



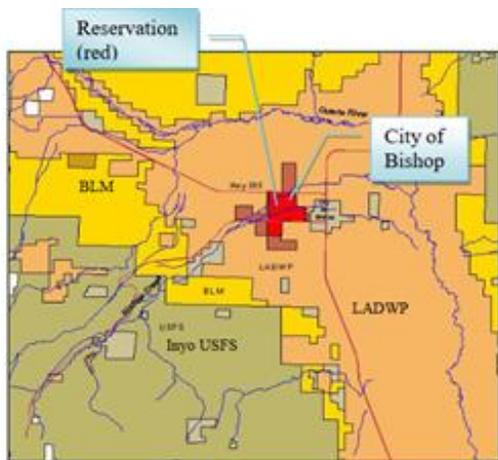
## IMPACTS OF CLIMATE CHANGE ON THE BISHOP PAIUTE TRIBE

*Rising temperatures and drought compounded by over pumping of groundwater are impacting the physical, cultural, and spiritual health of the Tribe, its habitats, and ecosystems.*

### Background

The Bishop Paiute Tribe is a federally recognized tribe living in Inyo County at the foot of the Eastern Sierra Nevada mountains, in the Owens Valley, just west of the city of Bishop. They are the fifth largest tribe in California with ~2,000 enrolled members and have one of the smallest land bases (879 acres) (BPT, 2018). Payahuunadü, or land of flowing water, is the Paiute word for the Owens Valley and Eastern Sierra region of California.

**Figure 1. Bishop Paiute Reservation (red) within the city of Bishop (brown)**



Source: BPTEO, 2018

The people of the Bishop Paiute Tribe are descendants of the “Nüü-Mü,” the original people of the Owens Valley who have lived in the area since time immemorial and whose ancestral lands encompassed over 2 million acres of the greater Owens Valley (BPT, 2018). In 1912 under pressure by the US Government, the Bishop Paiute people entered into a treaty in which the US Government reserved 67,120 acres of land in the Owens Valley named the Casa Diablo Indian Reservation for Indians of the area. However, the Paiute were never allowed to move to this Reservation. This treaty was broken in 1933 when President Roosevelt revoked the agreement (Executive Order 6206) and the lands were

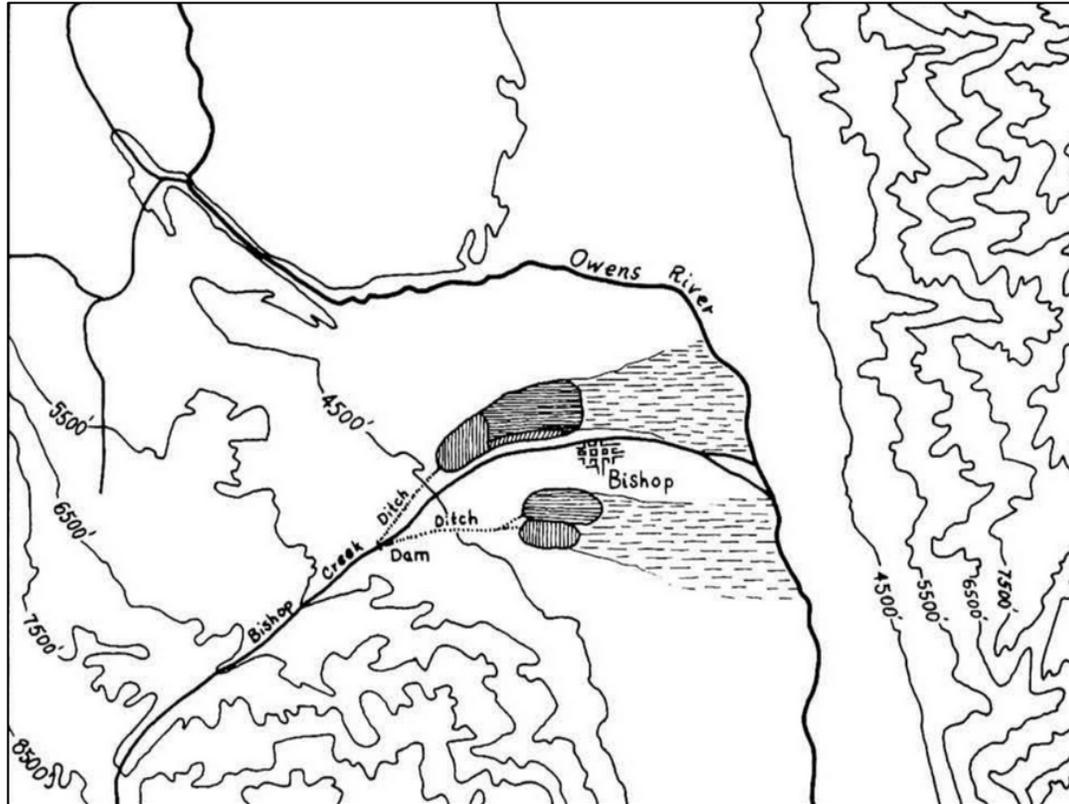
placed in watershed protection for the City of Los Angeles (OVIWC, 2021). In 1936, the City of Los Angeles and the federal government “traded” the 67,120-acre Casa Diablo lands for the 879 acres that now comprise the Bishop Paiute Reservation (BPT, 2021a).

Historically, the Paiute dug irrigation ditches that routed runoff from melting Sierra Nevada snow into the Payahuunadü. But unlike modern irrigation practices, the Paiutes did not channel the water onto farms or specific plots of land. Bishop Paiute Tribal Elder and water protector Harry Williams explained “We looked at everything as a garden. The natives made this place bloom like a rose. The water was used to irrigate ‘wild’ seed plants” (Williams, 2016).



Water was so important to the tribe that they had an elected position called the Tuvaiju who oversaw irrigation. The Tuvaiju would use an irrigating tool known as a “pavado” to direct water into the ditch network in the Payahuunadü.

**Figure 2. Drawing of traditional Paiute irrigation system at Pitana Patii, near present-day Bishop, Owens Valley, California.**



Source: Lawton et al., 1976

The Paiutes' valley was divided by the Bishop Creek into northern and southern plots. As is shown in Figure 2 above the Tribe created a dam system designed so that only one of the areas would receive water each year; the plots were purposefully alternated to conserve soil fertility. The irrigation helped the growth of grass nuts and tubers that made up a significant part of the native diet. The ditches also funneled native fish into areas where they were easy to catch. The irrigation canals distributed the water across the Payahuunadü (Wei, 2016).



Figure 3. Owens Lake and Vicinity between 1905-1911 and as seen from space in 2011



Sources: USGS, 1939 and NASA, 2011

Owens Lake had held water continuously, and at times overflowed to the south, for at least the 800,000 years prior to 1913 (Smith et al., 1993). In 1913 the Los Angeles Department of Water and Power (LADWP) began pumping Owens Lake, which at the time spanned 108 square miles (~1/3 the size of Lake Tahoe), to provide water to Los Angeles. By 1926 the lake was dry (Reheis et al., 1995). In 1970, a second aqueduct that mainly pumps groundwater from the Owens Valley for use in Los Angeles was added. This ongoing water export has intensified the effects of precipitation changes and drought caused by climate change in the Eastern Sierra. (BPT, 2020).



Figure 4. Dry winds blow sand across what used to be the north shore of Owens Lake



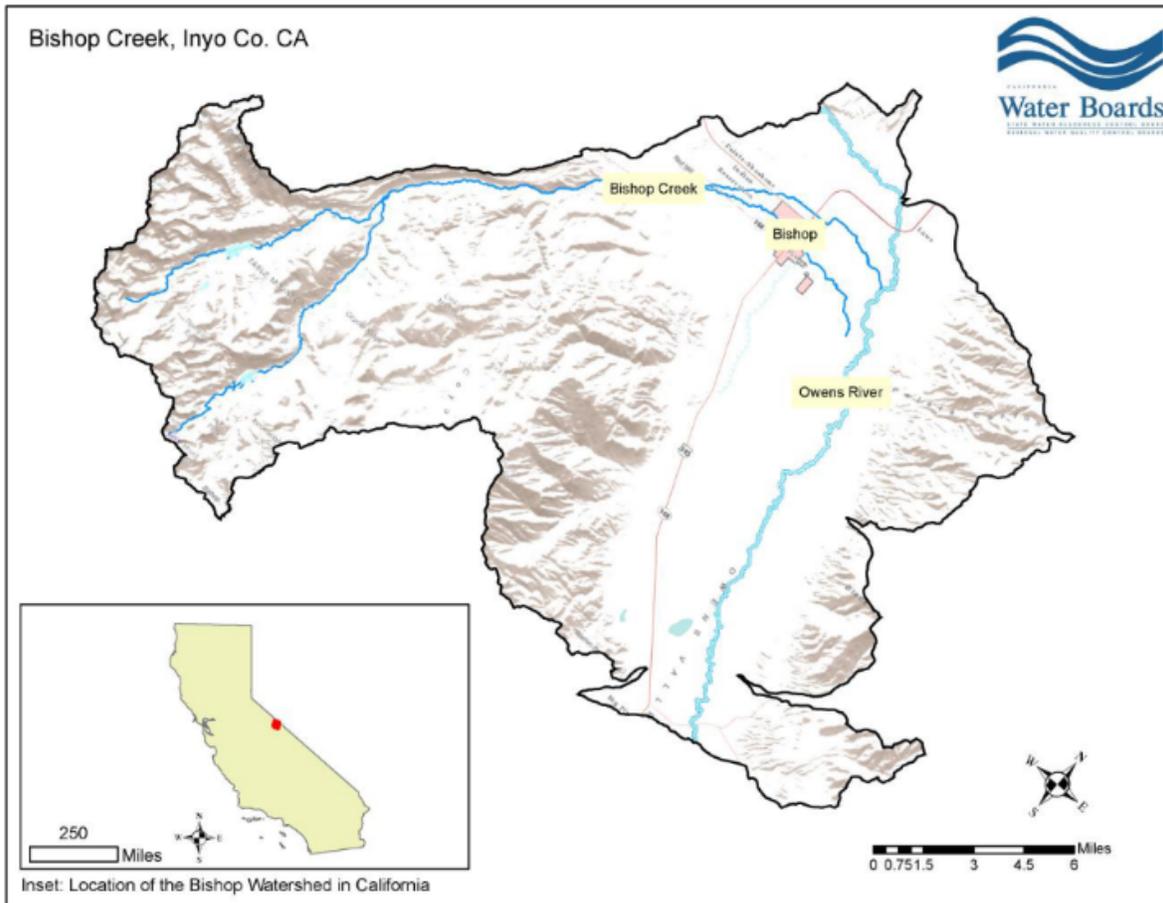
Photo credit: David McNew

This change to the Owens Valley climate has also caused a troubling rise in the level of PM10, inhalable particles with diameters that are generally 10 micrometers and smaller. Owens (dry) Lake is currently the largest source of PM10 in the United States, thirty tons of which is arsenic and nine tons of which is cadmium. USEPA estimates that 94% of the PM10 in the Owens Valley comes from the now dry Owens Lake (USEPA, 2017). Research has linked exposures to relatively low concentrations of particulate matter with premature death. At greatest risk are Tribal Elders and those with pre-existing respiratory or heart disease, lung disease, asthma or chronic obstructive pulmonary disease (USEPA, 2017).

The current Reservation ecosystem is over the Bishop Cone, an area characterized by a shallow water table with depths ranging from 1 to 10 feet below ground level. This substantially enhances vegetation coverage including a variety of pasture grasses and several types of deciduous tree species. As shown in Figure 5, both North and South Forks of Bishop Creek traverse the Reservation. With the exception of relatively recent increases in bacterial levels in South Fork stream water quality is excellent and supports a 5-mile-long riparian forest corridor providing a rich habitat for a variety of flora and fauna (BPT, 2018). Additionally, there is a wetland in the southeast corner of the Reservation within the Conservation Open Space Area (COSA).



Figure 5. Bishop Creek and surrounding Watershed, Inyo County, CA



Source: LRWQCB, 2020

In 1988 the Bishop Paiute Tribe established the COSA which serves as important habitat for native plants and animals. Furthermore, the COSA is currently being utilized to increase populations of threatened and endangered plants and animals, such as the Owens Valley Checkerbloom and the Inyo County Mariposa Lily. The Tribe has been working to introduce the Owens pupfish to the COSA via a Federal Safe Harbor Agreement, which would provide these culturally important fish with another refuge.

Because the impacts of climate change do not start and stop at the Reservation borders, and because the culture of the Bishop Paiute Tribe is tied to all their traditional lands, this report covers both the changes seen on the Reservation lands

Figure 6. Petroglyphs at the Volcanic Tablelands

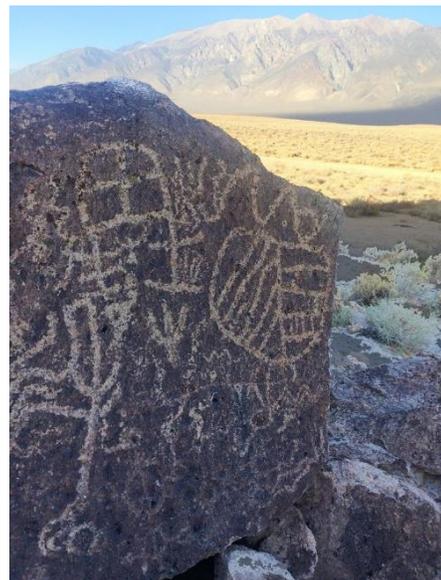


Photo credit: Sarah Rea



as well as on traditional lands of the Bishop Paiute such as Volcanic Tablelands and Fish Slough. Petroglyphs within the Volcanic Tablelands are shown in Figure 6.

### ***Cultural and Spiritual Health***

As the climate changes the cultural and spiritual health of the Bishop Paiute Tribe are impacted. You cannot separate the health of the earth from the health of the Bishop Paiute Tribe. The Tribe has seen a loss of gathering areas and ceremonial locations, a reduction in traditional medicines and foods, impacts on culturally important fish species, and a loss of the Bishop Paiute's traditional waters through both drought and groundwater pumping for export by LADWP. The Tribe has observed pumping is causing local streams and springs to die which has a cascading and compounding impact on the surrounding insects, fish, mammals, and vegetation (BPT, 2020).

The Bishop Paiute Tribe has created a web of interconnected efforts aimed at responding to the complexities of climate change. They are protecting their natural resources with a combination of mitigation efforts, such as installing rooftop solar panels, increasing food sovereignty, and invasive plant removal, as well as adaptation strategies such as protecting Tribal waters, providing cooling for elders, and educating Tribal members (Kapp, 2019).

### **CLIMATE CHANGE IMPACTS**

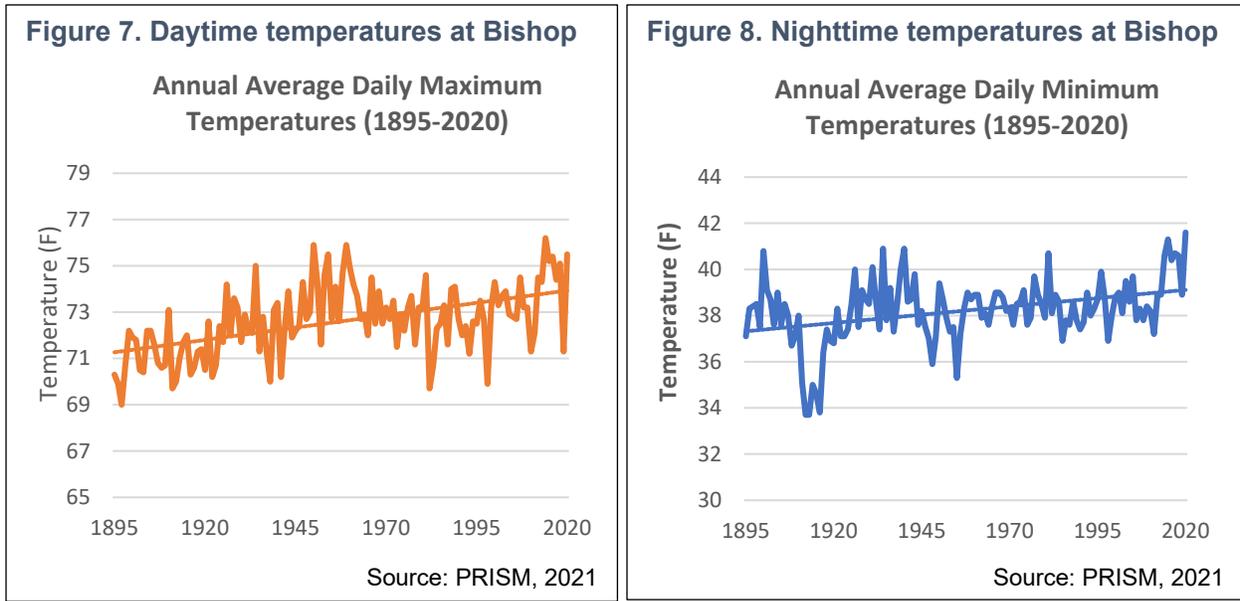
Climate change in the Bishop Tribal lands in the Eastern Sierra has impacted wildlife, native vegetation, and culturally important foods such as pine nuts, acorns, fish, and wild game. Drought in the area, along with beetle infestations, have caused an increase in tree mortality. The build-up of dead trees in the National Forest area at Indiana Summit and the increase of perennial weeds, shrubs, and other flashy fuels have increased the fire danger over time. Sporadic heavy rains in the winter and spring increase the growth of vegetation which then dry and become fuel in the hot summers (BPT, 2020).

### ***Elevated Temperatures***

Temperatures have been increasing in Bishop. Elevated temperatures affect human health, mental health, cultural and spiritual health, socio-economic health, as well as the plants and animals that are part of the Bishop Paiute's ecosystem. Elders, children, outdoor workers, and those with existing medical conditions are particularly susceptible to these impacts.

As shown in Figures 7 and 8 both the annual average daily maximum (daytime) temperatures and the annual average daily minimum (nighttime) temperatures are rising at Bishop, with the daytime temperatures rising faster.





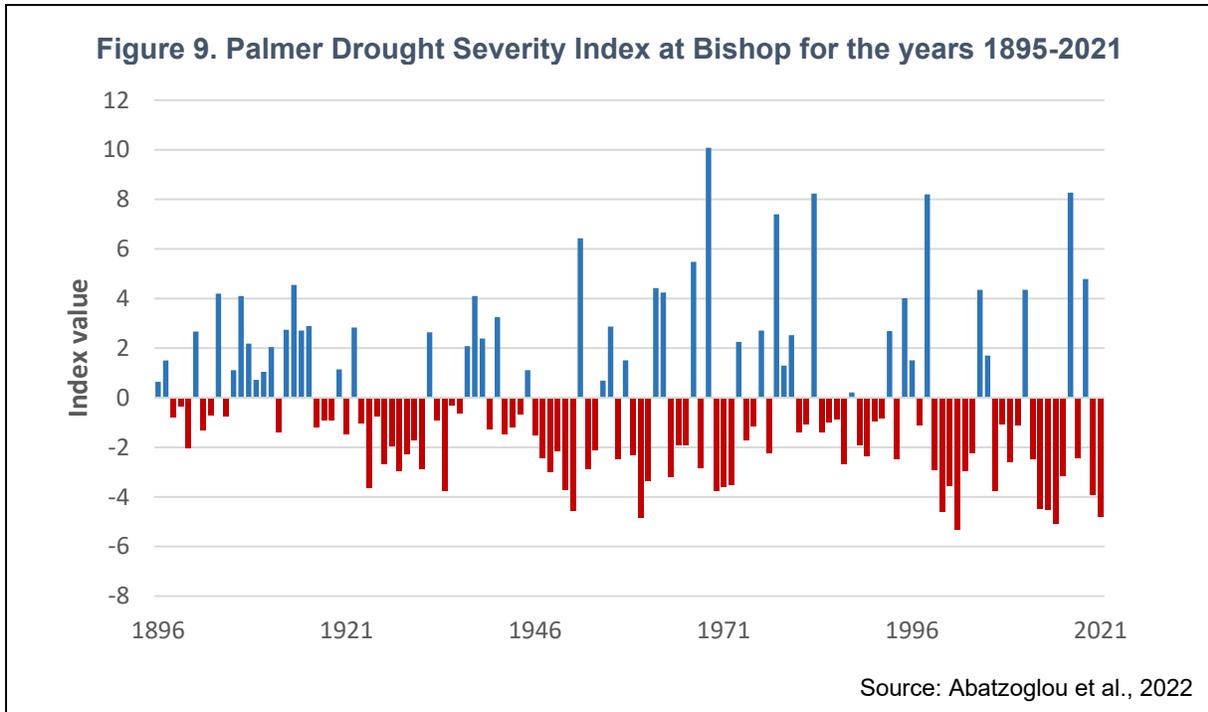
Warming temperatures are considered a high-risk exposure for the Bishop Paiute Tribe. As is evident from the increasing minimum temperatures, the cooling nights that the Bishop Paiute community has been accustomed to are warming over time. The combination of warmer daytime and nighttime temperatures is impacting both the human and the plant communities. As temperatures have increased, the Bishop Paiute Environmental Department has observed declining areas of important habitats including native grasslands, wetlands, riparian, and upland habitats and increasing levels of non-native grasses and shrubs (BPT, 2020). The conditions caused by drought and the over pumping of groundwater also allow invasive species to take hold (e.g., invasive weeds such as Pepperweed, Cheatgrass, Non-native Asters, and Tumbleweed).

**Drought**

The impacts of drought are intensified in the Owens Valley due to ground and surface water pumping by LADWP to supply water to Los Angeles (ICWD, 2021a). No matter how much snow or rain falls in the Eastern Sierra, the water needs of Los Angeles remain and will increase as populations increase, further burdening the Bishop Paiute community.

As is shown in Figure 9, Bishop is having more frequent, and more intense, dry years. The graph shows a commonly used measure of drought, the Palmer Drought Severity Index (PDSI), which combines both temperature and precipitation data to provide a measure of relative dryness (drought) on a scale from +10 (wet) to -10 (dry). The lower the number the drier the conditions. Prior to 1958, dry years (with PDSI values below zero) occurred 37 times, only one of which was classified as extreme drought (PDSI at or below -4). From 1959 to 2021 Bishop experienced 43 dry years, including 7 years of extreme drought (Abatzoglou et al., 2022).





As detailed in the history of the Bishop Paiute, water holds a strong cultural significance for the Paiute people. A lack of water impacts the survival of plants and animals, which hold cultural importance to the tribe.

### **Impacts to Vegetation**

Climate change in the Bishop Tribal lands in the Eastern Sierra has negatively affected native vegetation, including culturally important medicines and foods such as pine nuts and acorns. Drought in the Eastern Sierra, along with beetle infestations by the mountain pine beetle (*Dendroctonus ponderosae*), have caused an increase in tree mortality. As trees become stressed by drought, their vigor and defense mechanisms weaken, making them more vulnerable to attack. High temperatures exacerbate already stressed conditions for tree survival. (BPT, 2020).

In addition to the decreased availability of acorns, the Bishop Paiute Tribe and other Eastern Sierra Tribes reported a change in the taste of the flour made with local acorns. With the decrease in water and increase in temperatures in the Eastern Sierra, the Tribe has seen the local vegetation change from water-loving plants to shrubs. As these plants change, the animals that rely on them must necessarily change too (BPT, 2020).

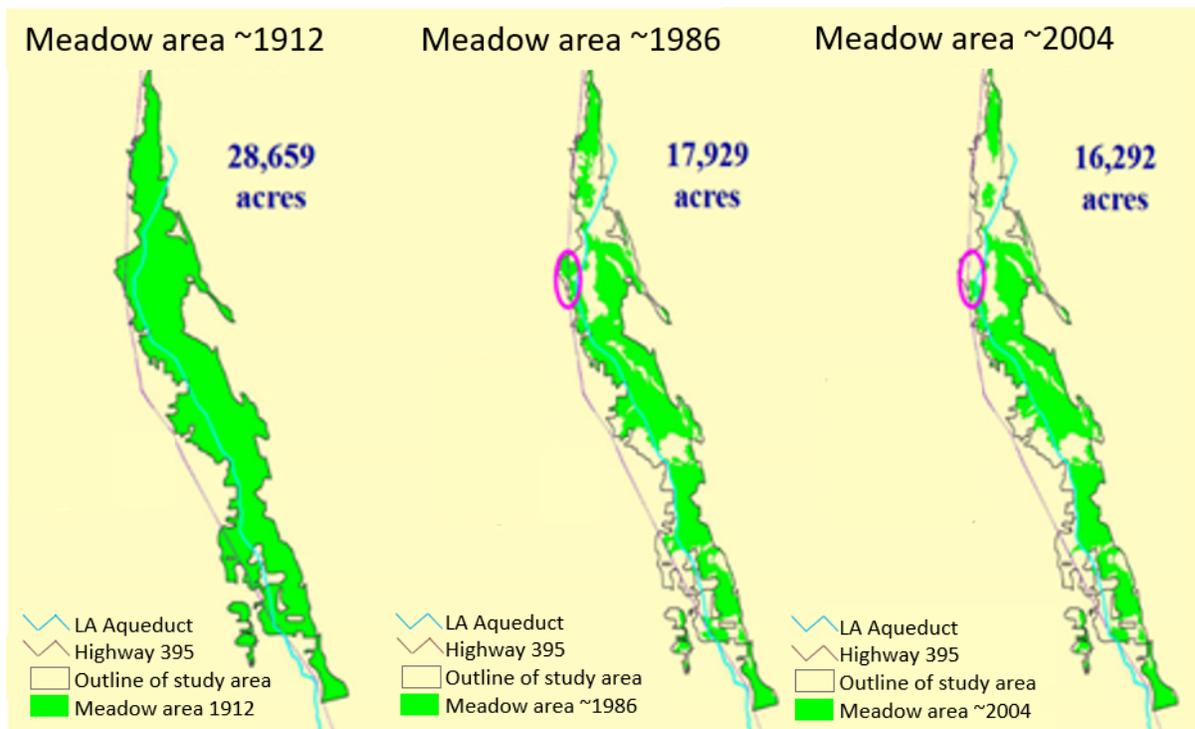
Bishop Paiute’s ecosystems have suffered from water deficits during years of low precipitation, exacerbated by the anthropogenic drought caused by pumping of the Owens Valley groundwater for use in Los Angeles. The entire region experienced a 6-year drought (1987–92), during which annual precipitation was below the 50-year median of 7.12 inches (USGS, 1998). Elmore et al. conducted a 16-year study which documented an increase in the depth to the groundwater table—associated with increased groundwater pumping—and analyzed changes in vegetative cover. The study



found plant cover to be correlated with groundwater depth, indicating that pumping exacerbates drought impacts to vegetation in the Owens Valley (Elmore et al., 2006).

As the Owens Valley climate continues to change, becoming warmer and dryer, the Valley meadows are disappearing, and the Tribe is seeing a desertification of the area. The Tribe knows that with sufficient water in the area, the meadows and grasses would thrive again (Bengochia, 2021). As shown in Figures 10 and 11, reductions in meadow vegetative cover have occurred with dropping water table levels. In 1912 a former United States Geological Survey (USGS) hydraulic engineer created maps showing ground water depths and vegetation types (Lee, 1912). Digitized versions of these maps are used here to compare ground water and meadow ecosystems. The maps in Figure 10 allow a comparison of the area occupied by meadows in 1912, 1986, and 2004. The 1912 map shows the baseline of the grasslands. The 1986 and 2004 maps, based on monitoring by LADWP, show substantial grassland loss with the area known as Blackrock 94 (see photograph, Figure 12) highlighted in pink. Figure 11 shows the water table levels in the same area. Due to groundwater pumping, water tables have gotten deeper and areas with shallow groundwater (less than 3 feet) have decreased substantially. The lack of groundwater corresponds to the lack of meadow in the same area.

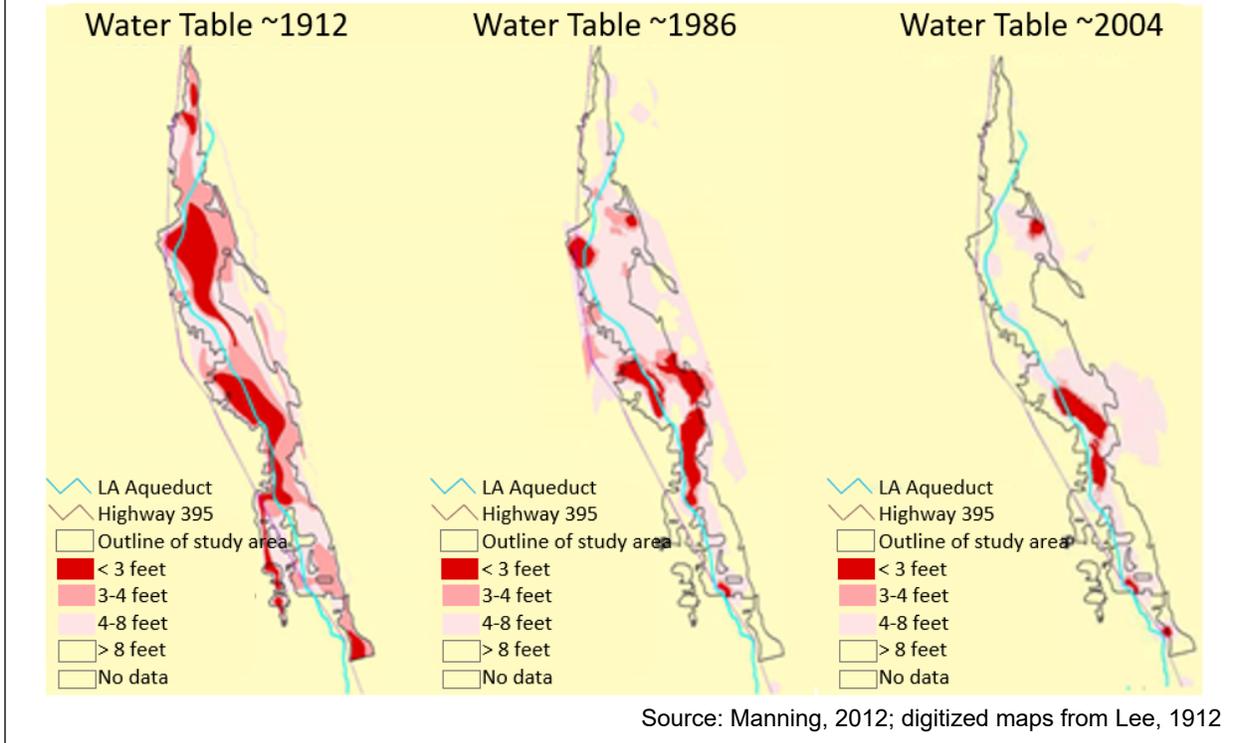
**Figure 10. Maps showing areas occupied by meadows (shown in green) in the Owens Valley in 1912, and reductions in 1986 and 2004. Blackrock 94 is highlighted in pink.**



Source: Manning, 2012; digitized maps from Lee, 1912



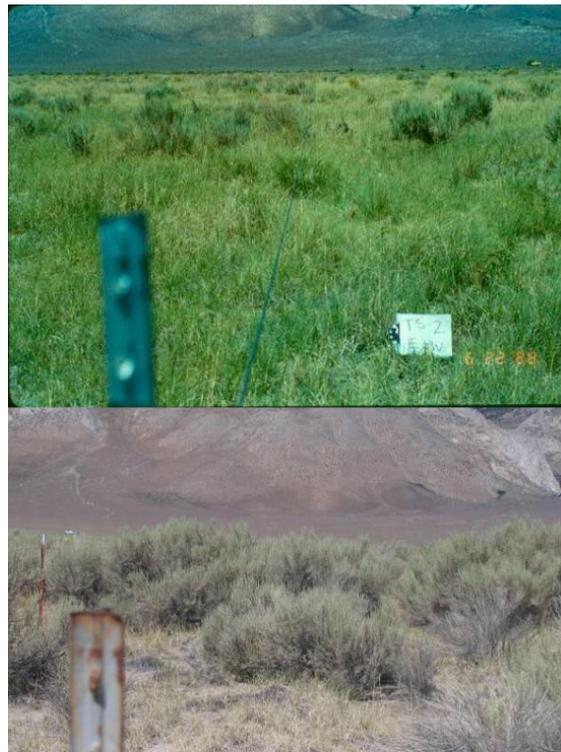
Figure 11. Maps showing depth of water table in the Owens Valley



The photographs in Figure 12 show the Blackrock 94 area in June of 1988 (top) and June of 2007 (bottom). In 1988 the area had 33% vegetation coverage, dominated by green grass with 4% shrubs. By 2007 vegetation coverage was reduced to 15% in the same area, consisting of ~11% shrubs and ~3% grass.

Maps more recent than 2004 showing data that can be compared to Figures 10 and 11 are not currently available. This is partly due to changes in the methods of data collection. It is noteworthy to mention that some groundwater data recently collected from County of Inyo Water Department suggests that comparing years 2021 and 2022 the average basin groundwater table was reduced by an average of approximately two (2) feet

Figure 12. Comparison of Blackrock 94 area June 1988 (top image) and 2007 (bottom)



Source: Manning, 2021



(ICWD, 2021b). The Owens Valley is a closed basin that has been drained over the past 100 years and the continuation of pumping is leading to a reduction of vegetation diversity including culturally important plants in the Payahuunadü.

Though it is generally rare in California, alkali meadow is a major vegetation type in Owens Valley, and on the Bishop Paiute Reservation. The Owens Valley has 67% of the alkali meadow in California. In the 1980s, LADWP biologists mapped at least 70,000 acres of Valley floor as dominated by California native grasses, supported by Owens Valley's naturally shallow groundwater (Davis *et al*, 1998). These meadows are home to species of cultural importance and conservation concern, both plants such as the Owens Valley checkerbloom and the Inyo County star tulip, and animals such as Owens Valley vole, northern harrier and red shouldered hawk (Elmore *et al*, 2006).

Meadows are a biodiverse habitat that sustain common as well as rare species. Owens Valley meadows are dominated by one or both native perennial grass species: saltgrass (*Distichlis spicata*) and alkali sacaton (*Sporobolus airoides*). Both are hardy species, with roots growing to approximately 2 meters. Other common grasses in meadows include Beardless wildrye (*Leymus triticoides*), Baltic rush (*Juncus balticus*), scratchgrass (*Muhlenbergia asperifolia*), basin wildrye (*Leymus cinereus*), and, to a lesser extent, alkali cordgrass (*Spartina gracilis*). Irises, lilies, and broad-leaved herbaceous plants intermingle with the grasses.

Other meadow species include:

- Alkali mallow (*Malvella leprosa*)
- Fish Slough milk vetch (*Astragalus lentiginosus ssp. Piscinensis*)
- Hall's meadow hawksbeard (*Crepis runcinata ssp. Hallii*)
- Inyo County star-tulip (*Calochortus excavatus*)
- Nevada blue-eyed grass (*Sisyrinchium halophilum*)
- Owens Valley checkerbloom (*Sidalcea covillei*)
- Saltmarsh bird's-beak (*Cordylanthus maritimus* Nutt. ex Benth.)
- Stinkweed (*Cleomella*)
- Wild licorice (*Glycyrrhiza lepidota* Pursh)
- Yerba mansa (*Anemopsis californica*)

Native shrubs include:

- Rabbitbrush (*Chrysothamnus nauseosus*)
- Nevada saltbush (*Atriplex lentiformis ssp. torreyi*)
- Greasewood (*Sarcobatus vermiculatus*)
- Sagebrush (*Artemisia tridentata*)

Of these species, the annual species *Malvella*, *Cleomella*, *Cordylanthus* are less tolerant of changes to water and are more likely to be lost as meadows are deprived of water. The Tribe has translocated many of these species to the COSA to attempt to preserve them.



Wetlands provide some of the richest habitat on the Bishop Reservation, supporting many species of plants and animals. There are approximately 25 acres of federally designated wetlands located in the eastern section of the Reservation (BPT, 2021b). One observable way the area has changed in the last 20 years is that much of the alkali meadow portion of the wetlands has been invaded by perennial pepperweed (*Lepidium latifolium*). This plant, not native to Owens Valley, has proved extraordinarily difficult to control. It propagates by seed and has very deep roots (BPT, 2021b).

The Bishop Paiute Tribe has long been attuned to seasonal variations related to planting and stewardship of plants. Jen Schlaich, Food Sovereignty Program Specialist for the Tribe, reported “Several Elders have noted changes in harvest times for traditional foods. Community members have also mentioned changes in seasons such as out of the ordinary weather patterns, warmer fall weather and colder spring weather” (Kapp, 2019).

In addition to the overall decline in the quality and abundance of native vegetation due to climate changes, the Bishop Paiute have seen a decrease in culturally important food species such as “wai” (Indian Ricegrass), tule, acorn and pine nut (BPT, 2020).

### **Impacts to Wildlife**

Impacts from climate change threaten the Bishop Paiute’s access to traditional foods such as fish, game, and wild and cultivated crops. These resources have provided sustenance as well as cultural, economic, and community health for generations.

**Figure 13. Owens Valley pupfish**



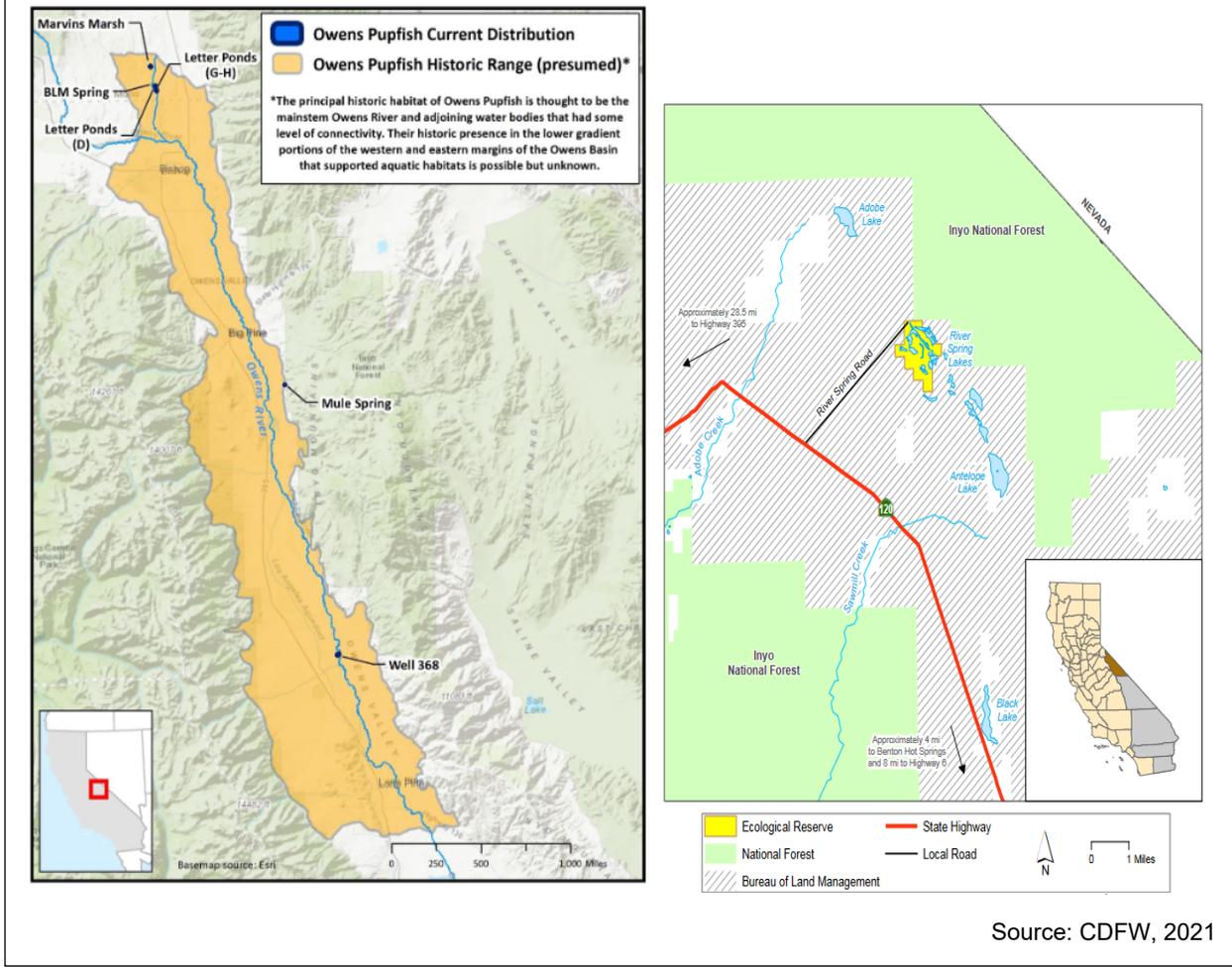
Source: UCD, 2021  
Phot credit: Joe Ferreira

The Bishop Paiute have cared for and been nourished by desert fish including the Owens pupfish (Figure 13) since time immemorial. The Owens pupfish (named for its playful nature) is a 2.0 inch long, silver-gray fish that turns a bright, florescent blue during spawning season. Historically, the pupfish was a staple food item for the Paiute people in the Owens Valley, who caught the fish by the hundreds and dried and stored them. The Tribe continues to try to protect and care for these threatened

fish but as their habitat shrinks due to climate change, land use practices, and extensive water development, they are now limited to the small areas shown in Figure 14 below (CDFW, 2020a) and a newly designated area called the River Springs Lake Ecological Reserve (CDFW, 2021).



**Figure 14. Maps of historic range and current distribution of Owens pupfish in Mono and Inyo counties (left), and of River Spring Lakes Ecological Reserve (right)**



Shell mounds of freshwater mussels (*Anodonta nuttalliana*) and surveys on the Bishop Paiute lands including the creeks and Owens Lake indicate the historic use of mussels as a food source. Mussels are no longer found in Owens Lake because it is dry, but they have been found in the Bishop Creek canal, which diverts water from the Owens River for use by LADWP, as recently as 2014 (Blevins et al., 2017), (CDFG, 2015). Freshwater mussels have also been seen in LADWP dredge piles (Klingler, 2021), but due to reduced numbers they are no longer used as a source of food for the Paiute people (Bengochia, 2021).

**Figure 15. Freshwater mussels in a canal dredge pile. The different sizes/ages classes indicate they were reproducing in the recent past.**



Photo credit: Ceal Klingler



The Owens Tui Chub (*Siphateles bicolor snyderi* or *Gila bicolor snyderi*) is endemic to the Owens Basin, Mono and Inyo Counties. It was a food source for the Bishop Paiute people but is now found in only six sites, including the COSA, all created for the preservation of the species on the Bishop Paiute lands. The COSA Tui Chub are hybridized. The Toikona Tui Chub is the original species and is now only found in isolated conservation areas to prevent hybridization (CDFW, 2020c).

The Owens speckled dace (*Rhinichthys osculus ssp.*) historically occupied most small streams and springs in the Owens Valley. By the 1980's the stream-fed ponds and springs that the Owens speckled dace lived in were depleted or destroyed by the construction of and pumping for the LA aqueducts, and they were extirpated from most of their historic range. The COSA on the Bishop Paiute lands is one of three remaining, isolated habitats left for these culturally important fish (Mussmann, et al. 2020).

The Paiute still hunt both large and small game and have noticed a decline in culturally important species. Rabbits, especially black-tailed jackrabbits and cottontail rabbits, used to be plentiful in the area. The Tribe has seen a decline in both species. As the area has suffered from drought and desertification, food on which the rabbits depend has become less available (Bengochia, 2021).

Mule deer is a culturally important species for the Bishop Paiute Tribe. Mule deer are in decline across the west, their migration patterns and food availability impacted by drought and other aspects of climate change (Aikens et al., 2020). In 2017, 120 mule deer that were migrating to their winter grounds in the Valley ran into persistent snow and ice sheets, not normally found in the area, and slid to their deaths. This type of event has only happened twice before that the Tribe knows of and never on this scale (Brown-Williams, 2017).

In 2020 the Bishop Paiute Tribe entered into an agreement with the California Department of Fish and Wildlife allowing the Tribe to take 16 deer for cultural education purposes. This agreement was the first of its kind and it recognizes the Tribe's authority to protect wildlife resources (CDFW, 2020b).

Some of the other impacts to wildlife the Tribe is experiencing include:

- Declining numbers of native fish such as Owens pupfish, Owens tui chub, Owens speckled dace, Owens sucker and tui kona tui chub
- Increasing stream temperatures
- Increasing bacteria levels (E. coli, cyanobacteria) in surface waters on the Reservation and associated adverse effects on local wildlife
- Decrease in bird species such as yellow-headed black bird, red-winged black bird, eagles, and swallows
- Decline in numbers of bats



The Tribe has also observed increases in non-native species that have the potential to take the place of native species as the climate of the Owens Valley warms and dries, such as:

- Barred Owl
- Black Witch moth (native to Mexico)
- Bullfrogs and mud snails
- Rainbow trout, largemouth bass, catfish, and perch

The Bishop Paiute lands provide habitat for many threatened or endangered species such as Western Meadowlark (*Sturnella neglecta*), Owens Valley vole (*Microtus californicus ssp. vallicola*), a myriad of insects and spiders, and many other animals. The Northern Harrier (*Circus cyaneus*) and Red Shouldered Hawk (*Buteo lineatus*) are year-round residents, breeding in Owens Valley and foraging in meadows. As discussed earlier, the meadows that these species rely upon are threatened by climate change impacts that continue to lower the water table (Manning, 1997).

### Wildfire

The incidence of large forest fires in the western United States has increased since the early 1980s (Wehner et al., 2018). Fire season in California is starting earlier and ending later each year (CAL FIRE 2021). Since 2007 there have been 10 fires over 100 acres in size that have impacted the Bishop Paiute. The Reservation is in an area designated as a High Fire Severity zone (BPT, 2018).

**Table 1. Wildfires Impacting the Bishop Paiute Tribe 2007-2020**

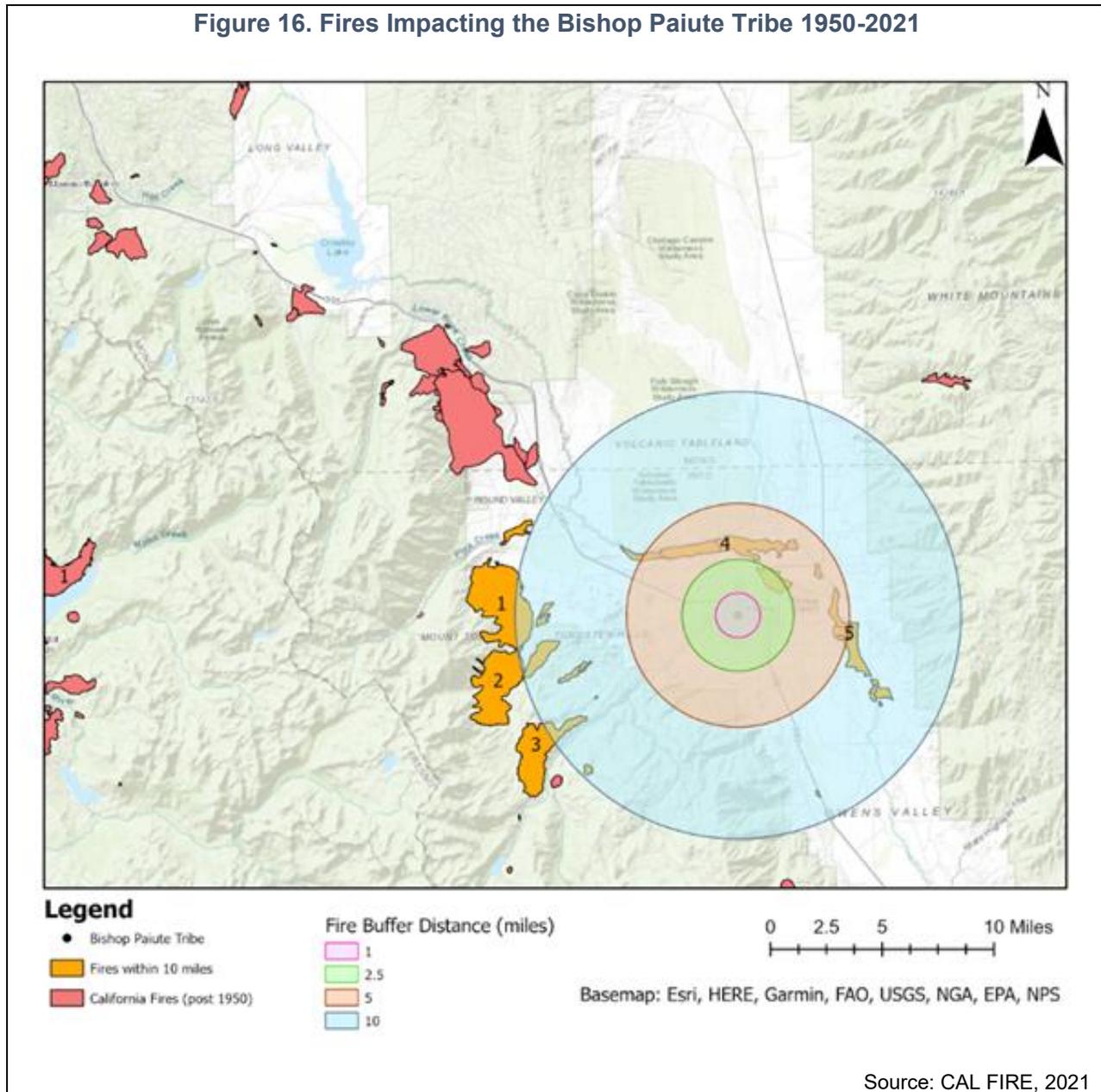
Year	Fire	Acres
2007	Inyo Complex (#1)	35,000
2009	Fort Fire (#4)	5,000
2009	Forks Fire	3,268
2011	Center Fire	850
2014	Bridges Fire	113
2015	Round Fire (#3)	7,000
2018	Pleasant Fire	2,070
2019	Cow Fire	1,975
2019	Taboose Fire (#2)	10,400
2020	Beach Fire (#5)	4,000

Source: CAL FIRE, 2021

The map in Figure 16 shows fires within 10 miles of the current Bishop Tribal lands that occurred between 1950 and 2020; the five largest fires are numbered. While the Reservation itself has not been burned by large wildfires, there have been impacts to the soils, riparian habitat, air, and water quality (BPT, 2018). Fires increase soil erosion, particularly in denuded watersheds. Wildland fires that eliminate forest areas affect soils, watershed value and habitat. Fires that burn hot and destroy most of the vegetation are also destructive to aquatic habitats.



Figure 16. Fires Impacting the Bishop Paiute Tribe 1950-2021



Years of drought, declining snowpack, over pumping of groundwater, and increasing temperatures, combined with more than a century of fire suppression and attendant changes in forest composition, have significantly increased fire severity, frequency, and size throughout the Eastern Sierra (Dettinger et al., 2018). The Tribe has noted that a build-up of dead trees in the National Forest area at Indiana Summit and the increase of weeds, shrubs, and other flashy fuels have increased the fire danger for the Tribe (BPT, 2020).

During the 2019 fire season, the overlap of smoke from fires such as the Taobose Fire shown in Figure 17, and dust from windstorms caused a build-up of respirable particulate matter (less than 10 micrometers in diameter; PM10) that was documented



by the Bishop Air Quality Monitoring Program (BPT, 2020). In 2021 there were 12 wildfires ranging in size from the 25-acre Pine Fire to the 963,306-acre Dixie fire that caused wildfire smoke exposure to the Tribe (BPT, 2021c).

Short-term exposures to PM10 have been associated primarily with worsening of respiratory diseases, including asthma and chronic obstructive pulmonary disease, leading to hospitalization and emergency department visits (CARB, 2021).

**Figure 17. The Taboose Fire, 2019**



Source: NWCG, 2019

Many mountain meadows below the elevation of 7,500 feet, including the meadows of the Eastern Sierra, are not truly natural but were influenced for millennia by Tribal burning practices. Native people altered the size and composition of meadows through periodic burning. Setting fires in the areas surrounding the meadows discouraged the encroachment of more wet-tolerant vegetation. Periodic burning within the meadow boundaries influenced the species composition, density, and abundance of native plant populations. Certain meadow plants such as deergrass, yampahs (a genus of wild carrot) and clovers were favored and maintained through burning (Anderson, 2005).

Historically, the Paiute conducted cultural burns on their lands. Controlled burns are no longer practiced by the Bishop Paiute. The population of the Bishop area has grown over time and federal land agencies control much of the lands the Tribe used to steward. On the Reservation the reduction of agricultural lands and densification of single-family homes (2000 members live on just 879 acres) have created a matrix of fuels that are unsafe to control with prescribed burns (BPTEO, 2021).

Burning was also used to increase foods such as wild onions and elderberries, and to clear out the underbrush to bring in new growth for the animals. The Owens Valley Indians also grew tobacco and burned the fields where the tobacco grew (Padilla, 2004).



As non-native vegetation dominates, the Valley is less resistant to fire. The roots of meadow grasses have evolved to tap into the historically shallow (8 feet) ground water of the area, while the roots of the encroaching shrubs can burrow deeper for water. In early July 2007, the Inyo Complex fire burned over 35,000 acres including a vegetation study area. Figure 18 shows two sites in the study area (TS1 and TS3) in 1988, when the grass-to-shrub ratios were similar in both locations (0.8 in TS1 and 0.9 in TS3). By 2007 site TS1 had been over pumped, and this anthropogenic climate change impact had promoted the growth of shrubs such as tumbleweed, resulting in a grass-to-shrub ratio of less than 0.1. In site TS3, an area that had been better managed and allowed more water, native grasses were nearly as abundant as they were in 1988. The top photos of Figure 19 below shows both the TS1 and TS3 areas soon after the Inyo Complex burned through the area. A year later (bottom photos) area TS1, which had been populated by non-native shrubs, still looked barren while area TS3, populated by native grasses, had nearly recovered.

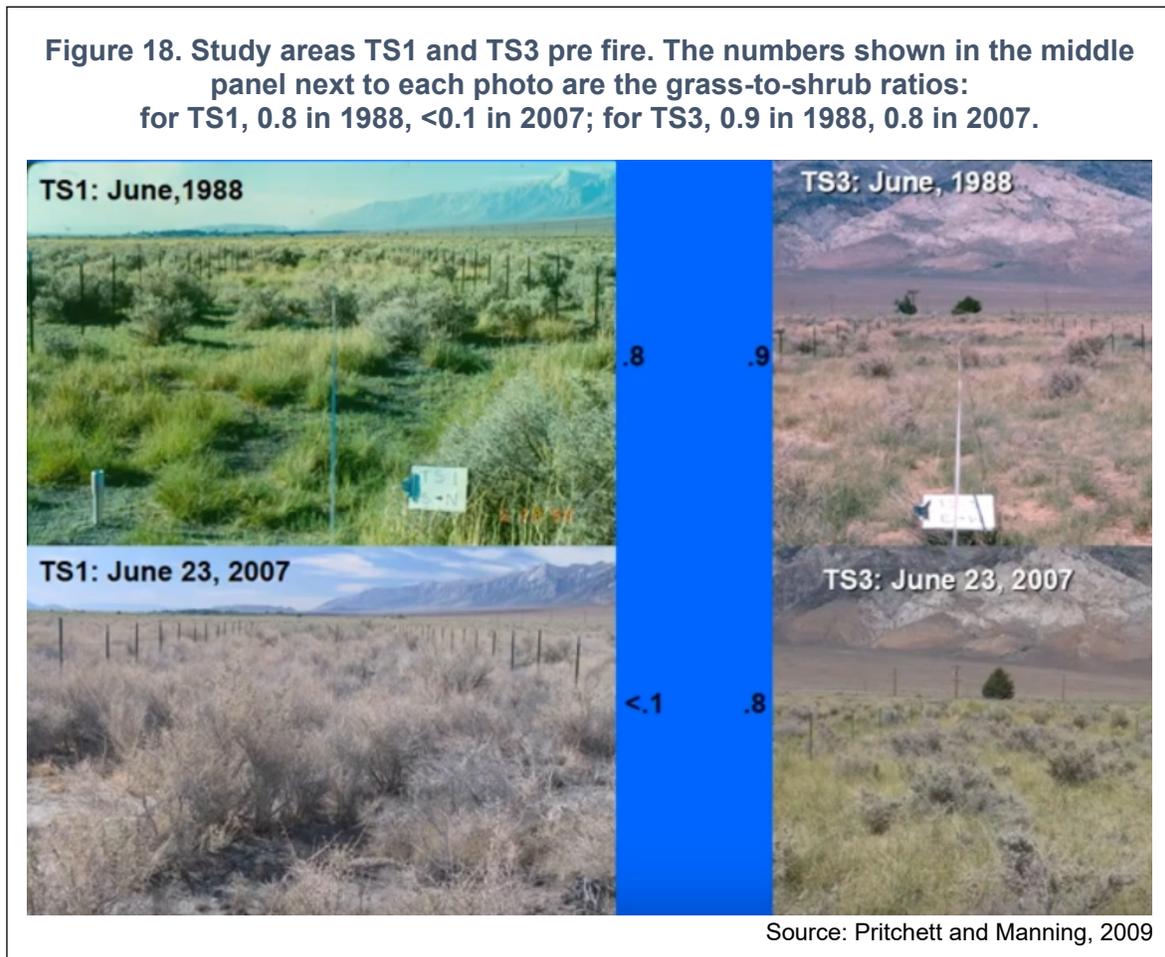
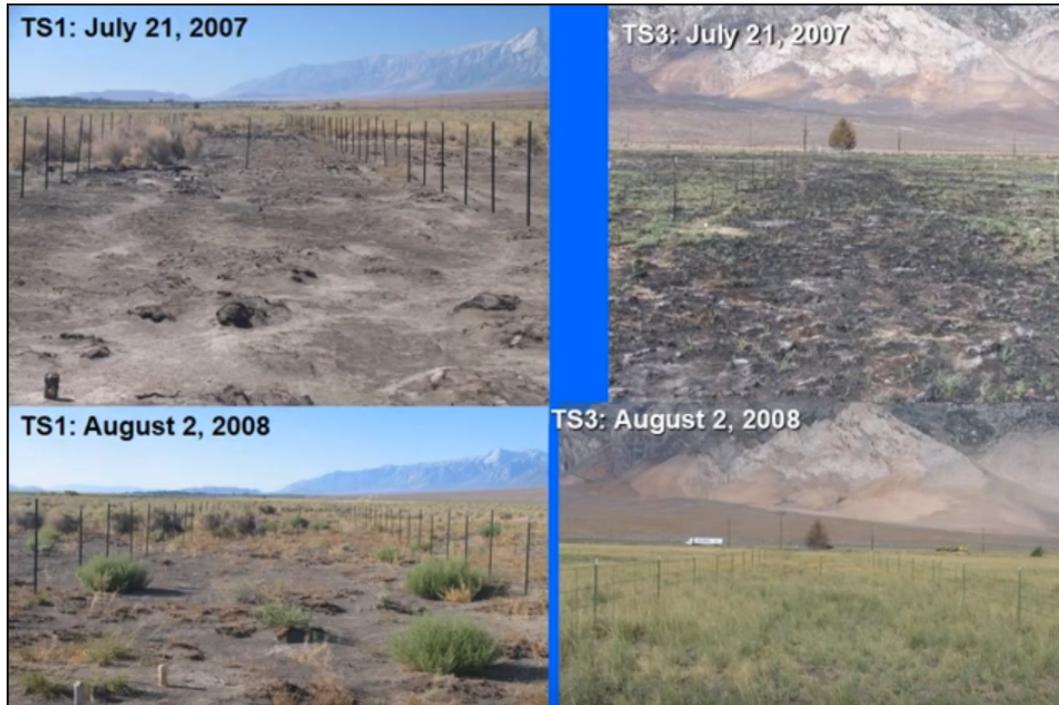


Figure 19. Areas TS1 and TS3 after the Inyo Complex Fire



Source: Pritchett and Manning, 2009

### Summary

Climate change is impacting the culture, lives, environment, and health of the Bishop Paiute Tribe. These changes are compounded by LADWP's diversion of water from the Payahuunadü.

The Bishop Paiute people continue to work to protect and enhance the natural resources and habitat of the Owens Valley. Because climate change is deeply affecting the environment and altering and disrupting the ecosystems within and around the Owens Valley, the Bishop Paiute community is actively working to understand, adapt to, and mitigate the effects of climate change and other impacts to their lands. Their goal is to continue to manage and protect their traditional lands and limit the impact climate change is having on the Bishop Paiute people's right to hunt, fish, and gather from their land—something that is integral to their culture, well-being and livelihood.



### For more information contact:

Bishop Paiute Tribe Environmental Office  
50 Tu Su Lane  
Bishop, CA 93514  
(760) 873-3584  
<http://www.bishoptribeemo.com>



**Suggested Citation:** Bishop Paiute Tribe (2022). Impacts of Climate Change on the Bishop Paiute Tribe. In: OEHHA 2022 Indicators of Climate Change in California

### References

Abatzoglou JT, McEvoy DJ and Redmond KT (2022), in press, [The West Wide Drought Tracker](#). Drought Monitoring at Fine Spatial Scales, *Bulletin of the American Meteorological Society*. Retrieved January 03, 2022.

Aikens EO, Monteith KL, Merkle JA, Dwinnell, SPH, Fralick GL, et al. (2020). Drought reshuffles plant phenology and reduces the foraging benefit of green-wave surfing for a migratory ungulate. *Global Change Biology* **26**(8): 4215-4225.

Bengochia, M (2021). Tribal Historic Preservation Officer, Bishop Paiute Tribe. Conversation about species impacted by climate change with Laurie Monserrat, OEHHA, November 8, 2021.

BPT (2018). Bishop Paiute Tribe. [2018 Hazard Mitigation Plan Update](#).

BPT (2020). Bishop Paiute Tribe. [Eastern Sierra Listening Session](#) hosted by the Bishop Paiute Tribe and the Office of Environmental Health Hazard Assessment.

BPT (2021a). Bishop Paiute Tribe. [Bishop Paiute Tribe, About Us](#). Retrieved November 05, 2021.

BPT (2021b). Bishop Paiute Tribe. [Bishop History of the COSA](#). Retrieved November 04, 2021.

BPT (2021c). Bishop Paiute Tribe. [Bishop Paiute Tribe 2021 Wildfire Summary](#).

BPTEO (2021). Bishop Paiute Tribe Environmental Office. Email correspondence between Brian Adkins, Environmental Director, Bishop Paiute Tribe and Laurie Monserrat, OEHHA.

Blevins E, Jepsen S, Box JB, Nez D, Howard J, et al. (2017). Extinction risk of western North American freshwater mussels: *Anodonta nuttalliana*, the *Anodonta oregonensis/kennerlyi* clade, *Gonidea angulata*, and *Margaritifera falcata*. *Freshwater Mollusk Biology and Conservation* **20**(2): 71-88

Brown-Williams P (2017). [Hazardous Conditions Lead to Migrating Mule Deer Deaths](#), Sierra Nevada bighorn sheep and wildlife of the Eastern Sierra November 20, 2017. Retrieved November 08, 2021

CAL FIRE (2021). [California Wildfire History and Statistics](#) Retrieved January 29, 2021.

CARB (2021). California Air Resources Board. [Inhalable Particulate Matter and Health \(PM2.5 and PM10\)](#).

CDFG (2015). California Department of Fish and Game. [The decline of native freshwater mussels \(\*Bivalvia: Unionoidea\*\) in California as determined from historical and current surveys](#).

CDFW (2020a). California Department of Fish and Wildlife. [Report to the Fish and Game Commission, Five-Year Species review of the Owens Pupfish \(\*Cyprinodon radiosus\*\)](#).

CDFW (2020b). California Department of Fish and Wildlife. [Bishop Paiute Tribe and Department of Fish and Wildlife Enter Into Historic Agreement](#). Retrieved November 08, 2021.

CDFW (2020c). California Department of Fish and Wildlife. [Report to the Fish and Game Commission, Five-Year Species review of the Owens Owens tui chub \(\*Siphateles bicolor snyderi\*\)](#).

(CDFW 2021). California Department of Fish and Wildlife. [River Spring Lakes Ecological Reserve](#)

Davis FW, Stoms DM, Hollander AD, Thomas KA, Stine PA, et al. (1998). [The California Gap Analysis Project--Final Report](#). University of California, Santa Barbara, CA.



- Dettinger M, Alpert H, Battles J, Kusel J, Saford H, et al. (2018). [Sierra Nevada Summary Report. California's Fourth Climate Change Assessment](#). Publication number: SUM-CCCA4-2018-004
- Elmore AJ, Manning SJ, Mustard JF and Craine JM (2006). Decline in alkali meadow vegetation cover in California: the effects of groundwater extraction and drought. *Journal of Applied Ecology* **43**: 770-779.
- ICWD (2021a). Inyo County Water Department. [Agreement Between the County of Inyo and the City of Los Angeles and Its Department of Water and Power on a Long Term Groundwater Management Plan for Owens Valley and Inyo County](#). Retrieved February 02, 2022.
- ICWD (2021b). Inyo County Water Department. [Depth to Water at Indicator Wells, April 2021](#). Retrieved February 02, 2022.
- Kapp A (2019). [The Bishop Paiute Tribe, September 2019](#). Climate Change Program, Institute for Tribal Environmental Professionals, Northern Arizona University.
- Klingler C (2021). Personal communication between Ceal Klingler and Laurie Monserrat, OEHHA, November 17, 2021.
- LRWQCB (2020). Lahontan Regional Water Quality Control Board. [Bishop Creek Vision Project](#).
- Lawton HW, Wilke PJ, DeDecker M, and Mason WM (1976). Agriculture Among the Paiute of Owens Valley. *The Journal of California Anthropology* **3**(1).
- Lee CH, (1912). An intensive study of the water resources of a part of Owens Valley, California. *US Geological Survey Water-Supply Paper* **294**: 135.
- Manning S (1997). [Plant Communities of LADWP Land in the Owens Valley: An Exploratory Analysis of Baseline Conditions](#). Inyo County Water Department, Bishop, California.
- Manning S (2012). [Groundwater pumping effects on native vegetation in Owens Valley](#).
- Mussmann SM, Douglas MR, Oakey DD and Douglas ME (2020). Defining relictual biodiversity: Conservation units in speckled dace (*Leuciscidae*: *Rhinichthys osculus*) of the Greater Death Valley ecosystem. *Ecology and Evolution* **10**: 10798– 10817.
- NASA (2011). National Aeronautics and Space Administration. [Astronaut photo ISS028-E-35137](#).
- NWCG (2019). National Wildfire Coordinating Group. [InciWeb for the Taboose Fire](#). Retrieved November 13, 2020.
- OVIWC (2021). Owens Valley Indian Water Commission. [A History of Water Rights and Land Struggles](#).
- Padilla P (2004). [Forgotten Fires, Native Americans and the Transient Wilderness](#) by Omer C. Stewart. *Natural Resources Journal* **44**: 1263.
- PRISM (2021). Parameter-elevation Regressions on Independent Slopes Model. Parameter-elevation Regressions on Independent Slopes Model for the Bishop Paiute Reservation Lat: 37.3438, Lon: -118.4062. Retrieved November 05, 2021.
- Pritchett D and Manning S (2009). [Groundwater extraction, fire, and desertification: A case study in Owens Valley, CA](#). Presented at the 2009 Ecological Society of America Meeting.
- Rea S (2018). [Petroglyphs at Volcanic Tablelands](#). Retrieved November 16, 2021.
- Reheis M and Kihl R (1995). Dust deposition in southern Nevada and California, 1984-1989: Relations to climate, source area, and source lithology. *Journal of Geophysical Research* **100**: 8893-8918.



Smith GI, Bischoff JL and Bradbury JP (1993). Synthesis of the paleoclimatic record from Owens Lake core OL-92: *Geological Society of America Special Paper* **317**: 143-160.

USEPA (2017). United States Environmental Protection Agency. [Owens Valley Particulate Matter Plan Q and A](#). Retrieved January 14, 2021.

USGS (1939). United States Geological Survey. [Owens Lake and Vicinity, California](#). Surveyed between 1905-1911. Retrieved January 03, 2022.

USGS (1998). United States Geological Survey. [Evaluation of the Hydrologic System and Selected Water-Management Alternatives in the Owens Valley, California](#).

UCD (2021). University of California Davis. [California Fish Website, Owens Pupfish](#).

Wehner, MF, Arnold JR, Knutson T, Kunkel KE and LeGrande AN (2018). [Droughts, floods, and wildfires](#). In: Climate Science Special Report: Fourth National Climate Assessment, Volume I (U.S. Global Change Research Program).

Wei C (2016). [How the Owens Valley Paiute Made the Desert Bloom](#).

Williams H (2016) [Quote from Harry Williams, Bishop Paiute Tribal Elder and Water Protector](#). In: How the Owens Valley Paiute Made the Desert Bloom.

