

FACING THE STORM

Indian Tribes, Climate-Induced Weather Extremes, and the Future for Indian Country

NATIONAL WILDLIFE FEDERATION

2011



Stephen C. Torbit



Report
CONFRONTING GLOBAL WARMING

Executive Summary

As sovereign nations, Indian Tribes consistently strive to fully exercise their right of self-determination and to maintain their cultural identity, often in the face of the severe economic, societal, and environmental challenges confronting them. Their sovereignty, cultures, and ways of life are profoundly tested in these times by the added challenge of climate change. Tribes are disproportionately impacted by rapidly changing climates, manifested in ecological shifts and extreme weather events, as compared to the general population, due to the often marginal nature and/or location of many Tribal lands. The high dependence of Tribes upon their lands and natural resources to sustain their economic, cultural, and spiritual practices, the relatively poor state of their infrastructure, and the great need for financial and technical resources to recover from such events all contribute to the disproportionate impact on Tribes. Nevertheless, Indian Tribes have significant strengths and resiliency to meet these challenges. This report provides a basis for Tribes to consider how they may be affected by changes in climate and weather extremes and steps they can take to proactively address these impacts.

Climate change contributes to weather extremes. These extremes include more severe drought and heat waves, more intense wildfires and heavier rainfall and snowfall events. This intensification will be the most tangible experience of climate change for many people. Such extreme events are showing noticeable trends across the United States and promise to become more severe, especially if climate change continues unabated. Extreme weather events are destructive and the recovery costs are great, which will further burden Indian Tribes more than others due to their relative lack of infrastructure, capacity, and financial support to address them.

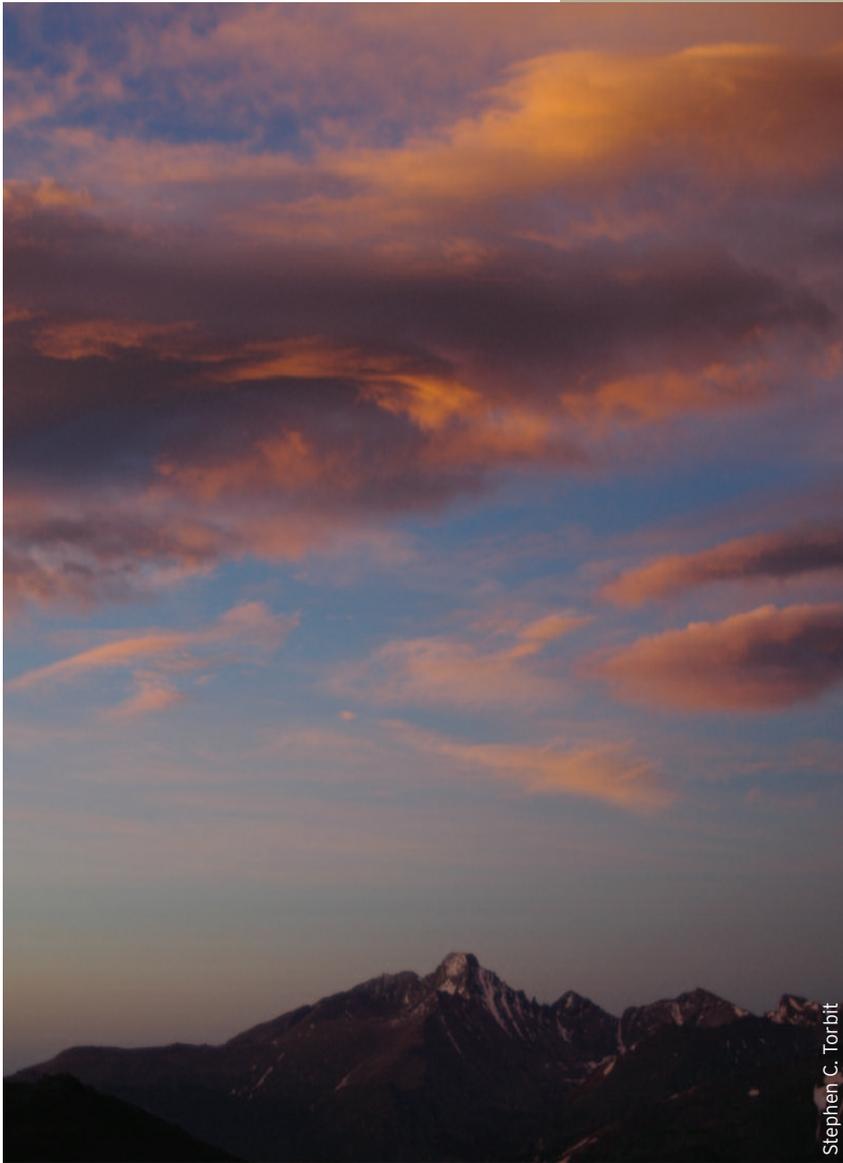
Tribal communities are particularly vulnerable to increasing weather and climate extremes. Indian Tribes often have a close connection to the land for economic development, sustenance, and for maintenance of cultural traditions, so changes to natural systems impact them more directly than the general population. In addition, high rates of poverty and unemployment on reservations mean that Tribes have limited resources to help their populations deal with weather and climate extremes, much less to adapt to a changing climate over the long term. Finally, because Tribes are restricted by reservation boundaries, their attachment to the land, and off-reservation treaty rights, moving to new areas to accommodate climate shifts is not a viable option.

Multiple climate-related threats can further challenge Tribal resiliency. Climate and weather extremes can interact to cause more severe impacts for communities and nature. The combination of extreme heat and drought can increase plant and wildlife mortality, cause electricity shortages, and heighten the risk of wildfires. These climate and weather extremes often occur in the context of other problems facing Tribes, from other sources of environmental degradation to limited economic resources.

Tribes can prepare for future climate change if they have adequate resources to do so.

Prompt and decisive action is needed to secure resources to address the impacts of climate change and to implement programs that help prepare Tribes, federal and state governments and agencies, and local communities to adapt to changes in climate. Indian Tribes have an opportunity to build on their close connection to the land, traditions of sustainability, and resilience to navigate a way forward through the changes of the coming decades.

INTRODUCTION



Stephen C. Torbit

There are 565 federally recognized Tribes in the United States, and an American Indian and Alaska Native population of 3.2 million.¹ Tribes exercise sovereignty over their lands and natural resources. They were sovereign nations before contact with Europeans and remain so today. Most reservation and trust lands are in the West, and more than one-half of Indians live in Arizona, California, New Mexico, Oklahoma and Washington. Most reservations are located in isolated areas and much of the housing lacks electricity and running water. Indian Health Services and the 1990 Census indicate that over 12 percent of Tribal housing lacks these basic necessities.

As Tribes strive toward greater self-determination, some face the challenges of a fragmented land base, lack of economic resources to allow for self-sufficiency, inconsistent or contradictory federal policies, insufficient access to federal programs supporting state and local governments, federal and state attacks on their sovereignty, and the challenge of maintaining and revitalizing cultural identity.² Overall, Native Americans living on reservations have rates of poverty and unemployment that are consistently at least twice the national average. Many Tribal members live below the poverty level and the average unemployment rate among Tribes is 45 percent.

Climate and Tribes



Stephen C. Torbit

The climate is changing due to anthropogenic activities, bringing widespread impacts for human and natural systems. The decade from 2000-2009 was the hottest on record and 2010 tied for the hottest year on record.³ These global temperature records are not surprising given the steady increase in the atmospheric greenhouse gas carbon dioxide, which hit 390 parts per million at the end of 2010.⁴ The gradual change in average temperature is affecting the frequency and severity of extreme weather and climate events — such as heat waves, droughts, heavy precipitation, wildfires, and winter storms—all of which have exhibited increasing trends in recent decades.

Tribes face substantial challenges related to these changing weather and climate extremes. Both historically and recently, Tribal communities have been significantly affected by severe

weather events and associated environmental impacts compared to the general population.⁵ Tribal communities find it especially difficult to respond to these changes due to a lack of economic, personnel, and environmental resources and, in some cases, small land bases. Tribes can use their inherent authorities (including taxation, natural resource and land use planning, zoning regulation, and licensing) to design and implement programs to adapt to and reduce the impacts of extreme weather events, but only if they have the resources to respond.

Tribal communities are deeply connected to local ecosystems and are economically and culturally dependent on the fish, wildlife, plants, and other resources of their lands.⁶ Thus, climate-induced shifts or outright loss of the habitats suitable for native species and resources can result in the

loss of economic and cultural resources. The geographic boundaries of reservations and resource availability restrict Tribal options for relocation, limiting opportunities to move to areas where climate change impacts are not as severe. Tribal rights to access resources on usual and accustomed areas outside of reservation boundaries are place-based regardless of climate-induced shifts in resource availability. This leaves Tribes in a position where they may no longer have access to important subsistence, medicinal, and cultural resources.⁷

Tribes are already feeling the effects of climate change. Predictions and increasing manifestations of worsening impacts, such as the continuing disappearance of roots, berries, salmon, caribou and other traditional food sources, will severely distress Tribal communities.⁸ The impacts are profound: economic and subsistence livelihoods may disappear, healthy foods may be replaced by foods known to increase the incidence of obesity and diabetes, and traditional practices and ceremonies that have bound Tribal peoples and societies together for generations may begin to unravel. Despite the significant climate-related challenges they face, Tribes have traditional ecological knowledge and government structures that can be used to alleviate some of the consequences. To accomplish this, Tribes should be allowed to participate meaningfully in scientific and programmatic efforts to understand how climate change impacts them, how they can and should be involved, and for those partners to acknowledge and accept traditional ecological knowledge as a valuable tool in developing solutions.

DROUGHT

Drought is perhaps the most pervasive climate-induced weather impact on Indian Tribes. Water is at the heart of many Tribal cultures and the foundation of their lifeways, economies, subsistence, and treaty rights. Water is essential to the sustainability of the fish, wildlife, and plants on which Tribes rely. The recent trend toward more severe and frequent droughts, especially in the American Southwest, threatens the very underpinnings of Tribal communities. The Southwest is already in the midst of a 10-15 year drought, and the future looks equally dry.

According to the Intergovernmental Panel on Climate Change, droughts will be longer, more numerous, and hotter in coming years.⁹ Many of the Southwest's rivers and reservoirs are experiencing historically low water levels and projections indicate that this trend will continue. Impacts from drought are pervasive. Droughts in the southeastern U.S. have dried up reservoirs and led to intense conflicts over water, while Florida, a key citrus-

producing state, is experiencing more frequent droughts that threaten its agricultural economy.¹⁰ Similarly, the Southwest, America's "produce-basket," which is important to Indians and non-Indians alike, is reliant on large and consistent amounts of water, and drought could wither these prospects in the near future.

Naturally arid locations, like the southwestern U.S., are prone to drought because they rely on a few

rainfall events to supply moisture. Future temperature increases and corresponding increases in evaporation mean that many land areas will become drier in the coming decades, especially if emissions intensify.¹¹ Indeed, climate projections indicate that the Southwest may transition to a more arid climate on a permanent basis over the next century and beyond, partially due to an extension of the semi-arid climate of Mexico northward.¹² In fact, climate observations indicate that this transition may have already begun.¹³

Declining mountain snowpack is also affecting water availability for the Southwest and other areas that depend on runoff. Snowpack has been shrinking, as more precipitation falls as rain instead of snow.¹⁴ Simultaneously, snowpack is now melting one to four weeks earlier than it did 50 years ago.¹⁵ Both of these trends can cause major water shortages in late summer and fall, as well as flooding in the winter and spring.



Impacts of Drought on Tribal Communities



Joseph O'Brien, USDA Forest Service, Bugwood.org

Hundreds of Tribes are reliant on freshwater resources for their daily needs and now face an ominous challenge in adapting to a drier future. The impacts of drought on forests, particularly in the West, provide an illustrative case study. Drought

parches forests and plants, lowers water levels in rivers and wetlands, and threatens agricultural productivity.

Massive die-offs of pine trees throughout Western North America are a particularly striking example of how drought, combined with higher temperatures, can affect natural habitats. Pinyon pines on thousands of square miles in the Four Corners region and lodgepole pines on millions of acres in the Rocky Mountains from New Mexico to British Columbia have died in recent years.¹⁶ Trees have natural mechanisms to manage short periods of drought, but these defenses break down when trees are exposed to unusually hot conditions at the same time.¹⁷ Furthermore, warmer and drier conditions are conducive to widespread beetle and other insect infestations, resulting in broad ranges of dead trees.¹⁸ Higher temperatures enhance winter survival of mountain

pine beetles and allow for a more rapid lifecycle. At the same time, moderate drought conditions for a year or longer can weaken trees, allowing bark beetles to overcome the trees' defense mechanisms more easily.

Forests act as natural safeguards for water by providing shade that controls temperature, helping to prevent erosion and siltation, and acting as a sponge to collect water. These benefits assist wildlife that live in forest and aquatic systems, and also maintain the wildlife, forest and aquatic resources that Tribes rely on. There are 326 reservations encompassing approximately 18.6 million forested acres, many of which lie in the western U.S.¹⁹ The loss of forest resources will be especially challenging for Tribes that rely upon them for their spiritual, cultural, and environmental values, and their potential to improve economic development opportunities.

Multiple Demands on Water in the West

Access to water in the Western United States has long been a contentious issue. Many Indian Tribes still have unresolved claims to water rights. Western water rights are based on prior appropriation that functions on the principle of "first in time, first in right." Because Tribes preceded the presence of others, they have senior rights to water. Nevertheless, the rapid settlement of the arid U.S. West in the 19th and 20th centuries and the need for water to develop the region outpaced the ability to confirm Indian water rights through adjudication.

Today, the burgeoning population of the West and its thirst for water is compounded by increasingly extreme periods of drought. Many of the region's rivers, such as the Colorado, are over-allocated to the multiple

urban, industrial, and agricultural uses, a problem that will only escalate with climate change. Many Tribes do not have the information to adequately monitor drought conditions and often lack the necessary technical and financial resources to plan and implement conservation measures or to meet water needs.²⁰ Thus, as drought worsens and water scarcity increases, Tribes' unsettled senior rights to water could enlarge the burden on all of the West's occupants, human and animal alike. Nevertheless, settling water rights presents an opportunity for Tribes to secure water for their communities as well as for the plants, wildlife, and habitat upon which they rely.



U.S. Geological Survey

THE COLORADO RIVER AND THE COCOPAH TRIBE



Stephen C. Torbit

For thousands of years, the Cocopah have been River People, depending on the Colorado River for physical and spiritual nourishment. The River and its plants and animals represent the Cocopah's traditional homeland and the foundation of their culture. Today, the River remains culturally important for traditional and spiritual reasons to the Cocopah. Yet drought is jeopardizing the very environmental and cultural foundation of the Tribe.

The Colorado River from Hoover Dam to the Mexican Delta is blockaded by more than 30 dams, irrigates over three million acres, and serves the water needs of 30 million people in two

countries. Damming of the River in the 20th century halted periodic flooding and shrunk Colorado River wetlands by more than 1.7 million acres, threatening wildlife and plant populations. Reduced water flows allowed invasive salt cedar to overtake much of the native habitat along the River. Today, the threat is even greater because salt cedar is more drought-tolerant than cottonwoods, willows, mesquite and other native plants.

Since 1999, Lake Mead, the nation's largest reservoir, has dropped to 37 percent of its capacity, the lowest level in more than 50 years.²¹ Climate change will reduce the Colorado River's flow anywhere from 5 to 30 percent.²² Climate-induced drought along the Colorado River and the impacts on wildlife and habitat compound the existing challenges of a water supply that is increasingly scarce due to invasive species, over-allocation, and rising human populations dependent on the River.

The Colorado River corridor between the U.S. and Mexico (the Limitrophe) includes 12 river miles within the Cocopah Reservation and 11 miles under federal management. The U.S. Limitrophe and the Mexican Delta to the south contain the best remaining native habitat on the River for more than 120 species of migratory neotropical songbirds, waterfowl, and other wetland birds, including threatened and endangered species. The Limitrophe's native plants are utilized by the Cocopah for traditional ceremonies, basketry, buildings, and other cultural purposes. In 2002, the Cocopah began developing a vision for protecting the River by collaborating with non-governmental and governmental partners. To confront the impacts of drought and the other challenges to the ecosystem, the Cocopah identified the highest priority habitat for restoration and have restored close to 60 acres.

Restoration and protection of the Limitrophe will help complete a link between protected regions along the Lower Colorado, treating the River as a complete ecosystem rather than as fragmented areas. However, riparian restoration is extremely expensive and the price tag will only increase as drought reduces the available water for reestablishing native habitat. Drought poses a difficult question for the Tribe: what costs are the Cocopah willing to bear to save the River and its wildlife? "We will bring the river back," replies Cocopah Elder Colin Soto. "No river, no Cocopah. The Tribe is connected to the river—this is our blood, this is who we are, river people."

WILDFIRE

Climate change is increasing the frequency and intensity of large wildfires as warmer, drier, and longer fire seasons lead to more dead trees, dry grasses, and other fuel sources.²³ Furthermore, fire suppression policies have allowed fuels to build up in sensitive areas, exacerbating other factors such as drought conditions. As wildfires have become a bigger problem so too have the risks to health, property, and ecosystems — risks that can acutely impact Tribal communities.



Wildfire Trends

In recent decades, the frequency of large wildfires and the total area burned have been steadily increasing in the Western United States.²⁴ Warmer springs and longer summer dry periods since the mid-1980s are linked to a four-fold increase in the number of major wildfires each year and a six-fold increase in the area of forest burned compared with the period between 1970 and 1986. The fire season stretches about 78 days longer and individual fires last about 30 days longer.²⁵

Nationally, the overall area burned is projected to double by late this century across 11 western states if the average summertime temperature increases by 2.9 degrees Fahrenheit, with Montana, Wyoming, New Mexico, and Utah being hit particularly hard.²⁶ Alaska is also expected to see the area of forests burned increase by a factor of two or three, primarily due to longer growing seasons and shifts in vegetation.²⁷ Increased frequency of lightning as thunderstorms become more severe could spark more wildfires.²⁸



Wildfires Impact Communities and Cultural Heritage

The costs related to fighting, containing and suppressing a wildfire can range from hundreds of thousands of dollars to tens of millions in manpower, water, and chemicals, depending on its size and how long it rages. The increase in big wildfires comes with increased losses and escalating firefighting costs. Property losses from wildfires have averaged more than \$1 billion each year over the past decade.²⁹ The U.S. Forest Service now spends 45 percent of its

annual budget on fire prevention and suppression, up from 20 percent in 2000.³⁰ For many Tribes in wildfire areas, the price tag of containing a fire and the recovery can be extraordinary.

In addition to the direct costs of the fires, Tribal communities must deal with the expenses of healthcare, air and water impairment, and damage to cultural properties. People exposed to smoke, airborne particulates, and other fire-related air pollutants have an increased risk for bronchitis,

asthma and other long term health effects. There are also risks related to burns and potential injuries from fighting the fire, including infection as burns and wounds heal. The cultural costs to Tribes are the most difficult to recover from because there are often no substitutes for what is lost. When a gravesite, structure or other item of historical or cultural significance is damaged, it cannot always be rebuilt nor can the intangible value be replaced.

Catastrophic Wildfires Threaten Wildlife and Habitats

Fires are a natural and beneficial part of many ecosystems, but an increasing trend toward extremely large, catastrophic fires can dramatically alter habitats by putting unnatural stresses on habitats and could completely transform ecosystems. For example, fires that burn too hot or too long can destroy soil structure or seed banks, making it difficult for plants to re-establish themselves after the fire.

In some cases, fires make it much easier for exotic, invasive plant species to get a foothold, leading to rapid habitat conversion that has ripple effects for wildlife. Such was the case following the 2002 Rodeo-Chediski fire in Arizona where large areas of Ponderosa Pine were converted to chaparral and related species.³¹

Intense wildfires damage forage areas and the vegetative cover key to wildlife. If these conditions occur, wildlife has less time to flee or find shelter. If the fire moves too fast, smoke, heat, and the fire itself are more likely to kill wildlife outright. If there is too much damage to the plant life that wildlife need for food, such that it cannot regenerate, then the wildlife can also become weaker and more susceptible to diseases or starvation from poor nutrition.³² For Tribes, this can be especially harmful if the lost plants and wildlife are significant for subsistence, traditional, and cultural uses.



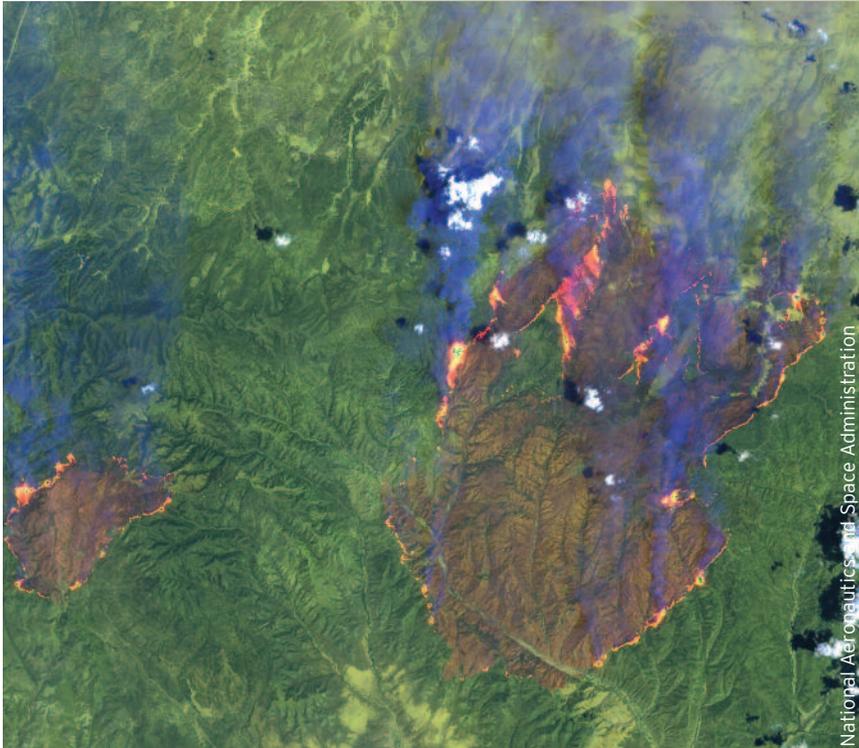
John McColgan, U.S. Forest Service



National Park Service

THE WHITE MOUNTAIN APACHE TRIBE AND THE RODEO-CHEDISKI FIRE

During the 1940s, a forest manager for the Bureau of Indian Affairs (BIA) assigned to the Fort Apache Agency, began an aggressive program of prescribed burns on the White Mountain Apache Reservation of Arizona that continues today. Callender intended these prescribed burns to allow for easier access to forest areas, improve the health of the forests by simulating naturally occurring fires, and alleviate the potential risks and impacts of large, uncontrolled, and destructive fires. This effort helped protect communities in the face of one of the worst wildfires in Arizona history.³³



On June 18, 2002, hoping to get hired on to a fire crew, a man started a fire which became known as the Rodeo Fire on the Apache Reservation. Two days later, a woman whose car ran out of gas and was lost, started a fire (the Chediski fire) in hopes that a helicopter would see and rescue her.³⁴ On June 23, 2002, the Rodeo and Chediski fires merged.

Before the fires, the Tribe's 12,000 members suffered from an unemployment rate of 60 percent. The White Mountain Apache Tribe is heavily timber dependent and the forest is spiritually and culturally important to the Tribe. The fire burned approximately 462,000 acres, 59 percent of which were on the Fort Apache Reservation (approximately 276,000 acres). The Rodeo-Chediski Fire forced the Tribe to close two of its' sawmills for lack of post-fire timber resources. The portion of the reservation that burned included about half of the Tribe's timber lands, with a value of \$237 million.³⁵

Recovery from such a fire is slow and costly. With more intense fires occurring every year, these expenses will only increase. The White Mountain Apache manage their timber under a comprehensive forest management plan that manages for wildlife and other resources in addition to timber.³⁶ One result of the fire was that the Tribe was forced to consider other less valuable timber products.

While the fire was devastating to the region, the Tribe took steps to reduce its impact. They were able to minimize some of the fire's effects by thinning underbrush and trees. Because of the Tribe's efforts, the fire stayed near the ground and many of the trees survived. The fire also stayed out of the forested communities near Show Low, saving the homes of some 10,000 residents. The White Mountain Apache Tribe is recovering because of its forest management practices and the emphasis that it placed on the cultural and environmental importance of the forest. In 2004, the Tribe received Forest Stewardship Council (FSC) Forest Management Certification for its management plan, which balances the cultural and economic needs of the Tribe. The plan supports Tribal member access to all Tribal lands, protection of cultural resources and sites, management prescriptions for threatened and endangered species, and management of timber harvesting.³⁷ Because of the Tribes' management and prescribed burning, when the Wallow Fire ignited in June 2011, flames that crossed into Apache country burned mostly at ground level and caused minimal environmental damage.³⁸

FLOODING

As climate change brings an increasing number of heavier rainfall events (more wintertime rain instead of snow and earlier seasonal melting of snowpack), Tribal lands are likely to experience more severe flooding events. Floods are among the most costly kind of weather and climate disasters in the United States, with impacts including destroyed homes and infrastructure, disease outbreaks, loss of cultural sites, and lost crops.³⁹ Tribes are especially vulnerable to more severe flooding because of their limited resources for recovery.



Donna Martinez/American Red Cross

Heavier Rainfall Events, Earlier Snowpack Melting, and Changing Winter Precipitation

Climate change is increasing the number of heavy rainfall events because warmer air can hold more water.⁴⁰ Long periods of heavy rainfall that contribute to major flooding are

becoming more common. In the Midwest and Northeast, big storms that historically would only be seen once every 20 years are projected to happen as often as every 4 to 6 years

by the end of the 21st century.⁴¹

Mountainous areas across western North America and in the Northeast have experienced snowmelt and peak stream flow earlier in the spring. Snowmelt discharge occurs 5 to 20 days earlier than it did 50 years ago.⁴² Dates of high flow in the Northeast are already one to two weeks earlier than in the 1970s.⁴³ These trends likely mean an increased risk of winter and early spring floods and water shortages in the summer and fall. At the same time, winter precipitation is beginning to shift toward more rain instead of snow. The fraction of wintertime precipitation falling as snow has declined by 9 percent since 1949 in the Western United States and by 23 percent in the Northeast.⁴⁴ The increase in winter rainfall will bring increased flooding risk during those months.



Donna Martinez/American Red Cross

The Bridger Range in Montana on June 9, 2011, was still packed with snow. Increasing temperatures and rainfall causes excessive melting and flooding.

Flooding Impacts on Tribal Communities



Donna Martinez/American Red Cross

Flooding has multiple causes and significant repercussions for Tribal communities. In Alaska, flooding can be caused by early snowmelt, melting permafrost, heavy rain and snowfall, melting sea ice, and rising sea levels. Studies in 2003 and 2009 by the U.S. General Accountability Office found that more than 200 Native Villages were affected to some degree by flooding and erosion and 31 villages face imminent threats that are compelling them to consider permanent relocation. In the Pacific Northwest, flooding can be caused by rising sea levels, early snowmelt, and warmer winters where precipitation falls as rain instead of snow. Drought conditions in the Southwest are also increasing the severity of flooding impacts. Over the last 10-15 years, it has been so dry that when heavy rains occur or snow melts quickly, rivers swell faster because parched earth does not have the ability to absorb the water and prevent banks from overflowing.

Floods from these causes result in erosion, standing water, mudslides and the destruction of homes and other buildings by washing them away or eroding the ground underneath. Other critical infrastructure, such as roads or power and phone lines, are cracked or washed away. Standing and stagnant water can lead to an increase in disease and parasites. These impacts increase when sewer systems and stormwater systems are overwhelmed by floods.

Recovery and rebuilding costs quickly add up and become unmanageable, especially for small or isolated Tribes with small land bases or insufficient financial resources. For example, a heavy rainfall event in July 2010 cost the Hopi First Mesa Consolidated Villages an estimated \$930,000 to repair roads, telephone lines, and water and sewer systems.⁴⁵ The costs of severe flooding are not unique to the Hopi and can be seen across many reservations. Furthermore, Tribal members that

reside along coastal areas and in floodplains may face the difficult decision of whether to relocate, if that is even an option given the geographical extent of their reservation. For those Tribes with no choice but to relocate, such as Native Villages in Alaska that are falling into the sea, recovery will be long, difficult, and extremely expensive, and the impacts to cultural values and resources could be devastating.

Crops are especially vulnerable to flooding, both during and after a storm event because excessively wet soil can create anoxic conditions, foster the spread of diseases and insects, and make it difficult to operate farm machinery needed to plant or harvest. One study estimates that flood-related losses to U.S. crops could double by 2030 due to increased frequency of excess soil moisture.⁴⁶ One example where flooding has had a drastic effect on Tribal agriculture is the Wind River Indian Reservation in Wyoming. In 2003, a lake once confined in Grasshopper Glacier and located within the Fitzpatrick Wilderness of Wyoming's Wind River Range, melted out. This water caused flash flooding for miles downstream and in the entire Dinwoody Valley below the glacier. The melting of the glacier resulted in minimal structural damage, but increased flooding and flash flooding risk.

Due to the changes in glacial melt, the Wind River Indian Reservation is also facing new agricultural concerns. There is an increase in silt buildup in the irrigation ditches from flooding, and there is also concern about late season irrigation, as the changes in melting patterns have decreased the flow available for irrigation during this period. Such flooding will likely continue to occur as the glacier continues to recede.⁴⁷

FLASH FLOODS ON THE DROUGHT-IMPACTED HOPI RESERVATION

In July 2010, the Hopi Reservation, like much of Arizona, was suffering from severe drought conditions. Hopi Tribal Chairman LeRoy Shingoitewa declared a state of emergency for the First Mesa Consolidated Villages area because severe storms were causing flash flooding. The drought parched the land and soils so badly that they could not absorb the drenching rainfall.

The heavy storms damaged most of the local roadways and made them impassable. The storms impaired water and sewer lines, brought down telephone lines, flooded homes, carried trash and other objects into yards, carved gullies, and filled drainage ditches with sand. Rockslides closed the main road into the village.⁴⁸ Several gravesites were also damaged by the flooding. The mitigation costs alone were estimated at \$300,000 with another \$630,000 needed to repair the sewer and water systems.⁴⁹



Flooding Impacts on River Habitats



Major floods and changes in the seasonal stream-flow regime can have significant impacts for fish and other wildlife that depend on rivers. Severe flooding can scour river and stream beds, stir up sediments, cause erosion (increasing siltation), and inundate surrounding land. All of these impacts on rivers can increase fish mortality, especially in the Pacific Northwest.⁵⁰ For example, stronger winter flood events may wash away the gravel beds that salmon, trout, and steelhead use for nesting sites.⁵¹ In addition, with heavy rainfall all at once, surface water does not have sufficient time to seep into the groundwater, which is necessary to restore aquifers and underground streams.⁵²

Changes in seasonal stream flow, especially associated with more wintertime rain instead of snow and with earlier snowpack melting, will disrupt the movements of migrating fish that rely on water conditions to control their development, time their migrations, and orient themselves to navigate effectively.⁵³ The shift in timing and location of runoff with respect to seasonal salmon migration is increasing juvenile mortality because river temperatures are now too high for survival when the salmon arrive. There is now a risk that over the next 40 to 80 years 50 percent of trout and salmon habitat will be lost.⁵⁴



exploratorium.edu

AK: Shishmaref, Alaska is one of many coastal Native Villages facing relocation due to threats from flooding and erosion related to a rise in sea level and a decrease in sea ice.



istockphoto.com

WY: The Wind River Reservation is being impacted by drought and changes in glacial melt the Tribe relies on for irrigation. These changes are also damaging agricultural infrastructure.



Doima Martinez/ARC

WA: The Hoh, Quinault, and Quileute Tribes face flooding that is damaging Tribal infrastructure, homes and buildings. Altered river flows and water temperatures are harming fisheries and scouring riverbeds.



USFWS

WA: The Tulalip Tribes and other Pacific Northwest Tribes are facing difficulty in accessing traditional foods and other resources at their usual and accustomed places due to shifts in timing and quantity of river flows that impact coldwater fisheries.



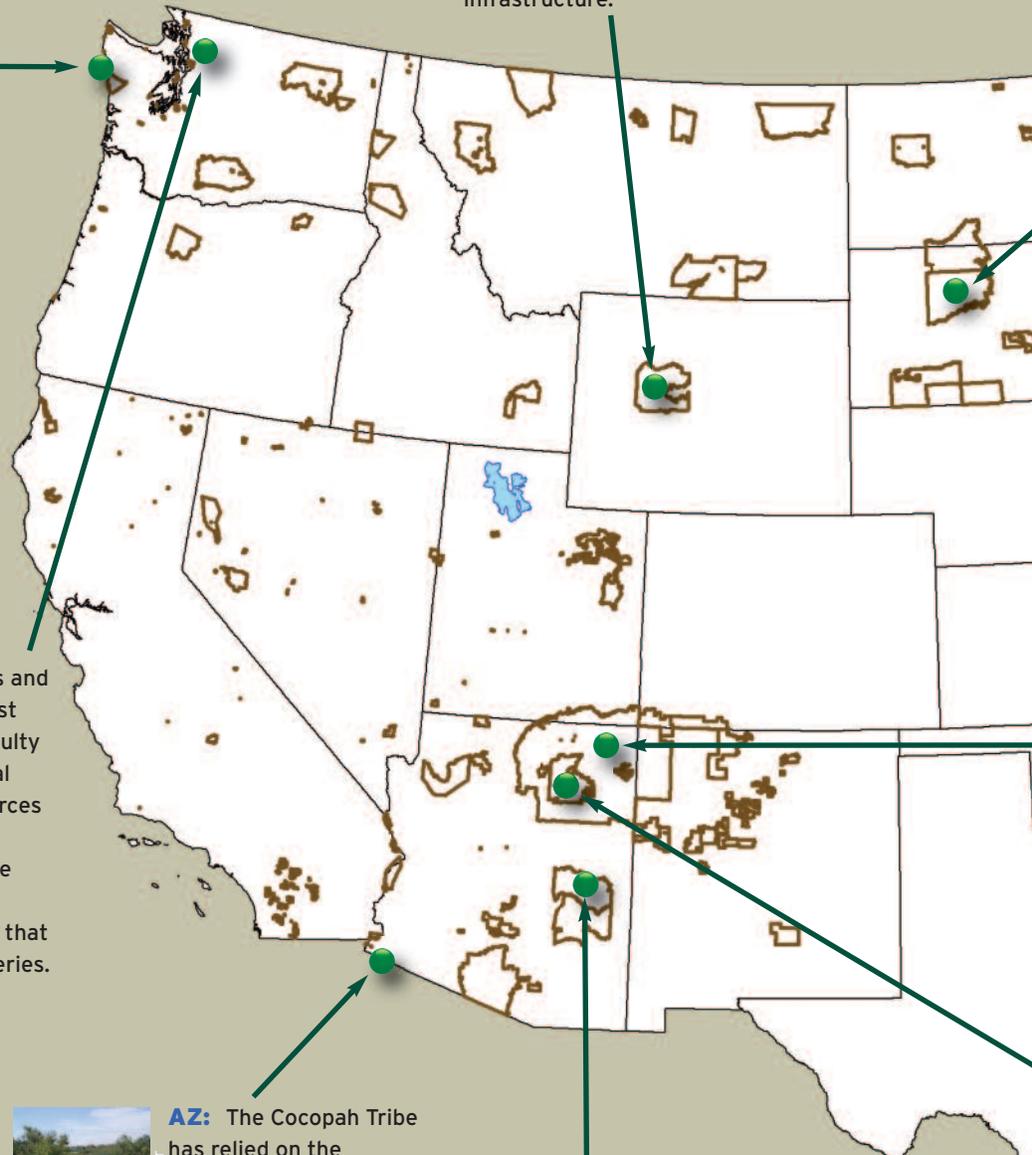
Garrit Voggesse

AZ: The Cocopah Tribe has relied on the Colorado River for thousands of years. Severe drought threatens cultural use of traditional plants, fish and wildlife, agriculture and other uses.



USFS

AZ: The White Mountain Apache Tribe relies on their forested lands for their culture and economic development. Wildfires can devastate these resource uses and destroy Tribal infrastructure, homes, and buildings.



LANDS



Flickr: queen of subtle

SD: The Cheyenne River Sioux Reservation faces increasingly harsh winters. Heavy snow, ice, and frigid temperatures make travel hazardous, knock out power, and damages infrastructure.



Shutterstock.com

AZ: Many villages on the Navajo Reservation are remote and difficult to access. They have less infrastructure and fewer utilities. Heavy snowfall and flood events increase these challenges.



Wikimedia: Promking

AZ: The Hopi Reservation is suffering from drought. Unusually severe storms, and the resultant flooding and mud slides, compound damage to infrastructure and cultural sites.



 Tribal Lands



SHISHMAREF, ALASKA

Eighty-six percent of Alaska Native Villages are threatened by erosion and flooding. Thirty-one villages face imminent threats and at least 12 have decided to relocate or to explore relocation options.⁵⁵ Melting ice and permafrost as well as rising sea levels and coastal storms all contribute to these growing problems.⁵⁶ For some villages, this potential concern is now a reality.

Shishmaref, an Inupiaq village in Alaska, is located on a barrier island just north of the Bering Strait and depends heavily on a subsistence lifestyle. Over the last several decades, warming temperatures have melted the permafrost underneath

the village. Higher temperatures have also resulted in a thinner buildup of ice along the coast. The village is now threatened by storm surges that are no longer dispersed by sea ice, and are eroding and flooding the ground on which the village stands. Since 2001, an average of 23 feet of shoreline is being lost per year because of storms.⁵⁷

Shishmaref villagers rely on a subsistence lifestyle, including hunting and fishing. With the changing precipitation and sea ice patterns, marine mammals (e.g., polar bears and ringed seals) are less able to find safe areas to den and seek protection from inclement weather, which means there are fewer for hunters to take.

The number of stranded ringed seal pups is increasing because earlier ice melt causes the mothers to abandon their pups. Often these pups are young, not fully weaned and cannot fend for themselves. The spotted seals are facing similar problems. Bearded seals, on the other hand, seem to be flourishing and hunters are having more success hunting them. They seem to be in good condition and concentrated in hunting areas (where they were far scarcer previously). The Nome area however, is seeing fewer seals. Walruses are now required to swim farther to find food due to the decrease in sea ice, and they are often smaller and weaker than their ancestors.⁵⁸ With these changing patterns, such resources are becoming more difficult for subsistence Native villagers to find. Not only are seals more difficult to locate, the conditions in the hunting areas make hunting more treacherous. Melting ice is limiting the hunters' ability to pursue and take the wildlife they need for survival.⁵⁹



Curtis Nayopuk



FLOODING IMPACTS ON THE HOH TRIBE AND THE QUINAULT INDIAN NATION

The Hoh Tribe has been living along the Hoh River and the Pacific Coast for centuries, and the area is culturally important to them. The Hoh Reservation is approximately one square mile, and the Tribal population is approximately 300. The Hoh River and salmon are a focal point of the Tribe's history and identity. However, flooding and rising sea levels have put Tribal members in a position where they cannot stay on their ancestral lands and are being forced to relocate for safety.

Flooding resulted in Tribal homes being abandoned or destroyed because they fell into the river or ocean, and the community center and Tribal headquarters now have a permanent ring of sandbags to keep flood waters back. There is little room for new buildings and development, because 90 percent of the open space on the reservation is in the floodplain.⁶⁰

In November 2009, storms caused wide-scale flooding that impacted the Quinault Indian Nation, located on the Pacific Coast in Washington, and the Hoh Tribe, located where the Pacific Ocean and the Hoh River meet in Washington. The Quinault Reservation encompasses approximately 300 square miles and has a population of just over 1,300 Tribal members.⁶¹ The larger land base helped minimize some of the more direct impacts faced by the Quinault, as compared to their northern neighbor, the Hoh Tribe. However, flooding put homes and other structures at risk. It limited access to more remote villages on the Quinault Reservation and caused damage to the infrastructure. The Quinault also face concerns regarding their fisheries because of the change in water levels, stream flows, and water temperatures. Villages along the Pacific need to be moved to higher ground, and many of the Tribal roads along the coast are at risk of flooding and being washed away or cracked by rising ocean levels and rising rivers.⁶²

SNOWFALL EVENTS

Scientists project that the next few decades will bring more unusually warm winters and more record-breaking snowstorms to the U.S.⁶³ If it gets much warmer, snowfall will become less and less common after mid-century. Meanwhile, Tribes in the northern part of the country will have to contend with increased challenges associated with heavy snowfall events.



More Frequent and Larger Winter Storms

Climate change is resulting in a clear trend of heavier precipitation events. Places where temperatures typically remain below freezing in winter are seeing bigger and more intense snowstorms,⁶⁴ especially in the upper Midwest and Northeast.⁶⁵ Storm tracks are shifting northward,⁶⁶ part of the reason that the area from the Dakotas

eastward to northern Michigan has seen a trend toward more heavy snowfall seasons.⁶⁷ Some areas bordering the Great Lakes also experience more lake-effect snow. Because the lakes are less likely to freeze over or are freezing later, surface water evaporation is recharging the atmosphere with

moisture, which subsequently precipitates as more snow as it moves ashore.⁶⁸ Lake-effect snow is expected to continue increasing over the next few decades, and then eventually decline as increasing wintertime temperature leads to rain instead of snow.⁶⁹

Snowstorm Impacts on Tribal Communities

Heavy snowfall has multiple impacts on Indian Tribes. Tribes with highly dispersed and isolated populations, especially those with limited resources or who are unaccustomed to heavy snow, face unique challenges. Clearing snow from roads and responding to medical emergencies in isolated areas can be costly and almost impossible in some cases. No matter how prepared Tribes are, the challenges inherent to unexpected or extreme snowfall are great. The more isolated and dispersed a population, the greater the associated risks tend to be. The costs of extreme snow events are not only related to the snowfall itself and snow removal, but

are also associated with the resultant flooding, erosion, and mudslides when the excessive snow starts to melt.

In January 2010, the Cheyenne River Sioux Reservation in South Dakota was hit by one of the worst winter storms seen in years. Many Tribal members were without power, water, or access to the main roads for two weeks due to the storm and five-foot snow drifts.⁷⁰ The ice storm and blizzard toppled thousands of power lines and caused water pipes to freeze, roads were coated with ice and covered in snow, and winds ranged from 25 to 50 miles per hour. The Tribe's \$175,000 emergency fund was depleted trying to

cope with the disaster. The Tribe distributed food, water, and propane, and the South Dakota National Guard helped bring in state-supplied generators.⁷¹

The long waits for snow removal were especially difficult for Tribal families who rely on propane for heating and were unable to refill their tanks due to impassable roads.⁷² Additional costs are associated with resultant flooding, erosion, and mudslides when excessive snow starts to melt. Likewise, individuals who require regular medical attention, such as those on kidney dialysis, can face significant problems if stranded for days or weeks.

NAVAJO NATION BLIZZARD

From January 18-23, 2002, more than four and a half feet of snow fell on areas of the Navajo Nation Reservation in Arizona that had been suffering from a decade-long drought and had not seen significant snowfall in years. Some areas of the Navajo Reservation received as much as eight feet of snow. This snowfall event ranked as the second worst on the snowstorm charts kept by the National Weather Service observing station in Flagstaff since 1898. President George W. Bush declared a state of emergency for Arizona, and the Navajo and Hopi Nations also declared states of emergency for their reservations. The Navajo Nation's Emergency Operations Center responded by coordinating the airlift of supplies (wood, food, water, coal, and hay) to Tribal members in remote locations, organizing the clearing of main and secondary roadways, and designing and implementing a response plan for dealing with stranded and relocated livestock (arranged for straw and hay to be dropped for feeding and secure areas for the relocated livestock). Given the remoteness of some areas and the impassability of the roads due to snowfall and drifting snow, getting supplies distributed became a priority for the Tribe.

The massive snowfall was only the beginning of the challenges. Once the snow began melting, it created a slushy, muddy mess, making travel even more treacherous and difficult, and these conditions worsened when the slush refroze after sundown. Because of the drought, the region greatly needed the precipitation, but not all at once. Dry creek beds and low-lying areas experienced extreme flooding. Despite the significant impacts, the Navajo Nation had a preparedness plan that enabled it to respond to the emergency quickly and efficiently. The Navajo coordinated its efforts with the state and federal governments to ensure that the agencies and the Tribe cooperated and did not duplicate work or miss critical needs.





Stephen C. Torbit

FACING MULTIPLE CLIMATE EXTREMES

All of the impacts and events discussed in this report build on one another, but rarely do they occur as isolated events. They sometimes occur simultaneously and at other times directly follow each other, compounding the pre-existing challenges Tribes face. The damage to Tribal natural and cultural resources from a variety of climate-related impacts can multiply over time. In addition, climate and weather extremes occur in the context of other problems already facing American Indians and Alaska Natives, including health, economic, and natural resource challenges.

Drought amplifies the risks posed by wildfire and flooding. Dry conditions provide more fuel available for high intensity fires and are one of the key factors behind the recent increase in wildfires in the West.⁷³ Drought also increases the probability of flash flooding because when it does rain earlier or snow melts more quickly, the dry, parched earth has less capacity to absorb the water.

To manage impacts from increasing extreme events, greater funding and technical assistance for Tribes are required. Tribes frequently do not have the capacity or resources to recover from individual events, much less multiple events that occur simultaneously or in rapid succession. Compared to state and local governments, Tribes receive much less federal funding and other resources to

deal with these issues. Within federal funding streams, Tribes are either expressly excluded, not mentioned at all, or are ineligible for other reasons, leaving a gap that they are unable to fill. When the federal government does allocate funding to Tribes, it is often a very small percentage compared to funds allocated to other entities.



Molguefile

USUAL AND ACCUSTOMED FISHING AND HUNTING AREAS AND CULTURAL RESOURCES OF NORTHWEST TRIBES

Pacific Northwest Tribes already face challenges related to the loss of salmon and salmon habitat because of commercial fishing, dams, other water development and contradictory applications of various federal policies. Tribal hunting, fishing and gathering rights are primarily place-based because they are rooted in historical and cultural practices tied to specific geographic regions. More extreme flooding events will exacerbate existing challenges. Tribes must stretch limited resources (land base, money, and staff) to adapt to and address extreme weather events. Tribes are facing similar concerns across the U.S. with respect to important environmental and cultural resources. For example, where the ocean meets the coast and the mountains in the Northwest, extreme weather variations are not unusual, but are now occurring more frequently, and in shorter, more intense bursts.⁷⁴ Usual and accustomed fishing and hunting areas are those areas where Tribes traditionally fished and hunted, and the rights to continue these activities are guaranteed by treaties between the Tribes and the federal government. This includes rights of access (such as right of ways over private lands), regardless of land ownership.

Alterations in timing and quantity of water available in the Tulalip Tribe's usual and accustomed fishing and hunting areas are pressuring native species and resources of cultural significance to shift in location or otherwise adapt to survive. Other species may become locally extinct due to an inability to adapt to changing conditions at the rate required. This shift could result in the loss of economic, cultural, and religious resources that cannot be replaced. Usual and accustomed areas are place-based, geographically

defined areas. The federal government and Tribes had no way of anticipating what would happen to Tribes' treaty right to resources in these areas should the relevant resources no longer thrive there. Many Tribes may be in a position where they no longer have access to important subsistence and cultural resources.⁷⁵ These concerns are not limited to the Tulalip, but are concerns common to many Tribes who have place-based rights in their treaties. As wildlife and plant life shifts continue to occur, there is an increased likelihood that more and more resources will be located in areas that are inaccessible to the Tribes.

The Quinault and Quileute Nations have reported a shift in coastal fish populations; they are now catching anchovies and sunfish for the first time as well as seeing a reduction in traditional fish such as salmon. The range of native grasses has been shifting northward, and invasive species such as Japanese knotweed are displacing native species. Tribal hunting, fishing, and gathering rights are primarily place-based because they are rooted in historical and cultural practices tied to specific geographic regions. Shifts in plant life and wildlife will lead to cultural loss as Tribes are forced to adapt to the new conditions.⁷⁶



USFWS

WILDLIFE, HABITAT IMPACTS, AND TRIBAL COMMUNITIES

Wildlife and their habitats have natural mechanisms to help them endure normal weather variations. However, the more extreme events caused by climate change are already pushing wildlife and their habitats beyond their normal tolerance levels.⁷⁷ Tribes face significant risks from rising temperatures that will result in a lack or reduced availability of wildlife, plant, and other resources that are culturally and medicinally important.⁷⁸

Plants are vulnerable to heat stress; normal metabolic processes such as photosynthesis become disrupted and plant growth slows when temperatures exceed certain tolerance levels.⁷⁹ When extreme heat is combined with unusually low soil moisture, trees and other plants are more susceptible to disease, insect infestation, and wildfire.⁸⁰ In some desert climates cacti are dying or have lower reproductive rates due to extreme heat and water shortages.⁸¹ Extreme heat also can burn berries, parch leaves and cause deformities that increase plant mortality.⁸²

Moose, a species important to many Tribes in the Great Lakes region, are suffering the impacts of warmer weather. In a recent study of moose at the southern edge of their range in northwest Minnesota, researchers found that over the past 40 years, declines in the moose population are related to increases in mean temperature with winter and summer temperatures increasing by an average of 12 and 4 degrees F (6.8 and 2.1 degrees C), respectively over this period. Lack of food resources and increased exposure to deer parasites associated with warmer summer temperatures appear to be the primary causes of more decline.⁸³ Summer can be especially stressful to moose because of the high energy cost required for them to keep cool. Heat stress results in lower overall activity, including foraging. Moose have a low surface area to volume ratio which conserves heat efficiently, but does not allow for heat to be expelled quickly. The resultant decreased activity increases the likelihood for weight loss, disease, and parasite concerns. The greatest effects are seen in adult moose due to their large size.⁸⁴ Studies suggest that the northwest Minnesota moose population likely will not persist over the next 60 years and the southern population may be restricted to areas where climate and habitat conditions are marginal, especially where deer are abundant and act as reservoir hosts for parasites.⁸⁵

Rising sea levels, an increase in flooding events, and warmer temperatures can cause damage to significant

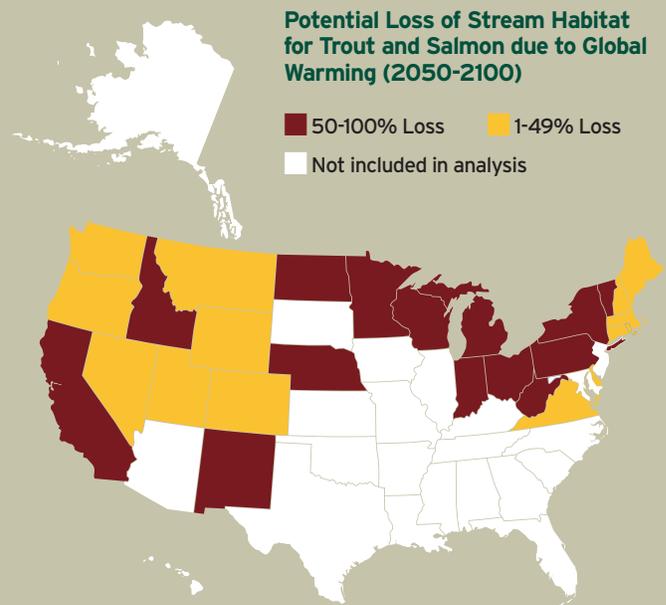


FIGURE: Projected loss of salmon and trout habitat in the U.S. in the next 90 years. U.S. Environmental Protection Agency. 1995. *Ecological Impacts from Climate Change: An Economic Analysis of Freshwater Recreational Fishing*. EPA 220-R-95-004. Exhibit 2-27.

wildlife and fish habitat, seriously impacting fisheries by altering spawning habitat and increasing siltation, making such resources more difficult to attain. Coldwater fish, such as salmon and trout, are especially vulnerable to variability in water temperatures. When it gets too warm, the fish experience slower growth, lower oxygen levels, and greater susceptibility to poisons, parasites, and disease. If streams in the region continue to be degraded, the impacts will increase accordingly. The shift in timing and location of seasonal salmon migration is increasing juvenile mortality because many river temperatures are too high for survival. There is now a risk that over the next 40 to 80 years, potentially 50 percent of trout and salmon habitat will be lost.⁸⁶ Habitat is at risk not only due to increasing temperatures, but also due to the resultant flooding caused by increased snowfall, and rapid snowmelt. This flooding scours river and stream beds, stirs up sediments, causes erosion (increasing siltation), and inundates land areas. High river flows in the winter scour gravel beds where salmon eggs are laid, washing them away and increasing risks to the salmon population.⁸⁷ All of these habitat impacts harm the fisheries by increasing fish mortality. Overall losses in cold water fisheries are a huge cause for concern. Tribes in the Pacific Northwest and Rocky Mountain West rely on salmon and trout fisheries for cultural, traditional, and food resources. This loss will have a significant impact on the culture and traditions of the Tribes that rely upon these fisheries.

CONFRONTING CHALLENGES ON TRIBAL LANDS: RECOMMENDATIONS FOR ACTION



Stephen C. Torbit

Climate change — especially the projected increase in weather and climate extremes — poses significant challenges for Tribes. With better access to technical, financial and capacity-building resources, Tribes can increase their resilience to climate change and surmount many of these challenges. Tribes have a good foundation to build on, including longstanding connections to and reverence for the land, traditions of sustainability, historical knowledge of the land and resources that cannot be matched, and expertise in natural resource and wildlife management. Throughout Indian Country and the nation, we are in danger from climate change. For the sake of our children and our children's future, Congress must take action to address this issue immediately.

Shortfalls and Inequities in Resources to Help Tribes Address Climate Change

Despite having some of the most pristine and undisturbed habitat in the United States, Tribes have been historically underfunded for, and in some instances excluded from, federal funding provided to states, local governments, and other entities for wildlife and natural resource conservation. Funding is crucial if Tribes are to effectively adapt to weather- and climate-related impacts on their reservations. While the inequity in funding stems from neglect, indifference, oversight, avoidance, and faulty assumptions, the solution is conceptually simple and the justification profound. Tribes should have at minimum, equitable opportunity to access federal funding provided to other entities, especially state governments. The federal government has a trust responsibility to assist Tribes in the protection of

their natural resources — a responsibility in some instances that is affirmed by treaties between Tribes and the United States. At minimum, that trust responsibility requires the federal government to provide Tribes equitable access to federal funding. The gulf between this aspiration and the present reality is currently significant.

BIA TRUST NATURAL RESOURCES PROGRAM

The Bureau of Indian Affairs (BIA) administers several programs to help Tribes manage their natural resources, such as forests, fish, wildlife, agriculture, and water, primarily through BIA's Trust Natural Resources (TNR) Program, which is the largest amount of base federal funding for Tribal natural resource management. Many Tribes have taken full

responsibility for management of those programs through compacts and contracts, so that much of this funding is simply passed through to the Tribes, which have demonstrated excellence in the management of these modest funds.

Because BIA spending on natural resources in the last 11 years has been relatively flat compared to inflation and BIA's budget has been historically inadequate to meet the natural resource requirements of Indian Tribes, their needs have multiplied. Tribes have more than \$356 million of unmet annual needs for natural resource management and conservation.⁸⁸ The U.S. Commission on Civil Rights noted, "Native American population needs have increased at a rate faster than inflation, as problems are compounded by years of neglect."⁸⁹

Current trends exacerbate these circumstances. A recent study by Tribal organizations compared the changes in fiscal year appropriations from Fiscal Year (FY) 2004 to 2011 for six bureaus within the Department of Interior (DOI). The study found that when DOI funding increased in a fiscal year, BIA experienced the smallest percentage increase of the six bureaus. When the DOI funding decreased in a fiscal year, BIA experienced the largest percentage decreases.⁹⁰ Congress must increase funding for the BIA TNR Program so that Tribes have the capability to fully address their conservation and climate adaptation needs.

DOI CLIMATE CHANGE ADAPTATION INITIATIVE

DOI began a Climate Change Adaptation Initiative in 2009, an undertaking that many Indian Tribes support in principle. The Adaptation Initiative, recently renamed the Cooperative Landscape Conservation program, is a glaring example of the trend of inequitable Tribal funding by the federal government. The initiative was spurred by Secretarial Order 3289, which in part recognized the need to address the disproportionate

impact climate change has upon Tribes due to their heavy dependence on natural resources.⁹¹ The \$136 million DOI requested for the Initiative in FY2011 provided no funding to BIA or Tribes. In FY2012, the DOI budget request for the Initiative is \$175 million, an increase of \$39 million over Fiscal Year 2011. Of the \$175 million, **only** \$200,000, or .001 percent, will be used to involve and assist Indian Tribes. This is highly inequitable, especially considering the disproportionate effect of climate change on Tribes and their homelands. Increasing pressure to slash the federal budget puts programs such as the Adaptation Initiative in the crosshairs of Congressional cuts. Because of the dire threats of climate change, the Adaptation Initiative must be bolstered, and sovereign Indian Tribes deserve a stronger role in the Initiative and a more equitable share of the funding.

OTHER FEDERAL NATURAL RESOURCE PROGRAMS

Indian Tribes are also excluded — because of statutes, regulations, or practice — from dozens of federal natural resource programs that provide assistance to states, local

governments, and other entities.

Statutory Exclusion — Tribes along the coasts place great value on coastal resources for environmental, cultural, ceremonial, and subsistence purposes. Yet Tribes and their lands are statutorily excluded from the Coastal Zone Management Act, Coastal and Estuarine Conservation Program, and National Estuarine Research Reserves, among others. Those programs combined provided \$116.6 million in FY2010 to eligible entities.⁹² In addition, Tribes cannot directly address the nearly one million acre backlog in the management of Tribal forestlands (in part to protect against wildfires) through the ironically titled Tribal Forest Protection Act. The Act enables Tribes to contract with the federal government to manage the health of federal land adjacent to or bordering Tribal land, but not the Tribal forest or range land.

De Facto Exclusion — Some federal programs provide funding to Tribes, but only when first provided to the states, which then have the discretion to decide whether to pass through funding to Tribes. This arrangement is on its face contrary to the nation-to-nation relationship between the federal government and Tribes — a relation that originates in the U.S. Constitution. The Cooperative Forestry Assistance Act, a principal program of the U.S. Forest Service, houses two programs: 1) the Forest Legacy Program, to assist states in the acquisition of conservation forest land; and 2) the Forest Stewardship Program, to help states with the management of state and private (and presumably Tribal) lands. While Tribes are by law eligible to receive funds in both cases, each state decides what funding will be provided for Tribal or Indian participation in the program. However, Tribes receive virtually no funding from either program.



Traditional Tribal Natural Resource Management Practices



Traditional Tribal natural resource management practices are inherently place-based, time-tested, climate-resilient, collectively managed, cost-effective, and sustainable. The proof is in the very existence of Tribal peoples. They would not have survived for millennia without practical, respectful, and spiritual connections to and understandings of their ancestral homelands and the Earth itself. Many of the practices continue today complemented by modern techniques, and many of these practices are well-suited to current climate adaptation efforts. Tribes are capable of adapting through the application of their own knowledge and of providing unique and often overlooked value to larger adaptation efforts beyond reservation boundaries.

The “organic” nature of these demonstrably effective Tribal practices has not yet been widely recognized, respected, and included in climate change research and activities. While such practices are arguably validated through what is known as the scientific method (hypothesize, test, analyze, conclude), oftentimes the organizational cultures and values of Tribes and the scientific community clash. Nevertheless, well-intentioned efforts to bring Tribal natural resource practices into discussions, studies, and activities are underway, including Tribal involvement in the National Climate Assessment, the Intergovernmental Panel on Climate Change, and various climate change adaptation efforts by the federal government.

Implement Programs on Reservations to Adapt to Extreme Events

Tribes can take many steps now to help their communities prepare for future climate changes. In many cases, increasing the resiliency of public and private infrastructure, as well as natural habitats, can provide a cushion when extreme weather and climate events occur. At the same time, efforts to shore up water and other treaty rights can help assure the longevity of natural resources important to Tribal communities.

WEATHERIZATION PROGRAMS ON RESERVATIONS

A simple and cost-effective way to cope with temperature extremes and reduce energy costs is to increase the energy efficiency of Tribal houses and

buildings. Weatherization includes strengthening insulation barriers, sealing gaps, replacing inefficient materials, and installing energy-efficient heating and cooling systems. Homes and buildings that are weatherized are more likely to withstand the impacts of severe weather, while simultaneously reducing energy costs.

Because Indian Tribes endure the highest energy costs in the nation, great savings can be achieved by weatherizing Tribal homes and buildings. Depending on the condition of the home or building, weatherization can save 15 to 40 percent in energy consumption and costs.⁹³ However, like the Cooperative

Forestry Assistance Act, Tribes are at the mercy of state discretion because Tribes can only receive funds through the state. Thus, if a state rejects Weatherization Funds (which some states did when the Recovery Act provided \$5 billion to the program), Tribes within that state are barred from the benefits of that program. Tribes can only receive funding directly if they undertake the burden of proving to DOE that the state is not serving Tribal needs.

ADAPTATION PLANNING

Tribes can develop climate change adaptation plans for their reservations to help them protect their natural resources and infrastructure from the

impacts of severe weather. However, to be able to undertake adaptation planning, Tribes need additional financial support and resources to build their capacity and implement adaptation efforts. While over 60 percent of states have undertaken comprehensive adaptation planning, and some have implemented those plans, only a handful of the 565 federally recognized Tribes have done the same.

WATER AND TREATY RIGHTS

Tribal water rights must be settled to secure water for Tribes, some of which could be used for environmental purposes to protect habitat and wildlife, and so federal, state, and local entities have more certainty about how the available water supply will be allocated. The federal government has a trust responsibility to support Tribal efforts to deal with severe weather impacts to their Tribal communities, resources and economies. By treaties, the federal government is obligated to protect Tribal rights to natural and cultural resources. By enforcing these rights, the negative impacts from extreme events can be lessened.

ENGAGE AND EDUCATE TRIBAL YOUTH

It is ultimately Tribal youth that are going to have to cope with the long-term consequences of climate change and extreme weather impacts. By engaging youth and improving the educational system to increase traditional and cultural knowledge, Tribes can take steps to provide the capacity to deal with severe weather and climate change impacts in their communities. More Tribal youth need to be educated in natural resource related fields and able to apply that education in service to their Tribes.

Collaborate to Address Climate and Weather Extremes

LEARNING FROM EACH OTHER

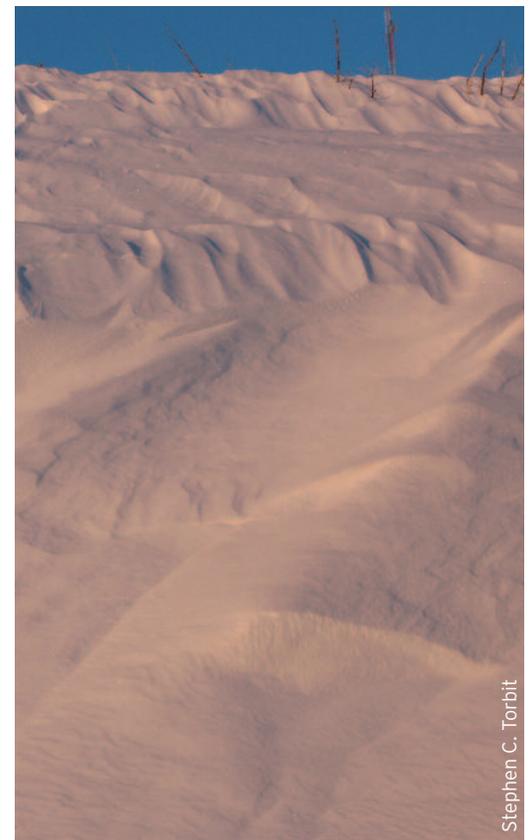
While many Tribes have not incorporated climate and weather extremes into their natural resource management plans nor created climate adaptation plans, some Tribes, such as the Swinomish, have already developed climate vulnerability assessments and strategies to address those challenges. The Swinomish and other Tribes are willing to share lessons learned and to provide guidance to Tribes that want to begin taking steps to integrate measures to address climate impacts into their planning efforts.

OUR NATURAL RESOURCES

In 2010, Tribes and Tribal organizations began uniting to develop a national Tribal natural resource strategy for conserving Tribal lands, wildlife, and natural and cultural resources. This coalition of more than 30 Tribes and Tribal organizations, known as Our Natural Resources (ONR, pronounced “Honor”), has coalesced around a vision for Tribal natural resource management and procuring the resources and capacity to implement its strategy.⁹⁴ Through this partnership, Tribes can present a united front to federal and state agencies, Congress, non-governmental organizations, and other entities that will bridge the gaps between Tribes and non-Tribal partners to address climate-induced weather extremes. ONR is also advocating for the establishment of an Indian Youth Service Corps, involving Tribes in youth initiatives such as America’s Great Outdoors and Let’s Move and consolidating federal, public, foundational and industry organizations to involve Tribal youth in natural resource activities.

PARTNERSHIPS AMONG UNCOMMON ALLIES

While there is a difficult past between Tribes and federal and state governments and agencies historically, the challenges of climate change require and offer an opportunity for new partnerships to leverage expertise, capacity, and resources to address climate and weather extremes. Climate and weather impacts do not respect jurisdictional boundaries, and neither should alliances to confront these challenges. Tribes can partner with other entities — such as academics and non-governmental organizations — to find common ground and build on each other’s strengths and assets. Moreover, many states and non-Tribal entities have had access to resources and the capacity to develop and begin implementing climate action or adaptation plans. These are resources that Tribes can tap into.



Stephen C. Torbit

Endnotes

¹ NCAI

² A fragmented land base means many Tribal reservations are checkerboard land allotments fragmented between Tribal ownership and private ownership. Checker-boarding means the ownership of land within the reservation is between Tribal trust land, individual Indian trust land, Indian fee land, and non-Indian fee land.

³ National Aeronautics and Space Administration (NASA), January 21, 2010. 2009: Second Warmest Year on Record; End of Warmest Decade, Available at: www.nasa.gov/topics/earth/features/temp-analysis-2009.html and National Oceanic and Atmospheric Administration (NOAA), January 12, 2011. NOAA: 2010 Tied For Warmest Year on Record, Available at: www.noaa.gov/stories/2011/20110112_globalstats.html.

⁴ NOAA, 2011a. Trends in Atmospheric Carbon Dioxide, Recent Global CO₂. Available at: www.esrl.noaa.gov/gmd/ccgg/trends/global.html (Accessed February 28, 2011).

⁵ Native American Rights Fund. Nation's Tribes Asking Congress for Swift Action on Climate Legislation March 2, 2009. Retrieved September 23, 2010. http://narfnnews.blogspot.com/2009/03/nations-tribes-asking-congress-for_02.html.

⁶ Cordalis, D. and Suagee, D.B. "The Effects of Climate Change on American Indian and Alaska Native Tribes," *Natural Resources and Environment* 22:3 pg 45 (Winter 2008).

⁷ Tulalip Natural Resources Department. *Climate Change Impacts on Tribal Resources*. <http://www.tulalip.nsn.us/pdf.docs/FINAL%20CC%20FLYER.pdf>

⁸ Cordalis, D. and Suagee, D.B. "The Effects of Climate Change on American Indian and Alaska Native Tribes," *Natural Resources and Environment* 22:3 pg 46 (Winter 2008).

⁹ IPCC, *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Core Writing Team, Pachauri, R.K and Reisinger, A., eds.): IPCC, Geneva, Switzerland, 2007.

¹⁰ Douglas B. Inkle, *Investing in America's Natural Resources: The Urgent Need for Climate Legislation*, National Wildlife Federation: Reston, VA, 2008.

¹¹ Dai, A., 2010. Drought under global warming: a review. *WIREs Climate Change*, 2(1): 45-65.

¹² Solomon, S., G-K Plattner, R. Knutti, and P. Friedlingstein, 2009. Irreversible climate change due to carbon dioxide emissions. *Proceedings of the National Academy of Sciences*, 106(6): 1,704-1,709. DOI: 10.1073/pnas.0812721106; Johanson, C.M., and Q. Fu, 2009: Hadley Cell Widening: Model Simulations versus Observations. *Journal of Climate*, 22: 2,713-2,725.

¹³ Seager, R., et al., 2007. Model Projections of an Imminent Transition to a More Arid Climate in Southwestern North America. *Science*, 316: 1,181-1,184.

¹⁴ Knowles, N., M.D. Dettinger, and D.R. Cayan, 2006. Trends in Snowfall versus Rainfall in the Western United States. *Journal of Climate*, 19: 4,545-4,559.

¹⁵ Mote, P.W., et al., 2005. Declining Mountain Snowpack in Western North America. *Bulletin of the American Meteorological Society* 86: 39-49.

¹⁶ Zack Guido, "The Final Gasp: Pinyon Pines Die Faster During Warmer Droughts," *Southwest Climate Outlook*, April 2010, 1-3.

¹⁷ Adams, H.D., et al., 2009. Temperature sensitivity of drought-induced tree mortality portends increased regional die-off under global-change-type drought. *Proceedings of the National Academy of Sciences*, 106(17): 7,063-7,066.

¹⁸ Joyce, L.A., et al., 2008. National Forests. In: *Preliminary review of adaptation options for climate-sensitive ecosystems and resources*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, U.S. Environmental Protection Agency, Washington, DC, USA: 3-1 to 3-127.

¹⁹ USDI, Bureau of Indian Affairs Division of Forestry Branch of Forest Resources Planning. *FY 2009: Quarter 4 Catalog of Forest Acres* September 20, 2009. www.itcnet.org/issues_projects/issues_2/forest_management/reports.html

²⁰ Intertribal Drought Council. *Tribal Drought Planning*. <http://www.drought.unl.edu/plan/tribalplans.htm>

²¹ Garrit Voggesser, "The Tribal Path Forward: Confronting Climate Change and Conserving Nature," *The Wildlife Professional*, Winter 2010: 25.

²² Sarah Zielinski, "The Colorado River Runs Dry," *Smithsonian*, October 2010; Tim P. Barnett and David W. Pierce, "Sustainable Water Deliveries from

the Colorado River in A Changing Climate," *Proceedings of the National Academy of Sciences*, 2009, available at <http://www.pnas.org/content/early/2009/04/17/0812762106>.

²³ Joyce, L.A., et al., 2008. National Forests. In: *Preliminary review of adaptation options for climate-sensitive ecosystems and resources*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, U.S. Environmental Protection Agency, Washington, DC, USA: 3-1 to 3-127.

²⁴ Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam, 2006. Warming and Earlier Spring Increases Western U.S. Forest Wildfire Activity, *Science* 313: 940-943.

²⁵ Williams, T and Hardison, P. 2007. *Global Climate Change: Justice, Security, and Economy*. Pg 12.

²⁶ McKenzie, D. et al., 2004. Climate Change, Wildfire, and Conservation. *Conservation Biology* 18(4): 1-13.

²⁷ Bachelet, D., J. Lenihan, R. Neilson, R. Drapek, and T. Kittel, 2005. Simulating the response of natural ecosystems and their fire regimes to climatic variability in Alaska. *Canadian Journal of Forest Research*, 35(9): 2244-2257.

²⁸ Price, C., 2008. Thunderstorms, Lightning and Climate Change. in *Lightning - Principles, Instruments and Applications*, ed. H.D. Betz, Springer Publications, in press.

²⁹ Niedzielski, J., S.B. Klinger, C.A. King, and K. Tappen, 2008. Wildfire Losses Set to Increase Industry's Catastrophe Woes. A.M. Best Research.

³⁰ Lipsher, S. 2008. Growing focus on fires leaves other Forest Service programs withering. *The Denver Post*, May 14, 2008.

³¹ Neary, D., 2009. Post-Wildland fire Desertification: Can Rehabilitation Treatments Make a Difference? *Fire Ecology Special Issue*, 5(1): 129-144.

³² California Department of Fish and Game. *Wildfire Season and Wildlife* <http://www.dfg.ca.gov/news/issues/fire/#2>.

³³ Keller, Paul. "Rodeo-Chediski: Tribal Loss" *Fire Management Today*. 65:1 Winter 2005. Pg 11.

³⁴ Ring, Ray, and Maclean, John. "The Fiery Touch" sidebar "Some Notable Arson Wildfire Cases in the West" *High Country News*. August 2, 2010.

³⁵ Keller, Paul. "Rodeo-Chediski: Tribal Loss" *Fire Management Today*. 65:1 Winter 2005. Pg 10.

³⁶ National Wildlife Federation. *Conservation on White Mountain Apache* Pg 13. ©2006

³⁷ Forest Stewardship Council. *White Mountain Apache Tribe Receives FSC Certification for 1.68 Million Acres*. <http://www.fscus.org/news/archive.php?article=301>

³⁸ Wagner, D. 2011. Wallow Fire: Tribe credits winds, prayer, prevention for dodging fire. *The Arizona Republic*.

³⁹ CCSP, 2008. *Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. T.R. Karl, et al. (eds.). Department of Commerce, NOAA's National Climatic Data Center, Washington, D.C., USA, 164 pp.

⁴⁰ Min, S.-K., X. Zhang, F.W. Zwiers, and G.C. Hegerl, 2011. Human contribution to more-intense precipitation extremes. *Nature*, 470: 378-381.

⁴¹ CCSP, 2008. *Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. T.R. Karl, et al. (eds.). Department of Commerce, NOAA's National Climatic Data Center, Washington, D.C., USA, 164 pp (Figure 3.5b).

⁴² Stewart, I.T., D.R. Cayan, and M.D. Dettinger, 2004. Changes in Snowmelt Runoff Timing in Western North America Under a 'Business As Usual' Climate Change Scenario. *Climatic Change*, 62: 217-232.

⁴³ Hayhoe, K., et al., 2007. Past and future changes in climate and hydrological indicators in the U.S. Northeast. *Climate Dynamics*, 28: 381-407. DOI 10.1007/s00382-006-0187-8.

⁴⁴ Knowles, N., M.D. Dettinger, and D.R. Cayan, 2006. Trends in Snowfall versus Rainfall in the Western United States. *Journal of Climate*, 19: 4,545-4,559; Huntington, T.G., G.A. Hodgkins, B.D. Keim, and R.W. Dudley, 2004. Changes in the Proportion of Precipitation Occurring as Snow in New England (1949-2000). *Journal of Climate*, 17(13): 2,626-2,636.

- ⁴⁵ Thayer, Rosanda Suetopka. "Hopi Tribe Continues to Recover from Flooding: Final Cost Estimates from Disaster Relief Efforts Total over \$300,000" *Navajo-Hopi Observer* August 18, 2010
- ⁴⁶ Rosenzweig, C. et al., 2002. Increased crop damage in the US from excess precipitation under climate change. *Global Environmental Change*, 12, 197-202.
- ⁴⁷ Oswald, Liz and Wohl, Ellen. Jökulhlaup in the Wind River Mountains, Shoshone National Forest, Wyoming Pg. 366 <http://www.stream.fs.fed.us/afsc/pdfs/Oswald.pdf>
- ⁴⁸ Tawahongva, Tyler. "Flooding in Polacca Prompts Emergency Declaration: Water and Sewer Systems Crippled" *Navajo-Hopi Observer*. August 3, 2010
- ⁴⁹ Thayer, Rosanda Suetopka. "Hopi Tribe Continues to Recover from Flooding: Final Cost Estimates from Disaster Relief Efforts Total over \$300,000" *Navajo-Hopi Observer* August 18, 2010
- ⁵⁰ McNutt, Debra, Ed. *Northwest Tribes: Meeting the Challenge of Climate Change*. Northwest Indian Applied Research Institute Pg. 6. <http://nwindian.evergreen.edu>
- ⁵¹ Lindley, S.T., et al., "Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin" *San Francisco Estuary and Watershed Science* 5 (2007): Art. 4. Available at: repositories.cdlib.org/jmie/sfews/vol5/iss1/art4/
- ⁵² McNutt, Debra, Ed. *Northwest Tribes: Meeting the Challenge of Climate Change*. Northwest Indian Applied Research Institute Pg. 6. <http://nwindian.evergreen.edu>
- ⁵³ Williams, J. "Central Valley Salmon: A Perspective on Chinook and Steelhead in the Central Valley of California" *San Francisco Estuary and Watershed Science* 4 (2006): Art. 2. Available at: <http://repositories.cdlib.org/jmie/sfews/vol4/iss3/art2/>
- ⁵⁴ Voggesser, Garrit." The Tribal Path Forward: Confronting Climate Change and Conserving Nature." *The Wildlife Professional*. Winter 2010. Pg 25
- ⁵⁵ Government Accountability Office. 2009. *Alaska Native Villages: Limited Progress Has Been Made on Relocating Villages Threatened by Flooding and Erosion*. GAO-09-551 <http://www.gao.gov/new.items/d09551.pdf>
- ⁵⁶ Maynard, Nancy G. Ed. *Native Peoples-Native Homelands Climate Change Workshop: Final Report*. U.S. Global Change Research Program October 28-November 1, 1998. Pg 4 http://www.gcrio.org/OnLnDoc/pdf/native_peoples.pdf
- ⁵⁷ Cordalis, D. and Suagee, D.B. "The Effects of Climate Change on American Indian and Alaska Native Tribes" *Natural Resources and Environment* 22:3 pgs 47 (Winter 2008)
- ⁵⁸ Pungowiyi, Caleb. *Native Observations of Climate change in the Marine Environment of the Bering Strait Region* http://www.arctic.noaa.gov/essay_pungowiyi.html
- ⁵⁹ Voggesser, Garrit." The Tribal Path Forward: Confronting Climate Change and Conserving Nature." *The Wildlife Professional*. Winter 2010. 25
- ⁶⁰ Oppmann, Patrick. "Constant Flooding Forces out Pacific Northwest Tribe" *CNN.Com* April 21, 2010 <http://edition.cnn.com/2010/US/04/21/hoh.reservation.flooding>
- ⁶¹ 2000 Census
- ⁶² National Tribal Air Association. *Impacts of Climate Change on Tribes in the United States*. Pg. 9 Submitted December 11, 2009.
- ⁶³ CCSP, 2008. *Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. T.R. Karl, et al. (eds.). Department of Commerce, NOAA's National Climatic Data Center, Washington, D.C., USA, 164 pp.
- ⁶⁴ Changnon, S.A., 2007. Catastrophic winter storms: An escalating problem. *Climatic Change* 84(2): 131-139.
- ⁶⁵ Changnon, S.A., D. Changnon, and T.R. Karl, 2006. Temporal and Spatial Characteristics of Snowstorms in the Contiguous United States. *Journal of Applied Meteorology and Climatology* 45: 1,141-1,155.
- ⁶⁶ U.S. Global Change Research Program (USGCRP), 2009. *Global Climate Change Impacts in the United States*, T.R. Karl, J.M. Melillo, and T.C. Peterson, (eds.). Cambridge University Press, 191 pp.
- ⁶⁷ Kunkel, K.E., et al., 2009. Trends in Twentieth-Century U.S. Extreme Snowfall Seasons. *Journal of Climate* 22: 6,204-6,216.
- ⁶⁸ U.S. Global Change Research Program (USGCRP), 2009. *Global Climate Change Impacts in the United States*, T.R. Karl, J.M. Melillo, and T.C. Peterson, (eds.). Cambridge University Press, 191 pp.
- ⁶⁹ Burnett, A.W., et al., 2003. Increasing Great Lake-effect Snowfall during the Twentieth Century: A Regional Response to Global Warming? *Journal of Climate* 16: 3,535-3,542.
- ⁷⁰ Claymore, Estella. "Storms Rip Reservation" *Native American Times*. July 14, 2010.
- ⁷¹ Associated Press. "Sioux Reservation Struggles After Winter Blast: Ice Storm, Blizzard Hit South Dakota Tribe more than Week Ago" February 1, 2010. <http://www.msnbc.msn.com/id/35188358/ns/weather>
- ⁷² Garrigan, M., 2009. Pine Ridge residents running low on fuel and food. *Rapid City Journal*, December 30, 2009.
- ⁷³ Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam, 2006. Warming and Earlier Spring Increases Western U.S. Forest Wildfire Activity, *Science* 313: 940-943.
- ⁷⁴ McNutt, Debra, Ed. *Northwest Tribes: Meeting the Challenge of Climate Change*. Northwest Indian Applied Research Institute Pg. 5. <http://nwindian.evergreen.edu>
- ⁷⁵ Tulalip Natural Resources Department. *Climate Change Impacts on Tribal Resources*. <http://www.tulalip.nsn.us/pdf/docs/FINAL%20CC%20FLYER.pdf>
- ⁷⁶ McNutt, Debra, Ed. *Northwest Tribes: Meeting the Challenge of Climate Change*. Northwest Indian Applied Research Institute. <http://nwindian.evergreen.edu>
- ⁷⁷ Pörtner, H.O., 2002. Climate variations and the physiological basis of temperature dependent biogeography: systemic to molecular hierarchy of thermal tolerance in animals. *Comparative Biochemistry and Physiology – Part A: Molecular & Integrative Physiology*, 132(4): 739-761.
- ⁷⁸ Harvard Medical School, Center for Health and the Global Environment. *Climate Change and Health in New Mexico*. September 2009. <http://chge.med.harvard.edu/programs/policy/factsheets/Climate%20Change%20and%20Health%20in%20New%20Mexico.pdf>
- ⁷⁹ A.J. Waskey. 2008. "Drought" in "Encyclopedia of global warming and climate change" by S.G. Philander. Volume 1, page 332.
- ⁸⁰ Van Mantgem, P.J., et al, 2009. Widespread Increase of Tree Mortality Rates in the Western United States. *Science* 323: 521-524.
- ⁸¹ U.S. Fish and Wildlife Service. 2010. *Rising to the Urgent challenge: Strategic Plan for Responding to Accelerating Climate Change*. pg 27. <http://www.fws.gov/home/climatechange/pdf/ccStrategicPlan.pdf>
- ⁸² Maynard, Nancy G. Ed. *Native Peoples-Native Homelands Climate Change Workshop: Final Report*. U.S. Global Change Research Program October 28-November 1, 1998. Pg 21 http://www.gcrio.org/OnLnDoc/pdf/native_peoples.pdf
- ⁸³ U.S. Fish and Wildlife Service. *Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change* <http://www.fws.gov/home/climatechange/pdf/CCStrategicPlan.pdf>
- ⁸⁴ Franzmann, Albert W. and Schwartz, Charles C. Eds. *Ecology and Management of the North American Moose: A Wildlife Management Institute Book*. Smithsonian Institution Press, 1997.
- ⁸⁵ National Wildlife Federation. *Global Warming and the Great Lakes*. <http://www.nwf.org/Global-Warming/Effects-on-Wildlife-and-Habitat/Great-Lakes.aspx>
- ⁸⁶ McNutt, Debra, Ed. *Northwest Tribes: Meeting the Challenge of Climate Change*. Northwest Indian Applied Research Institute Pg. 6. The Evergreen State College Olympia WA. <http://nwindian.evergreen.edu>
- ⁸⁷ National Wildlife Federation. *Fish Out of Water: A Guide to Global Warming and Pacific Northwest Rivers*. <http://www.nwf.org/News-and-Magazines/Media-Center/Faces-of-NWF/~media/PDFs/Global%20Warming/Reports/FishOutOfWaterReport.aspx>
- ⁸⁸ U.S. Department of the Interior, Bureau of Indian Affairs, *Report on Tribal Priority Allocations*, July 1999, 52
- ⁸⁹ U.S. Commission on Civil Rights, *A Quiet Crisis: Federal Funding and Unmet Needs in Indian Country* (Washington, D.C.: U.S. Commission on Civil Rights, July 2003), 11.
- ⁹⁰ http://www.ncai.org/fileadmin/Budget_2012/01_NCAI_Introduction_Budget_Doc.pdf
- ⁹¹ http://elips.doi.gov/app_SO/act_getfiles.cfm?order_number=3289A1
- ⁹² <http://coastalmanagement.noaa.gov/funding/welcome.html>
- ⁹³ National Wildlife Federation. 2010. The New Energy Future in Indian Country: Confronting Climate Change, Creating Jobs, and Conserving Nature. http://www.nwf.org/News-and-Magazines/Media-Center/Reports/Archive/2010/~media/PDFs/Global%20Warming/Reports/03-23-10_NWF_TribalLands_LoRes.aspx
- ⁹⁴ www.ournaturalresources.org



Stephen C. Torbit

ACKNOWLEDGEMENTS

Report prepared by National Wildlife Federation staff:

Renee Curry, Climate Science Assistant

Charissa Eichman, Tribal Lands Program Intern

Amanda Staudt, Climate Scientist

Garrit Voggesser, Tribal Lands Program Senior Manager

Myra Wilensky, Tribal Lands Global Warming Manager

The National Wildlife Federation thanks the following for their assistance in preparing the report:

Jose Aguto, National Congress of American Indians

Kim Gottschalk, Native American Rights Funds

Bob Gruenig, Stetson Law Offices

Julie Teel Simmonds, University of Colorado Law School

Sue Wotkyns, Institute for Tribal Environmental Professionals

INSPIRING AMERICANS TO PROTECT WILDLIFE FOR OUR CHILDREN'S FUTURE.

Rocky Mountain Regional Center
National Wildlife Federation
2260 Baseline Road
Suite 100
Boulder, CO 80302
303-786-8001
www.nwf.org

