National Park Service
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Natural Resource Stewardship and Science

Introduction to Traditional Ecological Knowledge in Wildlife Conservation

Natural Resource Report NPS/NRSS/BRD/NRR—2016/1291

ON THE COVER
Collaboration between the National Park Service and Alaska Huna Tlingit communities resulted in the Huna Tlingit Gull Egg Use Act, permitting traditional Indigenous management of glaucous-winged gulls (*Larus glaucescens*) via harvest of eggs in Glacier Bay National Park.
Photograph by: Forrest B. Lee, U.S. Fish and Wildlife Service

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Executive Summary

The purpose of this report is to assist National Park Service (NPS) staff in developing an awareness of the various ways Traditional Ecological Knowledge (TEK) is conceptualized and how it has been applied in wildlife conservation and management. Superintendents, wildlife biologists, ecologists and cultural resource managers, in particular, may find it useful. Definitions and descriptions of TEK are provided, as well as examples of TEK in natural resources research and management, particularly wildlife conservation. Best practices for working with tribes are identified, as provided in published literature from the NPS and other federal agencies and illustrated through a case study. Because of the "special relationship" with American Indians and the legal implications of the trust relationship between tribes and the federal government, park and program managers alike are encouraged to consider the tenets of TEK contained in this document, as well as additional materials that contain information on TEK.

TEK is a mixture of knowledge, beliefs, and practices operating in an iterative and holistic system that emerges over time, across generations. TEK has been applied in the management of various flora and fauna species on public lands. While researchers pursuing efforts in the TEK field have used various approaches, the understanding of what TEK is and in which circumstances and how to use it remain unclear. In TEK research efforts pertaining to wildlife, an understanding of the historical and legal context of Indigenous communities in the United States and the wildlife profession is of importance. While many scholars of Indigenous science understand TEK as science, some researchers still maintain the philosophical question of whether it is, indeed, "science." This uncertainty may lead to inequitable approaches to research with Indigenous communities. Therefore, it is worth exploring how various groups conceptualize TEK. Further, one might question how TEK may be considered in pursuits of acquiring the best available science for natural resources management. The methods for documenting TEK are derived from the social sciences. Thus, ecologists may prefer to engage social scientists to conduct research. Ecologists should, however, be aware of the methods available and their associated strengths and weaknesses for promoting substantive interchange.

TEK can enhance the knowledge base for decision-making about ecosystems, species and their habitats, and provide longitudinal knowledge for climate change projects. In addition, increased attention to tribal worldviews in TEK research could strengthen relationships with tribes over topics of common interest, reduce misunderstandings about tribal natural resource perspectives, and broaden understandings of ethics of wildlife use. However, it cannot be assumed, as many do, that the co-production of TEK in Western-dominated contexts will automatically lead to improved resource management and Indigenous empowerment. To work effectively with tribes, one should be aware of historical, legal, and cultural contexts and be willing to consider multiple knowledge systems as valid. Wildlife managers operating in Western-derived frameworks need to be aware that it is necessary to involve traditional Indigenous stewards of these places and to adopt de-centralized decision-making processes in order to give Indigenous peoples a real say in managing land and wildlife.

Lastly, it is important to remember that tribes have the sovereignty to decide whether they wish to share their TEK. One should not assume that National Park Service employees are free to approach any tribe and begin conducting TEK research. Rather, an emphasis should be placed on strengthening relationships with tribes. Cultural gaps can be bridged and compromises can be achieved between groups of people with different cultures, value systems or worldviews. While the potential to narrow the gap makes the attempt worthwhile, it may not always be possible. Research using both Indigenous and Western paradigms can result in mutually agreeable and equitable approaches to wildlife conservation, which can also lead to insights that are valuable for society as a whole.

Acknowledgments

We thank the Yurok Tribe for providing support to S. Ramos to pursue her PhD research, which she reflected upon to write the case study in Part II of this document. We also thank E. Leslie and the National Park Service (NPS) Biological Resources Division (BRD) for support of S. Ramos in the NPS Pathways Program, and for staff discussions and guidance throughout the development of this Natural Resources Report. We are grateful to the NPS BRD in conjunction with the Wildlife Conservation Society, Intertribal Timber Council, UA/Sloan Indigenous Graduate Partnership, American Indian Graduate Center, and the Peter Likins fellowship for funding support during S. Ramos' doctoral program. We are also grateful to her PhD committee members: M. Culver, B. Colombi, R. Trosper, and J. Koprowski, at The University of Arizona, for their support in her doctoral program while she developed this natural resource report. We thank S. Rinkevich for sharing literature regarding Traditional Ecological Knowledge and federal agencies. We also thank K. Greenwood, R. Kahn, D. Louie, R. Robinson, and J. Watkins for thorough reviews of drafts of this report, which greatly improved the content and direction.

Glossary

Consultation: NPS describes consultation as: "Consultation means the process of seeking, discussing, and considering the views of others, and, where feasible, seeking agreement with them…Consultation is built upon the exchange of ideas, not simply providing information" (National Park Service 1998, p. 20,504).

Federally Recognized Tribes: Tribes with whom the federal government maintains an official relationship, usually established by treaty, congressional legislation, or executive order. Federal recognition signifies that the U.S. government acknowledges the political sovereignty and Indian identity of a tribe (U.S. Environmental Protection Agency 2009). The Bureau of Indian Affairs maintains and regularly publishes the list of federally-recognized tribes:

http://www.bia.gov/WhoWeAre/BIA/OIS/TribalGovernmentServices/TribalDirectory/

Government-to-Government Relationship: Relationship that exists between federally recognized tribes and the federal government. In practice, the government-to-government relationship is frequently embodied by consultation and coordination between a designated tribal representative and a designated federal representative (U.S. Environmental Protection Agency 2009).

Indian Country: All land within the limits of any Indian reservation under the jurisdiction of the U.S. government, notwithstanding the issuance of any patent, and including rights-of-ways running through the reservation. In addition, Indian Country includes all dependent Indian communities as well as all Indian allotments to which Indian titles have not been extinguished (Getches 2005).

Jurisdiction: The legal authority a government has to govern its people and things in a specified territory. When a government has jurisdictional authority, its laws or regulations will apply, and its courts may be the forum in which disputes are heard (U.S. Environmental Protection Agency 2009).

Non-Federally Recognized Tribe: Tribe with whom the federal government does not maintain a government-to-government relationship, and to which the federal government does not recognize a trust responsibility toward. They may, however, be eligible for some federal programs based on their status as a community. They may also be recognized by states and be eligible for state programs (U.S. Environmental Protection Agency 2009).

Sovereignty: The status, dominion, rule or power of a sovereign. Tribes have the power to make and enforce laws for their tribe and reservation, and to establish courts and other forums for resolution of disputes (U.S. Environmental Protection Agency 2009; Getches et al. 2005).

Tribal Customary Law: Also known as Traditional Indian Law or Tribal Common Law. Laws that an Indigenous community held or continues to hold that are based in their own cultural and societal constructs. Traditional Indian Law may or may not be formally adopted in a given tribal government, but may be referred to and used in the community and its dispute resolution

systems, such as in peacemaking and tribal court proceedings (Austin 2009; pers. comm. Robert Williams, Federal Indian Law professor, The University of Arizona).

Federal Trust Species: Migratory birds, threatened species, endangered species, interjurisdictional fish, marine mammals, and other species of concern (16 U.S.C. § 3772).

Federal Trust Responsibility: This is rooted in the treaties between Indian tribes and the U.S. government where Indian land was ceded to the government, under treaties, in exchange for protection of remaining tribal land and rights. Under the trust doctrine, the U.S. government holds title to Indian land in trust for the beneficial use of Indian tribes and their members. Under this doctrine, the federal government requires its agencies to ensure the protection of tribal interests as they fulfill their overall missions (National Environmental Justice Advisory Council Indigenous Peoples Subcommittee 2000).

Wildlife: In this document, wildlife is defined as any member of the animal kingdom and includes a part, product, egg or offspring thereof, or the dead body or part thereof, except fish (following 36 CFR 1.4). This includes undomesticated, free-ranging terrestrial vertebrates such as reptiles, amphibians, birds and mammals. Although this is the definition provided for this document, note that Indigenous communities may not separate fish and other living beings from their understanding of wildlife (Ramos and Williams-Claussen 2016).

Introduction

Relevance and Purpose

> *"The sacred white buffalo stands, ironically, as central to the NPS arrowhead – both appropriated from American Indian cultures. For the NPS to carry these symbols as a legacy to its mission, the agency must increasingly live up to the value and power of such symbols. Our emblem should strive to honor the innate stewardship central to indigenous cultures and their impact and influence on the culture of the National Park Service." –Reed Robinson, Manager, Tribal Relations & Indian Affairs, National Park Service*

For many Indigenous peoples, this innate stewardship is embodied in cultural ways of life, such as ceremony and take of wildlife for food and regalia. Traditional Ecological Knowledge (TEK), a term derived in Western academia, is meant to describe the knowledge of the environment held by Indigenous communities, derived from these relationships with the environment. Such relationships resulted in what wilderness activist and writer John Muir saw at in the landscape at Yosemite, leading him to advocate for the establishment of a national park in 1890 – the landscape was not untouched wilderness, but had been intentionally managed by the Miwok since time immemorial. Examples of Miwok landscape management include annual burning, manual vegetation removal, and planting of edible flora, which were referenced in early settler accounts and were described as "wilderness" (Anderson 2005).

New guidance for NPS resource stewardship in the 21st century states, "Informed by scientific and scholarly research, and traditional ecological knowledge, we will manage our resources emphasizing resiliency, connectivity at landscape scales, and life-cycle stewardship" (National Park Service 2016). As TEK is now being acknowledged at the NPS leadership level, it is valuable for employees to have an awareness of the various understandings and applications of TEK.

Many Western-trained scientists have described the need for a more integrative, holistic or inclusive approach to natural resources management. Aldo Leopold's land ethic uses "land" as a synonym for "ecosystem." He wrote, "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect" (Knight 1996, p. 472). In the field of Conservation Biology scientists are urged to integrate several fields of study for the long-term viability of ecosystems (Soulé 1985). Numerous researchers have focused on the value of TEK as a holistic approach to natural resources management (Striplen and DeWeerdt 2002; The Wildlife Society 2010); TEK is recognized worldwide as an essential component to understanding natural systems (Ford and Martinez 2000). While researchers pursuing efforts in the TEK field have used various approaches, the understanding of what TEK is and in which circumstances and how to use it remain unclear. Additionally, an understanding of the historical and legal context of Indigenous communities in the United States and the wildlife profession is of importance when pursuing TEK projects, as conceptualization of TEK through an Indigenous cultural lens may differ from an academic lens. Further, the philosophical question of whether TEK is "science" seems to be a persistent uncertainty for some scholars, potentially leading to inequitable approaches to research with Indigenous communities (Ramos 2016).

In the United States, several federal agencies, such as the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration/National Marine Fisheries Service, have considered TEK in a variety of management actions (Sepez and Lazrus 2005). In one study of NPS resource managers, scientists and superintendents in the Intermountain and Pacific West Regions, most survey respondents indicated they believe TEK has a place in NPS cultural and natural resource management. Survey respondents stated direct resource improvements as a benefit to inclusion of TEK. For example, active physical management, especially restoration, of natural resources can be guided by TEK. One biologist stated that they thought the prevention of the loss of a sensitive plant population was the greatest benefit from the inclusion of TEK (Henn et al. 2010).

Although there has been an increased interest in how TEK can be used in contemporary natural resources conservation (Sepez and Lazrus 2005), differences in laws and policies between regions of the world, even between States and Tribes in the United States, and many challenges, have resulted in the development of various approaches. Further, each tribal nation has its own unique culture and relationship with the federal government, which results in complexities in TEK initiatives. Examples of how TEK has been used in both tribal and non-tribal entities will be provided throughout this document; however, the geographic and political scale of any given example may affect if and how it might be replicated by NPS. Nevertheless, given the significance of TEK and potential outcomes from its inclusion in NPS, consideration of the information in this document is warranted.

TEK research has been applied in many natural resource fields, including the wildlife profession. Examples of contemporary wildlife management with a TEK component include the polar bear (*Ursus maritimus*; Dowsley and Wenzel 2008) and gulls (see section entitled "TEK Research in Wildlife Conservation and Management"). Whether one believes in Indigenous peoples of the past as conservationists, two things are clear: (1) Native peoples had, and generally continue to have, profound respect for wildlife, as evidenced by wildlife symbolism in their religious practices and kinship systems and (2) Native peoples lived in a way that promoted the ecological integrity that we turn to historical journals to describe (Czech 1995). Some researchers have challenged Western-trained wildlife managers to recognize the value of Native American conservation practices and to foster positive relationships with Native American natural resources managers. Relatively large Native American reservations, Native American land-use ethics, and development of competent management programs make tribes potentially significant cooperators in federal wildlife conservation programs. However, it is important that cooperation between tribes and other management agencies must not only produce ecological benefits, but must also recognize the importance of subsistence hunting and resource use to the persistence of TEK in tribal communities. Understanding the importance of hunting, resource use, and spiritual customs such as prayer, ceremony, and songs, as components of TEK is essential when considering approaches to culturally sensitive wildlife management, especially in the NPS system where hunting is largely prohibited.

A shift toward increased attention to tribal belief systems in wildlife conservation could reduce misunderstandings about tribal natural resource perspectives and lead to insights that are valuable for society at large. The use of TEK can enhance the knowledge base for decision-making about

management of species and their habitats, provide longitudinal knowledge for climate change projects, and strengthen relationships with tribes over topics of common interest (Reo 2011). Although TEK is gaining recognition, there are few guidance documents for how federal employees can work with tribes and TEK in a culturally sensitive manner. Some tribes may not have the desire or capacity to engage with the NPS in TEK-related projects. NPS employees should not assume that tribes will openly share their TEK when approached; rather, there should be a primary focus on trying to understand tribal needs, what TEK means within a given tribal culture, and building relationships that respect and support those aspects. The purpose of this report is to assist Western-trained wildlife biologists and managers in developing awareness and understanding of what TEK is, tribal issues and concerns regarding TEK, as well as potential applications of TEK in the NPS. This report is meant to be less of a "how to" and more of an in-depth introduction. For a synopsis of TEK prepared by NPS Cultural Resources and Tribal Relations and American Cultures staff, see Appendix A. To work effectively with tribes and to fully engage with the information in this document, one should be aware of not only historical and legal contexts of contemporary Indian communities, but also cultural factors, methods of learning TEK information, and be willing to consider multiple knowledge systems as being valid and scientific.

Audience

This Natural Resources Report has been developed to provide general information and resources to NPS employees regarding TEK literature, philosophies, and applications. This document is available to all NPS employees; however, wildlife biologists, ecologists, natural resource managers, and interpreters, in particular, might find it useful.

Organization and Content

This report is organized into two parts. In part I, we provide an overview of legal and historical considerations, conceptions of TEK, areas of application for NPS, and research considerations. We provide in part II a case study of how TEK was used in concert with Western Ecological Knowledge (WEK) in the first author's dissertation work. Throughout this report, various examples of TEK efforts from many locations are represented. Although laws and policies are different in other countries, U.S. federal agencies, such as the NPS, can be informed by the various approaches and considerations used throughout the world. Exhaustive material on Federal Indian Law, consultation procedures, and TEK literature is beyond the scope of this document, but suggested additional resources are provided for the reader. This report is a living document, intended to be an introduction of concepts, which can be revised to include changes in policies and additional examples of TEK in wildlife conservation. Below is a description of each chapter:

Part I

Chapter 1: Legal Status of Tribes in the United States

To understand the present relationship between tribes and the federal government, it helps to understand the history of relations between them. There has been inconsistency with Indian affairs since the United States was created. Further, federal and state policies throughout United States history have impacted American Indian communities such that, in some cases, they interpret their current experiences through a lens of phases of this history (Ramos and

Williams-Claussen 2016). Provided in this chapter is a brief synopsis of major events in Federal Indian Law, presented first as primary context for the remainder of the document.

Chapter 2: Understanding TEK

Due to the relatively recent discourse regarding TEK in the wildlife field, very few Western-trained wildlife biologists have a clear understanding of what TEK is and how it might be used alongside Western science in the conservation of natural resources. This chapter provides descriptions of how TEK has been defined by both Indigenous and non-Indigenous people. It also introduces example studies and challenges to using both paradigms.

Chapter 3: Potential Areas of Integration of TEK in NPS

In this chapter, cooperative conservation and partnerships, as described in NPS policies, are identified as areas where NPS and tribes may develop mutually agreeable approaches to TEK research. Additional TEK materials and examples from NPS are shared. Also briefly described is the possibility of including TEK research as part of the procedures to implement the National Environmental Policy Act and the Endangered Species Act.

Chapter 4: Conducting TEK Research

Suggestions are provided in this chapter for considerations in consultation and collaboration. As TEK studies are conducted using social science, a brief description is given of various research methodologies.

Part II

Case study: "Navigating Culturally Sensitive Wildlife Research: Experiences of a Yurok Tribal Member Pursuing a Doctoral Degree"

In this section, the first author describes some of the considerations she made as a student researcher and tribal member in conducting TEK research. The piece is organized by the various processes she pursued in the chronology of her experience, such as project development, project implementation, and reporting.

PART I. Overview of TEK and Potential Applications and Considerations for NPS Wildlife Conservation

Chapter 1: Legal Status of Tribes in the United States

Who is a tribe?

Terms such as “tribe,” “American Indian,” “Alaska Native,” “Native American,” and “Indigenous peoples” are used in this document. Each of these terms can refer to a person descended from ancestors Indigenous to the lands that now constitute the United States. A general definition of a tribe is a body of people who are socially, politically, and religiously organized. The people may live together in a defined territory and speak a common language. The term "Indian tribes,” which appears in Article 1, Section 8 of the United States Constitution, has been used numerous times in legislation and as a result "Indian tribe" has become a frequently used legal term (U.S. Environmental Protection Agency 2009). The term "Alaska Native" is by definition exclusive to peoples Indigenous to Alaska. But as is the case for tribes located in the lower 48 states, tribes in Alaska are culturally diverse with traditions rooted in their ancestral lands. Generally, the term "Native American" includes both American Indians of the lower 48 states and Alaska Natives (U.S. Environmental Protection Agency 2009). For NPS, “American Indian tribe” means any band, nation, or other organized group or community of Indians, including any Alaska Native village, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians. Other groups of people with traditional associations to park lands or resources include Indigenous peoples of the Caribbean, Pacific islanders, and state-recognized tribes (American Indian Liaison Office, National Park Service 2006). Today, Native Americans (excluding Alaska natives) reside on approximately 21.5 million ha of lands reserved for them by the United States government. Their total landholdings are approximately the size of a major land-managing agency, and are managed by tribes and by the federal government in varying combinations (Czech 1995).

Federally Recognized Tribes

Another definition of a Native American is a person with tribal membership. Tribes define their own membership criteria, thus different tribes have different requirements for enrollment. There are individuals of Native American descent who cannot meet the enrollment criteria of their tribe, or tribes, of origin and, therefore, would not be considered to hold tribal membership (U.S. Environmental Protection Agency 2009).

Tribes are often referred to as "Nations,” which is another way of expressing their sovereign status. For the purposes of this document, the term "Indian tribes" refers to federally recognized tribes. Today, there are over 560 tribes recognized by the United States government, including over 220 Alaska Native Villages. These numbers are approximated because there are tribes currently seeking federal recognition. Each tribe has its own unique history and culture (U.S. Environmental Protection Agency 2009). The process of federal recognition is complex, expensive, and can last many decades.

Federally recognized tribes have a legal relationship with the United States government and its agencies unlike that of any other group of Americans. This relationship is based in large part on the recognition of tribes as sovereign nations in the United States Constitution. This relationship is furthered in historic treaties that the federal government signed with Indian tribes, which acknowledged and recognized the tribes' inherent sovereignty as nations. Therefore, the relationship between the federal government and federally recognized Indian tribes is a political one, based on this historic and evolving relationship between sovereign governments, and not on the ethnicity of Native Americans (U.S. Environmental Protection Agency 2009).

Government-to-Government Relations

Federal recognition of a tribe signifies the obligation of federal entities to conduct dealings with that tribe's leadership in a government-to-government relationship. This means that federal officials should be aware that each tribe is a distinct sovereign, separate from the federal government and separate from the states (U.S. Environmental Protection Agency 2009). Before Europeans first sailed to America, tribes were already sovereign; they conducted their own affairs and depended upon no other source of governmental power. American Indian tribes, some removed to reservations, retain inherent sovereignty. The United States did not grant tribal rights; rather, tribes reserved such rights as part of their pre-existing status as sovereign nations (U.S. Department of Energy 2000).

However, tribal sovereignty is not absolute; it has been challenged, defined, and fought over throughout United States history (U.S. Department of Energy 2000). The Constitution made scarce mention of tribes, but the Commerce clause declared commerce with Indian tribes a national affair to be regulated by the federal government (Czech 1995), thereby creating one of the earliest formal dealings in the government-to-government relationship. Since the 1970s, United States Presidents have consistently reaffirmed the primacy of the government-to-government relationship. Executive Order 13175 (65 Fed. Reg. 67249), "Consultation and Coordination with Tribal Governments," specifically states that each federal agency must ensure that it operates within a government-to-government relationship with federally recognized tribes. It also states that agencies should consult with tribal governments before taking action that affects tribal lands, resources, and tribal members. The Department of the Interior is committed to fulfilling its Tribal government-to-government relationship, embodied by consultation and coordination between designated tribal representatives and designated federal representatives on issues that have tribal implications (Department of Interior Policy on Consultation with Indian Tribes).

Non-Federally Recognized Tribes

Legally, there is a distinction between Indian tribes that are federally and non-federally recognized tribes. Non-recognized tribes do not have a government-to-government relationship with the federal government and its agencies, are generally ineligible for the federal services and assistance that federally recognized tribes receive, and do not hold the same legal rights as federally recognized tribes. They may, however, be recognized by states and be eligible for state programs (U.S. Environmental Protection Agency 2009). Federal recognition of tribes should not be a barrier for the NPS in forming relationships and mutual trust that may lead to TEK projects and culturally sensitive wildlife research; however, there might be differences in formal processes.

The Relationship between the NPS and Tribal Nations

The mission of the NPS is to preserve unimpaired the natural and cultural resources and values of NPS for the enjoyment, education, and inspiration of this and future generations (National Park Service 2006). The NPS cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world. As a federal agency, the NPS has a unique relationship with American Indians, Alaska Natives, and Native Hawaiians relative to any other groups in the United States (American Indian Liaison Office, National Park Service 2006). This relationship is founded in law and strengthened by a shared commitment to the stewardship of land and resources. The formal legal relationship between the NPS and American Indians, Alaska Natives, and Native Hawaiians is augmented by the historical, cultural, and spiritual relationships that these groups have with park lands, sites, vistas, and resources; they are their ancestral homelands and important resources in maintaining cultural identity (American Indian Liaison Office, National Park Service 2006).

In 2004, six units of the NPS were on, or contained trust land, one national park had been designated as Indian Country by Congress, twelve park units were on Indian reservations but did not contain trust land, and thirteen park units in Alaska contained land belonging to twenty-eight Alaska Native groups (King 2007; Wolfley 2016). In some regions, agreements have been made where the NPS parks operate through a lease. For example, landowners of American Samoa in conjunction with the American Samoa Government developed a compromise with the United States that allows lease of lands for the National Park of American Samoa. The Government of American Samoa, individuals and families of several villages maintain ownership of the lands (P.L. 100-571; P.L. 107-336).

The NPS pursues open, collaborative relationships with American Indians, Alaska Natives, and Native Hawaiians to support cultural and traditional practices and enhance NPS's understanding of the history and significance of sites and resources that are now in national parks. The following quotes further describe the relationship between the NPS and tribes:

> *"Within the constraints of legal authority and its duty to protect park resources, the Service will work with tribal governments to provide access to park resources and places that are essential for the continuation of traditional American Indian cultural or religious practices" (American Indian Liaison Office, National Park Service 2006. p. 2-3).*

> *"NPS will develop and implement its programs in a manner that reflects knowledge of and respect for the cultures of American Indian tribes or groups with demonstrated ancestral ties to particular resources in parks. Evidence of such ties will be established through systematic archeological or anthropological studies, including ethnographic oral history and ethnohistory studies or a combination of these sources" American Indian Liaison Office, National Park Service 2006, p. 5).*

History of the Relationship between Tribes and the Federal Government

To understand the present relationship between the tribes and the Federal government, it helps to understand some of the history of their relations. Federal policies have impacted American Indian communities such that, in some cases, they interpret their current experiences through a lens of

historical events (Ramos and Williams-Claussen 2016). Further, NPS policy has mirrored the tides of federal Indian policy. For example, the early Yellowstone model followed creating uninhabited wilderness, Indian removal, restriction of tribal hunting and subsistence gathering, and viewing Native Americans as visitors as opposed to inhabitants of their ancestral lands (King 2007). This section is intended to provide context and understanding of the major eras in Federal Indian Law as a brief synopsis of federal policy toward Indian nations. A helpful resource is "Cases and materials on Federal Indian Law" by Getches et al. (2005). We have used the timeframes from Getches et al. (2005) for each era; other resources may use slightly different dates. A detailed review of wildlife law as it applies to tribes is beyond the scope of this document; a helpful resource is "The Evolution of National Wildlife Law" by Bean and Rowland (1997).

The Formative Years: Treaty Making, Removal and Reservations (1789-1871)

Treaty Making

Treaties, the U.S. Constitution, and Supreme Court decisions form the foundation of federal Indian law and shape the federal-tribal relationship. During the framing of the Constitution, tribes were generally viewed as threats, and Hamilton's Federalist Paper No. 80 proposed that Indians be viewed as natural enemies of the new union (Czech 1995). Treaty-making occurred between European powers and tribes and, after the American Revolution, the United States followed suit. Treaties established the earliest pattern of legal and political interaction between the U.S. government and Indian tribes. In 1778, the United States signed its first treaty with an Indian tribe, the Delaware Indians. In 1871, when the treaty-making era formally ended, the U.S. had signed more than 350 treaties with Indian tribes. Even after 1871, there were many written agreements between tribes and the United States, which functioned like treaties (Czech 1995).

Native Americans ceded much of their lands and waters to the United States in the nineteenth century, after battles or under threat of war, as European settlers moved westward and displaced tribes from their lands. Federal officials drafted the agreements and tribal representatives rarely were given accurate or complete information as to what they were signing. The treaties reserved to the tribes certain rights, such as hunting and fishing, both on the lands they retained and the lands they ceded (Bean and Rowland 1997).

Removal

In what is now called the Marshall Trilogy from John Marshall's Supreme Court, the relationship between tribes and the United States government was more defined. In *Johnson versus McIntosh* (1823) and *Cherokee Nation versus Georgia* (1831), Marshall reduced Indian status, appeasing proponents of states' rights and Andrew Jackson's administration. Johnson v McIntosh determined that the United States had the right of pre-emption for land sales from tribes. In *Cherokee Nation versus Georgia*, tribes were determined to be "domestic dependent nations," which made the tribes subservient to the United States. Then in *Worcester versus Georgia* (1832), Marshall indicated that the Indians' status had been lowered enough and that tribal sovereignty would not be further diminished. In this case, tribes were determined to have weaker power than the United States, yet a right to self-government. Although many future lawmakers and judges would interpret the language of these cases, two things were evident: (1) tribes were sovereign to an extent and (2) the federal

government is their superior, not states (Czech 1995). States could not impose their laws on tribal lands and the federal-tribal relationship was reaffirmed.

With the passing of the Indian Removal Act in 1830, many tribes were removed from their eastern homelands to lands west of the Mississippi River, especially into the area known as Indian Territory, which is now the State of Oklahoma. These mass removals included the "Trail of Tears," a long journey traveled primarily on foot by the Cherokee, Choctaw, Creek, Chickasaw, and Seminole, during which many died (U.S. Environmental Protection Agency 2009).

Reservations

Removal policies gave way to the reservation system. Numerous treaties and other written agreements were made that required tribes to relocate to distant territories, or confined them to smaller areas that were "reserved" portions of the tribes' ancestral territories. Reservations were created by treaties, statutes, and executive orders (U.S. Environmental Protection Agency 2009). Nearly all treaties promised a permanent land base, as well as food, clothing, and services to be provided by the federal government (Wolfley 2016).

The Allotment and Assimilation Era (1871-1928)

The signing of treaties ceased in 1871, due to conflicts between the Senate and the House. A new policy was formed: assimilation. The General Allotment Act, also known as the "Dawes Act," was passed in 1887 and caused more damage to the Indian land base than any other event. Reservation lands were surveyed and individual parcels, or "allotments," were assigned to tribal members. After tribal members received their allotments, the remaining reservation land was declared "surplus" and opened to non-Indian settlement. As a result of allotment policies, by 1934 Indian tribes had lost 90 million of their 138 million acres of reservation lands. The Dawes Act was legitimized in an overwhelming way with *Lone Wolf versus Hitchcock* (1903). The Court established the concept of Congressional "plenary power" over tribes to legitimize a land grab in Oklahoma that Bureau of Indian Affairs (BIA) officials admitted was fraudulent. *Lone Wolf* thus allowed for wholesale treaty abrogation and also is the explicit origin of the "trust doctrine," with tribes classified as "wards" of the federal government. This era was also characterized by government-sponsored efforts to assimilate Native Americans into mainstream American society. In 1924, United States citizenship was granted to all Native Americans. Many Native American children were forcefully sent to boarding schools, separating them from their families and tribal communities. These schools had policies prohibiting the use of tribal languages, tribal dress, and traditional practices. Assimilation came to an end with the New Deal, but not before it had devastated tribal cultures (Czech 1995; Getches et al. 2005).

The Reorganization Policy (1928-1945)

The next phase of the federal government's policy toward Indians supported the reorganization of Indian tribes. The Indian Reorganization Act (IRA) of 1934 ended the allotment of reservations and reaffirmed that tribal governments had inherent powers. The Act also provided a mechanism for the standardization of tribal government through written constitutions and charters for tribes that would agree to federal oversight (U.S. Environmental Protection Agency 2009). Rebuilding under the IRA would also make tribes more conversant with the United States government. Indian Affairs were

shelved during World War II, along with many issues on the national agenda. After the war, there was a concerted effort to end tribal sovereignty, which was a critical period for wildlife conservation on tribal lands (Czech 1995).

The Termination Era (1945-1961)

In 1953, Joint Resolution 108 ordered the ceasing of wardship of Indian tribes by the United States government, terminating federal recognition of many Indian tribes (U.S. Environmental Protection Agency 2009). This meant that those tribes would no longer be recognized as distinct political entities (Getches et al. 2005). The intent was to promote the assimilation of Indians. In some cases, termination led to a loss of federal services and resources (U.S. Environmental Protection Agency 2009). During this era, Public Law 280 authorized some states to take criminal and civil jurisdiction in Indian Country (Getches et al. 2005).

The Self-Determination Era (1961-present)

In the late 1960s and early 1970s, federal Indian policy began to support the concept of Indian self-determination (U.S. Environmental Protection Agency 2009). The Indian Self-Determination and Education Assistance Act of 1975 was initiated by President Nixon and signed by President Ford. Contracts between the tribes and the BIA created tribally managed and funded programs (Czech 1995), which strengthened support for tribal governments and reaffirmed federal acknowledgment of tribal sovereignty (U.S. Environmental Protection Agency 2009). Many of these contracts, through Public Law 93-638, were instrumental in building tribal wildlife programs. As an example of tribal-federal relations in wildlife, in 1983, *New Mexico versus Mescalero Apache Tribe* determined that state wildlife jurisdiction and hunting license fees could not be applied on a reservation with an active tribal wildlife management program. Furthermore, the language in Mescalero reflected a strong sense of federal-Indian cooperation in wildlife management. This is logically interpreted as upholding tribal wildlife jurisdiction, but it could also be interpreted to support an increased role of the federal government in wildlife management (Czech 1995).

Chapter 2: Understanding TEK

Defining TEK

Many scholars have attempted to define TEK. One of the most commonly cited definitions is, "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes 2012). Winona LaDuke, Anishinaabe author, describes TEK as "the culturally and spiritually based way in which Indigenous people relate to their ecosystems. This knowledge is founded on spiritual-cultural instructions from time immemorial and on generations of careful observation within an ecosystem" (McGregor 2004, p. 393-394). The National Congress of American Indians, in the Resolution #PDX-11-036, Traditional Ecological Knowledge and Climate Change, writes, "American Indians/Alaska Natives are entrusted by our ancestors with traditional ecological knowledge (TEK) that has been an accumulation of centuries of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission." A group of scholars and researchers in the NPS have developed a working definition of TEK:

> [TEK] refers to the on-going accumulation of knowledge, practice and belief about relationships between living beings in a specific ecosystem that is acquired by indigenous people over hundreds or thousands of years through direct contact with the environment, handed down through generations by cultural transmission, and used for life-sustaining ways. This knowledge includes the relationships between people, plants, animals, natural phenomena, landscapes, and timing of events that are used for activities such as hunting, fishing, trapping, agriculture, and forestry. It encompasses the world view of indigenous people, which includes ecology, spirituality, human and animal relationships, and more. TEK is also called by other names, including but not limited to Indigenous Knowledge or Native Science (Appendix A, p. A-1).

Although there is often a desire to determine one definition for TEK that is applicable in every situation, it is difficult to form consensus. Therefore, some scholars suggest that instead of striving for such a definition, perhaps researchers should explore the role that the concept of TEK plays in facilitating or discouraging cross-cultural collaboration, such as in relationships between federal agencies and tribes. TEK can be viewed as a collaborative concept that serves to unite diverse populations to continually learn from one another about philosophies of knowledge, how various approaches can be blended together to better steward natural resources and adapt to climate change. Instead of focusing on defining TEK, researchers could focus on creating long-term processes that allow the variety of implications and approaches to be considered (Whyte 2013).

Many researchers use phrases such as "TEK and Western science" or "TEK and science;" however, it should be noted that some scholars and Indigenous communities consider TEK a branch of Indigenous, or Native, Science, as well as Western Ecological Science. To some people, TEK *is* science and use of the phrase "TEK and science" may connote that one is science and the other is not (Ramos 2016). In this document, we use "TEK" and "WEK" to facilitate transmission of information

and ideas in equitable terminology. "WEK" in this document means "Western science" and is used where the term "Western science" might be used.

There are coarse differences between TEK and WEK. For example, TEK tends to include spirituality in relationships with the environment while WEK tends to exclude spirituality. However, it can also be helpful to consider where there is overlap. In both paradigms, ecosystems are considered dynamic, and disturbance, including some level of anthropogenic use, is known to have an important role in ecosystem processes. Concepts such as landscape management and fields such as Conservation Biology have been developed in efforts toward more holistic approaches to natural resources management.

Validation of TEK

Much of the research that has included a TEK component has been subjected to validation through a Western process. That the validity or accuracy of one knowledge system must be confirmed by another raises issues over the equity of such an approach. Many authors suggest that the primacy of Western science is justified by the record of Western science in empirical, real-world problem solving (Gilchrist et al. 2005) and some researchers have worked with Indigenous communities who supported the validation approach (Gratani et al. 2011). However, others warn against the unilateral validation of TEK via a Western paradigm because it might be disempowering and disrespectful for local communities (Brook and McLachlan 2005). For others, however, Indigenous knowledge systems need no validation by Western knowledge systems because they have proved their validity by supporting communities for thousands of years (Michell 2005). Some Indigenous communities even believe their own science to be superior to Western science (Williams 2009).

TEK as Conceptualized by Indigenous Peoples

TEK is sometimes viewed as a source of knowledge about the environment that may be useful to broader society; in that view, TEK is a noun, something whose boundaries can be readily delineated and packaged for general consumption. Non-Indigenous views of TEK are often concerned with what the knowledge consists of and how it is transmitted. Yet to Indigenous peoples, TEK is an entire worldview, not merely information and data. TEK is a mixture of knowledge, beliefs, and practices operating in an iterative and holistic system that emerges over time, across generations. Indigenous communities often build a holistic understanding by monitoring many variables over a long period of time, accumulating a large amount of qualitative data, and building a mental model of healthy animals and their environment. This holistic picture can be used to assess change, without reducing the observed world into discrete, quantifiable variables (Berkes 2012).

Some Indigenous peoples have never heard the term "TEK," as it is derived from academia (Ramos and Williams-Claussen 2016). Indigenous scholars have described TEK with an action-oriented framework and as a way of life. One *does and lives* TEK; it is not limited to a "body of knowledge" (McGregor 2004). Indigenous understandings tend to focus on relationships between knowledge, people, and all of Creation (the "natural" world as well as the spiritual). Traditional knowledge is viewed as the process of participating fully and responsibly in such relationships (McGregor 2005; Pierotti 2010). In the Yurok culture, the relationship between Yurok and TEK can be conceptualized as a "system." For an all-encompassing philosophical framework for natural resources management,

Yurok language speakers developed the phrase *Hlkelonah ue meygeytohl*, translated as "To take care of the earth." This phrase encompasses ceremonial and spiritual practices as well as physical management and conservation, with physical and spiritual management being conducted in tandem (Ramos and Williams-Claussen 2016). In tribal communities, deep content expertise, local field knowledge, knowledge of spiritual traditions, and ethical knowledge are embodied in TEK holders (Reo 2011).

It is important to remember that culture is part of the broader framework of TEK and should be considered when interacting with Indigenous peoples (Ramos 2016). Culture could be described as "the way of life" of a people and includes a vast array of behaviors and beliefs, which can differ greatly from culture to culture. Factors include, but are not limited to (U.S. Environmental Protection Agency 2009):

- History, from a tribe's own perspective.
- Traditional values and attitudes, including the tribe's relationship with its homelands and social etiquette.
- Spirituality, such as ceremonies, rituals, sacred objects and places, and beliefs.
- Societal structure, including bands, clans and other kinship relations, gender roles, and the position of elders and children within the tribe.
- Governmental structures, protocols and laws, including traditional laws and westernized models.
- Language, which includes spoken, written, and non-verbal communications.

For many Indigenous peoples, spirituality is a fundamental element of TEK. Purely ecological aspects of tradition cannot be separated from the social and spiritual; stories and legends are part of culture and Indigenous knowledge because they signify meaning and values that are rooted in the land (Berkes 2012; Ramos and Williams-Claussen 2016). A strong respect for spirituality (whether traditional, Christian, or a combination of both) is common among tribes, and often forms a sense of group unity. Spiritual practices are often deeply ingrained in day-to-day living. For example, many tribes conduct meetings with traditional opening and closing ceremonies, which may be in the form of prayer. Specific practices such as ceremonies, prayers and religious protocols vary among tribes. For centuries after European contact, practitioners of traditional Native American religions were often persecuted and, as a result, ceremonies were practiced in secret (Ramos and Williams-Claussen 2016; U.S. Environmental Protection Agency 2009).

Relationships Between Indigenous Peoples and Animals

There are many differences between Indigenous and Western-derived wildlife management and stewardship that are important to be aware of when discussing issues with tribal peoples. Understanding the worldview of how indigenous peoples conceptualize TEK and relate to wildlife is important to find common ground in management. As an example of such relationships, in the Yurok culture, there is no direct language translation or equivalent concept of "wildlife." Animals are

considered to be people, providing teachings through stories and being represented as spiritual beings in ceremonies meant to balance the world (Ramos and Williams-Claussen 2016). In the Alaskan context, many terms associated with management of land and wildlife, such as "subsistence," "conservation," and "traditional use," have no counterparts in the languages or cultural practices of aboriginal peoples (Morrow and Hensel 1992).

Some models, such as that of preservationist, include the ideas that nature's value is a function of its degree of independence from humanity. In the preservationist lens, nature loses much of its essential character when considerably modified by humans. Respect for nature involves preservation of wilderness areas, free from significant human influence. However, such views make it difficult to envision a positive role for humans in nature and fail to provide guidance for how humans should treat nature. Some scholars argue that an adequate environmental philosophy must allow for the possibility of respectful use of nature (Hettinger 2005). For many, if not most tribes, a fundamental component of TEK is the use, such as hunting for food and ceremony, of resources in a sustainable manner. There is a dearth of peer-reviewed publications regarding TEK and wildlife conservation in the contiguous United States or that focus on the differences between Indigenous and Western-derived wildlife management; therefore, the examples provided here are from only a few sources.

To the Cree, the proper conservation of game includes the hunting and eating of animals. The preservationist ethic is not compatible with Cree conservation: "When you don't use a resource, you lose respect for it" (Berkes 2012). The Cree do not consider the killing of game as an act of violence. The hunter loves the animals he kills, as they sustain his family. The animals can only be hunted if they agree to be hunted. However, the Cree also understand that the principle of continued use has to be tempered with common sense and good management. The "manager," in the Cree system, is the senior hunter, called the tallyman. The senior hunter is the observer of nature, the interpreter of observations, the decision-maker in resource management, and the enforcer of rules of proper hunting conduct. It is the steward's obligation to expose when someone has violated the hunting customs and can shame them publicly, using the example to remind everyone else of the rules (Berkes 2012). Similarly, the Yurok take animals for food and ceremonial regalia (Ramos and Williams-Claussen 2016), but prior to European settlement and subsequent impacts on tribal peoples, they and many other California tribes devoted much effort to actively managing the landscape so that its ability to provide resources, such as wildlife, was maximized (Anderson 2005). Today, the Yurok strive to balance wildlife management with cultural needs (Ramos and Williams-Claussen 2016). The field of TEK can illuminate worldviews and cultural protocols surrounding hunting by Indigenous peoples.

Where some hunting management programs are primarily designed to meet the demand for non-subsistence hunters, management approaches for native subsistence and ceremonial hunting are designed to meet a tribe's community needs. Maximizing individual opportunity is an irrelevant concept in subsistence and ceremonial hunting (McCorquodale 1997; Reo and Whyte 2012). Tribal community needs for big game meat occur throughout the year, and sometimes unpredictably, such as in funerals. Within the culture of Washington's Yakama tribe, designated hunters responsible to provide subsistence or ceremonial meat represent a small fraction of the community and hunt as a

form of public service, not personal pursuit. The regulatory approach and bag limits of recreational hunting programs could not be applied to manage native subsistence and ceremonial hunting without significant detriment to tribal cultures (McCorquodale 1997). Further, programs, such as the Traditional Foods Movement and the Native Diabetes Wellness Program, have been supported by the Centers for Disease Control and Prevention to promote the connection between the consumption of traditional foods and health of Indigenous peoples. Through these initiatives, some tribes are working toward restoring fishing and hunting techniques (Centers for Disease Control and Prevention 2014).

Hunting of designated species within NPS units is only permitted when it is specifically authorized by statute (National Park Service 2006). Changes in some hunting policies within NPS would require congressional action; however, an understanding of some of the differences in hunting paradigms will benefit those who work with tribes. Hunting and fishing were such central elements of tribal cultural identity that the retention of hunting and fishing rights was the primary tribal concern expressed during treaty negotiations; tribal leaders insisted on the federal government's assurance that tribal subsistence hunting and fishing, the foundation of their society, would be protected in perpetuity. Although tribes have adapted to a world vastly different than that known by their ancestors, many have rejected the doctrine of assimilation, viewing complete assimilation as cultural annihilation. Subsistence hunting and fishing remain central features of contemporary tribal life in many cultures (McCorquodale 1997; Reo 2011); therefore, there are strong sentiments among Indigenous peoples who are not allowed to use resources from lands under NPS jurisdiction. It is important to be cognizant of a tribe's willingness - or lack thereof - to share information regarding resources that they are not able to legally obtain but that might be present on their ancestral lands, currently under NPS jurisdiction.

TEK Research in Wildlife Conservation and Management

Use of both Indigenous and Western science can enhance restoration efforts and a focus on culturally sensitive approaches to TEK research can bring the cultural context of tribes forward. For example, Federal and state agencies in Alaska worked with Native communities during the 1989 Exxon Valdez oil spill. TEK of local communities included historic population sizes and ranges of many species that were impacted by the oil spill. Other knowledge included diet, behavior, and relationships between injured species (Rinkevich et al. 2011). TEK and WEK were also used together to justify listing the polar bear (*Ursus maritimus*) as threatened under the Endangered Species Act, as Chukotka, Inuit and other Indigenous communities noted climate-related changes in the Arctic were negatively impacting polar bears (Rinkevich et al. 2011). However, in Canada, there have been restrictions on hunting this species that is culturally significant to Indigenous communities such as the Inuit. In co-management regimes, the Indigenous perspectives of the human-polar bear relationship are often poorly understood and have been undervalued (Dowsley and Wenzel 2008). Therefore, managers and tribal scientists were encouraged to begin a cross-cultural dialogue in building more understanding of the cultural relationship with polar bears in an effort to facilitate co-management (Dowsley and Wenzel 2008). Ramos and Culver (2016) conducted a wildlife survey with the Yurok Tribe where the Yurok worldview of TEK and the relationship with wildlife were used as cultural context in the research design. Use of noninvasive survey methods and adherence to

cultural protocols in the field as directed by the Yurok Culture Committee exemplified a culturally sensitive approach to obtaining information important to the management of natural resources.

TEK monitoring systems often assess some of the same environmental variables as Western science, such as breeding success (e.g., number of young per nest). Most traditional monitoring methods (as opposed to some contemporary management structures some tribes must operate for economic purposes) used by Indigenous peoples are rapid, low cost, and easily comprehensible assessments made by harvesters themselves (Berkes 2012). An NPS example of using TEK in wildlife management involves Huna Tlingit glaucous-winged gull (*Larus glaucescens*) egg harvests in Glacier Bay National Park. The researchers initiated their study at the request of the Park administration and the Hoonah Indian Association. The Huna leaders had specified the resolution of the gull egg harvest issue as their highest priority, and the Park agreed to fund the study as a first step in a joint effort to improve the historically strained relationship between the two parties. The Hunas asked why they weren't allowed to harvest gull eggs in their traditional homeland, when their traditional practice has ensured a sustainable harvest for centuries and has not caused noticeable harm to the bird populations in Glacier Bay. Conversely, the Park administration asked how they would be able to allow a harvest that was perceived to be destructive in the pristine ecosystem of Glacier Bay, which they are legally bound to manage. The research team documented the historical and contemporary methods and significance of gull egg harvests by Huna people. The Huna community had developed a traditional resource management system - a likely sustainable harvest of eggs - informed by empirical observation of gull breeding habits, and transmitted from generation to generation through explicit instruction (Sepez and Lazrus 2005). Results from the study contributed to the passing of the Huna Tlingit Traditional Gull Egg Use Act in 2014 (Pub.L. 113-142), authorizing the Hoonah Indian Association to harvest glaucous-winged gull eggs from Glacier Bay National Park twice a year from up to five locations.

Although access for this resource has been granted, climate change has been identified as a potential impact on the distribution of gull nesting sites. Sepez and Lazrus (2005) investigated the potential impact of the traditional harvest regime on the Marble Island glaucous-winged gull colonies in Glacier Bay. It was found that several colonies of gulls noted as of historical significance to the Huna no longer support nesting gulls, while new colonies have been established in areas more recently freed from retreating glaciers. Vegetational succession subsequent to glacial retreat has changed the gull habitat structure and may have led to some areas being abandoned by the birds, thus reducing access to the Indigenous community in ancestral lands. Park staff has worked with the Huna community since the completion of the study to help arrange the harvest of gull eggs at a small colony outside of the Park, which has allowed elders and young people from the community to experience the subsistence practice without fear of arrest for the first time in decades (Sepez and Lazrus 2005).

Challenges in the Unification of TEK and WEK

Challenges to TEK access and utilization have been identified by NPS employees (Henn et al. 2010), as well as other researchers in the TEK field. In general, challenges tend to fall under four general categories: (1) Political: questions of power sharing, who defines the rules, and underlying agendas

(e.g., co-management, allocation of funding, etc.); (2) Epistemological: very different forms of knowledge, not easily merged or compared, and difficulties with interdisciplinary science; (3) Sociocultural: trust, cultural differences, communication styles, jargon, social discourse, and intellectual property rights, appropriate compensation for the knowledge shared by Indigenous peoples; and (4) Technical: institutional barriers, data standards, peer review standards, data sharing protocols, and reporting (Cronin and Ostergren 2007; Fairley 2012; K. Greenwood *pers. comm.*). In addition, TEK is expressed in a form that is vastly different from, and largely incompatible with, that of WEK. Therefore, unification is an intricate matter that has yet to be accomplished without some concerns from tribes (McGregor 2009) as well as wildlife managers. In approaches outside of Indigenous communities, thinking of TEK as a knowledge base that can be "integrated" into WEK may reinforce Western cultural biases and work against full community involvement in managing natural resources. Alternatively, it may be more beneficial to think about Indigenous and Western science as complementary paradigms and consider the role of TEK in potential facilitation of cross-cultural and cross-situational collaboration (Whyte 2013). In the continuing effort to find more appropriate terminology, some scholars have begun using "co-production" of knowledge (K. Greenwood, pers. comm.).

Both Indigenous and Western-trained biologists have expressed opinions regarding the more intrinsic reasons for the lack of integration of TEK and WEK. These range from vague uneasiness to racist explosions of distrust to thoughtful argument. These sentiments can be rooted in inertia, inflexibility, lack of awareness and understanding, and power dynamics between people with differing political agendas and relationships to natural resources. Inertia is a general resistance to change because it disrupts the familiar: working within an established paradigm is simpler than adapting to a new one. Inflexibility means a resistance specifically to TEK and the changes required by its use. It relies on more subtle arguments, questioning the existence and efficacy of TEK, or expressing concern about ''political correctness'' replacing scientific rigor. Western-trained biologists sometimes view Indigenous peoples' insistence on the use of TEK with suspicion; some have even expressed that TEK is simply a political ploy invented by Indigenous peoples to gain control of wildlife from "qualified" scientific managers. Such resistance may be due to concerns about funding priorities, power over management decisions, and an unwillingness to work with non-"scientists," Indigenous or otherwise (Huntington 2000; Nadasdy 1999). Some Indigenous peoples feel that many Western-trained biologists do not have sincere intentions of trying to unify TEK and WEK, but are merely paying lip service to the idea because it has become politically expedient (Nadasdy 1999).

Another challenge is that many projects initiated and maintained by non-Indigenous interests do not obtain sufficient Indigenous input during the proposal and project planning stages. Upon the invitation for Indigenous peoples to participate, the project framework has often already been constructed around a Western worldview, with little room for Indigenous modification (McGregor 2009; Nadasdy 1999). There can exist a general distrust of and resistance to WEK in Indigenous communities, and the lack of involvement in research design can escalate opposition.

Sometimes terminology can be interpreted differently, leading to challenges in the way people communicate. While terms may seem straightforward, they can mask deep cultural differences and

can lead to serious misunderstandings and biases in favor of Western-trained managers by restricting the ways in which discussions (and thinking) occur about these issues (Morrow and Hensel 1992). For example, "natural," as in "natural conditions," is often used in natural resource management language and might be problematic because it often implies a landscape without human influence. Although U.S. policies are often derived from this notion, much of the "wilderness" encountered by European settlers in North America was actively managed in varying degrees by Indigenous peoples (Anderson 2005; Berkes 2012). For example, NPS Management Policies (2006) 4.4.2 "Management of Native Plants and Animals" reads, "Whenever possible, natural processes will be relied upon to maintain native plant and animal species and influence natural fluctuations in populations of these species." Although tribes are acknowledged as having been historically present on the landscape, their active management may not be a consideration of "natural conditions." For many Indigenous peoples, the distinction between nature and culture is meaningless; maintenance of "natural conditions" generally involves active management and use of natural resources (Anderson 2005; Berkes 2012). Conservation that is based on removal of humans to preserve wilderness is questionable through the lens of TEK (Berkes 2012).

Conflict between Indigenous and Western paradigms are similar outside of the United States and can result directly from laws and policies. For example, the Maori conservation ethic of sustainable utilization conflicts with New Zealand's 1987 Conservation Act, which stipulates "preservation" and "setting aside of land" to meet conservation objectives. The issue is not solely political jurisdiction of land, but from the Maori perspective, the unacceptable notion of conservation driven by the Western concept of a human-nature dichotomy. Such a dichotomy "only serves to further alienate all humans, particularly Maori, from their land, and thus from their stewardship responsibilities" (Roberts et al. 1995). Therefore, one major issue in using both TEK and WEK in wildlife conservation is the political drive to maintain a "preservation" model and meet NPS policies while having potential areas of ethical differences in how to manage resources. In some cases, it may be possible to conduct ethnographic research in a culturally appropriate manner but impossible to implement management actions developed from the research, due to NPS policies. Some tribes might be reluctant to share TEK with NPS if they do not see how their knowledge can be used effectively.

Many national and international programs incorporate Indigenous values and knowledge; in some cases, there is a legal obligation to do so. This has resulted in the creation of a "TEK industry," often generating material to be used as mandated (Berkes 2012). The concept of TEK has become compartmentalized in these processes, such as environmental assessment, in a way that corresponds to divisions that exist in Western scientific resource management (Berkes 2012; Nadasdy 1999). Western-trained scientists tend to be interested only in certain kinds of information; not all that TEK has to offer is considered relevant, a process called "distillation" (Nadasdy 1999), that has resulted in misapplications. This approach can cause the uniting of the two knowledge systems to be reduced to the technical exercise of combining sets of "data," taking TEK out of cultural context. The management system into which this new "integrated" knowledge" is supplanted usually remains essentially unchanged and fundamentally different from Indigenous paradigms (Berkes 2012). Some Indigenous communities view this approach as resembling assimilation because it reflects a

reductionist attitude by representing Indigenous knowledge as a catalogue of facts, some of which may be deemed useful for integration into Western knowledge systems.

Wildlife science is one of the newest sciences, established in 1933 with the efforts of Aldo Leopold (Krausman 2002). Wildlife management in North America has a long history as an established discipline in applied science and has been formally institutionalized through complex bureaucracies. These systems have long been the exclusive domain of Western-trained scientists and resource managers who have deep personal investment in scientific management as a profession. Therefore, some who have been introduced to TEK tend to view it (at best) as a supplementary body of information that does not threaten the fundamental assumptions of wildlife management itself. This is evident from the rhetoric about "incorporating" TEK "into" the management process, which assumes that the value of TEK lies in its use by wildlife managers (Nadasdy 1999). In TEK studies relating to wildlife, the stories, beliefs and values that inform Indigenous peoples' worldview and specify the proper relationship between Indigenous communities and animals often remain unacknowledged (Nadasdy 1999; Pierotti 2010). This may be due to the novelty of TEK in the Western wildlife profession, denoting areas where understanding and growth may occur by considering the cultural contexts of TEK and, thus, working toward cultural sensitivity. This natural resources report and other products by NPS Cultural Resources staff (see Appendix A) exemplify openness by the NPS to explore TEK broadly and holistically.

Even though much of the literature emphasizes the holistic nature of TEK, the general focus on individual species in TEK research presents a challenge because it does not conform to the views of Indigenous peoples, but to the needs and specifications of the scientists and government officials who are managing these populations in an established institutionalized setting. The problem with these approaches is that they ignore different "ways of knowing" and the cultural processes in which they operate (Nadasdy 1999). This is generally not what Indigenous peoples envision when sharing their lives, knowledge, and values with others (McGregor 2004; Nadasdy 1999). For Indigenous peoples this issue presents a dilemma: they wish to share knowledge, but it has to be protected to avoid exploitation (McGregor 2004).

Other challenges have stemmed from the perception that the degree by which people are engaged in their culture, or "cultural intactness," may be eroding (Striplen and DeWeerdt 2002). For example, in a study conducted among the Salishan peoples in the early 1990s about the reintroduction of wolves into northern Washington, people over sixty years of age indicated fondness for wolves and felt a sense of connection to them. People between thirty and sixty indicated indifference but felt that wolves were potentially harmful. People under thirty feared wolves and indicated that they disliked these animals (Periotti 2010). Some believe that TEK may have existed at one time but drastic changes in lifestyles of Indigenous peoples, some due to socioeconomic changes outside of their control, have eroded TEK to the point that it effectively no longer exists (Nadasdy1999; Arunotai 2006). Some scholars have interpreted this as a loss of values. However, definitions of culture and the significance of loss are increasingly debated in legal contexts (Kirsch 2001). Further, some Indigenous peoples believe that knowledge is not lost but will reveal itself again at the proper time to the proper person(s) (K. Greenwood, *pers. comm*.).

Access to and learning of TEK information also can be problematic (Nadasdy 1999) because TEK is rarely written down and must, in most cases, be documented as a project on its own prior to its use with another scientific undertaking. This formidable goal involves the need to use social science methods to gather biological data, so that TEK research and application becomes a multidisciplinary undertaking. Many wildlife biologists are unfamiliar with social science methods and may also be uncomfortable in cross-cultural interactions. Further, the holders of TEK are sometimes reluctant to share information, and issues of ownership and control over use of TEK sometimes arise (Huntington 2000). Thus, while there are many benefits of including TEK in wildlife conservation work, TEK should not be entered into lightly; rather, guidance and partnerships with expert TEK practitioners and NPS ethnographers should be sought (see Appendix A for key NPS contacts).

Chapter 3: Potential Ways for NPS to Include TEK

Partnerships and Collaborative Conservation

In the United States, a combination of public pressure, political realities and genuine scientific inquisitiveness has resulted in a growing interest in TEK research by many natural resources agencies (Sepez and Lazrus 2005). Opportunities to create collaborative partnerships between WEK-based agencies and Tribes may offer fruitful paths in conservation. However, some scholars advocate that Indigenous peoples must be full participants and co-managers (Alcorn 1993), at least in practice if there are no formal agreements. See the NPS TEK fact sheet for additional information on NPS partnerships with tribes (Appendix A).

A potential area for partnerships between the NPS and Tribes in TEK projects is the recent modification in NPS regulations governing the gathering of plants in national parks. The NPS issued a rule change, effective August 11, 2016, to allow legal procedures for members of federally recognized Tribes to gather and remove plants or plant parts for traditional purposes. The rule (81 FR 45024) explicitly mentions TEK and supports the concepts described in this document.

Additional NPS policies supporting TEK are provided below:

NPS Management Policies (2006), section 4.1.4 states,

"The Service will pursue opportunities to improve natural resource management within parks and across administrative boundaries by pursuing cooperative conservation with public agencies, appropriate representatives of American Indian tribes and other traditionally associated peoples, and private landowners in accordance with Executive Order 13352 (Facilitation of Cooperative Conservation). The Service recognizes that cooperation with other land and resource managers can accomplish ecosystem stability and other resource management objectives when the best efforts of a single manager might fail. Therefore, the Service will develop agreements with federal, tribal, state, and local governments and organizations; foreign governments and organizations; and private landowners, when appropriate, to coordinate plant, animal, water, and other natural resource management activities in ways that maintain and protect park resources and values. Such cooperation may include park restoration activities, research on park natural resources, and the management of species harvested in parks. Cooperation also may involve coordinating management activities in two or more separate areas, integrating management practices to reduce conflicts, coordinating research, sharing data and expertise, exchanging native biological resources for species management or ecosystem restoration purposes, establishing native wildlife corridors, and providing essential habitats adjacent to or across park boundaries."

Section 4.2.1 of NPS Management Policies (2006) states,

"The Service will: Identify, acquire, and interpret needed inventory, monitoring, and research, including applicable traditional knowledge, to obtain information and data that

will help park managers accomplish park management objectives provided for in law and planning documents…Use qualitative and quantitative techniques to monitor key aspects of resources and processes at regular intervals. The Service may support studies to (among other things): Understand the ceremonial and traditional resource management practices of Native Americans, subsistence uses by rural Alaska residents, and traditional uses by groups with demonstrated ties to particular natural resources of parks."

NPS Management Policies provides a section, "Cooperative Conservation Beyond Park Boundaries" (1.6), where it is recognized that parks are integral parts of larger regional environments. This section states that to support its primary concern of protecting park resources and values, the Service will work cooperatively with local and regional entities such as other federal agencies, tribal, state and local governments, and neighboring landowners. Further, "The Service will do these things because cooperative conservation activities are a vital element in establishing relationships that will benefit the parks and in fostering decisions that are sustainable. The Service will use all available tools to protect park resources and values from unacceptable impacts" (NPS Management Policies 2006, p. 13). NPS employees may ask, based on the information provided in this document, whether management of park resources to meet NPS policies has the flexibility to include traditional Indigenous management, which often means some level of anthropogenic disturbance, such as burning vegetation and take of wildlife. However, participation in or support of efforts can foster further awareness and dialogue that may identify actions compatible with both Western and Indigenous paradigms. Building partnerships with Tribes that include TEK is one way federal employees can honor the trust responsibility to tribes. Such partnerships allow for mutually beneficial relationships, especially when resources of mutual interest are concerned. Scholars with both TEK and WEK paradigms can benefit by mutual exchange of information and interpreting the information collaboratively (Appendix A; Rinkevich et al. 2011).

Below, we provide examples where NPS has developed collaborative relationships with Tribes in TEK projects:

Henn et al. (2010) conducted a survey of NPS units in the Intermountain and Pacific West Regions and found that parks have collaborated with Tribes in many TEK projects, including: (1) facilitating traditional management techniques, such as collecting native seeds for reseeding disturbed areas; (2) exploring prescribed fire in restoration and conservation; (3) inventory of cave cultural and natural resources to work toward knowledge diversity and understanding historical context in Environmental Impact Statement procedures; (4) conservation of Yellowstone bison; and (5) feasibility study of California condor reintroduction in Redwood National and State Parks.

TEK was included in the Joint Fire Science Program's (JFSP) fiscal year 2010 New Science Initiative, where JFSP partnered with the NPS, University of California, Berkely, Amah Mutsun Tribal Band, and San Francisco Estuary Institute. The project included restoration of traditional management practices in Pinnacles National Park - TEK with respect to fire ecology, culminating in a prescribed burn in areas with plants that are culturally significant to local tribes, such as the Amah Mutsun Tribal Band. TEK teaches that deergrass (*Muhlenbergia rigens*) and white root sedge (*Carex barbarae*), both used for basket making, respond favorably to anthropogenic management.

Additional culturally significant species are located in the area. The application of fire maintains healthy stands of deergrass and encourages new growth and flower stalk production (Johnson 2013).

As described above, under "TEK as Conceptualized by Indigenous Peoples," some Indigenous groups see ceremony and spirituality as essential components of TEK. While the inclusion of Indigenous spirituality as science (e.g. Native science; TEK) has not been accepted by some scholars, parks may facilitate this very integral component of TEK through partnerships and collaborations with tribes to revitalize ceremonies in parks - tribal ancestral lands. This aspect of TEK is as important to many tribes as those that may be considered natural resources science (e.g. flora and fauna use and conservation).

Traditional Cultural Properties

Traditional Cultural Properties (TCP's) are listed in the National Register. A TCP is determined to have association with cultural practices or beliefs of a living community that are (a) rooted in history and (b) maintain the continuing cultural identity of the community. In the identification of TCP's, the NPS has been directed to prepare guidelines to assist the documentation of intangible cultural resources, coordinate the incorporation of provisions for the consideration of such resources into Departmental planning documents and administrative manuals, and support the identification and documentation of such resources by State and Federal agencies. The NPS has developed guidelines to facilitate these processes (Parker and King 1998). Although the guidelines do not explicitly discuss TEK, there might be areas in the evaluation process where TEK can be included.

National Environmental Policy Act

The National Environmental Policy Act of 1969 (42 U.S.C. § 4321 et seq.; NEPA) requires the preparation of an environmental impact statement (EIS) for any proposed major federal action that may significantly affect the quality of the human environment. Under regulations issued by the Council of Environmental Quality (CEQ), 40 C.F.R. pts. 1500-1508, a federal agency may prepare an environmental assessment (EA) for use in determining whether a proposed action may result in significant impacts on the environment. If the responsible agency official determines that the proposed action will not have significant impacts, a finding no significant impact (FONSI) completes the NEPA process. If the EA does not support a FONSI, then an Environmental Impact Statement (EIS) must be prepared, unless new alternatives and/or mitigation measures are developed that will avoid significant impacts. In practice, for the vast majority of federal actions, an EA and FONSI fulfill the agency's responsibilities of NEPA compliance. While not explicitly written in NEPA, consultation under Executive Order 13175 (65 Fed. Reg. 67249) and the guidelines DOI Policy on Consultation with Indian Tribes should be followed.

TEK could be used to develop alternatives and evaluate environmental effects of a particular action. Subsistence resources, harvest practices, descriptions of migratory patterns, and species' habitat could be included in an assessment. Although the statutory language of NEPA does not mention Indian tribes, the CEQ regulations require agencies to contact tribes and provide opportunities for tribes to become involved at several steps in the preparation of an EIS, including:

Cooperating agencies – When the effects of a proposed action may occur "on a reservation," an Indian tribe, by agreement with the lead federal agency, may become a cooperating agency and have a direct role in the preparation of the EIS.

Scoping – The lead agency must invite "any affected Indian tribe" to participate in the scoping process for an EIS.

Commenting on an EIS – The lead agency must invite comments on a draft EIS from Indian tribes "when the effects may be on a reservation."

Environmental consequences – When an agency prepares an EIS for a proposed action, the analysis of environmental consequences in the EIS must include discussions of possible conflicts between the proposed action and the objectives of federal, regional, state, and local (and in the case of a reservation, Indian tribe) land use plans, polices and controls for the area concerned.

Public involvement – Whenever an agency provides public notice of a NEPA-related hearing, public meeting, or the availability of environmental documents, it shall include notice to Indian tribes "when effects may occur on reservations."

Endangered Species Act

The Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq.; ESA) was passed to protect and recover imperiled species and their ecosystems. The Federal Government, via the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, is responsible for implementing the ESA and views the conservation of endangered species as supportive of, and consistent with, the trust responsibility to Indian people (U.S. Fish and Wildlife Service; https://www.fws.gov/endangered/what-we-do/tribal-faq.html).

The ESA is nearly silent in its potential application in Indian Country (Getches et al. 2005). It provides a single subsection stating exemption from the takings prohibition for Native Alaskans and non-Native permanent residents of Alaska Native villages, if the taking is for subsistence purposes. There have been cases where Native Americans have taken endangered species and been convicted, such as when a Yankton Sioux tribal member shot four bald eagles on the Yankton Sioux reservation in South Dakota (United State v. Dion 476 U.S. 734). Due to the sovereign status of tribal governments, there is a large question as to whether the ESA applies to Indian tribes at all, which has resulted in litigation (Sanders 2007). This includes the question of whether the ESA applies to activities by Indian tribes or individuals exercising treaty rights (Wilkinson 1997).

When the ESA was passed, it posed a threat to the sovereignty and economic self-sufficiency of some tribes because if it was applied, efforts in economic development could potentially be stymied (Getches et al. 2005). Tribes were facing considerable pressure from ESA enforcement over timber harvesting, building construction, water development, and salmon harvesting (Wilkinson 1997). Many tribes perceived this as a disproportionate burden on tribal governments with severely underdeveloped reservations (Getches et al. 2005) to protect species that are in danger due to environmental impacts largely created by non-Indian development (Sanders 2007; Wilkinson 1997).

On the other hand, some tribes have used the ESA to protect resources that are important to their economic well-being and cultural survival (Getches et al. 2005).

Secretarial Order 3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act, was issued in 1997 and meant to harmonize the federal trust responsibility to tribes and the statutory missions of the Departments of the Interior and Commerce in implementing the ESA. In tribal meetings, participants concluded that the federal trust responsibility to tribes goes far beyond the ESA and includes a duty to restore tribal lands and adjacent federal lands so that tribes will be able to utilize species (Wilkinson 1997). Secretarial Order 3206 states that departments and their agencies should perform their responsibilities "in a manner that…strives to ensure that Indian tribes do not bear a disproportionate burden for the conservation of listed species, so as to avoid or minimize the potential for conflict and confrontation." Although some scholars believe Secretarial Order 3206 has not yet lived up to its full promise, it does assist federal land managers and tribal governments in building stronger working relationships in conservation efforts (Sanders 2007).

Given the intent of Secretarial Order 3206 and the goals of tribal nations, inclusion of TEK in endangered species recovery projects may provide avenues for mutually agreeable objectives. In an example of NPS and tribal collaboration for recovery of an endangered wildlife species, the NPS and the Yurok Tribe, along with the U.S. Fish and Wildlife Service and other parties, signed a Memorandum of Understanding (MOU) in 2014 to support proactive conservation efforts for the California condor (*Gymnogyps californianus*; U.S. Fish and Wildlife Service 2014). The condor has been federally listed under the Endangered Species Act since 1967 and by California state law since 1971. Although the MOU does not make any explicit statements regarding TEK, terminology such as "culturally important" seems to foster awareness and provide opportunities for inclusion of TEK. The following excerpts of the MOU demonstrate the support of NPS in culturally important species recovery programs:

> WHEREAS, the Parties recognize that condors occurred along the California North Coast region, prior to European arrival, and declined slowly after European contact until regional extirpation in the early twentieth century. *Condors are a trust species, culturally important to the Yurok People and many other Tribes in Northern California and the larger Pacific Northwest region* [emphasis added].
>
> WHEREAS, the National Park Service under the National Park Service Organic Act (16 U.S.C. 1 2 3, and 4), (39 Stat. 535) and amendments is a federal agency that "…shall promote and regulate the use of the Federal areas…which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The NPS manages lands in Redwood National Park within the historic range of the condor and is interested in participating in efforts to recover the condor.

WHEREAS, the Yurok Tribe exercises its inherent sovereignty in order to preserve, protect and restore Yurok natural resources and culture and the health and social well-being of existing and future Tribal members through its exercise of sovereign rights, culturally integrated methods and high quality scientific practices in coordination with the community and public and private agencies and organizaitons. The Yurok Tribe manages lands historically occupied by condors and is interested in participating in efforts to recover the condor.

Chapter 4: Conducting TEK Research

Consultation and Collaboration with Tribes

In Indian Country, consultation is a distinct concept under law and policy. Government-to-government consultation is different from the communication, coordination, and public-involvement efforts commonly carried out between tribal government staff members and equivalent federal agency employees. Many tribes have technical staff, legal counsel, advisors, and administrators employed to facilitate tribal affairs. These staff people generally do not speak on behalf of the tribe about tribal policies or governmental actions. However, they can be invaluable professional contacts for agency staff. Staff-to-staff work may precede government-to-government consultation or may carry out the policies agreed to in government-to-government consultations (U.S. Department of Energy 2000; Department of Interior Policy on Consultation with Indian Tribes).

Consultation is more than simply providing information about what an agency is planning to do and allowing concerned people to comment. Rather, "consultation" means that there must be two-way communication. In guidelines for federal agency historic preservation programs, the NPS defines consultation as: "the process of seeking, discussing, and considering the views of others, and, where feasible, seeking agreement with them…Consultation is built upon the exchange of ideas, not simply providing information" (National Park Service 1998, p. 20,504).

Inclusion of TEK is not required by law; however, it can be helpful to consider the cultural context and worldview of a tribe, especially in management of trust species. If one opts to initiate a TEK component for a project, it is best to develop it with tribal involvement from planning through reporting. Discussion of ongoing and planned projects with tribes when opportunities arise builds rapport and will provide a foundation of communication if requests are made to work with tribal members on TEK-related work. For additional information on advantages, see the NPS TEK fact sheet (Appendix A). Another resource that might be of interest is "Negotiating Research Relationships with Inuit Communities. A Guide for Researchers" (Inuit Tapiriit Kanatami and Nunavut Research Institute 2007).

In response to Executive Order 13175 (65 Fed. Reg. 67249), "Consultation and Coordination With Indian Tribal Governments", many agencies have developed programs and protocols to guide government officials in the consultation process. NPS policy is to consult with tribal governments on matters of mutual interest and concern. In addition, NPS is encouraged to provide staff training to improve its employees' understanding of the government-to-government relationship, trust responsibilities, and tribal culture and history (American Indian Liaison Office, National Park Service 2006). In 2011, Secretary Ken Salazar issued the most recent DOI Policy on Consultation with Indian Tribes (Department of Interior Policy on Consultation with Indian Tribes). It is beyond the scope of this document to provide a comprehensive and step-by-step guide to consultation, particularly since the mechanics vary from tribe to tribe. Guiding principles for interactions with Indigenous communities are provided in later in this chapter.

Social Science as a Route to TEK Research

The methods for learning TEK are derived from the social sciences, especially those pertaining to narrative methodologies, such as ethnographies, oral histories, or qualitative interviews. Ecologists may prefer to engage social scientists to conduct research, as they should be aware of the variety of methods available and their strengths and weaknesses for promoting substantive interchange (Huntington 2000). Although much of the information provided in the remainder of this section is modified from Huntington (2000), additional resources include The American Indian Oral History Manual (Trimble et al. 2008) and the NPS TEK fact sheet (Appendix A).

In general, any research with people, such as oral histories and ethnography, requires human subjects protocols. Some scholars have stated an explicit need for additional ethical considerations in exchanges of traditional knowledges and have developed guidelines for climate change initiatives (Climate and Traditional Knowledges Workgroup 2014). Although the content is very similar to this NPS report, it is recommended to access and read the Climate and Traditional Knowledges Workgroup (CTKW) document for additional context and considerations.

Initiation of a TEK project should take place only upon all necessary approvals of the project and any protocols that are in place, which may entail entering the Office of Management and Budget (OMB) or Institutional Review Board approval process for information collection from human subjects. Discussions with a TEK researcher or NPS anthropologist/ethnographer will be beneficial to determine which permissions and methods may be applicable. Such a researcher may be identified by a Superintendent, Cultural Resources staff, or Natural Resources staff (Appendix A). Below are starting points for data collection, slightly modified from Huntington (2000) and the NPS TEK fact sheet (Appendix A). They are not mutually exclusive and can be further developed to meet the needs of researchers and communities.

- Sampling: In the absence of personal experience with the pool of potential participants, the most practical option for participant selection is chain referral, or snowball sampling, where each participant suggests further experts (Heckathorn 2011; Huntington 2000). This method allows the researcher to evaluate the completeness of the selections based on when few or no new names are suggested. In nearly all cases of TEK research, the researcher will want to identify key informants rather than select a random sample of the community (Huntington 2000). This is important when targeting information about specific topics. Those who are knowledgeable about a given topic are most appropriate to interview as opposed to a random sample of all community members, which may yield valuable information, but perhaps not on the topic of choice. The Tribal leadership or an appointed committee can be asked to help select the most appropriate persons.

- Literature review: This is an important component in any research project. Most of the Tribes in the United States have been studied by an anthropologist at one time or another. During a literature search, ethnographies as well as collections of stories, myths, legends and songs will be instrumental to the researcher for information on societies, clans, keepers of knowledge, ceremonies, uses, processes and interactions. However, be aware that some accounts may not be accurate due to intentional efforts from tribes to protect their cultures from exploitation;

therefore, it is important to establish communication and relationships with the tribe(s) involved in the project to gain a sense of what is appropriate cultural knowledge to be shared outside of the community, regardless of what is found in published sources.

- Semi-directed (or semi-structured) interview: This is a standard ethnographic method for gathering information. Participants are guided in the discussions by the interviewer, but the direction and scope of the interview are allowed to follow the participants' train of thought. There is neither a fixed questionnaire, nor a preset limit on the time for discussions or the topics to be covered. The semi-directed interview is more of a conversation than a question-and-answer session. This is especially useful in cases where the participants are not comfortable with direct questions or in which the researcher cannot be sure that the questions are understood as intended. For example, semi-structured informal interviews have been conducted to explore the Yurok worldview regarding TEK and wildlife (Ramos and Williams-Claussen 2016).

- Focus groups: This method can be used to seek direction for additional subject matter and can be helpful to determine who within an indigenous Tribe holds the knowledge for the species being studied. There could be a clan, a society or another group who are the Keepers and transmitters of the information as not all information may be universally known within the Tribe. The use of focus groups is not recommended as a sole methodology for learning TEK. Focus groups also provide an opportunity to ask the Tribal participants whether there are specific topics they are interested in being pursued for a given project and how might be a culturally appropriate way to conduct the research (e.g. anything that should not be asked; culturally sensitive research protocols, etc.).

- Questionnaire: This method can be useful when the interviewer knows in advance what he or she is seeking. It simplifies comparisons between respondents and can provide new ideas and insights beyond the scope of the initial inquiry. Quantification, if desired and appropriate, is often simpler with a well-designed questionnaire. When quantification is not necessary for all responses, some questions can be left open-ended, giving the respondent a chance to add more detail or make associations beyond those anticipated in the questions. While a questionnaire may be applicable in certain circumstances, typically it is not appropriate as a sole method in a TEK project and will need to be combined with other methodologies.

- Analytical workshop: In some cases, collecting additional data is not as desirable as trying to interpret what is already known. Just as a workshop among scientists can help spur new ideas and challenge old assumptions, a workshop that brings together scientists and the holders of TEK can allow both groups to better understand the other's perspective and to offer fresh insights. By cooperating in the analysis of data, the two groups may also find common understanding and jointly develop priorities for management and future research. In the absence of a formal cooperative body, ad hoc workshops can be convened to address particular topics of interest.

- Collaborative fieldwork: Applying TEK to scientific research need not take place exclusively in an interview or meeting room. Collaborative fieldwork offers an excellent means of interacting

for an extended period. TEK has often been used to locate study sites, obtain specimens, and interpret field results.

- Linguistics: Use of linguistics can provide insight into a culture and its view of the natural world. Some Tribes now have written dictionaries for their languages. A native speaker can provide information about words, their meanings, associations and similarities. For example, the Yupik language on Nelson Island in Alaska is intrinsically tied to the environment – there are words to describe plants, activities, and elements in the Yupik language that are non-existent in other languages. These words help Yupik people to determine how they interact with their immediate environment.

General Guidance in Working with Tribes

The following are a few guiding principles and critical elements in working with tribes, from consultation to developing projects, to tribal etiquette. This information is taken from the following documents, with slight modifications: NPS TEK fact sheet (Appendix A), the National Environmental Justice Advisory Council Indigenous Peoples Subcommittee (2000), the U.S. Department of Interior Policy on Consultation with Indian Tribes, the U.S. Department Of Energy's document "Working with Tribal Nations" (2000), and the U.S. Environmental Protection Agency guidance, "Working Effectively with Tribal Governments" (2009).

Consultation

- Know the tribes
    - In order for any effective consultation and collaboration to take place, it is imperative that NPS employees know of all of the tribes and tribal organizations, and the tribal leaders, near their jurisdiction. This includes not only tribes with jurisdiction over tribal land, but also those tribes that claim a historical, cultural, religious, customary, cultural or aboriginal relationship with land within the agency's jurisdiction.
- Build on-going consultative relationships
    - Due to the long and complex relationship between the Federal government and Indian tribes, tribes often mistrust the Federal government. Trust must be earned over time. Staff can earn trust by educating themselves about how tribal governments operate, demonstrating respect for tribal values, having a proactive interest in tribal welfare, and following through on commitments. Since consultation and collaboration put demands on both tribes and agencies, the existence of on-going relationships will help tribes and agencies decide how to best allocate their resources among specific matters on which consultation may be appropriate.
- Contact Tribes early and allow sufficient time to consult
    - Provide the tribe adequate time to receive, process, and respond to requests for consultation and to formulate and express its views, and consider tribal views before making decisions.

- The DOI Policy on Consultation with Indian Tribes states that a Bureau of Office must notify Tribes at least 30 days prior to scheduling a consultation. Adequate notice entails providing a description of the topic(s) to be discussed, a timeline of the process, and possible outcomes. The notice should also give Tribal leaders the opportunity to provide feedback prior to the consultation, which may include requests for clarification and technical assistance.

- Establish training programs for all staff on consultation with tribes. A few existing trainings in DOI Learn include: Building Tribal and NPS Relationships, Consulting with Tribal Nations, Effective Tribal Consultation, and Tribal Consultation and the NPS.

- Encourage and enable staff who interact with tribes to take a Federal Indian Law course. This provides much of the legal background to understanding why formal tribal governments exist and operate the way they do.

- Maintain honesty and integrity in the consultation process.

- View consultation as an integral and essential element of the government-to-government relationship with tribes, not simply as a procedural requirement.

- Preparation for consultation.

  - Be aware that tribes are culturally and administratively different from each other.

  - Understand that some kinds of information are sensitive, particularly information regarding traditional religious practices.

  - Review any applicable agency consultation protocols and guidelines.

  - Work with tribal representatives to identify the ultimate goals of the consultation.

- Participants in consultation and collaboration.

  - Identify tribal representatives who will serve as the contacts in the consultation process.

  - Determine if a tribe would prefer having federal agencies coordinate their consultative efforts to reduce the burden on tribal staff and other resources.

  - Consultation with inter-tribal organizations may be useful on issues of regional or national scope; however, such consultation is not a substitute for consultation with each tribe unless specifically authorized by the involved tribe or tribes.

Preparing for a Project

- Be aware that tribes are culturally and administratively different from each other. Each tribal government is a separate sovereign, with varying degrees of governmental infrastructure and financial and human resources. To the greatest extent possible, staff should be knowledgeable as to the governmental infrastructure and resources of each tribe with whom they work. Although at

times, tribes unite to express concerns over impacts to tribal sovereignty, jurisdiction, etc., their perspectives, positions, attitudes, and concerns can vary significantly.

- The NPS TEK fact sheet notes that the researcher will negotiate a written document between the Tribe, researchers and funding agency. The document should cover the purpose of the research project, the methods used to identify participants and to obtain Prior and Informed Consent, methods for gathering research findings, description of how the information will be used, level of public access to the information, determination of ownership of the information and its results or products, how information will be disseminated and stored, applicability of the Tribe's research protocol, timeline, funding of the research including reciprocity and compensation to the Tribe and individuals taking part in the research, and communication of the process and results to the Tribal Council and Tribal members, as well as other topics of concern for the Tribe, researcher and funding agency. Discussion should also take place regarding where the data and raw materials will be stored or archived. The following bullets include considerations in these processes.

- Consider creating a team for the project. Ask if there is someone who could be a tribal mentor. Other possible "team members" could include: NPS Wildlife Biologist, Tribal Wildlife Biologist, NPS Anthropologist, and a Tribal Cultural Resources staff member. Schedule an initial meeting to discuss your ideas and research needs, as well as, the tribe's needs. Review the information under the "Tribal Etiquette" and "During Meetings" sections of this document and ask if there are additional communication guidelines to follow before attending meetings.

- Ask whether it might be of interest to hire and train an Indigenous person or tribal member to conduct any interviews that may take place and allow the tribe to oversee the process. This might depend on the capacity of the tribe. Another option might be to fund a tribal college or university student.

- Understand that some information, especially in TEK, is sensitive. Tribes may be reluctant to divulge certain information unless confidentiality can be assured. In some instances, Traditional Indian Law regarding confidentiality may apply and will be non-negotiable. Protection of TEK is a serious concern for many Tribal nations, and they are justified in this concern. The information learned through a TEK project is communal property with a host of social and moral responsibilities for the knowledge holders. While TEK is communal property, not all members of a Tribe are necessarily privy to it or to the breadth of it. Under these circumstances, TEK is not eligible for protection through intellectual property laws in the United States, which protect an individual's intellectual property for a finite time before the information enters the public domain. There has been some discussion that intangible property law may afford the protection desired by the Tribes. To date, there is no precedence for its use in the courts for protection of TEK, and so the level of protection intangible property law affords is theoretical. Tribal gatekeeping is currently the safest means of protecting sensitive TEK.

- Many tribes have at least two forms of leadership: (1) official tribal leaders who are elected or selected and (2) traditional/spiritual leaders. Although formal consultation takes place with

governmental leaders, on issues involving cultural heritage or religious practices, traditional cultural and spiritual leaders might be involved. In some cases, an individual might be both a government office holder and a cultural leader.

- Set and work toward common management goals. How does each group envision the landscape and wildlife populations? What part of TEK should be shared in order to achieve those goals?

- Provide a mechanism whereby information is not subject to FOIA; tribes are sovereign nations who often see their TEK as private. Also, do not expect that tribes give raw interviews or transcriptions to federal agencies. Allow the tribe to decide what they want to share.

- Working with a senior tribal official should be seen as equivalent to working with a very senior U.S. official. For instance, if you have an appointment with the President of the United States or the Secretary of the Interior, you make sure you are on time, have all the information that may be needed, and are respectful of the time pressures these officials are under. The same kind of respect should be extended to tribal officials, as they are of equivalent rank in their nation.

- People conducting research through university institutions should follow the Institutional Review Board (IRB) process for work with human subjects. Agency personnel may need to pursue OMB protocols for information collection. These options should be discussed with the team members or other professionals. Follow the Tribe's research protocol, if available. Some tribes, such as the Navajo Nation, have tribal IRB processes that must be followed in order to conduct research with the community (Brugge and Missaghian 2006).

- Be supportive if the tribe wishes to use their native language in any phase of the project.

- If invited, make an effort to have TEK experiences in the tribal community(ies) with whom you are working. Some cultural lessons can only be learned through actual interaction. To understand a culture, you need to understand its people and that requires regular and continuous interaction – not just officially, but socially as well. The result should be that you continue to learn from and respect the tribal culture with which you are working.

- Understand that TEK is not tied to the researcher's timeline. Like most governments, tribes experience changing priorities with changing administrations. Due to a variety of factors, a high turnover rate occurs frequently in tribal staff, and tribal governments are often understaffed. Government agencies place great importance on schedules and time. Indigenous people tend to place great emphasis upon achieving consensus. A meeting that might be announced for a few hours might go on for many hours until a conclusion is reached that brings about stability and harmony in relationships between members of the tribe. An agency person may feel that it is essential to have a tribal response in a week's time in order to meet a goal: a tribal group might feel that it is essential to take all the time necessary in order to discuss an issue that might affect the lives of people across several generations.

- Provide updates via email and request meetings throughout any process. The tribes who were consulted should be updated on the progress of the project and how information may or may not be included in park management.

Tribal Etiquette

Demonstrating Respect in Cross-Cultural Communication

In your work as a federal employee you are representing the federal government. Demonstrating sensitivity for different cultures is critical to the building of effective working relationships. Remember, many historic federal policies toward Native Americans resulted in a general distrust toward government officials, making it especially important that your interactions with tribes are carried out in a thoughtful manner. Tribes are sovereign nations, and should be treated accordingly. Respect can be demonstrated in many ways:

- Become familiar with the efforts and outcomes of your agency's prior work with the tribe.
- If there is an established protocol agreement with a tribe, make sure that you follow it. If there is no such protocol in place, talk to tribal leaders about whether it would be beneficial to establish one.
- Be open-minded. Keep your opinions flexible and be receptive to new ways of thinking and seeing the world.
- Be willing to admit limited knowledge of tribal culture, and invite tribal members to educate you about specific cultural protocols in their community. When in doubt about something, don't assume. Rather, ask respectfully. Ask whether you should share with others the information that is shared with you.
- Understand that certain objects, such as feathers, beadwork, artwork, medicine bags, etc., may be sacred, and should not be touched.
- Do not take photographs without permission.
- If you are unsure of the appropriate attire for any meeting or event, ask your tribal contacts for guidance.
- Federal jargon, acronyms, and standard operating procedures that are commonplace for federal employees may not be familiar to tribal members. Therefore, adjust your presentation accordingly. Educate, but don't patronize.

During Meetings

- Always be conscious of your conduct. Tribal cultures put great emphasis on judging character by one’s action, conduct, and response. The appropriate conduct is to be conservative and mindful. As a representative of the Federal government, your actions are indicative of your awareness of the government-to-government relationship with tribal nations.

- Elders are highly respected in tribal communities, whether they hold any official position. When speaking with a tribal elder, allow more time for a response than you might normally allow. English is often not the first language of many tribal elders. Also, tribal people allow a greater pause time between speakers, even in their own language; a pause indicates the other person is considering what you said. Indian elders may respond by using a story or an analogy to demonstrate their point. A hurried follow-up question may disrupt their response to your first question. Therefore, if you are in hurry, you might get no answer at all.

- Tribal people may attach greater significance to proposed NPS actions than NPS staff because they have a highly personal vested interest in NPS activities, as national parks are on tribal ancestral lands. Many parks were established in "open" lands as Indigenous peoples were forcefully removed to reservations. Parks retain resources that Indigenous peoples see as necessary for survival - physically, culturally, and spiritually.

During Ceremonies

Ceremonies are the reaffirmation of ancestral knowledge handed down over generations. In this manner, songs, dances, prayers, and regalia are direct links to cultural, religious, and family history. Tribal members' participation in cultural ceremonial life means a commitment to cultural and religious values and teachings. When it appears appropriate, staff might want to plan their visits so they have the flexibility to participate in a social or cultural event, when invited by the community, that will help build understanding and foster trusting relationships.

- Ask a contact person or mentor if it would be appropriate to attend a ceremony or if it would be best to wait to be invited. If it is determined that you will attend a ceremony, have a discussion with your contact person, or someone they refer you to, about appropriate behavior and any guidelines you should follow.

- Respect for cultural ceremonies is best shown through action. During invocations, prayers, or opening songs, be observant and determine appropriate behavior based on the behavior of tribal members, especially those of the same sex as you. There might be different roles for men and women, even if only observing.

- Show your respect for tribal ceremonies by allowing sufficient time to observe the entire ceremony, if possible. Just "putting in an appearance" might be seen as insulting and may increase suspicion about your sincerity. Be sincere.

- Many ceremonies and people in their regalia should not be recorded or photographed. One should ask whether is it permissible to take pictures, videotape, record, or otherwise document cultural ceremonies before reaching for a camera.

Broader Considerations

The use of TEK can enhance the knowledge base for decision-making about ecosystems, species and their habitats, provide longitudinal knowledge for climate change projects, and strengthen relationships with tribes over topics of common interest. Use of Native languages can facilitate language revitalization for communities, as well as yield ideas about conceptualizations of natural resources, landscapes, and ecosystems. However, rather than assuming, as many do, that the co-production of TEK in Western-dominated contexts will automatically lead to improved resource management and Indigenous empowerment, it is important to consider the philosophical context of each paradigm so that projects can be approached in a culturally sensitive manner (Ramos 2016). It is worth exploring how the two sciences are conceptualized by various groups and ask, on a case-by-case basis, whether it is appropriate to integrate them in non-tribal management initiatives. In approaches outside of Indigenous communities, thinking of TEK as a knowledge base that can be "integrated" into WEK may actually be reinforcing a number of Western cultural biases and work against full community involvement in managing natural resources (Nadasdy 1999). Indigenous practices of conservation differ from Western conservation in context and motive. Some researchers suggest it may be more appropriate to think about Indigenous and Western science as complementary paradigms and consider the role TEK can take in facilitating or discouraging cross-cultural and cross-situational collaboration (Whyte 2013). Further, dialogue surrounding the acknowledgement of TEK as science and whether there is potential for including it in "best available science" practices may facilitate partnerships and the growth of science overall.

Wildlife managers interested in TEK research and application might consider focusing on cultural sensitivity (see Part II of this document for a case study that includes cultural sensitivity) to bring forward the Indigenous worldview and experience, while respecting tribal sovereignty (Ramos 2016; Ramos and Williams-Claussen 2016). Consideration of cultural frameworks of tribal communities can lead to development of culturally sensitive field methods, establishment of trust that may lead to further collaboration, and potential data sharing agreements between tribes and the NPS. Additionally, understandings of ethics of wildlife use might be broadened: there might be consideration in Western-based management that harvest of animals - with Native cultural protocols that are intended to promote sustainability (Ramos and Williams-Claussen 2016) - may include "uses" other than sport or food, such as ceremonial regalia.

There may be unintended consequences from the collection of TEK information and so consideration of the long-term impacts of each project is important (Rinkevich et al. 2011). Insistence on a TEK component of every ecological research and management activity will likely reduce TEK to a token, to be included in a paragraph or two, and then ignored. There is a need to develop spaces where holders of different knowledge systems can develop a respectful and equitable dialogue on how to mutually validate and integrate their knowledge for effective natural resources management (Davidson-Hunt and O'Flaherty 2007). Wildlife managers operating in Western-derived frameworks need to be aware of the cultural history of places that support wildlife populations of interest; to involve traditional Indigenous stewards of these places and to adopt de-centralized decision-making processes that give Indigenous peoples a real say in managing land and wildlife (Aslin and Bennett

2005). TEK may only truly be "incorporated" into the management process when native elders and hunters have achieved full decision-making authority in that realm. Is it possible to develop a management process that makes full, unbiased use of the way of life that is traditional knowledge? This may be achieved if elders and hunters are relieved the burden of having to express themselves in ways that are foreign to them to justify their views and conform to a Western paradigm (Nadasdy 1999).

As a consideration in TEK initiatives, it may be most beneficial for collaborators to focus on developing mechanisms for continued transmission of TEK within Indigenous communities to ensure that the way of life to which the term traditional knowledge refers remains engaged by communities. One may ask, "Who is going to actually use, interpret and/or manipulate the information?" If the answer is not "local community members," the research might do more harm than good (Nadasdy 1999). In assisting with TEK transmission, some of the following efforts may already exist in some areas of the NPS system, but they are worth noting here. Working to strengthen the capacity of the tribe to achieve its own goals may improve relationships. For instance: tribal members could be hired to assist with research and management within parks; tribes may request technical assistance from a park through P.L. 93-638 & 25CFR Part 900/1000 (Indian Self Determination & Education Assistance Act of 1975); park leadership can consider providing to tribes culturally significant deceased animals to be used by tribes in their pursuits of cultural survival via TEK (e.g. ceremonial regalia). Further, internships and other educational opportunities could be established for American Indian college students to perform some of the work, building capacity for tribal nations.

It is important to remember that tribes have the sovereignty to decide whether they wish to share their TEK. One should not assume that NPS employees are free to approach any tribe and begin conducting TEK research. Rather, an emphasis should be placed on strengthening relationships with tribes. Even though there are potential benefits to Western-based projects to include TEK, tribes will likely want to evaluate whether there are benefits to their sharing TEK with an agency and, if so, whether those benefits outweigh any potential negative impacts to their communities and cultures. Cultural gaps can be bridged and compromises can be achieved between groups of people with different cultures, value systems or worldviews. The potential to narrow the gap makes the attempt worthwhile, but may not be possible in every instance (Aslin and Bennett 2005). With collaborative research, consistent communication and continued efforts from advocates of both paradigms in park and tribal leadership, barriers can be overcome in finding mutually agreeable and equitable approaches to TEK initiatives (Huntington 2000). Such approaches might also lead to insights that are valuable for society as a whole.

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PART II. Navigating Culturally Sensitive Wildlife Research: Experiences of a Yurok Tribal Member Pursuing a Doctoral Degree

A case study by Seafha C. Ramos

Positionality and Document Development

As a Yurok tribal member with an educational background in science, I dedicated my PhD research to conducting culturally sensitive research with the Yurok Tribe, which included a Traditional Ecological Knowledge (TEK) component. Approximately one year into my doctoral program, I joined the National Park Service Pathways Program as a biological sciences intern and was tasked with facilitating communication regarding TEK via the creation of a Natural Resources Report (NRR). In discussions with other NPS staff, we found there was a need for more TEK resources within NPS, specifically for wildlife and other natural resources professionals. Part I of this NRR is intended to provide an overview of TEK and potential applications and considerations in NPS. Part II, this case study, is intended to serve as one example research project where TEK is pursued in a culturally sensitive manner. While the focus is not an NPS project, considerations of how one may approach TEK are provided, which may be helpful to NPS natural resources staff who are interested in pursuing a TEK project.

Introduction

Numerous scholars have addressed TEK in natural resources fields, such as forestry (Klooster 2002; Cheveau 2008; Trosper & Parrotta 2012), fire ecology (Kimmerer & Lake 2001), fisheries (Menzies 2006) and wildlife management (Darimont et al. 2005; The Wildlife Society 2010; Reo & Whyte 2011). Focal areas have been the practicality of utilizing TEK and combining it with knowledge gained from Western science (WS; Huntington 2002; Nadasdy 1999). While researchers pursuing TEK efforts in the wildlife profession have used various approaches, the understanding of what TEK is remains ambiguous (McGregor 2004). Understandings of TEK through a Western lens may differ from those through a tribal lens (Ramos and Williams-Claussen 2016; Whyte 2013).

In Part I of this document, challenges in pursuing TEK research are described. For example, for tribal communities, spirituality is fundamental to TEK and Indigenous science (Ramos and Williams-Claussen 2016) but falls outside of the realm of Western science (WS; Berkes 2012). Additionally, there may be issues of unequal power dynamics in TEK initiatives (Nadasdy 1999). Another challenge is that TEK studies must often be conducted separately from a wildlife study, as TEK research is primarily a social rather than a biophysical science. Thus, there is a need for interdisciplinary approaches, which often require significant time and resources (Shackeroff & Campbell 2007). One difficulty for many in the wildlife profession is that they may be unfamiliar with social science methods and how to use them when working with Indigenous communities (Huntington 2000). Further, both professionals trained in Western wildlife management and Indigenous peoples in the community may have difficulty with cross-cultural interactions.

In the United States, federally recognized tribes retain important powers of self-government and maintain a unique legal relationship with the United States as affirmed by Congressional legislation and a long line of cases issued by the Supreme Court (Getches et al. 2005). Tribes can use their cultural traditions as a foundation to shape tribal natural resource programs (Long et al. 2003). As wildlife are important for tribal subsistence food and ceremonies (McCorquodale 1997; Reo and Whyte 2012), many tribes, such as the Yurok Tribe in northwestern California, have goals for robust wildlife programs (Yurok Tribe 2005). Yet, standard methods of Western wildlife management techniques may be in conflict with an Indigenous community's traditional values (Byers 1999).

I gave explicit effort to navigating some of the challenges in applied wildlife studies with a TEK component, while striving to respect the Yurok cultural paradigm. When I began my doctoral program, I had recently become aware of the terms "Indigenous science" (IS) and "TEK," as they are not generally used in Native communities. In addition, these academic terms were essentially absent during my experience in higher education disciplines such as biology and wildlife conservation. I asked questions posed by Berkes (2012) such as, "How can both paradigms be used together respectfully?" "How can we avoid treating TEK as just another information set from which "data" can be extracted and applied in a Western science framework"? I also asked, "What considerations are important for cultural survival of Yurok people (Ramos and Williams-Claussen 2016)?" The philosophical question of whether TEK is "science" seems to be a continued uncertainty in the literature, potentially resulting in inequitable approaches to research with Indigenous communities. Over the course of my research, I began to see how the common use of phrases such as "TEK and science" connote that one is "science" and the other is not. As TEK is a branch of both IS and Western Ecological Science (Ramos 2016), herein, I use "TEK" and Western Ecological Knowledge (WEK) as equitable terms with these two paradigms. I also use WS at times, especially when addressing the Western philosophy of science as a whole.

In this paper, I present my empirical process and approach, illustrating the weaving of IS and WS worldviews as I navigated the aforementioned challenges and questions. I approached my research with the understanding that IS and WS are equally valuable. First, I provide background information about the Yurok Tribe (hereafter "Yurok" or "Tribe"), including neighboring jurisdictions and collaborators for this research. Second, I explore several aspects of my PhD research experience. I discuss items such as the establishment of a network, finalizing the research topics and methods, and navigating various approval processes in the Tribe, a timber company and university. Third, I provide considerations I made in research implementation, data analysis, and reporting. I conclude with a discussion regarding factors that I consider essential in wildlife studies with a TEK component. Although I organized my research proposal into strictly "Western-based" and "Indigenous-based" components and had clearly delineated the two paradigms, ultimately, my research and resulting manuscripts became a blend of both. Thus, my intent is to describe my approach rather than explain how to pursue research with a particular lens.

The Yurok Tribe, Surrounding Jurisdictions and the Tribe's Wildlife Program

The federally recognized Yurok Tribe formally established its government in 1993 (Yurok Tribe 1993). One of the Tribe's goals is to promote cultural preservation, including revitalization of language and spiritual beliefs and practices, and ensuring that the Yurok cultural way of life is provided to future generations (Ramos and Williams-Claussen 2016; Yurok Tribe 1993). Also, the Tribe aims to restore, enhance, and manage the tribal fishery, tribal water rights, tribal forests, and all other natural resources (Yurok Tribe 1993). The reservation boundaries extend one mile from each side of the Lower Klamath River and 44 miles from the estuary to the confluence of the Klamath and Trinity rivers. Yurok ancestral territory is presently divided into several jurisdictions, including the Yurok reservation, Redwood National and State Park (RNSP) land, U.S.D.A. Forest Service lands, and lands under jurisdiction of Green Diamond Resources Company (GDRC), a private timber company. Those entities also have established natural resources management programs; all entities work to monitor and protect wildlife and their habitats. Each entity supports collaborative efforts to conserve natural resources. For example, RNSP employees conduct a wide range of resource management and educational activities and GDRC wildlife biologists monitor several species year-round. Due to the close proximity of each jurisdictional locale, collaboration in wildlife management efforts can be beneficial and such efforts have taken place.

The Tribe recently began developing a wildlife program. In the inaugural project, a tribal wildlife grant from the U.S. Fish and Wildlife Service was used to assess the feasibility of reintroducing the culturally significant California condor (*Pregoneesh; Gymnogyps californianus*) to Yurok ancestral lands (U.S. Fish and Wildlife Service 2014). However, expansion of the wildlife monitoring had been limited in initial years due to the infancy of the program. Within this context and my academic exploration of TEK literature, I entered my PhD program with a goal of conducting wildlife research with the Yurok Tribe.

Research Development

Ethics and cross-cultural interactions

It has been suggested that researchers working with Indigenous peoples should strive to use decolonizing methodologies intended to disentangle Indigenous communities and their cultures from the oppressive control of colonizing cultures and governments (Simpson 2004; Ramos 2016; Ramos and Williams-Claussen 2016). For instance, one researcher set out to clearly describe Inuit and Western understandings of the concept of Sila, which had been reported in divergent ways under the two paradigms. While Sila is perceived as a spiritual being in the Inuit culture, it had come to be consistently translated as "weather" by many Western-trained researchers. A cross-cultural dialogue was used in an effort to bridge the gap between Inuit and Western knowledge regarding Sila, in a manner that is respectful of both paradigms (Leduc 2007). Another methodology approaches Indigenous peoples as equal partners, as opposed to "objects" of research. Social interactions constitute part of the human context for all social science research; however, it is magnified in cross-cultural TEK research, where local peoples' worldviews may differ dramatically from those of Western-trained researchers (Shackeroff and Campbell 2007).

I felt that in working with TEK, it was my ethical responsibility to acknowledge and abide by the Tribe's sovereignty by using research approaches and methods that were approved by appropriate tribal departments and Tribal Council and that promote cultural survival if at all possible. Throughout the development of my research, I considered the history of Indian Country during the birth of the wildlife profession (Ramos 2016). This history is of great importance to understand in working with Indigenous peoples in the United States as it colors the way some Indigenous peoples think about their contemporary day-to-day experiences and impacts their relationships with wildlife (Ramos and Williams-Claussen 2016). It is also important to realize that, currently in the Era of Self-Determination (Getches et al. 2005), many Tribes are making efforts on a variety of fronts, including natural resources management, to improve the health and wellbeing of their communities (Ramos and Williams-Claussen 2016). I learned about both local and larger scale issues in stories from loved ones, as well as, in university classes. When I listened to community members speak about the revitalization of ceremonies after our ancestors were forcefully disallowed to perform them (Ramos and Williams-Claussen 2016), I was reminded of the passion and drive to maintain the Yurok way of life. And because wildlife contribute greatly to the Yurok way of life, these experiences gave me a deeper sense of why it is important to conserve wildlife, beyond strictly for the sake of biodiversity. Yurok cultural survival and, thus, the identity of Yurok people, depends on the ability of Yurok people to fulfill our purpose to create balance in the world (Ramos and Williams-Claussen 2016).

In regard to cross-cultural interactions, I found myself in an appropriate place culturally and professionally when I began to consider a PhD program. By that time, I had participated in many cultural activities. Although I was generally only able to go home during summers while in college, I attended language camps and classes. With the help of language teachers and classmates, I had progressed from barely understanding the pronunciation of the Yurok alphabet to being able to properly introduce myself and develop short sentences. I felt it was important for me to learn as much Yurok language as possible because language revitalization is such a critical component of the

community's efforts in cultural survival. Related to wildlife, I learned many animal names. I also attended basket classes and was able to complete three small baskets. Although this aspect of culture does not directly concern wildlife, during classes and in my interactions with loved ones, I was taught how to gather and prepare materials, which helped me maintain my connection to the landscape. Further, I was able to build deeper and stronger bonds with women who devote much of their energy to making baskets. These connections are important in maintaining cultural understanding and awareness. I learned valuable lessons from loved ones and by participating in ceremony.

Academically, I had obtained a BS and MS in WS-based disciplines (Biology and Wildlife Conservation and Management, respectively). I had exceptional WS advisors, professors and mentors who devoted time in preparing me for a career in WS. I learned methods for monitoring wildlife and fish, how to manage and interpret data in a Geographic Information System (GIS), how to use various statistical tests to analyze data and how to write for WS journals. I was encouraged to attend and present at WS-based professional conferences, such as The Wildlife Society, where I was active with the Native Peoples' Wildlife Management Working Group. Upon completion of my MS program, I began considering whether I should pursue a PhD. I knew that I wanted to work with the Yurok community, that I wanted to continue learning about wildlife conservation and that, if I were to enter into a doctoral program, I wanted to ensure Yurok culture had a primary place in my research. Upon my acceptance into my PhD program, my experiences in both paradigms guided me in decision-making throughout each stage of the research, from research design and development to writing the dissertation.

Establishing a network

The development of a team was critical in bringing my research to fruition. I would not have been able to complete any stage if it were not for a supportive group of experts in several areas. Before I applied to the PhD program, I met with the Yurok Natural Resources Committee (YNRC), Yurok Culture Committee (YCC) and Yurok Tribal Council to ask whether they would be supportive of me conducting research with the Tribe. I stated that I had not obtained research funding, but fully intended to seek funding avenues, and that if I were to pursue a PhD, I would want my work to be relevant to the Tribe, as well as local wildlife biologists in surrounding jurisdictions. Therefore, I also sought general support and suggestions for topics from agency wildlife biologists. Another approach might have been to develop my research topic, establish questions, write a proposal and then request approvals; however, working with the Tribe and agency staff from the initial stages was beneficial in finding mutual areas of interest and building professional relationships.

In navigating research development, I worked with several tribal representatives of various departments and programs, including: YNRC, YCC, Council, Self-Governance Office, Environmental Department, Wildlife Program, Cultural Resources, and the Legal Department. Additional key members of my network during this stage included my university doctoral committee, U.S. Fish and Wildlife Service, Arcata, CA, U.S.D.A. Forest Service Pacific Southwest Station Research Laboratory, Biological Resources Division of the National Park Service, the Wildlife Conservation Society, Redwood National and State Parks, and GDRC. Seeking input and guidance

from such diverse interests and backgrounds provided me with a broad spectrum and context of considerations in the development of my research objectives and design. Further, it allowed me to ensure that I would be following appropriate laws and expectations.

Establishing research topics and approvals

Rather than focusing on a particular wildlife species and then developing methods to access "data" from Yurok TEK, I considered the national and local history of Indian Country and how that history has impacted tribes, including the Yurok, as well as the contemporary goals of the Yurok community (Ramos 2016; Ramos and Williams-Claussen 2016) while exploring my research approach and questions. I worked with my network to design research that was culturally relevant, scientifically relevant, and feasible for me to conduct. The YNRC and agency biologists suggested several species of interest. I noted all of them and proceeded by examining the feasibility and potential funding options for each. During this stage, I explored possible studies with deer (*Puuek*; *Odocoileus hemionus columbianus*), the pileated woodpecker (*Kokonew*; *Dryocopus pileatus*), and even Pacific lamprey (*Ke'ween*; *Lampetra tridentata*). I was given the opportunity to intern during my first summer in the PhD program, under the Student Career Experience Program (now Pathways Program) in the U.S. Fish and Wildlife Service, Arcata, CA, office. It was then that I learned about the conservation priorities for the Humboldt marten (*Martes caurina humboldtensis*; hereafter "marten"), a species found in the local area and culturally significant to the Yurok and other tribes. Due to my efforts in maintaining my cultural connection, I had studied the Yurok names for many animals but could not find the name for marten. I asked several people in the Yurok community but, at that time, no one I spoke to knew the translation.

As I grappled with trying to understand the current methods of TEK and single-species research, I was also continuing meetings with tribal leaders and was reminded to think more holistically. I had initially thought to study one species and conduct TEK interviews about that species so that one set of information could "inform" the other (as is a common approach). I do not think that the status quo is necessarily inappropriate; at times, it may be the best option given particular research aims and resources. In my case, however, I aimed to approach my research from a broader perspective, which included using the Yurok cultural context as a framework for my study. In my approach, I strived to view the Yurok and Western paradigms as each having their own validity and usefulness to natural resources conservation. Therefore, rather than asking how TEK can inform WS, I asked how I might be able to use aspects of each to potentially inform overall approaches to wildlife research with tribes and contribute to the Yurok Tribe's recently developed wildlife program.

I began to explore multi-species approaches and in continued meetings with local agency biologists, I found that there was an interest in the community of mesocarnivores, including the marten, bobcat (*Chmuuek*; *Lynx rufus*), fisher (*Le'goh*; *Pekania pennanti*) and gray fox (*Wer-gers*; *Urocyon cinereoargenteus*). Based on my experiences in the Yurok community, I knew that using noninvasive approaches to wildlife monitoring would be more culturally sensitive. That is not to say that handling of animals is wrong per se but that I wanted to apply noninvasive sampling methods if possible due to the Yurok relationship with animals. I was taught that one should not handle an animal unless it is necessary; Yurok understand that sometimes it is necessary for the purposes of species recovery. At a

meeting with the Yurok Tribe Culture Committee, I noted the sentiment and asked if my approach seemed appropriate. As there were no statements to the contrary, I developed my proposal to include a noninvasive sampling study to detect species presence in various forest age classes within the Yurok reservation and GDRC lands.

During the proposal stage, I also began to explore methods of interviewing for the TEK portion of my work by reading literature in TEK and Human Dimensions of Wildlife (HDW). I had chosen a PhD minor in American Indian Studies (AIS), which I found to be extremely helpful in understanding the legal context of tribal governments and natural resources management via Indian Law classes. Through AIS coursework, I was also introduced to resources such as The American Indian Oral History Manual, which provides guidance for academic work with Indigenous communities. In the process of developing interview questions, I worked with the Yurok Tribal Historic Preservation Officer, YCC, YNRC and the Yurok Wildlife Program staff. Having the AIS coursework background allowed me to view the pursuit of TEK research from additional angles. I now had an understanding of Yurok cultural values, Western-based approaches to TEK research, wildlife management principles, social sciences frameworks as applied to HDW as well as with indigenous communities, and historical and contemporary laws and policies that have impacted tribal communities and guide their governmental operations and relationships with other entities. My research proposal included semi-structured interviews regarding the Yurok cultural conceptualization of TEK and the historical and contemporary relationship with wildlife to explore the worldview so that the end report might be used in continued development of the Tribe's Wildlife Program (Ramos and Williams-Claussen 2016).

I found research design and funding became very complex very quickly. In my case, I needed to understand and apply mixed methods with both quantitative and qualitative approaches in both the social and biological science aspects of my research. I also found research development to take considerable time: 3.5 years, including classes, proposal development and obtaining necessary approvals and funding. I strived to find funding sources and agreements for the interview component that would address any data sensitivity concerns and support the Tribe's sovereignty to choose whether information should be shared outside of the tribal community. For example, in my informed consent paperwork, interview participants were given the option to donate their interview to the Tribe, allowing an avenue for future analysis of the interviews for tribal projects. With such donation, the Tribal Council, or a person whom the Council delegates, can decide whether to make any such analyses and results publicly available.

Researchers who are considering TEK work should be aware that there are various tribal governmental structures and capacities; therefore, there may be a variety of logistical steps in conducting research. Researchers should be prepared to navigate tribal structures with patience and understanding. When working with various tribes, there might not be a standard protocol on which approvals are necessary or how to navigate tribal departments and there may be no manner in which to establish them ahead of time. In such situations, continuous communication is necessary to ensure Tribal protocols are followed. Alternatively, some tribes, such as the Tohono O'odham, have their

own Institutional Review Board codes that are intended to assist researchers and the tribes in navigating project proposals (http://www.tolc-nsn.org/docs/DraftResearchLaw.pdf).

Research Implementation

Upon approval of my proposal, I had to obtain a number of approvals for conducing my interdisciplinary work. For example, I needed to obtain a land access permit to GDRC property, which was obtained via collaboration between the Yurok and GDRC Legal Departments. I also developed informed consent documentation and obtained interview approval by working with the Yurok Council and the University of Arizona Institutional Review Board. I obtained approval of my wildlife scat sample collection protocol from the University of Arizona Institutional Animal Care and Use Committee. Some permissions required support from multiple Tribal departments, such as approval for access and use of Geographic Information System (GIS) information by the both the Yurok Tribal Heritage Preservation Officer (THPO) and the Yurok GIS Department. With the help of the Yurok Tribe Environmental Program Director, I requested a Council action to approve my use of a tribal vehicle for the wildlife work.

I found that where I had initially envisioned my wildlife dissertation chapter to include strictly WS methods, aspects of cultural sensitivity, such as following appropriate behavior as instructed by the Yurok Culture Committee, were important components in my wildlife study fieldwork (Ramos and Culver 2016). I knew from the beginning of my doctoral program that I would follow these guidelines, but I had questioned whether to include them in the written product because, while they do not impact the data collection or analysis, they may not be accepted as legitimate or relevant in WS. Although following Yurok cultural protocols in the field does not follow a standard WS approach, this allowed my field technician (another Yurok tribal member) and I to respect the Yurok cultural paradigm and maintain our connection to the landscape while still gathering the data necessary for analysis. We collected scats and sent them to The University of Arizona Conservation Genetics Lab, where I worked with laboratory technicians to use genetic analysis to identify the scat depositor species. From the results, we used genetic analyses to identify the mammalian prey items in the diet of mesocarnivores. All field data obtained from the wildlife study were provided to the Tribe (Ramos and Culver 2016).

As mentioned, when working with a tribal community, an understanding of the history and culture is important in developing culturally sensitive approaches. My understanding of and deep personal connection with the Yurok peoples' history and culture allowed me to relate to the Yurok Council, various tribal committees and interview participants. Further, my knowledge of the Yurok language obtained through classes and from my community allowed me to better perceive the Yurok worldview, values, conceptualizations and knowledge through our language and to understand the nuances of Yurok words when used by the interview participants. In an effort to follow Yurok cultural norms, I gave interview participants traditional gifts such as tea, home-canned foods such as fish and deer meat, and acorn flour when possible. Over time, I had obtained these gifts through gathering with other tribal members or in receiving and preparing them with my family. This cultural awareness added a deeper level of gratitude and effort to show my respect to the participants and also actively support TEK and cultural transmission and interaction. At times, I also gave *cheeek* (contemporary currency), as I understood that it can be used by people to support themselves and their families. Another effort to be culturally sensitive during research implementation included

hiring a Yurok tribal member as my field technician, to assist with the wildlife survey. I accomplished this with the help of my network contacts in the National Park Service, Wildlife Conservation Society, Yurok Tribe Environmental Program, and the Yurok Tribe Human Resources Department.

I strived to provide regular email updates and presentations to appropriate network branches as each stage of research development and implementation progressed. Elders taught me to introduce myself in a culturally appropriate way for presentations, which included stating my name, family and villages. After each initial meeting with the YCC, YNRC, and Council, I asked whether they would like for me to regularly to provide updates. They all said yes and so I honored that by requesting meetings with them as often as was feasible. By taking the historical and cultural Tribal aspects into consideration and maintaining regular communication throughout the implementation stage, researchers might develop a variety of ways to respect the cultural norms of the communities with which they work.

Data Analysis and Writing

During analysis of my scat samples, I reflected on the importance of language revitalization and decided to include in the manuscript regarding the wildlife survey, prepared for a WS journal, the Yurok names of the species we detected. Although there were a few discrepancies, we found the majority of those species in the U.C. Berkeley Yurok language website and additional materials provided by the Yurok Language Program. After my initial inquiry for the Yurok name for marten, which had not resulted in any known translations, a Yurok Language Program employee noted that they had heard it while listening to an audio recording. I was grateful that the need for this word was brought to peoples' attention and by using the language for a wildlife study we experienced an unanticipated instance of language revitalization: we learned that the Yurok name for marten is *woh-pey-roks*.

To conduct the interview analysis, I used emergent methodology, which is used to understand a situation and discover themes in the data itself. In this approach, the researcher uses coding to find categories or themes and sorts the information into meaningful patterns to discover potential linkages and explanations of the themes (Suter 2011). I followed Seidman (2006) in the preparation and the process of coding. In this approach, the researcher cannot address material with a set of hypotheses to test; rather, they must come to the transcripts with an open attitude, seeking what emerges as important. At the same time, all responses to a text are interactions between the reader and the text. The interviewer must come to the transcript prepared to let the interview breathe and speak for itself (Seidman 2006). Seidman also suggests performing a first round of coding by hand. I found this an extremely helpful exercise at it allowed me to link concepts easily for identification of the initial codes. Using the software is advantageous in synthesizing and seeing how all the themes come together, but having the hand-written notes jogged my memory. I met with the tribe's only tribal member who currently works in the wildlife program to discuss emerging themes from the interviews and whether the paper I was aiming to write would be beneficial to the goals of the wildlife program. She shared with me that she was developing an education and outreach project with the intent of discussing Yurok ethics of wildlife management with topics such as respect, relationships with wildlife, and spirituality. As many of the topics had emerged during my interviews, there was significant overlap between our projects, providing fertile ground for collaboration. I invited her to co-author my dissertation manuscript (Ramos and Williams-Claussen 2016), which may be used in her materials for the tribe.

Throughout this stage, I continued seeking input from and sharing preliminary findings with my network. For example, I attended Yurok Language Camp to informally share the results of my interviews with the teachers and asked for their input on language depicting the Yurok conceptualizations of TEK and wildlife. In the Yurok cultural paradigm, there is no translation of "wildlife" that has the same meaning as in the Western paradigm. The language teachers were reluctant to create a new Yurok translation for "wildlife" to conform to modern contexts, if the goal was to bring the Yurok paradigm forward. And so, for an inclusive philosophical framework for natural resources management, the language speakers developed the phrase *Hlkelonah ue meygeytohl*, translated as "To take care of the earth." This phrase encompasses ceremonial and

spiritual practices as well as physical management and conservation (Ramos and Williams-Claussen 2016). I submitted all dissertation chapters to my PhD committee, university labmates, the Tribal Council, the Yurok Tribe Heritage Preservation Officer, and the Yurok Tribe Wildlife Program for review. My co-authors of this NRR and I asked several NPS colleagues for their review. I also shared a draft of the wildlife survey chapter with colleagues in my network at the USDA Forest Service Redwood Sciences Laboratory. Each colleague in my network had a valuable perspective and expertise and their comments undoubtedly improved the quality of each paper.

Discussion

Although I feel my academic and tribal cultural experiences provided a lens by which I was able to more readily communicate cross-culturally, I am unsure if all of the same steps would be appropriate or feasible in other communities or by researchers who are not students or of American Indian descent. For example, federal biologists would most likely be required to pursue different avenues, such as obtaining interview approvals from the Office of Management and Budget, in addition to tribal approvals. Also, I strived to maintain my cultural connections, which would likely need to be approached differently from someone who is not a member of a Native community.

While I feel that the community connection was crucial for my personal fulfillment and efforts in cultural survival, as well as in conducting my research, at times I had to balance when I needed to be in the community versus at the university. With the two being a two-day drive apart, it was essential that I planned appropriately. In the beginning of my doctoral program, I spent the fall and spring semesters at the university in Tucson and summers in Yurok Country in northern California. During research implementation, I spent approximately 7 months each year in California. There were times while I was in the community that I chose to participate in cultural and community events that were not directly related to my research. While at the university I was able to primarily focus on my work. Although at times I felt guilty for missing events at home, I was relieved when I would talk to family and loved ones who gave their support for my absence, with the understanding that I was pursuing my education. In an effort to maintain my cultural connection, I would bring projects to Tucson. For example, I would stay in California until acorn gathering season and then take what I had gathered to Tucson for processing. While in Arizona, I also modified a ceremonial dress that was originally made for me when I was a young girl and then lent it to another young girl for a ceremony during one of my travels back to northern California. I experienced overwhelming joy in watching it dance for the first time in over two decades, while I neared completion of my doctoral research. That was one of the defining moments of my doctoral experience because, to me, it represented the cultural revitalization and survival that so many of my interview participants had discussed.

I strived to use the lessons I was taught from both paradigms, which resulted in a research framework that I feel respected both. TEK research may require extra vigilance to ensure respectful and culturally sensitive methods, the most powerful of which may, in some cases, mean staying out of an Indigenous community entirely. Successful TEK research is conducted in an ethically sound and methodologically rigorous manner, where goals are meaningful to both the researcher and the community (Shackeroff and Campbell 2007). I strived to uphold these concepts by intentionally including cultural sensitivity in each stage of my research. I feel that my approach to TEK research, which acknowledges the cultural paradigm, supports the tribe's efforts in self-determination, as the tribe continues building capacity to conduct natural resources management and cultural revitalization in a contemporary world. The interviews that I conducted, as well as, meetings with tribal committees, provided a cultural framework for conducting the wildlife survey, thus connecting the two "independent" studies. Further, providing all raw data, including interview transcripts and the scat collection locations and species identifications, is beneficial to the Tribe's current and future initiatives. For example, the interviews are being used to inform Tribal wildlife management, such

as the development of wildlife ordinances and an educational video to be distributed to community members.

The considerations and processes provided in this case study might be of value for someone who is considering or pursuing a TEK project. We can continue developing models of community-based research to help achieve real collaboration and co-management in potential areas of convergence, but in a way that is respectful to diverse community worldviews and values (Berkes 2012). In this paper, I have provided a description of some of the considerations I made while navigating TEK research and I recognize that there might not be one best approach. Researchers should be prepared to spend considerable time in demonstrating their intentions and building a supportive network before pursuing a TEK project. And, they should be prepared for cases when tribes deny requests for TEK studies. When a researcher makes sincere efforts to understand the struggle, resiliency, and complex history of a community, they may better address questions and approaches in a humble and culturally sensitive way. One of the benefits of engaging TEK is the exposure to multiple environmental and cultural perspectives such that all sides may broaden their view of wildlife management. Building a supportive team with colleagues from various cultural and professional backgrounds can provide such opportunities, which might be missed in TEK studies following a single paradigm alone.

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Appendix

The following six-page synopsis was prepared by NPS and U.S. Fish and Wildlife Service staff as a general overview of TEK for NPS.

National Park Service • U.S. Department of the Interior

Missouri National Recreational River – The Missouri spreads wide in one of its most natural sections upstream of the Mulberry Bend Overlook. NPS photo

Synopsis of Traditional Ecological Knowledge

By: *Sarah Rinkevich, Ph.D., Kim Greenwood, Joe Watkins, Ph.D., and Crystal Leonetti*

Working Definition of Traditional Ecological Knowledge

The western world has tried to name and define indigenous knowledge. While neither a particular name for the knowledge nor definition of it has been universally accepted, there are concepts that universally occur. Following, is an attempt to include these concepts into a working definition under the name of Traditional Ecological Knowledge.

Traditional Ecological Knowledge (hereafter, TEK) refers to the on-going accumulation of knowledge, practice and belief about relationships between living beings in a specific ecosystem that is acquired by indigenous people over hundreds or thousands of years through direct contact with the environment, handed down through generations by cultural transmission, and used for life-sustaining ways. This knowledge includes the relationships between people, plants, animals, natural phenomena, landscapes, and timing of events that are used for activities such as hunting, fishing, trapping, agriculture, and forestry. It encompasses the world view of indigenous people, which includes ecology, spirituality, human and animal relationships, and more. TEK is also called by other names, including but not limited to Indigenous Knowledge or Native Science.

TEK is different from user knowledge and local knowledge in that user knowledge is one person's experience over a lifetime or less, and local knowledge is more than one person's experience aggregated, showing a trajectory, but not yet time tested.

Words connote meaning; and therefore, by their use, can set or remove barriers. Some Indigenous peoples have concern with the use of words like "document," "record," "natural resources," and "management." This paper attempts to avoid the usage of words that may cause conflict. In places where one might anticipate reading "document" or "record" (as verbs), one will read words like "learning" and "living;" instead of "natural resources," one will read "environment" or "human-environment relations;" and for "management," one will read "caring for" or "taking care of."

Benefits of Using TEK

Dr. Selso Villegas, Tohono O'odham Nation Water Resource Director, said, "Traditional knowledge and western science both use observations and experiences to answer questions about the physical world." Since time immemorial, Tribes used traditional knowledge to care for their people's use of living things without obliterating or extinguishing them. Use of TEK enhances the knowledge used for decision-making about species and habitats, provides longitudinal knowledge for climate change and planning projects, and builds relationships with Tribes about environmental topics of common interest.

Although learning TEK is not government-to-government consultation, one initiates a TEK project through government-to-government consultation. It is one way federal employees can honor the federal trust responsibility to tribes with regard to the environment. Considering TEK allows a mutually beneficial relationship to be created between federal employees and indigenous scholars. Both can benefit by mutual exchange of information and interpreting the information collaboratively. A critical aspect of conservation biology and associated caring for the environment is acquiring information that is not only accurate, but trusted by those who make and abide by the decisions based on that information. The use of TEK offers one way of bridging gaps in perspective and understanding, especially when used in conjunction with knowledge derived from the western scientific method.

Mesa Verde National Park – example of farming terrace with check dam. NPS photo

Types of Projects Appropriate for Integration of TEK with Western Science

The types of projects appropriate for integration of TEK with Western Science are varied and limited only by the one's imagination and access to information. A few examples include: use of fire and herbivore grazing of plains and forests; water use; access plans to sensitive areas such as cultural sites, sites with habitat diversity, those that species use for migration, birthing, bedding, winter/summer feeding ranges; sites used for astronomy; land use plans and implementation; studies of weather patterns and variations including climate change and impacts thereof; ancient facilities uses and maintenance; and determination of harvest limits for flora and fauna.

Learning and Living TEK

Methods for learning TEK derive from the social sciences, especially Cultural Anthropology. The National Park Service has qualified cultural anthropologists and tribal liaisons on staff who have experience using these methods and can help you develop TEK projects to enhance your projects. In addition, TEK projects can be conducted by staff at tribal colleges and Cooperative Ecosystem Study Units (CESUs), as well as by contractors. TEK projects should be conducted by a professional.

Below are some of the methods that a professional TEK researcher may use, but they are not necessarily listed in the order TEK should be derived. While a researcher may not use all of these methods, more than one method should be employed.

Literature review is an important component in any research project. Most of the Tribes in the United States have been studied by an anthropologist at one time or another. During a literature search, ethnographies as well as collections of stories, myths, legends and songs will be instrumental to the researcher for information on societies, clans, keepers of knowledge, ceremonies, uses, processes and interactions.

The **semi-directed interview** is a standard ethnographic method for gathering information that uses primarily open-ended questions. For the purposes of TEK, the breadth of the questions may be limited compared to an ethnography, yet a skilled and experienced researcher can determine the appropriate reach of the interview questions. For example,

questions about a species may include such topics as the species itself, its habitat, interactions with other species, traditions and ceremonies surrounding the species or its parts, identification of who or which societies or clans hold knowledge and rights to the species, taboos, cyclical events, indicators for behavior, and vocabulary.

Focus groups have also been used by researchers to provide direction for additional subject matter and identification of experts. Focus groups can be helpful to determine who within an indigenous Tribe holds the knowledge for the species being studied. There could be a clan, a society or another group who are the Keepers and transmitters of the information as not all information may be universally known within the Tribe. The use of focus groups is not recommended as a sole methodology for learning TEK.

Biologists provide tribal youth in northern California and southern Oregon with a unique opportunity to combine their cultural knowledge about the local ecology with the high-tech capabilities of NASA, the Service and other federal agencies. Photo credit: USFWS

Participant observation is another research method used, which involves extensive time in a culture watching and recording what people do. Participant Observation can be a source to verify information that has been gleaned from interviews and as a source of information that the Tribe may forget to tell the researcher because it is considered either universally known or assumed.

Linguistics can provide insight into a culture and its view of the natural world. Some Tribes now have written dictionaries for their languages. A native speaker can provide information about words, their meanings, associations and similarities. For example, the Yupik language on Nelson Island in Alaska is intrinsically tied to the environment – there are words to describe plants, activities, and elements in the Yupik language that are non-existent in other languages. These words help Yupik people to determine how they interact with their immediate environment.

Mapping can be used in conjunction with the semi-directed interview to identify areas of significance, habitats, species migratory routes, etc. The visual created can be used to ground-truth information and create plans for managing and protecting these areas.

Considerations for Working with a Tribe on a TEK Project

Some Tribes will want to provide TEK for projects and will broach the subject. Other times, federal employees may have a project that would benefit from TEK inclusion.

The Superintendent or Cultural and/or Natural Resources staff will identify a professional TEK researcher to coordinate the project. The professional TEK researcher selected should have: familiarity and experience with the Tribe, experience using ethnographical protocols and methodologies, a foundation of trust with the community(ies), an understanding that TEK is not tied to the researcher's timetable, time to have TEK experiences in the indigenous community(ies), and the ability to leave one's own conceptions and predispositions behind to learn and experience the breadth of TEK.

The TEK researcher may establish a team, consisting of tribal staff members and agency staff members, to explore the proposed project. The researcher and funding agency should request permission from the Tribal Council and any appropriate elders groups or societies for the proposed research project.

The researcher's approach to the Tribal Council through government-to-government consultation should be one of openness to the possibility of working together. The researcher should allow the Tribe to determine from its perspective who from the Tribe will be involved in the project. If the Tribe does not want to participate on this

particular project, the researcher should thank them for their consideration of the project and drop the matter. Depending on the Tribe's response, the researcher may approach them with future projects. However the project unfolds, with or without TEK, it is important to keep the Tribal Council updated and included in the process to the level they desire.

For a TEK project, the researcher will negotiate a written document between the Tribe, researchers and funding agency. The document should cover the purpose of the research project, the methods used to identify participants and to obtain Prior and Informed Consent, methods for gathering research findings, description of how the information will be used, level of public access to the information, determination of ownership of the information and its results or products, how information will be disseminated and stored, applicability of the Tribe's research protocol, timeline, funding of the research including reciprocity to the Tribe and individuals taking part in the research, and communication of the process and results to the Tribal Council and Tribal members, as well as other topics of concern for the Tribe, researcher and funding agency.

Protection of TEK is a serious concern for many Tribal nations, and they are justified in this concern. The information learned through a TEK project is communal property with a host of social and moral responsibilities for the knowledge holders. While TEK is communal property, not all members of a Tribe are necessarily privy to it or to the breadth of it. Under these circumstances, TEK is not eligible for protection through intellectual property laws in the United States, which protect an individual's intellectual property for a finite time before the information enters the public domain. There has been some discussion that intangible property law may afford the protection desired by the Tribes. To date, there is no precedence for its use in the courts for protection of TEK, and so the level of protection intangible property law affords is theoretical. Tribal gatekeeping is currently the safest means of protecting sensitive TEK.

Lake Clark National Park & Preserve – A bull caribou grazes in autumn. NPS photo

How can I learn more?

Learning and experiencing TEK is not for a novice. Reading literature about TEK and speaking with professionals or those experienced in the field can help one determine if a project can benefit from TEK. Similarly, experienced professionals can help identify appropriate project personnel. In addition, even though one's intent in learning TEK may be altruistic, the ways the information is used can have unintended consequences. A cultural anthropologist will have experience with ethnology and/or TEK and will be able to provide insight.

There are a number of books and publications that examine TEK and its strengths in relation to Western science and evolutionary philosophy. Some of these books address the scientific basis of TEK, focusing on different concepts of communities and connections among living entities, the importance of understanding the meaning of relatedness in both spiritual and biological creation, and a careful comparison with evolutionary ecology. They may examine the themes and principles informing this knowledge, and offer a look at the complexities of conducting research from an indigenous perspective.

When TEK is combined with western science and decisions are being considered for taking care of the environment, think about the long-term impacts of these decisions beyond addressing the most pressing issue. New methodologies or technologies can have unintended consequences. Case studies are a way of learning to think beyond the anticipated result to the sometimes unintended consequences. The Suggested Reading List below provides information on the topics expressed in this Fact Sheet.

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https://www.nps.gov/subjects/tek/index.htm

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