making weaves together deergrass (*yuúlalash*), willow (*saxát*), and juncus (*sóyla*), and sumac (*sóoval*). The *wiiwish* and basket-weaving processes, from collection, preparation, aging, and dying of resources, is heavily dependent on environmental conditions that determine quality, location, timing, and harvesting of resources. Other culturally significant species include pine nuts, berries, cactus, yucca, mushrooms, milkweed, willow, and game, such as rabbit and deer. The La Jolla Tribe, and Tribes across San Diego and California, have always relied on the seasonal cycles of these plants and animals for harvesting and hunting. However, as temperature increases, Tribes across the region have observed shifts in the quantity, quality, and seasonal harvest time of many of these resources.



California Black Oak. *Credit: Franco Folini on Flickr.*

ect, 2019). Some of the most prevalent non-native grassland species observed on the La Jolla Reservation include short-pod mustard (*Hirschfeldia incana*), foxtail chess (*Bromus madritensis ssp. rubens*), perennial ryegrass (*Lolium perenne*), and ripgut grass (*Bromus diandrus*) (La Jolla Band of Luiseño Indians Environmental Department, 2019). Disturbed coastal sage-chaparral scrub are being converted to non-native grassland on the La Jolla Reservation and mostly dominated by short-pod mustard and non-native grasses, which are not optimal habitat conditions for many species (La Jolla Band of Luiseño Indians Environmental Department, 2019). While non-native species have persisted across the landscape for years, invasive species will likely increase with climate change, as they are often able to better adapt and flourish under projected climate conditions compared to many native communities that are endemic or sensitive (Fege et al., 2007).

One of the major invasive insect species in the area is the goldspotted oak borer (GSOB; *Agrilus auroguttatus*). GSOB outbreaks across California have significantly impacted oak communities, killing millions of Tanoaks (*Notholithocarpus densiflorus*), California Black Oaks (*Quercus Kelloggii*), and Coast Live Oaks (*Quercus agrifolia*) in California. GSOB is responsible for severe injury and mortality of oaks

"We use to sustain ourselves off of seasonal cycles of food to eat."

- LA JOLLA TRIBAL ELDER

NATIVE
(SAN BERNARDINO BLUEGRASS)

NON-NATIVE
(RIPGUT GRASS)

in woodlands and mixed-conifer forests throughout San Diego County (Scott et al., 2015). GSOB was first detected in San Diego County in 2004, and has killed more than 100,000 oak trees in the past decade (UC Riverside Center for Invasive Species Research, 2019) throughout the region where the oaks are prevelant (San Diego County including Cleveland National Forest, Descanso, and the La Jolla Reservation, and Idyllwild in Riverside County (Murphy, 2015)). In 2015, it was reported that GSOB had spread north from the mountains and forests of eastern San Diego County to Palomar Mountain and Hidden Meadows near Escondido, infecting approximately 100 oaks on Palomar mountain and 30 oaks in residential areas behind Escondido (Jones, 2015). Of the oak family, the Coast Live, Canyon Live, and Black Oak have experienced the largest losses (Murphy, 2015). While oak woodlands have in the past been able to adapt and persevere through change, the rate of changing climatic and environmental conditions could continue to weaken remaining oaks, making them even more susceptible to threats such as the GSOB (Murphy, 2015). Additionally, when GSOB kills large stands of trees there is an increase in wildfire danger (CISR, 2019). Oaks are a cultural keystone species (Long et al., 2015) and act as an ecological backbone that sustains the environment and many ecosystems (California Oaks Project, 2016) and future losses could result in further impacts for many of the region's tribal communities and sensitive ecosystems.

"We couldn't afford candy or gum but my grandma would get the milkweed and squeeze that white stuff out and make gum out of it. It didn't have any taste so she would sprinkle cinnamon on it. That was our gum."

- LA JOLLA TRIBAL ELDER

Tree surveys across the La Jolla Reservation have identified that many oak trees are infected with GSOB, specifically those at the La Jolla RV park. Not only do oak trees and their acorns hold cultural significance, they are important for the community's economy -- providing scenic and shaded spots for campground patrons, especially during the park's most touristy hot summer months. The loss of these oaks could deter campground visitors, and thus, significantly impact the economy as a whole. Thus, it is critical to begin planning and conservation efforts to ensure that these historic oaks remain in the community for many more years.

Adult goldspotted oak borer. *Credit: USDA Forest Service*

Local Impacts for Natural & Cultural Resources:

"I remember playing with the horny toads down by the water growing up -- now they're not there anymore."

- LA JOLLA TRIBAL MEMBER

Horned "Horny Toad" Lizard (*chaláka*). *Credit: Joanna Gilkeson/USFWS*

"The dirt is different, the trees are smaller."

- LA JOLLA TRIBAL ELDER

Drought

La Jolla faces a number of challenges in terms of water availability, quantity, and quality. Unlike most regions in San Diego County, the Reservation does not rely on imported water from Northern California and the Colorado River, meaning that the community's water supply is especially sensitive to local rainfall. While there are water conservation and management programs and plans already in place for San Diego's urban water supply, the Reservation's water resources rely solely on local groundwater. Additionally, areas of the San Luis Rey Watershed face water quality issues. In 2008, lower reaches of the San Luis River were listed on the Clean Water Act (CWA) Section 303(d) list as impaired by chlorine, enterococcus, fecal coliform, phosphorus, total dissolved solids (TDS), nitrogen, and toxicity (County of San Diego, Department of Parks and Recreation, 2011). A 2015 study conducted within the La Jolla Reservation Watershed confirm these 303(d) listings, finding that the region had several impaired parameters, including tempera-

ture, dissolved oxygen, turbidity, and E. Coli. These impaired parameters were identified to impact tribal use, including cultural use, conservation of aquatic life, wildfire prevention, livestock watering, and groundwater recharge. Lake Henshaw is the reservoir at the southeast base of Palomar Mountain upstream of the Reservation. It has been noted that when the Vista Irrigation District releases water into the San Luis Rey River, the Reservation area's water quality is degraded (EPA, 2011).

As a community reliant on local sources of water, the La Jolla Tribe is highly vulnerable to water-resource challenges. Water issues during periods of drought on the Reservation are closely tied to local rainfall and rainfall deficits. Local rainfall amounts play a substantial role in determining Tribal water supplies, more so than other areas of San Diego that are not reliant on groundwater. Drought conditions exacerbate the region's water resources, as seen in previous drought years. During past drought years, such as 2012-2016, the west side of the reservation experienced the largest impacts, where approximately 70 homes and two wells are located. These conditions caused declines in the static and dynamic water pressures in the community's wells. Drops in water pressure meant that the two wells that serve the western side of the community drew from the same water table, resulting in a significant drop of the water table (Weiser, 2016).

Record-low flows and poor water quality during drought conditions have plagued rivers throughout California, causing both coastal and mountain streams to dry up (Hanak et al., 2015). These harsh conditions harm already threatened and endangered fish species such as salmon, steelhead, and other native fishes (Hanak et al., 2015). Aquatic species are an important indicator of the health of a watershed, and thus, climate change impacts on the watershed's ecosystems, habitats, and species inevitably correspond to impacts for the Tribe (Krol, 2018). The La Jolla Tribal community has noticed several changes in drought conditions and the impacts on natural resources, including reduced summer-time rain and streamflow, declines in animal life and species, and loss of color and life in the landscape. Droughts are becoming longer in duration, with drier conditions such as lower soil moisture and higher moisture deficits that change the region's landscapes and landscape processes.

Exacerbated droughts and drought conditions will increasingly stress and threaten landscapes, and could put some species at risk of decline and ultimately, extinction. In general, the distribution of vegetation in California is expected to move upslope and northward with climate change. Surveys studying the short-term shifts in vegetation response to drought and climate variability help to understand the future trends under climate change (Molinari, 2019). For instance, a 2008 study by Kelly and Goulden (as cited in Molinari, 2019) in the Santa Rosa Mountains found that the average elevation of dominant plant species in 2006-2007 rose about 215 ft compared to 1977. Another study by Fellows and Goulden in 2012 (as cited in Molinari, 2019) found a similar pattern in the distribution of dead versus living trees in the San Jacinto Mountains, with an upslope shift in mid-montane species distributions after the 2002-2004 drought (Molinari, 2019). As warming increases and evapotranspiration intensifies, it is likely that these shifts in montane vegetation will expand in both spatial and temporal scales (Molinari, 2019). However, Southern California's increasingly fragmented landscapes can limit the ability of rare or native species to shift their ranges to adapt to climate change (Molinari, 2019). Additionally, San Diego County foothills will likely experience lower overall productivity of ecosystems and changes in blooming phenology of plant species (Fege et al., 2007). Future drought conditions, including warmer temperatures, less rainfall, and longer dry

Tree that has died as a result of GSOB. *Credit: USFS Region 5*

seasons, are also likely to weaken many plants, such as oak species, which could lead to further infestation and mortality of these already vulnerable species (Murphy, 2015).

The interaction between drought periods and fire can create additional challenges for southern California's landscapes. Drought following burning results in both short-term impacts, such as altered abundance and composition of chaparral species, to impacts from extended periods of drought, such as type conversion (replacement of one species to another). Canopy dieback from drought conditions can result in changes throughout the soil and surface, such as increased temperature, which continue to perpetuate conditions (Molinari, 2019).

Wildfire

As drought conditions worsen, and rainy seasons shorten, wildfire risk is likely to increase. The impact and aftermath of the 2007 Poomacha Fire and 2003 Cedar Fire can provide insight into the region's future wildfires. The 2007 burn area affected seven vegetation habitat communities, including Coastal Sage Scrub, Grassland, Riparian, Wetlands, Chaparral, Oak Woodlands, and Mixed Conifer Forest (The San Diego Wildfires Education Project, 2007).

Figure 15 and 16 show the extent of the Poomacha Fire and the areas of impact for regional plant and animal communities, including species listed as threatened and/or endangered. Figure 15 shows that the many species within the fire perimeter, including Arroyo Toad habitat along with smaller areas of Dunn's Mariposa Lily, Southwestern Willow Flycatcher, Coastal California Gnatcatcher, and Nevin's barberry habitat (DeVore, 2007). Figure 16 illustrates the many vegetation communities that were within the fire perimeter, primarily coniferous forest, coastal sage scrub, oak forest, grassland, chaparral, and other woodlands (Interagency Burned Area Emergency Response Team, 2007b).

In general, upland habitats, which are higher in elevation and dryer, are more fire prone. Upland habitats include coastal sage scrub, grassland, chaparral, oak woodlands, and mixed conifer, and it is likely these habitats will face direct fire impacts. Lowland habitats, including riparian, marsh, wooded, and scrub habitats, are likely to experience the indirect effects of fire (The San Diego Wildfires Education Project, 2007).

In the near term, the region's ecosystems are most threatened by landscape disturbance and fragmentation from fire disturbance and human development (Jennings et al., 2018). Given that the La Jolla Reservation area has varied terrain, from lower-lying areas to higher elevation mountainous regions, increased wildfire frequency will have different impacts for different areas and vegetation communities. Complex terrain has been shown to favor mixed severity fires, as a result of small-scale variations in moisture and wind (Neary & Leonard, 2019). The La Jolla Reservation and surrounding areas indicate high levels of fire severity, based on its vegetation density, slope severity, and other factors. Fire severity is used to describe the ecological, hydrological, and geological effects of a fire, where high severity zones reflect the magnitude of disturbance and the degree of change in ecosystem components. Thus, the Reservation's high fire hazard severity zones (Figure 11) reflects that the region is susceptible to a high degree of change in aboveground and belowground ecosystem components (Neary & Leonard, 2019).

Wildfire can also cause type conversion, replacing the species that have been present for many years. One La Jolla Tribal member has noticed shifts in vegetation over the last few years throughout the Reservation, and noted that since the Poomacha fire, fuel types have changed, undergoing type conversion across the landscape. Specifically, the fire allowed for Ceanothus to spread, creating changes for animals such as routes to water and shading out the understory vegetation. Since the fire, Tribal members have also noticed reductions in other species, such as elderberry. In San Diego County's mountain regions, it is likely that there will be a loss of conifers with significant changes in

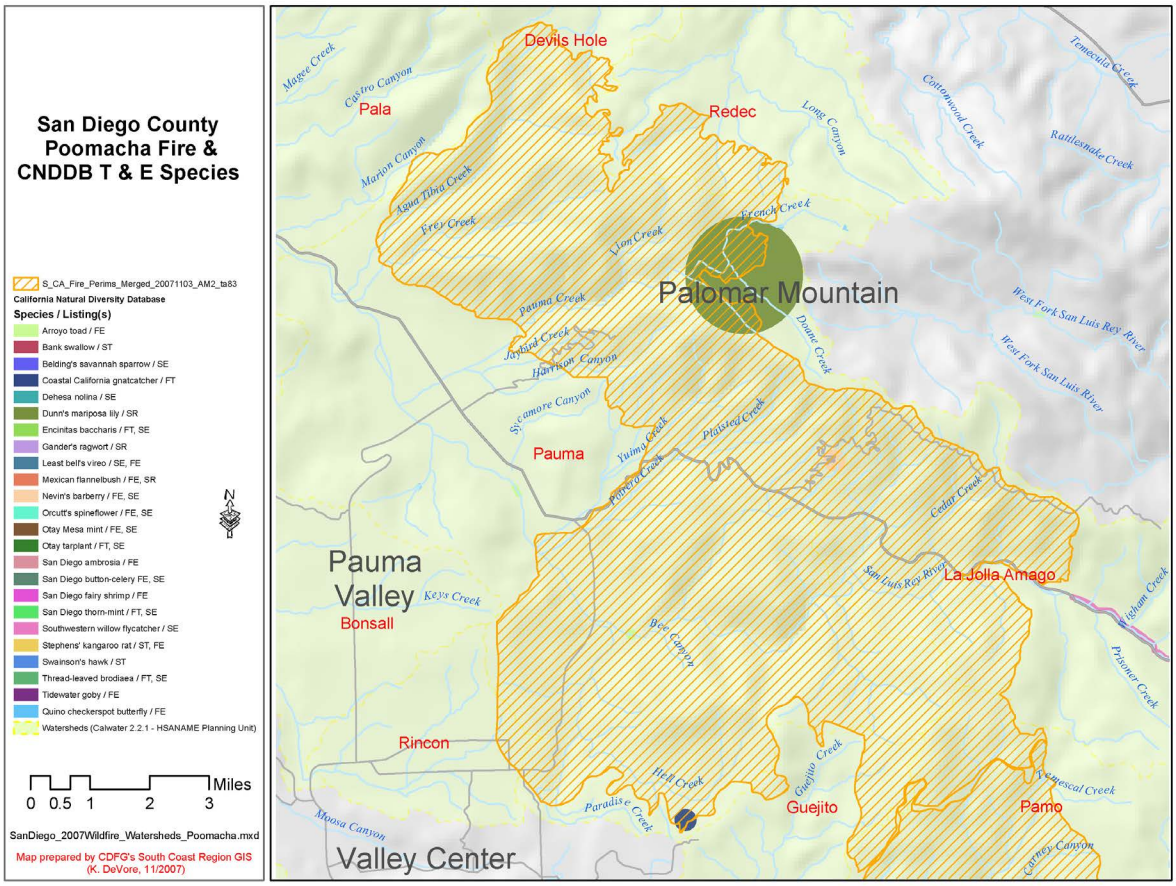


Figure 15. Map of the San Diego County Poomacha Fire (2007) extent and the areas home to species listed as threatened and/or endangered.

"In '76 when I came home, there was only 6 people living in Poomacha. You could see everything because the cows kept everything down. We had an open range and there was fire suppression."

- LA JOLLA TRIBAL MEMBER

species composition, while San Diego's desert-like landscapes will increase in mustard and other exotics, which negatively impact native shrubs and fauna (Regional Water Management Group and Regional Advisory Committee, 2019). Decreases in plant communities and tree canopy that host species such as the Laguna Mountains skipper butterfly (*Pyrgus ruralis lagunae*), the large-blotched salamander (*Ensatina eschschotzii klauberi*), mule deer (*Odocoileus hemionus*), and golden eagle (*Aquila chrysaetos*) and its rodent prey, could reduce habitat or habitat quality for these species (Molinari, 2019).

Invasive species can also play a significant role in increased fire risk. Non-native invasive vegetation that is commonly adjacent to developed land results in fuels and human activities that can increase fire risk (Regional Water Management Group and Regional Advisory Committee, 2019). The loss of trees from invasive species, such as the GSOB, enhance wildfire risk and with increased drought conditions and warmer temperatures could continue to weaken trees and exacerbate the risk and spread of invasive species. As a result, drought could further increase wildfire risk and harm to native species. Invasive annual grasses from drier climates, that are abundant throughout southern California's coastal sage scrub and chaparral habitats, are evidence for reduced ecological condition of the landscape (Molinari, 2019).

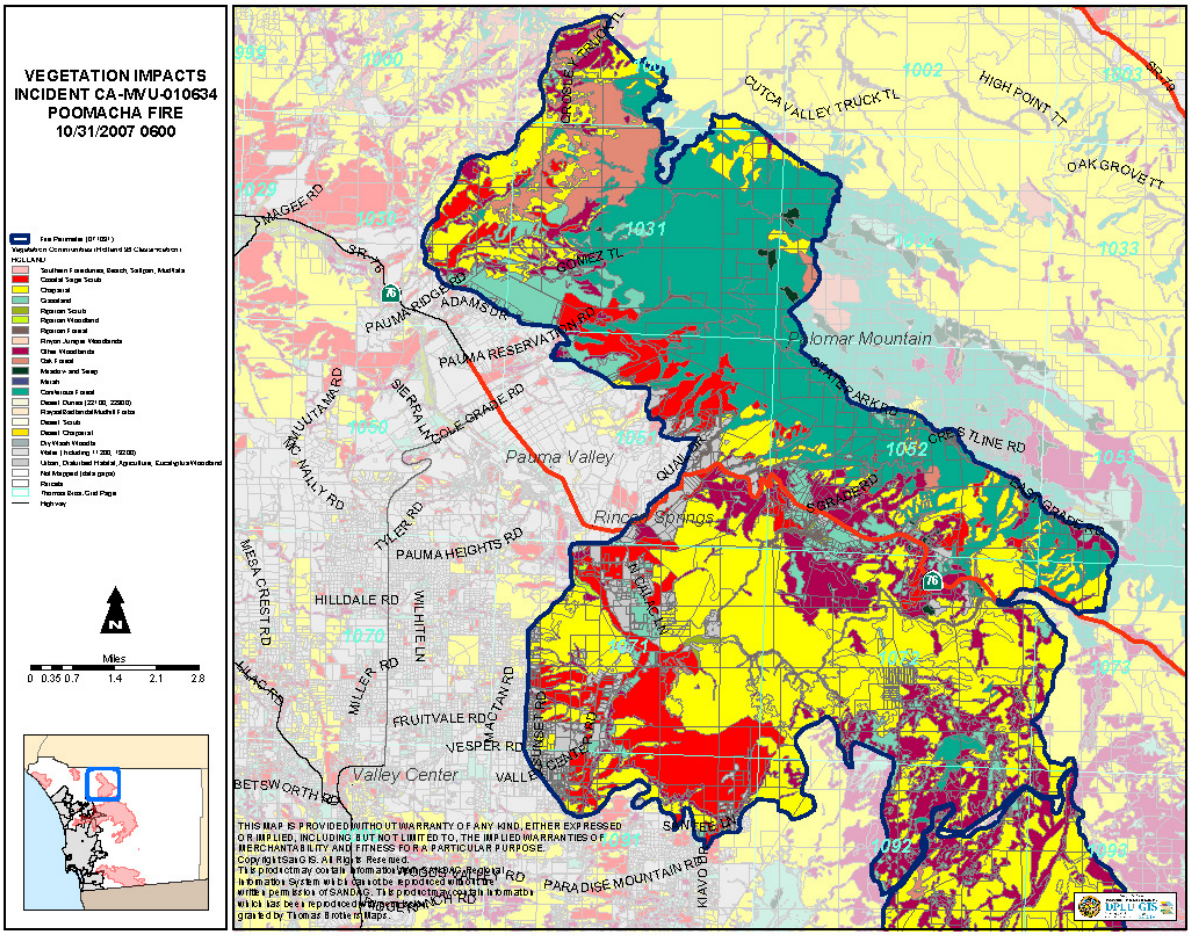


Figure 16. Map of the vegetation impacts of the Poomacha Fire (2007).

Non-native grasses can spread with shorter fire-return intervals and increasing temperatures under climate change, constraining and reducing native species and regeneration. Fire-return intervals of less than 10 years can allow for non-native species to replace chaparral, which require time for resprouting (Molinari, 2019). These invasive grass species can cause altered fire regimes, including greater ignitability (Molinari, 2019). Although upland habitat communities, such as coastal sage scrub and chaparral species are adapted to fire occurrence, fire frequency and intensity can promote further infestation of weeds. With accumulation of high fuel loads in chaparral communities, fires in the region are known to be unnaturally hot, destroying the seed banks of certain species (Interagency BAER Team, 2007b).

Wetland and riparian areas within the watershed are also vulnerable to the direct and indirect impacts of fire. Burned areas along the San Luis Rey River, slopes feeding into the river, and portions of the upper watershed could result in poor water quality from high burn severity and thus significant levels of ash and sediment. The San Luis Rey River and surrounding areas are home to some of the most extensive riparian habitat in the region that species have relied on throughout time (National Audubon Society, 2013). As a result, aquatic biota and riparian species that inhabit tributaries and riparian zones could be threatened by these direct fire and post-fire impacts. For instance, the Southwestern willow flycatcher (Empidonax traillii extimus) could be vulnerable to fire effects if water quality, habitat, or prey species are impacted. While the 2007 Poomacha Fire did not reach many areas occupied by flycatcher colonies (The San Diego Wildfires Education Project, 2007), this species along with others could be impacted by future fires, especially with increased severity and frequency of fire events predicted under a changing climate.

"It sounded like a freight train with the trees and boulders coming down . . . I am very lucky to be in a safe area."

- LA JOLLA TRIBAL ELDER
(La Jolla Band of Luiseño indians, 2007)

Storms

During large precipitation events, the River's floodplains are prone to flooding, as seen in the past flood events of 1978, 1980 (US Army Corps of Engineers, 2014), and in more recent events including February of 2019 (Bravo, 2019). Several reaches of the San Luis Rey River are FEMA-designated flood areas and experience localized flooding (Regional Water Management Group and Regional Advisory Committee, 2019). The County of San Diego reports that the Upper San Luis Rey River, between Lake Henshaw and the La Jolla Reservation, is known as an area of localized flooding and designated as a "hot spot" flood area (County of San Diego, 2007). As these heavy rainfall events become more intense and frequent, so too could incidences of flooding.

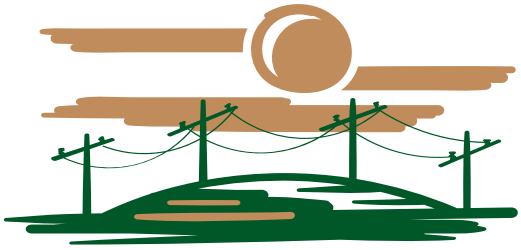
The region has also experienced flooding from rain events following the occurrence of major fires (Regional Water Management Group and Regional Advisory Committee, 2019), causing damage to landscapes, vegetation, and natural resources. During these events, rainfall acts as runoff and converges into channels and valleys rather than infiltrating into the soil. Flood and debris flow risk increases after fire, due to vegetation loss, weakened stability of soil, and enhanced soil exposure (California Water Science Center, 2018). Burned areas are more vulnerable to debris flows and flooding, with significantly less rainfall required to trigger these events. In southern California specifically, the U.S. Geological Survey (USGS) has recorded debris flows from only 0.3 inches of rain-

Aftermath of the debris flow in Amago Creek, following the Poomacha Fire. *Credit: La Jolla Environmental Department*

fall in 30 minutes (California Water Science Center, 2018). Debris flows are one of the most dangerous post-fire hazards, resulting in fast-moving flows that can result in the destruction of infrastructure, clearing of vegetation, blockage of drainage ways, and severe injury and mortality of human populations (California Water Science Center, 2018). These hazardous events have occurred in the San Luis Rey Watershed in the past. In 2007, the Rice and Poomacha fires compromised the stability of soils in the watershed, allowing for increased sediment runoff and mudslide events during post-fire rainfall events (Regional Water Management Group and Regional Advisory Committee, 2019). In 2007, following the Poomacha Fire, major debris flow events occurred on the Reservation in the Amago Creek. The FEMA Environmental Assessment of the Reservation notes that these events moved boulders and trees, which charged into the channels and lined the creek bed (McDaniel, 2008). Modeling of debris flow potential in the region indicates that fires coupled with debris flows, like the event in Amago, can remove all hillside vegetation and alter the ability of soil to absorb water, which creates hydrophobic soils that increase runoff (McDaniel, 2008). The Amago event left behind boulders and twenty foot high piles of tree trunks (McDaniel, 2008).

Wildfire and flooding conditions directly and indirectly impact the region's native plants and animal communities, including those that are culturally-significant to the Tribe. These events can directly affect migratory corridors and ecosystem connectivity, which could hinder the ability of species to migrate and adapt to extreme conditions. Impacts to essential wildlife habitat and migration corridors due to flooding could especially impact larger culturally significant species such as coyotes, bobcats, eagles, and many fish species. As a result, loss of suitable habitat conditions could ultimately lead to species mortality and potentially increases in human-wildlife conflict as animals flee from events.

Aftermath of the debris flow in Amago Creek, following the Poomacha Fire. *Credit: La Jolla Environmental Department*



"Animal life has declined. Different species are rare to see now. Vegetation used to stay green during the summer."

- LA JOLLA TRIBAL ELDER

Heat

Temperature can impact the characteristics of some plant communities. Studies report that some of Southern California's vegetation types, including chaparral and coastal sage scrub, have already experienced declines in color and overall greenness throughout the past 17 years (Hall et al., 2018). These vegetation types are prevalent throughout the La Jolla Reservation, and thus, it is likely that the La Jolla Reservation's landscape will continue to face changes as it warms. Increased temperature has been shown to change the distribution of native species, altering their geographic and temporal patterns of migration and habitat. It is projected that in general North American species will move towards habitats northward in latitude and upward in elevation with climate change (California Natural Resources Agency, 2014), and some plant species may shift up to 90 miles under climate change (California Department of Fish and Wildlife, 2019). Nearby reservations, such as the Pala Band of Mission Indians, have noticed that drying wetlands and riparian vegetation have caused shifts in upland plant species, such as manzanita, towards the riverbed (Pala Band of Mission Indians Environmental Department, 2019). However, many plant species are unable to naturally shift their geographical ranges fast enough to combat current and projected rates of climate change (Intergovernmental Panel on Climate Change, 2014). Species are also expected to experience changes in the timing of seasonal life-cycle events, including plant life stages of flowering and leaf emergence (California Water Science Center, 2018). Many of the culturally-significant and native species present on the La Jolla Reservation could face these changes to the timing of reproduction, altering their abundance and distribution. La Jolla community members note that the flowering and timing of elderberries, a culturally-significant plant, are different this year than previous years, resulting in scarce supplies of berries.

Extreme heat and changes in vegetation communities can impact regional wildlife as well. Changes in the phenology of local plant species has been shown to affect the breeding, migration, and pollination of the wildlife species that rely on these plants and habitats (California Natural Resources Agency, 2014). Extreme fire and heat events, in addition to changes in precipitation, can increase conditions that encourage the migration and spread of invasive plants and animals into the region, in turn threatening the landscape's sensitive native species. La Jolla Environmental Department have noticed the spread of invasive species such as Ailanthus known as "Tree of Heaven" on the Reservation along with other non-native and invasive species.

Species, especially those that are threatened and endangered, could be directly affected through altered temperature and precipitation regime, and indirectly through predation and competition of resources and habitat (Wilkening et al., 2019). Specially, in the Northeastern San Diego region, temperature increases are altering habitat suitability for endemic animal species. Some of these local endemic species threatened by increasing temperature are the federally endangered quino checkerspot butterfly and the California gnatcatcher (*Polioptila californica*) (Jennings et al.,

2018). Other federally endangered and/or threatened species in the region that could be especially vulnerable to climate change include Least Bell's vireo (*Vireo bellii pusillus*) (San Diego Gas & Electric, 2011), southwest willow flycatcher, coastal California gnatcatcher, quino checkerspot butterfly (Osborne, 2016 as cited in Pala Band of Mission Indians Environmental Department, 2019) and the arroyo toad (Pala Band of Mission Indians Environmental Department, 2019).

Additionally, extreme heat, heat waves, and higher minimum temperatures can impact temperature in the local river and streams that native fish rely on. Warmer temperatures can also cause higher water evaporation rates, lower water levels on the La Jolla Reservation's waterways and aquifers. Increased water temperatures, with decreased dissolved oxygen levels, increased toxicity of pollutants, increased turbidity from erosion, and increased water evaporation, can have severe implications for the region's aquatic organisms (Moyle et al., 2008). Southern California steelhead trout and coho salmon have been declining in California since the mid-20th century (Moyle et al., 2008) and trout in the San Luis Rey River are among the last in San Diego County (Pell, 2016). These fish populations are already listed as endangered and/or threatened, and are highly sensitive to changes in water conditions and quality. La Jolla community members note that some aquatic species that were once prevalent within the Reservation's waterways, such as crawdads and turtles, have significantly declined over the years and now occupy only specific areas of the river.

Great blue heron spotted on the Reservation. *Credit: La Jolla Environmental Department*

Opportunities for Increasing Tribal Resilience

Climate will continue to impact La Jolla's natural and cultural resources. Tribal resilience will require diverse approaches and strategies to address and adapt to these growing challenges. Potential adaptation opportunities can be divided into those focusing on ***community*** (engagement, education and outreach); ***research*** (monitoring and assessment); and ***planning*** (planning and management):

EXISTING EFFORTS & PROGRAMS

- ☐ Monitoring of oaks and GSOB at the La Jolla RV Park, campground, and riparian areas
- ☐ Participation in the Climate Science Alliance Tribal Workgroup discussions on natural resources

COMMUNITY ENGAGEMENT, EDUCATION, & OUTREACH

- ☐ Provide educational outreach programs & resources on the impacts of climate for natural resources and the actions people can take (conservation, water use, energy efficiency)
- ☐ Utilize drought services and participate in workshops such as the Native American Water Masters Association (RCAC) field training in document preparation
- ☐ Identify traditional and culturally significant adaptation strategies from the community that have been used to restore and buffer natural resources from storms/climate events (i.e. cultural fire regime, forest management, riparian corridor restoration)
- ☐ Encourage community members to sign up for San Diego County alert system

RESEARCH, MONITORING, & ASSESSMENT

- ☐ Create a monitoring system to track water resources, vegetation, and biology
  - ☐ Water resources: Monitor community water use, and La Jolla Amago Subbasin Aquifer; develop a map of aquifer system and outcroppings
  - ☐ Vegetation & biology: Monitor changes in oaks, acorns, grasses, animals, critical habitat and migration corridors
- ☐ Inventory areas (i.e. landscapes, riparian corridors), ecosystems, and species (plants and animals) that are most exposed and potentially vulnerable to climate impacts
  - ☐ Mapping: overlay vulnerable species and/or areas with heat, fire, precipitation projections to identify priority areas and target strategies
- ☐ Identify methods and incentives for stormwater collection and re-use by industry
- ☐ Closely monitor signs of GSOB infestation and infection throughout oak trees on the Reservation to understand trends in GSOB in terms of areas and tree characteristics most affected
- ☐ Consider introducing recommended strategies from resources such as the Statewide Integrated Pest Management Program to restore oak health, including spraying trees with insecticide, containment through wrapping trees, grinding infested wood, and biological control such as primary natural enemies
- ☐ Identify if there are certain oaks that are of most importance to the Tribe (culturally for the community and economically in terms of tourism) for prioritization of conservation and protection from GSOB
- ☐ Remove infested trees and implement additional planting throughout the Reservation, while considering planting of less susceptible or resistant oaks (such as Engelmann oak which does not appear to be seriously injured)

PLANNING AND MANAGEMENT

- ☐ Develop or promote water conservation or efficiency policies/programs to help households, businesses, and agricultural operations replace irrigation systems and install water efficient, drought resistant landscaping and water recycling systems
- ☐ Riparian corridor restoration: Expand riparian areas, natural floodplains, and wetlands using ecocultural aquatic/riparian species
- ☐ Create short-term and long-term strategies for preservation of vulnerable species.
    - ☐ Short-term: e.g conservation/restoration to help safeguard from immediate impacts
    - ☐ Long-term: e.g alternate strategies if short-term strategies no longer working, such as seed banking, propagation, and/or restoration
- ☐ Enhance drought preparedness through creating water conservation plans, drought contingency plans, and well monitoring logs

"There used to be a lot of farming on the Reservation back in the 1920's – we would grow everything, like peaches, figs, alfafa, wheat, melons, corn, and big beans. There were a lot of orchards and walnut groves. We were self-sufficient. Our grandparents didn't feel the depression because they were so self-sufficient."

- LA JOLLA TRIBAL ELDER

INFRASTRUCTURE & ECONOMY

Background and Existing Challenges:

The Reservation has faced many changes over the years. Elders remember that back in the 1920-30's, a large portion of the Reservation was designated for cattle and agriculture. While the Reservation still consists of a small portion of pasture/crop land, the majority of the land is used for commercial, recreational, and residential purposes (La Jolla Band of Luiseño Indians Environmental Department, 2007). There are approximately 1,323 acres of residential areas and over 150 houses, 910 acres of field crops, and the remaining area vacant or undeveloped land (Figure 17). Additionally, there are important community buildings and facilities on the Reservation, including the La Jolla Indian Reservation Volunteer Fire Department, Tribal Hall, Education Building, La Jolla Trading Post, Church, and Gymnasium. Non-tribally owned or operated facilities include Riverside Bar, Amago Tube Rentals, and the Amago Raceway.

The Tribal Hall functions as the community center, where most meetings, cultural gatherings, birthdays, and weddings take place. Additionally, the Tribe has designated Tribal Hall as the emergency operations center (EOC) and the Gymnasium as the emergency evacuation center during a disaster (La Jolla Band of Luiseño Indians Environmental Department, 2007). During the 2007 fires, the Education Building and Gymnasium became the emergency distribution center providing water, flood, clothing and emergency supplies (La Jolla Band of Luiseño Indians Environmental Department, 2007). The west side of the Reservation includes thirty residential homes and the community church, while the east side of the reservation contains all Tribal structures and facilities, such as the Tribal Hall, Gymnasium, water park and Trading Post (Figure 18) (La Jolla Band of Luiseño Indians Environmental Department, 2007). Some of the major roads that make up the Reservation are Redgate, Harolds, Yapitche, Church, and Poomacha. The Tribe's Pre-Hazard Mitigation Plan identified four businesses on the Reservation designated as critical, including the water park, Trading Post, the campground, and water operation sites (La Jolla Band of Luiseño Indians Environmental Department, 2007). Many important facilities such as schools, libraries, and hospitals are located outside of the Reservation, within proximity of 25 miles. The major highway, Scenic Route 76, provides access into the La Jolla Reservation from Interstate-15 and runs through the area from east to west (La Jolla Band of Luiseño Indians Environmental Department, 2019). The La Jolla

"The population has about tripled over the last 20-40 years - when the population of people came in, the cattle went out."

- LA JOLLA TRIBAL ELDER

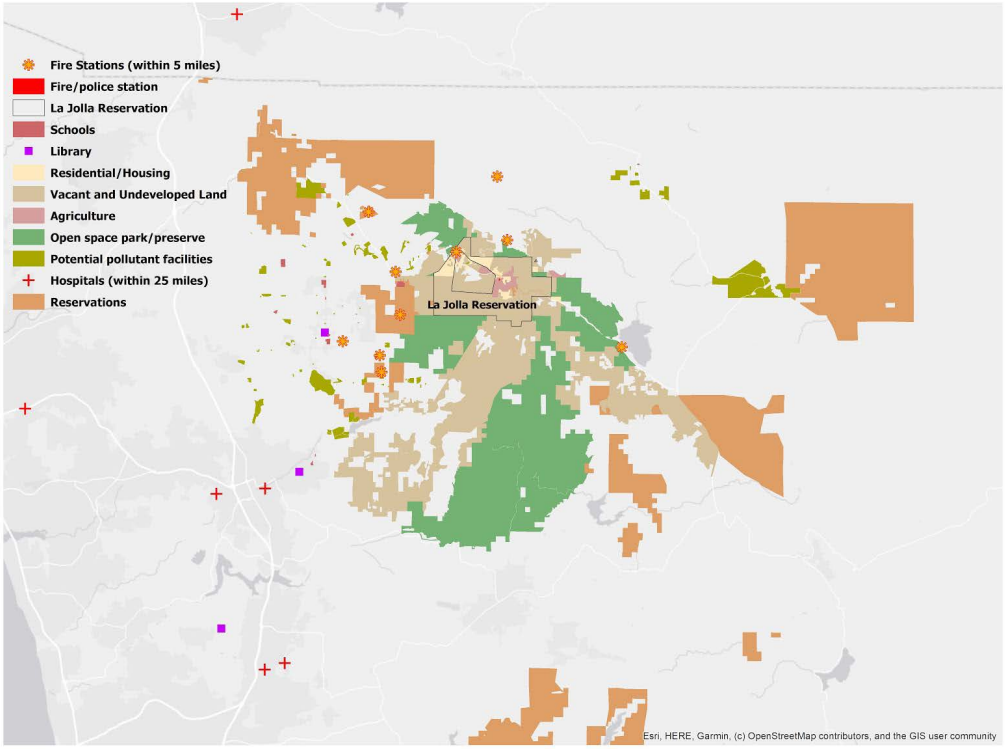


Figure 17. Current land use for the La Jolla Reservation with community buildings and facilities.

"A lot of people had horses - that was the way to get around."

- LA JOLLA TRIBAL ELDER

Reservation is surrounded by forest, private land, and other reservations, including Pala, Rincon, Pauma, and San Pasqual Reservations to the west/southwest, Palomar Mountain State Park and Observatory to the north, Lake Henshaw to the southeast, and tree farms, orchards, and the Cleveland National Forest adjacent to the area (La Jolla Band of Luiseño Indians Environmental Department, 2019).

There are several existing challenges that the community faces in terms of the Reservation's infrastructure. One of the major challenges results from the Reservation lands, situated within rugged, mixed terrain and soils, from riparian valley areas to rocky slopes. There are many areas on the Reservation classified as alluvial fans, making them especially prone to flooding and debris flows during heavy rains. The varied terrain makes it especially difficult for planning, development, construction, and implementation of infrastructure. The Tribe's Pre-Hazard Mitigation Plan identified 45 recorded archaeological sites on the Reservation, and two of these sites were recommended for hazard mitigation treatment (La Jolla Band of Luiseño Indians Environmental Department, 2007). The La Jolla Tribe has pursued efforts on many fronts to manage the Reservation's water resources, with the construction of a domestic water filtration plant, a groundwater monitoring system, and a wastewater treatment facility. Additionally, the Tribe operates three EPA-regulated Public Water Supply Systems, providing treated groundwater to community members (Regional Water Management Group and Regional Advisory Committee, 2019).

The La Jolla Tribe's major economic operations and commercial activities include the La Jolla Zip Zoom Zipline, the La Jolla Indian Campground and RV Park, and Tribal Post Store (La Jolla Band of Luiseño Indians Environmental Department, 2019). The Tribe's existing enterprises operate mainly during summer months (La Jolla Band of Luiseño Indians Environmental Department, 2019). The most recent Bureau of Indian Affairs Labor Force Status Report from 2010 estimates that the Tribe has a 70-75% unemployment rate, largely

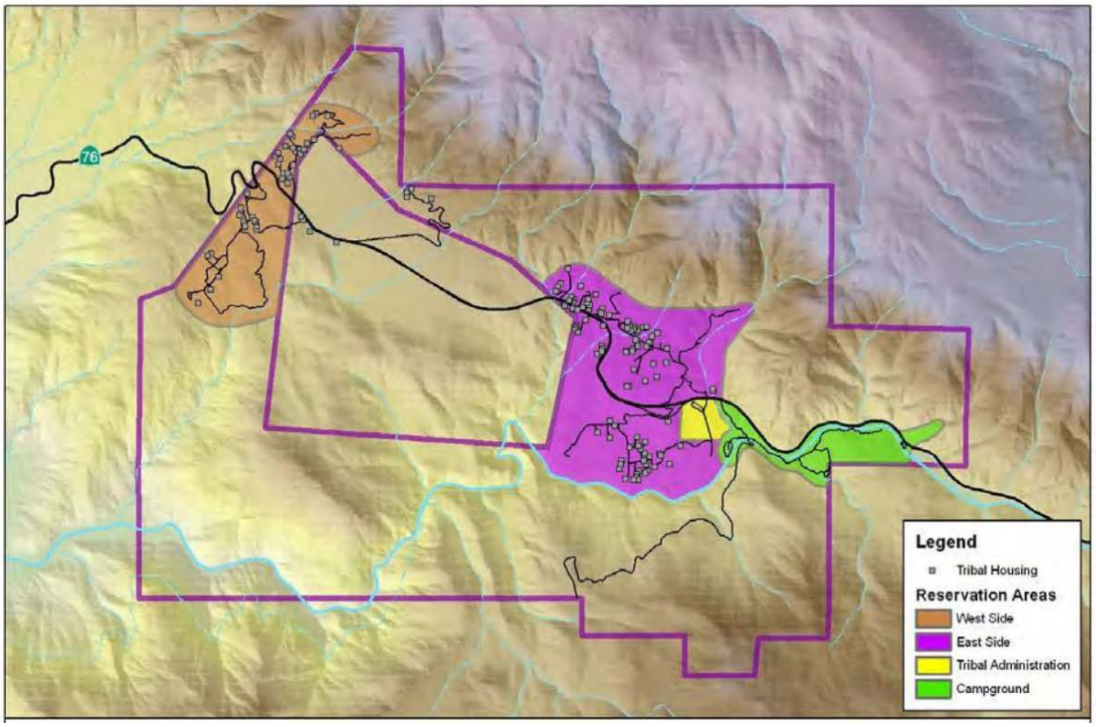


Figure 18. La Jolla Reservation areas, buildings, and community sites.

due to the seasonality of the Reservation's Tribal enterprises and employment opportunities (La Jolla Band of Luiseño Indians Environmental Department, 2007). There are economic challenges associated with the Tribe's major sources of revenue and support. Unlike many other reservations in the region that are gaming enterprises supported by casino revenue, the La Jolla Reservation instead relies primarily on the tourism industry and grant funds (Charities Aid Foundation of America, 2018). Thus, funding is often limited to support the needs of the community, including sufficient funding for implementing programs that control the encroachment of urban population and traffic on the highway (Regional Water Management Group and Regional Advisory Committee, 2019). In addition, the reservation's rural location within the county results in limited availability of resources. These geographic, economic, political, and social factors continue to create distinct challenges for the Tribe.

The La Jolla Tribe's communication, transportation, and utility services rely largely on external companies to manage supply and infrastructure. The Tribe is supplied internet service from Tribal Digital Village and utilities from San Diego Gas and Electric (SDG&E). The Tribe does not have a land use plan or zoning

"The old Tribal Hall was just adobe building with dirt floors, and we used to have our Tribal meetings in the oaks."

- LA JOLLA TRIBAL ELDER

ordinance and relies on the Tribal Council to guide, manage, and regulate land use and planning (La Jolla Band of Luiseño Indians Environmental Department, 2019). Additionally, if development continues to expand in the region vehicle traffic on Scenic Route 76 will increase and could impact tribal infrastructure (Regional Water Management Group and Regional Advisory Committee, 2019). With limited access in and out of the Reservation, it can pose challenges during heavy traffic times and/or risks during evacuations (La Jolla Band of Luiseño Indians Environmental Department, 2007). The Tribe's electricity and internet services, are often disrupted seasonally and during disasters. Internet and electricity services on the Reservation are not always reliable, especially during a disaster, and often leave the community isolated (La Jolla Band of Luiseño Indians Environmental Department, 2007).

La Jolla Reservation GHG Accounting

"We just found out how poor our air quality is here on the Reservation. Pollution in our air is high. How do we keep our families safe with breathing problems such as asthma?"

- LA JOLLA TRIBAL ELDER

The La Jolla Reservation's infrastructure plays a role in contributing to greenhouse gas emissions and pollutants in the air, which can hinder future development opportunities due to reduced air quality. According to the Tribe's Emissions Inventory, there are 1,211 point sources located within a 50 mile radius of the Reservation. The highest density of point sources is located in San Diego County, south-south west of the Reservation, as shown in Figure 19 (La Jolla Band of Luiseño Indians Environmental Department, 2016).

While the Reservation does not currently have any sources considered point sources, there are several nonpoint, off-road, and on-road sources. The major emissions for nonpoint, off-road and on-road sources include volatile organic compounds (VOCs), carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide (SO2), particulate matter (PM10 and PM2.5), ammonia (NH3), GHGs including carbon dioxide (CO2) and methane (CH4), and lead (pb). Major pollution sources that have been identified and inventoried on the Reservation include Residential Wood Stoves, Commercial and Residential Propane Use, Tribal Heavy Equipment Use, Wildfires/Pile Burning, Campground Campfire Burning, VMT on Paved

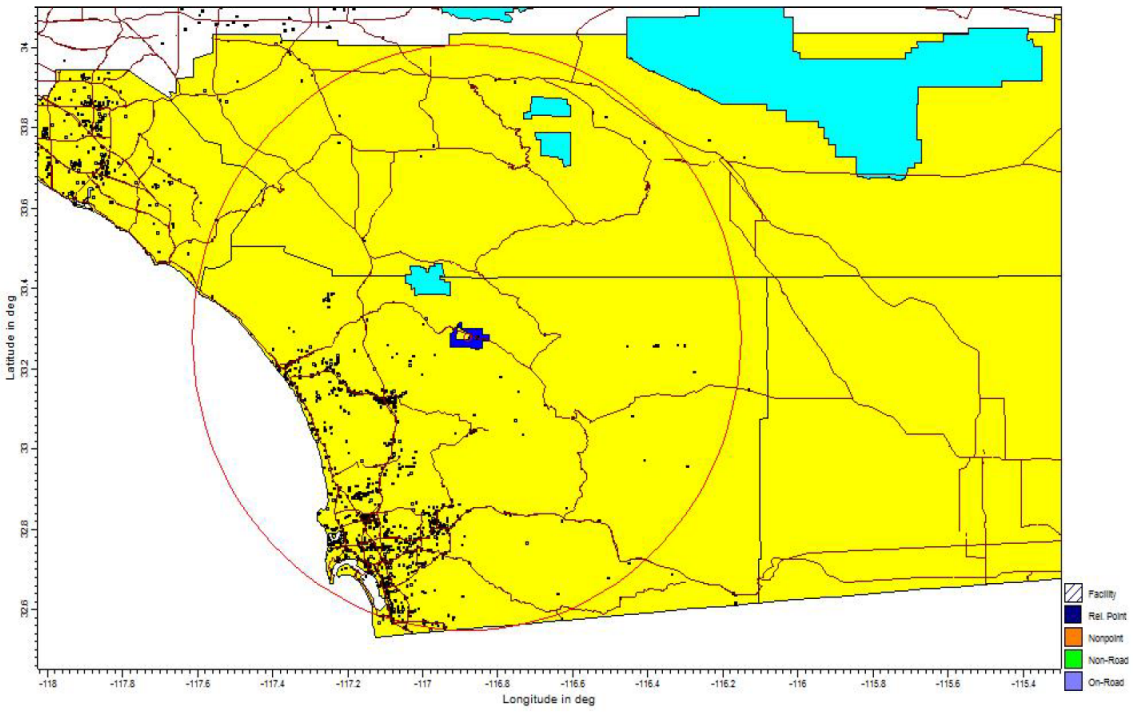
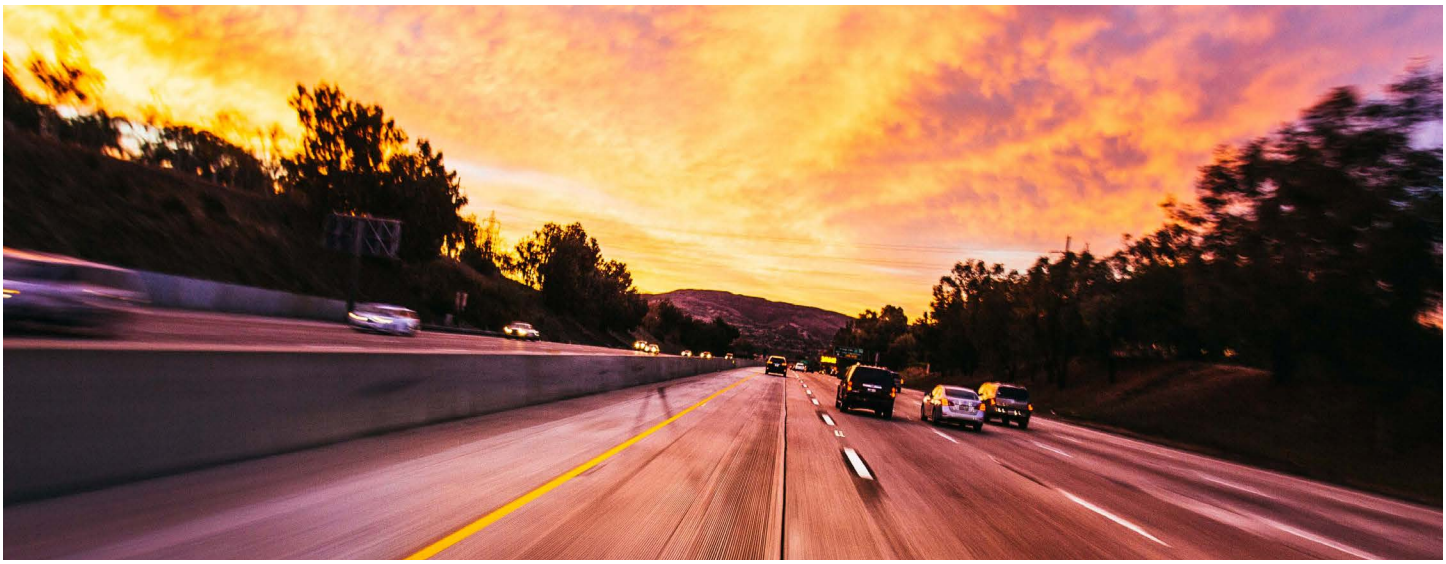


Figure 19. Reservation and Point Source Emissions Area.



and Unpaved Roads, and the Gas Dispensing Facility (La Jolla Band of Luiseño Indians Environmental Department, 2016). Together, these emissions contribute to the generally poor air quality on the Reservation and in San Diego County, as designated by the National Ambient Air Quality Standards (NAAQS). The top emitting sources and processes for VOC, CO, NOx, PM10 and PM2.5, CO2, and CH4 on the Reservation are the stationary source fuel combustion, residential, and wood sectors, accounting for 4.58 tons (80.68%) of VOC emissions in 2016. The waste disposal, treatment and recovery, open burning, all categories sectors make up the top emitting sources and processes for SO2 and NH3 (La Jolla Band of Luiseño Indians Environmental Department, 2016). The top nonpoint source pollutant emitted on the Reservation is CO2, with a total of 35.01 tons in 2016 (La Jolla Band of Luiseño Indians Environmental Department, 2016).

While the La Jolla Reservation's emissions are much lower than those of San Diego County given its smaller size and relatively rural landscape, the Tribe's infrastructure and operations do minimally contribute to the region's emissions. Specifically, Tribal Government buildings, facilities, and operations, including the campground, fire department, Tribal administration, and gymnasium, contribute to the La Jolla Reservation's emissions as stationary combustion emissions. Figure 20 shows the metric tons of carbon dioxide (MT CO2e) by Tribal department, with the greatest portion

"The berries that are by the roads we can't eat as much because the cars have ruined it."

- LA JOLLA TRIBAL ELDER

of emissions from the gymnasium, and a total stationary combustion emissions of 10.47 MT CO2e (La Jolla Band of Luiseño Indians Environmental Department, 2015) for 2015. Electricity use of Tribal facilities and operations also contributes to the Reservation's emissions, with the highest emissions from the administration (29.80 MT CO2e) and water departments (25.12 MT CO2e) (Figure 21) (La Jolla Band of Luiseño Indians Environmental Department, 2015). Figure 22 shows the emissions by Tribal Department for mobile combustion, with the greatest source coming from the Tribe (includes Recycling, SCTCA, Trash, Equipment, and FEMA) (La Jolla Band of Luiseño Indians Environmental Department, 2015). Figure 23 shows the emissions by source for the Tribe's total emissions (516 MT CO2e) for the year 2015. Overall, transportation (employee commute and mobile combustion) was the top emitting category for 2015 emissions, followed by electricity usage and waste generation (La Jolla Band of Luiseño Indians Environmental Department, 2015).

FIGURE 20. Emissions by Tribal Government department for stationary combustion of fossil fuels in metric tons of carbon dioxide equivalent (MTCO2e).

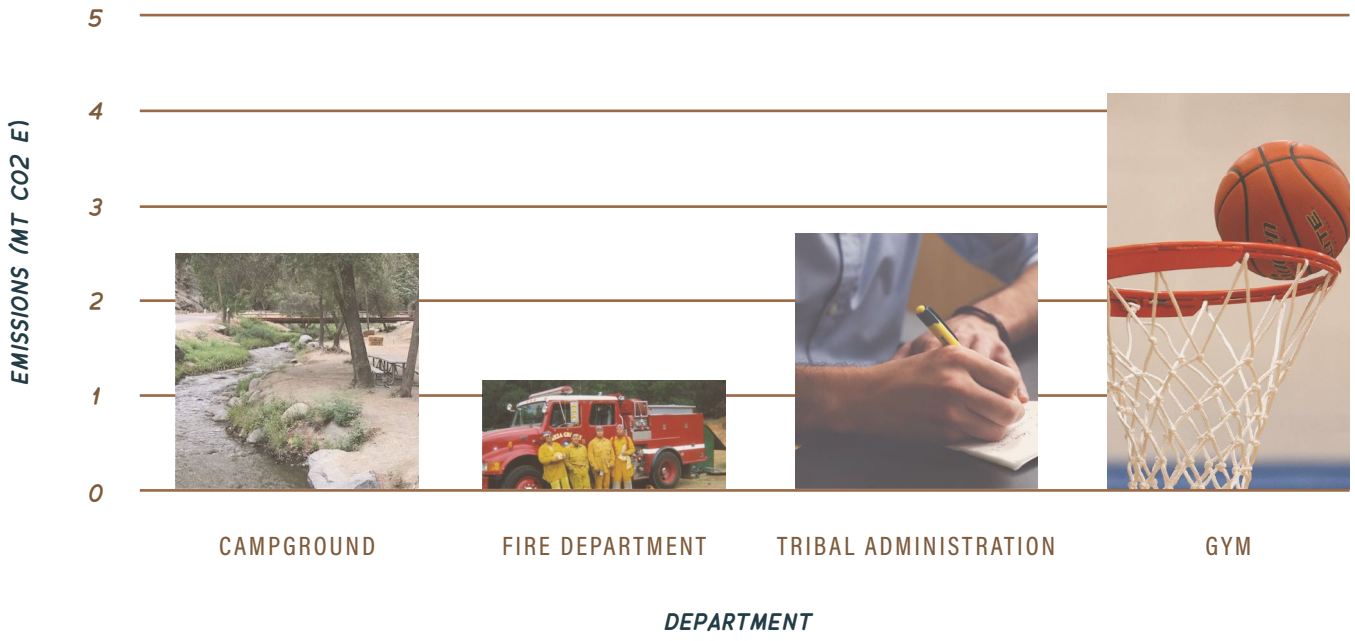


FIGURE 21. Emissions by Tribal Government department for electricity use in metric tons of carbon dioxide equivalent (MTCO2e).

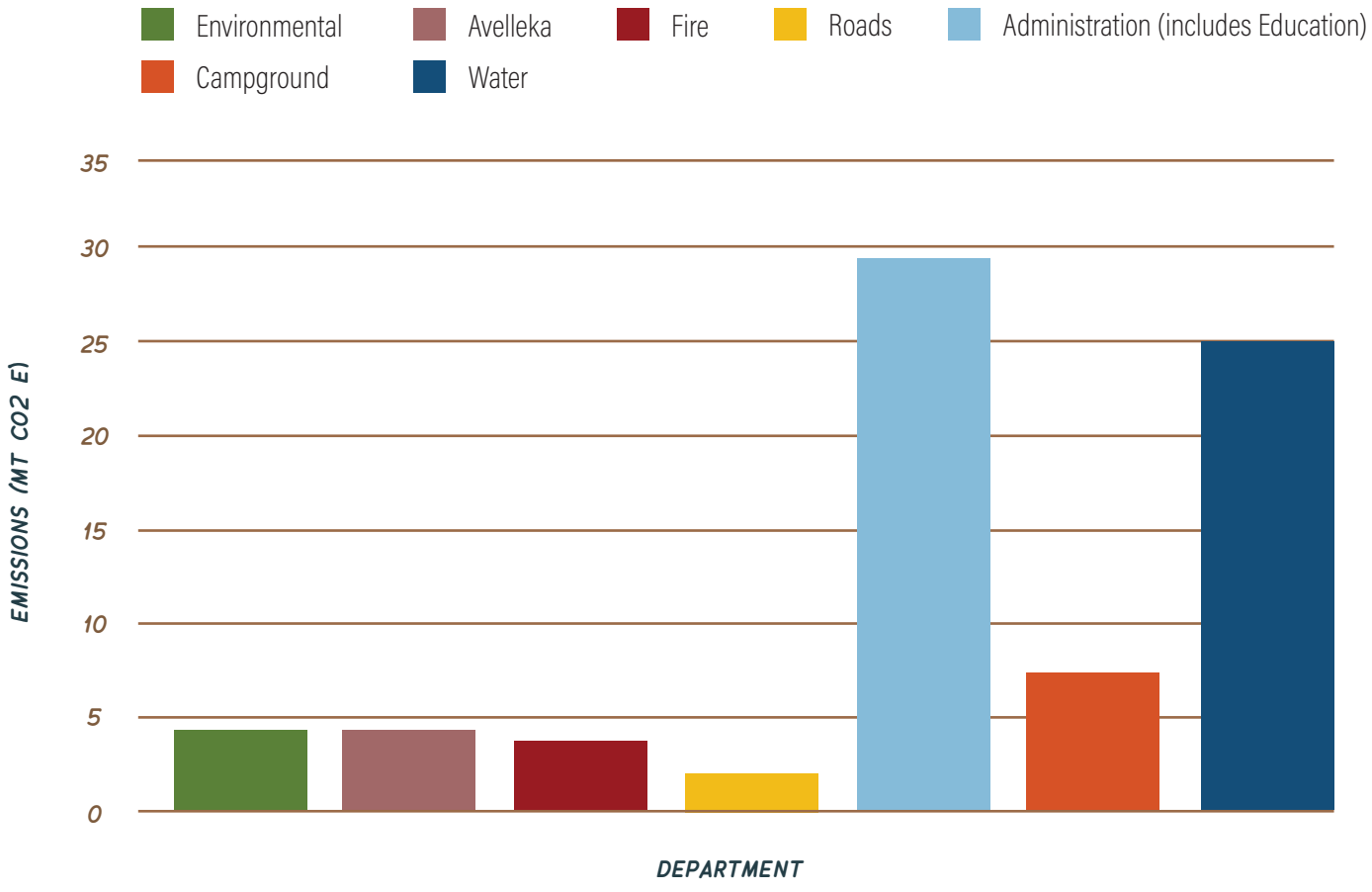


FIGURE 22. Transportation Emissions by Tribal Government department for mobile combustion.

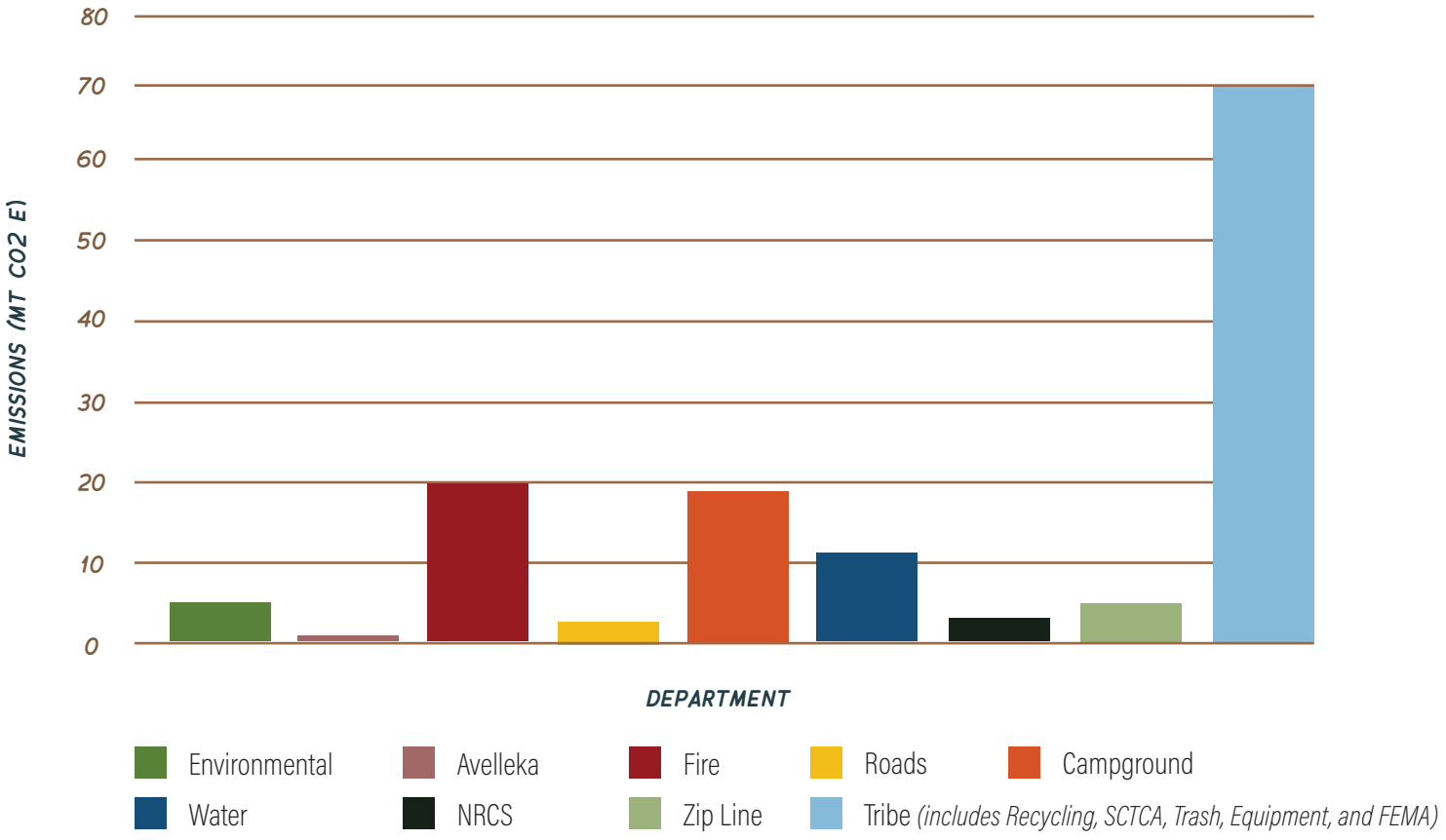


FIGURE 23. Total Tribal emissions (MT CO2e) by source in 2015.

Local Climate Impacts for Infrastructure & Economy

The entire Reservation area is likely to be impacted by climate hazards such as wildfire and storms, and their associated risks. Additionally, as the population grows and continues to develop, it will be important to consider the community's emissions and their contribution to exacerbating these climate impacts. Past events that have occurred on the Reservation can help the community anticipate and plan for future climate impacts. Drought, fire, extreme temperatures, and precipitation events will exacerbate the existing challenges with the Reservation's infrastructure and economy in the years to come. Climate impacts on the Reservation's infrastructure could also result in several economic implications for the community.

"We have noticed a build up of debris, a lack of vegetation management and clearing, and no one is helping to clean it up and dispose of it, which leads to more fire hazard."

- LA JOLLA TRIBAL ELDER

Destruction from the 2007 Poomacha Fire. *Credit: La Jolla Environmental Department*

"We had good water - really good water. Not like now."

- LA JOLLA TRIBAL ELDER

Drought

Longer, more frequent droughts and extended periods of increased temperature could result in higher energy demand with a need for more energy intensive methods. Energy demand coupled with diminished groundwater supply during more frequent and extended dry periods, could result in additional economic stress for the community and water department. Additionally, drought conditions can complicate firefighting efforts and amplify firefighting resource demands, such as chemical retardants, controlled burns, and suppressant equipment that rely on freshwater availability and minimum level of water pressure to work properly (Operational Analysis Division, U.S. Department of Homeland Security, 2015). If firefighting equipment is inoperable due to water scarcity and drought conditions, it may be harder to control wildfires, resulting in increased damage of infrastructure. Drought conditions will likely impact the Reservation's landscapes and vegetation. As drought reduces these natural and human-made barriers to fires, it will likely alter where and how fire burns (Wall & Brown, 2019). These conditions could not only amplify the risk of wildfire, but potentially cause fire to burn in areas surrounding community infrastructure, severely and permanently impacting the Reservation's critical structures and resources. Overall, the impacts of increased damage, resource demand, planning, and repair, will likely result in increased costs for the community.

Fire retardants used on a 2005 fire.
Credit: La Jolla Environmental Department

Wildfire

Wildfire occurrence will result in damage to local infrastructure and disruption to livelihood that will impact not only Tribal members' individual economic well-being, but the community's economy as a whole. The risk assessment performed for the La Jolla Reservation indicates that wildfire is one of the most likely events to impact the Reservation. Representatives from the La Jolla Fire Department express that cultural burning could be used as a tool for managing dangerous fires and infrastructure damage, however, the existing rules do not permit these traditional practices.

Past fires have had detrimental impacts on many of the region's communities and community infrastructure, including buildings, structures, roads, housing, and other infrastructure. Of the 24 fires that occurred between October 20 and November 30, 2007 in San Diego County, the Witch and Poomacha fires were the most devastating, merging together in the eastern areas of San Diego County (Grossi, 2008). Together, the fires burned 250,000 acres, including 1,900 structures of which many were residential properties (Grossi, 2008). The Poomacha fire resulted in 49,410 burned acres, 217 destroyed buildings, and 12 damage buildings. Approximately 95% of the Reservation was burned, including at least 1 commercial property and 78 outbuildings, in addition to many homes throughout the region. The fire also damaged highway guardrails, traffic warning signs, and the Red Gate Road neighborhood on the Reservation. Steel guardrails, traffic warning signs, reflective markers, and wooden support posts were replaced after the fires, covering 2,100 feet and 79 posts/signs, with 1,000 feet of steel rail damaged beyond repair (Interagency BAER Team, 2007a). The Witch Fire occurred south of the Reservation, ignited by westerly Santa Ana winds at Witch Creek near Ramona and burning many structures (Figure 24).

As seen in the Poomacha and Witch fires, important facilities and community structures are at risk of damage and destruction. Approximately 73% of the total structures burnt during the Poomacha, Rice, and Witch Fires were within areas of moderate to extreme fire-risk, indicating that while many structures were within high-risk areas, exceptional weather and climate conditions caused 30% of structures that burned were in regions that were historically low or very low-risk areas. High-risk areas are generally the wildland-urban interface or surrounded by burnable surface fuels, however, the 2007 fires illustrate that strong Santa Ana winds combined with pre-existing landscape conditions such as dry summer seasons and drought, can result in large quantities of highly burnable surface fuels (Grossi, 2008).

Given projections of more intense, frequent, and long dry seasons coupled with Santa Ana winds, it is possible that even areas at moderate to low fire risk could be highly vulnerable as these climate conditions worsen. Many of La Jolla's important facilities and buildings are located at the wildland-urban interface, surrounded by dry vegetation and other fuel sources, making the area highly vulnerable. The Poomacha fire perimeter had more vegetation fuels than many other

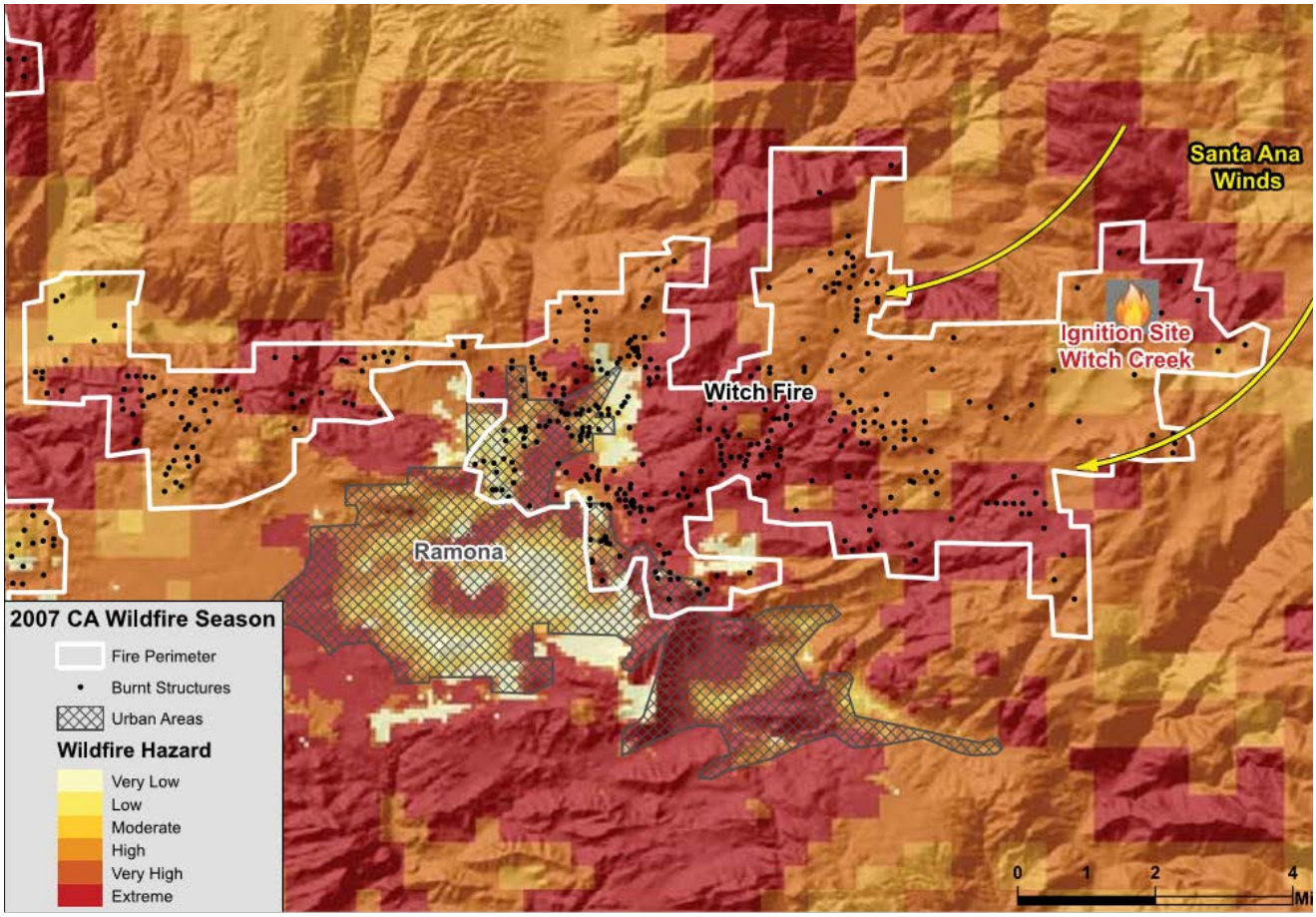


Figure 24. Witch Fire perimeter and structures burnt within fire-hazard risk areas.

2007 Southern California fires including the Witch Fire, with over 95% of the area covered by burnable vegetation fuels (Grossi, 2008).

Emergency response centers, water filtration plants, groundwater monitoring systems, and wastewater treatment facilities, are highly vulnerable to the impacts of wildfire. More frequent and intense wildfires could also increase exposure of pavement and other structures, such as communication lines, to extreme heat conditions during fire, causing damage to these resources and materials. Utilities are often disrupted on the Reservation, making loss of communication, internet, and electricity networks a primary concern among residents. The La Jolla Reservation maintains its own sewer and water lines and thus losing power causes water interruption (La Jolla Band of Luiseño Indians Environmental Department, 2007). Wildfire occurrence and periods of high wildfire risk can result in the loss of power, threatening the functioning of these essential networks that serve the community. The damage and destruction of these structures and networks could result in unsafe and hazardous conditions for the community.

Even areas outside the direct fire perimeters and boundaries can face impacts to infrastructure and economy. Proximity to fire can cause mandatory evacuation and nonstructural damage to homes, air conditioning systems, and items within buildings (Grossi, 2008). Mandatory evacuations of residents in areas not directly within the fire perimeter can also cause financial costs and losses for those evacuated. Although the Reservation was directly within the Poomacha fire perimeter, increased fire-risk across the region could cause more instances of proximity

Poomacha Fire clean-up. *Credit: La Jolla Environmental Department*

to fire, more frequent evacuations, and nonstructural damages (Grossi, 2008).

Wildfires directly impact air quality for communities nearby and across the region. Harmful impacts to air quality can make it harder to meet air quality standards, known as the National Ambient Air Quality Standards (NAAQS). San Diego County, including La Jolla Reservation lands, are designated as a nonattainment zone, meaning the area is considered to have air quality worse than the U.S. Environmental Protection Agency NAAQS (San Diego Air Pollution District, 2019). There is concern that lower air quality from wildfire occurrence would make it more challenging to meet NAAQs, which can hinder future home building, development, and tourism, corresponding to increased economic costs. Additionally, wildfire will likely result in economic costs for Tribal members, from missed work days, business losses, higher community infrastructure repair, and insurance costs. In total, the cost of fighting the 2007 fires was estimated at $41 million, with a total property damage of $1.6 billion (Raftery, 2017). As wildfire becomes more frequent and intense, the La Jolla Reservation and region as a whole could have less recovery time between events, meaning more repairs and greater economic challenges.

For thousands of years, California Tribes have used fire to create fire regimes that help manage natural resources, create diverse habitats, sustain landscapes, and promote healthy ecosystems. Community-based ignitions (controlled burning) were outlawed in 1910, making it illegal for the La Jolla Tribe and other regional Tribes to engage in cultural burning (Lake, 2013). The inability of the La Jolla Fire Department to use burning as a form of fire management could heighten the risk of fire, ensuing structural damage should an unplanned ignition occur. This is an important area for further consideration in protecting the community and conserving cultural and natural resources into the future.

"We used to have a fire crew here in La Jolla - Hot Shots - kids would make their school money by going on the Hot Shot crews."

- LA JOLLA TRIBAL ELDER

"The debris that came down from Yapicha Creek looked like the trees went through a mill..."

- LA JOLLA TRIBAL ELDER
(La Jolla Band of Luiseño indians, 2007)

Storms

Periods of heavy rainfall, especially following wildfire events, have the potential to not only damage but completely destroy buildings, homes, infrastructure, roads, and utility lines. The Reservation's soils and landscapes, including alluvial fans, stony fine sandy loam and rocky fine sandy loam, make certain areas especially prone to rapid runoff and high erosion potential (La Jolla Band of Luiseño Indians Environmental Department, 2019). The RV portion of the La Jolla Campground is an alluvial fan, making it prone to flooding and debris flows as experienced in past heavy rain events. The combination of soil type, steep mountain slopes and low flats of the San Luis Rey River valley have caused post-disaster erosion and debris-flow to become a major issue on the Reservation. These events can and have caused damage to important community infrastructure and homes (Federal Emergency Management Agency Region IX, 2013).

Strong rainfall and flooding events can impact the Reservation's internet and power services that are vulnerable to shut off during disruptions. Internet communication is powered by solar energy and is often impacted during winter months. With more frequent and intense storms, it is likely that these communication and power services will be prone to even more shut offs, leaving the community isolated during dangerous conditions.

La Jolla has experienced several cases of flooding, fires, and debris flows. Seasonal, fire, and/or storm-related floods in 2007, 2008, 2010, and 2019 caused damage to both the Reservation's infrastructure and natural environment. Extreme precipitation after the 2007 fire caused heavy mud flows that severely damaged Tribal infrastructure, including roadways, water systems, power, housing, drainage systems, and other utilities (La Jolla Band of Luiseño Indians Environmental Department, 2007). These events caused heavy erosion and damage on major dirt roads leading to the La Jolla Reservation's water tank pump house in addition to the loss of one home.

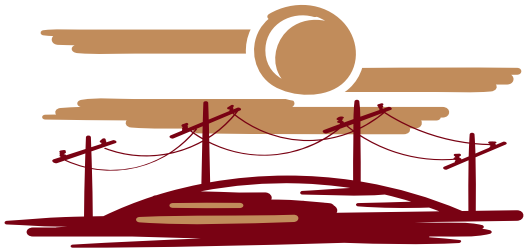
In 2010, the La Jolla Tribe experienced heavy rainfall that caused severe alluvial fan flooding in the campground area. These floods caused significant damage and heavy erosion to the campground's infrastructure, including roadways and water and drainage systems (La Jolla Band of Luiseño Indians Environmental Department, 2007). Additionally, the record breaking 24-hour rainfall event of February, 2019, caused damage to many areas within the La Jolla Reservation. The rains resulted in significant inundation of several public buildings and roads, including the Upper and Lower Roads of the Campground, the campground itself, the road to the Reservation's zipline, residential roads, and a 2.5 mile area along the San Luis Rey River (La Jolla Band of Luiseño Indians Environmental Department, 2007). Additionally, the rain event of January and February, 2017 resulted in major flooding of several areas throughout the La Jolla Reservation, and was declared a disaster by Presi-

dent Trump. These floods that destroyed areas of the La Jolla Reservation had been impacted by the 2007 fires (La Jolla Band of Luiseño Indians Environmental Department, 2007).

Damage resulting from severe storms, flooding, landslides, and mudslides during this period received a Presidential declaration of a major disaster by the Federal Emergency Management Agency (FEMA). According to FEMA's declaration, the Reservation's damage from the February 2019 event "is of sufficient severity and magnitude" (FEMA Region IX, 2013). The Tribe is still mitigating the after-math impacts of these severe 2017 and 2019 floods. Residents have also expressed concern over the presence of hazardous materials on the Reservation, from trucks using Route 76, inappropriate dumping of garbage waste, and the nearby San Onofre Nuclear Power Plant (La Jolla Band of Luiseño Indians Environmental Department, 2007). Storms, flooding, and landslides could result in more traffic accidents, and further buildup, movement, and spillage of waste and materials. These factors could increase the risk for hazardous material in contact with the community, in addition to fire risk. The Tribe's domestic water system supplies water from its storage tanks through a network of high-pressure pipes lying under the access road. The high-pressure pipe system is maintained with weight and compaction with the road, and has been identified as vulnerable to runoff and debris flows that could accelerate erosion. Erosion on the road threatens the structure of the water pipes, and thus, as fires and flooding become more common, La Jolla's domestic water system could be increasingly at-risk (Interagency BAER Team, 2007a).

The Tribe's major source of income, the La Jolla Indian Campground, spans three-miles along the San Luis Rey River, meaning it could be highly vulnerable to flooding, erosion, and debris-flow. Heightened risk of these events, post-event damage and dangerous conditions could impact campground business. Given the tribe's reliance on revenue from the tourism industry, impacts to the number of campground patrons could cause significant losses for the Tribe's economy. As the frequency and intensity of rainfall events continue to increase, the Reservation's infrastructure will likely experience more severe damage with shorter recovery periods.

Flood damage from a storm in 2004. *Credit: La Jolla Environmental Department*



"The weather patterns are shifting, there are less wet years, more fire risk, and increased burdens on health and safety."

- LA JOLLA TRIBAL ELDER

Heat

Hotter temperatures and extreme heat events can directly impact a community's infrastructure, which can cause additional heating and economic costs. Buildings, roads, and infrastructure can be heated up to 50 to 90 degrees hotter than the air while natural surfaces remain similar to the air temperature. This effect, known as the heat island effect, can keep many urban and suburban areas warmer than surrounding open space areas (Center for Climate and Energy Solutions (C2ES), 2019). Additionally, hotter temperatures and more frequent extreme heat events can increase strain on infrastructure, including power, water, and transport (C2ES, 2019). Additionally, higher temperatures can lead to electricity reliability issues during heat waves, as higher temperatures can lower the ability of transmission lines to carry power (C2ES, 2019). More reliance on electricity and air conditioning during heat waves could also increase energy prices for individuals, families, and the community.

The La Jolla Tribe has invested in solar panels for community buildings and residences however the community still relies on input from the grid operated by SDG&E. Opportunities for local or community based battery storage or independant microgrid options could protect the community from power cuts associated with wind events.

Opportunities for Increasing Tribal Resilience

Climate will continue to impact La Jolla's infrastructure and economy. Tribal resilience will require diverse approaches and strategies to address and adapt to these growing challenges. Potential adaptation opportunities can be divided into those focusing on *community* (engagement, education and outreach); *research* (monitoring and assessment); and *planning* (planning and management):

EXISTING EFFORTS & PROGRAMS

- ☐ FEMA Pre Disaster Mitigation Plan divides the Reservation into 12 zones and designates zone leaders in charge of notifying and looking out for community members within the boundaries of their designated zone. Zone leaders have phone numbers for each home in their zone and are working to acquire information on who are elders, have medical needs including electricity for medical needs, and contacts to notify in case of a disaster
- ☐ Air conditioned spaces, such as the Tribal Hall and Gym that can act as cool spaces for the community on high temperature days
- ☐ Working to build up community supplies to have in case of disaster
- ☐ Designation of Public Works Building as EOC Emergency Services Center
- ☐ Lake Henshaw dam release emergency plan that focuses on notifications in case of dam failure
- ☐ Mutual aid agreements

COMMUNITY ENGAGEMENT, EDUCATION, & OUTREACH

- ☐ Provide public with maps of cool/safe zones, community shelters, areas, and facilities to ensure community members have access to these resources

COMMUNITY ENGAGEMENT, EDUCATION, & OUTREACH (continued)

- ☐ Provide public with maps of cool/safe zones, community shelters, areas, and facilities to ensure community members have access to these resources
- ☐ Implement and promote community workshops and guidelines for checking on neighbors and community members
- ☐ Implement proactive planning and preparedness exercises/workshops for families, businesses, leaders, emergency response teams, etc. to review emergency planning protocols
    - ☐ Enforce and educate protocols listed in the FEMA Pre Disaster Mitigation Plan
- ☐ Provide emergency notifications such as real-time warnings before and after event occurrence to notify community of damaged, destroyed and/or hazardous infrastructure; Use media platforms (including website, social media, radio, TV) to convey information.
- ☐ Administer safety warnings relevant to infrastructure damage, closures, and/or hazards. Provide safety advisories and tips to prevent health/safety issues and worsened impacts in addition to providing information on emergency resources and emergency contacts if help is needed. Present estimated closure times, recovery rates, and status of safety limitations.
- ☐ Establish community workshops and media that encourage reduced energy consumption and greener transportation methods

RESEARCH, MONITORING, & ASSESSMENT

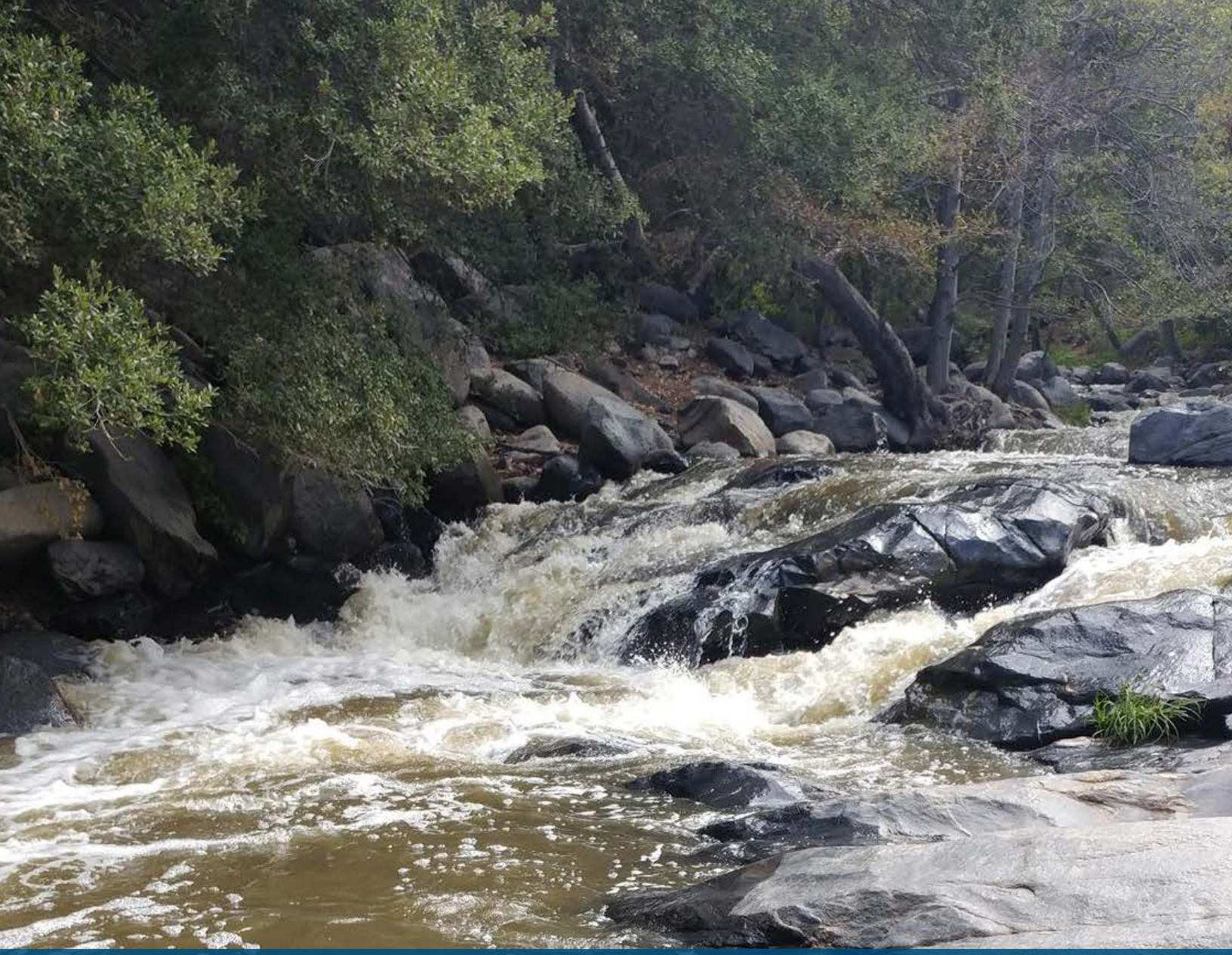
- ☐ Inventory of current availability of cool areas, emergency centers, air quality safe zones, and community gathering sites
- ☐ Mapping of critical facilities, infrastructure, roads and locations vulnerable to flooding, debris flow, and fire
- ☐ Implement U.S. Geological Survey (USGS) groundwater and surface-water monitoring systems for streamgages and wells, Automated Local Evaluation in Real-Time (ALERT). ALERT streamgages send warning when water levels reach a predetermined level or change rapidly
- ☐ Implement kiosks and signs that can broadcast emergency notifications and provide information

PLANNING AND MANAGEMENT

- ☐ Include climate change in overall Tribal strategic planning and include climate change planning in each department's planning documents and projects
- ☐ Develop or adopt building codes that include actions to adapt to climate change such as including PV on all buildings, thicker walls with higher R value insulation, Energy Star appliances, electric heat rather than gas, and ground-source heat exchange
- ☐ Develop plan for cultural burning and pursue changing local rules to allow for implementation of cultural burns
- ☐ Create a Tribal land use plan
- ☐ Review goals, strategies, and plans of emergency preparedness, response, and recovery under conditions induced by climate-related disruptions such as heat waves, migrating disease vectors, flooding, fires. Update these emergency response and disaster plans, including FEMA predisaster mitigation plan
- ☐ Establish tribal policies/procedures that reduce energy consumption; Implement energy efficiency protocols for public/community facilities
- ☐ Design assistance programs and protocols that designate safe and cool zones, provide information for how to address dislocation due to damaged/closed infrastructure
- ☐ Develop new/additional emergency response/community shelters/safe spaces/cool zones
- ☐ Designate an Emergency Manager to administer these community engagement/ education/outreach, research/monitoring/assessment, and planning/management strategies
- ☐ Flooding preparedness initiatives, such as: Evaluation of and improvements to stormwater infrastructure for high-intensity rainfall events
- ☐ Use tools/resources to assess the level of fire adaptation and track capacity of fire resilience over time (such as the Fire Adapted Communities Self-Assessment Tool)
- ☐ Make necessary updates and improvements to the Tribal Hall in order to ensure it can function as an EOC and/or build a new EOC

PLANNING AND MANAGEMENT (continued)

- ☐ Develop a micro-grid to create independence from the grid
  - ☐ Explore options for a community microgrid projects starting with critical facilities such as water supply, wastewater treatment, first responders, tribal hall, campground store, and health care centers
- ☐ Develop renewable power generation, storage, and back up power
- ☐ Implement and install BAER emergency stabilization recommendations (Combined BAER, 29) before the next rainy season, including:
  - ☐ Early warning system - stream gauges, rain gauges, radio-repeaters, weather stations, warning sirens, base stations for downstream warnings to the community
  - ☐ Road debris removal - removal and maintenance of sediment, debris, and rock fall
  - ☐ Flood hazard signs - Flood/mudflow hazard warning signs at low water crossings
  - ☐ Drain outlets - placed in locations where sheet flow from the road is concentrated on embankments
  - ☐ Channel debris cleanout - clear debris (large wood, brush, rock, flow impediments) out of stream and drainage channels adjacent to reservation roads
  - ☐ Culverts cleanout - clean culverts in areas at risk of flooding/debris flows
  - ☐ Culverts removal - remove or replace undersize culverts; install low water crossings to reduce the risk of flooding, blockage, and damage for nearby residents
  - ☐ Structural protection - Add K-rails and sandbags around structures to prevent flooding and mudflows
  - ☐ Update irrigation system - remove sediment and debris from irrigation diversion/ flush out sediment from pipelines that is projected to increase on the Reservation post-fire and during precipitation events
  - ☐ Cleanout sediment basin - remove debris and clean out sediment basins for maximized storage capacity



"People ate well, lived well, went hiking and were outdoors all the time until the sun went down — we were active everyday going to the river barefoot."

- LA JOLLA TRIBAL ELDER

River running through the La Jolla Indian Campground. *Credit: Campground Facebook Page*

HUMAN HEALTH & WELLNESS

Background and Existing Challenges:

Health and wellness are an important part of the La Jolla Tribe's vision for climate resilience. The Tribe has approximately 700 enrolled members, of which the majority live on the Reservation (NCAI, 2019). Of the population living on the Reservation, 13% are over the age of 60, while 72% are between 18-60, and 15% are under 18 years of age (NCAI, 2019). The community's nearest hospitals are located outside of the Reservation, at the Palomar Medical Center in Escondido or the Temecula Valley Hospital, both located within 50 miles of the Reservation. Community members also have access to the Indian Health Council (IHC) Clinic located in Rincon, which offers medical, dental, behavioral, and pharmacy services. Approximately 80% of the population use IHC services and the remaining portion use private insurance. There are several health issues that are prevalent in the Tribe, including diabetes, obesity, high blood pressure and childhood obesity (NCAI, 2019). Primary employers on the Reservation include Tribal Administration and the La Jolla Indian Reservation campground. In a 2011 survey, 15 members were employed full time jobs under Tribal Administration, 12 members employed in part time jobs, 39 members employed seasonal jobs at the La Jolla Campground, 48 members looking for work, and 34 families on public assistance (NCAI, 2019).

These demographic factors, in addition to the La Jolla Reservation location, have created several challenges for the La Jolla Tribe in terms of ensuring health and wellness throughout the community. Given that many community members are considered vulnerable (elderly, disabled, have health conditions, and/or are considered low income and unemployed), it can be difficult to ensure the overall physical health and mental wellness of the community. It is especially challenging for the community given its rural location, variable terrain and weather, and lack of on-Reservation health facilities and resources. The Tribe has no health and/or emergency facilities on-site, which can be difficult in a community with a large population of vulnerable individuals. The local gymnasium is the only fitness and/or health facility within the La Jolla Reservation. The community holds events and programs for wellness and community building, and is the leader of the Avellaka Program that addresses safety for Native women (National Indigenous Women's Resource Center, 2019). Additionally, there is only one road in and out of the La Jolla Reservation, and the closest public transportation bus system is seven miles from the Reservation.

"In the old days we had midwives and then everyone started going to Soboba but it would take a couple of weeks on horseback."

- LA JOLLA TRIBAL ELDER

Local Climate Impacts for Human Health & Wellness

"People didn't really get sick. It had a lot to do with the way they ate and took care of themselves. Now a days everything comes from the grocery stores and it's not fresh, it's all processed."

- LA JOLLA TRIBAL ELDER

Climate change is expected to be the greatest public health threat of the 21st century, exacerbating existing environmental health impacts. These environmental impacts, such as temperature and weather, affect not only human physical health, but cultural, spiritual, and socio-economic health as well. Together, these factors play a large role in contributing to overall personal and community wellness (Pala Band of Mission Indians Environmental Department, 2019). The La Jolla community has experienced climate and environmental-related health impacts for many years, and the community's existing health challenges place them at risk to climate change impacts. Changes in drought, wildfire, extreme heat and heat waves, and extreme precipitation and flooding, can exacerbate existing health challenges while creating implications for overall wellness.

There are many individuals within the Reservation that are considered to be vulnerable, including those who lack resources, are socially isolated, are elderly, or whose health is already compromised. Conditions such as asthma, heart, and lung diseases, which are relatively common health issues in communities, could worsen and become more prevalent with changing climate conditions (US Center for Disease Control and Prevention (CDC), 2019). Elders could be especially vulnerable to these health impacts, due to chronic health problems, limited mobility, and social isolation. The La Jolla community as a whole could be especially vulnerable to the impacts of climate change, given their location, economic status, and elder populations. The community is also uniquely challenged in their inability to resettle as a community beyond the federally-designated tribal homelands of the La Jolla Reservation. These factors create distinct challenges and disadvantages for avoiding the negative health impacts of climate change. Thus, it is important that La Jolla Tribal community consider and plan for these health impacts to ensure community resilience.

Remnants of belongings after the 2007 Poomacha Fire. *Credit: La Jolla Environmental Department*

"We used to use water well - we knew what was needed for people and animals to survive."

- LA JOLLA TRIBAL ELDER

Drought

Drought poses a number of secondary exposure health and wellness impacts. While the impacts of drought on health and wellness are often indirect, worsened drought could increase exposure to hazardous environmental conditions that enhance the risk of illness, disease, and mental health issues. Drought can have both short-term and long-term implications for health, and are thus often difficult to monitor, detect, and correlate (CDC, 2019).

One of the major ways in which drought impacts human health is through reduced air quality and the spread of air-borne illness. Droughts increase the risk for wildfires, and as a result, these events can increase particulate matter suspended in the air. Particulate matter can increase the risk for respiratory infections, chronic respiratory illnesses, and exacerbate conditions in which vulnerable populations with pre-existing health conditions are sensitive to (Kalansky et al., 2018). As droughts worsen, and landscapes become dryer, many arid regions in the U.S. are experiencing decreased air quality from increased dust storms and dust levels. In some areas, fungus spores attach to dust and can cause air-borne illness such as "Valley fever" (Public Health Institute, 2016). Cases of Valley fever have risen over the last decade, with a 15% increase each year from 1998 to 2011. Drought conditions, including dusty soil, may lead to higher dust levels and as a result, greater risk of Valley fever (Hall et al., 2018). Research also indicates

Indian Health Council Healthcare Providers
Credit: Blue Shield of California Foundation

Indian Health Council
Credit: Blue Shield of California Foundation

that drought can increase ozone levels, depending on severity of drought (American Chemical Society, 2019). The region is already considered to have high levels of ozone pollutants compared to the NAAQS, and thus further increases in ozone could have significant effects on the community's physical health.

Periods of drought can cause changes in human and animal behavior that increase the risk of vector-borne disease. During drought conditions, it is likely that animals will move into new areas, which can increase the likelihood of human contact with wildlife, insects pests, and their transmitted diseases (CDC, 2019). Changes in the pattern and distribution of vectors can increase risk of infection for human populations (CDC, 2019). Drought has a direct affect on water table levels, vegetation, and aquatic predators which are variables that influence mosquito populations. For instance, drought conditions can increase the prevalence of West Nile virus in mosquito and bird populations. Species carrying vectors such as West Nile Virus are able to establish new areas of breeding grounds as bodies of water become stagnant (CDC, 2019). Studies have found a correlation between West Nile virus incidence following a prior drought year (Brown et al., 2014).

Drought can impact the community's water resources, which can cause several consequences for human health. Higher water temperatures and sediments from drought and drought-related wildfires, can impact water quality for riverways such as the San Luis Rey River. Reduced water quality and increased temperature can hinder the ability of community members to access the river for recreation and natural resources, while also increasing the risk of infection from water-borne disease. Additionally, as a community that is not reliant on imported water supply, long-term drought conditions can threaten the La Jolla Reservation's water supply, causing a risk of water scarcity and as a result, reduced campground patrons.

Combined, drought conditions and health impacts from these conditions can cause consequences for overall wellness. Drought-related health impacts, such as illness and disease, can physically hinder community members from attending work, school, exercising, spending time outdoors, and gathering as a community. These physical and socio-economic impacts can cause chronic stress for individuals and the community as a whole. Impacts on water can also create several implications for mental wellness, including chronic stress from water scarcity, reduced ability to access and use water resources, and socio-economic consequences from reduced campground tourism. Long-term chronic stress from these conditions can cause community members to experience depression, anxiety, engage in substance abuse, and contribute to a loss of community togetherness.

"After the devastation of the fires . . . I fell into a path of drugs and alcohol to help cope with the post-fire devastation."

- LA JOLLA TRIBAL MEMBER

Wildfire

Wildfire can have many implications for the health and wellness of communities directly or indirectly exposed to fire conditions. Increased wildfire risk can lead to an increase in health risk, including direct effects such as safety and indirect effects associated with smoke and air quality. Given that the majority of the Reservation area is designated as "very high" or "high" risk in terms of Fire Hazard Severity Zones (Figure 11), the La Jolla community is likely to experience these health effects from wildfires.

The direct effects of wildfire threaten the safety of surrounding communities, causing injury and fatalities. In the 2007 Southern California wildfires, a total of 203 people were injured and 16 killed directly from the fires (The San Diego Wildfires Education Project, 2004). Wildfires can also cause severe indirect effects, such as unsafe air quality, that can threaten the health and wellness of exposed communities. Particulate matter, ozone, carbon monoxide, and nitrogen dioxide found in smoke have been linked to an increased risk of health impacts such as respiratory and cardiovascular conditions (Wettstein et al., 2018); (Pala Band of Mission Indians Environmental Department, 2019). In San Diego, inland communities, such as the La Jolla Tribe, are at highest risk of smoke exposure and poor air quality from fires (Kalansky et al., 2018). The National Institutes of Health (NIH) studied the Medi-Cal smoke-exposure records during the 2007 fires in San Diego, finding that asthma, and other respiratory diagnoses, increased during and after the wildfires (Hutchinson et al., 2018). Elders or individuals with existing health conditions or disabilities may be unable to escape quickly from wildfires, making these individuals highly vulnerable to wildfire. Studies show that elderly over 64 years old are most vulnerable to significant health impacts (Kalansky et al., 2018). Increased wildfire risk could threaten elders in the community who are considered most vulnerable to significant health impacts.

Wildfires can also disrupt services and damage infrastructure that support health services (Bell et al., 2016). SDG&E supplies the La Jolla Reservation's power and during wildfires or periods of high wildfire risk, it is common for SDG&E to turn off the power going to rural communities. Power outages can impact the functioning of critical community facilities and espe-

Smoke lingering in air during a fire.
Credit: La Jolla Environmental Department

cially impact compromised individuals in their home. During times of power outages and wildfire, vulnerable individuals will require additional assistance. As an area with limited resources, public health services, and personnel, the La Jolla Reservation could have difficulties in accessing and providing additional health resources during the event of a fire. The Tribe views power outages in combination with extreme heat as a natural hazard of concern, as outlined within the FEMA Multi-Hazard Mitigation Plan (La Jolla Band of Luiseño Indians Environmental Department, 2007).

Acute climate impacts with sudden onset, such as wildfires, can lead to a multitude of mental health and wellness burdens. Wildfire can result in the inability to gather and practice cultural traditions, and cause loss of work, school days, and business operations. Together, these impacts can lead to isolation, relocation, and the loss of cultural traditions and gatherings, which can in turn cause stress, anxiety, depression, post-traumatic stress disorder, and substance abuse (American Public Health Association, 2019). Additionally, the physical health impacts of disease and illness from reduced air and water quality can cause chronic stress, depression, and anxiety. These unsafe health and environmental conditions often result in diminished living conditions that can have an impact on overall wellness of Tribal members and the entire community.

Disaster Relief during the 2007 Poomacha Fire

"There used to be a lot of water, as kids, we could jump in and swim."

- LA JOLLA TRIBAL ELDER

Heat

Extreme heat-related human health effects are expected to significantly increase with climate change (Kalansky et al., 2018). California has already experienced changes in the number of illnesses and deaths related to heat over recent decades (Kalansky et al., 2018). For the period of 1987 and 2016, the National Weather Service (NWS) reported heat to be the number one weather-related cause of death in the nation, causing more deaths than other weather-related events including floods, lightning, tornadoes, and hurricanes (Kalansky et al., 2018). While the threshold for hazardous temperatures varies for each individual, the community has many members considered to be especially vulnerable to higher temperatures that could increase exposure to health-risks.

It is expected that San Diego county's inland and rural populations, such as the La Jolla community, are especially vulnerable to rising temperatures due to exposure of dangerously high temperatures (Kalansky et al., 2018). Not only will these populations experience extreme temperatures, but it is projected that populations will be exposed to these extreme temperatures for longer periods of time (Kalansky et al., 2018). As heat waves become more frequent and intense, they will also become more humid, with warmer nighttime temperatures than historically experienced. The combination of higher temperatures and reduced nighttime cooling will result in less relief from high temperatures and potentially more exposure to unsafe conditions (Kalansky et al., 2018). Additionally, high humidity will further exacerbate the impacts of heat on health. Shifts in timing of heat wave occurrence is

River running through the La Jolla Indian Campground.
Credit: Campground Facebook Page

also of concern for the health of human populations across San Diego. Early-season heat waves can have significant impacts on human health because they occur before a community has the chance to acclimate to warm summer weather (Kalansky et al., 2018).

Sustained high temperatures during heat waves can cause heat stroke, exhaustion, dehydration, and exacerbate pre-existing conditions and/or illnesses such as diabetes, and cardiovascular or respiratory disease (American Public Health Association, 2018). Rising temperatures in San Diego's waterways, such as the San Luis Rey, could increase exposure to microbes and waterborne agents, and increase disease through direct contact, consumption of aquatic species, and recreational activities (Kalansky et al., 2018). High temperatures and extreme heat events alone can cause stress, anxiety, and depression. Additionally, high heat could limit the ability of communities to be outside, exercise, and attend work and school. Extreme or prolonged heat events can also inhibit people from gathering together or participating in community events causing feelings of isolation that can exacerbate stress, anxiety, and depression.

Remnants of a structure after the 2007 Poomacha Fire. *Credit: La Jolla Environmental Department*

"All those dried up creeks all around, they use to run all year. There were springs, lots of springs and that was how we got water to our houses."

- LA JOLLA TRIBAL ELDER

Storms

Extreme precipitation storms can have severe implications for human health and wellness. Not only are floods one of the deadliest weather-related hazards in the nation (US Center for Disease Control and American Public Health Association, 2019), floods and heavy precipitation can lead to many indirect and direct health effects. As extreme precipitation events become increasingly frequent and severe, communities are at higher risk of exposure to unsafe and unhealthy conditions posing direct safety and health risks. Extreme precipitation can cause reduced water quality, increased mold infestation, and the spread of insects that host and transmit diseases. One of the major concerns with increased extreme precipitation are the debris flow they contribute to, and the far reaching effects these events can have on water quality in the mountains of southern California (California Institute for Water Resources, 2019). While debris flows in urban areas are often contained by basins, fine sediments are often released which have unknown impacts for the water quality of downstream water bodies (CIWR, 2019). As a non-urban, rural community, the La Jolla Reservation could potentially be at risk of larger sediment flows in addition to fine sediments.

These changes have direct impacts for health, including gastrointestinal illness, respiratory tract and skin infections due to contact or exposure to pathogens in contaminated water, illness and respiratory disease from mold infestation, illness and death from higher incidences of vector-borne diseases such as West Nile Virus and Zika (Bell et al., 2016). Extreme precipitation can also have socio-economic impacts for a community, including lost work, school, and business days, inability to access cultural resources and sites, isolation and relocation, post-traumatic stress, chronic illness and injury, inability to be outdoors, and financial stress from housing and business damages. These impacts can result in mental health impacts from stress, anxiety, depression, and grief. The 2010 and 2019 rainfall events caused flooding that resulted in isolation of community members and long-term damage to the community's housing and resources. From isolation to costly rebuilding, these past rainfall events illustrate how storms can impact the overall mental health and wellness of community members and the community as a whole.

***Aedes* species mosquito, a carrier of Zika**

Opportunities for Increasing Tribal Resilience

Climate will continue to impact La Jolla's overall health and wellness. Tribal resilience will require diverse approaches and strategies to address and adapt to these growing challenges. Potential adaptation opportunities can be divided into those focusing on *community* (engagement, education and outreach); *research* (monitoring and assessment); and *planning* (planning and management):

COMMUNITY ENGAGEMENT, EDUCATION, & OUTREACH

- ☐ Hold educational programs and workshops outlining climate change impacts on public health (water quality, disease, air quality etc.)
    - ☐ Provide resources that show the Reservation's community shelters, areas, facilities, and zones that can serve as cool and/or safe zones during extreme events
    - ☐ Provide families and individuals with resources to create family evacuation plans and emergency supply kits, sign up for alert systems, and educate on programs such as the National Flood Insurance Program (NFIP)
- ☐ More community health outreach and discussions for safety precautions and strategizing
- ☐ Community workshops and guidelines for checking on neighbors and community members
- ☐ Organize community events that promote health and wellness such as outdoor activities, exposure to nature, and exercise
- ☐ Re-establish the community garden, including recommendations from the Comprehensive Community Plan to have three gardens with focuses for medicine, traditional foods, and basketry, in addition to using irrigation from runoff from the mountain
    - ☐ Introduce community events at the garden and community volunteer hours to maintain the garden
- ☐ Educate, promote, and provide resources for community members on services available for health and mental wellness support
    - ☐ Programs and support though the Indian Health Council Behavioral Health Services including crisis intervention, staff psychiatrists, individual, child, and family counseling social services

COMMUNITY ENGAGEMENT, EDUCATION, & OUTREACH (continued)

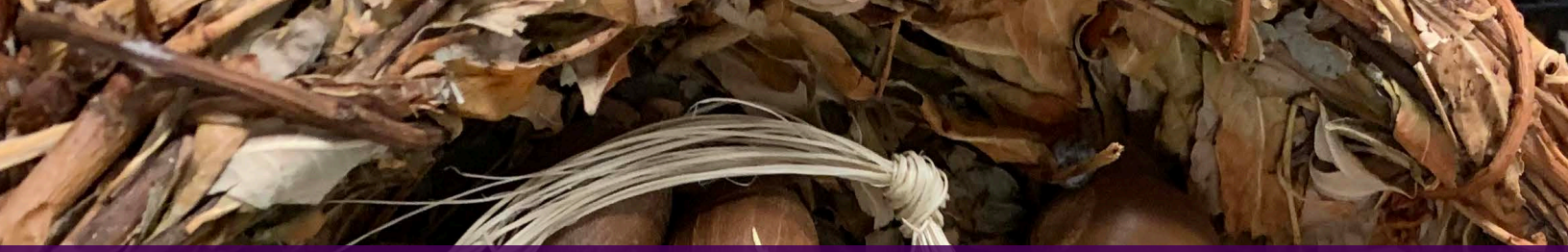
- ☐ Emotional recovery resources and free 24/7 counseling support from American Red Cross
- ☐ General Services, emergency room, and urgent care at Temecula Valley Hospital
- ☐ Education to help residents recognize symptoms, avoid risks, and psychologically cope with climate exposure-related illness
- ☐ Domestic violence support through the Avellaka Program

RESEARCH, MONITORING, & ASSESSMENT

- ☐ Map/identify locations that are newly at risk or at high risk, especially where that coincides with where vulnerable populations might be (elderly, youth, and those with health conditions)
- ☐ Mapping of cool spaces (or AC buildings) and safe zones
- ☐ Implement and operate an ozone monitor within Tribal boundaries

PLANNING AND MANAGEMENT

- ☐ Elect "emergency ambassadors" and social contacts for vulnerable individuals during extreme events and climate-related hazards
- ☐ Develop collaborative referral system to ensure residents can access available resources and services (e.g. health care, crisis counseling, and shelters) during and after climate events
- ☐ Review goals, strategies, and plans of emergency preparedness, response, and recovery under conditions induced by climate-related disruptions such as heat waves, migrating disease vectors, flooding, and fires
- ☐ Develop plans for if people/areas are disconnected or inaccessible
- ☐ Develop and invest in more cool/AC/safe zones



"We need to educate our community on what resiliency really means to our people and how moving forward supports our future."

- LA JOLLA TRIBAL MEMBER

COMMUNITY & TRADITIONS

Background and Existing Challenges:

The La Jolla Reservation has a relatively small population, with a majority of the 700 enrolled members living within the reservation boundaries. Elders note that the population has and continues to grow, observing that many community members have returned over the last 20 years after leaving. The majority of community members (72%) are between 18-60 years of age. Elders also make up a large part of the community (13%), many of which have lived on the Reservation for decades and have shared the wisdom and culture of the Tribe throughout time.

The La Jolla Reservation is split into multiple neighborhoods, separated from East to West. Some of the major roads that make up the Reservation are Redgate, Harolds, Yapitche, Church, and Poomacha. As a sovereign nation, the La Jolla Tribe does not receive the same resources as other cities or towns and has complex agreements on services and/or access to resources such as water supply. The La Jolla Tribe does not own or operate a casino and relies primarily on its Tribal enterprises in addition to grant funding for economic revenue. These conditions present challenges as it relates to employment opportunities make it difficult for Tribal members to work on-Reservation.

The La Jolla Tribe has faced challenges throughout time that continue to have an affect on the Tribe's cultural traditions. The Tribe was heavily impacted by non-native settlers and their attempts to take away the Luiseno culture, specifically the language. Today, only a handful of elders speak the traditional Chamteela language because students were punished for speaking their native language under the Mission System, effectively discouraging parents from passing the language onto the youth (La Jolla Band of Luiseño Indians Rural Community Assistance Corporation, 2011).

"We never had to watch out for anything. There were all kinds of snakes and things and we would run everywhere barefoot and nothing ever happened. We would stay out all day long playing together, bring our lunch and stay there the whole day."

- LA JOLLA TRIBAL ELDER

Local Climate Impacts for Community & Culture

"Some of my cousins didn't like Sherman Indian School so they left and walked all the way back home. My mother use to go up to Sherman just to get a new pair of shoes. And then she would come back home."

- LA JOLLA TRIBAL ELDER

While the La Jolla Tribe has adapted to changes throughout time, the impacts of climate change will present new challenges and exacerbate the Tribe's already existing challenges. Some of the most significant and distinct impacts will be on the La Jolla Tribe's community and traditions. Advancing tribal resilience will require that strengthening, engaging, educating, and gathering the community is at the forefront of climate adaptation efforts.

Collaborative art activity at the 2019 Intertribal Earth Day, hosted by the La Jolla Band of Luiseño Indians.
Credit: Climate Science Alliance

"They would take the kids down and gather the plants down by the river to make baskets, she taught us how to make baskets."

- LA JOLLA TRIBAL ELDER

Drought

Throughout time, the La Jolla people have utilized the region's natural resources as part of the Tribe's cultural traditions, practices, and livelihood. These resources are integral to the culture of the Tribe, and continue to be used for traditional food, medicine, and baskets. Drier conditions, such as longer drought periods, more dry years, higher moisture deficit, and lower soil moisture, are altering the landscapes throughout the La Jolla Reservation. These changes significantly impact the distribution and amount of culturally significant species and resources. Some of these natural resources include sage, willow, sumac, juncus, milkweed and acorns from oaks. As droughts become more severe and frequent, these conditions will continue to threaten the resources that are critical to the Tribe's culture. This could inhibit the community's ability to produce culturally important items, such as wiiwish, and partake in traditional practices. Many Tribal community members across the region have noticed shifts in harvest-timing and abundance of acorns, concerned for their ability to gather acorns each year. The inability to engage in traditional ways of life, such as food foraging and gathering, could result in a loss of culture and the traditions that connect the community. Additionally, many of these resources have been used throughout time as food and medicine, and thus, as resources are diminished, it could result in a lack of nutritional and medicinal abundance (Gaughen, 2019). A lack of nutritional and medicinal abundance can impact the overall mental and physical health of individuals, negatively impacting the well-being of the community.

White sage (*Salvia apiana*)

"We need to invest in a community center that can help bring together the youth, elders, and the entire community."

- LA JOLLA TRIBAL MEMBER

Wildfire

More frequent and intense wildfires could cause damage, destruction, and impair access to sacred cultural sites. As wildfires increase and intensify, it is likely that many areas throughout the reservation could face damage and/or destruction. The majority of the La Jolla Reservation has a high-risk of wildfire occurrence, threatening the resources and species that live on these lands. Many of these resources are critical to the culture and traditions of the La Jolla people. As these landscapes are increasingly damaged and destroyed by fire, they are often unable to support and provide habitat to the native species that rely on them. Wildfires can also result in long-term impacts, altering ecosystems, and species distribution and abundance in future years. Thus, wildfires can result in short-term and long-term changes for culturally significant species that have been used for many years as resources for the Tribe. Additionally, wildfires can cause disruptions for traditional gatherings, annual ceremonies, and access to cultural sites. As a result, the loss of culturally significant resources and sites can contribute to the loss of cultural character, practices, and traditions, having a significant impact on the community as a whole.

Aftermath of the Poomacha Fire in 2007.
Credit: La Jolla Environmental Department

"Our months of rain and sunshine have changed."

- LA JOLLA TRIBAL ELDER

Heat

Extreme heat and heat events can have direct impacts on the La Jolla people, animals, and vegetation, causing stress on the community and its cultural traditions. Elevated temperatures can directly cause unsafe living conditions that impact the well-being of Tribal members, affecting physical health, socio-economics, isolation, and mental health. The health and wellness of individual Tribal members play a significant role in the overall well-being of the community. The inability of individuals to gather, and engage in community events and traditions due to degraded health and well-being causes the community as a whole to suffer. Heat can also directly affect the ability of the community to partake in cultural traditions, in which people are unable to go outdoors and/or access cultural sites.

High temperatures and extended periods of heat threaten the health of many of the Reservation's ecosystems that provide critical habitat for culturally significant species. Heat can cause stress on these ecosystems and could result in harmful disturbance and/or species mortality. Changes in species distribution and abundance could threaten the ability of community members to forage and gather the resources needed for cultural traditions.

"Back in the day a lot of people had walnut and apricot groves, and they shared. At Christmas time one family would bring us half of a sack of walnuts."

- LA JOLLA TRIBAL ELDER

Storms

Increased variability of the region's precipitation regime, with more intense and frequent precipitation events, will have direct and indirect impacts for the La Jolla community and the people's cultural traditions. The La Jolla Reservation's geographic location and geologic characteristics make the reservation especially prone to events associated with heavy precipitation, such as flooding and debris flow. Heavy precipitation, storms, flooding, and debris flow can directly affect the La Jolla Reservation's community members, causing hazardous and unsafe conditions. Intense rainfall and associated events often damage roads, buildings, and infrastructure that make it difficult for community members to get around. These events can also damage cultural sites and community buildings that can cause the inability to come together for community gatherings and engage in cultural practices. Hazardous conditions can make it especially unsafe for elders to access community resources, receive necessary services, and get support. As a community that holds special value and honor for its elders, disconnectedness of elders to the rest of the community could have implications for the entire Tribal community. Together, these impacts can cause members to feel isolated and disconnected. The impacts on individual community members plays an important role in the overall connectedness of the community as a whole, and in turn, the community's cultural heritage.

Precipitation events not only impact the La Jolla Reservation's human communities, but its plant and animal populations as well, through direct and indirect ecological impacts. Heavy precipitation compounded with flooding and debris flow can result in direct impacts across the Reservation's natural systems, affecting the ecosystems, plants, and animals that inhabit these landscapes. Many of these natural resources, species, and lands are important to the culture of the La Jolla people, from traditional food and medicine, to their inclusion in the stories that have been passed down for generations. Directly, storms, flooding, and debris flows can result in mortality and injury of animals, and destruction of vegetation communities. Indirectly, the stress from storms, flooding, and debris flows could lead to disrupted habitat and migration patterns for wildlife. These events could also weaken plants and soils throughout the La Jolla Reservation, which could also impact food and habitat resources for wildlife. As a result, increased frequency and intensity of precipitation could cause altered and decreased abundance of species throughout the region. Many of these species are culturally important to the La Jolla people, used for basket-weaving, medicinal and food resources. Thus, increased exposure of vegetation communities and wildlife habitat to intense precipitation events could result in the inability to engage in cultural traditions and thus contribute to the loss of cultural heritage.

Community Garden at the La Jolla Reservation. *Credit: La Jolla Environmental Department*

"My grandmother had a garden when we came from El Centro in early 30's. I would go down there and pick melons with my grandma. And they raised beans there, big pink beans, and a lot of people shared that stuff. And they canned and pickled too. They also grew grains. They grew everything."

- LA JOLLA TRIBAL ELDER

Revegetation project on La Jolla Reservation. *Credit: La Jolla Environmental Department*

Opportunities for Increasing Tribal Resilience

Climate will continue to impact La Jolla's community and traditions. Tribal resilience will require diverse approaches and strategies to address and adapt to these growing challenges. Potential adaptation strategies can be divided into those focusing on *community* (engagement, education and outreach); *research* (monitoring and assessment); and *planning* (planning and management):

COMMUNITY ENGAGEMENT, EDUCATION, & OUTREACH

- ☐ Implement cultural activities and programs with the planting of cultural, native plants to increase knowledge on, and interest in cultural practices that use these resources
    - ☐ Design educational programs once these species are planted
- ☐ Continue to create and support community gathering such as Intertribal Earth Day and other opportunities to gather the community
- ☐ Organize a youth group that completes monthly community service around the Reservation and assists elders with tasks they need help with, such as cleaning the Cemetery
- ☐ Generate bi-annual hazard information newsletter
- ☐ Hold hazard preparedness and response trainings, such as evacuation drills
- ☐ Re-establish community garden and introduce community events at the garden
- ☐ Provide educational outreach programs and resources on the impacts of climate for cultural species, sites, and resources
    - ☐ Hold convenings to identify the community's priority concerns for these cultural plants, animals, resources, and sites
- ☐ Develop community programs that open the conversation about challenges for cultural identity with climate change and plans for how to move forward
- ☐ Identify traditional and culturally significant adaptation strategies from the community that have been used to restore and buffer cultural resources from storms/climate events
    - ☐ Communicate and provide these resources and strategies in workshops and educational events, especially to youth who can carry on and implement these practices

RESEARCH, MONITORING, & ASSESSMENT

- ☐ Monitor culturally-significant species to understand which species are most threatened and the cultural traditions that it could impact
- ☐ Complete a vulnerability assessment of all cultural lifeways and resources that may be disrupted or suffer as a result of climate change
    - ☐ Map and identify locations that are at high risk of climate impacts, and the cultural species, sites, and resources that coincide with these threatened areas

PLANNING AND MANAGEMENT

- ☐ Develop a social services department that includes elder protection and elder care
- ☐ Plant more native, culturally-significant plants, such as Juncus as a way to preserve cultural traditions
- ☐ Implement goals identified in Comprehensive Community Plan, such as creating Inter-Department Work Group
- ☐ Revise the 2011 Community Comprehensive Plan to reidentify the community's core values and concerns to update the vision statement
- ☐ Develop short-term and long-term plans for cultural sites that are highly vulnerable to the threats of climate change such as extreme events
    - ☐ Short-term planning (i.e. restoration/conservation practices that help buffer the impacts of extreme events)
    - ☐ Long-term planning (i.e. relocation) of cultural sites

"When our earth is struggling, we struggle, but we have the strength, knowledge, and the memory and can call on the things our parents and grandparents saw to learn from and use this insight to make our community resilient and strong."

- LA JOLLA TRIBAL MEMBER

PART IV

Advancing Tribal Resilience

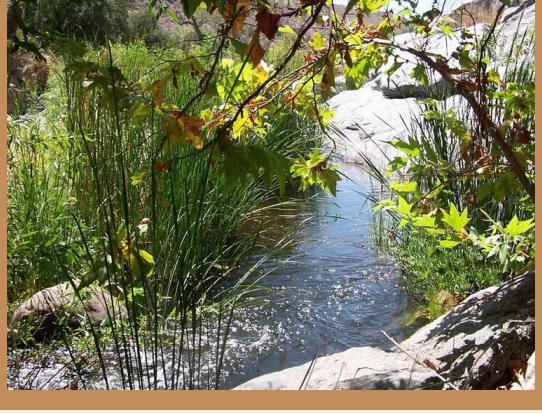
Learning from our Elders

Planning for climate change will be an ongoing process but Tribal Leadership, elders, and community members are committed to maintaining the culture and traditions of the people. The strength of this document is that it reflects the ideas, words, and memories shared by community members. Through outreach, community gatherings, surveys, and interviews, various suggestions and quotes emerged that were documented and integrated into the framework of this document.

AT THE HEART OF THIS ADAPTATION STRATEGY IS THE NEED TO NURTURE A SENSE OF COMMUNITY AMONG ALL RESIDENTS.

Elders recount how in the past the La Jolla community held cattle roundups and everyone had their own brand and the cowboys would run the cattle through the campground. Elders recall holding the first tribal meetings in the oaks before the old Tribal hall and jail were built. The base of the adobe for the old hall can still be seen today and you can imagine the dirt floor and walls with no windows. Across the way an old barn held a New Year's Eve dance. Today the elders feel that some of that community connection is failing and is evident in the inability to keep the cemeteries clean and the land taken care of. To address this, many felt that investing and supporting the youth of the community was the way forward to insure survival and resilience of the Tribe. To honor the stories and suggestions shared by La Jolla Tribal elders the following narrative reflects a compilation of their stories and guidance for moving forward and adapting to change.

THEIR ADVICE AND STORIES HAVE BEEN WOVEN TOGETHER INTO A SINGLE VOICE TO REFLECT A SHARED VISION FOR ADVANCING TRIBAL RESILIENCE BY INVESTING IN YOUTH AND COMMUNITY.


My advice to the youth if they have to survive another Depression or big change is to get them off their phones and learn. I am afraid that without their smart-phones they would never survive. If the Depression happened again they would probably leave the reservation. They wouldn't want to be around here. A long time ago we took care of everything. We had to keep our cemeteries clean, we didn't have WUI crew, or fire department to clean, we did it ourselves and our kids today they need to learn that, to take care of their own, to take care of their family plots, take care of their cemeteries, take care of their land. I think that is what we miss because our elders all did it. Everyone had their role to do here and I think we just forgot that.

When I was a kid I would ask my dad what was the Depression like, but they didn't feel it - they grew everything. They had an orchard, peach trees, what not. At that time there was fish in the creek so they would fish. And all they needed was flour and stuff like that. Everything else they grew in the garden- all their vegetables. They ate off the land—they were self-sufficient. People ate, lived well, went hiking and were outdoors all the time until the sun went down. Everyday we were active and going to the river barefoot - that's why we didn't get sick. When we were kids, we use to run around. We would walk everywhere. We would walk to the lake, we would walk to the stage stop, we would walk to the west end. If we wanted something to do, if we wanted to play football or baseball, we would walk. Nowadays, we don't see the kids outside anymore. They don't have good endurance; they are tired and can't keep up.

As climate changes so does the generation. It's hard to reel them back in. It's good to say things but we Elders need to lead by example and have those kids come together, take them out, spend time with them, teach them how to work and put some time in for their own people. We used to do everything ourselves and we need to teach youth to do this. Show them how to survive on their own. We need to show youth to hunt, hike, walk everywhere like we used to. They aren't even aware of the land they're on or what's surrounding them. We have rocks down in Poomacha that our relatives when they were kids marked on—their names and initials, but now the kids today don't know they exist or how to get

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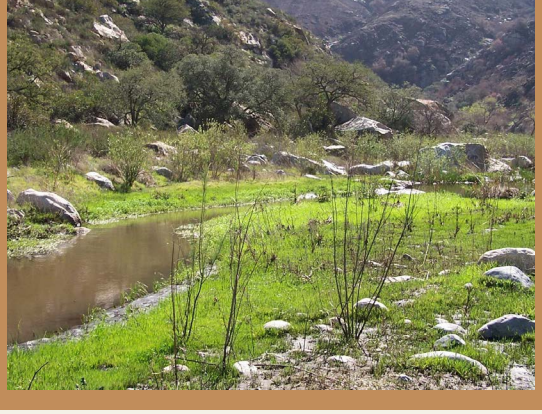


there. They don't even walk outside on their land to find out what is around them. They don't know it; they don't know how to get outside and walk around and see the things our parents and grandparents saw. We see the grinding stones and we know what those things are, but these kids today I have asked them "have you seen the rocks that your grandpa marked and they say no." It's a loss-the kids don't have that story or play in those places.

More and more people are coming back to the Reservation after leaving and never experiencing the culture/how it used to be, so even the parents can't pass on knowledge and ways of life to the youth. Elders and community members need to be active and show them how to go out there and survive, show them how to hunt, get rid of their phones and video games, show them the plants, take them hiking, help them learn to cultivate. If things get tough they need to know their land, all the different trees and plants and which ones are good to eat. We need the youth to learn by going outside and experiencing but they are scared and so are their parents. They are are afraid because wild animals and plants are unfamiliar. You learn these things about the land when you go out, how to use the plants and the animals, but fear stops people from going out. If you live in a cement jungle or you never get out of your house, you don't learn those things, so you tend not to go out. We need them to touch it, feel it, and smell it. We need to lead by example, so we need to do the same. Put down our phones, get outside, do it with them.

We need all our elders and community members to open up to the youth and share the memories and locations of important sites. We need to tell them to put their phones down and go find that rock, that place, go be outside. I think the kids are willing to do it and then they have something to tell their kids- that they went out and did it. Lets start now by creating opportunities to be together. To support and nurture a sense of community. Elders need to open up to youth, share stories with youth and give them insight. Need to get a youth program going that gets them to work, to do community service, clean sites, give back to others. Lets get started by buying something to keep brush down in cemetaries - tools that can help us clean and take care of their reservation, and bring our youth and elders together to share, learn, and act.

Opportunities for Individual Actions

WHAT CAN YOU DO TO ENHANCE TRIBAL RESILIENCE?

While La Jolla's Tribal resilience depends on the integrated efforts of the Tribe as a whole, there are many steps that individuals can take in order to build resilience for their homes, families, neighborhoods, and community. These strategies range from short-term to long-term actions, and can build off of efforts already existing within the community.

To start with, check out the next page for 10 things you can do to support Tribal Resilience.

Have an idea? Share it with us at: info@climatesciencealliance.org

Youth participating in Climate Kids - Tribes, a program of the Climate Science Alliance

In collaboration with Tribes and Tribal Professionals across the Nation, the Climate Science Alliance provides technical and staff support for projects, events, and planning. The Alliance also co-convenes the Tribal Working Group, working the build resilience specifically for Tribes in southern California:

Learn more at: **www.climatesciencealliance.org/tribal-resilience**

10 THINGS YOU CAN DO TO SUPPORT TRIBAL RESILIENCE

1. Review community emergency response plans with your family
2. Identify a safe and cool space to go during extreme events such as high heat days, flooding, fires, and natural disasters
3. Talk with your neighbors and friends about how to ensure communication and safety during disasters
4. Check in on elders and those needing additional assistance to help ensure that they are taken care of during a disaster
5. Research and talk with local health and wellness entities – such as the Indian Health Council – about social, health, and mental resources available
6. Visit the community garden with friends and family to plant and pull weeds
7. Volunteer and arrange community clean up days
8. Attend and participate in the Intertribal Earth Day and other community events
9. Adopt energy and water efficiency strategies into your lifestyle, such as turning off the lights, composting, and biking or carpooling to work or school
10. Share stories with the youth and learn about cultural traditions and stories from elders

SHARE YOUR ACTIONS WITH #10THINGSFORTRIBALRESILIENCE

Summary of Strategies & Opportunities

The La Jolla Tribe is, and always will be, resilient and will utilize its knowledge and actions to safeguard the past, present, and future. By focusing on taking care of the lands, investing in youth and community, and pursuing actions that update planning and preparedness will lay the groundwork for positive actions for years to come. The La Jolla Tribe has already initiated many strategies that can help enhance resilience in the face of a changing climate and is well poised to continue integrating the following suggestions to advance resilience at multiple scales.

Existing Strategies Initiated by the La Jolla Tribe

- ☐ Annual Intertribal Earth Day events
- ☐ A community garden
- ☐ Maintaining an Environmental Department that oversees oak monitoring, water quality monitoring program, and a nonpoint source pollution control program
- ☐ Waste water resource management and planning, including: wastewater management program; Integrated Solid Waste Management Plan, Household Hazardous Waste and E-Waste collection for residents, Source Waste Assessment Planning that protect the environment and local water resources
- ☐ The first Tribe in California to have an approved Drought Mitigation Plan
- ☐ Comprehensive Community Plan developed in 2011 with community value statement
- ☐ FEMA Pre-Disaster Mitigation Plan updated in 2019 with identified hazards specific to the community
- ☐ Maintaining a Cultural Department with youth educational and cultural programs
- ☐ Elder activities and programs

Opportunities for increasing Tribal resilience

Climate will continue to impact the La Jolla community. Tribal resilience will require diverse approaches and strategies to address and adapt to these growing challenges. Potential adaptation opportunities can be divided into those focusing on *community* (engagement, education and outreach); *research* (monitoring and assessment); and *planning* (planning and management).

This plan and the strategies and opportunities identified for increasing Tribal resilience presented throughout this document can serve as a foundation for identifying and justifying funding requests and support for new or on-going projects that will support Tribal resilience efforts now and in the future.

Outlined below are all of the strategies and opportunities presented in this plan for increasing Tribal resilience for natural & cultural resources, infrastructure & economy, health & wellness, and community & culture:

EXISTING EFFORTS & PROGRAMS

- ☐ Monitoring of oaks and GSOB at the La Jolla RV Park, campground, and riparian areas
- ☐ Participation in the Climate Science Alliance Tribal Workgroup discussions on natural resources
- ☐ FEMA Pre Disaster Mitigation Plan divides the Reservation into 12 zones and designates zone leaders in charge of notifying and looking out for community members within the boundaries of their designated zone. Zone leaders have phone numbers for each home in their zone and are working to acquire information on who are elders, have medical needs including electricity for medical needs, and contacts to notify in case of a disaster
- ☐ Air conditioned spaces, such as the Tribal Hall and Gym that can act as cool spaces for the community on high temperature days
- ☐ Working to build up community supplies to have in case of disaster
- ☐ Designation of Public Works Building as EOC Emergency Services Center
- ☐ Lake Henshaw dam release emergency plan that focuses on notifications in case of dam failure
- ☐ Mutual aid agreements
- ☐ Annual Intertribal Earth Day events

EXISTING EFFORTS & PROGRAMS (continued)

- ☐ A community garden
- ☐ Maintaining an Environmental Department that oversees oak monitoring, water quality monitoring program, and a nonpoint source pollution control program
- ☐ Waste water resource management and planning, including: wastewater management program; Integrated Solid Waste Management Plan, Household Hazardous Waste and E-Waste collection for residents, Source Waste Assessment Planning that protect the environment and local water resources
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- ☐ Maintaining a Cultural Department with youth educational and cultural programs
- ☐ Elder activities and programs

COMMUNITY ENGAGEMENT, EDUCATION, & OUTREACH

- ☐ Provide educational outreach programs & resources on the impacts of climate for natural resources and the actions people can take (conservation, water use, energy efficiency)
- ☐ Utilize drought services and participate in workshops such as the Native American Water Masters Association (RCAC) field training in document preparation
- ☐ Identify traditional and culturally significant adaptation strategies from the community that have been used to restore and buffer natural resources from storms/climate events (i.e. cultural fire regime, forest management, riparian corridor restoration)
- ☐ Encourage community members to sign up for San Diego County alert system
- ☐ Provide public with maps of cool/safe zones, community shelters, areas, and facilities to ensure community members have access to these resources
- ☐ Implement and promote community workshops and guidelines for checking on neighbors and community members

COMMUNITY ENGAGEMENT, EDUCATION, & OUTREACH (continued)

- ☐ Implement proactive planning and preparedness exercises/workshops for families, businesses, leaders, emergency response teams, etc. to review emergency planning protocols
    - ☐ Enforce and educate protocols listed in the FEMA Pre Disaster Mitigation Plan
- ☐ Provide emergency notifications such as real-time warnings before and after event occurrence to notify community of damaged, destroyed and/or hazardous infrastructure; Use media platforms (including website, social media, radio, TV) to convey information.
- ☐ Administer safety warnings relevant to infrastructure damage, closures, and/or hazards. Provide safety advisories and tips to prevent health/safety issues and worsened impacts in addition to providing information on emergency resources and emergency contacts if help is needed. Present estimated closure times, recovery rates, and status of safety limitations.
- ☐ Establish community workshops and media that encourage reduced energy consumption and greener transportation methods
- ☐ Hold educational programs and workshops outlining climate change impacts on public health (water quality, disease, air quality etc.)
    - ☐ Provide resources that show the Reservation's community shelters, areas, facilities, and zones that can serve as cool and/or safe zones during extreme events
    - ☐ Provide families and individuals with resources to create family evacuation plans and emergency supply kits, sign up for alert systems, and educate on programs such as the National Flood Insurance Program (NFIP)
- ☐ More community health outreach and discussions for safety precautions and strategizing
- ☐ Community workshops and guidelines for checking on neighbors and community members
- ☐ Organize community events that promote health and wellness such as outdoor activities, exposure to nature, and exercise
- ☐ Re-establish the community garden, including recommendations from the Comprehensive Community Plan to have three gardens with focuses for medicine, traditional foods, and basketry, in addition to using irrigation from runoff from the mountain
    - ☐ Introduce community events at the garden and community volunteer hours to maintain the garden
- ☐ Educate, promote, and provide resources for community members on services available for health and mental wellness support
    - ☐ Programs and support though the Indian Health Council Behavioral Health Services including crisis intervention, staff psychiatrists, individual, child, and family counseling social services

COMMUNITY ENGAGEMENT, EDUCATION, & OUTREACH (continued)

- [ ] Emotional recovery resources and free 24/7 counseling support from American Red Cross
- [ ] General Services, emergency room, and urgent care at Temecula Valley Hospital
- [ ] Education to help residents recognize symptoms, avoid risks, and psychologically cope with climate exposure-related illness
- [ ] Domestic violence support through the Avellaka Program

- [ ] Implement cultural activities and programs with the planting of cultural, native plants to increase knowledge on, and interest in cultural practices that use these resources
- [ ] Design educational programs once these species are planted
- [ ] Continue to create and support community gathering such as Intertribal Earth Day and other opportunities to gather the community
- [ ] Organize a youth group that completes monthly community service around the Reservation and assists elders with tasks they need help with, such as cleaning the Cemetery
- [ ] Generate bi-annual hazard information newsletter
- [ ] Hold hazard preparedness and response trainings, such as evacuation drills
- [ ] Re-establish community garden and introduce community events at the garden
- [ ] Provide educational outreach programs and resources on the impacts of climate for cultural species, sites, and resources
    - [ ] Hold convenings to identify the community's priority concerns for these cultural plants, animals, resources, and sites
- [ ] Develop community programs that open the conversation about challenges for cultural identity with climate change and plans for how to move forward
- [ ] Identify traditional and culturally significant adaptation strategies from the community that have been used to restore and buffer cultural resources from storms/climate events
    - [ ] Communicate and provide these resources and strategies in workshops and educational events, especially to youth who can carry on and implement these practices

RESEARCH, MONITORING, & ASSESSMENT

- ☐ Create a monitoring system to track water resources, vegetation, and biology
  - ☐ Water resources: Monitor community water use, and La Jolla Amago Subbasin Aquifer; develop a map of aquifer system and outcroppings
  - ☐ Vegetation & biology: Monitor changes in oaks, acorns, grasses, animals, critical habitat and migration corridors
- ☐ Inventory areas (i.e. landscapes, riparian corridors), ecosystems, and species (plants and animals) that are most exposed and potentially vulnerable to climate impacts
  - ☐ Mapping: Overlay vulnerable species and/or areas with heat, fire, precipitation projections to identify priority areas and target strategies
- ☐ Identify methods and incentives for stormwater collection and re-use by industry
- ☐ Closely monitor signs of GSOB infestation and infection throughout oak trees on the Reservation to understand trends in GSOB in terms of areas and tree characteristics most affected
- ☐ Consider introducing recommended strategies from resources such as the Statewide Integrated Pest Management Program to restore oak health, including spraying trees with insecticide, containment through wrapping trees, grinding infested wood, and biological control such as primary natural enemies
- ☐ Identify if there are certain oaks that are of most importance to the Tribe (culturally for the community and economically in terms of tourism) for prioritization of conservation and protection from GSOB
- ☐ Remove infested trees and implement additional planting throughout the Reservation, while considering planting of less susceptible or resistant oaks (such as Engelmann oak which does not appear to be seriously injured)
- ☐ Inventory of current availability of cool areas, emergency centers, air quality safe zones, and community gathering sites
- ☐ Mapping of critical facilities, infrastructure, roads and locations vulnerable to flooding, debris flow, and fire
- ☐ Implement U.S. Geological Survey (USGS) groundwater and surface-water monitoring systems for streamgages and wells, Automated Local Evaluation in Real-Time (ALERT). ALERT streamgages send warning when water levels reach a predetermined level or change rapidly
- ☐ Implement kiosks and signs that can broadcast emergency notifications and provide information

RESEARCH, MONITORING, & ASSESSMENT (continued)

- ☐ Map/identify locations that are newly at risk or at high risk, especially where that coincides with where vulnerable populations might be (elderly, youth, and those with health conditions)
- ☐ Mapping of cool spaces (or AC buildings) and safe zones
- ☐ Implement and operate an ozone monitor within Tribal boundaries
- ☐ Monitor culturally-significant species to understand which species are most threatened and the cultural traditions that it could impact
- ☐ Complete a vulnerability assessment of all cultural lifeways and resources that may be disrupted or suffer as a result of climate change
    - ☐ Map and identify locations that are at high risk of climate impacts, and the cultural species, sites, and resources that coincide with these threatened areas

PLANNING & MANAGEMENT

- ☐ Include climate change in overall Tribal strategic planning
- ☐ Include climate change planning in each department's planning documents and projects
- ☐ Develop or adopt building codes that include actions to adapt to climate change such as including PV on all buildings, thicker walls with higher R value insulation, Energy Star appliances, electric heat rather than gas, and ground-source heat exchange
- ☐ Develop renewable power generation, storage, and back-up power
- ☐ Develop a micro-grid to create independence from the grid
- ☐ Develop or promote water conservation or efficiency policies/programs to help households, businesses, and agricultural operations replace irrigation systems and install water efficient, drought resistant landscaping and water recycling systems
- ☐ Riparian corridor restoration: Expand riparian areas, natural floodplains, and wetlands using ecocultural aquatic/riparian species

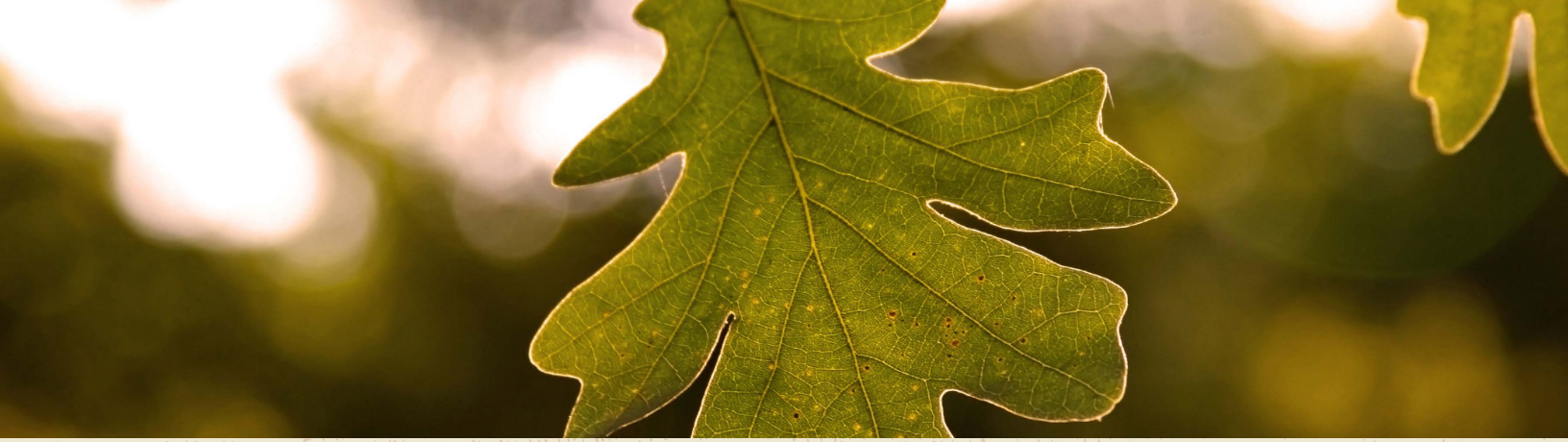
PLANNING & MANAGEMENT (continued)

- ☐ Create short-term and long-term strategies for preservation of vulnerable species.
  - ☐ Short-term: e.g conservation/restoration to help safeguard from immediate impacts
  - ☐ Long-term: e.g alternate strategies if short-term strategies no longer working, such as seed banking, propagation, and/or restoration
- ☐ Enhance drought preparedness through creating water conservation plans, drought contingency plans, and well monitoring logs
- ☐ Develop plan for cultural burning and pursue changing local rules to allow for implementation of cultural burns
- ☐ Create a Tribal land use plan
- ☐ Review goals, strategies, and plans of emergency preparedness, response, and recovery under conditions induced by climate-related disruptions such as heat waves, migrating disease vectors, flooding, fires. Update these emergency response and disaster plans, including FEMA predisaster mitigation plan
- ☐ Establish tribal policies/procedures that reduce energy consumption; Implement energy efficiency protocols for public/community facilities
- ☐ Design assistance programs and protocols that designate safe and cool zones, provide information for how to address dislocation due to damaged/closed infrastructure
- ☐ Develop new/additional emergency response/community shelters/safe spaces/cool zones
- ☐ Designate an Emergency Manager to administer these community engagement/ education/outreach, research/monitoring/assessment, and planning/management strategies
- ☐ Flooding preparedness initiatives, such as: Evaluation of and improvements to stormwater infrastructure for high-intensity rainfall events
- ☐ Use tools/resources to assess the level of fire adaptation and track capacity of fire resilience over time (such as the Fire Adapted Communities Self-Assessment Tool)
- ☐ Make necessary updates and improvements to the Tribal Hall in order to ensure it can function as an EOC and/or build a new EOC
- ☐ Explore options for a community microgrid projects starting with critical facilities such as water supply, waste-water treatment, first responders, tribal hall, campground store, and health care centers
- ☐ Implement and install BAER emergency stabilization recommendations (Combined BAER, 29) before the next rainy season, including:
  - ☐ Early warning system - stream gauges, rain gauges, radio-repeaters, weather stations, warning sirens, base stations for downstream warnings to the community
  - ☐ Road debris removal - removal and maintenance of sediment, debris, and rock fall
  - ☐ Flood hazard signs - Flood/mudflow hazard warning signs at low water crossings

PLANNING & MANAGEMENT (continued)

- Drain outlets - placed in locations where sheet flow from the road is concentrated on embankments
- Channel debris cleanout - clear debris (large wood, brush, rock, flow impediments) out of stream and drainage channels adjacent to reservation roads
- Culverts cleanout - clean culverts in areas at risk of flooding/debris flows
- Culverts removal - remove or replace undersize culverts; install low water crossings to reduce the risk of flooding, blockage, and damage for nearby residents
- Structural protection - Add K-rails and sandbags around structures to prevent flooding and mudflows
- Update irrigation system - remove sediment and debris from irrigation diversion/ flush out sediment from pipelines that is projected to increase on the Reservation post-fire and during precipitation events
- Cleanout sediment basin - remove debris and clean out sediment basins for maximized storage capacity

- Elect "emergency ambassadors" and social contacts for vulnerable individuals during extreme events and climate-related hazards
- Develop collaborative referral system to ensure residents can access available resources and services (e.g. health care, crisis counseling, and shelters) during and after climate events
- Review goals, strategies, and plans of emergency preparedness, response, and recovery under conditions induced by climate-related disruptions such as heat waves, migrating disease vectors, flooding, and fires
- Develop plans for if people/areas are disconnected or inaccessible
- Develop and invest in more cool/AC/safe zones
- Develop a social services department that includes elder protection and elder care
- Plant more native, culturally-significant plants, such as Juncus as a way to preserve cultural traditions
- Implement goals identified in Comprehensive Community Plan, such as creating Inter-Department Work Group
- Revise the 2011 Community Comprehensive Plan to reidentify the community's core values and concerns to update the vision statement
- Develop short-term and long-term plans for cultural sites that are highly vulnerable to the threats of climate change such as extreme events
    - Short-term planning (i.e. restoration/conservation practices that help buffer the impacts of extreme events)
    - Long-term planning (i.e. relocation) of cultural sites



Appendix

HOW A CHANGING CLIMATE WILL IMPACT

NATURAL RESOURCES

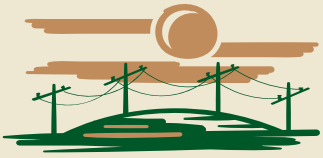
From the 2019 Climate Adaptation Plan for the La Jolla Band of Luiseño Indians

NATIVE PEOPLE ARE RESILIENT AND HAVE ALWAYS ADAPTED TO CHANGE. CLIMATE CHANGE POSES NEW AND UNIQUE CHALLENGES IN THE FORM OF EXTREME FIRE, HEAT, DROUGHT, AND STORMS THAT PUT PEOPLE AND COMMUNITIES AT RISK. WE CAN TAKE STEPS NOW TO PREPARE FOR THESE CHALLENGES AND REDUCE IMPACTS. THE TRIBAL RESILIENCE PLAN CAN BE A COMMUNITY VISION FOR KEEPING OUR EARTH AND OUR PEOPLE HEALTHY.

FIRE

More intense and frequent fires

- Damage/impair access to culturally-significant sites
- Increased soil erosion enhances risk of mudslides, flooding, and debris-flow
- Short, high intensity rainfall may not be able to replenish groundwater and/or surface water, impacting water availability for plants, animals, and people
- Reduced water quality from heavy rainfall, flooding, and mudslides



HEAT

Increased average temperatures and more intense and frequent heat events

- Higher temperatures

impact surface water availability

- Shifts in seasonal cues can disrupt the life cycle timing for plants and animals
- Warming and evaporation alter habitat and migration of aquatic species

DROUGHT

More frequent and intense droughts

- Changes in water availability for wildlife, plants, and people
- Shifts in seasonal life cycles and abundance
- Spread of invasive species that weaken, outcompete, and cause declines in native species
- Dead and dry vegetation increases the risk of fire

STORMS

Increased precipitation variability leading to more extreme storms

- Direct impact to wildlife and plants
- Increased soil erosion after fire can reduce the ability to retain moisture and regenerate the landscape
- Frequent and intense fire can devastate culturally-significant plants, such as oaks, juncus, sumac, and berries
- Fire alters water resources, habitat, migration of wildlife, and distribution of plants

YOU CAN MAKE A DIFFERENCE!

Check out the ***10 Things You Can Do to Support Tribal Resilience*** flyer for ideas

Our Climate Adaptation Plan involves three approaches to adapt to climate change:

PLANNING

- ☐ Develop and promote water conservation and efficiency policies/programs
- ☐ Create conservation strategies for threatened and declining wildlife and plants
- ☐ Implement recommendations from the Comprehensive Community Plan
- ☐ Maintain ongoing collaboration with other Tribes in the region to support Intertribal natural resources projects
- ☐ Create an invasive species response plan

COMMUNITY

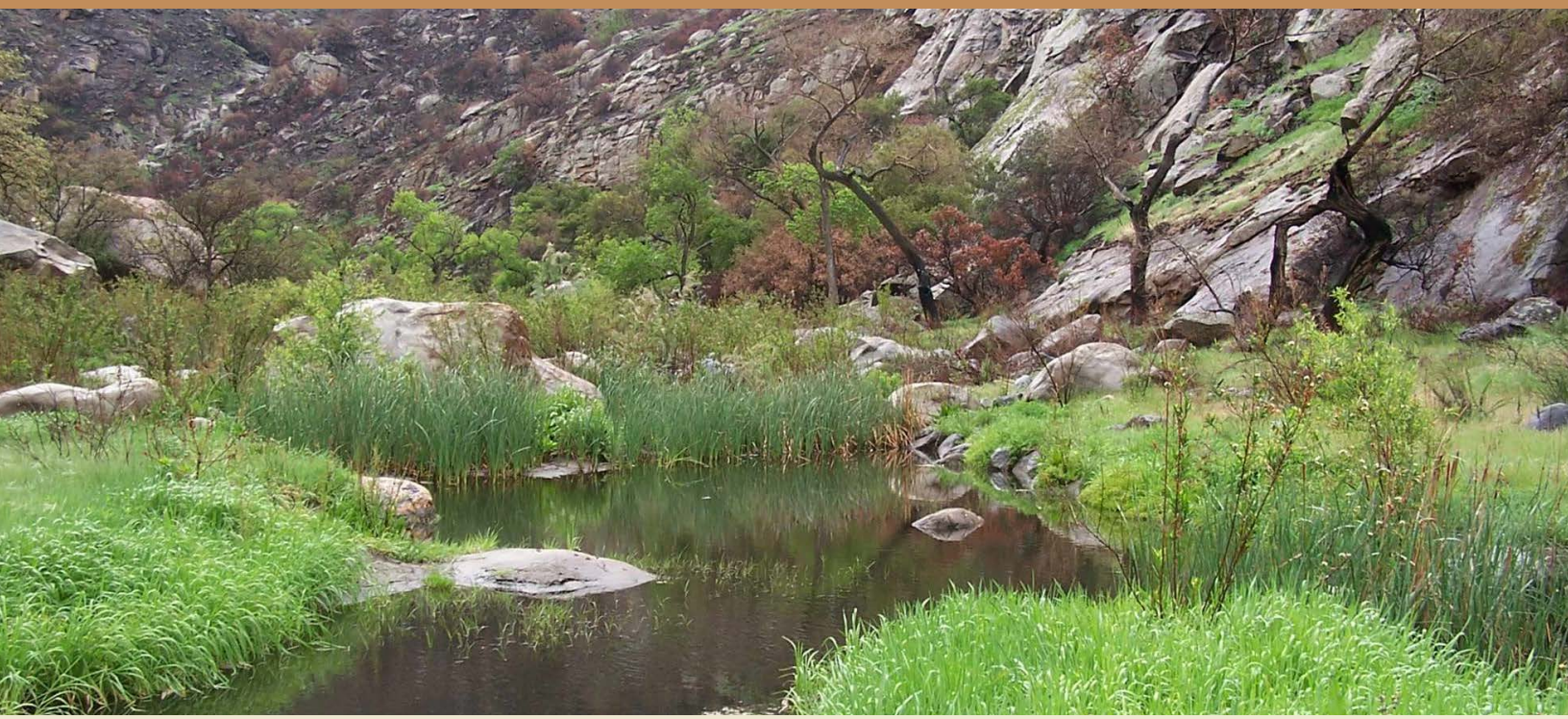
- ☐ Provide educational outreach programs and resources on climate impacts for natural resources and actions people can take
- ☐ Identify strategies from the community and elders that have been used to restore and buffer natural resources from extreme events in the past
- ☐ Organize opportunities to connect elders with youth to educate on cultural resources and traditions

RESEARCH

- ☐ Create a monitoring system to track changes in water availability and impacts to natural resources
- ☐ Inventory ecosystems and species that are most vulnerable to climate impacts and take steps to conserve and connect
- ☐ Map and monitor invasive species throughout the Reservation

View the full list of actions in the 2019 Climate Adaptation Plan!

HAVE AN IDEA? SHARE IT WITH US AT: INFO@CLIMATESCIENCEALLIANCE.ORG



The Climate Adaptation Plan was prepared by the La Jolla Band of Luiseño Indians Environmental Department in collaboration with the Climate Science Alliance, with funding from the Bureau of Indian Affairs at the U.S. Department of the Interior.

HOW A CHANGING CLIMATE WILL IMPACT

Infrastructure & Economy

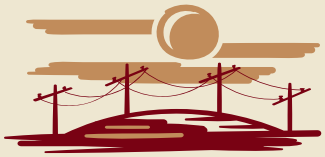
From the 2019 Climate Adaptation Plan for the La Jolla Band of Luiseño Indians

Native people are resilient and have always adapted to change. Climate change poses new and unique challenges in the form of extreme fire, heat, drought, and storms that put people and communities at risk. We can take steps now to prepare for these challenges and reduce impacts. The Tribal Resilience Plan can be a community vision for keeping our earth and our people healthy.

FIRE

More intense and frequent fires

- Damage/destruction of facilities, homes, and infrastructure
- Disruption to power, internet, telephones, and other public services
- Closures of schools and businesses that impact youth and result in economic losses
- Increased soil erosion after a fire can cause road closures during storm events



HEAT

Increased average temperatures and more intense and frequent heat events

- Increased energy demand to use AC, resulting in increased costs for families and the community
- Stress on infrastructure and higher maintenance costs for roads and buildings
- Plan for more cool/safe zones for people
- Heat stress & poor air quality can result in more emergency room visits and increased costs for individuals/families

DROUGHT

More frequent and intense droughts

- Increased stress on groundwater supply and surface water resources
- Increased risk of fire ignition on dry vegetation
- Weakening and/or death of trees that offer shade in the La Jolla Campground, resulting in fewer visitors and less revenue
- Water scarcity resulting in increased costs of food
- Lower water level/ pressure making it difficult to fight fires

STORMS

Increased precipitation variability leading to more extreme storms

- Damage/destruction of important community facilities and homes, resulting in expensive maintenance costs
- Flooding of the La Jolla Indian Campground resulting in reduction of visitors and higher maintenance costs
- Flooding can cause damage and closures of roads, power lines, and water infrastructure

YOU CAN MAKE A DIFFERENCE!

Check out the ***10 Things You Can Do to Support Tribal Resilience*** flyer for ideas

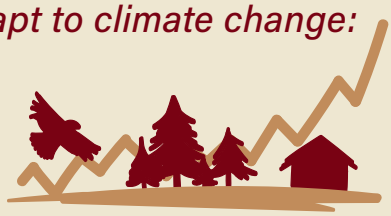
Our Climate Adaptation Plan involves three approaches to adapt to climate change:

PLANNING

- ☐ Create a Tribal land use plan that incorporates climate impacts and builds out infrastructure in a way that's more resilient
- ☐ Make necessary updates to the Tribal Hall to ensure it can function as an emergency operations center
- ☐ Implement development/ hazard mitigation strategies
- ☐ Establish workshops and media that encourage reduced energy consumption

COMMUNITY

- ☐ Continue to create programs, after-school activities, elder gatherings, etc. that build and sustain a sense of community
- ☐ Implement planning and preparedness exercises, workshops, and resources
- ☐ Create a community plan for checking on neighbors/ elders in the event of extreme weather or hazardous event
- ☐ Maintain collaboration with Tribes in the region to support Intertribal projects and emergency response



RESEARCH

- ☐ Map critical facilities, infrastructure, and locations vulnerable to extreme events
- ☐ Increase renewable energy resources (solar power, microgrid), to achieve energy resource independence, and ensure proper battery storage
- ☐ Inventory and update current cool areas, safe centers, air quality safe zones, emergency response centers, and community gathering sites

View the full list of actions in the 2019 Climate Adaptation Plan!

HAVE AN IDEA? SHARE IT WITH US AT: INFO@CLIMATESCIENCEALLIANCE.ORG

The Climate Adaptation Plan was prepared by the La Jolla Band of Luiseño Indians Environmental Department in collaboration with the Climate Science Alliance, with funding from the Bureau of Indian Affairs at the U.S. Department of the Interior.

HOW A CHANGING CLIMATE WILL IMPACT

HEALTH & WELLNESS

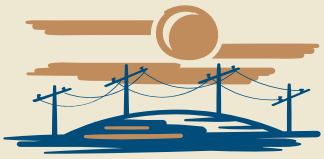
From the 2019 Climate Adaptation Plan for the La Jolla Band of Luiseño Indians

NATIVE PEOPLE ARE RESILIENT AND HAVE ALWAYS ADAPTED TO CHANGE. CLIMATE CHANGE POSES NEW AND UNIQUE CHALLENGES IN THE FORM OF EXTREME FIRE, HEAT, DROUGHT, AND STORMS THAT PUT PEOPLE AND COMMUNITIES AT RISK. WE CAN TAKE STEPS NOW TO PREPARE FOR THESE CHALLENGES AND REDUCE IMPACTS. THE TRIBAL RESILIENCE PLAN CAN BE A COMMUNITY VISION FOR KEEPING OUR EARTH AND OUR PEOPLE HEALTHY.

FIRE

More intense and frequent fires

- Injury and/or mortality directly from wildfire
- Reduced air and water quality causing illness, disease, and infection, and/or exacerbating pre-existing conditions like asthma
- Fire-induced isolation and relocation can have financial and emotional impacts (depression, anxiety, substance abuse, PTSD, and chronic stress) resulting from financial stress, inability to be outdoors, and attend work/school



HEAT

Increased average temperatures and more intense and frequent heat events

- Reduced night time cooling and less relief from daytime heat causing impacts for mental and physical health, especially for elders, children, and/or disabled
- Hotter temperatures causing unsafe working conditions, especially for those working outdoors
- Unsafe heat conditions resulting in heat stroke, exhaustion, dehydration, and illnesses

DROUGHT

More frequent and intense droughts

- Higher dust levels leading to greater risk of air-borne illnesses
- Increases in vector-borne disease, such as West Nile Virus, as species establish new areas of breeding grounds
- Water scarcity causing economic stress and impacts on mental health
- Lower water levels/ pressure resulting in backflow and growth of bacteria in residential water resources

STORMS

Increased precipitation variability leading to more extreme storms

- Severe storms causing flooding and debris-flow that can result in severe injury and/or mortality
- Reduced water quality
- Increased mold infestation and the spread of insects that host/transmit diseases
- Damage/destruction of infrastructure, homes, and cultural sites can impact mental health and wellness

YOU CAN MAKE A DIFFERENCE!

Check out the ***10 Things You Can Do to Support Tribal Resilience*** flyer for ideas

Our Climate Adaptation Plan involves three approaches to adapt to climate change:

PLANNING

- ☐ Design assistance programs and develop plans to prevent isolation and dislocation
- ☐ Elect “emergency ambassadors” and social contacts for elders, youth, and compromised
- ☐ Develop and invest in more cool/AC spaces and safe zones
- ☐ Maintain ongoing collaboration with other Tribes in the region to support the health and wellness of regional Tribal communities

COMMUNITY

- ☐ Organize educational programs outlining climate change impacts on health and wellness
- ☐ Publicize community areas and facilities that can serve as cool and/or safe zones
- ☐ Create family evacuation plans, emergency supply kits, and guidelines for checking on neighbors and elders
- ☐ Utilize and maintain the community garden as a location to promote health, culture, and wellness

RESEARCH

- ☐ Map and identify locations that are at high risk of climate events, especially where vulnerable populations are located (elderly, youth, and/or disabled)
- ☐ Map cool/AC spaces and safe zones
- ☐ Identify community’s concerns and vulnerabilities for health and wellness

View the full list of actions in the 2019 Climate Adaptation Plan!

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HOW A CHANGING CLIMATE WILL IMPACT

COMMUNITY & CULTURE

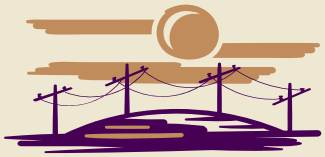
From the 2019 Climate Adaptation Plan for the La Jolla Band of Luiseño Indians

NATIVE PEOPLE ARE RESILIENT AND HAVE ALWAYS ADAPTED TO CHANGE. CLIMATE CHANGE POSES NEW AND UNIQUE CHALLENGES IN THE FORM OF EXTREME FIRE, HEAT, DROUGHT, AND STORMS THAT PUT PEOPLE AND COMMUNITIES AT RISK. WE CAN TAKE STEPS NOW TO PREPARE FOR THESE CHALLENGES AND REDUCE IMPACTS. THE TRIBAL RESILIENCE PLAN CAN BE A COMMUNITY VISION FOR KEEPING OUR EARTH AND OUR PEOPLE HEALTHY.

FIRE

More intense and frequent fires

- Loss of culturally-significant plants and animals can inhibit the ability to engage in traditional ways of life, resulting in impacts to the community and culture
- Road closures can cause isolation and relocation of individuals and families
- Damage/destruction of critical community/Tribal buildings and cultural sites could inhibit the ability of community members to gather in these spaces



HEAT

Increased average temperatures and more intense and frequent heat events

- Higher temperatures, more humidity, and less night time cooling can have direct impacts on health and well-being
- Impaired access to culturally-significant sites and resources, resulting in the inability to engage in traditional ways of life

DROUGHT

More frequent and intense droughts

- Loss of culturally-significant plants and animals can inhibit the ability to engage in traditional ways of life, such as basket-weaving, and result in impacts to the community's culture
- Shifts in seasonal life cycles, abundance, and geographic range of culturally-significant resources, such as acorns, could alter the community's traditional gathering locations, methods, and food sources (such as wiiwish)

STORMS

Increased precipitation variability leading to more extreme storms

- Storms, flooding, and debris-flows cause hazardous conditions that isolate community members and impact the ability to access community resources and attend work/school
- Inability to access culturally-significant sites and resources, disrupting the traditional ways of life
- Damage/destruction to critical infrastructure such as homes, businesses, and emergency centers

YOU CAN MAKE A DIFFERENCE!

Check out the ***10 Things You Can Do to Support Tribal Resilience*** flyer for ideas

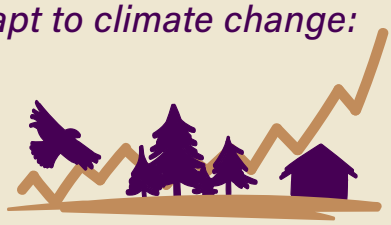
Our Climate Adaptation Plan involves three approaches to adapt to climate change:

PLANNING

- ☐ Plant more native and culturally-significant plants as a way to preserve cultural traditions
- ☐ Develop system to ensure residents can access available resources and services (e.g. health care, crisis counseling, shelters) during and after extreme events
- ☐ Design assistance programs and develop plans to prevent isolation and dislocation

COMMUNITY

- ☐ Develop educational programs outlining climate impacts and actions to preserve cultural resources
- ☐ Implement event at the community garden which focuses on medicine, traditional foods, basket weaving, and storytelling
- ☐ Connect elders with youth to educate on cultural resources and traditions
- ☐ Maintain collaboration with other Tribes in the region to support Tribal resilience and wellness



RESEARCH

- ☐ Hold gatherings to identify the community's priority concerns for plants, animals, resources, and sites
- ☐ Map and identify locations that are at high-risk of extreme events and areas where people can become easily isolated
- ☐ Map out culturally-significant locations that can be impacted during extreme events with a plan for reducing risks

View the full list of actions in the 2019 Climate Adaptation Plan!

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CLIMATE SCIENCE ALLIANCE

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LA JOLLA BAND OF LUISEÑO INDIANS

Adaptation Plan

The 2019 Climate Adaptation Plan is a living document and was prepared by the La Jolla Band of Luiseño Indians Environmental Department in collaboration with the Climate Science Alliance, with funding from the Bureau of Indian Affairs at the U.S. Department of the Interior.

CLIMATE SCIENCE ALLIANCE

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Adaptation Plan