

# Research for Resilience: Climate Change, the Crow Tribe and Indigenous

## Knowledge: Part 1

By

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Photography by Aaron Teasdale<sup>2</sup>

**Abstract.** This case illustrates how resilience can emerge from the interaction between different knowledge systems that make ecosystems and communities more resilient while facing the negative effects of climate change. Long-term cultural knowledge about adaptation and restoration is often missing from agency viewpoints that would lead to a protective shield of resilience for both environments and cultures. A fictional character, Veronica Stevens, a Native scientist who serves in dual capacities as a researcher with forestry experience and as a tribal relationship professional, narrates the case. She faces the challenge of opening up the communication channels for Indigenous knowledge to become a major component of agency planning and practice through the development of a framework that incorporates some of the knowledge and experience of the Crow Nation whose historic lands form the template for understanding ecological practices and principles. Part I chronicles the challenges an indigenous researcher faces when trying to communicate indigenous knowledge research into the understanding of government policy and land management.

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Crow Reservation: Wolf Mountains with the Bighorn Mountains in the distance Photo: Aaron Teasdale

### **THE STORY: VERONICA'S CHALLENGE**

Veronica earned her PhD in forest ecology from an Arizona university. Anxious to apply her knowledge and experience in tribal forestry, she was fortunate to receive a post-graduate internship with a U.S. Government Research Station. The station was located near several Plains Tribes, so this was an adventure in research far from her home that humbled her at the same time that it gave her a sense of her credibility and capacity. She was charged with a proposal focused on a specific tribal group, the Crow Nation, and a place, the Upper Missouri River Basin in the face of climate change. It presented an opportunity to establish an important framework for understanding future climate change adaptation. Arriving at the station, she met with her government supervisor. He showed her the formal proposal for the research project he had prepared, already approved and funded. She was surprised that the proposal was already written and funded: she assumed consultation with the Crow Tribe had already taken place. She had some concerns, but at the same time, she saw that this research project would result in a unique opportunity to communicate an understanding of Indigenous knowledge and practice with a wider national and international audience of Western scientists and federal land managers. It would be

published as a government technical report and it would go to numerous online resource sites as well as internal agency distribution. As far as Veronica knows, it will be the first government technical report on land management approached with indigenous methodology.

Veronica was well aware of the focus on the extractive and productive components related to land management by federal agencies. The Northern Great Plains States (Montana, Wyoming, North Dakota, South Dakota, and Nebraska) provide major resources to the United States and beyond. The region's livestock and grain production play a critical role in national food security, and its energy resources, primarily fossil fuels, contribute to national energy self-sufficiency.



Beet field on the Crow Reservation Photo credit: Aaron Teasdale

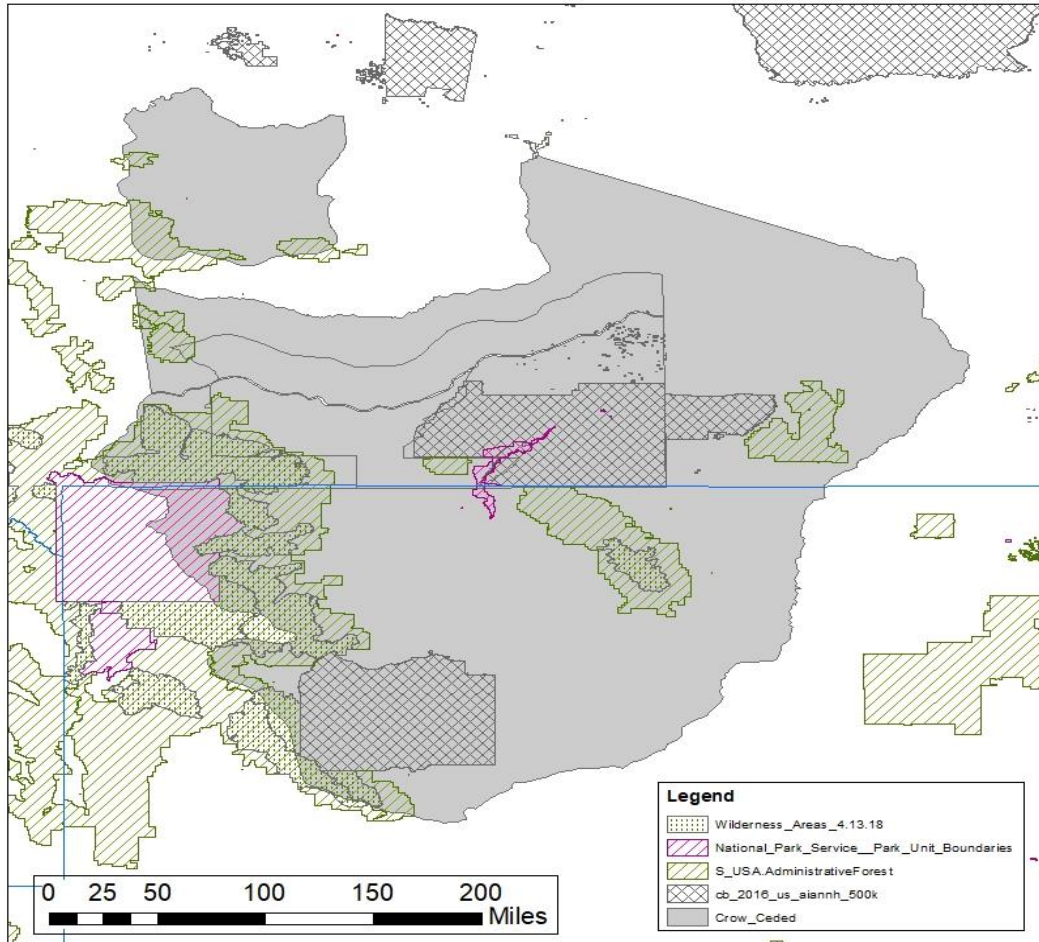
Tourism creates a semi-stable source of revenue in these States, generating \$17 billion in the area in 2017 (Dean Runyan Associates 2017, 2018; Grau 2018). Protection of valuable natural resources on

public lands and the communities surrounding those lands has been the focus of agency practice.

Veronica thinks they might be more successful in mitigating climate change if they paid more attention to Indigenous Knowledge as a major, if not the only, long-term source of maintaining the long-term resilience of the ecosystems and the communities on which they depend.

She knows that it has been difficult to open up channels of communications with the Western scientists who carry out agency planning and practice. She has dedicated her own research efforts to find pathways that achieve the broader objective of resilience and studies of collaboration. Her first step must be to learn from the area and the culture and to look for assistance and collaboration from culturally credible experts. She spends three weeks studying materials available online through The Little Big Horn College (LBHC) located at Crow Agency and books by Crow authors, plus background federal reports and planning documents on the area, especially those on water, forestry and climate change. She has to have travel money to go to the Crow Reservation because she does not agree to do a study like this without talking to people representing the Tribe. She is approved for one three-day trip. She has done her homework to learn some basics about the geographic setting and culture. Her knowledge is about to be tested in reality. Driving from the airport to the Crow Reservation after landing in Billings, Montana, she is struck by the dramatic landscape.

## **THE ENVIRONMENTAL AND CULTURAL SETTING**



**Figure 1 Federal Lands and Crow Seated Lands Map by Fernando Sanchez Tregueros**

The beauty of jagged mountain ranges surrounds the Crow Indian Reservation, with tilting angles that pour snowmelt into the valleys of the Bighorn River Basin. The northern part of the sacred Little Bighorn Range lies within the reservation boundaries and waters flow into the Little Bighorn Canyon. The southern end of the range soars to 13,167 feet (4,014 m) at Cloud Peak, known as Awaxaawakii or Extended Mountain (Bauerle et al. 2002-2012). This is the center of the world in the Crow traditional beliefs on the origin, evolution and structure of the universe, where the sacred tobacco plant, at the foot of this mountain range, first appeared to the Crow people during their migration. The seeds from this plant play a prominent role in the Crow origin stories, as they mark the separation of the Crow Nation from the Hidatsa in the late 1500s and are considered seeds of a rare and special tobacco plant (Yarlott, n.d.).

The Pryor Mountains on the northern side of Bighorn Canyon contain a bounty of culturally significant resources used for ceremonial, ritual, and subsistence uses within this richly biodiverse ecosystem. The mountain range ascends from the lower northern sections within the boundaries of the reservation to lands now managed by the Forest Service and BLM. The *Baahpuuo Isawaxaawu* or “Hitting Rock Mountains”, as the Crow refer to them (Bauerle et al. 2002-2012), include ice caves, historical and contemporary sites for vision quests, and the Pryor Mountain Wild Horse Range. The southern parts of the range boast elevations of 8,700 feet (2,652 m) that then descend into a desert ecosystem located to the south.

The low-lying Wolf Teeth Mountains guard the eastern boundaries of the Crow Indian Reservation, and provide ample grazing lands and excellent habitat for a variety of wildlife. In the present day, the Crow Tribe manages the southern Big Horn Mountains while the U.S. Forest Service manages the northern half. Despite management differences, the entire Big Horn Mountain Range remains sacred to the Crow.

Three national forests create the major boundaries of the contemporary Crow Indian Reservation. Custer Gallatin, Shoshone, and Bighorn National Forests are responsible for management of land ceded by the Crow, where the Tribe retains treaty rights for hunting and gathering of traditional natural resources. The National Park Service now protects the Custer National Battlefield, which is surrounded by reservation land and lies just outside Crow Agency.

The Bighorn Canyon National Recreation Area, with the lake created by a dam on the Bighorn River, is surrounded by reservation lands and was removed from the Crow Indian Reservation by federal condemnation. The Bureau of Reclamation currently manages the Yellowtail Dam, built on condemned Indian lands.

The Little Bighorn River flows directly through the heart of the Crow Indian Reservation, with its headwaters emanating from the Shoshone National Forest located in the south. The Crow call the Little Bighorn River *Lissaxpuatahcheeaashisee*, which means “The Large Bighorn Sheep River”; this river is deeply embedded in Crow cultural narratives (Bauerle et al. 2002–2012).



Little Bighorn River on the Crow Reservation Photo credit: Aaron Teasdale

The Bighorn River carves a dramatic canyon banded by cultural sites on both sides. The Bighorn National Forest contains a portion of the Bighorn Range, including Cloud Peak Wilderness. The beauty of this sacred Crow landscape was early recognized by the U.S. Government as a valuable natural resource. The Bighorn National Forest has managed the area as a special primitive area since 1932 until it was designated a wilderness through the National Wilderness Preservation System in 1984 (Wyoming Wilderness Act of 1984).

The Crow first obtained horses through a war party headed for the Fat River around 1730 to 1735; the party returned to the Wind River Camp with one animal. At about the same time, horses were obtained from the Great Salt Lake area, according to tribal sources (Medicine Crow 1992; Pomeranz, 2006)). In the Crow cultural narrative, the horse also arrived through a spiritual channel in a dream. The Crow soon became consummate equestrians and herd managers, supporting a rich cultural lifestyle that allowed significant mobility and economic advantages for both trading and raiding.



Crow Reservation -horses on the open range Photo credit: Aaron Teasdale

With the equestrian lifestyle, the Crow created a great dominion, retaining over 35,000,000 acres (about 141,640 km<sup>2</sup>) even after the first Fort Laramie Treaty of 1858. Additional treaties and Government policy of forced land cessations eventually reduced the total acreage of the reservation to its present size of approximately 2.3 million acres (9,308 km<sup>2</sup>). Life on the reservation led to new economic pursuits including agriculture, ranching, and economic development initiatives such as building a casino, implementing tourism ventures, and coal mining.

Culture and environment co-evolved on the Great Plains. It became a matter of public concern in recent decades due to extreme weather events driven by a warming climate (Fig. 1). Crow tribal members began to adapt their relations with natural and cultural resources more than 150 years ago, when they lost a lifestyle centered on trading, raiding, and hunting bison, as well as a vast land base in exchange for living on a reservation. They adapted to those changes by adopting an agricultural and ranching economy. In recent years, tourism was added to the economy. Specific cultural practices and traditional ceremonies



and rituals, however, remain important and define Crow cultural lifeways. On the Crow Indian Reservation, adaptation efforts combine long-term observed conditions with cultural and spiritual behavior. Although adaptation typically employs a scientific approach and modern technology, cultural and spiritual values are also incorporated into the management of natural and cultural resources on the reservation. Through combining traditional and Western education in practice, restoration actions may be passive, such as in leaving a forest burn area alone to allow native seeds to sprout and regenerate in the area. In other cases, plants or animals that have disappeared from the ecosystem may be restored to achieve ecological balance. For instance, bison and horses are culturally important animals that remain central to Crow belief systems. Consequently, restoration of bison and horse herds holds a broad range of values—ecological, economic, social, and cultural— for the Crow Tribe.

### **TRIP ONE - THE PEOPLES' METHODOLOGY, THE PEOPLES' KNOWLEDGE**

Veronica made preparations for the first research trip by studying the Crow process for developing Indigenous knowledge, noting that Crow tribal members were important contributors to a guide to protocols and understanding the culturally appropriate gathering and use of indigenous knowledge relating to climate change (Climate Change and Traditional Knowledge Workshop, 2014). She knew that tribal college libraries are a treasure trove of knowledge that often hold archival and unpublished materials and other materials not available elsewhere, so she headed directly to the tribal college library. The librarian helped her request copies of important writings by Dr. David Yarlott, the President of LBHC that were particularly helpful as were books by Crow authors. She also obtained some writings of tribal college faculty available at the College's bookstore. These materials give a truer reflection of tribal voice and values because they come out of the community. Journal articles, though necessary, often represent the researcher as interpreter and decision-maker and the community as the object of study. The process of gaining Indigenous knowledge engages community while it entails an intergenerational process where "teaching about the living environment involved, in part, around oral traditions where stories were passed from generation to generation" (Yarlott 1999, p. 27). These values have been taught among the

Crow through exposure to the natural world, by vision quests, and by experiencing the intimate connections between nature, traditional medicine, and ceremony:

“For our whole history, and even today, young Crow men have gone into the wilderness to fast and pray to First Maker, the giver and author of life, in order to obtain visionary power” (Medicine Crow 2006).

“To the Indian, medicine and religion are closely interwoven and knitted together: one is an integral part of the other, one cannot function without the other” (Medicine Crow 2006).

Threats to human and natural systems have also been expressed in Crow cultural terms:

“Mother Earth is under serious stress these days, and so are her native peoples” (Medicine Crow 2006).

Tribal restoration practices are derived from “two-eyed seeing” and incorporate Crow knowledge and environmental science (Bartlett 2012; Marshall 2017). First articulated by the Indigenous Elder Albert Marshall of the Mi’kmaw Tribe in Canada, “two-eyed seeing” is a form of resistance against domination by one worldview and assimilation of alternative knowledge bases. Bartlett (2012) notes that “two-eyed seeing” challenges those structures of academia where knowledge is divided into disciplines and “the shoals are poorly charted” for trans disciplinary research. “Two-eyed seeing” acknowledges the whole nature and distinct ways of knowing of both Indigenous and Western knowledge, weaving back and forth between epistemologies but allowing them to work together as in binocular vision (Marshall 2017). This interaction holds important advantages because it is always “fine-tuning your mind into different places at once,” and “you are always looking for another perspective and better ways of doing things” (Marshall 2017). “Two-eyed seeing” also provides guidance for identifying parallel points of Western and Indigenous-based science that outline long-term cycles or identifies specific phenological patterns. In Crow Indigenous knowledge, cultural and natural history are woven together,

demonstrating dense connections in the long-term coevolution of Indigenous communities and native ecosystems.



Ancient tipi rings on federal Bighorn National Recreation Area (NPS) demonstrate archeological evidence of past activity by Crow and other Tribes Photo: Aaron Teasdale

“To the Crow, the cultural landscape emphasizes the interrelationships between the past and the present, the living and the ancestors, people and the environment, and the spiritual and physical aspects of life...Since Crow people today can still recognize these same physical and spiritual qualities of the landscape, there is a continuing tie between the people and the place and the people who created/named the site, and those who view it today” (McCleary 2000).

“From all the interviews conducted with the Apsáalooke Elders, a sense of why there is a need for interrelatedness of all elements within an environment was visualized” (Yarlott 1999).

“In my youth, an Elder told us that the more you seek to understand the essence of the four basic principles of life—earth, water, fire and air—and how they interact, the more power you acquire” (Medicine Crow 2006).

These long-term intimate relationships led to a land and water ethic supporting resilience with Crow knowledge, especially in regard to ecosystem services flowing from riparian, grassland, and forest habitats. Riparian systems provide essential habitat for aquatic and terrestrial animal and plant species, which in the Upper Missouri River Basin have coevolved to respond to spring snowmelt-fed flooding followed by a summer drawdown in river flows. These hydrological patterns established moist banks and sandbars that promote cottonwood propagation. Plains cottonwood (*Populus deltoides* ssp. *monilifera*) is an ecological keystone species within riverine areas on the Crow Indian Reservation, as well a central cultural species for Crow spiritual connection within riparian ecosystems.

Veronica learns more from the dissertation and work of a Crow researcher who worked on in-person interviews with Crow Knowledge Holders, Crow Elders, and community surveys, to identify 23 different uses of plains cottonwood (Pretty Paint-Small 2013). The most frequently mentioned parts of the tree were branches and saplings, mainly for use in building roof thatch on shade structures and in the construction of the arbor at the Sundance ceremony (Pretty Paint- Pretty Paint-, personal communication in 2019). Details of other ceremonial uses are not mentioned in this publication as this information is protected sacred knowledge that is shared only by Crow Elders and Knowledge Holders.



Invasive olive trees line the river as it passes through the Crow Reservation during early high water flow  
Photo credit: Aaron Teasdale (2017)

### **Embracing Indigenous Knowledge About Climate Change Impacts**

Veronica is aware that owing to the broad diversity of Indigenous Peoples on Earth, the international community has not yet adopted a standard definition of the very word “Indigenous.” The United Nations recommends a multifaceted understanding of this concept which pivots on (1) self-identification as indigenous peoples, (2) historical continuity with pre-colonial regions and societies, (3) strong link to territories and natural resources, (4) distinct social, economic or political systems, (5) distinct language, culture and beliefs, (6) willingness to perpetuate ancestral environments and systems as distinctive peoples and communities, and (7) non-dominant presence of these communities in modern societies (UN DESA 2008; Lambert, Research for Indigenous Survival, 2014)).

While Indigenous Peoples do not necessarily claim to have complete knowledge about how to adapt to climate change (Watson et al. 2012), their long-term knowledge of cycles and baselines is critical to monitoring change and adaptation. Indigenous knowledge is shaped from the systematic observation of phenological (seasonal) cycles across generations and the historical and even prehistorical implementation of innovative solutions. Such solutions have not always been infallible under processes of adaptation to change, but they reflect a deep understanding of how ecosystems respond to natural or human-caused change. They provide a source of testable hypotheses and may lower risk through informed practice. Native Americans have moved villages, substituted materials for uses ranging from consumption to ceremonies, traded with others, or reduced dependence on items in short supply due to changes in the environment, (Jantarasami et al. 2018).

Indigenous health disparities place Tribes at increased risk of incurring the economic and cultural costs of adapting to a warming world. The negative impacts of climate change on tribal peoples are predicted to continue to disrupt the access to and availability of traditionally harvested flora and fauna that are intimately tied to their expression of cultural identity, threatening places including sacred sites and customs, and relationships that are central to their lifeways (Jantarasami et. al. 2018). In anticipation of such threats, Tribes in the U.S. proactively identified and addressed climate impacts by initiating research that aims to protect value-based species within ecosystems, sacred landscapes and at-risk water resources. Solutions include restoration of fire-adapted ecosystems by replicating natural vegetation density with fuels reduction treatments that are based on prescribed burning, and by mitigating climate change impacts through renewable energy programs on tribal lands (Black e.t al. 2015; Confederated CSKT 2013; McNeeley 2017; Oglala Lakota Nation 2012). Countering the economic and social costs of climate change, Indigenous histories and experience provide important knowledge systems in advancing the understanding of the impacts of climate change in these co-evolving human and natural systems.

Indigenous worldviews are unique in their belief in the sacredness and living nature of water, rocks, soil, air, celestial bodies, plants, and animals—all of which contain a *spirit* (Cajete 2000). Sometimes

described as a “kincentric” worldview (Salmon 2000), this Indigenous perspective frequently describes human and nonhuman forms as relatives; all are interconnected in their worldview and considered a part of one’s community. The study of those interconnections is important to understanding climate change impacts.

### **Summarizing the First Research Trip: Facing Research Realities**

Veronica recognizes that culturally defined value systems of Native Americans that are part of Indigenous ecological knowledge are often misunderstood by Western scientists and thus require a specific methodology for study. She is faced with the need to discover ways to incorporate the Indigenous voice and knowledge into the science-based management of public lands adjacent to American Indian reservations. It is important to follow practices that respect and protect this knowledge as Indigenous intellectual property. Although public land management agencies have acknowledged the challenges associated with a general one-size-fits-all approach to public land stewardship, insufficient progress has been made toward collaboratively developing creative stewardship approaches that address the tradeoffs inherent in managing a landscape occupied by people with culturally, politically, and environmentally disparate worldviews. Her research project will need to be reframed to meet those methodological and ethical frameworks that benefit both Tribes and government research.

Veronica returns home and receives key materials online from the librarian. She keeps up her research with some of the guidance provided by the library archivist about ongoing work on the online collection. Her work and several phone calls confirm that no consultation with the Tribe has occurred. She considers quitting the project, but she doesn’t want to leave a failed project behind that would suggest to higher USDA levels that tribal research is too difficult. Oh well, the project is bound to exceed its timeline while she redesigns the entire project.

### **THE SECOND TRIP: NEW DIRECTIONS**

Veronica argues for a second trip to Crow Country. Helped by a university faculty member who manages the budget for this project, in cooperation for the government Research Station, she is able to return. This time a talented and internationally known photographer accompanies her. This trip would be research by walking and driving around and learning from the community. There is still no formal approval from the Tribe or LBHC, so she must find a way to complete the project that is acceptable to both. The project is evolving into a three-pronged project---learning through photography, the tribal library and archives, and local advice.

Talking with LBHC professionals and faculty in the College cafeteria, Veronica learns that most of the Crow traditional ceremonies and livelihoods are centered upon the sacredness of water, corroborating library resources. (Lowie 1922, 1970) She is reminded of similarities to the Tribes of the Southwestern Region that she hails from. Meanwhile, her studies of government documents show that federal agencies have managed water resources for very different values. The Department of Interior (DOI), Bureau of Indian Affairs (BIA) began installing floodplain irrigation canals and divergent dams along the Little Bighorn and Bighorn Rivers within the Crow Indian Reservation in 1885. Over time, diversion dams, canals, and floodplain ditches were constructed and the Willow Creek Reservoir was developed to serve 53,000 acres (214 km<sup>2</sup>) of farmland. In 1944, construction of a major dam within the Crow Indian Reservation was authorized by the Flood Control Act to potentially serve another 42,600 acres (USDOI NPS 2019). Completed in 1966, the dam was named after Robert Yellowtail, who was chairman of the Crow Tribe from 1934 to 1945. Yellowtail was firmly against the damming of the Bighorn River; he protested and sued in court when the Tribe was forced to sell the dam site to the federal government.

As Veronica circumnavigates the Crow Reservation and adjacent federal lands with the photographer, they document not only the natural beauty, but also agriculture and other impacts within the bounds of the reservation. Irrigation within the reservation currently covers only 63,365 acres (256 km<sup>2</sup>) in 11 irrigation units along the Bighorn and Little Bighorn Rivers, Pryor Creek, and Lodge Grass Creek. Two of the irrigation units are privately owned and operated, while the remaining nine units are operated and



maintained by BIA. The majority of the benefits of the irrigation systems go to non-Indian landowners who own lands within the boundaries of the Reservation due to the Dawes Act. Since the opening of reservation lands for nontribal purchase by the General Allotment Act of 1887, often called the Dawes Act, land ownership within the exterior boundaries of the Crow Indian Reservation has turned into a mosaic of mixed ownership, with individually allotted lands (1,166,406 acres; 4712 km<sup>2</sup>) that are owned by tribal and nontribal owners, fee patent or privately owned, and State lands (709,167 acres; 2,865 km<sup>2</sup>), and tribal trust lands (404,172 acres, 633 km<sup>2</sup>). Lands within the reservation boundaries held in trust for the Crow Tribe by the federal government comprise approximately 1,135 acres (5 km<sup>2</sup>). The Montana Governor's Office of Indian Affairs (n.d.) indicates some aspects of this area and landscape that represent priorities to protect the Tribe's environmental, political, and socioeconomic status as a sovereign nation .

The primary irrigated crops today are hay and alfalfa, irrigated pasture, sugar beets and grains. Enabled by the General Allotment Act, or Dawes Act of 1887, it allowed allotment of lands in severalty to Indians on the various reservations that eventually led to substantial ownership by non-Indians and opened up "surplus lands" to non-Indians. In the end, it removed much of the agricultural land on the reservation from tribal ownership (Runyan, 1940). Today, benefits from these irrigation projects are shared by tribal members with the majority of benefits going to other landowners. Not all landowners apply sustainable practices and some of the crops require intensive water use.

Veronica reviewed general and scientific knowledge about the area before the trip. She noted that since the end of the 19<sup>th</sup> century, increased water demands for agricultural purposes resulted in science and engineering resources focused on building diversion dams for use in floodplain irrigation. After the Dust Bowl era of the 1930s, increasing need for water from the Bighorn River resulted in significant decreases in water flow. But construction of the Yellowtail Dam in the 1960s was the main factor in removing the natural flood pulse of the river. Although Crow Agency experienced severe flood events approximately every 40 to 50 years since establishment of the reservation, unusual early-season flooding in May 2007 and a severe flood event in spring 2011 have raised community concerns about the increase

in frequency and severity of flooding along the Little Bighorn River. Precipitation shifts from winter months to the spring over the last 10 years may be contributing to this higher frequency of spring floods (Doyle et. al. 2013). Recently, wildfires have become more frequent and burn hotter as well resulting in the reduction of populations of deer and elk, which tribal members traditionally hunted for subsistence purposes.

A recent climate change vulnerability survey in the Bighorn River basin found that the Native American residents surveyed have unique needs and preferences related to management of the regional water resources. Respondents felt the most important water-based values to protect in public lands were water quality and Native American cultural and spiritual values (Armatas et al. 2014). Least important were recreational uses, such as non-motorized and motorized ice recreation and snow-based, commercial land-based, river-based, and commercial water-based activities. Concerns about environmental degradation of water quality and quantity included impacts to drinking water, cloud-seeding impacts on plankton and fish, erosion and flooding, and reduction of mountain snowpack (Armatas et. al. 2014). The Crow respondents had unique preferences for management of other resources, including those affected by wildfire, flooding, and drought, or, more generally, disturbance generated by decreasing winter snowfall and warming temperatures over the last two decades.

Coupled with increased flood frequency and fire severity, the Crow people recognized the need for additional research to plan for mitigation of climate change impacts on water quality and quantity. Continued reduced availability of flora and fauna due to an ecologically threatened forest likewise affects the health of the communities within the reservation. Environmental degradation from severe weather and a continued warming trend reducing stream flows pose a significant economic threat to tribal members engaged in farming and ranching (Gowda et al. 2018; Jantarasami et al. 2018).

Veronica's second trip to Crow Country confirmed that it is unlikely any of the interviews prescribed by the initial proposal will be approved. In fact, no consultation with the LBHC or the Crow Tribe ever occurred despite promises to the contrary. She will have to appeal to college faculty and local experts to

rebuild a respectful project that will not violate tribal sensitivities and regulations. She discusses the project with several experts at Crow including tribal college faculty and BIA fire personnel and tribal government experts, especially in water and environmental areas. They are helpful, but it becomes clear that the interviews as originally proposed would not be approved. A strong preference, if not a requirement, is that interviews be conducted in the Crow language. Besides that, the development of a major research proposal without tribal collaboration from the very initiation of ideas was not likely to fly in the 21st Century. She follows up with the formal requests for interviews in both college and tribal processes as required by the federal proposal. As expected, she receives no response. She understands that other research projects with the history of collaboration and tribal engagement are priorities with Tribes. But denial opens the door to changing the project into a more credible research effort based on guidance from the community. After sending letters and making calls, it seems that it isn't possible to actually determine if the Tribe has an approval system for research. She spoke with the public affairs officer who also did not know of a process for research proposals. Like some other Tribes, they have placed the materials that they want to share in the tribal or tribal college library and archives, or they set up a cultural commission. Crow has delegated the decision for approving use of existing library and archival material to the Little Bighorn College Library. This will be the only avenue for obtaining existing interviews for analysis, since it is clear new interviews will not be approved. Since the existing interviews held by the Library span a number of years, this poses an exciting opportunity to look at the observations of elders over a significant time. She decides to go ahead and recreate the research proposal in the new context. She informs her research supervisor via email that she is making changes. No response is received.

### **Back at Home**

After returning home, Veronica initiates further study developing Western science about climate change in Crow Country. She begins a study of recent climate change impacts. In 2011, major flooding across the Missouri River Basin was followed by severe drought the next year. Similar impacts are predicted to become more common as global temperatures continue to rise. Additionally, projected

warmer and generally wetter conditions are expected to interact with elevated atmospheric carbon dioxide (CO<sub>2</sub>) concentrations, increasing the length of the growing season in the Northern Great Plains. Kates et. al. 2012; Ko et. al. 2012; Mueller et al. 2016; Reeves et. al. 2014; Wienhold et. al. 2017) Warmer and wetter conditions, coupled with fire suppression and seasonal drought driven by increasing evaporative demand, are already affecting the health of fire-adapted forest ecosystems and making them more susceptible to more frequent and more severe wildfires (Conant et al. 2018; CSKT 2013). These factors increase forest susceptibility to more common and more destructive pest outbreaks as well (Bentz et al. 1991; Lindner and Kolström 2008; Raffa et al. 2008; Vose et al. 2018). Access to and availability of goods and services that support the health and cultural lifeways of local communities are at risk as well (Doyle et al. 2013; Joyce et al. 2013; Kates et al. 2012; Norton-Smith et al. 2016). She finds that data and scientific findings are matching up with the Crow archival interviews she is starting to read.

More extensive reading confirms that some things are changing in good ways. Tribal experts and scientists are beginning to collaborate with University scientists. This encourages her to continue with the project with its challenging task of communicating Indigenous knowledge about climate change to government scientists. However, it does require a complete redesign. Fortunately, the relationship between perceptions of climate change, innovation, and Indigenous knowledge is becoming a well-discussed topic (Nabhan and Martinez 2012; Boelens, Chiba and Nakashima 2006; Baptiste et. al. 2017; Karki et. al. 2017; Nakashima et. al. 2012; Roué et. al. 2017; Roué and Molnár 2017). From this perspective, accumulated place-based cultural knowledge is shown to increase the exchange of knowledge of past environmental changes and phenological events, making it possible to incorporate that knowledge into practice. To this purpose, she prepares to examine Indigenous Peoples' responses to environmental changes and she refocuses the project as a case study to be conducted on the Crow (Apsáalooke) Indian Reservation in south-central Montana through the resources of LBHC, its library and archives. Also important are the published writings of Crow scientists and scholars who incorporate indigenous knowledge into their works (Doyle, 2013, Yarlott, 1999).

## **Facing the Challenge: Communicating Indigenous Knowledge**

Veronica is faced with the task of completing a report that includes ways to incorporate the Indigenous voice and worldviews in management of public lands adjacent to American Indian reservations. Fortunately, there are some models for her research. Recent scientific studies by some members of the combined federal, academic, and tribal research team that she works with underscored the importance and relevance of incorporating Indigenous knowledge in a respectful and sensitive manner into vulnerability assessments and adaptive management approaches for forest and fire management planning, including post fire restoration (McBride et. al. 2017; Sanchez-Trigueros et. al. 2016; Stumpff 2015; Wynecoop et. al. 2019). In a related project working with the Santa Clara Pueblo in New Mexico during post fire riparian restoration from recent large-scale fires, several principles were developed from place-based knowledge with prescriptions for more successful post fire restoration and increased resistance to future impacts using both biophysical and cultural perspectives. For instance, using native materials for reseeded and stabilization of structures offers an alternative to nonnative farm straw and cement. Following local prescriptions for placement and design of such structures accomplishes restoration purposes with attention to place-based knowledge and local cultural protocol (Stumpff 2015).

Recent efforts to support the Forest Vision 2020 Collaborative Forest Landscape Restoration Project, engaging the Confederated Colville Tribes, the Spokane Tribe, and the Colville National Forest in Washington, were aimed at establishing communication channels between Western science and Indigenous knowledge sources to generate knowledge in sustainable fuels and fire management. The effects of understory thinning, management-ignited fire, and management of low-intensity natural fires on traditional uses and meanings have provided a baseline for collaborative goal definition in the application of fuels reduction treatments, supporting treatments that are environmentally sustainable and protective of the tangible and intangible meanings that sit on public lands (Sanchez-Trigueros et. al. 2016; Wynecoop et. al. 2019). Emerging models like these are strengthening climate strategies by informing research with

knowledge that is place-based, holistic, and cognizant of the long-term dynamics embedded in Indigenous knowledge resources.

### **The Crow Nation and Climate Change Vulnerability in the Upper Missouri River Basin**

Veronica recognizes that incorporating place-based Indigenous knowledge into public land management planning and mitigation efforts takes a critical step forward in understanding community resilience by allowing for collaborative community processes to assist restoration. She sees that federal land managers in the Northern Great Plains currently lack a formal process and guidance for incorporating Indigenous knowledge into climate-related knowledge into climate-related disturbance adaptive planning, particularly relating to extreme disturbance events such as wildfires that change carbon sinks to carbon sources, drought (which interrupts water-dependent growth cycles and may lead to water pollution), and flooding (which disrupts land use) (Jay et. al. 2018). On the other hand, tribal communities living near public lands in Montana and Wyoming depend on neighboring public lands that were once part of their traditional land base to access flora and fauna for traditional uses for ceremonial, food source, and medicinal purposes. These Tribes have historical experience in surviving extreme weather and the effects of natural disturbance, such as wildfires, droughts, and floods. They have a unique understanding of climate-related impacts in the region, having overcome disturbance in the past with place-based knowledge. Accumulated experiences of adaptation and resilience to drastic natural and human-caused disturbance can inform current restoration and adaptation planning processes.



Drought on the prairie

Photo credit: Aaron Teasdale

### **Reviewing History on the Crow Reservation**

The current Crow Indian Reservation was established by the Treaty of Fort Laramie (1868) and is only a small part of the ancestral homelands of the Crow people, although knowledge and the use of culturally significant flora and fauna, and knowledge of the importance of water resources date back centuries, as reflected in their creation stories (Medicine Crow 1992). The Crow people have lived in the Yellowstone River Valley since the late 17<sup>th</sup> century, following a migration pattern beginning in the mid-1500s, when they split from the Mandan/Hidatsa Tribes (currently located in North Dakota) and eventually settled in the Powder River Basin, located in the current area of Montana and Wyoming (Medicine Crow 1979). In the pre-treaty days, the Crow Tribe influence extended over 50 million acres (about 202,000 km<sup>2</sup>) in the Upper Missouri River Basin from Yellowstone Lake (southwest of the current reservation borders) across the Wind River basin and the grasslands east of the Black Hills, in Wyoming, and across the Bighorn

River, the Yellowstone River, and the Musselshell River basins, in northern Wyoming and central Montana. These corners mark the historical boundaries of the Crow Tribe “like four tipi poles” as described by Sits in the Middle of the Land at the Fort Laramie Treaty negotiations (Yarlott, n.d.).

The traditional language of the Crow descends from the Siouan language family, and is currently spoken by about 85 percent of the Crow as their first language. The name Crow as a synonym for Apsáalooke is likely a mistranslation from French fur traders of the compound word “children of the large-beaked bird,” one of several names used by the Apsáalooke or related groups to refer to themselves (DeMallie and Sturtevant 2001). Multiple spellings of the Apsáalooke and related groups, such as the Absaroka, Apsalooke, Apsaroke, and Absarokee occur in the literature. In this case, Apsáalooke and Crow are used interchangeably.

The climate on the Crow Indian Reservation varies from humid above 7,000 feet (2,100 m) in the Bighorn Mountains, with 24 inches (610 mm) of annual precipitation, to semiarid around 2,900 feet (900 m) in Crow Agency (the administrative capital of the Crow Indian Reservation) just south of Hardin, with 12 inches (305 mm) of annual precipitation (NOAA 2018). Nestled within the Yellowstone, Bighorn, and Little Bighorn basins, the reservation contains 2,307,506 acres (9,338 km<sup>2</sup>). Approximately 10,000 enrolled tribal members reside in the vicinity of Crow Agency and in the communities of Garryowen, Saint Xavier, Lodge Grass, Wyola, and Pryor along the Bighorn and Little Bighorn River valleys, which are located within the exterior boundary of the reservation (Doyle et al. 2013; Montana Governor’s Office of Indian Affairs, n.d.). Major highway access is by U.S. Interstate 90 (north/south) and U.S. Highway 212 (east/west).

## **Research and the Law**

Back at home after her second trip to the Crow Nation, Veronica is working to be sure that federal scientists and managers understand that Native American and tribal values, under the provisions of the National Forest System Land Management Planning rule (USDA FS 2012), are subject to federal



protection. However, institutional barriers to land ownership and management capabilities can inappropriately limit the adaptive capacity of Treaty Tribes to take effective action on self-prescribed measures, especially when they face institutional barriers on adjacent federal lands. Barriers to planning and management based on science include limited access to traditional territory and resources, and insufficient capacity of existing laws, programs, and lack of funding within the United States to protect lands and traditional resources of American Indian and Alaska Native Tribes (Black et. al. 2015; CSKT 2013; McNeeley 2017; Norton-Smith et. al. 2016; Oglala Lakota Nation 2012).

Issues of environmental justice magnified by climate change soon emerged. The noted Native attorney, Rebecca Tsosie (2007, 2009) describes two categories of Indigenous claims for environmental justice that are associated with adaptation to climate change: 1) Native claims for regulating control over reservation lands (sovereignty claims) and 2) claims by Indigenous Peoples that they have unique interests and therefore ought to be represented as “rights holders” in decision-making (whether national or international) that impacts their communities, often guaranteed through treaty rights. A lesson from the first category of claims is that for Indigenous Peoples equality of status as governments—that is, sovereignty instead of a focus on minority rights— was the key to environmental justice.

Claims in the second category relate to multi-stakeholder collaboration and serve as facilitators of knowledge exchange, so they become relevant for comprehensive adaptation planning in questions with multiple perspectives. Because many of the impacts of climate change fall disproportionately on Indigenous communities (Jantarasami et. al. 2018), Native Americans have the right to be included in environmentally responsible policymaking that counters those impacts, not just by virtue of their rights as a minority population but also because they are sovereign rights holders. Tribal sovereignty and the trust responsibility may not have always protected American Indian Tribes from external threats, but legal principles enabled protective case law (e.g., Womble et. al. 2018) and control of policymaking that would otherwise contradict their unalienable and inherent rights (Saavedra Buckley 2019). In sum, building resilience within Indigenous communities rests on the legal required proactive efforts of federal, state, and

local governments to lift institutional barriers that prevent Tribes from adequately protecting their culturally important relationships with natural resources. In recent years, laws protecting tribal religious rights and laws encouraging government-to-government collaboration like the Tribal Forestry Act encourage progress. As sovereign governments, Tribes have the unique authority to enter into innovative agreements with federal agencies.

### **Adjacent Mixed-Ownership Federal Lands and the Crow Indian Reservation**

Driving around the borders of the reservation with the photographer, Veronica realizes that her work must include the importance of federal lands with multiple designations surrounding the Crow Indian Reservation, and the array of legislatively designated uses across stewardship agencies. These lands were part of the traditional Crow territory prior to forced settlement on the Crow Indian Reservation, as delimited in 1868. Western science and GIS mapping places the Crow Indian Reservation at the center-west of the Upper Missouri River Basin, immediately adjacent to the Bighorn and Custer National Forests. These forest systems are interdependent with the Shoshone National Forest and include the headwaters of the Bighorn River, flowing north from the Montana-Wyoming state line to the Little Bighorn River just outside Hardin, Montana. The reservation is next to non-Forest Service land management units such as the Bighorn Canyon National Recreation Area (once part of the Reservation) managed by the National Park Service, the Pryor Mountain Wild Horse Range, and other U.S. Department of the Interior (DOI), Bureau of Land Management (BLM) lands. Once part of the Crow domain, much of these public lands contain a rich history of Native American culturally identified landscapes such as burial grounds, spiritual sites, pictographs, and petroglyphs—a direct reflection of Native Americans’ historical association with these lands.

The Bighorn Canyon National Recreation Area is managed by NPS and intrudes into the Crow Indian Reservation along its southern boundary. The Custer Gallatin and Bighorn National Forests currently share northern boundaries with the Crow Tribe. The Pryor Mountain Wild Horse Range, managed by BLM (including some NPS and Forest Service lands) likewise shares boundaries with the Custer Gallatin

National Forest, the Bighorn Canyon National Recreation Area, and the Crow Tribe. The Shoshone National Forest does not share a boundary with the Crow Indian Reservation but does give rise to the Shoshone and Bighorn Rivers, each serving as important water resources to Crow tribally owned lands. All of these lands, except the Bighorn Canyon National Recreation Area and the Crow Indian Reservation, contain areas designated under the Wilderness Act of 1964 as wilderness areas or wilderness study areas.

The Pryor Mountain Wild Horse Range is a unique refuge for the wild horse. Many of the wild horses that inhabit the range show primitive striping on their backs, withers and legs, and are believed to be feral descendants of Spanish, Arabian and English stock brought by European settlers. A significant portion of the Wild Horse Range is classified as wilderness study areas on BLM lands; so federal agencies are required to manage them in accordance with the designation of the Wilderness Act. until Congress decides to release acreage or pass legislation that brings them into the National Wilderness Preservation System. In a letter of April 13<sup>th</sup>, 2017 to the Custer Gallatin National nonprofit group stated “no correlation with ecological, geological or geographical boundaries exists”. (Pryor Mt. Coalition letter of April 13, 2017)] Similarly, public recreational uses in the Pryors are not correlated with the areas managed by different agencies.



Bighorn sheep in the Pryor Mountains Photo credit: Aaron Teasdale

Veronica finds that legislative designations and land policy documents that indicate multiple uses within federal mixed-ownership lands adjacent to Indian trust lands create the possibility of conflicting values:

“Across all lands, (1) recreation and (2) wildlife values are commonly listed as resources that require protection, closely followed by (3) water quality, quantity, and access. (Stumpff, et al. 2020)

However, the viability of a wild horse population on the Pryor Mountain Wild Horse Range with wilderness management objectives on designated areas does open up possible areas of collaboration, including the cultural values, sacred sites protection and bison herd management that are important to the Crow Tribe. Specific threats to resilience include those closely associated with climate change, such as (1) drought, (2) wildfire, (3) pests, and (4) plant diseases. Other impacts also listed in the corpus are (5)

livestock overgrazing, (6) land development activities, and (7) mineral and fossil fuel extraction. On the Crow Indian Reservation, additional socioeconomic threats are at play and broadly impact the quality of the environment and human well being. “In accomplishing sustainability objectives, overlapping management boundaries seem to be less of a problem than overlapping legislated purpose for the public lands under study. ” (Stumpff, et al 2020)

Veronica finds that recent collaborative research by federal agencies, universities, and Tribes in the Columbia and Upper Missouri River Basins suggests an interest in actively incorporating Indigenous knowledge into adaptive forest management planning that is going to be useful to share with agency scientists. Community engagement in science is a more effective method of collective knowledge exchange and education, rather than top-down models. Strong interest in such collaborations continues to grow amid post fire riparian and forest restoration undertaken partially in response to the recent large fires that have plagued the western United States. Impacts of climate change present ecological, cultural, and economic restoration challenges (Carver et al. 2009; Watson et al. 2013).

Veronica has used government documents, taken advice from Crow experts and diligently checked online resources. She knows that she will need to go further to select a methodology, make contacts to incorporate Native voice and create a symbolic cross-cultural framework for communication. The kind of data she has suggests the kind of methodology she can use. In a perfect world one would choose the methodology first based on the kind of problem one was going to study. Choosing a unit of analysis is key---is one studying quantitative individual behavior statistics, agencies or institutions, political policy, leadership action or cultural values? Here she seems to be settling in on the existing ethnographic interviews.

### **Reviewing Progress: Three Results of Veronica’s Initial Research**

From her initial overview of the climate change issue on the Great Plains, Veronica sees three reasons that federal scientists need to understand more about Indigenous knowledge and rights. First, if the goals are a more holistic approach to the management of national resources in the United States, a fuller understanding of the benefits flowing from land and water protection, a better understanding of the threats to the continuation of these benefits, then incorporation of Indigenous knowledge is needed for both pragmatic and ethical reasons. On a pragmatic basis, incorporating Indigenous knowledge systems into federal decision-making, if such knowledge is freely given and duly protected, will facilitate the production of emergent knowledge through collaborative processes.

Second, she knows she will need to emphasize the ethical and legal grounds for federal scientists. Native Americans have ties with their historical homelands and hold rights that need to be honored in federal policymaking and implementation on lands that are often in public holdings (Watson et. al. 2012). The federal Indian trust responsibility is a legal mandate under which the federal government “has charged itself with moral obligations of the highest responsibility and trust” toward Tribes (*Seminole Nation v. United States*, 316 U.S. 286, 296-97, 1942). Since 1831, the United States formally recognizes the existence of the federal trust relationship toward Tribes, as first discussed by Chief Justice John Marshall (*Cherokee Nation v. Georgia*, 30 US 1, 16, 1831). As a consequence, the federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the federal government to protect tribal treaty rights, lands, assets, and resources, and a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native Tribes.

Third, she needs to communicate the value of Indigenous knowledge about restoration of whole systems after disturbance. This requires attention to the cultural as well as the biophysical elements. Coupling human and natural systems with an interdisciplinary integration of socioeconomic and Earth systems creates a holistic approach to systems vulnerability and restoration emerges (Liu et. al. 2007; Turner et. al. 2003), so there is potential for developing points of synergy and knowledge exchange between holders of Indigenous knowledge and Western scientists.

## **TRIP THREE: CHOOSING INDIGENOUS KNOWLEDGE, CREATING A NEW RESEARCH PROJECT**

. Her experience tells her that Indigenous knowledge, particularly traditional phenological knowledge, offers a rich resource of knowledge to understand impacts of climate-related disturbance in the Northern Great Plains. This is important to share with Western natural and social scientists because of the breadth of time and depth of local detail that make up climate change science. Indigenous knowledge contributes to the understanding of ecosystem changes as a result of multiple stressors, including climate, and provides information where data are limited, but where existing relationships to the land date back many generations (Doyle et. al. 2013). In short, Indigenous knowledge offers the possibility of identifying the effects of recurring disturbance and best practices for adaptation. On the second trip, she found a treasure trove of information in the LBHC Library and Archives that supports these ideas. This material was curated by the Tribe and is open to her. At last, a resource is discovered that may replace the lack of new interviews. The archive and library hold collections of interviews going back to the 1990's. This is even better, since the interviews reflect changing conditions over time. She was particularly moved when the archivist showed her a picture of the Crow Shield, belonging to a revered leader. She hopes the shield will provide inspiration when she feels like quitting again. It's going to be a fuss trying to get a third trip to Crow Nation to do what she needs to do.

She reflects on the situation. The original research proposal came from a higher level of the USDA research as a funded project. It outlined a well-accepted social and psychological format that prescribed interviews of Crow elders. After Veronica learned that this project had not been developed from the grass roots of Crow involvement and it was not in line with current Native thinking about protocols for research and interviews, she knew it must be redesigned. At this point she decides not to ask permission, but to apologize later if the need be, as the saying goes. Veronica begins to develop an alternate approach. She knows more time must be spent discussing the project and building relationships with Crow scholars and experts from Little Bighorn College. She plans a third trip to the Crow Reservation despite her

misgivings about the possibility of disapproval and she plans a visit, specifically to the College. Federal travel authorities begin to squeak, so to get the time that she needs, her colleague at a University agrees to be the direct contractor the federal funds to the University. This makes things run a little better.

Veronica knows she must spend more time researching by walking around. Lunchroom discussions and library explorations, a short meeting with a Dean and contacts with a tribal water quality expert and informal discussions with faculty who were sweeping up leaves on the college grounds in preparation for an accreditation visit all help her to form her approach. In the library she discovers a number of older studies that include interviews with elders, but she needs to go back and hand copy much of the material. She has also found archival interviews and interviews in more recent books and journal articles with Crow authorship. With this combined data, she can use a method called ethnological meta-analysis. She recalls the definition of ethnological meta-analysis as “as a meta-ethnological method that allows synthesizing qualitative studies in order to achieve a new conceptual understanding of a particular phenomenon.” (Sage, n.d.) By using the publications she has located through tribal sources, all of which are public and available through the archives, books and articles, she chooses the method that will allow her to explore ethnological data in depth through qualitative frameworks that encompass several studies and their existing interviews.

Ethnological meta-analysis has proven to be particularly helpful in bridging the gap between science and Indigenous knowledge, given its suitability for synthesizing qualitative research and developing models that interpret findings across multiple studies (Atkins et. al. 2008). In ethnographic interviews, data collection and subsequent analysis primarily rely on spoken or written statements to synthesize and interpret information, so it has come to be a key practice for cross-culturally communicating different understandings of natural and cultural resource values. However, ethnological analysis does not diminish the benefits of including quantitative analysis in the application of Indigenous knowledge, as long as accurate quantitative data are available. In fact, both quantitative and qualitative data can be used in culturally appropriate sources such as fire management plans and integrated natural resource plans, and in



decision-making that extends beyond the current political boundaries of Indian reservations, such as management of larger watersheds and ecosystems in multi-ownership lands (Walters and Andersen 2013). In any case, scientific research practice should always honor and support tribal decisions regarding the extent of their contributed knowledge base, whether and when to share that knowledge, and the way to use it (Climate Change and Traditional Knowledge Workgroup 2014). Ultimately, Tribes in the U.S. hold the right to develop their own sovereign plans and protocols in planning for climate change impacts.

This type of analysis provides suitable methods for understanding the body of Indigenous knowledge, including its subset traditional phenological knowledge (Gamborg et. al. 2012). A unique set of skills is necessary for the development of an Indigenous knowledge base. While some practices used in Western science are not consistent with the skills necessary to develop and preserve Indigenous knowledge (e.g., controlled experiments for hypothesis testing), practices like systematic observation and trial and error are a common thread in both knowledge systems for problem solving and generation of knowledge. In addition, Indigenous knowledge is a reflection of cultural lifeways, so it may include both scientific methodology and the honoring of cultural identities associated with a particular environment. Moreover, Indigenous knowledge may sometimes be the only source of information about long-term cycles that takes account of human behavior. In sum, Indigenous knowledge presents a holistic perspective that does not dissociate cultural heritage from the earth sciences and vice versa, becoming a natural paradigm for the study of coupled human and natural systems. She will have to conceive of some kind of a framework that communicates this to non-Native researchers while analyzing the data in a cultural context.

Walking around and asking for help with humility from those holding key knowledge resources on the Crow Reservation is next. Now she has the methodology question settled, she knows what kind of data she needs to gather. The College library and buildings may close for a variety of reasons, often on short notice. She will need to quickly fill in the gaps in timing, since she is on a short leash. No permission for interviews was ever gained and Crow tribal academics show a strong preference for interviews in the Crow language. She will need to work in the library from dawn to dusk. Key materials cannot be

checked out, so she hand copies the material as she works through the volumes. The collection is invaluable because it represents a collection curated and shared through this tribal institution. She discovers unshelved volumes of interviews going back to 1993. She will be able to draw out Indigenous knowledge from these interviews going back to the 1990's and special resources held by the tribal library and all of this with steady support from the librarian and archivist. But she must compress the work into four days and also arrange meetings and review and record data resources. The government sponsors are increasingly reticent, but she points out that field studies take more time than she has been given.

### **THE WRITING BEGINS**

With a new research design in place, Veronica writes her case study. Halfway through she gets an email from her research supervisor that he wants the case to be about resistance. She manages to weave a small thread about resistance into the first adaptation thread of her work, but the bulk of the case she has designed is about resilience. She ignores the direction except for this minor compromise in the beginning and proceeds with the overall concept of resilience in a cyclical process, as symbolized through a protective Shield, her original inspiration from the visits to the Crow Nation. She submits her case.

### **PEER REVIEW AND EDITORS**

The peer review process begins. Two peer reviews are required for publication. Soon, her case study attracts attention for its emphasis on Indigenous method and knowledge. Cascading peer reviews follow--agency officials at several levels, American Indian liaisons, agency specialists, government publication editors and research directors all participate in the review---and two more years pass. She must continually formulate responses to the peer reviews, often needing to educate reviewers on basic facts. Some add their own material that may not be relevant or accurate. One troubling addition is a major paragraph discussing psychological risk. The paragraph suggests that incorporating Indigenous knowledge adds a risk factor. A cascade of emails follows---this addition came from higher up, but it would defeat the purpose of her entire work. Finally, she is able to get most of it edited out and the rest reworded to suggest incorporating Indigenous knowledge could actually lower risk. The process goes on.

She documents 90 corrections to various attempts to reword or add material from her original. Many more emails and responses to various editors ensues. She demands a review by at least one Crow expert in the field. Finally it is done....or....

Enter two different editors. It is decided to add a chunk of material on federal mixed-ownership lands gathered by a visiting foreign guest that is made up of copying pages from Forest Service Plans. The order comes down that she must put it in her research. "Integrate this" they say. More material is added that is patently inaccurate and she repeatedly corrects it as the versions evolve. She is now well past two years without remuneration for the work, but this far in she decides that getting it right is the primary value. The importance of getting this published is next. Getting work on the importance of Indigenous knowledge and Indigenous thinking about the environment published through a major government publication with wide distribution seems more important than resisting at this point. Her University colleague helps her organize the new material into her draft so this material can fit in. The section made up of mostly copied pages from federal management documents is, for the most part, put in a separate section from the work. It is done except for a few more months with a government editor. The research supervisor finally approves and sends it out for publication just days before he retires. Finally it is published.

Veronica has promised the tribal college that she will also develop a teaching case study from her work. This honors the principle that the Tribe should benefit from the research work. She begins work on it over the summer and completes it as the leaves begin to fall.