Traditional Ecological Knowledge and Climate Change, and Effects on Forests

Christopher A. Ervin

Dinè Institute for Navajo Nation Educators

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Author Note:

Christopher A. Ervin, Dine Institute Fellow, is a High School Science teacher, whose focus is Environmental Science, and Chemistry, working at Holbrook High School, within the Holbrook Unified School District #3.

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Correspondence in regard to this curriculum unit can be addressed to Christopher Ervin, PO Box 1639, St. Johns, AZ 85936, or email at dineteacherinstitute@nau.edu.

Introduction

Climate Change is defined by the United Nations Framework Convention on Climate Change (UNFCCC) as "A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, and which is in addition to natural climate variability observed over comparable time periods." The National Aeronautics and Space Administration defines it as, "A long-term change in the average weather patterns that have come to define Earth's local, regional and global climates."

Whether you believe climate change is real or not, it is not going anywhere without our understanding and cultural awareness. The cold hard facts are right in front of us, and yet, we still have people in political power that deny its existence. Future generations will have the responsibility of coping with our inaction and ineptitude. For years now our climate has been shifting due to human input. Here, in the Southwest, just take a look at Lake Mead and at the water level for Lake Powell. The Southwest is in the firm grip of a severe drought. The warming pattern caused by global warming has shifted the precipitation patterns to where there is not much of it to go around. Water is already starting to be at critical levels in several locals throughout the southwest.

Here are a few facts, as set forth by the Intergovernmental Panel on Climate Change, Climate Change Synthesis 2023, Synthesis Report, Summary for Lawmakers;

> "Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and among individuals (high confidence).", "Global net anthropogenic GHG emissions have been estimated to be 59 ± 6.6 GtCO2-eq9 in 2019, about 12% (6.5 GtCO2-eq) higher than in 2010 and 54% (21 GtCO2-eq) higher than in 1990, with the largest share and growth in gross GHG emissions occurring in CO2 from fossil fuels combustion and industrial processes (CO2-FFI) followed by methane, whereas the highest relative growth occurred in fluorinated gases (F-gases), starting from low levels in 1990. Average annual GHG emissions during 2010–2019 were higher than in any previous decade on record, while the rate of growth between 2010 and 2019 (1.3% yr-1) was lower than that between 2000 and 2009 (2.1% yr-1)."

Climate change is devastating many ecosystems and deteriorating many traditional ways of life. Through this unit, I intend to form a collaboration between Traditional Ecological Knowledge (TEK) and modern western science in a way that represents cultural awareness and sustainability. Traditional Ecological Knowledge (TEK) has been defined as, "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 with one another and with their environment" (Berkes, 2012, p.7).

TEK has many thoughts on keeping our planet in good shape. The thought of the Earth as the mother of life; taking care of the mother (Earth) and it will take care of us. Many Native American tribes have an idea of life arising from the Earth and therefore, the importance of taking care of our planet.

Native American perspectives on environmental stewardship

"The general thought among many Native Americans regarding environmental care centers on a deep sense of connection, respect, and responsibility towards the natural world. They view the Earth as a living entity, often referred to as "Mother Earth," that sustains all life, and humans are seen as interconnected with, not separate from, nature," (AI Google.)

Key themes and values (as noted from Google AI):

- Interconnectedness: Native American worldviews emphasize the idea that all living beings and the environment are connected in a web of relationships. This promotes a sense of responsibility to maintain balance and harmony within the ecosystem.
- Stewardship and Guardianship: Many Indigenous communities see themselves as custodians of the land, responsible for its care and preservation for future generations.
- Respect and Reciprocity: Respect for the natural world is paramount, and it's reflected in practices like only taking what is needed, making offerings before and after harvests, and acknowledging the agency of the land and its resources. Reciprocity means if you care for the land, it will care for you in return.
- Sustainable Practices: Traditional ecological knowledge (TEK) has guided sustainable practices for centuries, including fire management, crop rotation, and responsible hunting and fishing.
- Spiritual Connection: Native American spirituality is deeply tied to the natural world. Sacred sites, ceremonies, and rituals honor the spirits of animals, plants, and natural elements.
- Accountability: Native Americans often see a direct connection between human actions and the well-being of the environment, believing that harmful practices have negative consequences that ripple outwards.

Reasons for a Unit on Climate Change and its Effects on Arizona Forests

Currently, in the Environmental Science curriculum I teach, we have a unit called *Land Biomes,* which incorporates types of forests in the world. My plan is to bring a portion of that unit down to a more local area, Arizona, specifically. Climate Change is recognized as a major concern in the scientific community, and by governments worldwide. "The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 195 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016," (United Nations Climate Change). With the Paris Agreement in place, which the United States is not a part of, the world recognizes the importance of stemming our global shift in climate that is known to be caused by human endeavors. Another goal is to incorporate Traditional Ecological Knowledge (TEK), and how our Native American communities have dealt, and are dealing with, the rapidly changing climate, as far as our Arizona forests are

concerned. Traditional ecological knowledge can help build an understanding of climate impacts on ecological processes and phenomena across spatial and temporal scales for different organisms, habitats, and various ecosystems (Nabhan 2010). The addition of TEK in my unit lessons is in response to being a culturally responsive educator. The students that fill my classroom are, for the most part, Navajo. Incorporating their elder's thoughts and ideas, is an essential way to honor their heritage and include cultural sustaining practices passed down for millenia. The mesh between western science and TEK, to me, is a responsible way to educate my Native American students and their peers. These different perspectives help to give my students a well rounded view of, not only science, but also of cultural differences of thought and insight.

Context and Rationale

I am Christopher Ervin, my educational journey has been kind of unique, at least to me. I did not start college until I was 28, after 10 years in the Navy, and a year as a police officer. My educational journey started at a community college in North Carolina, and I transferred to a local Historically Black University, Elizabeth City State University. I started in pre-law and switched directions, and graduated with a degree in Geology. Moving on to pursue a masters in geology, I applied to be a National Science Foundation Fellow (NSFF), and was granted a spot while attending Eastern Kentucky University. In being a NSFF, I was assigned to a middle school classroom in Richmond, KY, to help the teacher and be a "professional Resource" for that teacher. It was in this role, the first time I was able to write lesson plans and take part in teaching young people in a classroom setting. The first year I was in a 7th grade classroom, my second year I split time between an 8th grade class and a 6th grade class. My time as a NSFF was the basis for me becoming an educator.

Beyond that adventure in education, I went on to receive a master's degree in Secondary Education and then, a master's degree in administration and Supervision in Education.
I have taught in Arizona since 2008. My educational journey here in Arizona has been a very diverse journey with many stops along the way. I have settled in northeastern Arizona, and make my home in St. Johns, Arizona. I finished my second year at Holbrook High School this year and thoroughly enjoyed my second year as a teacher at a school with such a diverse population.

Holbrook High School is located in northern Arizona in the town of Holbrook, Arizona. The Holbrook high school community is a diverse and eclectic environment. The student population, according to the Holbrook High School website (https://www.holbrook.k12.az.us/o/hhs/page/school-profile), is made up of approximately 700 students. Of those 700 students 68% are Native American, 16% Hispanic, 12% Anglo, and 4% other. There are currently 40 certified teachers on staff at the high school; 21 of those teachers have a bachelor's degree, 15 have master's degrees, one has a doctorate, there are 3 others that maintain a CTE certificate without having a bachelor's degree. Holbrook high has a dormitory close to campus that is run by tribal entities, and is capable of housing 128 total students; 64 male and 64 female.

According to the same Holbrook Unified website, there are 64% of students, excluding the students residing in the dormitory, that receive free lunch. Holbrook is a Title 1 school, with more than 40% of its population from low income families. Holbrook High School offers a variety of extracurricular activities like athletics, fine arts, and clubs of various functions, as well as a great variety of afterschool tutorials.

Instructional Plan

This is my second year of participating in the Institute for Native-Serving Educators (INE), the biggest objective for my unit is to bring culture into my classroom. With all of the Environmental Science lessons I deliver, I try in some way to bring it back to a local level. While that may not be the definition of culturally responsive, I feel that it incorporates a bit, for the kids, ownership of what is happening on their Native lands.

The number one objective for this unit is not necessarily content, yes I know, we all have to ensure our content is delivered with haste in order to make it through all of our standards that are necessary for "real learning", and for the rich education that we are empowered to bestow. However, bringing a lesson that supports integrating traditional ecological knowledge in a classroom, you may want to consider your priorities, I know I did.

As with the unit from last year, my number one objective for this unit is to ensure the students are aware that we are using traditional ecological knowledge in both cultural respects, and from an educational perspective as well, concerning climate change and the effects of it on our forests here in Arizona, and look at how Native elders have used/adjusted in a traditional sense.

Students will be able to:

- Identify traditional ecological uses for adjusting to and taking care of Native forests and woodlands.
- Identify and explain what TEK and western science have in common and how they are different.
- Compare and contrast conventional western methods/uses for sustaining Native forests and woodlands with the TEK approach.
- Explain the importance of incorporating cultural traditional ecological knowledge in a science classroom setting.
- Write a summary/explanation of the unit in terms of meaning and substance to themselves.

Dinè Content Standards

High School - Dinè History Standards

- Concept 3, PO 2, I will research how American government affected the Dinè way of life and that of surrounding tribes.
- Concept 4, PO 3, I will interview and research the reasons for changes in living environments.

Arizona State High School standards associated with and/or fulfilled with this unit are:

- Essential HS.E1U1.11 Analyze and interpret data to determine how energy from the Sun affects weather patterns and climate.
- Plus HS+E.E1U1.4 Analyze and interpret geoscience data to make the claim that dynamic interactions with Earth's surface can create feedbacks that cause changes to other Earth systems.
- Essential HS.E1U3.14 Engage in argument from evidence about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.
- Plus HS+E.E1U3.9 Construct an explanation, based on evidence, for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- Plus HS+E.E1U3.10 Ask questions, define problems, and evaluate a solution to a complex problem, based on prioritized criteria and tradeoffs, that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Teaching Strategies

Guided note taking will be the delivery method for the information presented in this unit. My environmental science class consists of 10th through 12th grade students. The norm for this class and those students at Holbrook High School is to take guided notes and do activities according to the notes they record for any of the units presented in science class. As my curriculum has already been prepared before my arrival at the high school, this unit is an addendum to an existing unit. This unit is sort of a miniunit within the larger unit encompassing Land Biomes.

The Opening activity for this unit will be completing vocabulary for the topic of discussion. Holbrook high school highly encourages teachers to use a teaching method called Write Pair Share (WPS), that will be an activity used throughout the unit.The first WPS activity will be for the students to define Traditional Ecological Knowledge, share that with a partner and then amend their definition based on both of their interpretations.

The students will participate in taking guided notes. At various points through the note's delivery process, there will be different activities to enforce the notes and concepts presented in the notes. About every 10 minutes worth of notes will equal a 2-minute activity of some sort, known as "pit stops" in my school. I believe this concept comes from the premise as put forth by the book *Teach like a Champion*. Those activities can be anything you want to build into your unit, I will use a variety of things to check for understanding during those times. Things that might be included with white boarding the answer to a question or two based on the part of the lecture I am in at the time may be included. There may also be a, turn to your partner and discuss, or summarize, activities like these can be put in your unit however you see fit for your students. Materials for this unit are included in the appendices at the end of the paper.

Materials include:

- Google slides presentation
    - Pit Stops within the presentation (Meant to reinforce material and check for understanding along the way).
- Guided notes packet
- Vocabulary handout
- Various worksheets

There are plenty of other materials that you may see fit to use.
I invite you to see how this unit fits into your curriculum and give it a go!! I think you and your students will really enjoy it.

Thank you very much!!

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