

## ETHICAL SCIENCE AND INDIGENOUS SUSTAINABILITY

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Thesis: Native Americans attained sustainability thousands of years ago and their knowledge systems evolved into a set of sustainable guidelines using ethics and values, scientific content, and objectives. Western science must acknowledge the holistic nature of indigenous science in order to keep the context of indigenous knowledge intact.

### **Abstract**

Western academics continue to debate the definition of sustainability and western science tends to ignore ethics as part of the goal of objectivity. Definitions of sustainability within the context of western science attempt to define sustainability as a goal without providing a clear path to attain the goal. Native American tribes have attained sustainability over thousands of years. My research attempted to answer the question of how sustainability is defined from the Native American perspective and how sustainability is practiced by tribal groups. During my internship with the EPA, I interviewed tribal natural resource managers and wrote case studies about the tribes' climate change work. In addition, I conducted literary research on indigenous methods for sustainability and found evidence for defining sustainability within works on traditional ecological knowledge (TEK). Native American definitions of sustainability include ethical values because indigenous science also includes decisions informed by ethical values. Indigenous science focuses on content as action, as a verb, and the Native American definition of sustainability is a verb. Therefore, indigenous environmental sustainability is a set of ethical actions, it is the path taken to the goal. Indigenous knowledge content and actions based on the content are used together with ethical guidelines, forming a holistic approach that aims to preserve healthy natural systems for future generations. In the indigenous worldview the intention of how information will be used is just as important as the information itself. The next

logical step in embracing TEK is to understand the cultural context of traditional tribal ethics and management systems.

## **INTRODUCTION**

During a meeting with Native American tribal chairs at the White House in November 2009, President Obama told the attendees “We have a lot to learn from your nations in order to create the kind of sustainability in our environment that we so desperately need” (Grossman, Parker 2012, 16). What the American government needs is a policy of sustainability and President Obama is right to recognize the knowledge that tribal nations have regarding sustainable management. The Environmental Protection Agency (EPA) Region 10 website describes the history of the word sustainability as arriving “in 1969 with the passage of the National Environmental Policy Act (NEPA)” (EPA 2014). The words “sustainability” and “sustainable” have a short history of use in English literature as shown in the N-gram graph (*fig 1*). Academic and scientific journals struggle to define sustainable ethics (Vucetich 2010, 539) and the new realm of sustainability science alludes to ethics yet fails to include influences of behavior in their work (Komiya 2006, 5). Definitional forms of sustainability number more than 300 (Dobson 1998, 33) and this struggle of definition resides in the attempt to define sustainability as a noun, as knowledge content, or as a goal in an undefined future. In indigenous worldview, sustainability is viewed as an action or a path taken to attain a goal.

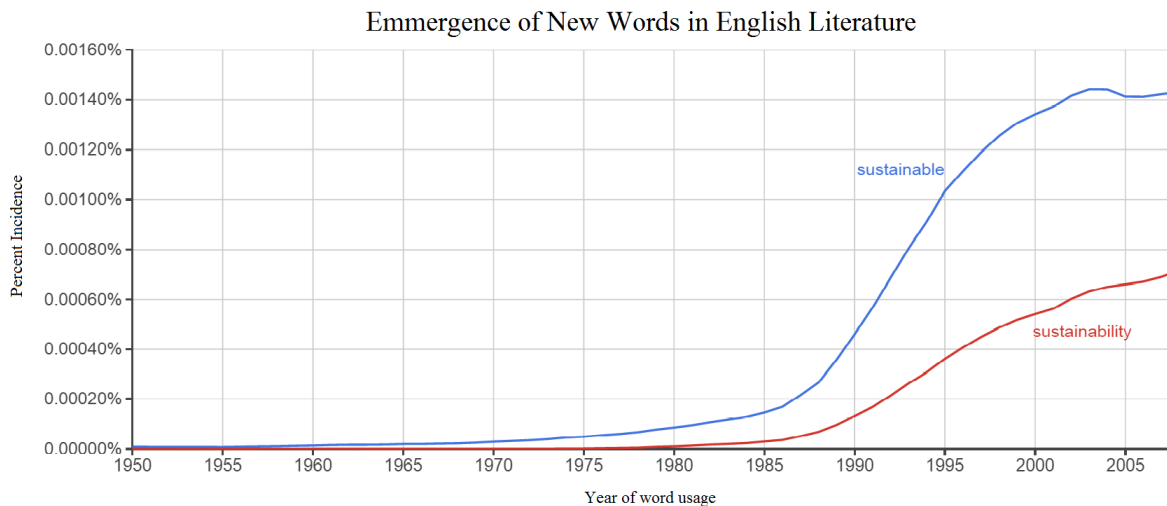


Figure 1. 1950-2010 N-gram graph of print usage of Sustainable and Sustainability; source: Google N-gram Viewer

Academics look to tribes' traditional ecological knowledge (TEK) for scientific content (TEK is also referred to as "Native science"). The description of TEK has recently been improved by tribal professionals to Traditional Knowledges/Traditional Knowledge systems (TKs) (CTKW 2014, 1, 7). Changes in definition are a reflection of tribal ownership of information because TKs is more than just ecological knowledge content. I will use the acronym TKs and I also prefer to capitalize the word Native because it describes a legal identity and differentiates between native plants or animals and Native human beings. Western academics tend to largely ignore tribal ethics because western academics have been trained to avoid ethics (Reo, Whyte 2012, 25). Western science has a goal of objectivity by ignoring cultural influences (Mason et al. 2012, 188). Ethics are a set of moral principles that govern behavior and action, therefore, environmental ethics really should be relatable to sustainable policies: a set of governing rules to define behavior and action in the natural environment.

Native cultures hold a set of environmental ethics because they have achieved sustainability in their resource management systems through time-tested practices over thousands of years (Trosper 2002, 330; Menzies 2007, 444; Grossman, Parker 2012, 22). Indigenous academics and writers consistently discuss scientific content along with their traditional sustainable worldviews and ethical values because the intention, or protocol of how information is used is very important to indigenous sustainability (Whyte 2015, 2). Native science is an action, a verb as opposed to western science's claim that science should be content without values (Medin, Bang). Sustainability science need not invent itself without any input from cultures that have proven themselves to be able to behave sustainably and indigenous cultures can teach humanity that sustainability will not be attained if ethics continue to be ignored by western science (Vucetich 2010, 540). Native American tribes share in common with each other a set of sustainable traditional values that continue to be taught to the younger Native generation today. I will discuss the sustainable traditional values through a meta-analysis of research, teasing out values from academic discussions of TKs. Analyzing Native knowledge systems will inform us about indigenous worldviews and values. Results from dialogs with tribal members during my research interviews and during discussions are in line with my academic research. Case studies that I produced during my internship with the EPA will provide examples of traditional sustainable values in practice and will also provide examples of scientific work that was able to integrate traditional knowledge and western knowledge.

## **BODY**

The history of environmental ethics in American academia begins with Aldo Leopold's call for a "land ethic" in the Sand County Almanac, (1949).<sup>i</sup> A unifying set of values has not been created or adopted by the American public since then. Indigenous people have been

practicing environmental ethics for thousands of years before the formation of the United States. Ethics, morals, values, and worldviews are used to inform action and therefore environmental impact. Values are judgements of importance, a set of standards of behavior, a way of being or doing. Ethical and moral principles may have legal implications, and I will focus on sustainable values as they can have broad applications.

### **Climate Change Case Studies**

During my internship with the EPA I conducted interviews with natural resource managers of several tribes in EPA's Region 10 in order to produce four case studies of climate change work. My site supervisor was Michael Cox, Climate Change Advisor in the Office of Environmental Assessment. Tribal governments are at the forefront of communities creating climate change adaptation plans because tribes are key stakeholders and they have the best natural state information (TKs) with which to gauge climate changes. During each interview I would ask how traditional knowledge was used for the projects in order to empower tribal communities and to gain insight on tribal sustainability. My most enjoyable and informative discussion about indigenous sustainability was with Larry Campbell, a Swinomish tribal elder. Before each interview I conducted background research on the tribes and on the project work. I took careful notes and transcribing and translating spoken to written word was interesting work. I wrote drafts and underwent peer review with my supervisor and with the natural resource managers. During the internship's short time frame I was able to set up interviews, write the case studies, conduct further research, and return a finished product to my supervisor and to the tribes interviewed. Because TKs contains traditional values, each case study is an example of values in practice; see Appendix A for case study descriptions.

## Tribes Know Sustainability

Native American worldviews and ethical values are sustainable and are an integral part of TKs. Over thousands of years of developing sustainable management systems Native American tribes have learned to place great importance on traditional values as a set of standards of behavior used to inform management (Trosper 2002, 330). TKs goals are to perform resource management actions that create positive results in the natural world. Characteristics of the traditional knowledge system are completely immersed and informed by this rounded goal of positive action.

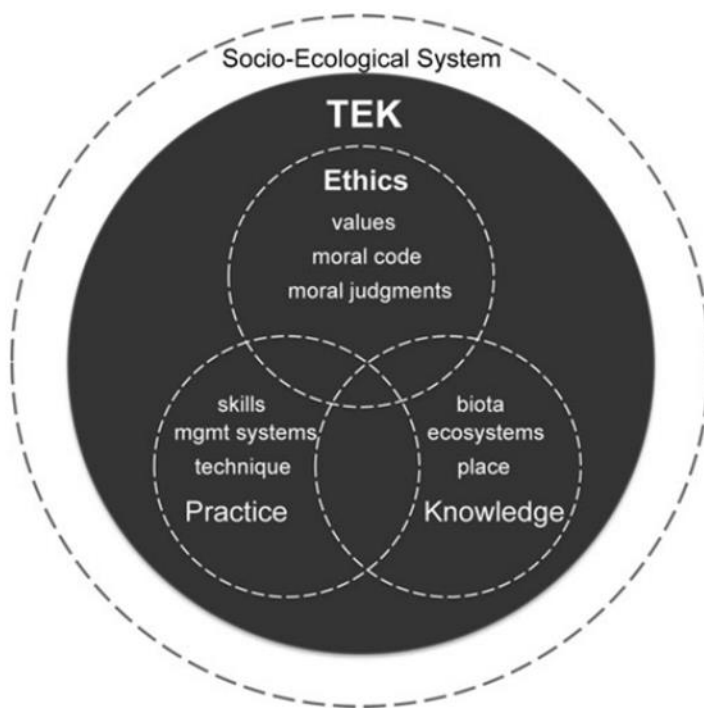


Fig 2. Conceptual diagram of components of traditional ecological knowledge situated within broader Socio-Ecological Systems. Source: Reo, Whyte 2012.

Traditional knowledge is made up of worldviews (moral, ethical, or spiritual values), knowledge (content), and sustainable practices (practical applications of knowledge) (Reo 2012, 15). *Figure 2* is a Venn diagram of how the three components overlap but I argue that the overlap is much greater than shown. Due to the fact that Native science focuses on action, the

intention of action is very important to indigenous peoples. Attitude, or intention of action is defined by Whyte as protocols in the English language (2015, 5). TKs content is not usually discussed by tribal members and tribal academics without also discussing ethical values or how the knowledge content will be used. Another way to visualize the relationship of components of TKs is to imagine “interconnected webs of environmental, moral, social, political, and spiritual knowledges” (CTKW 2014, 1). This interconnected knowledge approach is a very important feature of TKs and I cannot stress enough how TKs is holistic in its nature and does not separate itself into various components (McGregor 2008, 144).

### **Indigenous Sustainable Worldviews**

Indigenous worldview is fairly homogenous between tribes, as tribes have all formed sustainable worldviews. Ecological knowledge content will vary among tribes as their homelands vary but broader aspects of worldview will be very similar among tribes. One example of a homogenous indigenous worldview is the belief that animals have spirits. Belief in an animal’s spirit draws from the indigenous worldviews of humans as a part of nature and everything in nature has a role to play (Medin, Bang 2014, 186). Creatures are relatives to humans and are equals, they have intelligence and knowledge, and travel to the spirit world in similar manner to humans. The concept of the spirit of an animal helps to ensure sustainable resource management by creating empathy and reverence for the animal’s life. Keep in mind that experiential equality of humans and animals also solidifies the indigenous sustainable values that I define.

Indigenous sustainable worldviews are holistic and inclusive. The needs of humans, animals, and ecosystems are considered congruently and indigenous science deals in whole and intact natural systems. Not only are the pressing needs of the present generation discussed but the needs of future generations are included as the community is reminded that our actions have

lasting implications. Holistic thought process is evident in the Menominee concept that every animal and plant has a role to play in nature (Medin, Bang 2014, 123, 141). Roles in nature are complex and all creatures are acknowledged as giving a meaningful contribution. A culture that thinks in terms of system needs creates an ethical code that is also holistic. Whole-system philosophy leads to a scientific system that does not separate goals from content and practice. Ethics, knowledge, and action are inter-related and are almost always discussed holistically by tribal knowledge bearers when discussing TKs.

Native American scholar Paula Gunn Allen describes key fundamental worldview differences between western and Native cultures. Indians (her nomenclature) tend to view “space as spherical and time as cyclical” and non-Indians tend to view “space as linear and time as sequential” (Gunn Allen 1986, 59). Western worldview of linear space and sequential time lead western thinkers to view all knowledge as new knowledge; ironic when noting that “new age” ideals are actually ancient in nature. Spherical space and a cyclical time frame is an example of tribal cultures’ psychological closeness to nature as both are direct iterations of nature (Medin, Bang 2014, 123). To indigenous people, humans are a part of nature and all life is related to humanity and this worldview is reflected in TKs content and application.

Assimilation policies have attempted to remove tribal culture but tribes have retained “characteristics of outlook and experience that are the bedrock of tribal life”. The bedrock of tribal life is the set of values and worldviews that have guided tribal people to live sustainably for thousands of years. “In tribal systems relationship is central” and Gunn Allen makes no distinction of with whom the relationships are formed (1986, 56, 59). Relationships among humans, between humans and nature, and between past and future generations are therefore central to tribal values and to TKs scientific content.



## **Ethical Science: A Gift of Lessons from Nature**

Sustainable tribal values are lessons from nature and are regarded as holding just as much importance as scientific content. The importance of lessons from nature is so great that to tribal elders, traditional knowledge is a “gift from the creator, the ancestors, acquired through dreams, or in direct conversations with the spirit world, the plant people, the animal people, or other spiritual origins” (Grossman, Parker 2012, 62). “Gift” is a reflection of the reciprocal relationship that Native cultures form with nature and holds an implied meaning of indigenous peoples being bestowed the information through good behavior. Communication flows in two directions, not one, and provides an expressive outlet for tribal members to be active participants in building their relationships with the natural world. Spirituality in TKs highlights the sacredness of information earned from nature and places the highest ethical value that can be given to traditional knowledge. Cultural appropriation occurs when the sacred meaning, the context, behind indigenous knowledge is ignored or removed and the academic community needs to be careful to not appropriate TKs. Traditional knowledge bearers can feel empowered if they are ensured that the context behind TKs is respected and kept intact (McGregor 2008, 140). Most importantly, political and scientific empowerment will occur when indigenous people are involved in the resource management process (McGregor 2008, 146).

Context is very important when discussing culture and within the systems-based realm of Native science context is key. Cultural context is also very important in understanding Native science as science is fundamentally a cultural practice (Medin, Bang 2014, 4). Western science claims to be objective and clinical but values and worldviews can be inferred about the cultures that participate in scientific endeavors (163). The worldview of indigenous science is very different from that of western science and worldviews are reflected within science (12, 122).

Information about the worldviews and qualities of Native science (TKs) and western science (SEK) can be supported by *Table 1* (Mason et al. 2012, 188). TKs is a practice of science that does not separate itself from its cultural and spiritual values (Medin, Bang 2014, 163).

Table 2. Worldviews can be informed from characteristics of traditional knowledge and scientific ecological knowledge. Adapted from Berkes 1993 (Mason et al. 2012, 188).

Traditional Knowledge (TK)	Scientific Ecological Knowledge (SEK)
Abstract	Concrete
Qualitative	Quantitative
Inclusive	Exclusive
Intuitive	Intellectual
Holistic	Reductionist
Spiritual (social values)	Clinical (value free)
Coexistence	Control
Diachronic (long time series and place oriented)	Synchronic (short time series and broad generalities)
People are part of nature (reciprocity)	People apart from nature (competition)
Communal knowledge based on insights collected by practitioners (transferred generation to generation)	Individual knowledge data collected by specialists/ researchers (shared by publication)
Action	Content

### Informing Western Science with Ethics of Native Science

Although there are differences between SEK and TKs, they are legitimate equals and utilizing the best facets of each knowledge system could create a more robust resource management policy than either system alone. The knowledge systems share the similarity of “systematic observation” with the goal of “reliable predictability”. Information about “cause-and-effect relationships” is used in both to make policy decisions. Both systems are dynamic and responsive to changes in the evolution of their understanding of the natural world (Mason et al 2012, 192).

A key difference between the two knowledge systems is the tendency for western science to label information as a noun while indigenous science is a verb, a way of doing as opposed to content (Medin, Bang 2014, 225; McGregor 2008, 145). How knowledge will be used for practice always accompanies TK content because ethics inform action and Native science is part of a larger ethical knowledge system. Western science does not need to go through the scientific process of trial-and-error in order to create a new set of ethics, SEK should create true partnerships with indigenous people in order to adopt sustainable indigenous ethical values.

### **Characteristics that Define Tribal Values**

Traditional tribal values exhibit a set of characteristics and qualities that help define them as being integral to sustainable practices and policies. Sustainable tribal values must be unchanged: even in the face of vast cultural change due to assimilation policies, termination, modernization, and globalization. Traditional values are the bedrock of indigenous culture and they form the foundation upon which all other cultural norms are built (Gunn Allen 1986, 56). These bedrock tribal values are taught to the youngest generation today and form the heart of the definition of tradition. Tribal values are homogenous across North America, the content of TKs and some concepts about morality will vary among tribes but guiding values of sustainability do not vary among tribes. All Native American tribes have had to face the same question about how to manage resources sustainably and all tribes have come to similar answers about their core values. Forward-thinking values help to ensure that future generations are able to lead healthy and full lives. 7 Generations is an example of forward-thinking that reminds us that our actions today have far-reaching implications (Swinomish 2010, 6). Values are unifying and serve as a way to create community, building unity from the family, to the village, to the tribe, to the region. A unified set of values ensures that the values are followed by all members of the

community. Lastly, tribal values are proactive; since humans are viewed as part of nature, human actions are impactful and ethical codes are reiterated within the community before actions begin.

### **Indigenous Sustainable Traditional Values**

Traditional values must meet the qualifiers and characteristics in order to be sustainable. The following core guiding values are inter-related because indigenous worldview is holistic and systems-based.

- ❖ **Relationship:** Central to tribal culture is the importance of creating and maintaining relationships (Gunn Allen 1986, 56). Traditional worldview of humans as a part of nature leads to viewing relationships as holistic and include non-humans: animals, spirits, and ecosystems. A commonly invoked phrase during ceremony, public speech, or prayer that is used to remind the community of relationship among humans and nature is “All my relations.”
- ❖ **Respect:** “Respect is a core concept that permeates [indigenous peoples] consciousness and is deeply nested in a cultural cosmovision in which obligations to show respect extend outwards to one's family, kin, elders, community, ancestors and all one's relations. (CTKW 2014, 6)” Given more space, I would discuss the many other aspects of the indigenous definition of respect: community, 7 Generations, connectedness (holism), and humility (Trosper 1995, 66-71).
- ❖ **Responsibility:** Obligations to family members and the natural world are needed to maintain good relationships. Children are taught at a young age to have a strong sense of responsibility for their actions.
- ❖ **Reciprocity:** Acts of sharing and giving are very important to tribal cultures. Giving is a way to build relationship, show thankfulness through sharing, show responsibility, and

show respect. The Northwest Coastal economic system was dominated by reciprocity and chiefs were expected to accumulate wealth and then “distribute it to the benefit and renown of his people” (Trosper 2002, 339).

- ❖ **Appreciation:** This value is used during prayer and is a central component of almost all Native ceremonies. Thankfulness combines all of the other values because it is respectful, an act of responsibility, builds upon the relationship between humans and natural systems, and shows reciprocity between humans and natural systems. Gifts of food, clothing, and tools are shared with the community as recognition of the belief that gifts are originally sourced from nature.
- ❖ **Conservation:** The indigenous concept of conservation varies from the western notion. Low consumption maybe a better term and the proverb “Take only what you need” illustrates indigenous conservation (Menzies 2007, 455-456).

Selfish and greedy behavior do not follow traditional sustainable values. Givers are taught not to expect a return gift because that expectation would be equal to greed and selfishness. Selfish behavior destroys relationships, is a form of disrespect, and does not allow for reciprocity. Greed does not allow the expression of appreciation for nature’s gifts and greed drives people to disobey natural law. During interviews with tribal members, all interviewees said that they were taught to view greed as bad behavior.

### **Natural Law**

The concept of a Natural Law ties in the indigenous sustainable values nicely. Shelly Vendiola of the Swinomish Climate Change Initiative provides a definition of a set of natural laws that are common among indigenous groups:

“Natural law is a way of living in the world that is governed by nature and tied to our Native language, creation stories, songs, and ceremonies. Natural law teaches us to give

reverence, have gratitude, and never waste these resources. The natural law is to take only what is needed and to leave the rest, and to offer thanks to Creator for providing our traditional foods” (Parker 2012, 146-147).

Natural law is part of a dynamic ethical worldview that comes directly from the land, it is a set of moral values that comes from a culture that views itself as working within the constraints of nature’s capacity to provide. SEK’s worldview aims to control nature and to ignore nature’s limits while the TKs worldview acknowledges nature’s role as the ultimate governing body and TKs humbles itself to ecosystem limits. TKs listens to the lessons that nature provides and responds with constant thankfulness that reminds tribal members to show respect to natural law.

### **Traditional Values Are Taught and Reinforced**

Sustainable tribal values are taught and reinforced to all members of a tribal community in order to ensure that values are followed. Traditional tribal values are a central component of TKs and are taught through active and very personalized interactions and “learning by doing” (Mason et al, 188). Native Americans use proverbs, ceremonies, and stories to teach their children sustainable values (Marchand 2014, 16). Traditional values are intergenerational, as lessons are passed from one generation to the next “through indigenous subsistence and ceremonial practices and indigenous languages” (CTKW 2014, 3). Tribal ceremonies reinforce cultural values to the young and adult members and it gives elders the satisfaction of knowing that their lessons and worldviews have also been respected and adhered to (Marchand 2014, 79). Tribal leaders are expected to exhibit morality and be fine examples of tribal values and to lead through action (Trospen 2002, 339). Traditional indigenous guidelines for teaching give responsibility to the teacher to ensure that the student will use the knowledge in the correct way and will not cause harm to the community or nature (CTKW 2014, 15). Social pressure is also used to reinforce values and begin with a “talking-to” by a tribal elder. If the offender continues

harsher methods are used like shaming, shunning, loss of reciprocity, and finally banishment.

Banishment may seem brutal but the offender has a chance to return to community if they show signs of rehabilitation (Kunesh, 2007, 86-100).

### **“Take Only What You Need”**

The Ts’msyeen had the technology and the ability to overharvest their fisheries but they sustainably managed their rivers for more than 9,000 years (Menzies 2007, 444). “Take what you need” is an indigenous proverb that was a ubiquitous answer when asked how to use resources responsibly (455-456). I feel the responsibility to add the word “only” to this proverb to remind readers that taking more than needed would violate the proverb. Another proverb example is “syt güülm goot” which means “being of one heart”, a concept that “underpins Gitxaala approaches to resources and how they should be used and shared” (442). The following example of a Ts’msyeen planning for a harvest takes into consideration who they are going to help before departing:

“Before I leave, I find out who I want to help, who I want to give to. That tells me how much I need.... You just feel it. You know when you have enough. You don’t shoot animals you have no use for. If you’re going to treat Nature like that she can come back on you twice as hard.” – Colin Nelson (Menzies 2007, 456).

### **An Economy of Reciprocity Ensures Good Resource Management**

A case study on sustainability of tribes of the Northwest Coast gives us insight on management systems operating in an economy that is not based on modern capitalism.

Archeological evidence proves that Northwest Coastal cultures generated their sustainable cultures about 3,000 years ago (Trosper 2002, 330). Environmental ethics of the Northwest Coast contain these elements: Unity of man and nature (“all my relations”), importance of restraint in consumption (“take what you need”), and a long time horizon (“7 generations”) (335). Economic

incentives of reciprocity encourages the responsibility of resource management because reciprocity reduces the “incentive to harvest too much” (332-333).

### **Interview Results**

I conducted a small sample size of interviews with ten tribal members. A common response when asked about similarities between western and indigenous definitions of sustainability was a criticism of the western worldview of sustainability. Some respondents said that sustainability is a term used to greenwash products and is used as a way for companies to gain consumer sentiment. One interviewee said that westerners “don’t know how” to be sustainable and I find it interesting that the choice of words focused on action as opposed to saying that westerners don’t know how to define the goal of sustainability. At the same time, there was some criticism of one’s own Native community that do not always have actions in line with morals and values, which I would argue is an artifact of living in a western world. I am happy to report that interview answers are in-line with academic research.

### **Ability to Change Worldview**

During my internship with the EPA I was pleased to learn that non-native resource managers adopted tribal values and worldviews in a respectful manner. I believe that adoption of traditional values occurred over a long time-frame as the non-member employees gained personal insight while working with tribes. I was a bit frustrated to observe that some EPA employees that were not able to form relationships with tribes did not show the same intimate understanding or adaptation of traditional values. Non-member tribal employees provided examples of adoption of traditional sustainable values and worldviews, while maintaining context of the tribes they represent. Adoption of Native worldviews and values is a marker of success of an indigenous natural resources project (Whyte, personal communication).



## CONCLUSION

Native American cultures contain a sustainable set of management practices that place ethical values at the same importance as scientific content. The way the information is used is of equal importance to the information itself. Western science focuses solely on content in order to satisfy curiosity or inquiry but sustainability, like the indigenous worldview of science, is a verb. Recognizing that sustainability is concrete action as opposed to abstract content will help to solve academia's struggle to define sustainability. Sustainable traditional values are bound up with TKs because the values are a branch of science; like science, values are a lesson that comes from nature.

Worldviews of indigenous cultures evolved over thousands of years to become sustainable worldviews and are very different from the popular worldviews of European American culture. Indigenous worldviews continue to be taught to younger generations and has survived many aspects of cultural change because it is the bedrock of tribal culture (Gunn Allen 1986, 56). SEK and TKs are legitimate equals and using the best facets of each system will create a management system that is stronger than each system alone (Mason et al. 2012, 192). Traditional tribal values exhibit a set of characteristics and qualities that help define them as being integral to sustainable practices and policies. They are holistic, forward-thinking, proactive, unifying, and homogenous across North America. Traditional sustainable values are relationship, respect, responsibility, reciprocity, appreciation, and low consumption. All of the values are a part of the Native American concept of Natural Law, which recognizes the constrictions that nature imposes on human behavior. Sustainable tribal values are taught and reinforced to all members of a tribal community in order to ensure that values are followed. Tribal values are taught through stories, proverbs, leadership action, and intergenerational

teaching. Values are reinforced during ceremonies, during acts of reciprocity, and during traditional tribal justice systems.

Indigenous people will feel empowered when the terminology of how they want information to be used is solidified. Acknowledging the sustainable policy and ethical context of TKs will only serve to strengthen relationships between indigenous and western scientists. Beyond simply respecting TKs, the next logical step is to both understand and maintain the context of ethical and management components of TKs.

Future discussions of indigenous sustainability include a rich array of facets and even within this paper the discussion has lost some depth due to language barriers and lack of space. The ways that indigenous environmental ethics are taught and reinforced can be expanded. Some ideas within SEK are actually worldviews instead of scientific content (i.e. Western scientific confusion about altruism in biology) and through this capstone I have found the terminology needed to explain my observations. Jared Diamond is guilty of the rationalization of selfish behavior as an inherent human behavior. But selfishness is the pinnacle of unethical behavior in the indigenous sustainable worldview and a discussion about whether selfishness really is an inherent human behavior is necessary. I would enjoy a further study of economic systems of reciprocity and their relationship with sustainability. Revisit Leopold's essay and you will see examples of how his ideas are the western version of indigenous sustainability. A further discussion from the indigenous perspective of Cronon's criticism (*The Trouble with Wilderness*) of society's worldview of humans apart from nature would provide Cronon's argument the proof that he needs to show that humanity is able to view itself as an integral part of nature.

The American government has much to learn about sustainability from indigenous culture. Sustainability from the indigenous perspective is an action that uses scientific content

informed from observations and from ethical values. Indigenous sustainability is more than sustaining resource use for human benefit, it is about creating abundance in nature for the health of ourselves and our animal and plant relatives. Knowing what sustainability is will not provide sustainability – using the knowledge in the right way will be the only way to achieve sustainability.

## Appendix A

Table 1. Tangible deliverables produced during my Capstone Experience Winter 2015.

Deliverable	Recipients	Description
Suquamish Tribe Case Study	Suquamish Tribe; Michael Cox, US EPA Region 10	A newsletter style report, two pages discussing advocacy work for ocean acidification education.
Sitka Tribe of Alaska Case Study	Sitka Tribe of Alaska; Michael Cox, US EPA Region 10	A newsletter style report, two pages discussing formation of a network of harmful algal bloom monitors.
Jamestown S’Klallam Tribe Case Study	Jamestown S’Klallam Tribe; Michael Cox, US EPA Region 10	A newsletter style report, two pages discussing the tribe’s community-gearred adaptation plan
Noosack Tribe Case Study	Noosack Tribe; Michael Cox, US EPA Region 10	A newsletter style report, two pages discussing the pilot qualitative Total Maximum Daily Load (TMDL) report- the first TMDL to include future impacts of climate change on the Nooksack River and endangered salmon species.
Case Study format guide, interview notes	Michael Cox, US EPA Region 10	The guide is a set of suggestions for future interns and includes a table for organizing networking and tribe responses. I interviewed 9 tribes and 4 were interested in case studies.
Annotated bibliography	Charlotte Cote; P. Sean MacDonald	An annotated bibliography of sources to be used in Capstone analysis paper, as required by the Capstone guidelines.
Progress memos	P. Sean MacDonald	Two memos addressed to the Capstone Instructor detailing progress and lessons learned. Delivery dates were January 23, 2015 and March 20, 2015.
Capstone Blog Entry	Capstone Tumblr	A short review of my capstone experience.

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## FIGURES

Table 2. Worldviews can be informed from characteristics of traditional knowledge and scientific ecological knowledge. Adapted from Berkes 1993 (Mason et al. 2012, 188).

Traditional Knowledge (TK)	Scientific Ecological Knowledge (SEK)
Abstract	Concrete
Qualitative	Quantitative
Inclusive	Exclusive
Intuitive	Intellectual
Holistic	Reductionist
Spiritual (social values)	Clinical (value free)
Coexistence	Control
Diachronic (long time series and place oriented)	Synchronic (short time series and broad generalities)
People are part of nature (reciprocity)	People apart from nature (competition)
Communal knowledge based on insights collected by practitioners (transferred generation to generation)	Individual knowledge data collected by specialists/ researchers (shared by publication)
Action	Content

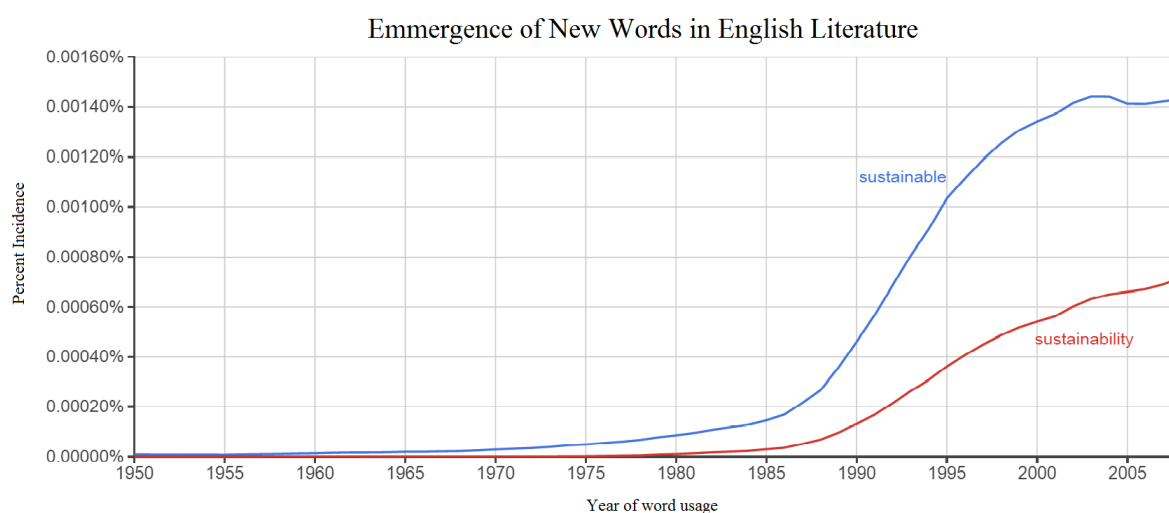


Figure 2. 1950-2010 N-gram graph of print usage of Sustainable and Sustainability; source: Google N-gram Viewer

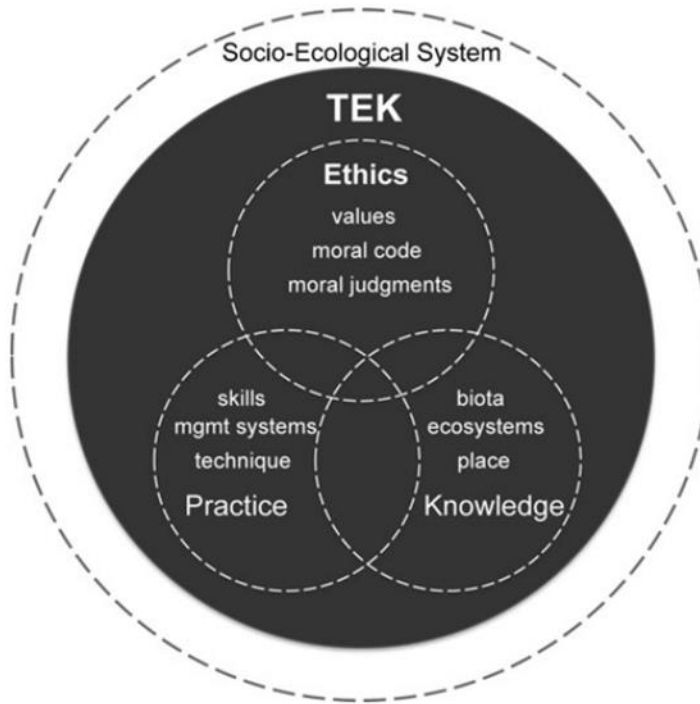


Fig 2. Conceptual diagram of components of traditional ecological knowledge situated within broader Socio-Ecological Systems. Source: Reo, Whyte 2012.

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† If I had the space in this assignment I would critique Jared Diamond's Collapse. His work is used as if it is a textbook in courses about sustainability and is another example of the struggle to define sustainability. Diamond fails to discuss ethics and when it does speak about values assumes that all humans are inherently selfish, which goes against traditional sustainable values. Diamond is not able to see through another cultural lens besides his own and some of his statements are worldviews that are stated as if they are facts without any academic backing.