SUPPLEMENTARY MATERIALS

Cozzetto K, Chief K, Dittmer K, Brubaker M, Gough R, Souza K, Ettawageshik F, Wotkyns S, Opitz-Stapleton S, Duren S, Chavan P (2013) Climate change impacts on the water resources of American Indians and Alaska Natives in the U.S. Climatic Change, doi: 10.1007/s10584-013-0852-y

1 INTRODUCTION – Water is Sacred

Water is sacred. This is tradition. In contrast to the non-tribal utilitarian view of water, Native Americans revere water and water is life. In the language of the Lakota, Mni Wiconi (witchony) means "Water is Life" for all - humans and animal nations. Water is used in sacred purification rituals, religious and cultural ceremonies, and family blessings; to acknowledge all our relations and recognize our connection to Mother Earth, Father Sky, and the ocean. Water is not viewed in singularity as marine, terrestrial, or atmospheric, but rather, water is viewed holistically as an integrating component of the whole system connecting continents, plants, humans, in the continuous cycling of liquid, solid, and vapor states. Water gives life – as humans are conceived in water, born in water, and return to the water world upon death.

Water is the physical manifestation of spirituality. In Polynesian tradition, the word for water was interchangeable with the word for spiritual power. The spirit of water is given freely. The rain, the rivers, the lakes, and the seas give life-supporting qualities to all. Many tribal traditions believe that all things in this physical world have a counterpart in the spirit world. Navajos believe in the balance of life and water (hózhó) where male rain (representing thunder and lightning) and female rain (representing the gentle showers) unite on the mountains and spring life on Mother Earth according to their own song, life, and spirit. Like other tribes, Navajos have many water clans that families acknowledge as their identity.

Without water, life would not exist as we know it. Let us notice the cycles and patterns of water - how the ocean becomes the clouds, clouds like our imagination, changing constantly, full of possibilities and then we are born. Tiny raindrops fall upon the mountaintops of our lives and our journeys begin – from the tiny puddles of our families to the brooks and streams of our villages, the rivers of our education, and the ponds and lakes of our vocations. Water flows and moves but always seeks its own level and always returns to the sea. When the journey is complete and the raindrop reaches the sea; does the raindrop remember that it was a raindrop?

Water is the one thing we all need, all of us, all of life. This is the respect, honor, and tradition of water and as Native Americans, we believe we must protect it always.

3 HAZARDS AND VULNERABILITY CONTEXT

Similar to indigenous peoples around the world in developed and developing countries, AIAN residing on tribal lands in the U.S. often live in rural communities with smaller populations, under lower socio-economic conditions, and frequently experience greater political marginalization than their non-indigenous counterparts (Nakashima et al. 2012; UN 2009). AIAN depend more on subsistence-type livelihoods and have deep spiritual and cultural connections with their land and water. This section describes the types of climate, hydrologic, and ecosystem changes that constitute hazards experienced by Native Americans. It also describes sets of vulnerability/adaptive capacity factors that are held in common by many tribes, although, again, each tribe's situation is unique. Although we separate vulnerability factors into various categories for ease of conceptualization, these factors, as indicated in Figure 2, will affect one another.

3.1 Climate, hydrologic, and ecosystem change hazards

Climate variability and change are currently resulting in or are likely to result in a rise in temperature, alterations to the intensity, frequency, intra-annual timing and duration of precipitation, shifts in evapotranspiration rates, and increases in extreme events (CCSP 2008). These climatic changes are altering regional hydrology (i.e., quantity, quality, timing) in a variety of ways, such as such as shifting snowmelt to earlier in the season, accelerating glacier melting and permafrost thawing, and increasing precipitation extremes (Table S1). Because ecosystems have evolved to function within particular ranges of climatic (e.g., summer monsoon) and physiochemical conditions (e.g., water temperature, salinity level), with certain seasonal timings of events (e.g., snowmelt, lake stratification) and with specific combinations of species, changes in climatic and hydrologic parameters will lead to ecosystem changes. Ecosystem changes include habitat loss, alterations in the timing and lengths of lake stratification, and altered nutrient cycling and productivity (Tillman and Siemann 2011; Table S2). They also include those changes related directly to species, for instance, shifts in geographic ranges, changes in population numbers, and altered timing of life cycle events (e.g., spawning, migration). These types of changes constitute hazards to which Native Americans are exposed. Ecosystem changes affect ecosystem services, which are discussed further below. Some accompanying articles in this special issue discuss climate and ecosystem changes in certain regions in more depth. Dittmer and Grah et al. discuss streamflows in the Pacific Northwest and implications for salmon. Because the direct effects of climate change on groundwater systems are still not well understood, these are not included in Table S1 other than to note that increasing saltwater intrusion into coastal freshwater aquifers is likely to occur (Taylor et al. 2013). Factors contributing to saltwater intrusion (i.e. the movement of saltwater into freshwater aquifers) may include sea level rise and storm surges and very importantly groundwater abstractions from coastal aquifers (Kundzewicz 2008; Nicholls and Cazenave 2010; Taylor et al. 2013).

Table S1. Examples of changes in hydrologic processes of concern to tribes

Continental and Mountainous Regions (including Alaska)	Great Lakes	Coastal Regions and Islands (including Alaska)	Additional changes in Alaska
Shifts in winter precipitation from snow to rain[1]	Overall substantial decreases in extent of ice coverage[2]	Sea level rise and coastal inundation[3]	Changes in Arctic sea ice[4]
Shifts to earlier snowmelt[5]	Warming of temperatures in some lakes[6]	Increasing saltwater intrusion[7]	Increases in permafrost thawing[8]
Increases in river temperatures[9]	Water levels in Lakes Michigan and Huron at record lows and levels in other lakes continuing to drop[10]	Rising ocean temperatures[11]	Increasing river turbidity[12]
Shifts to earlier lake and river ice breakup and later lake and river ice freeze up[13]		Increasing ocean acidification[14,a]	Increasing river erosion[15]
Accelerating glacial retreat, particularly in Alaska and the Pacific Northwest[16]		Increasing coastal erosion[17]	Lake drying[18]
Increases in drought particularly in the southern U.S.[19]		Increases in intense tropical cyclone activity (i.e. tropical storms, hurricanes)[20]	
Increases in storm intensities, which will affect flooding[21]		Expanding coastal dead zones[22,b]	

a - Ocean acidification refers to the ocean uptake of rising levels of atmospheric CO_2, which creates more carbonic acid and decreases ocean pH.

b - Coastal dead zones are areas near the ocean floor with low or no oxygen.

1 - Barnett et al. 2005; 2 - Wang et al. 2012; 3 - Church and White 2006; 4 - IPCC 2007; 5 - Barnett et al. 2005, Kundzewicz et al. 2008; 6 - Lofgren and Gronewold 2012; 7 - Kundzewicz et al. 2008; Nicholls and Cazenave 2010; 8 - IPCC 2007; 9 - Kaushal et al. 2010; 10 – MDNR 2013; USACE 2013; 11- Lyman et al. 2010; 12 – Brubaker et al. 2011a, 2012, Durand et al. 2011 13 - IPCC 2007; 14 - Doney et al. 2009; 15 – USACE 2009, Durand et al. 2011; 16 - IPCC 2007; 17 - Scavia et al. 2002; Zhang et al. 2004, USACE 2009; 18 – Gross and Jones 2012; 19 – Cayan et al. 2010; IPCC 2007; Seager et al. 2007; Seager et al. 2010 20 - IPCC 2007; 21 - IPCC 2007, Karl and Knight 1998; 22 - Diaz and Rosenberg 2008

Table S2. Examples of potential ecosystem changes resulting from climate change

Implications for ecosystems
○ "Altered nutrient cycling and productivity" [4]
○ "Changes in stratification and eutrophication" [4]
○ Lower dissolved oxygen in waters [2]
○ Habitat loss and conversion [1,2,4]
Implications for species, populations, communities [a]
○ Shifts in species geographic ranges (often polewards or along elevational gradients) [1,2,4]
○ Changes in phenology (timing of life history events) and development [1,2,4]
○ Effects on survival and fecundity [1]
○ Changes in population sizes (often thought of in terms of reductions but could also have population imbalances in a positive direction) [1,2,3]
○ De-coupling of ecological relationships (e.g., plant-pollinator) [1,2]
○ "Shifts in community composition, competition, and survival" [a,4]
○ Increased spread of invasive or non-native species [1,2,4]
○ "Increased spread of wildlife diseases, parasites, and zoonoses (including Lyme borreliosis and plague)" [1]

a – Population refers to a group of individuals from one species living in a particular area and community refers to all the organisms interacting and living in a specific area (Molles Jr. 2008).
b – Zoonoses refer to diseases that can be transmitted from animals to humans.

1 – Mawdsley et al. 2009; 2 – NFWPCAP 2012; 3 – NPS and CAW 2007; 4 – Tillman and Siemann 2010

3.2 Socioeconomic factors

Factors such as community structure, rural-urban composition, population growth rates, and educational attainment are recognized components of social vulnerability (Cutter et al. 2010). An examination of 2010 Census data for over 400 tribal lands shows that although there were ten tribal areas with combined Native and non-Native populations greater than 100,000 people (e.g., several Oklahoma Tribal Statistical Areas, Navajo Nation), 98% had fewer than 100,000 residents, and 69% had less than 2,000 people (Table S3). Approximately 47% of residents on tribal lands lived in rural areas and 53% in urban areas. However, for communities with less than 2,000 residents, the breakdown was 78% rural to 22% urban, which contrasts with the 19% rural to 81% urban breakdown for the U.S. as a whole. Small, rural AIAN communities often have higher per household water supply costs because of smaller economies of scale and because of higher costs for transporting materials to more remote areas (USEPA 2001). Climate change impacts on water supply could combine with these factors to strain the economic viability of providing potable water to residents (see Sec. 4, AK). As for population growth rates, according to the Census data between 2000 and 2010, some Native American community populations increased while others decreased. Increases in community populations affect water demands while decreases in population affect the financial base for the community and economies of scale in managing water infrastructure.

The Census Bureau's 2006-2010 American Community Survey provides additional socioeconomic data for AIAN living in approximately 300 tribal land areas (Table S3). This includes data on educational attainment. The ACS indicates that 23.5% of AIAN on tribal lands have not graduated from high school, nearly 9 percentage points higher than for the U.S. as a whole, and that only 10.4% have received a bachelor's degree or higher, nearly 18 percentage points lower than for the U.S. as a whole. This can affect a community's technical capacity (Gautam et al. 2013) for climate change adaptation, for instance, having a trained workforce that understands traditional values and cultural sensitivities along with knowledge of technical approaches to adequately prepare for climate change impacts. Educational attainment levels also affect household income levels and skilled labor opportunities, such that households have fewer financial resources to plan for or recover from hazard events and rely more on subsistence-based livelihoods that are vulnerable to climate, hydrological and ecosystem shifts.

The overall tribal economic status is generally much lower than for the U.S. as a whole. According to the ACS survey noted above, the average unemployment percentage was 14.9%, or nearly double, the U.S. average (Table S3). The median household income was $33,379 or 36% below the national average, and more than a quarter (29.3%) of people lived below the poverty level, approximately double the national average.

A 2005 Bureau of Indian Affairs (BIA) American Indian Population and Labor Force Report states a 49% unemployment rate for AIAN living on or near tribal lands. This is based on data from 73% of the then 561 federally recognized tribes and provides an alternate and much higher percent unemployment number than the Census data. The BIA report notes that the 49% unemployment figure includes both those adults currently available for work who are actively looking and those who would like a job but have stopped looking. The American Community Survey unemployment percentages include only adults who have actively looked for work within the 4 weeks prior to completing the survey. An updated BIA report is expected out in 2013. Lower economic conditions can affect the ability of tribes to effectively manage their water resources (e.g., see political and infrastructure contexts)

Although a variety of economic activities take place in tribal areas including tourism, gaming, non-renewable extraction (e.g., oil, gas, and coal), and renewable energy production, many Native Americans practice a traditional subsistence lifestyle and depend on the harvest of natural resources for their livelihood, engaging in activities such as fishing, hunting, gathering plants and nuts, small-scale ranching and agriculture, and tribal arts and crafts. This can make Native Americans particularly susceptible to decreases in water availability or changes in species' distributions. Because of high unemployment and poverty, economic development is often a high priority for many tribes and is dependent on having reliable water resources in the face of climate changes.

Box S1 – Population growth and declining salmon in the Pacific Northwest

In the 1990s, after 150 years of overfishing, habitat destruction, and dam construction and operation, salmon populations hit an all-time historic low in the Columbia River basin (Dittmer 2013). In contrast, the populations of the four Columbia River Basin treaty tribes – Nez Perce (3500 enrolled in 2011), Umatilla (2800 enrolled in 2011), Warm Springs (5000 enrolled in 2011), and Yakama (10,200 enrolled in 2011) - have increased in the last 20 years (CRITFC 2013b). This trend has increased their sense of urgency for restoring Pacific Northwest salmon runs because as tribal populations grow so does their need for this important food and cultural resource, which is at high risk due to climate change/variability impacts. Photos: Boys fishing for Fall Chinook salmon at Celilo Falls (left), First Salmon Ceremony at the Celilo Longhouse (right). *Photo Credit: Columbia River Inter-Tribal Fish Commission 2013a,c*.

Table S3. 2010 Socioeconomic and infrastructural characteristics of American Indians and Alaska Natives in the U.S.

	U.S.		Tribal Lands[1]	
	All people	AIAN[2,3]	All people[4]	AIAN[2]
Social characteristics *(Source: 2010 Census)*				
Total population	308,745,538	5,220,579	4,842,112 [5]	1,140,104 [6]
% of total population living in rural areas	19%	n/a	47% [5]	n/a
% of total population living in urban areas	81%	n/a	53% [5]	n/a
% of tribal lands with < 2000 residents	---	---	69% [5]	n/a
% of tribal lands with 2000-10,000 residents	---	---	20% [5]	n/a
% of tribal lands with 10,000-100,000 residents	---	---	9% [5]	n/a
% of tribal lands with > 100,000 residents	---	---	2% [5]	n/a
Socioeconomic, infrastructural characteristics *(Source: Census Bureau's 2006-10 American Community Survey) Community Survey)*				
% of population 25 years and older who had not graduated from high school	15%	20%	17% [7]	24% [8]
% of population 25 years and older with Bachelor's degree or higher	28%	16%	18% [7]	10% [8]
% of occupied housing units with no telephone service available	4%	7%	6% [7]	12% [8]
% unemployed - civilian labor force	8%	14%	8% [7]	15% [8]
Median household income[9]	$51,914	$38,806	$42,645 [7]	$33,379 [8]
% of people living below the poverty level [10]	14%	23%	19% [7]	29% [8]

1: Tribal lands may include reservations, off-reservation trust lands, Alaska Native Village Statistical Areas (ANVSAs), Oklahoma Tribal Statistical Areas (OTSAs), state-designated tribal statistical areas (SDTSAs), and tribal-designated statistical areas (TDSAs).
2: AIAN = American Indian and Alaska Native either fully or in combination with one or more races.
3: The numbers presented in this column include AIAN living both on and off tribal lands.
4: Considerable numbers of non-AIAN live on some tribal lands, and these non-AIAN residents are included in the calculation of numbers for this column.
5: The number of tribal lands used in the *all people* calculations based on 2010 Census data was 476.
6: The number of tribal lands used in the *AIAN* calculations based on 2010 Census data was 412. This number differs from that used in the *all people* calculations because of how people report their race/ethnicity. People may or may not identify a specific race.
7: The number of tribal lands used in the *all people* calculations based on the 2006-10 ACS data is 380.
8: The number of tribal lands used in the *AIAN* calculations based on 2006-10 ACS data is 316. This number differs from that used in the *all people* calculations for the same reason as in footnote #6.
9: In 2010 inflation-adjusted dollars
10: % of people whose income in the past 12 months is below the poverty level
n/a = not available
Averages for tribal lands as a combined group were calculated by weighting the statistic for a given tribal area by the percentage of the total AIAN population represented by that tribal area.

3.3 Political factors

Federally recognized tribes are domestic dependent nations with inherent rights of self-governance. Treaties, court decisions, and tribal legislation define this sovereignty and govern relationships between the tribes and outside entities (Houser et al. 2001). Important implications of this status in the climate change context are illuminated below.

When tribes entered into treaties defining reservation lands, for the first time in Native history, geographic boundaries became fixed. This restricted migration, which was a critical strategy for adapting to changing water resources and species movement (Gautam et al. 2013). Often, tribes were settled on remnants of their original land base or forcibly relocated to lands which were considered less valuable in terms of water resources and agricultural potential (Houser et al. 2001). Some tribes specifically reserved the right to fish, hunt, and gather in customary areas off-reservation in treaties (Houser et al. 2001), however, these place-based rights may become geographically mismatched with species distributions as ranges shift in response to changing climatic conditions.

The foundational case protecting tribal water resources is the 1908 *Winters* case [207 US 564 (1908)], which recognized that tribes inherited reserved water rights when their reservation was created for the amount necessary to fulfill the purpose of the reservation and for a priority date based on the date the reservation was created. Many of these "federal reserved rights" have yet to be adjudicated or exercised in full and many tribes are still in the process of negotiating with municipal, industrial, private, state, and federal stakeholders to quantify tribal water rights. Often, tribes who litigated and won their water rights did not win infrastructure funds (paper water rights) and are struggling to finance infrastructure to develop their water rights (wet water). Furthermore, tribes are often underrepresented in water availability studies such as the recently released Bureau of Reclamation Colorado River Basin Study in which the Ten Tribes Partnership voiced this complaint. Similarly, some international water commitments have not considered tribal rights (Houser et al. 2001). The first congressionally approved tribal water rights settlement was in 1978 for the Ak-Chin Indian Community. As of July 2011, Congress has approved 27 tribal water rights settlements including one on the east coast where riparian law is practiced and the remaining in western states where prior appropriation is in place (Anderson 2010; Claims Resolution Act of 2010). Arizona and New Mexico have the highest number of tribal water rights settlements (9 and 4 respectively). However, there are no settlements in Washington and Oregon where traditional subsistence like salmon are endangered and important to the tribes (Rancier 2012).

Off-reservation planning and decision-making processes for managing water resources are also critical for tribes. Off-reservation water use and pollution have direct impacts on tribal water resources yet tribes are often underrepresented in water resource management discussions. Climate change impacts on water quantity, quality, and timing add to the legal and planning complexities and compound concern that Indian water rights may be sacrificed under climate change resulting in unmet present and future human and environmental water demands for the tribe.

It is also important to note that some Native Americans have not received federal or state recognition. This non-status leaves them with no legal leverage to address climate, hydrological, or ecosystem change issues (ITEP 2012b).

Box S2 – Midwest Tribes engage in international efforts to protect the Great Lakes

In an example of adaptive capacity, many Midwest Tribal Nations are working with their Canadian First Nation counterparts to protect Great Lakes' waters. In 2004, 130 of the approximately 185 Great Lakes Tribal Nations and Canadian First Nations signed the November 23, 2004 *Tribal and First Nations Great Lakes Water Accord.* On November 8, 2006, *the Treaty Regarding the Preservation, Protection, and Enhancement of the Waters of the Saint Mary's River Ecosystem* was signed between the Sault Sainte Marie Tribe of Chippewa Indians, the Bay Mills Indian Community, Batchewana First Nation and Garden River First Nation, all of whom share interests in the St. Mary's River that flows from Lake Superior down towards Lake Huron.

3.4 Infrastructural factors

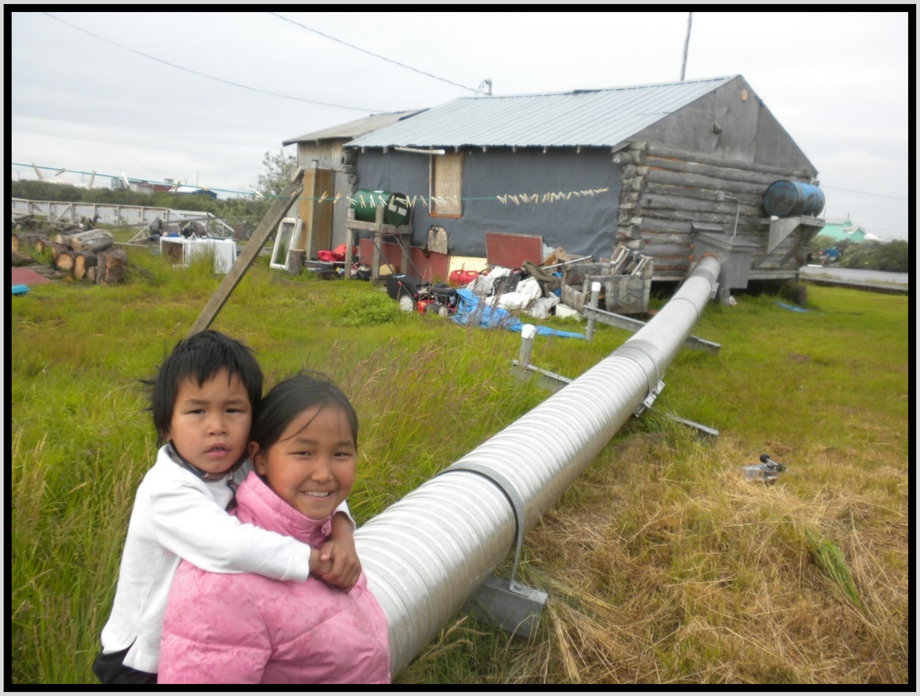
Water infrastructure pertains to physical structures (e.g., dams, water supply and wastewater treatment plants, transmission lines, stormwater drainage systems, irrigation canals, etc.) used to develop, use, and manage water for a variety of purposes (e.g., drinking, construction, industrial, hydropower, agriculture, ranching). Water infrastructure is engineered for particular ranges of climatic, physiochemical, and biological conditions, and considers seasonal timings. For example, water treatment systems are engineered based on ability to treat a certain initial quality of water to a specific water quality standard (e.g., see Sec. 4). Storage tank and reservoir capacities account for the length of the collection season, the timing of runoff, and demands for water. Buried transmission pipeline specifications are geared for particular moisture conditions of the surrounding ground. However, changing climate and hydrologic regimes are creating environmental conditions that tribal water infrastructure may not be designed to accommodate, resulting, in cases, in the deterioration of the physical structures and its effectiveness (e.g., ability to treat water to a specified water quality standard). Disruptions to water resource infrastructure as a result of climate change impacts can have important economic and public health consequences to tribes (see Box S3).

Box S3 – Water access and public health in Alaskan Native Communities

Accessing adequate quality and quantity of water is a challenge for many Alaska Native communities with important implications for public health. A 2008 study demonstrated the relationship between in-home water service and rates of hospitalization. Regions with lower home water service had significantly higher rates of pneumonia, influenza, skin and respiratory infections (Hennessy et al. 2008). Climate driven events such as droughts and floods can cause damage or disruption to water service, and increase risk of hospitalization from infectious disease.

Generally poorer economic conditions on tribal lands may mean that infrastructure is maintained infrequently, is inadequate, or that it is lacking entirely. Deferred maintenance can reduce system performance, reliability, and safety. Damage to infrastructure can increase costs of providing water and these costs can quickly drain the financial reserves of small tribal communities as general funds are expended for emergency response (Brubaker 2012; TetraTech 2010). Inadequate or non-existent infrastructure can make tribal communities more vulnerable to flooding, drought, and waterborne diseases.

Box S4 - Infrastructure Damage in Selawik, Alaska



Children in the village of Selawik, Alaska play on an insulated water line. Because of thawing permafrost, lines are sinking causing junctions to stress, break, and then in the winter, freeze (Brubaker et al. 2012). *Photo credit: Mike Brubaker, Alaska Native Tribal Health Consortium, 2011*

According to an Indian Health Service (IHS) Sanitation Facilities Construction Program report (2011) approximately 9% of AIAN homes lack a safe and reliable water supply. The report also notes that, like elsewhere in the U.S., water and sanitation infrastructure is aging, which can make it less reliable and increase operation and maintenance costs. According to a 2013 IHS fact sheet, 12% of AIAN homes lacked a safe and adequate water supply and/or waste disposal facilities as compared to less than 1% for the U.S. as a whole. In some Native American communities, particularly in Alaska and on the Navajo Nation, considerable portions of the population, approximately 13% and 25-40% of households, respectively, haul water (ITFAS 2008; NDWR 2003). Even without climate-related impacts, these water haulers are more susceptible to waterborne diseases especially if water is obtained from nonpotable sources such as livestock wells or if unsanitary hauling methods are used (ITFAS 2008). A 1999

EPA American Indian and Alaska Native Village Water Systems Survey (2001) estimated that the total 20 year capital investment needs of Drinking Water State Revolving Fund eligible public water systems in Indian Country was $2.2 billion over 20 years. An updated report based on a 2011 survey is expected out in 2013. It is clear that tribes have significant water access needs that increase their vulnerability to health impacts as a result of climate change.

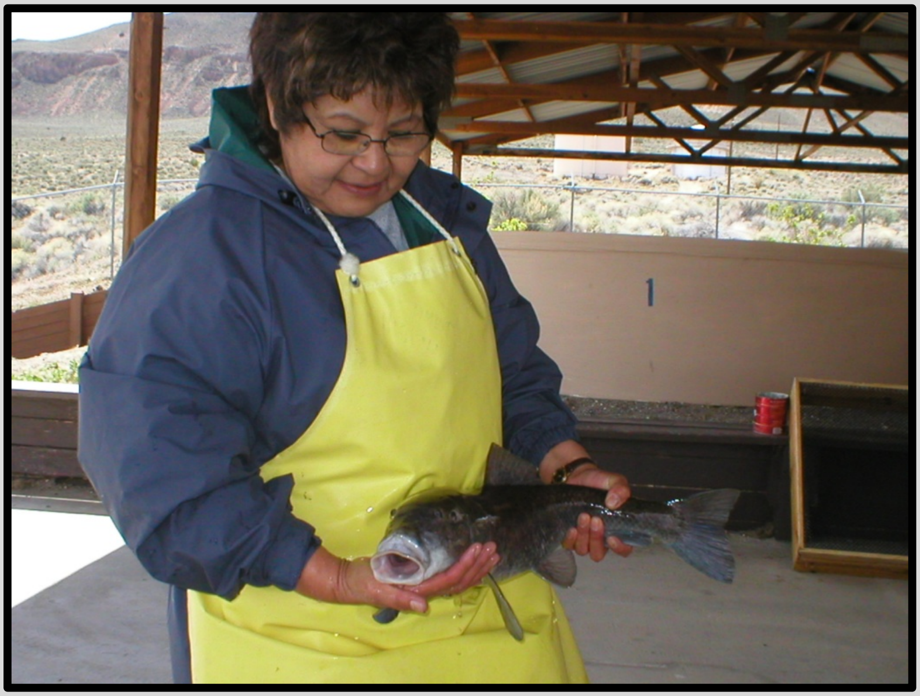
Figure S1. Navajo home of elderly woman, who has no running water or electricity and who hauls water from a community well five miles away and stores water in steel barrels. *Photo credit: Karletta Chief.*

Lacks of other types of infrastructure (e.g., communication, housing, etc.) are also factors increasing tribal vulnerability to climate change hazards. According to the 2006-2010 ACS, nearly 12% of AIAN homes on tribal lands have no phone service, which can be critical for communication for disaster response. The latest report, a 1996 Housing and Urban Development (HUD) Assessment of American Indian Housing Needs and Programs, suggested that almost 40% of housing in tribal areas was inadequate or overcrowded, which can drastically increase the impacts of climate-related hazards such as flooding or heat waves on Native Americans. An updated HUD report is expected out in 2014.

3.5 Ecosystem services and land-use factors

People benefit from ecosystems in a variety of ways. These benefits are sometimes described as ecosystem services of which there are four commonly used categories: 1) provisioning (e.g., supply of food, water, timber), 2) regulating (e.g., water regulation such as water purification provided by a stream into which wastewater is discharged), 3) cultural services (e.g., supplying spiritual or recreational opportunities), and 4) supporting (e.g., photosynthesis, which supports food provisioning for example) (MEA 2005). Because climate changes can lead to ecosystem changes, they can also affect ecosystem services. In addition, depressed economic conditions, in combination with attempts to maintain traditional livelihoods on fixed, marginal plots of land (see political context above), urbanization, land-use changes, and invasive species are degrading tribal ecosystem health and services (see Box S6). Pressure for natural resource exploration and development, both within and outside of tribal lands is also altering the health of various ecosystems and their ability to respond to and recover from human- and climate-induced events. One important ecosystem service for AIAN is provided by groundwater, which supplies approximately 93% of American Indian and 66% of rural Alaska Native village drinking water systems (USEPA 2001, ANTHC 2011). Others are provisioning of subsistence and supplemental foods and of spiritual and cultural services (see Sec. 3.6).

Box S5 - Cui-ui and drought



Pyramid Lake in Nevada is home to a large (> 2ft) and long-lived (> 40 years) endangered fish species native to the lake called cui-ui. This fish is the primary cultural resource of the Pyramid Lake Paiute Tribe (PLPT) (see Southwest section). Each year, between March and June, in response to seasonal fresh turbid flow entering the lake from the Truckee River, cui-ui migrate up the river to spawn (Scoppettone and Rissler, 2000). During drought years with low stream flow, the fish retreat to the periphery of the lake and presumably do not reproduce. Increased drought frequency could thus potentially affect cui-ui and the PLPT. Photo: Elizabeth Thomas, PLPT Tribal member and Fishery employee for over 25 years, is holding a Cui-ui. *Photo credit: Pyramid Lake Fisheries*

Box S6 - Overgrazing and runoff

One example of land use practices interacting with climate-related events is overgrazing. As noted in the Navajo Water Resources Development Strategy (2011), overgrazing leads to more intense runoff events and greater sediment loading on reservoirs and has significantly impacted Navajo watersheds. Overgrazing leads to degraded soil fertility and quality and decreased forage, however, historical and political factors contribute to a more complex challenge for the Navajo Nation. A historical U.S. government policy enacted in the 1930s required Navajo livestock owners to graze their livestock within one of 20 newly demarcated grazing districts, interrupting traditional Navajo grazing management of moving livestock to areas less affected by drought thus minimizing impacts of overgrazing (UNISDR 2011). Another policy enforced on Navajo residents was validating land use rights by livestock ownership and grazing thus imposing a primarily dominant ranching livelihood when other livelihoods existed (e.g., farming, gathering plants and herbs for medicine, rug weaving, and food (UNISDR 2011). Another complicating factor is the marginal nature of Navajo lands, which consist of the driest one-third of their traditional homelands (UNISDR 2011). Currently, when drought occurs, Navajo residents will haul water for livestock such as cattle or sheep, transfer their livestock off the reservation and pay rent for grazing on abundant pastures, or less commonly, sell their livestock. Therefore, detrimental impacts on the land due to a tribal traditional livelihood of ranching imposed with historical and political regulations can be further negatively heightened by climate change.

Figure S2. Water is hauled for horse belonging to a Navajo family living in a remote location on the Navajo Nation. *Photo credit: Karletta Chief*

3.6 Spiritual and cultural factors

Native Americans are intimately connected to the places in which they live through spiritual, cultural, and traditional livelihoods and values. They are the keepers of complex and extensive bodies of ecological and societal knowledge passed on through generations (UN 2009). They strongly associate cultural identities and traditional knowledge with their waters and lands and seek spiritual and religious inspiration from them. Particular locations such as mountains or springs are held sacred and certain waters may be used for ceremonial purposes (see Box S7). In addition, many tribes respect, acknowledge, and hold sacred the individual role of species on Mother Earth and thus impacts on these species are of inherent concern to tribes. Traditional ecological knowledge contributes to human cultural diversity and is a repository of long-term observations of environmental changes that have occurred and of adaptation strategies that have been effective in the past. This knowledge may be able to extend the environmental record in data sparse regions, improve monitoring design, and contribute to the future adaptive capacity of AIAN (see Boxes S8 and S9).

Figure S3. Native American looks across Pyramid Lake to which the Pyramid Lake Paiute Tribe is deeply connected to spiritually, culturally, and economically. *Photo credit: Dan Mosely.*

Box S7 - Southwestern tribes oppose artificial snowmaking and consider it a desecration of sacred mountains.

More than 13 southwestern tribes, who hold San Francisco Peaks as a sacred mountain, oppose artificial snowmaking by Arizona Snowbowl Ski Resort near Flagstaff, Arizona. Snowbowl is experiencing declining trends in snowfall and unprofitable ski seasons due to lack of sufficient snowfall, and diminishing snowpack is expected with warming trends associated with climate change. In 2005, one of the largest tribes in the United States, the Navajo Nation, who refer to San Francisco Peaks as Dook’o’ooslííd (Abalone Shell Mountain or Shining On Top), along with the Havasupai Nation, the Hualapai Tribe and others filed a lawsuit (*Navajo Nation, et al. vs. United States Forest Service et al.*) opposing snowmaking plans on the grounds that artificial snowmaking using reclaimed wastewater desecrates a holy site infringing on their religious rights and that the holy mountain is meant to only receive naturally occurring rain and snow. In addition, tribes are concerned that reclaimed wastewater known to contain endocrine disruptors would pose health risks to an individual who ingests the snow. For the Navajo people, Dook’o’ooslííd is one of the sacred mountains set in western cardinal directions and represents a stage of life, adulthood, the setting of the sun represented by the color yellow among other sacred teachings. Similarly, the Hopi people regard San Francisco Peaks as holy and refer to the peaks as Nuvatukya'ovi (The Place of Snow on the Very Top) where Hopi deities (Katsinam, more widely known as Kachinas) bring rain to the region. The White Mountain Apache of the Fort Apache Reservation believe that San Francisco Peaks represent the ascension of adolescent girls into womanhood in the Sunrise Ceremony. For the Havasupai people, San Francisco Peaks are the origin of humans. To the Yavapai-Apache people, the peaks are one of the "*sacred places where the Earth brushes up against the unseen world*." The Forest Service identified San Francisco Peaks as a Traditional Cultural Property (TCP) as defined in the National Register Bulletin 38 and determined it eligible for inclusion on the National Register of Historic Places. Tribes continue to fight against artificial snowmaking on sacred mountains, and low-latitude resorts will need to consider climate change adaptation strategies and whether ski resorts are economically viable and wise in a water scarce region where water resources will dwindle under climate change impacts.

Box S8 - *Siku-Inuit-Hila* (Sea Ice–People–Weather) Project

Many coastal Native Arctic communities depend heavily on sea ice for subsistence hunting, for travel, and as a source of freshwater during the winter when creeks, for instance, do not flow. They have extensive knowledge of sea ice changes gained both through experience and oral histories. Researchers are interested in sea ice processes because of the important role played by sea ice in the global climate system yet quantitative sea ice data from Arctic regions is sparse. Residents in three Arctic communities – Barrow, Alaska, Clyde River, Nunavut, Canada, and Quaanaaq, Greenland – are collaborating with researchers at the National Snow and Ice Data Center on the development and implementation of a community based sea ice observing network known as the *Siku-Inuit-Hila (Sea Ice-People-Weather) project*.

Indigenous residents are involved at all stages of monitoring design and implementation. This helps ensure that data collected are relevant for both residents and researchers. Local ecological knowledge informs the location of monitoring stations. For example, at Qaanaaq, residents observed that currents influencing sea ice varied across the fjord and thus monitoring stations were established in a transect to examine this. Local ecological knowledge is also incorporated into decisions on when to deploy and remove instruments on seasonal sea ice and how to work on changing sea ice so as to prevent equipment failure and data loss. Indigenous residents play key roles in data collection and analysis and in equipment maintenance, which occurs more frequently than would otherwise be possible without their assistance and again helps prevent equipment failure from harsh Arctic weather and associated breaks in record continuity.

Residents participating in the community sea ice observing network receive all the equipment, two days of training, monetary compensation for the work they do in operating and maintaining the network, and a detailed monitoring handbook. Researchers participating in the sea ice observing network receive data from data sparse regions and have the opportunity to learn local skills for assessing sea ice conditions. The two-way exchange of knowledge appears to be enhancing the understanding of sea ice characteristics in the participating areas.

Source: Mahoney et al. 2009

Box S9 – Traditional Ecological Knowledges – Possibilities and Concerns

Indigenous cultures provide different ways of knowing and of thinking about ecosystem management and adaptation to varying environmental conditions (Berkes et al. 2000). Interest in such traditional ecological knowledges (TEKs; Wildcat this issue) is growing because of the contributions TEKs can make to improving sustainable resource management (Berkes et al. 2000). Some Native American groups are revitalizing traditional practices as ways to increase sustainability and reconnect with their cultural heritages. However, tribal peoples are also expressing deep concerns about intellectual property rights related to TEKs and the potential misuse and exploitation of TEKs by non-indigenous peoples (personal communications, 2013).

Examples of TEKs can be found throughout the world (Berkes et al. 2000). In Hawaii, ancient Hawaiians made use of *ahupua'a*, which were wedge-shaped land divisions extending from the uplands to the sea that were managed in an integrated fashion (Costa-Pierce 1987). *Ahupua'a* often contained different types of fishponds varying in their degree of salinity from freshwater to brackish to seawater. One type of pond was the *loko i'a kalo* or freshwater taro ponds established in the uplands (Costa-Pierce 1987). These ponds combined agriculture (the growing of taro) with aquaculture. The continual grazing and pruning activities of certain fish species may have decreased pests and enhanced taro growth (Costa-Pierce 1987). The Ko'ie'ie Fishpond on the island of Maui is an example of a *loko kuapa* or seawater type of pond that originally consisted of a rock wall enclosing three acres of ocean. The Maui Fishpond Association is working to revitalize the Ko'ie'ie Fishpond, in particular by restoring the rock wall. The State of Hawaii and the University of Hawaii are conducting research to study the pond's fish and invertebrate populations (Tom 2007). In addition to rock walls, *loko kuapa* also typically contained grates that allowed water and small fish to move into the pond but prevented large fish from leaving, thus allowing for natural stocking of the ponds from the ocean. On the island of Molokai, women and children would gather coralline algae for the strengthening of loko kuapa walls as the algae secretes a natural cement (Costa-Pierce 1987).

In the southwest, Native Americans adapted their farming to the region's arid conditions through *Ak-Chin* types of practices that include, for example, planting where water collects naturally on the landscape (NDWR 2003). On the Hopi Reservation in Arizona, the Natwani Coalition is promoting the growing of traditional foods and both the continuation of traditional Hopi farming practices and the development of innovative new ones with the ultimate goal of improving the health of the Hopi and Tewa people. Natwani initiatives include a monthly radio program, Hopi Farm Talk, a bi-annual Agriculture and Food symposium, and a farming curriculum for youth (http://www.hopifoundation.org/programs/natwani).

TEKs are a critical component of tribal climate adaptation processes. However, they are also highly sensitive resources that have been exploited by non-tribal peoples. AIAN must be able to retain control over all aspects of TEKs – their collection, integration into climate adaptation processes, dissemination, and ownership.

Box S10 – Anishinabe Creation Story enforces respect of Mother Earth and Remembrance of the Great Flood

The Anishinabe people have adapted and survived past climatic changes. The Anishinabe Creation Story teaches respect of Mother Earth, maintaining harmony, and tells of their survival of the Great Flood. In the Creation Story, there was disharmony, internal conflicts and fighting among the people, and disrespect for all living things on Mother Earth. So Kitchi-Manitou purified Mother Earth with a great flood. Nanaboozhoo and a few birds and animals survived the flood and floated on a log searching for land. One by one Nanaboozhoo and various animals (the loon, helldiver, mink, etc.) attempted to dive down to the bottom of the water in futile efforts to grab a handful of Earth only to barely survive while re-surfacing. Finally, the muskrat was successful but after sacrificing his life. Then, the turtle sacrificed his life and offered to have the earth placed on his back so Nanaboozho placed the earth on the turtle's back and the piece of earth began to grow larger and larger as Nanaboozho and the animals sang and danced in an ever-growing circle. This piece of land is called Turtle Island and is known today as North America. The muskrat was honored for his sacrifice by his resiliency to survive, adapt, thrive, and multiply despite draining marshes and build their homes in a little ball of Earth in remembrance of the great flood.

Box S11 - Algal Blooms and the Interconnectedness among Climate Changes and Vulnerability Factors

Sometimes, multiple climate change and vulnerability factors interact to create levels of impacts. For instance, urban and agricultural development has led to the nutrient enrichment of surface waters, which contributes to algal blooms. More intense winter-spring storms followed by prolonged summer drought have led to higher nutrient loadings and can exacerbate blooms (Paerl and Huisman 2008). Warmer temperatures can cause lakes to stratify earlier and destratify later leading to longer bloom growth seasons. Die off and decomposition of blooms may lead to oxygen depletion resulting in fish kills. Some algal species produce toxins harmful to humans and livestock (CDC 2010). Algal blooms can also interfere with drinking water treatment as demonstrated in Alaska communities, where warming temperatures are for the first time causing algal blooms and fouling water filtration systems (Brubaker et al. 2010, see AK section). Algal blooms can also create problems with the use of waters for ceremonial or recreational purposes as it has for some California tribes (Klamath Basin Water Quality Work Group, 2008).

4 IMPACTS

Climate change impacts to tribal water resources, livelihoods, and cultures are as diverse and unique as individual tribes and their cultures and geographic settings. However, based on our review, we have identified five categories of common impacts. These include impacts on: 1) water supply and management (including water sources and infrastructure), 2) aquatic species important for culture and subsistence, 3) ranching and agriculture particularly from climate extremes (e.g. droughts, floods), 4) tribal sovereignty and rights associated with water resources, fishing, hunting, and gathering, and 5) soil quality (e.g., from coastal and riverine erosion prompting tribal relocation or from drought-related land degradation). Several accompanying papers in this special issue expand on these themes, including the impacts of climate change on traditional foods (Lynn et al. 2013), a broader range of impacts for Alaska Natives (Cochran et al. 2013), and the relocation of tribal communities (Maldonado et al. 2013). As discussed below, observed impacts are predominantly detrimental. In addition to impacts, we have, in cases, also noted contributing vulnerability factors. The amount of climate change impact information that we were able to find was greater for some regions as opposed to others, and this is reflected in the differing lengths of the regional summaries.

4.1 Alaska

Alaska, which is as large as one third of the continental U.S., is home to 227 federally recognized Alaska Native villages and communities (Table S7). Most of the villages are small and isolated, and many residents engage in traditional subsistence hunting (e.g., walruses, caribou), fishing (e.g., salmon), and gathering and are highly dependent on the state's rich water resources (ADFG 2010). Much of the water is frozen most of the year or locked up in glaciers or frozen ground. However, the Arctic including Arctic Alaska is experiencing some of the most profound warming in the world, which is melting frozen water (IPCC 2007). Key water-related climate change impacts are impacts to subsistence activities, coastal and riverine erosion (Bowden et al. 2008; Lindsey 2011) leading to the need for community relocation and impacts to water supply and infrastructure.

In particular with respect to water supply, rural Alaska Native communities both in the Arctic and elsewhere in Alaska depend on groundwater (66%), lakes and reservoirs (20%), and rivers and creeks (14%) for their water (ANTHC 2011). Little information is available on changes to Alaska Native groundwater supplies, however, surface water sources and water supply infrastructure are being dramatically affected by climate changes (Alessa et al. 2008**;** Evengard et al. 2011**;** Warren et al. 2005**;** White et al. 2007). Emerging issues include increased algal blooms in rivers and in tundra lakes (Brubaker et al. 2010), increasing river turbidity due to permafrost thawing and erosion (Brubaker et al. 2011a, 2012; Durand et al. 2011), and increasing infrastructure damage due to subsidence from permafrost thawing and erosion (Durand et al. 2011; Larsen et al. 2008; USACE 2009), which is affecting the economic viability of providing water service. As permafrost thaws and the ground absorbs water, water levels in some tundra lakes are decreasing or lakes are draining entirely causing water supply problems

(Roach et al. 2011**;** Rover et al. 2012). In some instances though, lakes are expanding possibly due to contributions from melting permafrost (Brubaker et al. 2010). Specific examples of climate change impacts on subsistence activities, coastal erosion, and water infrastructure are included in the discussion below.

Life for many coastal Alaskan Natives revolves around the hunting of sea mammals such as seals, walruses, and whales. Sea ice plays a key role in this. Thinner ice and unusual cracks can create hazardous conditions leading to injuries and equipment loss (Mahoney et al. 2009). Timing shifts in sea ice freezing and thawing due to warming alters hunting patterns (NSIDC 2012). In 2002, hunters in the coastal village of Shishmaref had to travel as far as 200 miles away from town to hunt for walrus, and hunters are changing from traveling on sea ice to using boats to hunt for seals (NSIDC 2012). Point Hope is a coastal Inupiat Eskimo village of over 700 residents located on the northwest Alaska coast. Residents depend on underground cellars dug into the permafrost to keep fish and meat fresh and edible. However, as permafrost thaws, this is becoming a much less reliable option and Point Hope does not currently have any alternative (Brubaker et al. 2010). For its water supply, Point Hope pumps and treats water from a tundra lake during the summer months when the lake is not frozen and stores it for use throughout the year. However, warming temperatures are contributing to algal blooms in the lake that are clogging water filters, disrupting water treatment, and causing a significant increase in the amount of labor and consumables needed to treat the water (Brubaker et al. 2010). In summer 2008, for instance, operators had to change filters almost 50 times per day instead of the standard four filter changes. In some coastal areas, storm surges and delays in the development of sea ice, which acts as a natural erosion protection against wave action, are contributing to considerable coastal erosion. Kivalina is an Inupiat Eskimo village of about 400 residents located on a barrier island in the Arctic Circle. Since 1952, the village has lost over 19 acres to erosion. At the same time, the population since the 1970s has doubled, leading to crowding. Given the degree of erosion, Kivalina is considering relocation. Estimates of relocation costs range from 100-400 million dollars (Brubaker et al. 2011b). Because of land loss, other coastal Native villages are being forced to consider relocation as well (Gray 2007).

Selawik is an Inupiat Eskimo village of about 800 residents who live on the Selawik River delta and rely on the river for drinking water and on resources such as whitefish, sheefish, caribou, and moose. The town is low lying and built on marshy ground with raised boardwalks and roads. The river and a small airport runway are the main means of transport year round. River bank erosion driven by permafrost thawing has been causing high turbidity levels in the river, which has resulted in boil water notices and increased risk of waterborne diseases (Brubaker et al. 2012). In 2004, for example, a slump developed along the riverbanks that caused the river to be cloudy for days. Beaver, which can carry giardia, are now occupying rivers in northern Alaska for the first time since the last ice age and are causing concern for residents. The beavers are an example of shifting wildlife acting as vectors for waterborne diseases. Subsidence due to permafrost thawing and erosion are causing widespread physical damage to water and sanitation infrastructure. Because of permafrost, utility lines in Selawik are located aboveground and are insulated to prevent freezing (see Box S3). As permafrost thaws, the supports and foundations for the utility lines are settling, sometimes at different rates, putting stress on utility lines. Junction boxes are particularly vulnerable to damage and once pipe seals break, cold air can enter and freeze water in the pipes, which can cause further damage. This happened during the 2011-12 winter, for example, and many families were without water service for several months. During winter, the primary mode of transport for Selawik residents is by snow machine on the river ice. However, warming is making ice conditions more hazardous for travel.

Noatak is an Inupiat Eskimo community of about 500 residents located upstream on the Noatak River and who maintain seasonal subsistence camps up and down the river and along the Chukchi Sea coast. Important subsistence species include Dolly Varden trout, chum salmon, whitefish, and bearded seal (Brubaker et al. 2011a). Noatak gets its water from three shallow wells in the Noatak River, and in recent years, these wells have sometimes gone dry. In addition, similarly to Selawik, the Noatak River is experiencing seasonal turbidity issues related to erosion driven by permafrost thawing, which is showing up in the well water. The high turbidity levels are clogging filters, lessening the effectiveness of chlorine disinfection, and increasing treatment costs. Also, similarly to Selawik, permafrost thawing is contributing to widespread infrastructure damage. For instance Noatak's water treatment plant foundation has become unstable, and water mains are leaking or breaking. Permafrost thawing is also a factor in the erosion and exposure of an old dumpsite. Waste from the site is falling into and contaminating the Noatak River. Coastal seasonal camps are experiencing a greater risk of flooding.

Newtok is a Native American Community located along the Ninglick River. It is experiencing extensive riverine erosion that has been exacerbated by permafrost thawing of the ice-rich riverbank. The long-term average erosion rate is 71 feet per year, and the community is actively trying to relocate as quickly as possible (USACE 2009; Maldonado et al. 2013).

4.2 Pacific Northwest

The Pacific Northwest (PNW) is home to 42 federally recognized tribes (Table S7). The Cascade Mountains run north-south through the region dividing it into a coastal zone west of the Cascades and a continental zone east of the mountains. The Puget Sound is a large inlet waterway (carved out by Pleistocene glaciers) consisting of many deep-water estuaries. It is located along the coast in the center of western Washington. The region has an October-March precipitation season much of which is stored in the mountain snowpack and then released during the annual April-July snowmelt period.

The PNW has a network of rivers hosting several salmon species. For many PNW tribes, salmon are keystone species for subsistence, livelihood, spiritual and religious practices, and cultural identity. They are "First Foods" that have been consumed traditionally and connect the generations (Drummond and Steele 2013b; ITEP 2011). Salmon are cold-water fish whose life histories span diverse aquatic environments. In general, they spawn in late summer/autumn in fresh, headwater streams where fertilized eggs are buried in gravel to incubate over winter

(Crozier et al. 2008). In the spring, the newly hatched salmon (fry) emerge. After spending days to one year in freshwater bodies, the juveniles migrate to lower river estuaries to acclimate to saltwater. They then migrate out to the ocean for two to five years before returning upriver as fully-grown adults to spawn and die, often at their places of birth. Many PNW tribes celebrate the return of salmon as assuring the renewal and continuation of human and all life (CRITFC 2013c).

Salmon have been in decline for over 150 years due to factors such as habitat degradation and loss, hydroelectric dams, overfishing, and invasive species (Sanderson et al. 2009; Dittmer 2013). Most PNW tribes are working to help salmon populations recover. Water supplies are important for tribal salmon hatcheries, salmon reintroduction efforts (CRITFC 2013d), riparian restoration, forestry, agriculture, small-scale hydropower, and municipal uses. Key climate change impacts include effects on salmon and shellfish, coastal erosion, and the exercise of treaty rights.

Storm intensities during the early part of the wet season are increasing (CIG 2012) and can lead to increased flooding, habitat scouring, and washing away of buried salmon eggs. Warming water temperatures can affect the timing of life cycle events and have lethal and sublethal effects (e.g., increasing susceptibility to warm water diseases). Warmer waters, for example, can lead to earlier emergence of salmon from eggs, which could lead to mismatches between fry and their food supplies whose life cycle timings may not be changing at the same rates (Crozier et al. 2008). Warming air temperatures can shift snowmelt to earlier in the spring, which may lead to shifted seasonal river flows, including higher winter flood flows and lower summer flows, as well as to unfavorably warm water temperatures earlier in the summer (Dittmer 2013). Salmon may respond by migrating downstream earlier, however, this change in migration timing may be mismatched with downstream conditions and survival (Crozier et al. 2008). Warmer summer water temperatures are already affecting the migration of returning adult salmon. Since 2003, for instance, salmon pause their upstream late summer migration at Bonneville Dam on the Columbia River due to excessively hot water until cooler waters occur. Lower summer flows can also make it more difficult for returning salmon to reach spawning grounds.

West of the Cascades, changes in coastal processes are also affecting tribes. The Swinomish Indian Reservation is located on the southeastern peninsula of Fidalgo Island (WA), and in addition to salmon, the Swinomish (WA) depend on a variety of shellfish as important staples of food and culture. In their Climate Adaptation Action Plan, the Swinomish identified inundation from sea level rise and flooding from storm surges as potentially major threats to their estuaries, which provide critical habitat for shellfish such as clams, crabs, oysters, shrimp, and mussels that the tribe also considers to be cultural keystone species and some of which provide food for salmon juveniles (Drummond and Steele 2013a; SITC 2010). Impacts relate not only to habitat loss but the loss of traditional gathering places and place-based knowledge accumulated over time about species' interactions and behaviors (ITEP 2011). The Swinomish are also concerned that inundation and flooding could contaminate their drinking water supply, cause travel disruptions on roads and bridges, and adversely affect culturally important archeological sites and artifacts. In addition, they identified the potential for increased shellfish contamination through paralytic shellfish poison toxins due to increasing sea temperatures and water quality changes as a possible public health impact (SITC 2010).

Ocean acidification is another concern for coastal tribes as it can disrupt the calcification process involved in shell development and affect the reproduction and growth of marine organisms (Ingram et al. 2012). In the Puget Sound, urbanization and ocean acidification could combine to create certain locations with more intense hypoxia (low/no oxygen) and lower pH (Feely et al. 2010). Traditional foods like roots and berries are suffering from increased soil salinization due to sea-level rise (Papiez 2009).

For the Quileute Nation and Hoh Tribe (WA), increased winter storms are coinciding with high tides at the Quileute and Hoh River mouths to create high storm surges that threaten salmon habitat and, that together with sea level rise, are washing away tribal lands. The Quileute are considering relocation. The Hoh are in the process of relocating to higher National Park Service land (ITEP 2012a). Species migration and relocation out of traditional hunting/gathering areas appears to be increasing (Papiez 2009). The Quinault and Quileute Nations of Washington have reported reductions in traditional fish such as salmon and that they are now catching saltwater fish such as anchovies for the first time (NWF 2011). Treaty-protected rights to hunt, fish, and gather are typically linked to reservation locations or customary areas on public lands. Tribes like the Tulalip (WA) are concerned that, as species move, their distributions may become mismatched with locations of tribal access.

4.3 Southwest

The Southwestern U.S. (SW) extending from California to Utah and Arizona is home to 170 federally recognized tribes (Table S7). Tribes have small and large holdings set in areas of rural and urban land and in economies of ranching, agriculture, mining, tourism, retail, and various industries. Tribal lands span diverse ecosystems and climatic regions, with varied climate change impacts. Key climate change impacts stem from drought and flooding that affect livestock, agriculture, water supply, water rights, soil quality, and aquatic species.

Increasing aridity and drought threaten SW tribal cultures pushing them to use marginal resources. Most of the 21 Colorado Plateau tribes have been experiencing drought for more than a decade (Redsteer et al. 2012). In the SW, drought is expected in to increase in frequency and severity in the future (Cayan et al. 2010; MacDonald 2010; Seager et al. 2007; Seager and Vecchi 2010). On the Navajo Nation (AZ-NM-UT), Navajo elders observed a long-term reduction in annual snowfall over the past century, a transition from wet conditions to dry conditions in the 1940’s, and a decline in surface water features (Redsteer et al., 2011a). Monitoring records corroborate the observed changes in annual snowfall and the long-term decrease in precipitation (Redsteer et al., 2011b). The ranges and abundance of plants and animals are changing and Navajo elders are observing migration of wildlife towards Navajo homes and that they are starting to use livestock water. On Navajo and Hopi lands in Arizona, lack of moisture has extended sand dune growth and migration to a third of the reservations, covering housing, causing transportation problems, and contributing to loss of endangered native plants and grazing land (Redsteer et al. 2011; 2012). In 2009, Redsteer et al. (2010) reported dune migration rates as high as 112-157 feet per year and movement of 3 feet in a single windstorm.

Drought severely impacts drinking water access on the Navajo Reservation where 25-40% of residents haul water at costs that may be 20 times more than for non-water haulers while per capita income is less than half the U.S. average (NDWR 2003). According to one study, the average trip was 14 miles one way (ITFAS 2008) and can be as long as 40 miles one way (NDWR 2003). During drought, distances traveled to find public water systems that can provide water increase, and the cost of hauling water can double (NDWR 2003). Some residents may also start to make use of non-potable sources.

In Arizona, the Hualapai Tribe depends on tourism, big-game hunting, cattle grazing, and forestry for revenue, and its economy was greatly impacted by a multi-year drought in the early 2000s. In 2002, the tribe lost over 40 head of elk and 30 cattle due to drought conditions. Loss of wildlife and livestock continued despite the tribe's efforts to haul water and feed to remote locations during the extended drought. Cattle districts on the reservation limited their stocking rates by 30% in 2001-2002 because of continuing drought, resulting in losses of nearly $500,000 to cattle ranchers on the reservation (Christensen 2003). In 2003, approximately 500 cattle in the tribal herd were sold because of the costs of supplemental water and feed (Knutson et al. 2006). During drought, demands on water supplies increase because of the need to haul water for cattle, increased use of evaporative coolers, and fire suppression activities (Christensen 2003). Other observed impacts included more wildfires, road closures due to wildfire threat, forage reduction and invasive species, increase in wildlife disease, decreasing quality of big-game animals and fewer hunting permits issued, loss of wetlands and riparian habitat, wind erosion and visibility problems, and increased operating expenses for a tribally owned and operated river rafting company (Knutson et al. 2006).

In Nevada, the Pyramid Lake Paiute Tribe is deeply connected culturally, physically, and spiritually to the unique and fragile ecosystem of Pyramid Lake, which covers nearly a quarter of their reservation. Climate change impacts will significantly alter the ecosystem of this lake, which is located at the terminal end of the Truckee River. Pyramid Lake is home to an endangered species native to the lake called cui-ui that is the primary cultural resource of the tribe and to the Lahontan cutthroat trout, a native threatened fish renowned for its size. Traditionally, Paiute people would travel to the lake for annual cui-ui spawning at which time fish were gathered and dried. Today, the tribal economy is mostly centered on fishing and recreational activities at Pyramid Lake (Gautam et al. 2013). The lake's wetlands also provide reeds for basketry, which remains a symbol of native identity. An example of devastating drought impacts in the past was an excessive diversion at Derby Dam for agricultural use that blocked access to upriver spawning grounds and left dying fish for 2 miles downstream of the dam (Gautam et al. 2013). Ranching is a recent tribal livelihood that was introduced in the early 20th century that can be upset by climate change as indicated by a 2003 drought that significantly reduced grazing land and led to cattle encroachment upon wetlands. Climate change may also amplify existing invasive and noxious weed problems in the riparian, agricultural, and rangeland areas due to direct and indirect human mediated pathways (PLPT and USDA NRCS 2005; Smith et al. 2001). In the future, drought combined with increased temperatures and reduced inflows will likely increase salinity concentrations in the lake leading to reduced biodiversity with dominance of warmer temperature and salt tolerant species (Gautam et al. 2013).

Extreme precipitation events have also affected tribes. In September 2003, the Navajo town of Kayenta, AZ experienced flooding as drainage systems were not designed for more intense storms (Leeper 2009). From 2008-2010, the Havasupai Tribe had several severe floods that damaged trails, campgrounds, and recreational areas in Havasu Canyon, greatly impacting tourism revenue (Wotykns 2010). In January 2010, the Navajo Nation and Hopi Tribe were impacted by a storm producing four feet of snowfall; food and supplies were flown in to people who were stranded in remote areas (Krajnak 2010). In July, 2010, the Hopi Tribe declared a state of emergency due to flooding that closed roads and damaged water, sewer, and telephone lines, homes, and gravesites (Arizona Emergency Information Network 2010).

Over 20 southwestern tribes have reservation lands and associated water rights in the Colorado River watershed. Anticipated decreased flows due to climate change combined with rapid population growth in the region are increasing the urgency of adjudicating and defining tribal water rights (Cordalis and Suagee 2008; Karl et al. 2009).

4.4 Great Plains

The Great Plains extend from Montana to Texas with the Rocky Mountains marking the region's western edge. Historically, the Plains were predominantly grasslands and the range of vast bison herds. Today, 70 federally recognized tribes call the Great Plains their home (Table S7) and engage in subsistence and economic activities such as agriculture, ranching, tourism, energy extraction, and more recently, renewable energy production. Key water-related climate change impacts include those on water supply infrastructure, ranching, agriculture, and water for ceremonial uses stemming from climate extremes such as drought and flooding and from increased glacial melting and shifts in snowmelt timing.

In North Dakota, the Standing Rock Sioux Tribe depends on a sole intake pipe from the Missouri River at Fort Yates, the location of tribal headquarters, for its water supply. A 2003 drought caused water levels to drop so low that silt and sludge clogged the pipe. The tribe did not have water for several days and an Indian Health Service hospital had to temporarily shut down (Albrecht 2003). As the drought persisted into 2005, water levels in the Missouri River basin kept decreasing with Lake Oahe dropping to levels that were 28 feet below normal. An anticipated similar intake pipe situation caused the Army Corps of Engineers to move the sole water supply intake pipe for the Cheyenne River Sioux tribe and other South Dakota residents to a different location as a temporary solution with an expected timeframe of 9 months for completion and a cost of several million dollars (Downey 2005, Native American Law digest).

In 2011, Oklahoma and Texas experienced a historic drought and heat wave. In

Oklahoma, as an example, the Jan-Aug. precipitation total was the second driest on record and summer (Jun-Aug.) temperatures were the hottest on record. High temperatures throughout Oklahoma averaged 100.5 °F (OK Climatological Survey, 2011). This drought/heat wave was in mind when representatives from 21 Oklahoma tribes (including the Cherokee, Chickasaw, and Choctaw Nations for example) and 1 Texas tribe (the Alabama-Coushatta Tribe) met in December 2011 to discuss climate variability and change as part of a joint Haskell Indian Nations University (HINU), Oklahoma Climatological Survey (OCS), and Southern Climate Impacts Planning Program (SCIPP) meeting (Riley et al., 2012). Drought impacts noted by tribes included the drying up of ponds, water quality concerns related to stagnant streams providing less dilution of contaminants, and difficulties producing enough food for sustenance and hay to feed cattle. The lack of hay forced many farmers to sell their livestock prematurely and depressed markets resulting from the accelerated selloff. Low water levels contributed to fish die-offs and blooms of blue-green algae, some species of which can produce toxins that are harmful to humans and animals (CDC 2010). Tribes relying on hydropower had difficulty meeting energy needs and drying soils shrinking and compacting around pipes caused water main breaks. Flowing water, crucial to many tribal ceremonies, was lacking. One meeting participant noted that they had to travel 20 miles to find water to complete a ceremony. Some meeting participants were concerned about potential declines in tourism and associated decreases in tourism revenue. Concerns regarding health risks for children playing in dried up lead-contaminated creek beds were also expressed. In terms of broader climate change impacts, some tribal members fear that their cultural identity will be lost if their natural resources disappear. Drought can amplify wildfire and flooding risks by creating dry conditions that provide increased fuel for high intensity fires, which in turn create water repellent post-fire soils that lead to increased runoff and subsequent debris flows that decrease water storage capacity (NWF 2011; Moench and Fusaro 2012).

Flooding can also cause various impacts including potential loss of life, property, and crops and potential increases in contaminants introduced to the water supply. In February 2011, the Pine Ridge Reservation (SD) experienced unusually early flooding when statewide high temperatures reached 40-70°F causing premature snowmelt (Skadsen and Todey 2011). This, combined with ice jams and clogged culverts, resulted in flooding throughout much of the reservation (ICTMN 2011) and emergency drinking water and supplies had to be delivered to stranded residents. Tribes often have widely dispersed populations that can make emergency response to situations like this challenging.

Residents of the Wind River Reservation (WY) depend on Rocky Mountain snowmelt for irrigation water, and during times of earlier snowmelt concerns about water for late season agricultural irrigation arise. In addition, flooding from the dramatic glacial retreat in the Wind River Mountain range is causing silt build up in irrigation ditches (NWF 2011). Also, in some Rocky Mountain areas, dust from anthropogenically disturbed soils decreases snow albedo thus increasing the absorption of solar radiation (Painter et al. 2010). This radiative forcing has been shown to contribute to earlier snowmelt, which exacerbates any impacts from warming temperatures. In addition, earlier snowmelt results in earlier exposure of vegetation and soils, which increases evapotranspiration losses relative to snow-covered conditions. Modeling of dust effects for the Colorado River has shown that this longer snow-free season decreases annual runoff totals (Painter et al. 2010).

4.5 Midwest

The Midwest (MW) is the location of the five lakes comprising the Great Lakes that together form Earth's largest surface freshwater system, containing about 20% of the world's fresh surface water supply (Wang et al. 2012). Thirty federally recognized tribes live in MW states and depend on this abundant water resource (Table S7). For example, ceremonies honoring the water as the life-blood of Mother Earth are held throughout the MW region. MW tribes depend on the waters for subsistence and commercial fishing and for the use of water-based plant materials for traditional crafts and artwork (Tribal and First Nations Great Lakes Water Accord 2004). Additionally, most MW tribes now operate gaming facilities and other tourism enterprises that rely heavily upon abundant water resources for aesthetic and recreational uses (Tribal Gaming in the States 2007).

Many MW tribes consider adaptation to the changing climate to be one of the most important long-range environmental issues for tribal nations. These nations are now fixed in place politically/geographically and thus, for the first time, will not be able to move with the changing climate. Michigan tribes have worked with the state to negotiate and sign the May 12, 2004 Intergovernmental Accord Between the Federally Recognized Indian Tribes in Michigan and the Governor of the State of Michigan Concerning Protection of Shared Water Resources and the June 11th, 2009 Intergovernmental Accord between the Tribal Leaders of the Federally Recognized Indian Tribes in Michigan and the Governor of Michigan to Address the Crucial Issue of Climate Change. Bi-annual meetings are held between the state and tribes to discuss issues regarding shared responsibilities and potential cooperative efforts.

Impacts on MW tribes are diverse and key impacts are related to flora and fauna that are important for diet, acknowledging clan responsibilities, and tribal social and mental health (F. Ettawageshik, personal communication). Other significant impacts include those related to crop losses and the exercise of treaty rights. Traditional healers in the region, for instance, have noted that lack of moisture and unreliable springtime temperatures have caused significant wild and cultivated crop losses (traditional healers personal communication, 2012; CIAB 2012)

Wild rice (manoomin) is a sacred food of great importance to the Anishinabe tribes of the Great Lakes area and may be detrimentally affected by climate change. In the Migration Story of the Ojibwe (an Anishinabe-speaking tribe), Kitchi-Manitou (The Great Mystery) foretold of the coming of the light-skinned race and instructed them to journey westward from the eastern coast until they found "the food that grows on water" (Benton-Benai 1988) or they would be wiped out as a people (Riccobono 2011). Kitchi-Manitou gave them the responsibility to take care of the seed/food so that the seed can take of their people. Since that migration was completed around 1400 A.D., many generations of Great Lakes tribes have harvested wild rice as a source of food and spiritual sustenance. However, since the 1900's, the loss of wild rice acreage due to mining, dams, expanding agricultural ditch networks and other activities has been substantial (FDLNR 2013). Warmer temperatures due to climate change could further decrease rice distribution by reducing seed dormancy and favoring invasive, outcompeting plants and invasive carp, which consume and uproot the plant (MDNR 2008). Warm, humid conditions are conducive to brown spot disease (MDNR 2008), and managers are concerned about a potential movement of the disease northward (T. Howes 2013, personal communication). Over the past 10 years, outbreaks of brown spot disease have become more frequent in Wisconsin and southern Minnesota (T. Howes 2013, personal communication).

Water levels also influence rice survival, and the potential increase in both droughts and floods in the future with climate change is of concern to managers, as wild rice does not tolerate either of those extremes well (T. Howes 2013, personal communication; MDNR 2008). Severe drought can be bad for pollination leading to a lack of seed production. Likewise rapid water level fluctuations associated with flooding can uproot wild rice plants, also leading to lack of seed production. Extremely low Lake Superior levels in 2007 forced the Bad River Band of the Lake Superior Tribe of Chippewa (WI) to cancel its annual wild rice harvest due to dramatic crop size reductions (UW Sea Grant 2007). A June 2012 flood led to near total crop failure on the Fond du Lac (FDL) Reservation with only 35 acres out of 800 producing wild rice seed (T. Howes 2013; personal communication). This affected FDL and Mille Lac manoomin harvesters who rely on harvest revenues for meeting family and educational needs (N. Crowe 2013, personal communication). Non-Native harvesters were also impacted, and harvesters were forced to travel farther to gather rice.

Tribes in the Great Lakes area rely on treaty fishing, hunting, and gathering rights. The exercise of these rights requires considerable attention to environmental issues, including climate changes that affect species and habitats. These rights have been the subject of several court cases, which have resulted in decisions upholding tribal rights. Consent decrees and other agreements outline the responsibilities of each party in the exercise of Treaty rights *(1972 Gurnoe Decision; 1983 Voigt Decision; 1999 Mille Lacs Decision; US vs. MI 2000 Consent Decree for 1836 Treaty; US vs. MI 2007 Inland Consent Decree).*

4.6 East

The eastern U.S. extends from Maine to Florida and Louisiana. Twenty seven federally recognized tribes live in the East (Table S7). The region is humid with cooler temperatures in the north and subtropical temperatures in the south. Tribal members rely on natural resources to provide them with food and spiritual sustenance. Many tribal members engage in hunting (e.g., moose, deer, muskrats), fishing (e.g., lobsters, shrimp) and gathering (e.g., blueberries). Medicine men and women and ethno-biologists gather plants, herbs and animals as part of cultural practices on tribal land and other traditionally occupied areas. Tribal members rely on diverse water resources including riverine, wetland, estuarine, and oceanic ones. Key climate change impacts include those on aquatic species of cultural and livelihood importance and coastal erosion.

Riverine tribal communities may be exposed to higher incidences of flooding as a result of increased snowfall and rapid snowmelt (Horton et al. submitted). Fishery habitat may also be impacted as higher river flows during winter can potentially scour fish habitat and nesting sites, increasing fish mortality.

The fishing/shellfish livelihoods of both riverine and coastal tribes may be affected by warming water temperatures, which can result in lower oxygen levels and greater susceptibility to poisons, parasites, and disease, which can stunt growth and increase juvenile mortality (Frumhoff et al. 2007; Horton et al. submitted). Although warming in the Northeast's colder water, particularly in the eastern Gulf of Maine, could boost lobster productivity, warmer waters may also be more hospitable for a bacterial condition known as lobster shell disease that grotesquely scars lobster shells making them less lucrative for sale (Frumhoff et al. 2007) impacting Northeastern coastal tribes like the Pleasant Point Passamaquoddy in Maine who harvest lobster. Tribal communities often consume higher amounts of fish and shellfish than the average population increasing their exposure to methylmercury accumulated in seafood. One study found that warming oceans might facilitate the methylation of mercury and its uptake by fish (Booth and Zeller 2005).

Similar to PNW tribes, the livelihoods of coastal tribes in the East may be affected by ocean acidification, which could influence the ability of shellfish to process calcium and magnesium carbonate and impact shell development (Ingram et al. 2012). Rising sea levels may inundate and cause damage to fish and wildlife habitat (Frumhoff et al. 2007).

In coastal Louisiana, tribes have observed a variety of substantial environmental changes including increased flooding, major land loss (including the loss of wetlands and barrier islands), saltwater intrusion, and rising temperatures. These changes were the topic of discussion during a 2012 meeting of several coastal Louisiana tribes including the Grand Bayou Village, Grand Caillou/Dulac, Isle de Jean Charles and Pointe-au-Chien Indian Tribes (ITEP 2012b). Local tribal members and leaders, tribal members from other regions, faith leaders, and government officials including representatives from USDA's Natural Resources Conservation Service attended the meeting, which was documented and submitted as input for the 2013 National Climate Assessment (Louisiana Workshop 2012). The changes stem from a complex combination of human and environmental factors to which climate change may be contributing (Bethel et al. 2011; Maldonado et al. 2013). Extensive oil and gas development in the Gulf Coast has resulted in the construction and dredging of canals and the installation of thousands of miles of pipelines cutting through marshlands (Maldonado et al. 2013). The region has experienced six major storms since 2005, including Hurricanes Katrina and Rita, and most recently Hurricane Isaac. The Mississippi River levee system has decreased sediment deposition and associated land buildup. Rising sea levels can also contribute to inundation and saltwater intrusion (Nicholls and Cazenave 2010).

Impacts from land loss observed by tribes include decreasing land available to farm. Tribes are also greatly concerned about the potential need for relocation and the fracturing of communities that could ensue as well as the high costs that would entail

(Maldonado et al. 2013). Saltwater intrusion is contributing to the demise of coastal forests, and lack of vegetation allows storms to erode coasts more easily (ITEP 2012b). Saltwater intrusion is also negatively affecting the survival of traditional medicinal plants. Without access to these plants, tribal members must now pay for medical remedies that they may not have paid for before. Saltwater intrusion is also harming tribal capacities to farm. Rising temperatures have limited the ability of tribes to make multiday fishing and shrimping trips because of costs associated with refrigeration (Louisiana Workshop 2012; NRCS 2012). Decreases in fresh vegetables and seafood have led to increases in processed food consumption with associated impacts on tribal health (ITEP 2012c).

The Gulf of Mexico along the Louisiana/Texas coast is also the location of one of the world's largest zones of seasonally-formed coastal hypoxia (Rabalais et al. 2009), which is a concern for tribes. Climate changes may act to exacerbate the formation/duration of hypoxic zones. For example, increased surface water temperatures will likely strengthen water column stratification and could thus contribute to the formation and duration of oxygen-depleted areas (Diaz and Rosenberg 2008; Rabalais et al. 2009). If river discharges increase, this could also lead to elevated nutrient loading likewise contributing to worsened hypoxia (Diaz and Rosenberg 2008; Rabalais et al. 2009). In some situations though, climate changes could act to alleviate hypoxia to some degree. Lower river discharges, for instance, could lead to fewer nutrients reaching coastal areas, thus decreasing one of the factors contributing to hypoxic zones (Rabalais et al. 2009). More frequent or severe storms could disrupt water column stratification, lessening hypoxia, however, the effects may only be temporary (Diaz and Rosenberg 2008; Rabalais et al. 2009). Apart from climate changes, rising populations and more intense agriculture and industrialization will likely contribute to greater nutrient loading and associated hypoxia unless interventions are pursued (Rabalais et al. 2009).

In addition to the various issues noted above, one final complicating factor for many Louisiana coastal tribes in terms of responding to environmental changes is that many tribes, including the four noted above, lack federal recognition. This non-status limits the ability of the tribes to obtain funding. The tribes, for example, cannot receive assistance from the Bureau of Indian Affairs (ITEP 2012c).

5 CONCLUDING THOUGHTS

From the discussion above, certain common themes among climate changes affecting tribes and among impacts on tribes can be drawn. Coastal tribes, whether they are located along the Alaska, East, West, or Gulf Coasts are concerned with sea level rise and coastal inundation, increasing coastal erosion, ocean acidification, saltwater intrusion, and warming ocean temperatures (see Table S1). Tribes in continental and mountainous regions are concerned with warming water temperatures, shifts to earlier snowmelt, and increasing extremes in precipitation leading to both flooding and droughts (see Table S1). Many of the observed impacts from these and other changes fall into one of five categories: 1) water supply and management (including water sources and infrastructure), 2) aquatic species important for culture and subsistence, 3) ranching and agriculture particularly from climate extremes (e.g. droughts, floods), 4) tribal sovereignty and rights associated with water resources, fishing, hunting, and gathering, and 5) soil quality (e.g., from coastal and riverine erosion prompting tribal relocation or from drought-related land degradation).

The literature we have reviewed represents just a fraction of the issues facing the varied tribes in the U.S. We encourage the continuation of efforts to identify climate change impacts on tribes as well as factors (Fig. 2) contributing to those impacts. These efforts include meetings such as those held by tribes in Oklahoma and southern Louisiana as part of the National Climate Assessment process (Louisiana Workshop 2012; Riley 2012) and by tribes in Arizona and New Mexico as part of a joint Institute for Tribal Environmental Professionals and Forest Service Rocky Mountain Research station workshop (Wotkyns 2011**)**.

In addition to identifying impacts, tribes have an urgent need to prepare for and respond to climate change impacts and tribes as well as non-tribal entities supporting such efforts need to do so in a way that considers cultural and traditional values. In addressing these issues, it is important to take into account not only the climate hazards but also the socioeconomic, political, and other factors (Fig. 2) that increase or decrease a community's vulnerability and its adaptive capacity. Table S6 provides an extensive list of action categories that could increase the adaptive capacity of tribes, how they relate to reducing hazard exposure and vulnerability factors, and examples of such actions currently taking place. Cochran et al. (2013) also propose strategies by which AIAN can contribute to understanding and adapting to climate change.

More specifically, Native American tribes need relevant and culturally appropriate monitoring, assessment, and research on their waters and lands and to develop or be included in the development of contingency, management, and adaptation and mitigation plans. Tribes also greatly need actual implementation of projects. Although climate change preparedness can take place as a stand-alone effort, climate change considerations can be included as part of planning and implementation that is already occurring (Table S4).

Culturally appropriate engagement includes tribal participation in all aspects of project design and implementation, respects tribal sovereignty, local laws, and the need to obtain consent, respects the dignity of people, ensures confidentiality when desired, and accounts for tribal concerns about control over data and how they are used (Pearce et al. 2009). It also acknowledges and takes into account that what may be acceptable in a non-indigenous arena (e.g. research objectives and methods, adaptation strategies) may not be acceptable according to local cultural norms (Pearce et al. 2009).

Tribes or intertribal organizations must decide what relevant monitoring, assessment, planning, and research consists of. In Table 1, we propose examples of research questions that might be significant for tribes based on the five impact categories. These include examples of science, policy, and social science questions related both to further identifying impacts and contributing climate and vulnerability factors and to identifying adaptation strategies.

In thinking about adaptation planning it is important to note that different changes in climate, its multiple impacts, and factors of tribal vulnerability/adaptive capacity will all interact with each other to create levels of interconnected impacts. Adaptation processes must thus use a holistic approach considering interactions across sectors (e.g. municipal water, agricultural water, energy) and within and among various scales (e.g. spatial, temporal, decision-making) (NRC 2010). Adaptation actions will also be most effective if integrated into a broader sustainability agenda rather than as a stand-alone effort (NRC 2010). Climate change considerations can be included as part of planning and implementation that is already occurring, such as the kinds of plans listed in Table S4.

In addition, there are also uncertainties in projecting impacts because of uncertainty in model projections, lack of community-specific climate and water resources data, and the difficulty of projecting interactions among changes, impacts, and factors. Vulnerabilities/capacities and impacts themselves are also continuously changing because of the dynamic nature of climate change, greenhouse gas emissions, economic conditions, and population among other factors. Because of uncertainties and the dynamic nature of processes leading to impacts, adaptation processes need to be flexible and iterative, include relevant monitoring to allow for continual evaluation of our understandings of impacts and the effectiveness of adaptation strategies, and permit the modification of adaptation actions as new information becomes available (Millar et al. 2007). For AIAN, who have been left out of discussions in the past, it is also important that adaptation planning be participatory and transparent.

To the benefit of adaptation planning, as well as monitoring, assessment, and research, traditional ecological knowledges (TEKs; Wildcat, this issue) should be incorporated at all stages in a way that respects individual and tribal sovereignty over TEKs. Capacity building in the form of training and education opportunities will enhance tribes' abilities to conduct their own monitoring, assessments, planning, and implementation. Many tribes have unquantified and/or undeveloped water rights, which makes planning for tribes and others in a region more challenging (Collins et al. 2010). It is thus imperative that tribes adjudicate and solidify their water rights and that water management polices be designed to consider climate change scenarios while also considering tribal rights. The lack of monitoring on tribal waters and lands is also great, and improvements in monitoring are needed both to help quantify environmental changes that are occurring and to assess the effectiveness of adaptation strategies (Collins et al. 2010; Ferguson et al. 2011; Garfin 2012). Because tribes are stretched thin in addressing current problems, much less preparing for future climate change impacts, funding strategies to help with all stages of climate change preparedness are critical. It is important to develop funding and training mechanisms for long-term maintenance and upgrades of monitoring equipment, drinking water treatment systems, and the like. Without routine maintenance and upgrades, monitoring equipment may not provide accurate data or drinking water treatment systems may not be able to treat water to health standards, particularly during droughts or floods. In addition, because of the uncertain and dynamic nature of climate changes and other vulnerability factors, climate adaptation and other plans need to be regularly reviewed and modified, which requires long-term funding, commitment and capacity as well.

In all the aforementioned undertakings, tribes can take advantage of cooperative and shared partnerships with government entities, nonprofit organizations, universities, tribal colleges, and one another (Table S5). For in the end, like raindrops forming an ocean, we are all family, in relationship, and deeply connected.

Table 1. Examples of Potentially Significant Research Questions based on the Five Impacts Categories

1) Impacts on water supply and management (including water sources and infrastructure)

- How will climate change and other vulnerability factors such as population growth and land use changes affect the quantity and quality of AIAN surface and groundwater?
- Given the importance of groundwater for AIAN drinking water systems, how can groundwater-surface water systems be collaboratively and conjunctively managed to maintain the viability and quality of AIAN aquifers?
- What are the most effective ways (in terms of decreasing health risks, time, costs) for addressing water supply deficiencies in Indian Country, while taking climate change into account?
- How can AIAN water supply infrastructure be better adapted to the climate changes occurring (e.g. drought, permafrost melting, algal blooms)?

2) Impacts on aquatic species important for culture and subsistence

- Which species are particularly important to tribes for culture and subsistence (acknowledging that for many tribes all species are inherently important)?
- How are and will climate changes and other vulnerability factors (e.g., habitat fragmentation) affect the geographic ranges and populations of such species?
- What partnerships are needed and what strategies can help promote species resilience and transition?

3) Impacts on ranching and agriculture particularly from climate extremes (e.g., droughts, floods)

- How can AIAN ranching and agriculture be made more resilient to climate extremes such as drought and flooding?

4) Impacts on tribal sovereignty and rights associated with water resources, fishing, hunting, and gathering

- What are the potential impacts of climate change on tribal water rights (both in terms of quantity and quality) and off-reservation rights to fish, hunt, and gather?
- How can climate change considerations be incorporated into AIAN water rights negotiations?
- What types of legal and governmental processes can be put into place to allow tribes to renegotiate off-reservation rights to fish, hunt, and gather if species migrate to new areas?

5) Impacts on soil quality (e.g. coastal and riverine erosion prompting tribal relocation and drought-related land degradation)

- Which tribes have a higher risk of losing their lands due to climate-related changes (e.g., coastal inundation, melting permafrost, coastal and riverine erosion) and to other vulnerability factors (e.g., levee systems leading to decreased sediment deposition and land buildup, unsustainable resource extraction) or have a higher risk of lands becoming unusable due to factors such as drought-related soil degradation and sand dune formation and migration?
- What strategies can be put into place to decrease land loss or restore degraded lands?
- What types of governmental processes (tribal and federal) can be put into place to assist tribes with identifying lands and funds for relocation if that becomes a necessity?
- How can sites and/or practices that may be lost be documented most effectively?

Table S4. Examples of already occurring planning/ implementation into which climate change considerations can be incorporated

- ○ Economic development plans
- ○ Ecosystem management plans
- ○ Emergency response (short-term), hazard response (short-term) and mitigation (long-term) plans to prepare for and lessen the impacts of climate extremes such as droughts, flooding, and heat waves
- ○ Public health plans
- ○ Long-term water supply and management strategies
- ○ Reservoir operation plans
- ○ Stormwater management plans
- ○ Water supply contingency plans - to ensure water security in times of disaster, shortage, or disturbance
- ○ Infrastructure upgrades
- ○ Infrastructure construction as part of new development or after a natural disaster has occurred

Table S5. Sampling of Potential Partners for Working on Climate Change Issues

- ○ Governmental entities
- ○ Non-profit organizations
- ○ Tribes
- ○ Tribal colleges
- ○ Universities and research Institutions

Some specific examples include:

- ○ Alaska Native Tribal Health Consortium (ANTHC)
- ○ Indigenous Peoples Climate Change Working Group
- ○ Center for Native Peoples and the Environment, State University of New York
- ○ PRiMO Pacific Risk Management Ohana
- ○ DOI's Bureau of Reclamation
- ○ DOI's Landscape Conservation Cooperatives (LCCs)
- ○ DOI's Climate Science Centers (CSCs)
- ○ FEMA/DHS University of Hawaii National Disaster Preparedness Training Center
- ○ National Center for Atmospheric Research (NCAR)
- ○ NAU's Institute for Tribal Environmental Professionals (NAU ITEP)
- ○ NOAA's Coastal Services Center and Pacific Services Center
- ○ NOAA's National Integrated Drought Information System (NIDIS)
- ○ NOAA's Regional Integrated Sciences and Assessments programs (RISAs)
- ○ University of Hawaii National Disaster Training Center
- ○ USGS National Climate Change & Wildlife Science Center
- ○ Western Governors' Association Climate Program

DHS – Department of Homeland Security; DOI – Department of the Interior; FEMA Federal Emergency Management Agency; NAU – Northern Arizona University; NOAA – National Oceanic and Atmospheric Administration; USGS – United States Geological Survey

Table S6. Increasing tribal climate change resilience

Hazard/vulnerability factor	Types of actions that would increase adaptive capacity	Examples of Solutions
Changes in climate, hydrology, and ecosystems		
Rising greenhouse gas emissions Lack of tribe-specific monitoring data (Collins et al. 2010; Ferguson et al. 2011; Garfin 2012) Lack of tribe-specific research	○ More and sustained monitoring of weather, climate, water, and ecosystems to establish baseline conditions (i.e. baseline assessments and inventories) and to observe long-term changes. (Houser et al. 2001) ○ Improved access to regional data (Ferguson et al. 2011) ○ Understandable, tribe-specific data about climate change trends and projections (Houser et al. 2001). ○ Tribe-specific research and demonstration projects on current and potential climate change impacts on tribal water supplies including groundwater; on erosion processes affecting tribal communities; on the abundance and geographic distribution of aquatic species that are keystones for culture and subsistence; on tribal access to culturally important species both on and off-tribal lands (Houser et al. 2001; Leeper 2009)	The **Alaska Native Science Commission (ANSC)** is a non-profit organization that brings together Alaska Native communities and researchers, promotes the inclusion of Alaska Native priorities and participation of Alaska Natives in research, and provides an archive of research relevant for Native communities. (http://www.nativescience.org/) The **Alaska Native Tribal Health Consortium (ANTHC) Center for Climate and Health** investigates health impacts from climate change that result, for example, from damage to health infrastructure such as water systems. (http://www.anthc.org/chs/ces/climate/) The **Exchange for Local Observations and Knowledge of the Arctic (ELOKA)** facilitates the collection, preservation, and management of local and traditional knowledge and provides a means for residents, scientists, policy makers, and the general public to access the data and collectively work to increase understanding of the Arctic system. (http://eloka-arctic.org/about/index.html) **Federal-State-Tribal Fishery managers interested in modified reservoir rule curves**: Increasing weather variability may cause early winter snowmelt or an extended winter dry period. In such cases, expected water does not materialize and a reservoir may then be over-drafted. Planned fish flows from the reservoir may not occur. This is of concern to PNW tribes with respect to salmon. New optimized reservoir rule curves (Lee et al. 2009) can give operators more ability to buffer against increasing climate change/variability, especially in the moisture-rich Pacific Northwest.

Hazard/vulnerability factor	Types of actions that would increase adaptive capacity	Examples of Solutions
	○ Tribe-specific vulnerability and risk assessments that include the various hazard and vulnerability factors (Fig. 2) (Collins et al. 2010). ○ Processes for holders of Traditional Ecological Knowledges (TEKs) to partner with researchers to integrate and supplement scientific monitoring data with TEKs (Nakashima et al. 2012) in a way that takes into account tribal sovereignty over such knowledge (Wildcat this issue). ○ Tribal projects to reduce greenhouse gas emissions (Cordalis and Suagee 2008) ○ Outreach to connect tribal scientists and personnel with researchers to collaborate on research projects, build tribal capacity, and build trust ○ Mechanisms for tribes to communicate their monitoring and research interests to federal agencies	The **Intertribal Council on Utility Policy (ICOUP)** is a northern Great Plains organization that promotes tribal wind power development and provides renewable energy credits and carbon dioxide offsets. (http://www.intertribalcoup.org/) ***Siku-Inuit-Hila project*** - see Box S8 The **Tribal Green Building Codes Workgroup** consists of tribal and federal agency representatives who work together to support green building in Indian Country including the development of tribal green building codes. Such codes address topics such as safety concerns, reduction in energy usage to lower energy costs and decrease greenhouse gas emissions, and water and building materials usage. (http://www.epa.gov/region9/ greenbuilding/tribal-workgroup.html) The **University of Oregon/USDA Forest Service Pacific Northwest Research Station Tribal Climate Change Project** fosters communication among tribes, government agencies, and researchers on tribal climate change adaptation and mitigation planning and research needs and opportunities. Key focus areas include: the consideration of traditional knowledge in understanding impacts and identifying culturally appropriate adaptation strategies, the inclusion of tribes in federal and state climate change planning efforts, and the inclusion of tribal climate change considerations in the management of off-reservation resources. (http://tribalclimate.uoregon.edu/)

Hazard/vulnerability factor	Types of actions that would increase adaptive capacity	Examples of Solutions
Socioeconomic factors		

Limited staff overall and limited staff with some of the technical expertise needed to conduct monitoring/assessments
 	
Limited funding (Collins et al. 2010)
 	
Lack of tribal awareness of funding opportunities (Teel and Duren 2011)
	○ Improved K-12 education on tribal lands, sustainable economic development (See Sec. 3.2)
	
	○ Training opportunities and technical assistance for capacity building so that tribes can conduct their own/contribute to monitoring, research, and plan development (Teel and Duren 2011). Training in and assistance with grant and proposal writing is also needed (Collins et al. 2010).
	  ○ One tribal workshop suggestion was that federal agencies support dedicated tribal liaisons who visit tribes, provide technical consulting services, and have budgets to support tribal projects. Technical consulting services might include help in designing new or improving existing monitoring systems and data management systems and visiting tribal resource managers and technicians to check data and calibrate instruments (Ferguson et al. 2011).
	
	○ Funding mechanisms for tribal climate change planning and implementation efforts.
	
	○ Greater outreach to let tribes know about funding opportunities that already exist (Teel and Duren 2011).
	  ○ This could include an easily searchable, centralized federal government website, maintained on a long-term basis with clear explanations of eligibility and other proposal requirements (Teel and Duren 2011).
		The **Institute for Tribal Environmental Professionals (ITEP)** at Northern Arizona University has a long history (20 years) of working with tribal communities in the U.S. on issues including climate change adaptation. ITEP offers climate change trainings and has developed tools and resources that tribes can use for adaptation planning. ITEP's informational resources include a website on Tribes and Climate Change and a monthly Tribal Climate Change newsletter that includes funding opportunities. (http://www4.nau.edu/tribalclimatechange/)
		
		NCAR Tribal Colleges Project – In 2011, the National Center for Atmospheric Research (NCAR) hosted a workshop to initiate discussions about how tribal colleges, AIAN Nations, and NCAR could work together to conduct tribe-relevant climate change research and education. One result was a summer research experience in which tribal college students received training at tribal colleges and NCAR on scientific research and various tools (e.g., GIS, air monitoring units, etc.), carried out research on climate change issues directly affecting tribes, and performed outreach to their tribal communities on research results. Tribal students were able to integrate traditional tribal perspectives and knowledge with western science education. (http://www2.ucar.edu/for-staff/daily/calendar/2011-09-26/climate-change-native-lands-opportunites-ncar-and-tribal-college)

Hazard/vulnerability factor	Types of actions that would increase adaptive capacity	Examples of Solutions
Political factors		
Lack of tribal climate change planning Lack of tribal inclusion in broader regional planning Inefficient or lack of interagency coordination Undefined water rights (Collins et al. 2010)	○ Inclusion of climate change considerations in tribal planning and implementation that is already occurring (see Table S3) and/or development of tribal climate change adaptation plans. ○ Inclusion of tribes in regional and watershed-based water resources management and climate change planning. ○ Expansion of the scope of climate change discussions and planning to include social and cultural considerations (Teel and Duren 2011) ○ Improved collaboration and coordination between tribes and federal agencies to monitor environmental parameters and co-manage resources along shared borders and within watersheds (Teel and Duren 2011). ○ Mechanisms for sharing information about tribal climate change impacts and adaptation planning. ○ Processes for TEK holders to partner with researchers to co-generate knowledge about effective adaptation strategies (Nakashima et al. 2012). ○ Quantified and defined water rights that consider climate change impacts and include diversified, reliable, and quality water resources (Colby, 2009). Long-term, equitable solutions for water rights issues and issues of tribal access to hunting, fishing, and gathering grounds (Collins et al. 2010) ○ Assistance for tribes without federal or state-recognition, who are currently completely excluded from discussions, cannot adjudicate rights, or petition for federal aid.	The **Nez Perce Tribe, Idaho** is engaged in **co-management efforts** to protect on and off-reservation tribal resources that may be affected by climate change including salmon, bison, and a traditional food and medicinal plant called camas through partnerships with the National Park Service regarding changing habitats and EPA regarding environmental regulations like the Clean Water Act. The **Nez Perce Tribe's (Idaho) Clearwater River Sub-basin Climate Change Adaptation Plan** applies a holistic forestry-watershed-economics approach to preserving a big part of the Nez Perce Tribe's ancestral homeland (NPT 2011). The **Swinomish Indian Tribal Community** in Washington state has taken a lead in tribal climate adaptation planning, having developed a **Climate Adaptation Action Plan** in 2010, covering coastal resources, upland resources, public health, and community infrastructure (SITC 2010). In an example of interagency and tribal cooperation, **tribes** are working with the Climate Assessment for the Southwest (**CLIMAS**), the National Integrated Drought Information System (**NIDIS**), the U.S. Geological Survey (**USGS**), and the National Drought Mitigation Center (**NDMC**) on developing a **drought early warning system for the Four Corners region** (Ferguson et al. 2011). To facilitate the distribution and sharing of climate change information relevant for tribes, Western Water Assessment (**WWA**) and **NIDIS** have developed a searchable **Native Communities and Climate Change database** containing resources on climate change impacts on AIAN, tribal adaptation planning and actions, and relevant laws and policies. (http://tribesandclimatechange.org)

Hazard/vulnerability factor	Types of actions that would increase adaptive capacity	Examples of Solutions
Infrastructural factors		
Deficiencies in water supply, sanitation, and stormwater infrastructure (IHS 2011) Deficiencies in phone, internet, and housing infrastructure (See Sec. 3.4)	○ Improvement of tribal water supply, sanitation, and stormwater infrastructure. This should include long-term maintenance. Upgrades and installation of new infrastructure should take climate change considerations into account whenever possible. ○ Improvement of tribal communications, power, and housing infrastructure. Many households lack basic phone services and internet connectivity, limiting their access to information that can assist them in hazard and livelihood planning, monitoring, and emergency response (See Sec. 3.4). Many households also live in substandard housing that can increase the impacts of hazards such as flooding. ○ Research on adapting water supply, sanitation, stormwater, and other infrastructure to altered environmental conditions.	The Indian Health Service's (**IHS) Sanitation Facilities Construction Program** carries out projects to meet AIAN water supply and sanitation needs. Example projects carried out in 2010 include installing new pumps at the Big Bend Lift Station for the Crow Creek Reservation, SD, installing a water storage tank at the Pueblo of Laguna, NM, and installing satellite radio transmitters, pressure transducers, and dataloggers for water treatment systems belonging to the Yurok Tribe, CA (IHS 2011). On the Pine Ridge Reservation, SD, the Oglala Lakota College (OLC), Thunder Valley Development Corporation, Oyate Omnicye Regional Planning Project, and the University of Colorado's Environmental Design Program are partnering on a **Native American Sustainable Housing Initiative** (**NASHI**). The initiative is identifying housing options for Pine Ridge that are healthy, culturally appropriate, energy efficient, and affordable. A research component involves the construction of houses made from different local, building materials on the OLC campus and monitoring the homes for indoor air quality, air temperature, humidity, energy performance, and durability. (http://nashidesignbuild.org/)
Ecosystem services and land use factors		
Degraded waters and lands	○ Restoration projects that take into account the multiple environmental and human factors involved in water and land degradation as well as climate change considerations ○ Riparian restoration, for example, can reduce water temperatures and improve habitat for aquatic organisms (CH2M HILL 2009)	**Zia Pueblo, NM Sacred Spring Restoration -** At Zia Pueblo, a spring sacred to the tribe dried up after years of drought and livestock grazing. In 2009, the tribe, a restoration ecologist, and volunteers built several rock dams above the spring to catch runoff and sediment from the sandstone bluffs and clay hills above and planted native grass seeds at the site. The structures are designed to spur vegetation growth and recharge the soil instead of allowing moisture to run off and create deep ruts in the earth. A second restoration phase is now being planned. (http://riograndereturn.com/zia2.php)

Hazard/vulnerability factor	Types of actions that would increase adaptive capacity	Examples of Solutions
Spiritual and cultural factors		
Vast reservoir of Traditional Ecological Knowledges (TEKs; Wildcat this issue) of climate change observations and also of adaptation strategies (Nakashima et al. 2012)	○ Support and processes for tribes to document Traditional Ecological Knowledges (TEKs) of environmental changes that have been occurring and of traditional adaptation strategies. ○ Support for the passing of TEKs and traditional adaptation strategies through the generations. ○ Involve Native American youth in research and restoration efforts to not only facilitate climate change education but also to retain culture and TEKs, expose them to higher learning opportunities, and foster a commitment to their tribe and natural resources issues (Chief et al. 2009; Kimmerer 2002).	The Haudenosaunee Environmental Task Force (HETF) **Environmental Youth Corps (HEYC) program** teaches youth from the six nations of the Haudenosaunee Confederacy about environmental and cultural restoration through wilderness trips. On March 24, 2013, the Tuscarora HETF embarked on a 1,300-mile HEYC excursion from their original homelands in Snow Hill, North Carolina to the current Tuscarora Nation territory in New York. The 73-day running/biking/hiking/canoeing trip was intended to celebrate 300 years of Tuscarora survival since their migration from North Carolina to New York in 1713; and bring attention to climate shifts. (http://tuscaroraenvironment.com/index.php/migration-2013) The **Native Earth: Northeast Regional Native Youth Environmental Camp** held in New York is a 1-2 week summer camp for indigenous youth (9-12th graders) providing opportunities for youth to learn about both Traditional Ecological Knowledges and environmental science from tribal elders and environmental professionals. It is a collaborative effort between the HETF and *the Center for Native Peoples and the Environment at the State University of New York with financial support from the National Science Foundation.* *(*http://www.esf.edu/nativepeoples/nativeearth.htm*)*

Table S7. Number of federally recognized tribes in the United States by state and region (Federal Register 2011)

Region	State	# tribes
Pacific Northwest	WA	29
	OR	9
	ID	4
	Total	**42**
Southwest	CA	104
	NV	17
	UT	5
	CO	2
	AZ	21
	NM	21
	Total	**170**
Great Plains	MT	7
	ND	5
	SD	7
	WY	2
	NE	5
	KS	3
	OK	38
	TX	3
	Total	**70**
Midwest	MN	6
	WI	11
	MI	12
	IA	1
	Total	**30**
East Coast	AL	1
	CT	2
	FL	2
	LA	4
	MA	2
	ME	4
	MS	1
	NC	1
	NY	8
	RI	1
	SC	1
	Total	**27**
Alaska	AK	**227**
Hawaii	HI	**0**
GRAND TOTAL		**566**

Table S8. 566 federally recognized tribes in the United States by state and region (Federal Register 2011)

No.	Tribe	State(s)	Designated State	Region
1	Agdaagux Tribe of King Cove	Alaska	Alaska	AK
2	Akiachak Native Community	Alaska	Alaska	AK
3	Akiak Native Community	Alaska	Alaska	AK
4	Alatna Village	Alaska	Alaska	AK
5	Algaaciq Native Village (St. Mary's)	Alaska	Alaska	AK
6	Allakaket Village	Alaska	Alaska	AK
7	Angoon Community Association	Alaska	Alaska	AK
8	Anvik Village	Alaska	Alaska	AK
9	*Arctic Village (See Native Village of Venetie Tribal Government)	Alaska	Alaska	AK
10	Asa'carsarmiut Tribe	Alaska	Alaska	AK
11	Atqasuk Village (Atkasook)	Alaska	Alaska	AK
12	Beaver Village	Alaska	Alaska	AK
13	Birch Creek Tribe	Alaska	Alaska	AK
14	Central Council of the Tlingit & Haida Indian Tribes	Alaska	Alaska	AK
15	Chalkyitsik Village	Alaska	Alaska	AK
16	Cheesh-Na Tribe (previously listed as the Native Village of Chistochina)	Alaska	Alaska	AK
17	Chevak Native Village	Alaska	Alaska	AK
18	Chickaloon Native Village	Alaska	Alaska	AK
19	Chignik Bay Tribal Council (previously listed as the Native Village of Chignik)	Alaska	Alaska	AK
20	Chignik Lake Village	Alaska	Alaska	AK
21	Chilkat Indian Village (Klukwan)	Alaska	Alaska	AK
22	Chilkoot Indian Association (Haines)	Alaska	Alaska	AK
23	Chinik Eskimo Community (Golovin)	Alaska	Alaska	AK
24	Chuloonawick Native Village	Alaska	Alaska	AK
25	Circle Native Community	Alaska	Alaska	AK
26	Craig Tribal Association (previously listed as the Craig Community Association)	Alaska	Alaska	AK
27	Curyung Tribal Council	Alaska	Alaska	AK
28	Douglas Indian Association	Alaska	Alaska	AK
29	Egegik Village	Alaska	Alaska	AK
30	Eklutna Native Village	Alaska	Alaska	AK
31	Ekwok Village	Alaska	Alaska	AK
32	Emmonak Village	Alaska	Alaska	AK
33	Evansville Village (aka Bettles Field)	Alaska	Alaska	AK
34	Galena Village (aka Louden Village)	Alaska	Alaska	AK
35	Gulkana Village	Alaska	Alaska	AK
36	Healy Lake Village	Alaska	Alaska	AK
37	Holy Cross Village	Alaska	Alaska	AK
38	Hoonah Indian Association	Alaska	Alaska	AK
39	Hughes Village	Alaska	Alaska	AK
40	Huslia Village	Alaska	Alaska	AK
41	Hydaburg Cooperative Association	Alaska	Alaska	AK
42	Igiugig Village	Alaska	Alaska	AK
43	Inupiat Community of the Arctic Slope	Alaska	Alaska	AK
44	Iqurmuit Traditional Council	Alaska	Alaska	AK
45	Ivanoff Bay Village	Alaska	Alaska	AK
46	Kaguyak Village	Alaska	Alaska	AK
47	Kaktovik Village (aka Barter Island)	Alaska	Alaska	AK
48	Kasigluk Traditional Elders Council	Alaska	Alaska	AK

No.	Tribe	State(s)	Designated State	Region
49	Kenaitze Indian Tribe	Alaska	Alaska	AK
50	Ketchikan Indian Corporation	Alaska	Alaska	AK
51	King Island Native Community	Alaska	Alaska	AK
52	King Salmon Tribe	Alaska	Alaska	AK
53	Klawock Cooperative Association	Alaska	Alaska	AK
54	Knik Tribe	Alaska	Alaska	AK
55	Kokhanok Village	Alaska	Alaska	AK
56	Koyukuk Native Village	Alaska	Alaska	AK
57	Levelock Village	Alaska	Alaska	AK
58	Lime Village	Alaska	Alaska	AK
59	Manley Hot Springs Village	Alaska	Alaska	AK
60	Manokotak Village	Alaska	Alaska	AK
61	McGrath Native Village	Alaska	Alaska	AK
62	Mentasta Traditional Council	Alaska	Alaska	AK
63	Metlakatla Indian Community, Annette Island Reserve	Alaska	Alaska	AK
64	Naknek Native Village	Alaska	Alaska	AK
65	Native Village of Afognak	Alaska	Alaska	AK
66	Native Village of Akhiok	Alaska	Alaska	AK
67	Native Village of Akutan	Alaska	Alaska	AK
68	Native Village of Aleknagik	Alaska	Alaska	AK
69	Native Village of Ambler	Alaska	Alaska	AK
70	Native Village of Atka	Alaska	Alaska	AK
71	Native Village of Barrow Inupiat Traditional Government	Alaska	Alaska	AK
72	Native Village of Belkofski	Alaska	Alaska	AK
73	Native Village of Brevig Mission	Alaska	Alaska	AK
74	Native Village of Buckland	Alaska	Alaska	AK
75	Native Village of Cantwell	Alaska	Alaska	AK
76	Native Village of Chenega (aka Chanega)	Alaska	Alaska	AK
77	Native Village of Chignik Lagoon	Alaska	Alaska	AK
78	Native Village of Chitina	Alaska	Alaska	AK
79	Native Village of Chuathbaluk (Russian Mission, Kuskokwim)	Alaska	Alaska	AK
80	Native Village of Council	Alaska	Alaska	AK
81	Native Village of Deering	Alaska	Alaska	AK
82	Native Village of Diomede (aka Inalik)	Alaska	Alaska	AK
83	Native Village of Eagle	Alaska	Alaska	AK
84	Native Village of Eek	Alaska	Alaska	AK
85	Native Village of Ekuk	Alaska	Alaska	AK
86	Native Village of Elim	Alaska	Alaska	AK
87	Native Village of Eyak (Cordova)	Alaska	Alaska	AK
88	Native Village of False Pass	Alaska	Alaska	AK
89	Native Village of Fort Yukon	Alaska	Alaska	AK
90	Native Village of Gakona	Alaska	Alaska	AK
91	Native Village of Gambell	Alaska	Alaska	AK
92	Native Village of Georgetown	Alaska	Alaska	AK
93	Native Village of Goodnews Bay	Alaska	Alaska	AK
94	Native Village of Hamilton	Alaska	Alaska	AK
95	Native Village of Hooper Bay	Alaska	Alaska	AK
96	Native Village of Kanatak	Alaska	Alaska	AK
97	Native Village of Karluk	Alaska	Alaska	AK
98	Native Village of Kiana	Alaska	Alaska	AK
99	Native Village of Kipnuk	Alaska	Alaska	AK
100	Native Village of Kivalina	Alaska	Alaska	AK
101	Native Village of Kluti Kaah (aka Copper Center)	Alaska	Alaska	AK
102	Native Village of Kobuk	Alaska	Alaska	AK
103	Native Village of Kongiganak	Alaska	Alaska	AK
104	Native Village of Kotzebue	Alaska	Alaska	AK

No.	Tribe	State(s)	Designated State	Region
105	Native Village of Koyuk	Alaska	Alaska	AK
106	Native Village of Kwigillingok	Alaska	Alaska	AK
107	Native Village of Kwinhagak (aka Quinhagak)	Alaska	Alaska	AK
108	Native Village of Larsen Bay	Alaska	Alaska	AK
109	Native Village of Marshall (aka Fortuna Ledge)	Alaska	Alaska	AK
110	Native Village of Mary's Igloo	Alaska	Alaska	AK
111	Native Village of Mekoryuk	Alaska	Alaska	AK
112	Native Village of Minto	Alaska	Alaska	AK
113	Native Village of Nanwalek (aka English Bay)	Alaska	Alaska	AK
114	Native Village of Napaimute	Alaska	Alaska	AK
115	Native Village of Napakiak	Alaska	Alaska	AK
116	Native Village of Napaskiak	Alaska	Alaska	AK
117	Native Village of Nelson Lagoon	Alaska	Alaska	AK
118	Native Village of Nightmute	Alaska	Alaska	AK
119	Native Village of Nikolski	Alaska	Alaska	AK
120	Native Village of Noatak	Alaska	Alaska	AK
121	Native Village of Nuiqsut (aka Nooiksut)	Alaska	Alaska	AK
122	Native Village of Nunam Iqua (previously listed as the Native Village of Sheldon's Point)	Alaska	Alaska	AK
123	Native Village of Nunapitchuk	Alaska	Alaska	AK
124	Native Village of Ouzinkie	Alaska	Alaska	AK
125	Native Village of Paimiut	Alaska	Alaska	AK
126	Native Village of Perryville	Alaska	Alaska	AK
127	Native Village of Pilot Point	Alaska	Alaska	AK
128	Native Village of Pitka's Point	Alaska	Alaska	AK
129	Native Village of Point Hope	Alaska	Alaska	AK
130	Native Village of Point Lay	Alaska	Alaska	AK
131	Native Village of Port Graham	Alaska	Alaska	AK
132	Native Village of Port Heiden	Alaska	Alaska	AK
133	Native Village of Port Lions	Alaska	Alaska	AK
134	Native Village of Ruby	Alaska	Alaska	AK
135	Native Village of Saint Michael	Alaska	Alaska	AK
136	Native Village of Savoonga	Alaska	Alaska	AK
137	Native Village of Scammon Bay	Alaska	Alaska	AK
138	Native Village of Selawik	Alaska	Alaska	AK
139	Native Village of Shaktoolik	Alaska	Alaska	AK
140	Native Village of Shishmaref	Alaska	Alaska	AK
141	Native Village of Shungnak	Alaska	Alaska	AK
142	Native Village of Stevens	Alaska	Alaska	AK
143	Native Village of Tanacross	Alaska	Alaska	AK
144	Native Village of Tanana	Alaska	Alaska	AK
145	Native Village of Tatitlek	Alaska	Alaska	AK
146	Native Village of Tazlina	Alaska	Alaska	AK
147	Native Village of Teller	Alaska	Alaska	AK
148	Native Village of Tetlin	Alaska	Alaska	AK
149	Native Village of Tuntutuliak	Alaska	Alaska	AK
150	Native Village of Tununak	Alaska	Alaska	AK
151	Native Village of Tyonek	Alaska	Alaska	AK
152	Native Village of Unalakleet	Alaska	Alaska	AK
153	Native Village of Unga	Alaska	Alaska	AK
154	*Native Village of Venetie Tribal Government (Arctic Village and Village of Venetie)	Alaska	Alaska	AK
155	Native Village of Wales	Alaska	Alaska	AK
156	Native Village of White Mountain	Alaska	Alaska	AK
157	Nenana Native Association	Alaska	Alaska	AK
158	New Koliganek Village Council	Alaska	Alaska	AK

No.	Tribe	State(s)	Designated State	Region
159	New Stuyahok Village	Alaska	Alaska	AK
160	Newhalen Village	Alaska	Alaska	AK
161	Newtok Village	Alaska	Alaska	AK
162	Nikolai Village	Alaska	Alaska	AK
163	Ninilchik Village	Alaska	Alaska	AK
164	Nome Eskimo Community	Alaska	Alaska	AK
165	Nondalton Village	Alaska	Alaska	AK
166	Noorvik Native Community	Alaska	Alaska	AK
167	Northway Village	Alaska	Alaska	AK
168	Nulato Village	Alaska	Alaska	AK
169	Nunakauyarmiut Tribe	Alaska	Alaska	AK
170	Organized Village of Grayling (aka Holikachuk)	Alaska	Alaska	AK
171	Organized Village of Kake	Alaska	Alaska	AK
172	Organized Village of Kasaan	Alaska	Alaska	AK
173	Organized Village of Kwethluk	Alaska	Alaska	AK
174	Organized Village of Saxman	Alaska	Alaska	AK
175	Orutsararmuit Native Village (aka Bethel)	Alaska	Alaska	AK
176	Oscarville Traditional Village	Alaska	Alaska	AK
177	Pauloff Harbor Village	Alaska	Alaska	AK
178	Pedro Bay Village	Alaska	Alaska	AK
179	Petersburg Indian Association	Alaska	Alaska	AK
180	Pilot Station Traditional Village	Alaska	Alaska	AK
181	Platinum Traditional Village	Alaska	Alaska	AK
182	Portage Creek Village (aka Ohgsenakale)	Alaska	Alaska	AK
183	Pribilof Islands Aleut Communities of St. Paul & St. George Islands	Alaska	Alaska	AK
184	Qagan Tayagungin Tribe of Sand Point Village	Alaska	Alaska	AK
185	Qawalangin Tribe of Unalaska	Alaska	Alaska	AK
186	Rampart Village	Alaska	Alaska	AK
187	Saint George Island (See Pribilof Islands Aleut Communities of St. Paul & St. George Islands)	Alaska	Alaska	AK
188	Saint Paul Island (See Pribilof Islands Aleut Communities of St. Paul & St. George Islands)	Alaska	Alaska	AK
189	Seldovia Village Tribe	Alaska	Alaska	AK
190	Shageluk Native Village	Alaska	Alaska	AK
191	Sitka Tribe of Alaska	Alaska	Alaska	AK
192	Skagway Village	Alaska	Alaska	AK
193	South Naknek Village	Alaska	Alaska	AK
194	Stebbins Community Association	Alaska	Alaska	AK
195	Sun'aq Tribe of Kodiak (previously listed as the Shoonaq' Tribe of Kodiak)	Alaska	Alaska	AK
196	Takotna Village	Alaska	Alaska	AK
197	Tangirnaq Native Village (formerly Lesnoi Village (aka Woody Island))	Alaska	Alaska	AK
198	Telida Village	Alaska	Alaska	AK
199	Traditional Village of Togiak	Alaska	Alaska	AK
200	Tuluksak Native Community	Alaska	Alaska	AK
201	Twin Hills Village	Alaska	Alaska	AK
202	Ugashik Village	Alaska	Alaska	AK
203	Umkumiut Native Village (previously listed as Umkumiute Native Village)	Alaska	Alaska	AK
204	Village of Alakanuk	Alaska	Alaska	AK
205	Village of Anaktuvuk Pass	Alaska	Alaska	AK
206	Village of Aniak	Alaska	Alaska	AK
207	Village of Atmautluak	Alaska	Alaska	AK
208	Village of Bill Moore's Slough	Alaska	Alaska	AK
209	Village of Chefornak	Alaska	Alaska	AK

No.	Tribe	State(s)	Designated State	Region
210	Village of Clarks Point	Alaska	Alaska	AK
211	Village of Crooked Creek	Alaska	Alaska	AK
212	Village of Dot Lake	Alaska	Alaska	AK
213	Village of Iliamna	Alaska	Alaska	AK
214	Village of Kalskag	Alaska	Alaska	AK
215	Village of Kaltag	Alaska	Alaska	AK
216	Village of Kotlik	Alaska	Alaska	AK
217	Village of Lower Kalskag	Alaska	Alaska	AK
218	Village of Ohogamiut	Alaska	Alaska	AK
219	Village of Old Harbor	Alaska	Alaska	AK
220	Village of Red Devil	Alaska	Alaska	AK
221	Village of Salamatoff	Alaska	Alaska	AK
222	Village of Sleetmute	Alaska	Alaska	AK
223	Village of Solomon	Alaska	Alaska	AK
224	Village of Stony River	Alaska	Alaska	AK
225	*Village of Venetie (See Native Village of Venetie Tribal Government)	Alaska	Alaska	AK
226	Village of Wainwright	Alaska	Alaska	AK
227	Wrangell Cooperative Association	Alaska	Alaska	AK
228	Yakutat Tlingit Tribe	Alaska	Alaska	AK
229	Yupiit of Andreafski	Alaska	Alaska	AK
230	Poarch Band of Creeks (previously listed as the Poarch Band of Creek Indians of Alabama)	Alabama	Alabama	East
231	Mashantucket Pequot Indian Tribe (previously listed as the Mashantucket Pequot Tribe of Connecticut)	Connecticut	Connecticut	East
232	Mohegan Indian Tribe of Connecticut	Connecticut	Connecticut	East
233	Seminole Tribe of Florida (previously listed as the Seminole Tribe of Florida (Dania	Florida	Florida	East
234	Miccosukee Tribe of Indians	Florida	Florida	East
235	Chitimacha Tribe of Louisiana	Louisiana	Louisiana	East
236	Coushatta Tribe of Louisiana	Louisiana	Louisiana	East
237	Jena Band of Choctaw Indians	Louisiana	Louisiana	East
238	Tunica-Biloxi Indian Tribe	Louisiana	Louisiana	East
239	Passamaquoddy Tribe	Maine	Maine	East
240	Penobscot Nation (previously listed as the Penobscot Tribe of Maine)	Maine	Maine	East
241	Aroostook Band of Micmacs (previously listed as the Aroostook Band of Micmac Indians)	Maine	Maine	East
242	Houlton Band of Maliseet Indians	Maine	Maine	East
243	Mashpee Wampanoag Indian Tribal Council	Massachusetts	Massachusetts	East
244	Wampanoag Tribe of Gay Head (Aquinnah)	Massachusetts	Massachusetts	East
245	Mississippi Band of Choctaw Indians	Mississippi	Mississippi	East
246	Saint Regis Mohawk Tribe (previously listed as the St. Regis Band of Mohawk Indians of New York)	New York	New York	East
247	Cayuga Nation	New York	New York	East
248	Oneida Nation of New York	New York	New York	East
249	Onondaga Nation	New York	New York	East
250	Seneca Nation of Indians (previously listed as the Seneca Nation of New York)	New York	New York	East
251	Tonawanda Band of Seneca (previously listed as the Tonawanda Band of Seneca Indians of New York)	New York	New York	East
252	Tuscarora Nation	New York	New York	East
253	Shinnecock Indian Nation	New York	New York	East
254	Eastern Band of Cherokee Indians	North Carolina	North Carolina	East
255	Narragansett Indian Tribe	Rhode Island	Rhode Island	East
256	Catawba Indian Nation (aka Catawba Tribe of South Carolina)	South Carolina	South Carolina	East

No.	Tribe	State(s)	Designated State	Region
257	Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas	Kansas	Kansas	GP
258	Prairie Band Potawatomi Nation (previously listed as the Prairie Band of Potawatomi Nation	Kansas	Kansas	GP
259	Sac & Fox Nation of Missouri in Kansas and Nebraska	Kansas, Nebraska	Kansas	GP
260	Blackfeet Tribe of the Blackfeet Indian Reservation of Montana	Montana	Montana	GP
261	Chippewa-Cree Indians of the Rocky Boy's Reservation	Montana	Montana	GP
262	Confederated Salish and Kootenai Tribes of the Flathead Reservation	Montana	Montana	GP
263	Crow Tribe of Montana	Montana	Montana	GP
264	Fort Belknap Indian Community of the Fort Belknap Reservation of Montana	Montana	Montana	GP
265	Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation	Montana	Montana	GP
266	Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation	Montana	Montana	GP
267	Ponca Tribe of Nebraska	Nebraska	Nebraska	GP
268	Iowa Tribe of Kansas and Nebraska	Nebraska	Nebraska	GP
269	Omaha Tribe of Nebraska	Nebraska	Nebraska	GP
270	Santee Sioux Nation	Nebraska	Nebraska	GP
271	Winnebago Tribe of Nebraska	Nebraska	Nebraska	GP
272	Spirit Lake Tribe	North Dakota	North Dakota	GP
273	Turtle Mountain Band of Chippewa Indians of North Dakota	North Dakota	North Dakota	GP
274	Standing Rock Sioux Tribe of North & South Dakota	North Dakota, South Dakota	North Dakota	GP
275	Sisseton-Wahpeton Oyate of the Lake Traverse Reservation	North Dakota	North Dakota	GP
276	Three Affiliated Tribes of the Fort Berthold Reservation	North Dakota	North Dakota	GP
277	Absentee-Shawnee Tribe of Indians of Oklahoma	Oklahoma	Oklahoma	GP
278	Apache Tribe of Oklahoma	Oklahoma	Oklahoma	GP
279	Caddo Nation of Oklahoma	Oklahoma	Oklahoma	GP
280	Cherokee Nation	Oklahoma	Oklahoma	GP
281	Chickasaw Nation	Oklahoma	Oklahoma	GP
282	Choctaw Nation of Oklahoma	Oklahoma	Oklahoma	GP
283	Citizen Potawatomi Nation	Oklahoma	Oklahoma	GP
284	Comanche Nation	Oklahoma	Oklahoma	GP
285	Delaware Nation	Oklahoma	Oklahoma	GP
286	Eastern Shawnee Tribe of Oklahoma	Oklahoma	Oklahoma	GP
287	Fort Sill Apache Tribe of Oklahoma	Oklahoma	Oklahoma	GP
288	Iowa Tribe of Oklahoma	Oklahoma	Oklahoma	GP
289	Kaw Nation	Oklahoma	Oklahoma	GP
290	Kickapoo Tribe of Oklahoma	Oklahoma	Oklahoma	GP
291	Kiowa Indian Tribe of Oklahoma	Oklahoma	Oklahoma	GP
292	Modoc Tribe of Oklahoma	Oklahoma	Oklahoma	GP
293	Otoe-Missouria Tribe of Indians	Oklahoma	Oklahoma	GP
294	Ottawa Tribe of Oklahoma	Oklahoma	Oklahoma	GP
295	Pawnee Nation of Oklahoma	Oklahoma	Oklahoma	GP
296	Peoria Tribe of Indians of Oklahoma	Oklahoma	Oklahoma	GP
297	Ponca Tribe of Indians of Oklahoma	Oklahoma	Oklahoma	GP
298	Sac & Fox Nation	Oklahoma	Oklahoma	GP
299	Seneca-Cayuga Tribe of Oklahoma	Oklahoma	Oklahoma	GP
300	The Osage Nation (previously listed as the Osage Tribe)	Oklahoma	Oklahoma	GP
301	The Seminole Nation of Oklahoma	Oklahoma	Oklahoma	GP
302	Tonkawa Tribe of Indians of Oklahoma	Oklahoma	Oklahoma	GP
303	United Keetoowah Band of Cherokee Indians in Oklahoma	Oklahoma	Oklahoma	GP

No.	Tribe	State(s)	Designated State	Region
304	Wichita and Affiliated Tribes (Wichita	Oklahoma	Oklahoma	GP
305	Alabama-Quassarte Tribal Town	Oklahoma	Oklahoma	GP
306	Delaware Tribe of Indians	Oklahoma	Oklahoma	GP
307	Kialegee Tribal Town	Oklahoma	Oklahoma	GP
308	Quapaw Tribe of Indians	Oklahoma	Oklahoma	GP
309	Shawnee Tribe	Oklahoma	Oklahoma	GP
310	The Muscogee (Creek) Nation	Oklahoma	Oklahoma	GP
311	Thlopthlocco Tribal Town	Oklahoma	Oklahoma	GP
312	Wyandotte Nation	Oklahoma	Oklahoma	GP
313	Cheyenne and Arapaho Tribes	Oklahoma	Oklahoma	GP
314	Miami Tribe of Oklahoma	Oklahoma	Oklahoma	GP
315	Cheyenne River Sioux Tribe of the Cheyenne River Reservation	South Dakota	South Dakota	GP
316	Crow Creek Sioux Tribe of the Crow Creek Reservation	South Dakota	South Dakota	GP
317	Flandreau Santee Sioux Tribe of South Dakota	South Dakota	South Dakota	GP
318	Lower Brule Sioux Tribe of the Lower Brule Reservation	South Dakota	South Dakota	GP
319	Oglala Sioux Tribe (previously listed as the Oglala Sioux Tribe of the Pine Ridge Reservation	South Dakota	South Dakota	GP
320	Rosebud Sioux Tribe of the Rosebud Indian Reservation	South Dakota	South Dakota	GP
321	Yankton Sioux Tribe of South Dakota	South Dakota	South Dakota	GP
322	Alabama-Coushatta Tribe of Texas (previously listed as the Alabama-Coushatta Tribes of Texas)	Texas	Texas	GP
323	Kickapoo Traditional Tribe of Texas	Texas	Texas	GP
324	Ysleta Del Sur Pueblo of Texas	Texas	Texas	GP
325	Arapaho Tribe of the Wind River Reservation	Wyoming	Wyoming	GP
326	Shoshone Tribe of the Wind River Reservation	Wyoming	Wyoming	GP
327	Sac & Fox Tribe of the Mississippi in Iowa	Iowa	Iowa	MW
328	Saginaw Chippewa Indian Tribe of Michigan	Michigan	Michigan	MW
329	Bay Mills Indian Community	Michigan	Michigan	MW
330	Grand Traverse Band of Ottawa and Chippewa Indians	Michigan	Michigan	MW
331	Hannahville Indian Community	Michigan	Michigan	MW
332	Keweenaw Bay Indian Community	Michigan	Michigan	MW
333	Lac Vieux Desert Band of Lake Superior Chippewa Indians	Michigan	Michigan	MW
334	Little River Band of Ottawa Indians	Michigan	Michigan	MW
335	Little Traverse Bay Bands of Odawa Indians	Michigan	Michigan	MW
336	Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan	Michigan	Michigan	MW
337	Sault Ste. Marie Tribe of Chippewa Indians of Michigan	Michigan	Michigan	MW
338	Pokagon Band of Potawatomi Indians	Michigan, Indiana	Michigan	MW
339	Nottawaseppi Huron Band of the Potawatomi	Michigan	Michigan	MW
340	Lower Sioux Indian Community in the State of Minnesota	Minnesota	Minnesota	MW
341	Prairie Island Indian Community in the State of Minnesota	Minnesota	Minnesota	MW
342	Red Lake Band of Chippewa Indians	Minnesota	Minnesota	MW
343	Shakopee Mdewakanton Sioux Community of Minnesota	Minnesota	Minnesota	MW
344	Upper Sioux Community	Minnesota	Minnesota	MW
345	Minnesota Chippewa Tribe (Six component reservations: Bois Forte Band (Nett Lake); Fond du Lac Band; Grand Portage Band; Leech Lake Band; Mille Lacs Band; White Earth Band)	Minnesota	Minnesota	MW
346	Bad River Band of the Lake Superior Tribe of Chippewa Indians of the Bad River Reservation	Wisconsin	Wisconsin	MW
347	Forest County Potawatomi Community	Wisconsin	Wisconsin	MW
348	Ho-Chunk Nation of Wisconsin	Wisconsin	Wisconsin	MW
349	Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin	Wisconsin	Wisconsin	MW

No.	Tribe	State(s)	Designated State	Region
350	Lac du Flambeau Band of Lake Superior Chippewa Indians of the Lac du Flambeau Reservation of Wisconsin	Wisconsin	Wisconsin	MW
351	Menominee Indian Tribe of Wisconsin	Wisconsin	Wisconsin	MW
352	Oneida Tribe of Indians of Wisconsin	Wisconsin	Wisconsin	MW
353	Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin	Wisconsin	Wisconsin	MW
354	Sokaogon Chippewa Community	Wisconsin	Wisconsin	MW
355	St. Croix Chippewa Indians of Wisconsin	Wisconsin	Wisconsin	MW
356	Stockbridge Munsee Community	Wisconsin	Wisconsin	MW
357	Coeur D'Alene Tribe (previously listed as the Coeur D'Alene Tribe of the Coeur D'Alene Reservation	Idaho	Idaho	PNW
358	Kootenai Tribe of Idaho	Idaho	Idaho	PNW
359	Nez Perce Tribe (previously listed as Nez Perce Tribe of Idaho)	Idaho	Idaho	PNW
360	Shoshone-Bannock Tribes of the Fort Hall Reservation	Idaho	Idaho	PNW
361	Burns Paiute Tribe (previously listed as the Burns Paiute Tribe of the Burns Paiute Indian Colony of Oregon)	Oregon	Oregon	PNW
362	Confederated Tribes of Siletz Indians of Oregon (previously listed as the Confederated Tribes of the Siletz Reservation)	Oregon	Oregon	PNW
363	Confederated Tribes of the Coos	Oregon	Oregon	PNW
364	Confederated Tribes of the Grand Ronde Community of Oregon	Oregon	Oregon	PNW
365	Confederated Tribes of the Umatilla Indian Reservation (previously listed as the Confederated Tribes of the Umatilla Reservation	Oregon	Oregon	PNW
366	Confederated Tribes of the Warm Springs Reservation of Oregon	Oregon	Oregon	PNW
367	Coquille Indian Tribe (previously listed as the Coquille Tribe of Oregon)	Oregon	Oregon	PNW
368	Cow Creek Band of Umpqua Tribe of Indians (previously listed as the Cow Creek Band of Umpqua Indians of Oregon)	Oregon	Oregon	PNW
369	Klamath Tribes	Oregon	Oregon	PNW
370	Sauk-Suiattle Indian Tribe	Washington	Washington	PNW
371	Confederated Tribes and Bands of the Yakama Nation	Washington	Washington	PNW
372	Confederated Tribes of the Chehalis Reservation	Washington	Washington	PNW
373	Confederated Tribes of the Colville Reservation	Washington	Washington	PNW
374	Hoh Indian Tribe (previously listed as the Hoh Indian Tribe of the Hoh Indian Reservation	Washington	Washington	PNW
375	Lower Elwha Tribal Community (previously listed as the Lower Elwha Tribal Community of the Lower Elwha Reservation	Washington	Washington	PNW
376	Muckleshoot Indian Tribe (previously listed as the Muckleshoot Indian Tribe of the Muckleshoot Reservation	Washington	Washington	PNW
377	Nisqually Indian Tribe (previously listed as the Nisqually Indian Tribe of the Nisqually Reservation	Washington	Washington	PNW
378	Port Gamble Band of S'Klallam Indians (previously listed as the Port Gamble Indian Community of the Port Gamble Reservation	Washington	Washington	PNW
379	Puyallup Tribe of the Puyallup Reservation	Washington	Washington	PNW
380	Quileute Tribe of the Quileute Reservation	Washington	Washington	PNW
381	Quinault Indian Nation (previously listed as the Quinault Tribe of the Quinault Reservation	Washington	Washington	PNW
382	Samish Indian Nation (previously listed as the Samish Indian Tribe	Washington	Washington	PNW
383	Shoalwater Bay Indian Tribe of the Shoalwater Bay Indian Reservation (previously listed as the Shoalwater Bay Tribe of the Shoalwater Bay Indian Reservation	Washington	Washington	PNW

No.	Tribe	State(s)	Designated State	Region
384	Skokomish Indian Tribe (previously listed as the Skokomish Indian Tribe of the Skokomish Reservation	Washington	Washington	PNW
385	Snoqualmie Indian Tribe (previously listed as the Snoqualmie Tribe	Washington	Washington	PNW
386	Spokane Tribe of the Spokane Reservation	Washington	Washington	PNW
387	Squaxin Island Tribe of the Squaxin Island Reservation	Washington	Washington	PNW
388	Stillaguamish Tribe of Indians of Washington (previously listed as the Stillaguamish Tribe of Washington)	Washington	Washington	PNW
389	Swinomish Indians of the Swinomish Reservation of Washington	Washington	Washington	PNW
390	Tulalip Tribes of Washington (previously listed as the Tulalip Tribes of the Tulalip Reservation	Washington	Washington	PNW
391	Cowlitz Indian Tribe	Washington	Washington	PNW
392	Jamestown S'Klallam Tribe	Washington	Washington	PNW
393	Kalispel Indian Community of the Kalispel Reservation	Washington	Washington	PNW
394	Lummi Tribe of the Lummi Reservation	Washington	Washington	PNW
395	Makah Indian Tribe of the Makah Indian Reservation	Washington	Washington	PNW
396	Nooksack Indian Tribe	Washington	Washington	PNW
397	Suquamish Indian Tribe of the Port Madison Reservation	Washington	Washington	PNW
398	Upper Skagit Indian Tribe	Washington	Washington	PNW
399	Ak Chin Indian Community of the Maricopa (Ak Chin) Indian Reservation	Arizona	Arizona	SW
400	Cocopah Tribe of Arizona	Arizona	Arizona	SW
401	Fort McDowell Yavapai Nation	Arizona	Arizona	SW
402	Gila River Indian Community of the Gila River Indian Reservation	Arizona	Arizona	SW
403	Havasupai Tribe of the Havasupai Reservation	Arizona	Arizona	SW
404	Hopi Tribe of Arizona	Arizona	Arizona	SW
405	Hualapai Indian Tribe of the Hualapai Indian Reservation	Arizona	Arizona	SW
406	Kaibab Band of Paiute Indians of the Kaibab Indian Reservation	Arizona	Arizona	SW
407	Pascua Yaqui Tribe of Arizona	Arizona	Arizona	SW
408	Salt River Pima-Maricopa Indian Community of the Salt River Reservation	Arizona	Arizona	SW
409	San Carlos Apache Tribe of the San Carlos Reservation	Arizona	Arizona	SW
410	San Juan Southern Paiute Tribe of Arizona	Arizona	Arizona	SW
411	Tohono O'odham Nation of Arizona	Arizona	Arizona	SW
412	Tonto Apache Tribe of Arizona	Arizona	Arizona	SW
413	White Mountain Apache Tribe of the Fort Apache Reservation	Arizona	Arizona	SW
414	Yavapai-Apache Nation of the Camp Verde Indian Reservation	Arizona	Arizona	SW
415	Yavapai-Prescott Indian Tribe (previously listed as the Yavapai-Prescott Tribe of the Yavapai Reservation	Arizona	Arizona	SW
416	Colorado River Indian Tribes of the Colorado River Indian Reservation	Arizona and California	Arizona	SW
417	Fort Mojave Indian Tribe of	Arizona, California, Nevada	Arizona	SW
418	Navajo Nation	Arizona, New Mexico, Utah	Arizona	SW
419	Quechan Tribe of the Fort Yuma Indian Reservation	California, Arizona	Arizona	SW
420	Agua Caliente Band of Cahuilla Indians of the Agua Caliente Indian Reservation	California	California	SW
421	Alturas Indian Rancheria	California	California	SW
422	Bear River Band of the Rohnerville Rancheria	California	California	SW

No.	Tribe	State(s)	Designated State	Region
423	Berry Creek Rancheria of Maidu Indians of California	California	California	SW
424	Big Lagoon Rancheria	California	California	SW
425	Big Pine Paiute Tribe of the Owens Valley (previously listed as the Big Pine Band of Owens Valley Paiute Shoshone Indians of the Big Pine Reservation	California	California	SW
426	Big Sandy Rancheria of Western Mono Indians of California (previously listed as the Big Sandy Rancheria of Mono Indians of California)	California	California	SW
427	Big Valley Band of Pomo Indians of the Big Valley Rancheria	California	California	SW
428	Bishop Paiute Tribe (previously listed as the Paiute-Shoshone Indians of the Bishop Community of the Bishop Colony	California	California	SW
429	Blue Lake Rancheria	California	California	SW
430	Bridgeport Indian Colony (previously listed as the Bridgeport Paiute Indian Colony of California)	California	California	SW
431	Buena Vista Rancheria of Me-Wuk Indians of California	California	California	SW
432	Cabazon Band of Mission Indians	California	California	SW
433	Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria	California	California	SW
434	Cahto Tribe (previously listed as the Cahto Indian Tribe of the Laytonville Rancheria	California	California	SW
435	Cahuilla Band of Mission Indians of the Cahuilla Reservation	California	California	SW
436	California Valley Miwok Tribe	California	California	SW
437	Campo Band of Diegueno Mission Indians of the Campo Indian Reservation	California	California	SW
438	Capitan Grande Band of Diegueno Mission Indians of California: (Barona Group of Capitan Grande Band of Mission Indians of the Barona Reservation	California	California	SW
439	Cedarville Rancheria	California	California	SW
440	Chemehuevi Indian Tribe of the Chemehuevi Reservation	California	California	SW
441	Cher-Ae Heights Indian Community of the Trinidad Rancheria	California	California	SW
442	Chicken Ranch Rancheria of Me-Wuk Indians of California	California	California	SW
443	Cloverdale Rancheria of Pomo Indians of California	California	California	SW
444	Cold Springs Rancheria of Mono Indians of California	California	California	SW
445	Cortina Indian Rancheria of Wintun Indians of California	California	California	SW
446	Coyote Valley Reservation (formerly Coyote Valley Band of Pomo Indians of California)	California	California	SW
447	Death Valley Timbi-sha Shoshone Tribe (previously listed as Death Valley Timbi-Sha Shoshone Band of California)	California	California	SW
448	Dry Creek Rancheria Band of Pomo Indians	California	California	SW
449	Elem Indian Colony of Pomo Indians of the Sulphur Bank Rancheria	California	California	SW
450	Elk Valley Rancheria	California	California	SW
451	Enterprise Rancheria of Maidu Indians of California	California	California	SW
452	Ewiiaapaayp Band of Kumeyaay Indians	California	California	SW
453	Federated Indians of Graton Rancheria	California	California	SW
454	Fort Bidwell Indian Community of the Fort Bidwell Reservation of California	California	California	SW
455	Fort Independence Indian Community of Paiute Indians of the Fort Independence Reservation	California	California	SW
456	Greenville Rancheria (previously listed as the Greenville Rancheria of Maidu Indians of California)	California	California	SW
457	Grindstone Indian Rancheria of Wintun-Wailaki Indians of California	California	California	SW

No.	Tribe	State(s)	Designated State	Region
458	Guidiville Rancheria of California	California	California	SW
459	Habematolel Pomo of Upper Lake	California	California	SW
460	Hoopa Valley Tribe	California	California	SW
461	Inaja Band of Diegueno Mission Indians of the Inaja and Cosmit Reservation	California	California	SW
462	Ione Band of Miwok Indians of California	California	California	SW
463	Jackson Rancheria of Me-Wuk Indians of California	California	California	SW
464	Jamul Indian Village of California	California	California	SW
465	Karuk Tribe (previously listed as the Karuk Tribe of California)	California	California	SW
466	Kashia Band of Pomo Indians of the Stewarts Point Rancheria	California	California	SW
467	Lone Pine Paiute-Shoshone Tribe (previously listed as the Paiute-Shoshone Indians of the Lone Pine Community of the Lone Pine Reservation	California	California	SW
468	Lower Lake Rancheria	California	California	SW
469	Lytton Rancheria of California	California	California	SW
470	Manzanita Band of Diegueno Mission Indians of the Manzanita Reservation	California	California	SW
471	Mechoopda Indian Tribe of Chico Rancheria	California	California	SW
472	Mooretown Rancheria of Maidu Indians of California	California	California	SW
473	Morongo Band of Mission Indians	California	California	SW
474	Northfork Rancheria of Mono Indians of California	California	California	SW
475	Pala Band of Luiseno Mission Indians of the Pala Reservation	California	California	SW
476	Paskenta Band of Nomlaki Indians of California	California	California	SW
477	Pauma Band of Luiseno Mission Indians of the Pauma & Yuima Reservation	California	California	SW
478	Pechanga Band of Luiseno Mission Indians of the Pechanga Reservation	California	California	SW
479	Picayune Rancheria of Chukchansi Indians of California	California	California	SW
480	Pinoleville Pomo Nation	California	California	SW
481	Pit River Tribe	California	California	SW
482	Potter Valley Tribe	California	California	SW
483	Quartz Valley Indian Community of the Quartz Valley Reservation of California	California	California	SW
484	Redding Rancheria	California	California	SW
485	Redwood Valley or Little River Band of Pomo Indians of the Redwood Valley Rancheria California (previously listed as the Redwood Valley Rancheria of Pomo Indians of California)	California	California	SW
486	Resighini Rancheria	California	California	SW
487	Rincon Band of Luiseno Mission Indians of the Rincon Reservation	California	California	SW
488	Round Valley Indian Tribes	California	California	SW
489	Sherwood Valley Rancheria of Pomo Indians of California	California	California	SW
490	Shingle Springs Band of Miwok Indians	California	California	SW
491	Smith River Rancheria	California	California	SW
492	Soboba Band of Luiseno Indians	California	California	SW
493	Susanville Indian Rancheria	California	California	SW
494	Table Mountain Rancheria of California	California	California	SW
495	Torres Martinez Desert Cahuilla Indians	California	California	SW
496	Tule River Indian Tribe of the Tule River Reservation	California	California	SW
497	Tuolumne Band of Me-Wuk Indians of the Tuolumne Rancheria of California	California	California	SW
498	Twenty-Nine Palms Band of Mission Indians of California	California	California	SW

No.	Tribe	State(s)	Designated State	Region
499	United Auburn Indian Community of the Auburn Rancheria of California	California	California	SW
500	Utu Utu Gwaitu Paiute Tribe of the Benton Paiute Reservation	California	California	SW
501	Wilton Rancheria	California	California	SW
502	Sycuan Band of the Kumeyaay Nation	California	California	SW
503	Tejon Indian Tribe	California	California	SW
504	Augustine Band of Cahuilla Indians	California	California	SW
505	Hopland Band of Pomo Indians	California	California	SW
506	Iipay Nation of Santa Ysabel	California	California	SW
507	La Jolla Band of Luiseno Indians	California	California	SW
508	La Posta Band of Diegueno Mission Indians of the La Posta Indian Reservation	California	California	SW
509	Los Coyotes Band of Cahuilla and Cupeno Indians	California	California	SW
510	Manchester Band of Pomo Indians of the Manchester Rancheria	California	California	SW
511	Mesa Grande Band of Diegueno Mission Indians of the Mesa Grande Reservation	California	California	SW
512	Ramona Band of Cahuilla	California	California	SW
513	Robinson Rancheria Band of Pomo Indians	California	California	SW
514	San Manuel Band of Mission Indians	California	California	SW
515	San Pasqual Band of Diegueno Mission Indians of California	California	California	SW
516	Santa Rosa Band of Cahuilla Indians	California	California	SW
517	Santa Rosa Indian Community of the Santa Rosa Rancheria	California	California	SW
518	Santa Ynez Band of Chumash Mission Indians of the Santa Ynez Reservation	California	California	SW
519	Scotts Valley Band of Pomo Indians of California	California	California	SW
520	Wiyot Tribe	California	California	SW
521	Yocha Dehe Wintun Nation	California	California	SW
522	Yurok Tribe of the Yurok Reservation	California	California	SW
523	Middletown Rancheria of Pomo Indians of California	California	California	SW
524	Southern Ute Indian Tribe of the Southern Ute Reservation	Colorado	Colorado	SW
525	Ute Mountain Tribe of the Ute Mountain Reservation	Colorado, New Mexico, Utah	Colorado	SW
526	Winnemucca Indian Colony of Nevada	Nevada	Nevada	SW
527	Duckwater Shoshone Tribe of the Duckwater Reservation	Nevada	Nevada	SW
528	Ely Shoshone Tribe of Nevada	Nevada	Nevada	SW
529	Las Vegas Tribe of Paiute Indians of the Las Vegas Indian Colony	Nevada	Nevada	SW
530	Lovelock Paiute Tribe of the Lovelock Indian Colony	Nevada	Nevada	SW
531	Moapa Band of Paiute Indians of the Moapa River Indian Reservation	Nevada	Nevada	SW
532	Paiute-Shoshone Tribe of the Fallon Reservation and Colony	Nevada	Nevada	SW
533	Pyramid Lake Paiute Tribe of the Pyramid Lake Reservation	Nevada	Nevada	SW
534	Reno-Sparks Indian Colony	Nevada	Nevada	SW
535	Shoshone-Paiute Tribes of the Duck Valley Reservation	Nevada	Nevada	SW
536	Summit Lake Paiute Tribe of Nevada	Nevada	Nevada	SW
537	Te-Moak Tribe of Western Shoshone Indians of Nevada (Four constituent bands: Battle Mountain Band; Elko Band; South Fork Band and Wells Band)	Nevada	Nevada	SW
538	Walker River Paiute Tribe of the Walker River Reservation	Nevada	Nevada	SW

No.	Tribe	State(s)	Designated State	Region
539	Yerington Paiute Tribe of the Yerington Colony & Campbell Ranch	Nevada	Nevada	SW
540	Yomba Shoshone Tribe of the Yomba Reservation	Nevada	Nevada	SW
541	Fort McDermitt Paiute and Shoshone Tribes of the Fort McDermitt Indian Reservation	Nevada, Oregon	Nevada	SW
542	Washoe Tribe of Nevada & California (Carson Colony	Nevada, California	Nevada	SW
543	Jicarilla Apache Nation	New Mexico	New Mexico	SW
544	Mescalero Apache Tribe of the Mescalero Reservation	New Mexico	New Mexico	SW
545	Ohkay Owingeh	New Mexico	New Mexico	SW
546	Pueblo of Acoma	New Mexico	New Mexico	SW
547	Pueblo of Cochiti	New Mexico	New Mexico	SW
548	Pueblo of Isleta	New Mexico	New Mexico	SW
549	Pueblo of Jemez	New Mexico	New Mexico	SW
550	Pueblo of Laguna	New Mexico	New Mexico	SW
551	Pueblo of Nambe	New Mexico	New Mexico	SW
552	Pueblo of Picuris	New Mexico	New Mexico	SW
553	Pueblo of Pojoaque	New Mexico	New Mexico	SW
554	Pueblo of San Felipe	New Mexico	New Mexico	SW
555	Pueblo of San Ildefonso	New Mexico	New Mexico	SW
556	Pueblo of Sandia	New Mexico	New Mexico	SW
557	Pueblo of Santa Ana	New Mexico	New Mexico	SW
558	Pueblo of Santa Clara	New Mexico	New Mexico	SW
559	Pueblo of Taos	New Mexico	New Mexico	SW
560	Pueblo of Tesuque	New Mexico	New Mexico	SW
561	Pueblo of Zia	New Mexico	New Mexico	SW
562	Zuni Tribe of the Zuni Reservation	New Mexico	New Mexico	SW
563	Kewa Pueblo	New Mexico	New Mexico	SW
564	Confederated Tribes of the Goshute Reservation	Nevada, Utah	Utah	SW
565	Northwestern Band of Shoshoni Nation (previously listed as the Northwestern Band of Shoshoni Nation of Utah (Washakie)	Utah	Utah	SW
566	Paiute Indian Tribe of Utah (Cedar Band of Paiutes	Utah	Utah	SW
567	Skull Valley Band of Goshute Indians of Utah	Utah	Utah	SW
568	Ute Indian Tribe of the Uintah & Ouray Reservation	Utah	Utah	SW

* *Native Village of Venetie Tribal Government includes Artic Village and Village of Venetie, therefore it was only counted once, resulting in 566 federally recognized tribes.*

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