

Tribes and Indigenous Peoples

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Key Message 1

Wind River Indian Reservation students collect seeds for a land restoration project.

Indigenous Livelihoods and Economies at Risk

Climate change threatens Indigenous peoples' livelihoods and economies, including agriculture, hunting and gathering, fishing, forestry, energy, recreation, and tourism enterprises. Indigenous peoples' economies rely on, but face institutional barriers to, their self-determined management of water, land, other natural resources, and infrastructure that will be impacted increasingly by changes in climate.

Key Message 2

Physical, Mental, and Indigenous Values-Based Health at Risk

Indigenous health is based on interconnected social and ecological systems that are being disrupted by a changing climate. As these changes continue, the health of individuals and communities will be uniquely challenged by climate impacts to lands, waters, foods, and other plant and animal species. These impacts threaten sites, practices, and relationships with cultural, spiritual, or ceremonial importance that are foundational to Indigenous peoples' cultural heritages, identities, and physical and mental health.

Key Message 3

Adaptation, Disaster Management, Displacement, and Community-Led Relocations

Many Indigenous peoples have been proactively identifying and addressing climate impacts; however, institutional barriers exist in the United States that severely limit their adaptive capacities. These barriers include limited access to traditional territory and resources and the limitations of existing policies, programs, and funding mechanisms in accounting for the unique conditions of Indigenous communities. Successful adaptation in Indigenous contexts relies on use of Indigenous knowledge, resilient and robust social systems and protocols, a commitment to principles of self-determination, and proactive efforts on the part of federal, state, and local governments to alleviate institutional barriers.

Executive Summary

Indigenous peoples in the United States are diverse and distinct political and cultural groups and populations. Though they may be affected by climate change in ways that are similar to others in the United States, Indigenous peoples can also be affected uniquely and disproportionately. Many Indigenous peoples have lived in particular areas for hundreds if not thousands of years. Indigenous peoples' histories and shared experience engender distinct knowledge about climate change impacts and strategies for adaptation. Indigenous peoples' traditional knowledge systems can play a role in advancing understanding of climate change and in developing more comprehensive climate adaptation strategies.

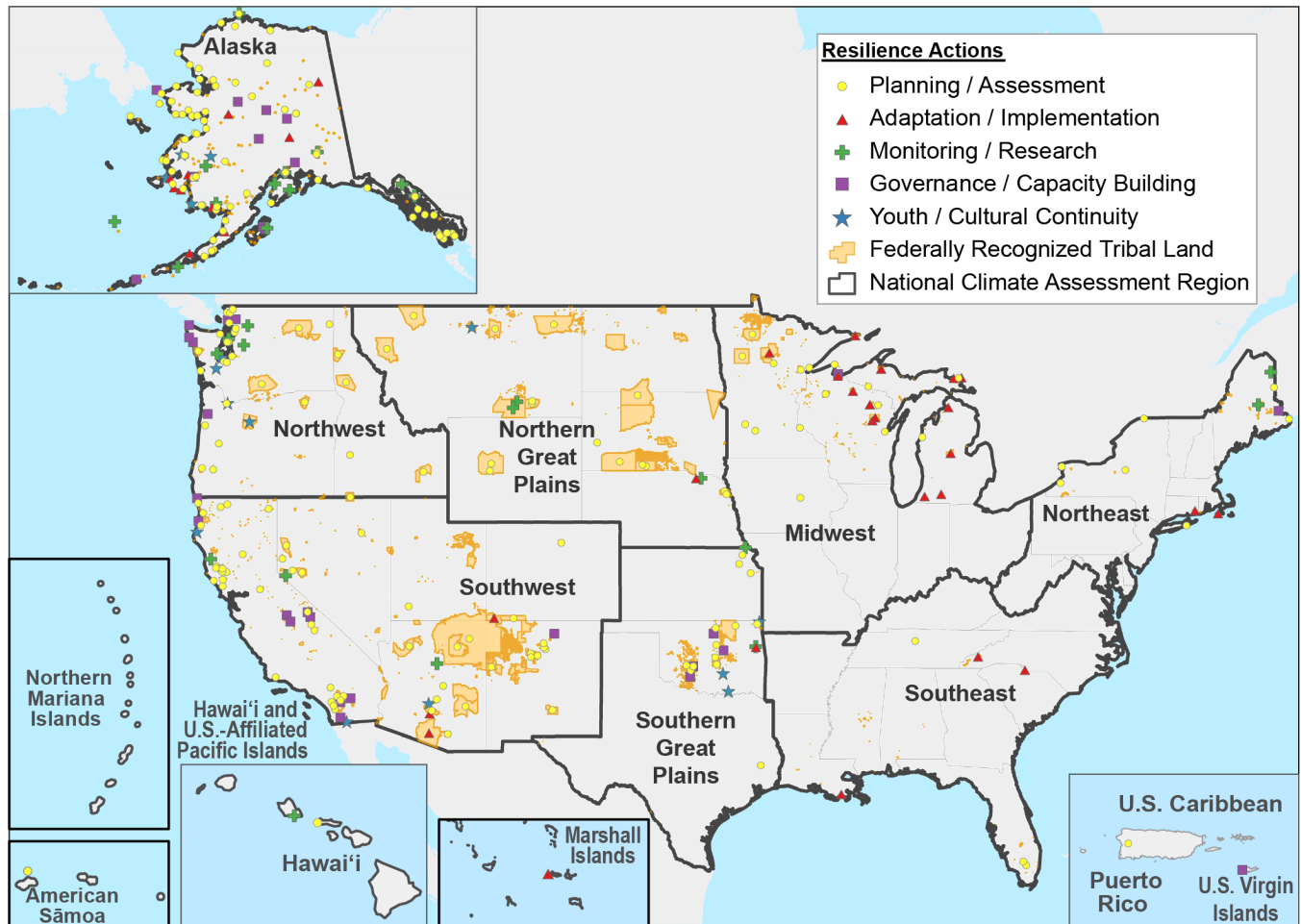
Observed and projected changes of increased wildfire, diminished snowpack, pervasive drought, flooding, ocean acidification, and sea level rise threaten the viability of Indigenous peoples' traditional subsistence and commercial activities that include agriculture, hunting and gathering, fisheries, forestry, energy, recreation, and tourism enterprises. Despite institutional barriers to tribal self-determination stemming from federal trust authority over tribal trust lands, a number of tribes have adaptation plans that include a focus on subsistence and commercial economic

activities. Some tribes are also pursuing climate mitigation actions through the development of renewable energy on tribal lands.

Climate impacts to lands, waters, foods, and other plant and animal species threaten cultural heritage sites and practices that sustain intra- and intergenerational relationships built on sharing traditional knowledges, food, and ceremonial or cultural objects. This weakens place-based cultural identities, may worsen historical trauma still experienced by many Indigenous peoples in the United States, and adversely affects mental health and Indigenous values-based understandings of health.

Throughout the United States, climate-related disasters are causing Indigenous communities to consider or actively pursue relocation as an adaptation strategy. Challenges to Indigenous actions to address disaster management and recovery, displacement, and relocation in the face of climate change include economic, social, political, and legal considerations that severely constrain their abilities to respond to rapid ecological shifts and complicate action toward safe and self-determined futures for these communities.

Indigenous Peoples' Climate Initiatives and Plans



Many Indigenous peoples are taking steps to adapt to climate change impacts. Search the online version of this map by activity type, region, and sector to find more information and links to each project: <https://biamaps.doi.gov/nca/>. To provide feedback and add new projects for inclusion in the database, see: <https://www.bia.gov/bia/ots/tribal-resilience-program/nca/>. Thus far, tribal entities in the Northwest have the highest concentration of climate activities (Ch. 24: Northwest). For other case studies of selected tribal adaptation activities, see both the Institute for Tribal Environmental Professionals' Tribal Profiles,¹ and Tribal Case Studies within the U.S. Climate Resilience Toolkit.^{2,3} From Figure 15.1 (Source: Bureau of Indian Affairs).

State of the Sector

Indigenous peoples in the United States are diverse and distinct political and cultural groups and populations. Though they may be affected by climate change in ways that are similar to others in the United States, Indigenous peoples can also be affected uniquely and disproportionately. Many Indigenous peoples have lived in particular areas for hundreds if not thousands of years, and their cultures, spiritual practices, and economies have evolved to be adaptive to local seasonal and interannual environmental changes.⁴ Thus, Indigenous knowledge systems differ from those of non-Indigenous peoples who colonized and settled the United States, and they engender distinct knowledge about climate change impacts and strategies for adaptation.^{4,5,6} Indigenous knowledges, accumulated over generations through direct contact with the environment, broadly refer to Indigenous peoples' systems of observing, monitoring, researching, recording, communicating, and learning and their social adaptive capacity to adjust to or prepare for changes. One of these knowledge systems that is often referred to in the context of climate change is traditional ecological knowledge, which primarily focuses on the relationships between humans, plants, animals, natural phenomena, and the landscape.

A growing number of tribal governments and intertribal organizations are developing climate adaptation plans, with some in the early stages of implementation. Many Indigenous peoples support their own technical staff who study and manage broad sectoral programs and issues, which now include climate change adaptation planning and implementation. To this end, Indigenous peoples regularly collaborate with climate scientists and other professionals working in academic, governmental, and nongovernmental organizations, especially in the use of downscaled (local-scale) climate

information and tools that have become more available in recent years. While not comprehensive, Figure 15.1 identifies over 800 activities across all regions featured in this report that Indigenous peoples and their partners have undertaken in the last decade. This map catalogues several broad types of adaptation projects: planning and assessment, adaptation and implementation, monitoring and research, governance and capacity building, and youth engagement and cultural continuity. Collectively, these activities span many sectors and all regions of the country. Projects are primarily planning related and include adaptation planning, vulnerability assessments, and professional development to increase the skills and capacity of tribal staff and management.

These actions in response to climate change occur in a broader context in which Indigenous peoples today, including federally and non-federally recognized tribes, are continuing to seek and exercise self-determination to define their own political status and to freely pursue economic, social, and cultural development. Limits to Indigenous self-determined action can intensify vulnerability to climate change in many cases. In the 19th century, the United States established a trust responsibility to federally recognized tribes, which is a legal and fiduciary obligation to honor their treaty rights and support tribal self-determination. The trust responsibility is meant to include financial support and the provision of essential services, such as education, health, public safety, and environmental protection. However, trust responsibility also authorizes the U.S. Government to manage tribal lands and the revenues generated from these lands. This can limit self-determination in cases where the U.S. Government's management of tribes' trust assets lacks accountability or does not adequately fulfill the federal policy requirement of consultation with tribes on a sovereign government-to-government basis.

Indigenous Peoples' Climate Initiatives and Plans

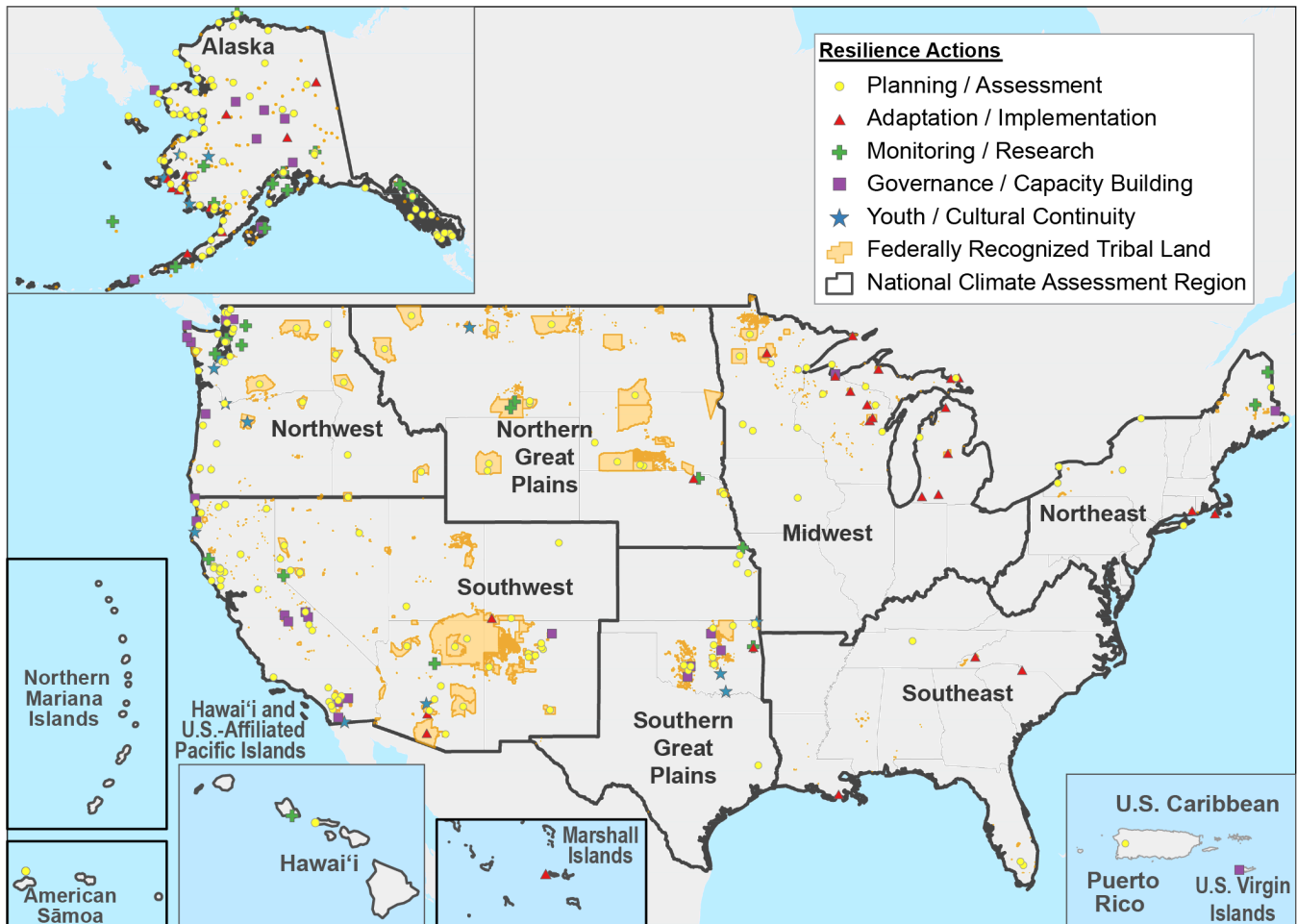


Figure 15.1: Many Indigenous peoples are taking steps to adapt to climate change impacts. Search the online version of this map by activity type, region, and sector to find more information and links to each project: <https://biamaps.doi.gov/nca/>. To provide feedback and add new projects for inclusion in the database, see: <https://www.bia.gov/bia/ots/tribal-resilience-program/nca/>. Thus far, tribal entities in the Northwest have the highest concentration of climate activities (Ch. 24: Northwest). For other case studies of tribal adaptation activities, see both the Institute for Tribal Environmental Professionals' Tribal Profiles,¹ and Tribal Case Studies within the U.S. Climate Resilience Toolkit.^{2,3} Source: Bureau of Indian Affairs.

Non-federally recognized tribes, Native Hawaiians, and other Indigenous peoples also have rights to self-determination to protect their traditional knowledges, cultures, and ancestral lands, while developing their economies and providing community services; but they do so without reservation lands, treaty rights, and federal provision of essential services, among other rights, authorities, and capacities to which federally recognized tribes can appeal.

This chapter expands on the Indigenous Peoples chapter from the Third National Climate Assessment⁷ and on Indigenous contributions to earlier

assessments, with a focus on three major themes as expressed in the Key Messages that were not discussed in previous assessments in as much detail. This chapter recognizes that Indigenous communities of the United States represent diverse cultures, histories, governments, and environments and that their individual experiences with climate change will differ. In addition, this chapter attempts to provide more information than previous assessments about Indigenous issues in the Pacific Islands and the Caribbean regions, although in some cases, especially for the Caribbean, the literature is sparse. Thus, uniform, national-scale quantitative metrics of

risk across this broad spectrum of conditions are not available. Nevertheless, Indigenous peoples and their partners are building comprehensive understandings of local climate change risks and taking steps to adapt to these threats.

Key Message 1

Indigenous Livelihoods and Economies at Risk

Climate change threatens Indigenous peoples' livelihoods and economies, including agriculture, hunting and gathering, fishing, forestry, energy, recreation, and tourism enterprises. Indigenous peoples' economies rely on, but face institutional barriers to, their self-determined management of water, land, other natural resources, and infrastructure that will be impacted increasingly by changes in climate.

While the lands, waters, and other natural resources of Indigenous peoples hold sacred cultural significance, they also play a principal role in ensuring the viability of these communities' economies and livelihoods.^{5,8} Tribal trust lands provide habitat for more than 525 species listed under the Endangered Species Act, and more than 13,000 miles of rivers and 997,000 lakes are located on federally recognized tribal lands.⁹ For many tribes, despite this endowment of natural resources, median household income is only 69% of the national average median income.¹⁰ Challenges to economic development for federally recognized tribes are in part related to institutional barriers to tribal self-determination stemming from federal trust authority over tribal trust lands.^{8,11} Due to past federal policies, including the Dawes Act (1887) and Indian Reorganization Act (1934), most reservation lands today constitute a checkerboard pattern of trust and fee-simple (private) land ownership, highly fractionated

government trust lands with many owners, and trust lands subject to ongoing federal oversight in resource management decisions.^{12,13,14,15} These issues are complicated further when multiple or overlapping federal, state, or local government jurisdictions are involved.¹⁶

Historical and ongoing federal oversight of natural resource management on tribal lands can, in some cases, hinder growth in tribal and individual natural resource-based business enterprises, because tribes lack the autonomy to determine their own property rights and related institutions.^{17,18} Similar critiques of historic and contemporary U.S. policy have been identified in studies of Indigenous climate change adaptation.^{19,20} Non-federally recognized tribes lack legal status to qualify for federal funding and economic development support, though some are eligible for state support.²¹ Funding limitations are often identified as a barrier to the planning or implementation of climate adaptation or mitigation actions,²² which suggests that increased economic revenues could create opportunities for tribes to choose to pursue climate actions.

Many Indigenous peoples continue to express their cultural relationships with ancestral lands through traditional subsistence economies. Such economies rely on local natural resources for personal use (such as food, shelter, fuel, clothing, tools, transportation, and arts and crafts) and for trade, barter, or sharing. Climate change threatens these delicately balanced subsistence networks by, for example, changing the patterns of seasonal timing and availability of culturally important species in traditional hunting, gathering, and fishing areas^{4,5,7,22,23,24,25,26,27,28,29,30,31,32} Each of the Fourth National Climate Assessment's regional chapters includes at least one example of climate impacts or adaptation related to Indigenous subsistence species or practices.

Most Indigenous peoples across all regions of the United States pursue a mix of traditional subsistence and commercial sector activities that include agriculture, hunting and gathering, fisheries, forestry, energy, recreation, and tourism enterprises.^{5,22,33,34,35} Observed and projected changes of increased wildfire, diminished snowpack, pervasive drought, flooding, ocean acidification, and sea level rise (Ch. 2: Climate) threaten the viability of each of these enterprises.^{22,29,33,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52} Tribal casino properties, for example, often include water-dependent recreational amenities that, due to pervasive drought, are impacted by changes to local water regimes,⁵³ and some tribes account for this in their adaptation plans, such as the Confederated Salish and Kootenai Tribes⁵⁴ and the Lummi Nation.⁵⁵ In addition, Indigenous agriculture is already being adversely affected by changing patterns of flooding, drought, dust storms, and rising temperatures, with future projections varying by region but indicating increased soil erosion and irrigation water demand and decreased crop quality and animal herd sizes (Ch. 25: Southwest, KM 4 and 6).^{22,41,52,56,57,58} Some tribes include consideration of subsistence and commercial economic resources in their adaptation plans. For example, the 1854 Treaty Authority Adaptation Plan,⁵⁹ which includes the Bois Forte, Fond du Lac, and Grand Portage Tribes, provides detailed adaptation strategies customized to protect and sustain walleye, sturgeon, moose, and wild rice, among others (Ch. 21: Midwest). Similarly, the Confederated Tribes of the Umatilla Indian Reservation⁶⁰ have identified climate risks to salmon, elk, deer, roots, and huckleberry habitat (Ch. 24: Northwest, KM 2).

Federal and state legal frameworks and regulatory actions can compound physical climate change stressors on Indigenous peoples' subsistence economies and act as a barrier to climate change adaptation. For example, federal and state fish and wildlife regulations, such as endangered species listings, are meant to respond to species



Members of the Oglala Lakota Nation plant climate-resilient tree species on the Pine Ridge Indian Reservation in South Dakota. Photo credit: © Alex Basaraba (www.alexbasaraba.com).

population declines that can be exacerbated by climate change (Ch. 7: Ecosystems), but they can further stress Indigenous subsistence economies that have traditionally relied on those species.^{61,62,63} Such regulatory actions taken without the input of Indigenous peoples can limit traditional sources of income, such as arts and crafts that are part of Indigenous economies. For example, some Alaska Natives utilize skins, furs, and walrus tusks to support local subsistence economies and to produce clothing and crafts that support local tourism.^{64,65}

Another recognized barrier to economic self-determination and climate adaptation for federally recognized tribes with resource constraints is the costly and lengthy process to quantify, secure, and use appropriated water rights.^{7,41,53,66,67,68} This is particularly the case in the arid western United States, where the majority of reservation land acreage is located and where prior appropriation doctrine is the primary mechanism for allocating scarce water resources.⁶⁶ As water becomes more scarce and regional demands increase, the quantification of water rights is viewed by many as necessary to design and plan adaptation strategies that secure water for various uses: cultural, municipal, recreational, agricultural, fisheries, and aquatic resources, among others.^{4,19,58,66,67,69,70,71} To date, approximately 30 reservations have

engaged in water rights settlements,⁷² and while research shows that water rights quantification can positively affect tribal economies, additional analysis is necessary to better understand these effects.⁶⁶

Infrastructure and linked systems that support Indigenous economies and livelihoods are at risk from more frequent or intense heavy downpours, floods, heat waves, wildfires, and droughts, as well as higher sea levels and storm surges.^{19,49,73} As shown in Figure 15.2, Indigenous peoples are vulnerable to infrastructure disruptions that can occur at the level of an individual household (for

example, housing and sanitary water supply); within larger regional, integrated systems (such as for power, transportation, and telecommunication) (Ch. 17: Complex Systems); or within human systems that rely on such infrastructure to provide other essential services (such as emergency medical response). This vulnerability is partly due to long-standing, unmet infrastructure needs and deferred maintenance challenges.⁷⁴ For example, many Indigenous communities lack sufficient water delivery and treatment facilities and the operating capital needed to maintain and/or improve those facilities.^{41,75,76}

Infrastructure and Economic Vulnerabilities

Household and Community Infrastructure

Many Indigenous communities struggle with poor economic conditions that limit their ability to provide adequate household and local infrastructure. For example, an estimated 12% of households lack a safe water supply or wastewater disposal.

Regional Systems Infrastructure

Many Indigenous communities are located in areas that lack robust and redundant regional systems for transportation, communication, water, and power, increasing their vulnerability to system damages and outages that disrupt businesses and incur high costs to repair.



Figure 15.2: Communities' economic potential and livelihoods rely on infrastructure and the essential services it delivers, and many tribes and Indigenous communities already face acute infrastructure challenges that make them highly vulnerable to climate impacts.²² Indigenous peoples along the coasts and in the islands, the Southwest, and Alaska have experienced the most extensive infrastructure-related impacts thus far (Ch. 8: Coastal; Ch. 20: U.S. Caribbean; Ch. 25: Southwest; Ch. 26: Alaska; Ch. 27: Hawai'i & Pacific Islands). Source: USGCRP.

Indigenous peoples also have unmet needs and challenges in the energy sector. The evolution of the federal trust doctrine, and its associated timely and costly regulatory oversight of resource use on tribal trust lands, challenges federally recognized tribes' ability to secure outside investments in energy and related infrastructure development (Ch. 4: Energy, KM 3; Ch. 29: Mitigation).^{77,78} In addition, non-tribal entities operate the majority of energy development on tribal land, reducing opportunities for tribal workforce development and capacity building for self-directing future energy projects.⁷⁹ Still, energy development, particularly renewable energy, that is implemented in accordance with Indigenous values holds promise as a source of revenue, employment, and economic self-determination.^{22,80} While not all Indigenous communities support energy development due to concerns about cultural and environmental impacts, there are a number of examples of growing interest in renewable energy.⁷⁹ The Pueblo of Jemez, for example, has developed the Nation's first utility-scale solar project on tribal lands, and other tribes view renewable energy as a key strategy for climate mitigation.²² Tribes have also identified small-scale distributed electricity generation systems and energy efficiency as supporting their climate adaptation goals through increased energy independence.^{22,79}

Key Message 2

Physical, Mental, and Indigenous Values-Based Health at Risk

Indigenous health is based on interconnected social and ecological systems that are being disrupted by a changing climate. As these changes continue, the health of individuals and communities will be uniquely challenged by climate impacts to lands, waters, foods, and other plant and animal species. These impacts threaten sites, practices, and relationships with cultural, spiritual, or ceremonial importance that are foundational to Indigenous peoples' cultural heritages, identities, and physical and mental health.

Physical health risks and impacts to Indigenous peoples are the same as those faced by the general U.S. population (Ch. 14: Human Health); however, certain factors, known as the social determinants of health, are unique and contribute to the increased vulnerability of Indigenous peoples to adverse and potentially severe or fatal health outcomes (Box 15.1). Conventional Western science approaches to measuring and analyzing Indigenous health, adaptive capacity, health disparities, and environmental justice issues typically do not capture many of the key elements of health and resilience that are important to Indigenous populations.^{81,82,83,84,85,86} These elements emphasize non-physiological aspects of health, which include concepts related to community connection, natural resources security, cultural use, education and knowledge, self-determination and autonomy, and resilience.^{83,84} For example, the Swinomish Indian Tribal Community has used shellfish beds and shoreline armoring as indicators to evaluate health in the context of a changing climate.⁸¹

Box 15.1: Social Determinants of Indigenous Health

A number of health risks are higher among Indigenous populations due in part to historic and contemporary social, political, and economic factors that can affect conditions of daily life and limit resources and opportunities for leading a healthy life.⁸⁷ Many Indigenous peoples still experience historical trauma associated with colonization, removal from their homelands, and loss of their traditional ways of life, and this has been identified as a contributor to contemporary physical and mental health impacts.^{88,89} Other factors include institutional racism, living and working circumstances that increase exposure to health threats, and limited access to healthcare services.^{87,89} Though local trends may differ across the country, in general, Indigenous peoples have disproportionately higher rates of asthma,⁹⁰ cardiovascular disease,^{91,92,93,94} Alzheimer's disease or dementia,^{95,96} diabetes,⁹⁷ and obesity.⁹³ These health disparities have direct linkages to increased vulnerability to climate change impacts, including changes in the pollen season and allergenicity, air quality, and extreme weather events (Ch. 14: Human Health).⁹⁸ For example, diabetes prevalence within federally recognized tribes is about twice that of the general U.S. population.⁹⁷ People with diabetes are more sensitive to extreme heat and air pollution, and physical health impacts can also influence mental health.⁹

Indigenous peoples have a unique and interconnected relationship with the natural environment that is integral to their place-based social, cultural, and spiritual identity; intangible cultural heritage (traditions or living expressions transmitted and inherited through generations); and subsistence practices and livelihoods.^{61,82,87,99,100} Climate change impacts to ecosystems (Ch. 7: Ecosystems) alter the relationships between humans and animals, between individuals, and within and between communities; these relationships are central to Indigenous physical, mental, and spiritual health.^{82,86,101,102} This alteration in relationships occurs when individuals, families, and communities (within and between generations) are less able or not able to share traditional knowledges about the natural environment (such as where and when to harvest or hunt), food, and ceremonial or cultural objects, among other things, because the knowledge is no longer accurate or traditional foodstuffs and species are less available due to climate change. For many Indigenous peoples, the act of sharing is fundamental to these intra- and intergenerational relationships, sustains cultural practices and shared identity, and underpins subsistence practices.^{44,103} A projected health-related consequence of reduced

or lost access to the knowledge, experiences, and relationships built on sharing is increased food insecurity for households reliant on subsistence practices.⁶¹ For example, in Alaska, changes in sea ice coverage and thickness and the timing of ice formation (Ch. 9: Oceans; Ch. 26: Alaska) can lead to decreased access to hunting and fishing areas, which can mean people are unable to access food sources (that is, loss of cultural use.⁸¹ This can then result in lost opportunity for the social components of these activities, including reduced community connection (e.g., Donatuto et al. 2014⁸¹), less food and knowledge sharing, and diminished relationship building.^{44,61}

Communities that rely on the natural environment for sustenance and livelihoods are at increased risk for adverse mental health outcomes related to climate change.¹⁰⁴ Many Indigenous communities share a focus on relationships between people and wildlife and on a respect for natural resources.^{29,81,105} Climate impacts to lands, waters, foods, and other plant and animal species undermine these relationships, affect place-based cultural heritages and identities, and may worsen the historical trauma still experienced by many Indigenous peoples.^{86,101,102} For example, in

Arctic Indigenous communities, changing wildlife and vegetation patterns are disrupting traditional and subsistence practices and have been associated with increased rates of mood and anxiety disorders; strong emotional responses; and loss of connections to homeland, social networks, and self-worth.^{82,101} Additionally, climate impacts that degrade water quality can adversely affect sacred water sources and aquatic species on which subsistence livelihoods and associated relationships are based, increasing the risk of mental health impacts in addition to the well-studied physical health concerns.^{53,71} Damage to cultural heritage sites from climate change can affect mental health through impacts to cultural, economic, and social relationships.¹⁰⁶ Media imagery and reports or stories of climate risks and vulnerability also lead to psychological trauma or increased anger, anxiety, depression, fear, and stress.¹⁰⁷ These impacts can intensify existing social stressors, such as loss of jobs and social connections, loss of social support, and family distress.^{101,104}

Climate change adaptation measures can reduce physiological vulnerability to health risks; to date, most observational evidence comes from behavioral and public health responses to extreme heat.^{108,109,110,111} Organizations including the National Indian Health Board and the Alaska Native Tribal Health Consortium have ongoing efforts to increase Indigenous adaptive capacity specifically for health. Some tribes have climate vulnerability assessments that acknowledge the role of traditional subsistence species, or First Foods, as an essential aspect of health and tribal resilience; for example, the Yurok Tribe assesses the role of salmon in community health,¹¹² and the Confederated Tribes of the Umatilla Indian Reservation⁶⁰ discuss climate risks to salmon, elk, deer, roots, and huckleberry habitat (Ch. 24: Northwest, KM 2). In the Republic of the Marshall Islands, a community-led planning

process known as Reimaanlok incorporates traditional knowledge and facilitates local self-determination to support shared goals of climate adaptation, natural resource management, and community health.⁸⁵

Key Message 3

Adaptation, Disaster Management, Displacement, and Community-Led Relocations

Many Indigenous peoples have been proactively identifying and addressing climate impacts; however, institutional barriers exist in the United States that severely limit their adaptive capacities. These barriers include limited access to traditional territory and resources and the limitations of existing policies, programs, and funding mechanisms in accounting for the unique conditions of Indigenous communities. Successful adaptation in Indigenous contexts relies on use of Indigenous knowledge, resilient and robust social systems and protocols, a commitment to principles of self-determination, and proactive efforts on the part of federal, state, and local governments to alleviate institutional barriers.

Indigenous peoples have a long and rich history of adaptation to climate variability^{1,71,113,114} that is rooted in their dynamic relationships to the natural environment.¹¹⁵ However, the ability of Indigenous peoples to anticipate and respond to climate change is affected by economic, social, political, and legal considerations that severely constrain their abilities to consider and respond to rapid ecological shifts. Despite the many examples of Indigenous peoples undertaking climate vulnerability assessments and adaptation planning (see Figure 15.1 for

links to information on current adaptation efforts), as the pace of ecological changes increases with climate change, and sociopolitical obstacles to implementing responses continue to exist, there are challenges and barriers to adaptation.^{116,117}

Incorporating Indigenous Knowledges in Adaptation

Indigenous knowledge systems can play a role in advancing understanding of climate change and in developing more comprehensive climate adaptation strategies,^{6,7,118} in part because they focus on understanding relationships of interdependency and involve multigenerational knowledge of ecosystem phenology (the study of cyclic and seasonal natural phenomena)^{6,119,120} and ecological shifts.^{25,121} For example, Inupiat residents in Alaska have identified cyclical patterns of coastal erosion, and their understanding of how quickly and in which direction wind and wave energy reaches the coast can help communities prone to flooding.¹²² Indigenous adaptation planning, including considerations of issues such as flooding and water rights, benefits from a greater focus on participatory planning in natural resource management.^{19,22,123,124,125,126} This planning incorporates local knowledge and values from conception through implementation^{127,128,129} in ways that ensure the protection of Indigenous knowledges and Indigenous peoples' rights not to share sensitive information.²² In this way, traditional ways of knowing are contributing to sustainable land management practices under changing environmental conditions.^{130,131,132,133} For example, the Wabanaki Nations of Maine work closely with local researchers, foresters, and landowners as part of the Cooperative Emerald Ash Borer Project to precisely catalogue and map the decline of the native black ash deciduous trees on which these communities rely for economic, cultural, and spiritual practices. The cooperative leverages Indigenous knowledge of environmental history as

it relates to the invasive emerald ash borer beetle.¹³¹ Additionally, the Nez Perce Tribe employs Indigenous knowledges as part of an initiative to enhance local salmon populations that have been in decline (Ch. 24: Northwest, KM 2). For more on Indigenous knowledges, see the regional chapters in this assessment.

Limited Access to Traditional Territory and Decision-Making

Historically in North America, Indigenous peoples occupied vast amounts of land and had access to a wide range of natural resources. Under these conditions, high mobility provided a robust response to changing environmental conditions,¹²² but such options today are limited or nonexistent. Multiple considerations, such as whether tribes have corporate status, federal recognition, reservation lands, off-reservation resource rights, specified water rights, access to Ceded Territories and traditional resources, among many others, affect how Indigenous communities develop and implement climate adaptation efforts.²² Specifically, limitations on the abilities of tribal individuals, communities, businesses, and governing bodies to manage land, participate in policymaking, and access various resources can act as barriers to climate adaptation efforts. Federally recognized tribes have access to a distinct array of resources, programs, and legal authorities, yet they still face numerous limitations in their abilities to implement adaptive strategies. For example, when ecosystems or species' habitats or migration routes shift due to changes in climate, tribes' rights to gather, hunt, trap, and fish within recognized areas are constrained by reservation or other legally defined borders, making adaptation more challenging.^{22,40,48,134} This is also the case when federal or state regulations fail to prioritize Indigenous peoples' access to traditional resources. Tribes with noncontiguous reservation lands can be negatively impacted by non-tribal landowners who do not support

climate adaptation efforts, and many Indigenous peoples lacking federal recognition often lack the autonomy, funding, and governmental support to address climate change.^{31,48,135,136} Because of these and other considerations, decisions regarding natural resource use are often made without appropriate consultation and collaboration with Indigenous peoples,¹⁹ a process that further inhibits local adaptive capacity.

Disaster Management

As in many communities, Indigenous peoples are experiencing climate change impacts from more frequent and severe weather events, including drought, heat waves, hurricanes, torrential downpours, and flooding (Ch. 2: Climate).¹³⁷ In recent years, the Federal Government has made amendments to disaster recovery laws that provide more autonomy to tribes in managing disaster recovery, including the Sandy Recovery Improvement Act of 2013, which grants tribes the authority to request a disaster declaration and assistance from the President, instead of relying on state authorities.¹³⁸ However, many tribes continue to face hurdles to disaster management and disaster risk reduction planning. A study of tribes' participation in the federally run and subsidized National Flood Insurance Program finds that, as of 2012, only 7% of tribal communities were participating in the program due to lack of information, limited local government capacity, and limited land jurisdiction.¹³⁹

Risk management and feasible adaptation options are also limited by fundamental issues with federal disaster funding that can be especially prohibitive for tribes. Federal programs are designed to offer extensive emergency relief after disasters have occurred, but they have only limited funding for hazard mitigation or preparation for long-term environmental change.¹⁴⁰ Most slow-onset disasters, such as erosion, are absent from the Federal

Government's primary disaster recovery legislation, the Stafford Act, making it particularly challenging to prepare for changing coastlines.^{141,142} Additionally, the low population and rural contexts of many Indigenous communities limit the score they can receive in state and federal cost-benefit analyses, which also severely limits funding for disaster risk reduction.^{140,143,144}

Displacement and Relocation

Many Indigenous peoples are now facing relocation due to climate-related disasters, more frequent coastal and riverine flooding, loss of land due to erosion, permafrost thawing, or compromised livelihoods caused by ecological shifts linked to climate change.^{7,122,145,146,147} Throughout the 18th, 19th, and 20th centuries, Indigenous peoples were removed in large numbers from their homelands by settler colonial governments, leading, in many cases, to death, diaspora, and socioeconomic struggles. The historical context of forced relocations of Indigenous peoples emphasizes the need for relocation frameworks that protect self-determination.^{120,144,146,148}

In various regions of the United States, communities of Indigenous peoples are considering relocation or actively pursuing relocation as an adaptation strategy, including communities in Alaska, the Southeast, the Pacific Islands, and the Pacific Northwest (Figure 15.3) (Ch. 19: Southeast; Ch. 24: Northwest; Ch. 26: Alaska; Ch. 27: Hawai'i & Pacific Islands). The complex barriers to adapting to these extreme circumstances continue to be the lack of statutes and regulations, legal authority, and governance structures that enable federal, state, and local actors to coordinate funding priorities and regulations.⁷ For example, many tribal communities facing slow-onset disasters, as described above, fail to qualify for relocation funds because they have not been declared federal disaster areas. Also, because



Isle de Jean Charles, LA, and Kivalina, AK

Figure 15.3: These photos show aerial views of (left) Isle de Jean Charles, Louisiana, and (right) Kivalina, Alaska. As projections of sea level rise and coastal inundation are realized, many impacted communities are confronting political, ecological, and existential questions about how to adapt. Photo credits: (left) Ronald Stine; (right) ShoreZone (CC BY 3.0).

there is no single, comprehensive federal program to assist tribes with relocation efforts, tribes must rely on project-specific funding streams that are not designed for relocation initiatives and that often have conflicting requirements and priorities.¹⁴⁷ These barriers are even more challenging when tribes lack federal recognition.^{146,149} Additionally, there is no clear platform through which communities can connect non-Indigenous scientific information with their own knowledge systems to inform local decision-making processes as to whether adaptation is best achieved through relocation or by protecting in place through capital investments such as flood management infrastructure.^{150,151} Finally, even if relocation is agreed on and logistically feasible, the challenges associated with maintaining community and cultural continuity often undermine the objective of the adaptation strategy, and models for mitigating the impacts of relocation on cultural institutions are rare and difficult to replicate.¹⁵²

In the past few years, solutions have emerged to better address the need for community-driven relocations, but even these have proven more complex for tribal communities than originally expected. The state-recognized Isle de Jean Charles Band of Biloxi-Chitimacha-



Community Planning

Figure 15.4: Some tribal communities at risk of displacement from climate change are actively planning whole-community relocation strategies. As part of the resettlement of the tribal community of Isle de Jean Charles, residents are working with the Lowlander Center (a local, nongovernmental organization), the State of Louisiana, and others to finalize a plan that reflects the physical, sociocultural, and economic needs of the community. Photo credit: Louisiana Office of Community Development.

Choctaw of Louisiana, in partnership with the Lowlander Center (Figure 15.4), developed a community resettlement plan that was selected in 2016, in conjunction with the State of Louisiana's application to the National Disaster Resilience Competition, to receive funding from the U.S. Department of Housing and Urban Development. Due to restrictions on the funding included within the legislation and the tribe's lack of federal recognition, the state is

managing the resettlement of the entire island community, which limits tribal authority over relocation plans. This arrangement exemplifies one way in which tribes are limited in deploying adaptation strategies when using funds that are not specifically designed to meet the unique needs of tribal communities (Ch. 19: Southeast). Though promising, this solution, to date, is a pilot program through a one-time competitive funding opportunity, and there is no planned ongoing support for other community-led resettlements. Outside of this pilot program, the most promising funding options for facilitating relocations away from changing coastlines are voluntary buyout programs offered by some local, state, and federal entities, but new research suggests that these are particularly ill-suited to tribes because of their focus on individual households, instead of community-wide relocations.¹⁵³ Central organizing institutions, such as the Denali Commission that is assessing relocation challenges for communities in rural Alaska, may help provide structure for joint state, federal, and tribal partnerships for pursuing safe, timely, and culturally appropriate relocation. More research would be required to properly assess whether these and other solutions would facilitate action toward safe and self-determined futures for these communities.

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Opening Image Credit

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Traceable Accounts

Process Description

The report authors developed this chapter through technical discussions of relevant evidence and expert deliberation via several meetings, teleconferences, and email exchanges between the spring of 2016 and June 2017. The authors considered inputs and comments submitted by the public in response to the U.S. Global Change Research Program's (USGCRP) Federal Register Notices, as well as public input provided through regional engagement workshops and engagement webinars. The author team also considered comments provided by experts within federal agencies through a formal interagency review process.

Additional efforts to solicit input for the chapter were undertaken in 2016–2017. The Bureau of Indian Affairs (BIA) worked with partners, the College of Menominee Nation, and the Salish Kootenai College to develop and execute an outreach plan for the chapter. This included awarding mini-grants for community meetings in the fall of 2016 and attending and presenting at tribally focused meetings such as the American Indian Higher Education Consortium 2016 Student Conference (March 2016), the Annual National Conference of the Native American Fish and Wildlife Society (May 2016), the National Tribal Forum on Air Quality (May 2016), the workshops of Rising Voices (2016, 2017), the Native Waters on Arid Lands Tribal Summit (November 2017), the BIA Tribal Providers Conference in Alaska (November 2017), and the Tribes & First Nations Summit (December 2017), among others. Additionally, through these tribal partners, the BIA provided 28 travel scholarships to interested tribal partners to attend and comment on the initial draft content of all regional chapters at the USGCRP's regional engagement workshops. Additional avenues to communicate during these formal open-comment periods included multiple webinars, website notices on the BIA Tribal Resilience Program page, and email notices through BIA and partner email lists. In particular, the BIA solicited comments from multiple tribal partners on the completeness of the online interactive version of the map in Figure 15.1. Chapter authors and collaborators also presented at interactive forums with tribal representatives, such as the National Adaptation Forum (2017), and in various webinars to extend awareness of formal requests for comment opportunities through the USGCRP and partners, such as the Pacific Northwest Tribal Climate Change Network. The feedback and reports from these activities were used to ensure that the Key Messages and supporting text included the most prominent topics and themes.

Key Message 1

Indigenous Livelihoods and Economies at Risk

Climate change threatens Indigenous peoples' livelihoods and economies, including agriculture, hunting and gathering, fishing, forestry, energy, recreation, and tourism enterprises (*very high confidence*). Indigenous peoples' economies rely on, but face institutional barriers to, their self-determined management of water, land, other natural resources, and infrastructure (*high confidence*) that will be impacted increasingly by changes in climate (*likely, high confidence*).

Description of evidence base

Multiple studies of Indigenous peoples in the United States provide consistent and high-quality evidence that climate change is both a current and future threat to Indigenous livelihoods and economies. The climate impacts on traditional subsistence economies and hunting and gathering activities have been extensively documented and consistently provide qualitative observational evidence of impacts.^{4,5,7,22,23,24,25,26,27,28,29,31,32,44} There is also very robust documentation of observed adverse climate change related impacts to Indigenous commercial sector activities in agriculture, fishing, forestry, and energy,^{22,29,33,36,37,39,40,41,42,43,44,45,46,47,48,49,73,154} as well as recreation, tourism, and gaming.^{5,50,51,52,53} These sectors form the basis of most Indigenous economies in the United States.

Multiple studies also consistently identify funding constraints as barriers to the economic development of federally and non-federally recognized tribes,^{21,22} as well as barriers that limit self-determination stemming from historical and ongoing federal oversight of natural resources on tribal trust lands,^{8,11,17,18} including energy resources.^{77,78} Multiple qualitative studies provide consistent and high-quality evidence of current vulnerabilities and challenges related to infrastructure and linked systems that support Indigenous economies and livelihoods.^{19,22,49,73,74,76} Despite these challenges, there is consistent and high-quality evidence supporting the finding that energy development, particularly renewable energy, that is implemented in accordance with Indigenous values holds promise as a source of revenue, employment, economic self-determination, and climate mitigation and adaptation for Indigenous communities.^{22,79,80}

The studies cited above consistently conclude that these impacts on livelihoods and economies will increase under future projections of climate change. However, methods for making these determinations vary, and quantitative or modeling results that are specific to Indigenous peoples in the United States are limited.

Major uncertainties

As with all prospective studies, there is some uncertainty inherent in modeled projections of future changes, including both global climate system models and economic sector models. In addition, none of the cited studies explicitly modeled the effects of climate adaptation actions in the relevant economic sectors and the extent to which such actions may reduce Indigenous vulnerabilities.

The literature currently lacks studies that attempt to quantify and/or monetize climate impacts on Indigenous economies or economic activities. Instead, the studies cited above in the “Description of evidence base” section are qualitative analyses. The chapter references Chapter 29: Mitigation for some quantitative studies about climate impacts to U.S. economic sectors, but these are not specifically about Indigenous economies. Quantitative national studies of climate impacts may have general applicability to Indigenous peoples, but their overall utility in quantifying impacts to Indigenous peoples may be limited, because there is uncertainty regarding the extent to which appropriate extrapolations can be made between Indigenous and non-Indigenous contexts.

Other uncertainties include characterizing future impacts and vulnerabilities in a shifting policy landscape, when vulnerabilities can be either exacerbated or alleviated in part by policy changes, such as the quantification and adjudication of federal reserved water rights and the development

of policies that promote or inhibit the development of adaptation and mitigation strategies (for example, the development of water rights for instream flow purposes).¹⁹

Description of confidence and likelihood

Given the amount of robust and consistent studies in the literature, the authors have *very high confidence* that Indigenous peoples' subsistence and commercial livelihoods and economies, including agriculture, hunting and gathering, fishing, forestry, recreation, tourism, and energy, face current threats from climate impacts to water, land, and other natural resources, as well as infrastructure and related human systems and services. The authors have *high confidence* in the available evidence indicating that it is *likely* that future climate change will increase impacts to water, land, other natural resources, and infrastructure that support Indigenous people's livelihoods and economies. The authors have *high confidence* that Indigenous peoples' economies depend on, but face institutional barriers to, their self-determined management of water, land, other natural resources, and infrastructure, stemming from funding constraints and the complexities of federal oversight of trust resources.

Key Message 2

Physical, Mental, and Indigenous Values-Based Health at Risk

Indigenous health is based on interconnected social and ecological systems that are being disrupted by a changing climate (*high confidence*). As these changes continue, the health of individuals and communities will be uniquely challenged by climate impacts to lands, waters, foods, and other plant and animal species (*likely, high confidence*). These impacts threaten sites, practices, and relationships with cultural, spiritual, or ceremonial importance that are foundational to Indigenous peoples' cultural heritages, identities, and physical and mental health (*high confidence*).

Description of evidence base

Multiple epidemiological studies provide consistent and high-quality evidence that Indigenous peoples face health disparities according to conventional Western science approaches to assessing health risk; in general, Indigenous peoples have disproportionately higher rates of asthma,⁹⁰ cardiovascular disease,^{91,92,93,94} Alzheimer's disease or dementia,^{95,96} diabetes,⁹⁷ and obesity.⁹³ There is also robust qualitative evidence that various social determinants of health affect Indigenous health disparities, including historical trauma,^{88,89} institutional racism, living and working circumstances that increase exposure to health threats, and limited access to healthcare services.^{87,89} A recent peer-reviewed scientific assessment of health concluded that these health disparities have direct linkages to increased vulnerability to climate change impacts from changes in the pollen season and allergenicity, air quality, and extreme weather events.⁹⁸

Additionally, a number of qualitative studies consistently find that Indigenous health, adaptive capacity, and health disparities/environmental justice issues typically do not capture many of the key elements of health and resilience that are important to Indigenous populations, which include concepts related to community connection, natural resources security, cultural use, education and knowledge, self-determination, and autonomy.^{81,82,83,84,85,86} Available qualitative evidence consistently identifies Indigenous peoples as having a unique and interconnected relationship

with the natural environment and wildlife that is integral to their place-based social, cultural, and spiritual identity; intangible cultural heritage (traditions or living expressions transmitted and inherited through generations); and subsistence practices and livelihoods that foster intra- and intergenerational knowledge sharing and relationships.^{29,44,61,81,82,86,87,99,100,101,102,103,105} Climate impacts to lands, waters, foods, and other plant and animal species undermine these relationships, affect place-based cultural heritages and identities (including through damage to cultural heritage sites), may worsen historical trauma still experienced by many Indigenous peoples, and ultimately result in adverse mental health impacts.^{86,101,102,106} There is robust documentation of observed adverse climate change related impacts on culture and food security,^{44,61,99,103} physical health,⁹⁸ and mental health.^{71,101,102,104,107}

The studies consistently conclude that these adverse impacts to culture,^{61,155} food security,^{61,99} and overall human health^{98,99,101,102} will continue under future projections of climate change, though methods for making these determinations vary, and there are limited quantitative or modeling results that are specific to Indigenous peoples in the United States.

There is consistent evidence from behavioral and public health research showing that responses to extreme heat serve as examples of climate change adaptation.^{108,109,110,111} There are also multiple examples of tribal health vulnerability assessments that acknowledge the role of traditional subsistence species, or First Foods, as an essential aspect of health and tribal resilience.^{60,112} One example from the Republic of the Marshall Islands illustrates a community-led planning process that incorporates traditional knowledge, facilitates local self-determination, and supports climate adaptation, natural resource management, and community health goals.⁸⁵

Major uncertainties

The literature currently lacks national-scale studies that quantify and/or monetize climate impacts on Indigenous health, either through traditional Western science health metrics or Indigenous values-based metrics and indicators of health. There are quantitative studies of specific health-relevant topics, such as climate impacts to air quality (Ch. 13: Air Quality) or extreme heat (Ch. 29: Mitigation), but health impact models have not to date been used to model Indigenous population-specific climate impacts. Quantitative national studies of climate impacts may have general applicability to Indigenous peoples, but their overall utility in quantifying impacts to Indigenous peoples may be limited, because there is uncertainty regarding the extent to which appropriate extrapolations can be made between Indigenous and non-Indigenous contexts. In addition, none of the studies explicitly modeled the effects of climate adaptation actions and the extent to which such actions may reduce Indigenous vulnerabilities or projected future impacts.

Other uncertainties include characterizing future impacts and vulnerabilities in a shifting policy landscape, in which vulnerabilities can be either exacerbated or alleviated in part by policy or programmatic changes, such as a recognition of the non-physiological aspects of Indigenous health.

Description of confidence and likelihood

Based on available evidence, the authors have *high confidence* that Indigenous health is based on interconnected social and ecological systems that are being disrupted by a changing climate. The authors have *high confidence* in the available evidence indicating that it is *likely* that future climate

change will increase impacts to lands, waters, foods, and other plant and animal species and that Indigenous health will be uniquely challenged by these impacts. The authors have *high confidence*, based on the quality of available evidence, that the lands, waters, foods, and other natural resources and species are foundational to Indigenous peoples' cultural heritages, identities, and physical and mental health due to their essential role in maintaining Indigenous peoples' sites, practices, and relationships with cultural, spiritual, or ceremonial importance.

Key Message 3

Adaptation, Disaster Management, Displacement, and Community-Led Relocations

Many Indigenous peoples have been proactively identifying and addressing climate impacts; however, institutional barriers exist in the United States that severely limit their adaptive capacities (*very high confidence*). These barriers include limited access to traditional territory and resources and the limitations of existing policies, programs, and funding mechanisms in accounting for the unique conditions of Indigenous communities. Successful adaptation in Indigenous contexts relies on use of Indigenous knowledge, resilient and robust social systems and protocols, a commitment to principles of self-determination, and proactive efforts on the part of federal, state, and local governments to alleviate institutional barriers (*high confidence*).

Description of evidence base

There is robust documentation of ongoing Indigenous adaptation to climate variability and change.^{1,71,113,114,116,117} There is also a very strong evidence base with multiple sources, consistent results, and high consensus that Indigenous peoples face obstacles to adaptation, including:

- a limited capacity to implement adaptation strategies,^{19,139,150,151}
- limited access to traditional territory and resources,^{6,22,31,48,134,135,136,139,146,149} and
- limitations of existing policies, programs, and funding mechanisms.^{6,7,31,135,136,139,140,142,143,144,146,147,149,150,151}

There are many studies that provide evidence with medium consensus that effective participatory planning processes for environmental decision-making (such as for sustainable land management or climate adaptation) are guided by Indigenous knowledge and resilient and robust social systems and protocols).^{6,7,118,119,120,127,128,129,131,132,133} In addition, some studies draw conclusions regarding the principles of self-determination in adaptation or relocation planning and decision processes.^{144,146,148}

Major uncertainties

Adaptation is still in its infancy in most Indigenous (and non-Indigenous) communities in the United States, so there have not been enough projects implemented all the way to completion to be able to observe results and draw conclusions regarding the efficacy of any particular adaptation process or approach. Extrapolations can be made, however, from other relevant and closely related environmental decision-making processes, such as for land or water resource management.

Description of confidence and likelihood

Based on the quality of available evidence, the authors have *very high confidence* that Indigenous peoples are proactively identifying and addressing climate impacts but that many face various obstacles limiting their implementation of adaptation practices. There is *high confidence* that successful adaptation in Indigenous contexts leverages Indigenous knowledge, robust social systems and protocols, and a commitment to Indigenous self-determination.

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