Chapter 11

Climate Resilience through Equity and Justice

Holistic Leadership by Tribal Nations and Indigenous Communities in the Southwestern United States

Julie Maldonado and Beth Rose Middleton

Climate-induced impacts are adversely affecting the health, livelihoods, cultural resources, and spiritual well-being of Indigenous communities in the southwestern United States. Hotter temperatures, intensified drought, more flooding, vast tree mortality, and increased wildfires are disrupting the ecosystems upon which Indigenous people depend. At the same time, many Indigenous communities and Tribal nations in the region are leading actions to mitigate against and adapt to the effects of the climate crisis, and to secure a sustainable future for generations to come. Indigenous and Traditional Knowledges are increasingly recognized by Western scientists as necessary and valuable to inform and guide climate adaptation (CTKW 2014; IPCC 2014). Indigenous leadership in the face of global planetary change offers innovation, guidance, and place-based, time-tested knowledge on how to address climate change from a holistic framework that foregrounds equity and justice. This chapter draws largely from the research conducted by the authors for the 2018 Fourth United States National Climate Assessment (NCA), Southwest Chapter, Key Message 4: Indigenous Peoples (Gonzalez et al. 2018). In the NCA, the Southwest region includes Arizona, California, Colorado, Nevada, New Mexico, and Utah. Thus, what is termed the "southwestern US" in this chapter covers the geographic and political boundaries spanning vast

Notes for this chapter begin on page 282.

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and diverse landscapes and climates—from the arid desert to the coastal rainforest.

Background

The US Southwest has the largest population of Indigenous peoples of any region in the United States. There are currently 182 federally recognized tribes in the Southwest (Federal Register 2019; National Conference of State Legislatures 2020), as well as numerous non–federally recognized tribes and Indigenous communities, many of whom are already experiencing the impacts of a changing climate. Cumulative climate stressors and responses cannot be viewed in an isolated, static context. These stressors are layered on top of and exacerbate existing challenges, historical legacies and traumas, and marginalizing forces, including the creation of energy sacrifice zones and the establishment of hydroelectric and water storage infrastructure without Indigenous consent. Indeed, many Indigenous people articulate that climate change began with European contact and the shift in associated land management "from carrying capacity sustainability to a resource extraction model" (Goode et al. 2018). It is critical to take a long perspective, both toward the past and the future, in order to understand the present effects, projected impacts, and current and proposed actions to mitigate and adapt to climate change.

To begin with, the present and emerging climate change impacts on Indigenous peoples, lands, and resources in the Southwest must be placed within the context of continued settler colonization and forced removals (Wildcat 2009; Goldtooth and Awanyankapi 2010; Whyte 2016, 2017), such as the Long Walk endured by the Diné (Navajo) (Denetdale 2009) and the march of Concow Maidu people to Round Valley in northern California (Bauer 2016). Historical traumas, socioeconomic and political pressures, and extractive infrastructure all combine to impact Indigenous peoples' adaptive capacity and exacerbate current and projected climate impacts (Maynard 2014; Whyte 2013, 2017).

The colonizers forced Native populations across the Southwest onto marginal lands within their territories that non-Native settlers found inhospitable due to the limited water quantity and poor soil quality. For example, as settlers moved into the Southwest, the Diné underwent a series of colonial-driven policies and initiatives that left them impoverished and marginalized both physically and in other ways. They were forced in the reservation movement to less fertile territory replete with rocky dirt, sandstone outcroppings, and lack of water. To compensate, the US government provided them with sheep, and then when the sheep population grew

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beyond what the government deemed viable on the land, the sheep were slaughtered. In consequence, and with few resources, many Diné were further impoverished. The original and abiding arid conditions converged with poverty and economic and political marginalization to convert a prolonged drought across the Navajo Nation into a widespread disaster (Redsteer et al. 2011) when extreme storms in 2013 resulted in flooding that displaced dozens of Diné families (ICMN 2013).

In addition, what colonial powers once saw as wasteland turned out to be rich in natural resources, including fossil fuel energy resources. The legacies of colonialism and forced removals established the twenty-first-century pathway for the extreme levels of extraction by the petroleum industry (Powell 2018), which saw the area as one to exploit as an energy sacrifice zone—"a place where human lives are valued less than the natural resources that can be extracted from the region" (Buckley and Allen 2011: 171). The Four Corners region of the Southwest has over forty thousand existing natural gas wells and associated infrastructure, as well as two large coal plants (Four Corners Power Plant and San Juan Generating Station). The Navajo Generating Station coal-fired power plant provides power to pump water from the Colorado River to urban centers such as Phoenix, while Diné communities adjacent to the station lack running water (Powell and Maldonado 2017).

Diné are not alone in facing intertwined impacts of coloniality and climate change. In the face of such challenges, many tribes in the Southwest have limited resources for risk reduction, mitigation planning, and adaptation. Only a few Southwestern tribes have completed specific drought plans (National Drought Mitigation Center 2021), and many tribes have reported that they are not able to comprehensively monitor environmental shifts (Ferguson and Crimmins 2009; Redsteer et al. 2013). Additionally, the limited funding that is available to tribes is only available in the form of short-term grants, which are insufficient to deal with long-ranging mitigation planning and adaptation responses (Ferguson et al. 2010).

Current Climate Change Effects on Tribes in the US Southwest

Perhaps in its most serious fallout, drought exacerbated by human-caused climate change across the Southwest (Diffenbaugh, Swain, and Touma 2015; Udall and Overpeck 2017) has contributed to the degradation of traditional foods of the region's tribes. These consist, in part, of food sources such as corn, squash, acorn, and pronghorn antelope herds, staples of distinct Southwest Indigenous populations' agricultural and stewardship/subsistence legacy. Increasing temperatures have further caused a decline

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in Southwest pine nut populations, an essential food for some tribes (Lanner 1981; Washoe Tribe 2009; Redmond, Forcella, and Barger 2012; Redmond et al. 2017). Diné elders have observed that intensifying dryness has not only contributed to declines in corn and other culturally significant crops but also wild vegetation and animal populations, even avian species such as eagles, as well as the crucial flow of specific water springs (Redsteer et al. 2015). The loss of traditional foods accompanies increasing rates of diabetes and heart disease across Indigenous populations (Norgaard 2005; Lynn et al. 2013), resulting in cumulative physical, mental, and spiritual health effects.

Some tribes in the Southwest are also noting and experiencing extreme fluctuations in the region's prevailing natural state, once quite stable. The Navajo Nation has experienced prolonged drought since the 1990s, after which it underwent, as mentioned above, extreme storms that resulted in flooding that displaced many Diné families (ICMN 2013). Higher temperatures and evaporation, diminished soil moisture (Seager and Hoerling 2014; Diffenbaugh et al. 2015; Seager et al. 2015; Williams et al. 2015; Cheng et al. 2016), and impacts to snow-related parameters (Pierce and Cayan 2013) have further resulted in the decline of surface vegetation and an increase in sand dune mobility on some Navajo and Hopi lands, putting rangeland productivity at risk along with damaged infrastructure and loss of native plants (Redsteer et al. 2011; Redsteer 2012).

Climate disruption is contributing to another dire circumstance in the Southwest, namely increasing wildfires (Littell et al. 2009; Abatzoglou and Williams 2016). Affecting many tribes and their lands, subsistence, and community and cultural infrastructure, the fires have expanded in number, severity, and location. In addition to human-caused climate change, the fires are also, in part, fueled by underlying historical colonial-driven policies, including mismanagement of the land and fire suppression (Norton-Smith et al. 2016), extractive logging activities, monoculture replanting, and postlogging effects on water and certain fish, wildlife, and plants, such as tanoaks and beargrass, which some tribes in the greater southwestern region rely on for food and cultural purposes (Karuk Tribe 2010; Voggesser et al. 2013). Due in part to the suppression of traditional tribal burning leading to the increased density of other vegetation, the ability of oaks to withstand climate-related stress has decreased (Long et al. 2017). Declining surface soil moisture and higher temperatures and evaporation (Seager et al. 2014; Diffenbaugh et al. 2015; Williams et al. 2015; Cheng et al. 2016) converge with oak trees' decreased resilience, diminished acorn production, and fire and pest threat to reduce the availability and quality of acorns for tribal food consumption and cultural purposes (Voggesser et al. 2013).

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For coastal tribes in the northern Pacific coast of the region, their homelands were once essentially a cold climate rainforest, abundant in coastal shellfish, freshwater fish in streams, ocean fish, and forest wildlife and edibles. One of the main foods sustaining the people was salmon. Today, increasing ocean and coastal water temperatures, in addition to nonclimate factors such as dam infrastructure, habitat degradation, and overharvesting by non-Natives, are affecting species such as salmon, on which northern Pacific Coast tribes rely for subsistence and cultural perpetuation (Jenni et al. 2014; Sloan and Hostler 2014; Hutto et al. 2015). These changes also affect mental and spiritual health, disrupting cultural connections to plant and animal relatives and to related place-based identity and practices (Donatuto et al. 2014; Rising Voices 2014).

Projected Future Climate Change Effects on Tribes in the Southwestern United States

It is projected that climate changes in the southwestern United States will worsen over the next several decades. The effects will no doubt cause further impacts to traditional foods, medicinal plants, and cultural resources (Lynn et al. 2013; Sloan and Hostler 2014). In the southwestern US, increased variability in water supply due to what will likely become consistent droughts may lead to heightened insecurity in settlements located on or reliant upon rivers and other water sources. For example, the 2004 Gila River Indian Community Water Rights Settlement Act allows the Gila River Indian Community to lease their unused water supplies. While such leases are a possible new source of economic development, the diversion of water allocations could place communities at risk of losing their own necessary water supply if there is then not enough water to go around, yet they are committed to provide purchased water to other entities per a lease agreement. Murphy cites National Climatic Data Center statistics on increasing drought in Arizona and warns that water supplies will decrease while demand continues to increase, resulting in a situation in which "water sold must be delivered, regardless of the condition of the selling reservation . . . it is possible for a group to oversell its appropriated water. In this worst-case scenario, the Community will have to breach its contracts for the survival of its people" (Murphy 2003–4: 185).

Increasing drought also leads to increased food-security and food-sovereignty risks. Projected reductions of runoff from decreasing and melting snowpack would increase the salinity of Pyramid Lake in Nevada. Diverse Paiute peoples live in a part of the southwestern region between the Rocky and Sierra Nevada Mountains characterized by isolated high,

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snowy mountain peaks, stretches of salt flats, land bearing little vegetation, hot summers, and cold winters. Traditional foods include small wildlife such as rabbits, as well as pine nuts and cattails, and fish if available. Climate change–induced decreasing snowpack and earlier snowmelt in this case will reduce fish biodiversity and, in particular, affect the spawning and sustenance of the endangered cui-ui fish, which is of central importance to the Pyramid Lake Paiute Tribe (Gautam, Chief, and Smith Jr. 2013).[1]

During colonization, some tribal economies throughout the southwestern United States became dependent on livestock, largely sheep but also cattle, which continues today (e.g., at Navajo Nation, Pyramid Lake Paiute Tribe, Southern Ute Tribe, and tribes at the US-Mexico border, e.g., at Tohono O'odham Nation Pascua Yaqui Tribe). These tribal populations are at risk of climate change–related stresses that are unbalancing the rangelands' ecosystems and, as a result, impacting their economic resources and livelihoods (Cozzetto et al. 2013; Redsteer et al. 2013; Nania et al. 2014; Redsteer et al. 2015; Norton-Smith et al. 2016). In addition, much of the southwestern US is at high risk of exposure to the expansion of invasive plant and animal species under new climate conditions (Early et al. 2016), namely, invasive cheatgrass, leafy spurge, and other species that reduce forage for livestock.

Many California tribes (for example, Yurok, Paiute, Miwok, Western Mono) are concerned about loss of acorns, a highly nutritional traditional food also used for medicinal purposes and basketry (Ortiz 2008; Long et al. 2017, 2016), due to "sudden oak death," which is spread by a pathogen that is known to increase with shifts in humidity and temperature (Guo, Kelly, and Graham 2005; Liu et al. 2007; Redsteer et al. 2013; Norton-Smith et al. 2016). Projected climate change effects may continue to shift bark beetles up in elevation (Sidder et al. 2016), which have already devastated much mountain fir forest in their rapid and fierce climate-driven expansion, potentially causing more losses to other traditional tribal food resources.

Especially relevant for coastal northern California tribes, projected climate changes increase the risks to salmon (Dittmer 2013; Jenni et al. 2014; Montag et al. 2014). Increased sea level rise and ocean temperatures, along with ocean acidification, increase risks of inundation of shellfish beds (Lynn et al. 2013), pathogens that cause shellfish poisoning (Cozzetto et al. 2013; Sloan and Hostler 2014), and damage to shellfish populations, which can cause cascading effects in food and ecological systems upon which some tribes depend (Feely et al. 2012; Dalton, Mote, and Snover 2013; Lynn et al. 2013).

In addition to warming, projected extreme shifts in weather include colder periods during the winter. Some tribes, such as some pueblos and

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tribes of New Mexico, have related human health concerns, as colder winter periods mean increasing use of wood-burning stoves for heating, resulting in worsening air quality, increased exposure to particulate matter, and accompanying higher incidences of asthma (National Tribal Air Association 2009). For many nations, extreme heat is also a concern. In California, the number of extreme heat days is expected to rise following current trends, creating especially dangerous conditions for low-income elders who may not be able to afford air conditioning or may not have access to "cool zones" (Gaughen in Goode et al. 2018; Climate Central 2016).

Emerging "Indigenuity" Responses

Although historical traumas, socioeconomic and political pressures, and extractive infrastructure have already reduced many Indigenous peoples' adaptive capacity to current and projected climate impacts (Maynard 2014; Whyte 2013, 2017), Indigenous peoples, nations, and pueblos across the Southwest and other areas are among those leading the way in innovative adaptation and mitigation actions. They are employing "indigenuity" in devising responses rooted in traditional knowledge (Wildcat 2009, 2013). Traditional knowledge embodies ways to "live well with" human and nonhuman beings within a framework that recognizes and honors interspecies relationality (Todd 2018). Kathy Sanchez (San Ildefonso Pueblo) with Tewa Women United calls for a "relational culture," one in which "everyone is Indigenous to the land from where they are from, in which we know how to be centered in that land, and in which we work together based on a 'relational culture'" (Powell and Maldonado 2017). Melanie Yazzie (Diné) and Cutcha Risling Baldy (Hupa, Yurok, Karuk) foreground a "radical relationality," which centers Indigenous understandings of relationship/relatedness/reciprocity as part of a radical shift away from colonial ways of thinking and treating the land and water (see Yazzie and Risling Baldy 2018). Indigenous approaches to addressing settler colonial disruptions and the ways in which such disruptions have and continue to exacerbate, extend, and amplify the impacts of climate change are rooted in Indigenous epistemologies and Indigenous resilience.

Indigenous and Traditional Knowledges[2] (IK/TKs), which often include knowledge about interrelationships between species and interconnectivity within an ecosystem, are increasingly recognized as necessary and valuable to inform and guide climate adaptation (CTKW 2014; IPCC 2014). Traditional Ecological Knowledge (TEK) about traditional plant species and habitat composition can provide early warning or detection of invasive species and support ecological restoration (ITEP 2012). Some

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tribes are also using TEK to reintegrate traditional foods into their diets, such as the Tesuque Pueblo of New Mexico, who are reviving their Indigenous agricultural techniques (Viles 2011). Others, such as the Karuk Tribe (2010), the North Fork Mono (Long et al. 2017; Goode et al 2018), and the Mountain Maidu in California (Middleton 2012), use TEK to guide resource management efforts.

Building on generations of accrued knowledge, some tribes use fire to resist the impacts of climate change, increase ecosystem resilience, manage crops, and enhance productivity of significant traditional food sources and culturally important species (Voggesser et al. 2013; Norgaard 2014a, 2014b; Vinyeta and Lynn 2013). Fire is traditionally used as a central tool in social, cultural, and spiritual practices. For example, fire enhances three-quarters of Karuk traditional food and culturally important species (Norgaard et al. 2016). Over the past hundred years, US policy approached wildfire mitigation through wildfire suppression and exclusion (Norton-Smith et al. 2016). In the Southwest, tribes, pueblos, agencies, and organizations are reinvigorating Indigenous burning practices to mitigate the increasing threat of fire under current conditions and projected climate changes.

Traditional burning practices restore natural habitats, reduce hazardous forest fire fuel loads, and protect culturally important plants such as hazel and beargrass for basketweaving, medicinal plants, traditional food sources, and animal species (Middleton 2012; Lake and Long 2014; Norgaard 2014a, 2014b; Yurok Today 2014a; Long et al. 2017, 2016; Goode et al. 2018). Such practices not only reduce the threat of major fires by thinning densely stocked forests, but also increase grasslands, thereby preserving groundwater that would be taken up by the succession of woody plants. While the impacts of floral changes will vary depending upon other climatic factors, such as changes in precipitation, practicing traditional land stewardship may contribute to offsetting these impacts by stabilizing or increasing the amount of groundwater available by maintaining meadows (Scott et al. 2014).

Utilizing Indigenous and Tribal knowledge and management principles to guide the regular use of fire on the landscape can both mitigate against the damaging risks of spreading wildfires and protect public and tribal trust resources as the impacts of climate change expand (Norgaard 2014b; Norgaard et al. 2016). The Yurok tribal and community members in Northwest California, for instance, have formed the Cultural Fire Management Council (CFMC) to bring fire back to the landscape as a form of restoration (Yurok Today 2014a). Through the CFMC, the Yurok Tribe, in partnership with the Nature Conservancy Fire Learning Network, Firestorm Inc., Yurok Forestry/Wildland Fire, the Northern California Indian Development Council, and the US Forest Service, is reinvigorating

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their cultural burning practices. The collaboration is also designed to train the Yurok Wildland Fire crew through the Prescribed Fire Training Exchange (TREX), a training exchange program between firefighters from federal and state agencies, nongovernmental organizations, and the tribe's fire crew (FLN 2014; Yurok Today 2014a; TREX 2017). "Restoration of the land means restoration of the people," said Margo Robbins, the CFMC president. "Returning fire to the land enables us to continue the traditions of our ancestors" (Yurok Today 2014a).

Some tribes in the Southwest have also developed climate adaptation plans. The Yurok Tribe and the Gila River Indian Community have, for example, partnered with the Institute for Tribal Environmental Professionals, and the Tohono O'odham Nation collaborated with the University of Arizona's Center for Climate Adaptation Science and Solutions, becoming among the first tribes in the region to develop climate adaptation and resiliency plans. The Navajo Nation has collaborated with outside scientists to develop the Navajo Nation Assessment (Nania et al. 2014) and used projected climate changes to inform their drought contingency plan (Bierbaum et al. 2013) and their hazard mitigation and State Wildlife Action planning processes (Navajo Nation Department of Water Resources 2003).[3] However, a notable gap is the available capacity and funds to move from planning to implementation (Black et al. 2015).

Drawing on multiple knowledge systems to inform ecological restoration within their ancestral territory, the Amah Mutsun Tribe of the central California coast has developed a land trust that is engaged in a collaborative "eco-archaeology" project with archaeologists and ecologists at the University of California–Berkeley. The partners are triangulating multiple methods to identify the historical ecology and associated management practices at the Quiroste Valley Cultural Preserve (Lightfoot and Lopez 2013). Youth members of the Amah Mutsun Native Stewardship Corps are working to remove invasive plants and restore the landscapes so that culturally important species (and the human practices associated with them) can thrive (Hannibal 2016).

A number of tribes are also working in the legal arena to protect culturally/ecologically important resources. Whether applied to mining, agriculture, or residential development, western water-using groups have become increasingly dependent on groundwater, and "with the effects of climate change looming, it is highly likely that tribes will [also] become increasingly dependent on groundwater" (Irwinsky 2014–15: 565). Until the 2015 and 2017 rulings in favor of tribes in *Agua Caliente Band of Cahuilla Indians v. Coachella Valley Water District*, the courts were largely silent on whether tribes had rights to groundwater that were the same as the surface rights confirmed in *Winters v. US* (1908) (Irwinsky 2014–15). Follow-

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ing *Agua Caliente*, tribes with *Winters* rights also have affirmed groundwater rights, including rights to ensure adequate quality and quantity of groundwater. Such a clarification of tribal jurisdiction is increasingly important in an era of uncertain water availability due to climatic change. Tribes also continue to challenge established water doctrines that have long ignored both tribes' responsibilities (Wildcat 2009; Tonino 2016) and rights to water. In California, the North Coast region (Region 1) of the State Water Resources Control Board (CA-SWRCB) was the first region to recognize Tribal Cultural and Subsistence uses of water as formal beneficial uses (see Reed, Middleton Manning, and Martinez 2020), and tribal representatives and allies are working to expand that category to SWRCB regions statewide.

Meanwhile tribal leaders also continue to advocate for a human right to water and actualizing the principles of the United Nations Declaration on the Rights of Indigenous Peoples. Winnemem Wintu Chief and Spiritual Leader Caleen Sisk is working in northern California to fight the proposed raising of Shasta Dam and to encourage a sustainable solution for the return of salmon to the McCloud River watershed above the dam, citing international recognition of Indigenous peoples' rights to cultural perpetuation, which requires healthy homelands (Marcus 2015; Winnemem Wintu, n.d.). The Yurok Tribe recently recognized the rights of the Klamath River (Yurok Tribe, 2019; Yurok Today 2019), and the Yurok, Karuk, and other partners continue to work toward the removal of dams on the lower Klamath River, which would be the largest dam removal project in US history (Flaccus 2020; see also KRRC 2018). Water throughout the southwestern United States has long been central to the conveyance and processing of minerals and fossil fuels within Indian territory. While policies such as the Indian Mineral Leasing Act have encouraged various tribes' dependence on fossil fuel resources (Voggesser 2010), and extraction has created energy sacrifice zones across southwestern tribal territories in particular (Smith and Frehner 2010), tribes across the southwestern US especially are leading the way in using renewable energy sources (Powell and Long 2010) and resisting the imposed limitations of western water law to reinvigorate Indigenous water stewardship (Curley 2019; Nolan 2019).

A number of tribes are employing solar, wind, geothermal, and biomass to meet their energy needs (EIA 2016). The Tonto Apache Tribe in Arizona has undertaken a renewable energy initiative to build a 249-kilowatt solar photovoltaic system for the tribe's Mazatzal Hotel on the tribe's reservation (Office of Indian Energy Policy and Programs 2015b). Yoeme at the US-Mexico border are working to develop the second largest solar array on a reservation (Black et al. 2015). The Southern Ute Tribe in Colorado has established a facility to make fuel from algae, which is grown adjacent

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to a natural gas–processing facility on the reservation (ICMN 2010). In California, the Ramona Band of Cahuilla has established a microgrid to utilize renewable resources to meet all of their energy needs, becoming the first reservation in the US to be completely off grid. Also in California, the Campo Kumeyaay Nation was the first tribe in the United States to develop a utility-scale wind project on land leased from the tribe (EIA 2016).[4] In New Mexico, Santo Domingo Tribe received a grant in 2015 to install a 115-kilowatt solar PV system, which will power the tribe's water pump and water treatment facility (USDOE 2015). Jemez Pueblo in New Mexico has initiated renewable energy projects (including solar and geothermal) and energy efficiency and planning throughout the Pueblo (ITEP 2012). Fort McDowell Yavapai Nation in Arizona is initiating solar power projects (ITEP 2013a). Santa Ynez Band of Chumash Indians in Southern California has developed projects to work toward energy independence based on renewable energy sources, and the Chumash Casino is focused on developing green initiatives such as a roof liner on the casino to absorb heat and reduce the energy required to maintain a comfortable temperature in the building (ITEP 2013b). NativeSun (Hopi Nation) has installed hundreds of solar units around the region; Native American Photovoltaics has installed dozens of solar systems for homes previously without electricity on the Navajo Reservation; the Campo and Viejas Bands of Kumeyaay people in Southern California, in partnership with Superior Energy LLC, established a reservation-based commercial wind farm. The Blue Lake Rancheria Tribe in California has established a "first-of-a-kind biogas fuel cell system," fueled by wood waste from timber harvesting (EIA 2016). Further, the tribe was named a climate action champion in 2015–16 for implementing innovative climate actions such as an "all-of-the-above renewable strategy of transportation, residential, and municipal renewable energy projects" (Office of Indian Energy Policy and Programs 2015a).

Some tribes have also signed agreements to sell energy to outside entities to help meet their energy demands. Moapa Paiute's 250-megawatt solar project on the Moapa River Indian Reservation in Nevada has a power purchase agreement to sell solar power to the Los Angeles Department of Water and Power (Lott 2014). However, within the context of nontribal (both private as well as federal) ownership of tribal homelands, inadequate cultural resource protection laws, and short-term economic incentives, tribes are also at risk of being negatively affected by renewable energy projects. There are instances, in southern California and Nevada in particular, of tribal lands being encroached upon and desecrated by solar and wind projects (Maynard 2014; Sahagun 2014).

In addition to finding culturally appropriate ways to produce energy as climate change effects encroach upon tribal homelands, some tribes are

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also developing projects to sequester emissions from greenhouse gases, often in collaboration with surrounding states. States including California have recognized the importance of keeping carbon sequestered in high-carbon environments, such as temperate mixed coniferous and redwood forests (McKittrick 2014; Middleton Manning and Reed 2019). One mechanism to incentivize carbon sequestration is the carbon credit market, which is either voluntary or mandatory and operates on regional, national, and international scales. On the international level, REDD (Reducing Emissions from Deforestation and Forest Degradation) is a mechanism that provides countries financial incentives to reduce emissions through forest management options. Unfortunately, implementing these incentives often involves privatized land grabs (see Indigenous Environmental Network n.d.; Lohmann 2006). Market-based carbon sequestration regimes can be problematic for Indigenous peoples if their land rights are not recognized or if they are not centrally involved in project design, planning, development, and implementation (Campbell 2015–16). "Because [these] initiatives essentially turn forests into commodities by drawing financial resources into developing countries, land tenure rights are crucial to determining who has the authority to accept or reject [carbon credit] projects, who can manage the forests, and who is ultimately the financial beneficiary of the program" (Campbell 2015–16: 206).

Two tribes in California (Yurok and Round Valley) have developed carbon-offset projects on their forestlands under California's robust cap-and-trade program. These nations have asserted their sovereignty and developed these projects to support tribally led restoration and stewardship. As a result of their carbon-offset projects, the Yurok Tribe has placed over fifty thousand acres of ancestral land back into tribal ownership after nearly one hundred years (Middleton and Reed 2019). Former Yurok Tribal Chairman Thomas O'Rourke described why the tribe has chosen to participate in the carbon market: "To not only do our part with global warming, but to preserve our way of life so that our future generations can see the pristine forest that our parents' grandparents saw" (Barboza 2014; see also Yurok Today 2014b).

Conclusion

Experiencing impacts to their health, livelihoods, economies, subsistence, cultural resources, lifeways, and spiritual well-being, Indigenous communities, nations, and peoples in the southwestern United States are leading resiliency efforts and innovative adaptation and mitigation actions

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to address the climate crisis for current generations and those to come. Indigenous leadership in climate resilience is changing not only adaptation processes and implementation but also the very definitions of related concepts like food security. For example, an expanded definition of food security in a context of ongoing colonial disruption and climatic change accounts for the importance of the availability of traditional foods:

> Food security means more than simply whether or not sufficient food is being produced or harvested in a "one-size-fits-all" food-to-nutrition relationship, and expands to include all of the various ways in which a food system supports health in the biophysical, social, and ecological dimensions. These include the importance of culturally preferred foods. . . . wild fish and game . . . are important for food security . . . because they are important to the preservation and transmission of traditions and cultural practices, for the maintenance of social networks and interpersonal relationships, and for supporting individual and community sense of self-worth and identity. (Gerlach and Loring 2013)

As such, achieving food security means securing Indigenous land and water rights and responsibilities, as both land and water are transforming in unforeseen ways.

To address the climate crisis in a way that is attentive to environmental and climate justice and Indigenous rights, it is vital to bring multiple knowledges and knowledge holders together. Collaborations and partnerships between Indigenous knowledge holders and Indigenous and non-Indigenous climate and earth scientists, while ensuring the safeguarding of sensitive information (Maldonado et al. 2016; Tonino 2016; Indigenous Science Statement 2017; Rising Voices 2017), can focus beyond short-term economic gain and toward long-term solutions (Smith Jr. et al. 2014). Recognizing tribal land and water rights and centering Indigenous leadership in project design and implementation are essential to devising mitigation and adaptation projects that support Indigenous lifeways and livelihoods (Campbell 2015–16). Climate adaptation collaborations are most effective when they incorporate spiritual and cultural perspectives on mitigation and adaptation pathways (Powell and Maldonado 2017). It is beyond time to listen, learn, and act in response to the climate crisis, guided by the deep place-based knowledges of those who, despite generations of trauma and centuries of violence, have survived, adapted, and continue to be resilient.

Julie Maldonado is associate director for the Livelihoods Knowledge Exchange Network (LiKEN), a nonprofit link-tank for policy-relevant research toward postcarbon livelihoods and communities. In this capacity, she serves as codirector of the Rising Voices Center for Indigenous and

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Earth Sciences, which facilitates intercultural, relational-based approaches for understanding and adapting to extreme weather and climate change. Dr. Maldonado is also a lecturer in the University of California-Santa Barbara's Environmental Studies Program. She previously worked for the US Global Change Research Program and is an author on the 3rd, 4th, and 5th US National Climate Assessments. As a public anthropologist, her work focuses on climate adaptation, disasters, displacement, resettlement, and environmental and climate justice. Her recent book, *Seeking Justice in an Energy Sacrifice Zone: Standing on Vanishing Land in Coastal Louisiana*, emerged from years of collaborative work with tribal communities in coastal Louisiana experiencing and responding to repeat disasters and climate chaos. The book was released shortly before the release of her coedited volume, *Challenging the Prevailing Paradigm of Displacement and Resettlement: Risks, Impoverishment, Legacies, Solutions*.

Beth Rose Middleton is a professor at the Department of Native American Studies, University of California, Davis. Her research centers on Native environmental policy and Native activism for site protection using conservation tools, and her broader research interests include intergenerational trauma and healing, rural environmental justice, digital humanities, and Indigenous analyses of climate change. She received her BA in Nature and Culture from UC Davis and her PhD in Environmental Science, Policy, and Management from UC Berkeley. She has written two books: *Trust in the Land: New Directions in Tribal Conservation* (University of Arizona Press, 2011), on Native applications of conservation easements, and *Upstream: Trust Lands and Power on the Feather River* (University of Arizona Press, 2018), on the history of Indian allotment lands at the headwaters of the California State Water Project.

Notes

1. The Pyramid Lake Paiute Tribe's "Paiute name is *Kuyuidokado*, or cui-ui eaters, named after the Pyramid Lake sucker fish" (Gautam et al. 2013).
2. Following the "Guidelines for Considering Traditional Knowledges in Climate Change Initiatives" (CTKW 2014), we use the plural "knowledges."
3. For a list of US Bureau of Indian Affairs–funded Tribal resilience programs across the Southwest, see https://biamaps.doi.gov/tribalresilience/.
4. For further information, see Map: The US Department of Energy Office of Indian Energy supported energy efficiency and renewable energy projects, https://energy.gov/indianenergy/maps/tribal-energy-projects-database.

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