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CO-CREATING CULTURALLY INCLUSIVE CLIMATE CHANGE
PROGRAMMING: A QUALITATIVE STUDY WITH
INDIGENOUS POPULATIONS IN
SOUTHEAST UTAH

by

Bayli R. Hanson

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Environment and Society

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2023

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ABSTRACT

Co-Creating Culturally Inclusive Climate Change Programming: A Qualitative
Study with Indigenous Populations in Southeast Utah

by

Bayli R. Hanson, Master of Science

Utah State University, 2023

Major Professor: Dr. Roslynn Brain McCann
Department: Environment and Society

Underrepresented communities, including Indigenous populations, experience climate change at a more extreme rate due to where they live, despite their knowledge of and connection to the land. Due to this interconnection, there have been negative impacts on cultural identities in correlation with environmental degradation. For example, Indigenous communities that continue to hunt and forage on traditional lands are now being met with difficulty and limited resources due to changes in the land itself. This study aims to better understand Indigenous perspectives of climate change and local solutions, lessons learned from collaborating with Indigenous communities, and to co-create a climate change curriculum with Indigenous populations in southeastern Utah. We still do not have a standard set of indicators for the responsible inclusion of Indigenous knowledge and people in environmental sciences (David-Chavez & Gavin, 2018). The curriculum will be applied

to an Indigenous-centric field experience as a partnership with the Nature Conservancy, including information about Western science practices in climate change programming. The skills accrued by students engaged in the climate change curriculum and their communities will better prepare them to engage in climate change decisions and adaptation and mitigation efforts that will strengthen future resilience. The co-created curriculum will function as a bridge between university-based scientific research, traditional ecological knowledge, and community needs to better connect with the social systems to which students in the program belong. Indigenous populations have been advocates for the sustainable management of natural resources for generations. Working with traditional knowledge and experience could be one of the best ways to implement climate change adaptation strategies more efficiently among Indigenous communities (Makando & Thomas, 2018). This article will share information on the problem we are addressing, the methods we implemented, and the results from a qualitative study.

(189 Pages)

PUBLIC ABSTRACT

Co-Creating Culturally Inclusive Climate Change Programming:

A Qualitative Study with Indigenous

Populations in Southeast Utah

Bayli R. Hanson

This study explores the impact of climate change on underrepresented communities, particularly Indigenous populations in the Colorado Plateau region, and the negative effects on their cultural identities and traditional practices. Despite their knowledge and connection to the land, Indigenous communities are experiencing climate change at a more extreme rate due to their geographical location and the lasting impacts of settler colonialism. The study aims to better understand Indigenous perspectives of climate change, co-create a climate change curriculum with Indigenous populations in southeastern Utah, and apply it to an Indigenous-centric field experience. By incorporating traditional ecological knowledge and Western science practices, this curriculum will better prepare students to engage in climate change decisions and adaptation efforts. The study highlights the need to work with traditional knowledge and experience to implement climate change adaptation strategies more efficiently among Indigenous communities.

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Bayli R. Hanson

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CHAPTER I

UNDERREPRESENTED COMMUNITIES & CLIMATE CHANGE

This chapter will explore the overarching themes that are discussed in more detail in the following two chapters of climate change perceptions and co-creation strategies with Indigenous populations. The impact of climate change on Indigenous communities is a significant and urgent concern. As noted by the Status of Tribes and Climate Change Working Group (STCCWG, 2021), Indigenous communities are among the most vulnerable to the effects of climate change. This is due to their reliance on natural resources for their livelihoods and their deep connection to the land. The report highlights that climate change has caused a range of environmental impacts, including altered ecosystems, extreme weather events, and rising sea levels, all of which have had significant effects on Indigenous communities' health, cultural practices, and ways of life.

The report also notes that Indigenous communities have often been excluded from decision-making processes related to climate change, leading to further marginalization and inequality (STCCWG, 2021). This exclusion has made it difficult for Indigenous peoples to have a say in the policies and programs that directly impact their communities. The effects of climate change on Indigenous communities are not just environmental, but also cultural and social, and addressing these issues requires a comprehensive approach that includes Indigenous peoples in decision-making and the creation of climate change adaptation and mitigation strategies.

Indigenous communities have a wealth of knowledge and expertise in environmental management and stewardship, which is critical to incorporate into climate change planning and decision-making. According to a report by the International Institute for Sustainable Development, "Indigenous peoples have developed a sophisticated understanding of their ecosystems and have developed management practices that are sustainable, effective, and adapted to the unique conditions of their environment" (Recio, & Hestad, 2022). By including Indigenous viewpoints and opinions in climate change planning, we can develop more efficient and fair solutions to the effects of climate change and ensure that no community is left behind in our efforts to build a more sustainable future.

To address these issues, there is a growing recognition of the potential for Indigenous and settler knowledge to be interwoven for environmental protection. Takach (2021) argues that collaboration between Indigenous and settler communities is essential for addressing climate change and environmental protection. He notes that Indigenous knowledge and practices, which are grounded in a deep understanding of the environment and intergenerational knowledge, can be complementary to Western scientific approaches. Takach (2021) suggests that incorporating Indigenous knowledge into environmental decision-making can lead to more sustainable outcomes and foster more equitable and respectful relationships between Indigenous and non-Indigenous communities.

Working with Indigenous communities to combine Western science with Indigenous knowledge to create a place-based climate curriculum is a dominant topic in the context of climate change and environmental justice (Hoagland, 2016; Sweet, 2018). This approach recognizes the need to incorporate Indigenous knowledge, culture, and

practices in climate education to empower Indigenous communities to address the impacts of climate change while also promoting equity and justice (Takach, 2021; STCCWG, 2021). By integrating Indigenous knowledge and practices with Western science, the curriculum can become more effective in addressing the complex and interconnected nature of climate change issues (Hoagland, 2016).

The integration of Indigenous knowledge and practices can also promote a more sustainable and equitable approach to resource development and environmental protection (Takach, 2021). This approach recognizes the historical and ongoing impacts of colonialism and capitalism on Indigenous communities and the need to decolonize and transform existing power structures (STACCWG, 2021; Meadow et al., 2021). In addition, the incorporation of Indigenous knowledge can promote cultural humility and a more nuanced understanding of impacts on local identities (Yarker, 2018). Indigenous knowledge and practices in climate education and resource development can contribute to environmental justice, sustainability, and cultural preservation (Cladis, 2018; Kruger et al., 2020). By recognizing the value and importance of Indigenous knowledge and practices, this approach can also promote greater collaboration and understanding between Indigenous communities and non-Indigenous knowledge users (Bamzai-Dodson & McPherson, 2021).

Currently, there is a shortage of universally accepted criteria for properly incorporating Indigenous knowledge and individuals into environmental sciences. Additionally, there is a need for a better comprehension of the degree to which this inclusion should be implemented (David-Chavez & Gavin, 2018). Now that we have this

information, let's move on to discussing the issue at hand, my research questions, methods, and concluding arguments.

Situation Statement

This research is part of a larger National Science Foundation Project called the Climate Change Community Programs and Opportunities (C3PO), which spans multiple states including Pennsylvania, Washington, Alaska, and Utah. The C3PO project aims to develop a climate curriculum that promotes community participation at the local level, with a focus on making training and outreach methods more inclusive and culturally relevant to underrepresented communities. Each state is working with a specific community group, with the Washington team focusing on the Latinx community, Pennsylvania on rural women in the timber industry, Alaska on Indigenous youth, and our project in Utah navigating the co-creation process with Indigenous communities in the Southeastern part of the state.

Our objective is to advance informal learning of climate change and to expand our knowledge on how to disseminate critical scientific information while collaborating with Indigenous communities in the co-creation of knowledge. Through this collaboration, we aim to increase community participation in climate adaptation and mitigation decisions and improve their welfare. Initially, the C3PO project had a goal of creating a standard curriculum. However, based on insights gained from talking circles, we have since shifted our focus and moved away from this initial aim. Instead, our goal was to create a solution that prioritizes intuitiveness for the Nature Conservancy's NATURE program while also

accommodating cultural differences. Future work from the project will involve extending lessons to other US Cooperative Extension System (CES) programs and underrepresented communities.

Regarding US CES, less than 50 climate change-focused programs were identified in a national search and call for CES programs in 2020 (Kipp et. al., 2021). Similar to CES programs, community-engaged learning (CEL) programs also seek to promote community education and outreach, often through collaboration with universities and other community partners. According to the article "A Call for a National Community Resilience Extension Partnership to Bridge Resilience Research to Communities" by Clavin et al. (2023), CEL programs are fundamental and needed because they provide opportunities for students to engage in service-learning and community-based research, which can enhance their academic learning and develop their professional skills while simultaneously addressing real-world issues faced by communities. These programs can also contribute to building stronger connections between universities and communities and foster collaboration among diverse partners. In the context of community resilience, CEL programs can help communities build capacity for disaster preparedness, response, and recovery by providing them with relevant knowledge, skills, and resources (Clavin, et. al., 2023). By involving community members and organizations in the design, implementation, and evaluation of CEL programs, researchers and practitioners can ensure that their work is responsive to local needs and priorities and promotes community ownership and sustainability. Therefore, CEL programs should be integrated into the proposed national community resilience extension partnership to bridge resilience research to communities (Clavin et. al., 2023).

In a qualitative national study, it was identified that CES programs needed to better reach underrepresented communities, including Indigenous communities (Kipp et. al., 2021). Indigenous perspectives can offer unique insights into community resilience, particularly in the context of disasters and other crises. Again, Indigenous knowledge systems are often deeply connected to the natural environment and emphasize the importance of intergenerational learning, community relationships, and cultural traditions. These perspectives can offer valuable insights into how communities can prepare for and respond to disasters, as well as how to support community healing and recovery.

Global networks of scientists have recognized the value of Indigenous knowledge systems for the adaptive capability of humanity in times of extreme climate variability. The IPCC's Working Groups emphasized Indigenous knowledge systems as resources for adaptation to climate change. Moreover, the involvement of local people and their knowledge in decision-making is critical for ensuring their security (David-Chavez & Gavin, 2018, pg. 2).

Community participation in the co-creation of knowledge about climate change, by integrating their values and objectives into the climate change education program, can increase people's motivation to become engaged in climate change adaptation and mitigation strategies (Kruger, et. al., 2018). The science, technology, engineering, and math (STEM) subjects covered in the module will be grounded in up-to-date research and proven methods for tackling climate change. Our approach to STEM curriculum uniquely focuses on place-based and bottom-up environmental education, which sets us apart from a standard curriculum like the Climate Stewards Curriculum we were originally working

from. We intend to continue working closely with members of the tribes engaged in this project, along with the National Extension Climate Initiative (NECI), to disseminate our research and education activities across CES program areas.

Research Questions

1. How do Indigenous communities in Southeastern Utah understand climate change and examples of climate resilience?
2. What are the lessons learned for producing a co-created climate change program with and for Indigenous populations?

Study Area: Southwest Region

Garfin et al. (2014) explains that the Southwest region of the US, including Arizona, Colorado, New Mexico, Oklahoma, Texas, Utah, and Wyoming, is already experiencing the effects of climate change, including increased temperatures, declining snowpack, reduced streamflow, and more frequent and severe droughts and wildfires. These changes are expected to continue and intensify in the future, leading to impacts on the region's ecosystems, water resources, and human systems such as agriculture and public health.

Adaptation and mitigation measures are necessary to address these impacts. Adaptation strategies include water conservation and efficiency, land-use planning, and enhancing the resilience of ecosystems and human communities (Garfin et al., 2014).

Mitigation efforts involve reducing greenhouse gas emissions through energy efficiency, renewable energy, and other measures (Garfin et al., 2014).

It is vital to collaborate among community partners in addressing the challenges posed by climate change in the Southwest, including coordination between government agencies, tribal nations, and local communities (Garfin et al., 2014). Projections show that the impacts of climate change will be particularly significant for vulnerable populations, such as low-income and tribal communities. These populations may face increased heat waves, air pollution, and reduced water availability (Garfin et al., 2014).

Therefore, it is recommended that the Southwest region adopt adaptation strategies such as increasing water-use efficiency, improving water management, reducing greenhouse gas emissions, and promoting resilient communities to help reduce the risks associated with climate change (Garfin et al., 2014). Additionally, implementing policies that reduce greenhouse gas emissions could mitigate the worst impacts of climate change and protect vulnerable populations in the Southwest region (Garfin et al., 2014).

Southeastern Utah

Indigenous communities in Southeastern Utah have faced a range of environmental justice issues related to energy development, land use, and water rights. One key issue is the impact of oil and gas drilling on Indigenous lands and communities (STACCWG, 2021). Many Indigenous communities in the region depend on the land for their subsistence

and cultural practices, but oil and gas development can disrupt these activities and harm the health of people and wildlife.

In addition, Indigenous communities have faced challenges in accessing and managing water resources in the region. The Colorado River, which runs through Southeastern Utah, has been heavily dammed and diverted for agricultural and urban uses, limiting water availability for Indigenous communities. Many Indigenous peoples also have traditional water rights that have been ignored or marginalized by government agencies and water users (STACCWG, 2021).

Another key issue is the impact of uranium mining on Indigenous lands and communities. Uranium mining was a major industry in the region in the mid-20th century, but it left a legacy of contamination and health impacts for Indigenous peoples and other residents (Göcke, Gross, & Heinrichs, 2014). Many Indigenous communities have been working to clean up contaminated sites and prevent further mining activity in the region. In addition to the environmental justice issues faced by Indigenous peoples in Southeastern Utah, recognizing the ongoing impacts of settler colonialism is paramount. This includes displacement from traditional lands, forced assimilation, and the erasure of Indigenous cultures and identities (Recio, & Hestad, 2022). These systemic issues have far-reaching consequences for Indigenous communities across North America and around the world. Addressing these challenges requires a commitment to Indigenous sovereignty and self-determination, as well as a recognition of the unique connections between Indigenous peoples and the natural world.

Methods & Theory

Taking a qualitative approach when working with underrepresented communities is beneficial to for several reasons:

1. **Inclusivity:** Qualitative research methods are more inclusive, allowing for a more diverse range of voices to be heard. These methods often involve open-ended questions, which allow participants to express themselves in their own words, rather than being limited to predefined categories or options (Nowell et. al., 2017).
2. **Contextualization:** Qualitative research allows for a deeper understanding of the context in which underrepresented communities exist. This includes cultural, historical, and social factors that may influence their experiences and perspectives. Understanding these contextual factors is important for creating interventions and policies that are culturally appropriate and relevant (Enn, 2012).
3. **Empowerment:** Qualitative research can empower underrepresented communities by giving them a voice and an opportunity to shape the research process. This can help to counteract the power imbalances that often exist between researchers and marginalized communities (Enn, 2012).
4. **Complexity:** Qualitative research is well-suited for exploring complex social phenomena and understanding the nuances of individuals' experiences. Underrepresented communities often face multiple intersecting forms of oppression and discrimination, and a qualitative approach can help to capture the complexity of these experiences (Toman, Curtis, & Shindler, 2021).

5. **Trust:** Qualitative research can help to build trust between researchers and underrepresented communities. By taking the time to listen to their perspectives and experiences, researchers can demonstrate their commitment to understanding and addressing their needs and concerns. This can help to establish a more collaborative and equitable research relationship (Toman, Curtis, & Shindler, 2021).

In addition to the qualitative nature of this project, a phenomenological theoretical framework was applied for the purpose of representing and understanding different perspectives on climate change. Phenomenology is a theoretical approach to qualitative research that seeks to understand how people make sense of their lived experiences (Alhazmi, & Kaufmann, 2022). At its core, phenomenology is concerned with the exploration and description of how people experience the world around them (van Manen, 1990). It aims to uncover the meanings that people attribute to their experiences and how they make sense of them. Phenomenology is a useful approach for understanding complex social phenomena such as the experiences of marginalized or stigmatized populations, and it can help to provide insights into how people navigate and make meaning of their experiences (Alhazmi & Kaufmann, 2022). This approach also involves a focus on the description of lived experiences, rather than attempting to explain or interpret them (van Manen, 1990). It often involves interviews or other forms of qualitative data collection that allow participants to describe their experiences in their own words (Alhazmi & Kaufmann, 2022). Researchers who use this approach seek to identify patterns and themes that emerge from the data, as well as any contradictions or inconsistencies (Alhazmi & Kaufmann, 2022).

Cultural Humility Framework

Cultural humility is a framework for qualitative research that emphasizes the importance of self-reflection, critical awareness, and sensitivity to the cultural context in which research takes place (Sweet, 2018). It is often used in research involving marginalized or oppressed populations, as a way of promoting ethical and respectful research practices (Sweet, 2018). We selected this framework because cultural humility encourages researchers to approach their work with a sense of humility and openness, recognizing that their own cultural biases and assumptions may influence the research process and the interpretation of findings. It involves acknowledging the power dynamics that exist between the researcher and the research participants, and actively working to mitigate these power imbalances.

The cultural humility framework encourages researchers to engage in ongoing self-reflection and critical awareness of their own cultural identity, biases, and assumptions (Sweet, 2018). It also emphasizes the importance of building trust and rapport with research participants and engaging in a collaborative and respectful research process.

In practice, the cultural humility framework may involve taking steps such as

- Engaging in ongoing critical reflection on one's own cultural identity and biases.
- Being open and responsive to feedback from research participants.
- Engaging in active listening and valuing the perspectives and experiences of research participants.

- Building trust and rapport with research participants through respectful and ethical research practices.
- Recognizing and working to mitigate power imbalances between the researcher and the research participants.
- Being sensitive to the cultural context in which research takes place, and adapting research methods and practices accordingly (Sweet, 2018).

These steps proved to be very helpful in guiding my research, especially when working with communities that have different cultural backgrounds from mine. The cultural humility framework is a way of promoting ethical and respectful research practices that prioritize the voices and experiences of marginalized populations, and work to mitigate the power imbalances that can exist between researchers and research participants. Cultural competence can be easily confused or used interchangeably with cultural humility but is more known because of its presence in workforce cultural training (Lekas et al., 2020). These two related but distinct concepts are often used in discussions of cultural awareness and sensitivity. Cultural competence refers to the ability to effectively work with people from different cultural backgrounds, including believing you now have a full understanding of their beliefs, values, and customs (Sweet, 2018). It is often described as a set of skills or knowledge that can be learned and applied in professional settings.

Cultural humility, on the other hand, is a mindset or approach that emphasizes a willingness to learn from and engage with people from different cultures. It involves recognizing the limitations of one's cultural perspective and being open to new experiences and perspectives. Rather than assuming that one has all the answers, cultural humility

involves an ongoing process of self-reflection, learning, and growth. In short, cultural competence focuses on acquiring knowledge and skills to effectively work with people from different cultures, while cultural humility emphasizes a mindset of openness, reflection, and learning in the pursuit of cultural understanding and awareness (Sweet, 2018).

Ethical and Logistical Considerations

Of note, it is our positionality as white, female, academics that grew up in Western society. Multiple conflicts come with our positionality that are specific to Indigenous communities— one being that there is a past of mistrust with academics because of their use of Indigenous knowledge without giving proper credit to the community; sometimes even claiming it as their own. Another is that we are white settlers and belong to a Western culture that has dispossessed and inflicted violence upon Indigenous communities. In light of historic and ongoing issues of academic conduct with tribes, our team spent a large amount of time building relationships before moving forward with the interviews and talking circles. Due to traumatic historical factors, language posed a potential challenge in this project. To overcome this issue, we moved away from an academic tone and adopted a more culturally sensitive approach. As an example, we used the term "talking circles" to refer to focus groups. This change was suggested by colleagues who have extensive experience working with tribal members and it has been well-received as it feels more culturally appropriate and relatable. We have worked through other potential language considerations as we created our question guide and partnered with the Native American

Tribes Upholding Restoration and Education (NATURE) program. Recognizing the uniqueness of each tribe, our intention was to ask questions that respect their individuality without generalizations or assumptions. It's crucial to acknowledge that the level of connection to the land may vary among different tribes. Furthermore, we aimed to use language that promotes equality and inclusivity, avoiding any phrasing that implies a hierarchy or disparages other cultures. As an example, referring to certain tribes as "disadvantaged" can be offensive.

Decolonizing language is essential because language is a powerful tool that reflects and shapes our perceptions of the world around us. Language can either uphold or challenge systems of oppression, including colonialism and imperialism. Decolonizing language involves examining and challenging the assumptions and biases that are embedded in our language and creating a new language that is more inclusive, respectful, and accurate (Thambinathan & Kinsella, 2021).

Using words like "stakeholder" can be problematic because such words often reinforce a Western-centric and capitalist worldview that prioritizes profit and power over the well-being of communities and the environment (ICT Inc., 2021). This language can also erase or marginalize the perspectives and voices of Indigenous peoples, who have historically been excluded from decision-making processes. By decolonizing language, we can create more equitable and just systems of communication and decision-making that are grounded in diverse perspectives and values. This can include using language that recognizes and respects Indigenous knowledge and practices, and that is inclusive of people from diverse backgrounds and experiences. Ultimately, decolonizing language can help us to build more respectful and sustainable relationships with each other and with the planet.

Something else to consider is that it is potentially hypocritical for Euro-Americans to seek collaboration with Indigenous populations to fight climate change without acknowledging and addressing the systemic issues that have allowed capitalism to thrive and contribute to environmental destruction. The profit-driven mentality of capitalism has often prioritized short-term economic gain over long-term environmental sustainability, leading to practices such as resource extraction, pollution, and deforestation that have had negative impacts on the environment and Indigenous communities (Crook, Short, & South, 2018). Therefore, it should be a priority for Euro-Americans who seek to collaborate with Indigenous populations to approach the issue with a critical perspective on the underlying systems that have contributed to environmental damage, including capitalism and settler colonialism. They must recognize and work to challenge the power dynamics and institutionalized inequalities that have allowed capitalist practices to continue unchecked. Additionally, they should engage in meaningful and respectful collaboration with Indigenous communities that centers on Indigenous leadership and self-determination, rather than simply using their knowledge and labor to mitigate the effects of a problem caused by non-Indigenous groups. Failure to do so risks perpetuating the systemic oppression of Indigenous communities and the environment.

It is essential to acknowledge settler colonialism's role in the injustice Indigenous tribes still experience today and how it is directly impacted by the systems colonization has embedded in our culture in the US (Whyte, 2016). Norgaard (2019), discusses how Western influences have always looked at topics like food, cultural identity, and the environment as separate when at the root, they are intertwined. Therefore, the imperative to "unsettle" or "decolonize" academia becomes key, representing a significant stride

towards comprehending the intricate interconnections between Indigenous perspectives, the environment, and contemporary social issues. By embracing this transformative approach, we pave the way for environmental justice, as we recognize and honor the importance of Indigenous knowledge systems in charting a path forward. This paradigm shift acknowledges that Indigenous views are not only valid but indispensable as we move forward.

Upcoming Research Chapters

In the upcoming research chapters, we will delve deeper into the methods and theories utilized in this project. This will include the use of the cultural humility framework and qualitative methods, such as talking circles, transcribing, and coding. We'll provide an overview of our engagement plan and program recommendations. Additionally, we'll break down our process and discuss lessons learned.

In Chapter 1, titled "Indigenous Climate Change Perceptions", we will explore the process of conducting talking circles with NATURE students, Indigenous-led organizations, and members of the community. Subsequently, we will delve into the key findings and takeaways that emerged from these discussions.

Chapter 2, "Co-Creation: Building Relationships for Meaningful Indigenous Climate Education", will explore meaningful collaboration using a bottom-up approach and co-creation methods. We'll examine the specific topics covered in the new climate module, which was co-created with previous participants of the NATURE program. We'll also discuss lessons learned and provide recommendations for improvement.

The final chapter, "Conclusion and Recommendations", will summarize the key findings and contributions of the project, as well as discuss the implications for future research and practice. Last, we'll provide a final reflection on the project and its significance. Appendices will include materials such as the climate module and talking circle takeaways, which will provide additional context and detail for interested readers.

Conclusion

In this chapter, a comprehensive outline was presented for the subsequent two research chapters. These chapters delve into Indigenous perspectives on climate change, the imperative for expanded Community-Based Environmental Education programs, the efficacy of co-creation in climate change initiatives, and the methodologies employed throughout each phase.

The incorporation of Indigenous knowledge into climate change planning refers to the integration of traditional ecological knowledge and practices of Indigenous peoples into teaching and learning about the environment. This inclusion is essential for promoting environmental justice and reconciliation, as it recognizes the unique contributions of Indigenous peoples to our understanding of the environment and their long-standing relationship with nature. Indigenous knowledge offers a holistic perspective on the environment that recognizes the interconnectedness of all living things and promotes sustainable practices. This perspective emphasizes the importance of respecting the natural world, rather than dominating it for human benefit. By incorporating Indigenous perspectives into environmental education, we can help to promote a more equitable and

just approach to environmental policy and address the historical injustices faced by Indigenous communities.

In addition to promoting environmental justice, incorporating Indigenous knowledge into education can also help to mitigate the impacts of climate change on Indigenous communities. These communities are often disproportionately affected by climate change due to their reliance on traditional subsistence activities, and the impacts of climate change on their lands and cultures can be devastating. Collaborative efforts between Indigenous and settler communities are needed to address environmental protection and climate change. Incorporating Indigenous knowledge into decision-making and education can lead to more sustainable and equitable outcomes and help to foster respectful relationships between Indigenous and non-Indigenous communities. It is essential to recognize and collaborate with Indigenous peoples, appreciating their unique contributions.

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CHAPTER II

INDIGENOUS CLIMATE CHANGE PERCEPTIONS

Introduction

Indigenous peoples have unique perspectives on climate change that are shaped by their deep connections to the natural world and their traditional knowledge systems. The Status of Tribes and Climate Change Report, published by the Status of Tribes and Climate Change Working Group (STACCWG) at Northern Arizona University, highlights several key themes in Indigenous perspectives on climate change (STACCWG, 2021). One key point is the recognition of climate change as an indication of broader environmental and social issues. Indigenous peoples often view climate change as part of a larger group of interconnected issues, such as land degradation, loss of biodiversity, and social and economic inequities. This holistic perspective reflects the importance of the natural world to Indigenous cultures and the ways in which environmental issues are intertwined with social and cultural concerns (Recio, & Hestad, 2022).

Another key point is the importance of traditional knowledge and practices in responding to climate change. Indigenous peoples have developed sophisticated systems of ecological knowledge and management over thousands of years, and many communities continue to rely on these practices to adapt to changing environmental conditions (The Wilson Center, 2019). However, Indigenous peoples also face significant challenges in maintaining these knowledge systems in the face of ongoing environmental and social pressures.

The STACCWG (2021) report also highlights the importance of recognizing Indigenous sovereignty and self-determination in climate change research and policy. Indigenous peoples have often been marginalized or excluded from climate change discussions and decision-making processes, despite being disproportionately affected by its impacts. By recognizing Indigenous sovereignty and engaging in collaborative, community-driven research, and policy processes, it may be possible to develop more effective and equitable responses to climate change (Dent et.al., 2023) Indigenous perspectives on climate change offer valuable insights into the complex social and ecological dynamics of this issue on a global scale. By centering Indigenous knowledge and practices, and recognizing the importance of Indigenous sovereignty and self-determination, it may be possible to develop more inclusive and effective approaches to addressing climate change.

Included in centering Indigenous knowledge is preserving and respecting sacred sites, which are central to Indigenous spiritual beliefs and practices and are often threatened by environmental degradation and resource extraction. The destruction of sacred sites not only violates Indigenous peoples' religious freedom but also their right to a healthy environment (Cladis, 2018). The Diné (Navajo people) struggle for environmental justice is intimately connected to their spiritual beliefs, in which they see the natural world and human beings as interconnected and interdependent (Cladis, 2018). Environmental justice movements should consider the spiritual dimensions of the struggle for a healthy environment and recognize the importance of sacred sites to Indigenous peoples. Protection of sacred sites is not only a matter of religious freedom but also of environmental justice and human rights (Cladis, 2018).

The relationships between capitalism, colonialism, and Indigenous environmental justice are complex. These systems are deeply interconnected, and environmental exploitation and social injustices are often interdependent (Whyte, 2016). Indigenous peoples have been resisting and challenging these systems through various forms of activism, including direct action, legal challenges, and Indigenous-led conservation initiatives. It is critical that we are centering Indigenous voices and knowledge in environmental justice movements and calls for a transformative shift away from capitalist and colonial frameworks toward more just and sustainable systems (Sakshi, 2021).

Climate Change

According to the National Climate Assessment report published in 2014, climate change is expected to have significant impacts on various sectors of the US economy. These sectors include:

- **Agriculture:** Climate change impacts are expected to increase the frequency and severity of extreme weather events, such as droughts and floods, which will reduce crop yields and increase food prices. Pest and disease pressures are also expected to increase, affecting livestock production and crop yields (Hatfield et al., 2014).
- **Water Resources:** Changes in precipitation patterns and increased evaporation rates due to higher temperatures will affect water availability in many regions, resulting in water shortages, reduced water quality, and increased competition for water resources among different sectors (Georgakakos et al. 2014).

- Energy: Changes in temperature and precipitation patterns will affect the demand for heating and cooling, as well as the availability and cost of energy resources such as natural gas, coal, and hydropower. Increasing temperatures can also reduce the efficiency of power plants (Dell et al., 2014).
- Transportation: Climate change impacts such as increased flooding and extreme heat will affect transportation infrastructure, including roads, bridges, and railways. These impacts can disrupt transportation systems and increase maintenance costs (Schwartz et al., 2014).
- Human Health: Climate change can increase the frequency and severity of extreme weather events such as heat waves, which can lead to heat exhaustion, heat stroke, and other health problems. Changes in air quality and the spread of disease-carrying insects and pests are also expected to affect human health (Luber et al., 2014).
- Forests: Climate change impacts such as changes in temperature and precipitation patterns, increased wildfires, and insect infestations will affect forest ecosystems, leading to changes in species composition, reduced forest productivity, and loss of habitat for wildlife (Joyce et al., 2014).
- Ecosystems: Climate change impacts will affect ecosystem services such as water purification, carbon storage, and pollination. Changes in temperature and precipitation patterns will also affect the distribution and abundance of plant and animal species (Groffman et al., 2014).

Adaptation and Mitigation

The Fourth National Climate Assessment also states that both adaptation and mitigation strategies are needed to address the impacts of climate change in the United States (Reidmiller et al., 2018). Adaptation involves adjusting to the current and future impacts of climate change, while mitigation involves reducing greenhouse gas emissions to limit the magnitude and rate of climate change (Reidmiller et al., 2018).

Indigenous communities have implemented various adaptation and mitigation strategies to address the impacts of climate change. As previously mentioned, traditional ecological knowledge (TEK) is a key adaptation strategy. Managing and adapting to environmental changes may require the integration of Indigenous knowledge and scientific research. However, TEK doesn't have to be combined with Western science to serve fruitful adaptation, though many tribes do blend both (Bennett et al., 2014, p. 300). Indigenous communities have also engaged in activities such as restoring wetlands and coastal areas, relocating vulnerable communities, and modifying infrastructure to be more resilient to extreme weather events (Reidmiller et al., 2018,).

On the mitigation side, renewable energy development on Indigenous lands is one strategy being pursued, with solar and wind power being the most common forms (Bennett et al., 2014, p. 310). Many Indigenous communities are also working to reduce their carbon footprint through sustainable agriculture and transportation practices (Bennett et al., 2014, p. 312). The Fourth National Climate Assessment highlights that current efforts to reduce climate change are insufficient, and more action is necessary to prevent significant impacts in the future (Reidmiller et al., 2018). It's crucial to recognize that Indigenous communities

have a minimal contribution to greenhouse gas emissions. Therefore, the responsibility of impactful mitigation efforts falls primarily on those who are accountable for the issue.

Methods & Theory

The purpose of this research is to gain insight into how Indigenous communities in Southeastern Utah perceive climate change and examples of how they adapt to it. To accomplish this, we partnered with community organizations consisting of Indigenous tribal members to explore their personal experiences with climate change, identify perceived primary factors contributing to it, and identify ways to increase climate resilience. We also coordinated with the Native American Tribes Upholding Restoration and Education (NATURE) program at Dugout Ranch in Bears Ears National Monument and sought guidance from specific Navajo Nation Utah Chapters to ensure that we approached the project and its target population appropriately.

We aimed to demonstrate how any modifications can benefit and sustainably impact community members. To achieve this, we attended community events and public spaces in an informal setting to become more approachable and known. Our goal was to first immerse ourselves in the community, display our dedication, and foster relationships (Skill, Stafford, and McCann, 2019).

Data collection was done in the form of:

- Two talking circles with the NATURE students; one at the beginning and one at the end of the program (6 participants)
- One-on-one interviews with each of the NATURE staff (4 participants)

- One talking circle with organizational partners; including both representatives from Women of Bears Ears and the Rural Utah Project (3 participants)
- One community talking circle during the Red Canyon Powwow (6 participants)

Talking Circles

Focus groups have been a large portion of this project, but to avoid using academic jargon, we resorted to calling them “talking circles” instead. The term “talking circles” was suggested advised by a colleague heavily engaged in work with various tribes in the Intermountain West region. Talking circles are a valuable qualitative research method because they provide an opportunity for participants to discuss a specific topic or issue in a group setting, with researchers serving mainly in a listening role. This interaction can generate rich and detailed data, allowing researchers to gain a deeper understanding of the topic being studied. Additionally, the group setting can facilitate dynamics and interaction among participants, which can lead to the emergence of new perspectives, ideas, and insights that may not have been revealed in individual interviews (Nyumba, 2018). Talking circles can be useful for capturing diverse perspectives, which can help to identify common themes or patterns, as well as variations in experiences and perspectives. They can provide context and depth to the data by allowing participants to elaborate on their experiences and perspectives, clarifying ambiguous or complex issues, and providing a more comprehensive understanding of the topic being studied (Krueger, 2002) Finally, talking

circles and can be particularly useful for exploring sensitive or controversial topics where a group setting may provide additional insights and understanding (Krueger, 2002).

By adding a phenomenological lens, we can better understand the structures and meanings of experience from the perspective of the individual who is having that experience, rather than from an external or objective viewpoint. Phenomenology aims to uncover the underlying essence of experience, rather than simply observing its surface-level characteristics (Alhazmi, & Kaufmann, 2022). Phenomenologists study the conscious experience of individuals in various contexts, including perception, emotion, memory, and imagination (Alhazmi & Kaufmann, 2022). In phenomenology, subjective experience is the foundation of all knowledge, and it is through direct experience that we come to understand the world around us (Alhazmi & Kaufmann, 2022).

Transcribing

Otter Ai is a transcription and voice recording software that is designed to make qualitative research more efficient and accurate (Otter.ai, n.d). One of its key features is its ability to transcribe audio recordings in real-time, saving researchers a significant amount of time that would otherwise be spent transcribing manually. This allows researchers to focus more on the analysis and interpretation of the data. Through the transcription process, patterns and themes began to emerge using Otter Ai alongside a better understanding of commonalities in perspectives shared by the individuals and participants.

Coding

Coding is a widely used method in qualitative research for analyzing data. It involves breaking down qualitative data, such as interviews, focus groups, or written documents, into smaller segments or units, and assigning descriptive labels or codes to them. These codes can then be used to identify patterns, themes, and relationships within the data, and to draw out key insights.

Coding is a useful method for qualitative research for several reasons. First, it provides a systematic way to organize and analyze large amounts of qualitative data, allowing researchers to identify patterns and themes that may not be immediately apparent from the raw data (Saldaña, 2021). This can help to identify key insights and themes that may inform future research or practice. It allows for greater accuracy and consistency in the analysis of qualitative data. By using a systematic coding scheme, researchers can ensure that all data is analyzed in a consistent and reliable manner, reducing the potential for subjective interpretation or bias (Saldaña, 2021).

Coding can also help to identify and explore complex social phenomena or experiences. By breaking down qualitative data into smaller segments, researchers can identify specific aspects of an experience or phenomenon and explore them in greater depth, providing a more nuanced understanding of the topic. Finally, coding can also help to increase the transparency and rigor of qualitative research. By clearly documenting the coding process and the rationale behind each code, researchers can ensure that their analysis is transparent and reproducible, allowing others to assess the validity of their findings (Saldaña, 2021). Dedoose was used to code and analyze this study's data, which

is a web-based software that is designed to facilitate qualitative data analysis (Dedoose.com, n.d). It offers a range of features that can make the process of analyzing qualitative data more efficient and effective.

Collaboration Process

To ensure ethical and respectful engagement with Indigenous populations in southeastern Utah, we began our process by reaching out to several connections who could serve as consultants. We wanted to gather insights and recommendations on how to approach the project in a culturally sensitive manner. Initially, our intention was to collaborate with both Indigenous and Latinx communities in the area. However, we soon realized that given the project's grant timeline and the time it takes to develop relationships with either group, we could only meaningfully work with just one. Consequently, we made the decision to dedicate the entire project to working with Indigenous communities in Southeastern Utah. This choice was influenced by the longstanding history and ongoing large-scale presence of Indigenous populations in southeastern Utah.

Moreover, we originally sought to hire an Indigenous and Latinx community coordinator but discovered that finding an individual who possessed depth skills in working with both groups was extremely rare. Despite offering a competitive wage of \$20/hour, we unfortunately, did not receive any qualified applications for the position. There could be various additional reasons for the lack of applications, such as outreach methods that were not effective for Indigenous populations, discomfort with working with academia, or difficulty in maintaining the project timeline while decolonizing our approach. In the end,

we hired a Euro-American individual with extensive diversity, equity, and inclusion (DEI) experience in training and practice. She also had prior experience working with Indigenous populations.

Throughout our project, we consulted with multiple Indigenous individuals who are connected to organizations or the University. Their insights and recommendations provided us with valuable guidance on how to approach the project in a culturally sensitive and respectful manner. They shared with us best practices for moving forward and helped us understand the importance of persistence when trying to contact potential participants or facilitators representative of Indigenous communities. We recognized the need to decolonize the process and ensure successful communication with Indigenous communities. To achieve this, we applied a multifaceted approach. While we typically reached out through email, we found it effective to follow up with a call or text. By doing so, we demonstrated our commitment and showed that we valued their time and input. We also learned to be patient and respectful of their schedules, understanding that some individuals may need more time to respond.

Through our consultation process, we were able to identify some key steps for further engagement with the Navajo Nation IRB and chapter houses. We reached out to the Navajo Nation's IRB, Red Mesa chapter, White Mesa Chapter, and the Aneth Chapter, but only heard back from one. Eventually, we were able to secure a spot on the agenda for a Red Mesa chapter meeting where we presented our research and received valuable input. Prior to the meeting, we had a Diné colleague review our presentation and offer advice, including using simpler language, such as "understand" instead of "conceptualize." We

were also advised that we may be asked about our approval to gather information from Navajo Nation IRB. While we were not required to obtain approval, given that our research was taking place outside the jurisdiction of the Navajo Nation, we attempted to contact them to seek their approval as a sign of respect. A colleague from the Navajo Nation emphasized the importance of ensuring that the information we gathered is non-identifying and will not be published without explicit consent. During the chapter meeting, which was conducted partially in Diné and lasted over two hours, we experienced a cultural difference in perception of time. While academics often have strict timeframes and schedules, Indigenous members tend to have a more relaxed approach to time. Despite this, we were grateful for the opportunity to eventually present our research to the chapter and receive their feedback.

Again, during our engagement process, we attempted to reach out to the Navajo Nation IRB to confirm our research methods and obtain their approval. We sent them information about our research and followed up several times but did not receive a response. Our Diné partners advised us that "no news is good news," indicating that the Navajo Nation IRB likely did not oppose our submission. However, this created an issue with our own institution's IRB, which had concerns about the lack of confirmation from the Navajo Nation IRB even though our research was not taking place within the jurisdiction of the Navajo Nation. We had to provide additional evidence to prove that we made a good-faith effort to obtain approval, including copies of our emails and follow-up attempts. This process caused significant delays in our research timeline.

At the same time, we were in the process of building a partnership with the Nature Conservancy's NATURE program rather than creating our own program. We wanted to avoid creating competition and establish a collaborative relationship with them. However, we were aware that building trust with Indigenous communities can be challenging, especially for researchers. Therefore, we engaged in extensive communication with the NATURE program leads, being transparent about our intentions, the questions we would ask, and our plans for publishing the results. We understood the importance of creating a comfortable space for the students and the need to respect their boundaries. We provided them with all the necessary documents, including consent forms and other supporting materials, to ensure complete transparency. After multiple rounds of communication and clarifications, we were eventually granted approval to proceed with the student talking circles.

After the presentation to the Red Mesa chapter, our project advisor, McCann, was invited to participate in their chapter's Earth Day clean-up event. Given that she lived closer to the Navajo Nation Reservation, she agreed to volunteer at the event as part of our engagement process and get to know community members better. Building relationships with community members and seeing where they live is critical for this type of work. Our PI had also volunteered at regional powwows in the past and established a valuable connection with one of the leaders, which ultimately helped us secure participation in the Red Mesa Powwow and aided our co-creation process (Chapter 3).

Our first talking circles and interviews were with the Canyonlands Research Center's NATURE program. We conducted individual interviews with their staff and engaged students in talking circles (focus groups) to gain a better understanding of the co-

creation process, perceptions of community, climate change, and preferred methods of information exchange, and, at the end of the program, what was effective and what was not. The reflection talking circle focused more on what stuck with them from the program and how they can take the experience into their community. This was done using procedures recommended during our meetings with representative individuals and Chapters – including how to recruit participants for our community talking circle.

Our team learned about the 2022 Red Mesa Powwow in Moab and followed advice from experienced colleagues and Diné partners to attend an existing event and table for participants. We were advised that engaging with members through existing events is a better approach as they are more comfortable in that space. We applied and paid for a table at the powwow, which demonstrated our valid reason to be there and confirmed that we were welcome. At the powwow, we provided flyers with information about the talking circle, including the topics we would be discussing, and incentives provided if they participated. We felt it was important to inform participants that they would be paid for their time and that refreshments would be provided. After discussing with a tribal member, we realized that a sign-up sheet was unnecessary as their word was enough confirmation. Similarly, we provided a physical consent form for each participant, but we were informed that verbal consent was preferred, and the forms were only used for informational purposes. We made sure to follow the community's preference for consent to ensure that all participants were comfortable and fully aware of their involvement in the project.

Despite the stormy weather conditions with snow, hail, rain, and strong winds in a 24-hour period, we were thrilled to see that a handful of community members attended the

talking circle the following morning, which was held in an open-air pavilion. To ensure everyone was as comfortable as possible, we provided refreshments, space heaters, and blankets. The participants engaged in a thought-provoking conversation while our team listened attentively, and the experience was both informative and fulfilling. The participants expressed their enjoyment of the process, highlighting the need for these types of spaces where they can speak freely. One community member who attended as a listener reached out to us soon after to express their enjoyment of the discussion and expressed interest in having similar conversations in the future. This led to a series of communications aimed at organizing another community talking circle with farmers in the San Rafael Swell area. However, we were unable to bring this to fruition as the farming season had ended, and it was challenging to contact and coordinate with everyone. On a positive note, we were invited to attend two additional powwows in 2023 and were asked to help improve the environmental footprint of the powwows, which boosted our team's morale and excitement moving forward. The project advisor is now consulting with the powwow organizer on a range of topics from composting and recycling to implementing an incentive for carpooling.

During the organizational talking circle with members of the Rural Utah Project and Women of Bears Ears, we were confronted with unsettling details regarding the exploitation of Indigenous lands and people. We also discussed the importance of education in uplifting Indigenous populations and encouraging them to participate in policy and other efforts aimed at increasing access to resources for their communities. Although we were hoping for more participants, we still managed to have a thoughtful and enlightening conversation. We tried to follow up with those who were unable to attend, but

unfortunately, we did not receive any responses. If we had more time, we could have persistently tried to reach out and make more talking circles happen through connections.

During my visit to the USU Blanding campus, we held a final talking circle with the NATURE students in the campus Hogan. This time, we asked the students to reflect on their experiences in the NATURE program and provide feedback on its teaching practices, topics, successes, and areas for improvement. Towards the end of the discussion, we also covered a few climate-related questions. The Hogan setting proved to be a much more comfortable space for the students to share their thoughts and feelings openly. This experience reinforced my understanding that the settings for these talking circles significantly impact the level of comfort and openness among participants. One of the things that I learned during this reflection was a unique perspective on how Diné people view the world. The Hogan is a sacred space where traditional knowledge is preserved, and one can only walk clockwise. This is common in many tribes and is a sign of respect on sacred sites. This tradition reflects the idea of moving forward and not backward, even though traditional knowledge is technically looking into the past. This worldview demonstrates the resilience of Indigenous communities and their ability to incorporate traditional knowledge as a path to moving forward.

To ensure that our reporting was unbiased and that we did not influence the narrative, we developed a system for documenting the main takeaways from each talking circle through a notetaker, facilitator, and audio recorder. We shared major takeaway(s) reports (Appendix C) with the participants and encouraged them to contact us if they found any inaccuracies. Our goal was to keep communication open and transparent, in order to

improve our relationships with the participants. We also asked participants if they wished to be acknowledged in any publications and how they would like to be acknowledged. We had discussions with them about ensuring that nothing in the publication would be identifiable or traceable to them specifically. Additionally, we remained in contact with the program and previous students to keep them informed about additional opportunities with the project or otherwise.

Results and Discussion

The results from the analysis have provided valuable insights into Indigenous perspectives on climate change, including perceptions of its causes and strategies for enhancing resilience in the most affected communities. We will explore and discuss these results in detail but before delving into the findings, however, we will provide an overview of the key question themes and examples that contextualize the discussions conducted during the research. This contextual background will help establish a foundation for the subsequent analysis and interpretation of the results. The full Talking Circle Question Guide can be found in Appendix A.

Question Themes and Examples

NATURE student questions:

- a. The aim of these questions is to obtain feedback from potential caretakers on their preferences for a curriculum and ways to enhance its accessibility

to students. Initially, the responses to these questions were intended to steer the program. However, upon reflection, the queries aimed to obtain perspectives on what participants would like to see in a curriculum for upcoming learners and how to make it more accessible.

- Beginning: “What would you identify as some of the top climate change needs in your community, and what are the challenges (or barriers) to integrating solutions for those needs?”
- Reflection (after): “What do you wish the course would have addressed (at all or more in-depth)

Organization and Community questions:

- a. Questions were crafted to highlight their community identity, sharing information, and dynamics in climate change action.
 - Community: "What kinds of activities help you & others build a sense of community?"
 - Climate Change: "Could you describe some of the climate change impacts you have experienced (or been impacted by) as an individual and have seen as a pressing issue within your Native communities?"

Talking Circle Takeaways

In the first talking circle with the NATURE Program’s 2022 cohort, participants discussed their communities' core values, which included strong support systems and

agriculture-based livelihoods. However, some youths don't have the same amount of interest in engaging in traditional gatherings and environmental conservation, which could hinder efforts to build climate resilience. Additionally, housing, access to basic needs, and learning styles were discussed, with storytelling emerging as a popular method for sharing knowledge. Participants expressed a desire to integrate place-based knowledge into education to promote responsible practices and hope to apply the skills they learned in the program in their communities. During my visit to the Nature Conservancy's Dugout Ranch, I conducted one-on-one interviews with NATURE program staff, which covered topics like student involvement in program planning, teaching practices, and program growth. Through these interviews, which primarily were applied in Chapter 3, I gained a better understanding of the program's creation and evolution over the past few years.

During the community talking circle at the Red Mesa Powwow, participants discussed how climate issues affecting Native communities stem from colonialism and capitalism. The conversation briefly touched on settler colonialism, and participants expressed concerns about knowledge extraction. Members also highlighted issues like land degradation from toxins, mining, and abandoned gas stations. The importance of respecting nature and Indigenous cultures was emphasized, and participants expressed a need for mental health resources, political representation, and preserving traditional medicine. The group highlighted that White-centric organizations often lead environmental movements and suggested that Indigenous people could be the ones to save the world.

In the organizational talking circle with members of Women of Bears Ears and Rural Utah Project, various topics, including education, policy, and community dynamics,

were discussed. The conversation underscored the importance of personable public service and the difficulties in communicating with elders and youth on the reservation. Participants stressed the importance of education in building relationships through collaboration and integrating Indigenous cultures and practices into Westernized ways of thinking. They also discussed the importance of respecting Native Nations' and Tribes' privacy and preserving their cultural identity. However, government entities and environmental justice proved to be challenging topics, given their history of oppressing Indigenous peoples. It was noted that land in Native communities and on reservations has been overgrazed, and climate change has impacted natural ecosystems. As a result, many Native families have had to sell their livestock and feral/wild horses.

Coding

The qualitative coding process was a large step in my research, allowing me to gain a deeper understanding of the data and insights shared in the talking circles. Keeping in mind that some codes were not explicitly mentioned but were applied when topics were indirectly discussed. Effective coding requires a strong grasp of the conversation's context and an understanding of how cultural and language differences may impact interpretations. Based on my experience, coding is a time-intensive and thoughtful process, but essential for obtaining valid results.

During the qualitative coding process, I generated 36 codes, which included 5 "parent" or main codes, resulting in a total of 478 code applications. To keep track of each media transcript, I assigned a descriptor to indicate which group was involved in that

media. Specifically, the four descriptors used were 1) NATURE Program students, 2) NATURE Program staff, 3) Organizational, and 4) Community. These descriptors helped me organize and analyze the data more efficiently using Dedoose.

I have created a code chart for the climate change and community topics discussed in the talking circles, which included the NATURE students' first talking circle, the last quarter of the reflection circle, the organizational talking circle, and the community talking circle. This chart includes the code, its description, and the frequency of its application.

Table 1

Climate Change and Community Code Chart

Code	Code Description	Code Frequency
Climate change (parent)	Mention of climate change or explains components of climate change	14
Agriculture	Mention of agriculture or explains components of agricultural practices	26
Capitalism	Mentioned directly or explains contributions to a capitalist society	15
Environmental education	Mentioned directly or explains components of environmental education	18
Extraction	Mentioned directly or explains components of extraction	10
Flooding	Mentioned directly or refers to how it contributes to ecological degradation and washouts	4
Human health	Mentioned illnesses brought on by climate change both directly and indirectly	15
Pollution	Mentioned pollution or explains components of pollution they have seen	20

Code	Code Description	Code Frequency
Sustainability	Mentions of taking care of the environment taking care of you, self sufficiency	10
Water	Mentions of lack of water and poor water quality	13
Community (parent)	Mentioned directly or explains components of community or theirs specifically	25
COVID	Mentioned COVID directly when discussing hardships	12
Caretakers of the Earth	Mentioned directly or given examples when talking about climate change	20
Communication	Mentioned directly or explains components and examples of communication	11
Cultural practices	Mentioned directly or explains the importance and components of their cultural practices	29
Development	Referred to through examples of the ways communities are or are not developing	20
Education	Mentioned directly or explains ways community members interact with education	12
Knowledge sharing	Mentioned directly or discussing how they share knowledge or barriers to knowledge sharing between generations	15
Lack of access to resources	Mentioned directly or explains barriers they face when trying to access resources	20
Language	Mentioned directly, or explains times where they use their language or times, they felt misunderstood	8
Policy	Times where policy could have made a difference or barriers to policy	7
Privacy	Mentioned directly or explains preservation of aspects of their culture, including in academic research	9
Public service	Mentioned directly or explains times where help has been given or received during hardship and otherwise	27

Code	Code Description	Code Frequency
Relationship with government	Mentions of fear of government, relationships with government over time, and government exploitation	10
Resilience	Mentioned directly or referred to by explaining how their community survives hardship	7
Trust	Mentioned directly or explains mistrust or building of trust	11
Injustice (parent)	Examples given of times they were mistreated, kept in the dark, or lied to.	5
Assimilation	Mentions of assimilation programs or moments they felt forced to work within a colonized system	6
Colonization	Mentioned directly or explains components of colonization or power dynamics	10
Defaced	Mentions of mistreatment of sacred sites and Indigenous land	4
Environmental injustice	Mentions of environmental pollution or purposeful degradation that has had a lasting impact on the community	16
Exploitation	Mistreatment of communities and their resources	22
Racism	Times they have experienced racism directly or resources that are designed in a way that makes it difficult or impossible for their community to use	5
Solutions (parent)	Mentions of what justice and solutions may look like in their community	5
System change	References to ways systems that oppress them need to change	4
Next Generation (parent)	Mentioned directly or explains the responsibilities of the next generation	13

This coding chart provides valuable insights into the main topics that emerged during the talking circles. While we expected to see certain topics, we also found some interesting and unexpected findings. The codes that were applied the most, with 15 or more mentions, included knowledge sharing, capitalism, human health, environmental justice, environmental education, development, caretakers of the earth, lack of access to resources, pollution, exploitation, community, agriculture, public service, and cultural practices.

It's essential to consider that some of the codes mentioned more frequently were influenced by factors such as the questions we asked, the group we spoke to, or the timing of the project. For example, our conversations took place soon after the major COVID shutdowns, so human health was likely discussed more frequently than it would have been if the discussions occurred before the pandemic. Another example is public service, which emerged as a significant theme when discussing the hardships brought on by the COVID-19 pandemic.

Regarding the results, I noticed that NATURE students were less willing to discuss the injustices brought on by settlers compared to community and organizational members who had more experience and knowledge on the topic due to their age. Our discussions with the NATURE students were also limited by time constraints, preventing us from covering more climate-related questions, including those addressing mitigation and adaptation strategies. However, the students' use of storytelling and examples to answer questions provided valuable cultural context for me as a researcher. In addition, the NATURE students tended to take their time to contemplate their answers and respond literally to questions. Using the tool, Descriptor x Code Case Count, I noticed the theme of

public service, such as food banks and trash clean-ups, emerged as a significant topic among the NATURE students. We discussed how community-building contributes to resilience and how coming together during hardships, chapter meetings, and traditional ceremonies help foster a sense of community. Additionally, agriculture, being caretakers of the land, and educating the next generation also emerged as major themes. From the reflection talking circle, many of the students expressed that they need better curriculum for teaching the younger generations traditional knowledge and the history of their community. The students also mentioned in the reflection that knowledge sharing is getting difficult due to loss of passed down knowledge from colonization, and not enough traditional information in their curriculums.

Again, using the Descriptor x Code Count tool, privacy was not one of the top applied codes, but it was ranked high and emphasized in the organizational talking circle to the level that it felt important to include. It was mentioned directly in relation to not having to divulge all the cultural knowledge from Indigenous populations, including ceremonial practices and items that are used during those, where sacred sites are located, language, and other forms of knowledge extraction. Some indirect mentions of privacy refer to people coming onto Indigenous lands without being invited, and even for the NATURE students– giving time for them to talk to their elders and getting permission to participate in the talking circles. It is good practice to reiterate that they do not need to share anything they do not want to during these conversations with us.

“How much more do we have to give up for people to realize that this is our lives, we want to keep as much of it intact and within ourselves within the communities and not be exposed to everyone else.” (P5)

“Preservation of language, preservation of knowledge of medicine that is not considered pharmaceutical, preservation of songs, there are a lot of songs that only certain elders know now that a lot of people never learned that they can't pass on anymore.” (P15)

During the organizational talking circle, we discussed several significant topics including the complex relationship with the government, the exploitation of Indigenous land and people, education, trust, and lack of resources. These issues are interconnected; for instance, the exploitation of Indigenous land and resources has contributed to a relationship of mistrust between Indigenous populations and the government. In response, some potential solutions proposed were to provide education on policy making, voting, and traditional practices for all ages, particularly the youth and young adults. Another proposition included to lean on more traditional methods to prevent ecosystem degradation and mitigate climate risks, preserving natural resources.

“The different resources, especially monetary wise, we have absolutely no economic base here on the reservation, any type of economy that we see, was usually through just trade and barter. But now it has a price on it because of inflation happening and everything that's happening through climate change. It's made it harder for people to just be able to be a community anymore and just have that exchange happen between families and between neighbors. So, we really don't have any type of resources in the sense that we can come up with a lot of these different programs to help our communities where climate change is a concern or economic development is a concern. So, we must look at different organizations who are willing to provide some of these monetary resources.” (P5)

One interesting finding from the discussions was the difference in opinion across Indigenous populations on accepting help from the Western world versus moving forward on their own as Indigenous communities. This difference in generational thinking was highlighted, with elders and older generations being less open to change while younger

generations desiring progress, such as having running water and electricity on the reservation.

“It's really hard for me to explain because a lot of the people within my community, the people that I've built a rapport with, the response that I get from them is ‘Why do you feel like you need to get the non-Indigenous involved? Why can't we do this on our own? Why can't we reimplement a lot of the teachings in the culture, and then bring that together and see what we can do with our teaching and implement it into the Western colonials education system, whether that's trade school, whether that's learning about science and how that applies, how Navajo apply science to everything that they do and how science is identified here and in the non-native side of things.’” (P5)

A related point expressed during the talking circles was that it is challenging to prioritize concerns about climate change when communities are still struggling to attain equal footing with other communities. This was also echoed during the community talking circle. Therefore, while climate change impacts various aspects of their lives, it is not their primary concern at present. Our data reflects this as climate change did not arise as frequently as other topics indirectly impacted by it.

“It affects our crops; it affects our lifestyle. This is our food this is how we survive because we don't have stores that are right next door, Walmart's that are 20 minutes away. Some people must travel hours. We rely on making sure our cattle our sheep, all those animals our crops survive in the season. Because at the end of our crop season, that's what's going to make us get through winter. And our crops don't grow like that, we are stuck halfway through winter, starving. Got to go to the city, go get food and pay those prices, and then processed food gets us sick, because we're so used to our foods on our land, with no processed, no pesticides, no extra sugars, no salt.” (P15)

“I think a lot of isn't climate right now. It's trying to preserve our way of life. We're trying to stay alive, and at the same time, we're trying to express that us trying to stay alive comes from the results of our surroundings, our environment. But we

need to stay alive, we've got to figure out how we're going to still plant crops every year, how we're going to keep our livestock alive.” (P15)

“You know, I noticed this year that there has been a lack of bees. So that pollination between, whether it's dry farming, or there's irrigated farming, any of that the lack of bees has really impacted growth, whether it's within the city or out in rural areas. That's another thing that would really help with a lot of these farmers, because a lot of them, they'll grow things, but they don't produce anything from it.” (P6)

The community talking circle provided a platform to discuss the interconnected themes of land and knowledge extraction and their link to systemic oppression faced by Indigenous communities. Participants spoke at length about the impact of assimilation programs, colonization, and capitalism on societal structures, and the resulting challenges faced by Indigenous communities. The effects of these systems are widespread, including extraction practices, pollution, and environmental injustices, which have significant implications for human health.

“It makes me not want to participate in spaces like this. But I feel like spaces like this are important. Hopefully, people here can unplug their capitalist mindsets and hear my voice. What we need to understand is that in these spaces, it's the Indigenous people who have the wisdom. Don't ever give up that wisdom without being compensated because that's bullshit. That's enough.” (P18)

During the discussions, participants shared that they do not place the same emphasis on materialism as Western cultures. They emphasized the value of alternative systems not based on capitalism and expressed concern about the degradation of their land due to harmful practices such as the disposal of toxins and drilling. Over time, they have noticed changes in the land, including the negative effects of uranium mining on native land on the quality of water and soil used by Indigenous peoples. Participants agreed that science,

technology, engineering, and math (STEM) should be used to test the safety of water and landscapes. They also shared stories of abandoned gas stations, leaving Indigenous communities to deal with the refuse. It is worth noting that Indigenous peoples have a long-held belief in taking only what is necessary from the land and leaving the rest with respect, including valuable resources such as Uranium.

“Testing the soil so we're not being in a place that radiates or has no good minerals for us to plant. Water, making sure our water safe that we can get it for our livestock to keep them alive, being able to use the science basically test our areas, so we're not getting sick anymore.” (P15)

Participants agreed that when the government provides money in response to environmental degradation or pollution, it is seen as a "slap in the face." They argued that this approach provides only a quick fix rather than addressing the systemic issues and providing adequate resources for the affected communities. They emphasized the need for resources for mental health support, political representation, and the preservation of traditional medicines. One participant made an important point that environmental movements are often led by White-centric nonprofit organizations that control the money and narrative, leading to solutions based on capitalism and White supremacy. Participants stressed the need to prioritize Indigenous voices and leadership to create lasting change that benefits both people and the planet.

“I wish that a long, long time ago they didn't find that uranium. Up above the hill, and from my understanding, the uranium is in the water table now deep deep into the water table, the most pristine water that you can ever find on the face of the earth, it's getting in there. That's the water that we drink. My understanding is not far away from those water tables are the main water tables that are going to affect my community.” (P17)

The co-occurrence tool was one of the key analytical tools utilized in my research. In the context of qualitative coding, co-occurrence refers to the frequent appearance of two or more categories or codes together in the same data set. This approach proved invaluable in uncovering patterns, relationships, and themes that may not have been apparent from a simple analysis of individual codes or categories. Notably, several significant co-occurrences emerged, including the close relationship between community and public service. This finding serves to reinforce the idea that public service plays a central role in the formation and strengthening of Indigenous communities. Another key co-occurrence was the pairing of environmental injustice with capitalism, which highlights the role of capitalism in driving environmental degradation and extraction, often leaving Indigenous communities to bear the burden of pollution and its associated health impacts. Similarly, the close link between environmental injustice and pollution is further evidence of the harmful impacts of oppressive systems on Indigenous populations. Additionally, the frequent co-occurrence of colonization and exploitation underscores the ways in which oppressive systems lead to the exploitation of both people and the environment in affected regions. Finally, the frequent pairing of agriculture and water is unsurprising given the centrality of agriculture to many Indigenous communities' economic base.

“I want everybody to say this with me: colonialism causes climate change, okay? Say it with me: colonialism causes climate change. When you have an economy that's built on extraction, more and more capitalism. ‘I need more stuff. Bigger is better.’ If there's not an opportunity to make profit, they don't want to do it. And as Indigenous people we don't really look at things like that. That was a very non-Indigenous settlers' mentality. Now the settlers that came here, that was their way of doing business, they came here, killed a lot of people, raped the land, and it's been continuing for the last 500 years of occupation. We have to change the way

we think of things, we have to not only include indigenous people, but they need to be leading the charge. There needs to be a change, a shift in power. It's hard for people who are settlers to realize that because they've been driving the car for the last three to 400 years. But it's funny, because in the last 300 or 400 years, we're in a climate change crisis right now.” (P18)

“Once we were colonized, you know, everything from there on has been adapting to progress.” (P6)

Moving Towards Co-creation

Through the talking circles, our small team came to terms with no longer using the University of California’s Climate Stewards curriculum as originally planned because it still follows a very academic layout and is not conducive to the approach, we are finding to be most effective and desired in Indigenous communities. Instead, we have found that a bottom-up approach that is place-based and Indigenous-centric would be the best way to combine traditional ecological knowledge and Western scientific practices, including STEM. We have decided to create a climate resiliency module for the CRC’s NATURE Program specifically to fit this new model. One of the weaknesses we found in the program was that there is no requirement to investigate the significant threat of climate change in either the curriculum or student capstone projects. This is one of the recommendations we sent to the program to implement and is separate from the co-creation process of the climate resiliency module. Below are the other recommendations including short explanations:

Nature Program Recommendations (Appendix D)

1. Projects should be place-based and community-centric addressing and speaking to climate needs and adaptations within specific tribal nations and communities.
 - Stewardship should also be introduced in the NATURE program– this enhances the likelihood that the program content can be applied and benefit their communities.
2. Further diversify guest speakers, with at least half belonging to a Tribal Nation
 - Younger generations have expressed being less connected to their culture. Hence, it is crucial that they can see opportunities combining their cultural background and the Western skills the program aims to teach. This encourages intersectionality within many fields.
3. Centralize capstone projects around a theme such as climate resilience and include a climate resilience module in the course.
 - The scientific community agrees that climate change is one of the most pressing issues of our time, posing major threats to humanity and the ecosystems upon which we depend and are a part, and Indigenous communities are on the frontlines of climate change impacts.
4. Document and share processes and impacts to both improve visibility and the program moving forward.
 - Most students learned about the program through flyers or educators that were aware of the program.
 - Sharing how a bottom-up method has been successful in this program may encourage other programs to adopt a similar approach.

The upcoming research chapter will detail the co-creation process of developing a climate change module for the NATURE program. This process entailed collaborating closely with three former students of the program who deeply understood the program's content, what was missing from it, and what motivated Indigenous students to participate. Additionally, we maintained open communication with NATURE program staff and provided full transparency regarding the activities we were funding and the individuals we were connecting with the program staff.

Lessons Learned

It is important to use Indigenous facilitators when collaborating with Indigenous communities because they can act as cultural liaisons and bridge the communication gap between researchers and community members. Indigenous facilitators have an intimate understanding of the community's values, traditions, and beliefs, and can help ensure that the research is conducted in a culturally sensitive and respectful manner. They can also help researchers navigate any cultural protocols, which are essential to conducting research with Indigenous communities. Additionally, the use of Indigenous facilitators can promote community ownership and participation in the research process. By involving Indigenous facilitators, researchers can work collaboratively with the community and build trust and mutual respect. This approach can help ensure that the research findings are relevant, applicable, and useful to the community.

It is also vital to reach out to Indigenous Chapters in the area before conducting research with Indigenous communities. Indigenous chapters are usually organized groups that represent the interests of the immediate community and can provide valuable insight into the cultural protocols, norms, and expectations for research. By consulting with Indigenous chapters, researchers can ensure that their research is culturally appropriate and respectful of the community's values and traditions. This approach can also help researchers identify potential issues or concerns that may arise during the research process and develop strategies to address them. This is something that we struggled with in our efforts and have learned requires time and patience as academics. Often, we did not receive a response or were unsure of how to participate or get on the agenda of a Chapter meeting. We had reached out to the White Mesa, Aneth, and Red Mesa Chapters and only met with Red Mesa, but this was a success from our perspective.

Transparency is crucial when working with Indigenous communities because it fosters trust and builds relationships based on mutual respect. Historically, indigenous communities have experienced exploitation and marginalization, and as a result, they may be skeptical of outsiders who seek to work with them. Being transparent about intentions, objectives, and methods can help mitigate this skepticism and build trust. It also ensures that the community is fully informed about the proposed project or initiative, including its potential benefits and drawbacks. This allows community members to make informed decisions about whether to participate and to provide feedback and input throughout the process.

Indigenous communities often have unique cultural practices and values that must be respected in any project or initiative involving them. Transparency can help to ensure that these practices and values are considered and integrated into the project in a meaningful way. This reasoning can also extend to sharing all materials created when working with Indigenous communities in academic research, which is crucial for various reasons. It demonstrates respect for the unique knowledge systems and ways of knowing Indigenous communities that are often disregarded in academic research. Sharing materials helps to ensure that community members provide informed consent and have a complete understanding of the research process and the use of their knowledge and experiences. Sharing materials enables other researchers to replicate the study, test the validity of the findings, and build upon the research. Finally, sharing materials provides accountability, which is critical for ensuring ethical and responsible research practices.

When conducting research with Indigenous communities, it is essential to consider the existing programs and initiatives that are already in place to address the community's needs. In many cases, these programs are led by Indigenous people themselves and have been developed with a deep understanding of the community's cultural values, knowledge systems, and unique needs. By tagging onto existing Indigenous programs, researchers can avoid creating competition and instead collaborate with the community to support and strengthen these programs. This approach can help to build trust with the community and create a more equitable and collaborative research partnership. Instead of creating new programs as a default, using grant funding to support existing Indigenous programs can help to ensure that the funds are used in a way that is aligned with the community's needs

and priorities. This approach also helps to promote sustainability by providing long-term support for programs that have already established roots within the community.

When conducting academic research with Indigenous communities, researchers should be prepared to deviate significantly from the planned timeline and budget. This is because Indigenous communities often have unique knowledge systems and cultural practices that may require more time to fully understand and integrate into the research process. Building trust and establishing relationships with the community is crucial, and this cannot be rushed. Western research practices do not always account for the time needed to build trust with Indigenous communities and researchers may need to spend additional time building relationships and demonstrating their commitment to the community. The research approach may need to be adapted to the community's needs and priorities.

Researchers may need to provide additional support or adapt the research approach to fit within the community's existing resources. Qualitative research often uncovers unexpected findings that may require additional time and resources to fully understand and integrate into the research. It is essential for researchers to be flexible and adapt the research approach to accommodate these unexpected findings.

On the topic of being adaptable, surveys or polls may not always be effective when working with Indigenous communities. One reason for this is language barriers, as Indigenous communities often have their own languages, which may not be well represented in surveys or polls. Another reason is that they may not be culturally appropriate for Indigenous communities, as they may not align with the community's unique values, beliefs, and ways of knowing. A lack of trust can make it difficult to get

accurate responses in surveys or polls due to uncertainty of intentions (Bonevski et al., 2014). Indigenous communities may not trust outsiders or researchers who are unfamiliar with their community. Power dynamics and historical trauma can also be barriers to effective survey or poll responses. Indigenous communities may feel that researchers are only interested in collecting data for their own benefit, without any intention of using the data to benefit the community. Researchers should consider alternative methods of data collection, such as community engagement, talking circles, or one-on-one interviews, which may be more appropriate and effective in Indigenous research contexts.

We have found that researchers may need to be persistent when contacting Indigenous individuals because they may be more difficult to reach due to a variety of factors. Some Indigenous individuals may live in remote or rural areas without access to reliable communication technology, making it more difficult to contact them. Others may have limited internet access or may not check their email regularly. Yet others are overwhelmed with the number of emails they receive and projects they are asked to engage in. Something that has been suggested to us was to follow up by phone call or text when we have not received a response to an email.

Being persistent in contacting Indigenous individuals shows that researchers are committed to engaging with the community and are willing to put in the effort to build relationships and establish trust. It also demonstrates respect for Indigenous protocols and values, which prioritize relationship-building and reciprocity. However, researchers should also be mindful of the boundaries and priorities of the community. They should respect the community's right to refuse participation in the research and avoid engaging in persistent

or intrusive behavior. Ultimately, building trust and relationships with Indigenous communities takes time and requires a culturally sensitive and respectful approach.

Providing time and silence before moving to the next question is also recommended when conducting qualitative interviews with Indigenous communities. This is because it allows participants to reflect on the question and gather their thoughts, which is especially important when discussing complex or sensitive topics. Many Indigenous cultures value thoughtful and deliberate communication, and participants may need time to consider their responses before answering. By providing time and silence, it also acknowledges the role of oral traditions and storytelling in Indigenous cultures. Participants may want to share their experiences and perspectives in a narrative form, rather than in a direct answer to a specific question. By allowing for silence, participants may feel more comfortable sharing their stories and personal experiences, which can provide valuable insights into the community's beliefs, values, and practices. It demonstrates respect for the participant's knowledge and expertise. Patience and providing time for participants to answer at their own pace can show that they, as researchers, value the participant's perspectives and are interested in learning from them.

When it comes to the talking circles, we knew it would be more comfortable for the students for the circles to be facilitated by someone who is more representative of the community. We were so happy when we were able to find someone to facilitate that has a close relationship with the students and is Indigenous. One thing we would do in the future is provide more training and practice facilitation to encourage a more conversational flow. Without this, we had very similar answers from the students, though they have had similar

experiences, they answered one by one. We began to doubt whether their response was a genuine personal opinion or just repeated by someone else.

Last, through our experience in this process, we recommend identifying others who are deeply engaged in working with tribal members to lean on as a support network. This would allow for the sharing of barriers, the weight of bearing the burden of centuries of abuse and injustice, and to share successes.

Limitations and Implications for Further Research

When working with Indigenous groups within Utah, the research process needs to be engaged with a cultural humility perspective. This means recognizing that as outsiders to the community, researchers must listen and learn from community members rather than assuming that they have all the answers. It is essential to build relationships with Indigenous communities based on trust, mutual respect, and open communication, and to prioritize their voices and perspectives throughout the research process.

One of the primary limitations that researchers may encounter is limited access to Indigenous communities, as they may be geographically remote or difficult to reach due to a lack of resources or mistrust. Cultural differences can also create misunderstandings or conflicts between researchers and community members, and language barriers may make communication challenging. Power imbalances may also be present, with researchers holding more power and resources than Indigenous communities, leading to the potential for exploitation or harm.

Researchers must be aware of the historical trauma related to colonization, genocide, and forced assimilation that Indigenous communities may have experienced. This trauma can create mistrust and skepticism of outside researchers, making it essential to approach the research process sensitively and respectfully. Additionally, researchers must navigate complex ethical considerations related to informed consent, data ownership, and confidentiality when working with Indigenous communities. Additionally, time constraints may limit the ability to build relationships with Indigenous communities or gather data in a culturally appropriate manner. Researchers must be aware of these limitations and work collaboratively with Indigenous communities to address them in a respectful and meaningful manner. By approaching the research process with cultural humility, researchers can help to build trust, foster respectful relationships, and promote the well-being of Indigenous communities.

Conclusion

The inclusion of Indigenous perspectives on climate change offers valuable insights into the complex social and ecological dynamics of this global issue. Centering Indigenous knowledge and practices, recognizing the importance of Indigenous sovereignty and self-determination, and being transparent in research are all critical components of developing more inclusive and effective approaches to addressing climate change. Sharing materials and tagging onto existing Indigenous programs can help promote respect, transparency, accountability, and equitable and inclusive research practices. Additionally, being prepared to deviate from planned timelines and budgets is necessary to build trust and relationships

with Indigenous communities, which takes time and requires a culturally sensitive approach. By prioritizing the needs and priorities of Indigenous communities in climate change research, it may be possible to develop more sustainable and effective solutions to this global issue. This chapter highlights that there have been lasting impacts from colonization and exploitation of tribal lands and people, education, and physical resources (i.e., policy education, water filtration, and economic infrastructure). We learned that is best to come in from the perspective of a student rather than an academic, transparency is paramount, and being able to actively listen is a powerful skill.

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CHAPTER III

CO-CREATION: BUILDING RELATIONSHIPS FOR MEANINGFUL INDIGENOUS CLIMATE EDUCATION

Introduction

Collaboration with Indigenous communities is indispensable for fostering meaningful climate change adaptation and mitigation efforts. Indigenous peoples have a deep understanding of the natural world and have developed sustainable practices that have allowed them to thrive for thousands of years. Collaborating with Indigenous communities can offer valuable perspectives that can inform and enrich our own practices and policies. Collaboration with Indigenous communities must be approached in a respectful and open manner, recognizing the valuable knowledge and perspectives they can offer. By working together, we can gain a deeper understanding of their practices and incorporate them into our own policies and practices in a way that is mutually beneficial. Also, many Indigenous communities have been disproportionately impacted by environmental degradation and climate change, often due to historical and ongoing systemic injustices (Norton-Smith et al., 2016). Collaborating with these communities can help address these injustices and ensure that they are included in decision-making processes related to environmental issues.

Indigenous peoples have unique rights and interests related to their lands, waters, and resources that are often not adequately recognized or protected by the government and

industry. Collaborating with Indigenous communities can help ensure that these rights are respected and that Indigenous peoples have agency in decisions that affect their lives and livelihoods. Overall, collaboration with Indigenous communities is essential for achieving a sustainable future that recognizes and respects the diverse knowledge, experiences, and rights of all peoples and the natural world.

The importance of recognizing and respecting the distinct knowledge systems and perspectives of Indigenous peoples, and the need to create spaces for meaningful dialogue and collaboration between Indigenous and non-Indigenous communities is emphasized by Takach (2021). Interweaving Indigenous and settler knowledge systems is essential for achieving environmental protection and reconciling the history of colonialism and its impact on Indigenous communities, as well as ensuring a sustainable future for all (Takach, 2021). Coproduction can enhance the relevance, usability, and trustworthiness of climate science and it should be a deliberate and ongoing process. It is fundamental to involve communication and collaboration, shared decision-making, and ongoing evaluation and feedback (Meadow, et.al., 2021).

To make a meaningful impact on society, climate services must provide decision-makers with actionable information that is relevant, accessible, and usable. These services rely on scientifically based products and information that enhance users' understanding of climate impacts on their decisions and actions (www.ametsoc.org). Bamzai-Dodson and McPherson (2021) emphasize the importance of designing climate services for maximum effectiveness. There are many challenges to the development and implementation of actionable climate services, such as the need for interdisciplinary collaboration and the

difficulty of communicating uncertainty in climate projections. The development of actionable climate services requires a focus on user needs, an understanding of decision contexts, and ongoing evaluation and feedback. Bamzai-Dodson and McPherson (2021) emphasize the importance of co-design and co-production of climate services with decision-makers and stakeholders to ensure their relevance and usability.

There is a need to challenge dominant Western worldviews and prioritize the perspectives and voices of marginalized communities, including Indigenous peoples, in environmental decision-making processes (Lin et al., 2020). Traditional business models that focus solely on economic value creation are not sustainable in the long term and need to be re-evaluated. A more holistic model integrates various value co-creation methodologies such as design thinking, open innovation, and stakeholder engagement to promote sustainable development and social responsibility (Kruger, Caiado, França, & Quelhas, 2020).

Indigenous Knowledge and Education

Indigenous knowledge plays a vital role in environmental education as it offers an alternative perspective to the Western scientific approach. According to Jing Lin et al. (2020), Indigenous knowledge is derived from the long-standing relationships that Indigenous communities have had with the natural world. It encompasses traditional ecological knowledge, which includes local knowledge of plants, animals, and their habitats, as well as knowledge of the seasons, weather patterns, and cycles. This knowledge

is often passed down through oral traditions and can offer a more holistic understanding of the environment.

Incorporating Indigenous perspectives into education is crucial for promoting environmental justice. As Sakshi (2021), argues, environmental justice must include the rights of all species to life and respect. Indigenous knowledge recognizes the interconnectedness of all living things and promotes sustainable practices that ensure the well-being of the environment and all its inhabitants. By incorporating Indigenous perspectives into education, including science, technology, engineering, and math (STEM) education, students can learn about the value of traditional ecological knowledge and the importance of sustainable practices. This can help to promote more equitable and just environmental policies.

Acknowledging the history of colonialism and how it has impacted Indigenous communities and their relationship with the environment is paramount (Bacon, 2019; Sakshi, 2021). Incorporating Indigenous perspectives into education, if done in an ethical manner, can help begin to address the historical, settler erasure of Indigenous knowledges. By acknowledging and incorporating Indigenous knowledge and perspectives, educators can help to promote a more inclusive and diverse approach to education, in this case, environmental education.

Environmental Justice and Education

Environmental justice and education are deeply interconnected, as environmental injustice disproportionately affects marginalized and underrepresented communities. Sweet (2018) argues that incorporating environmental justice into education can help to address these disparities by empowering individuals and communities to advocate for themselves and address environmental issues. Furthermore, environmental education can help to foster a sense of agency and empowerment in these communities, allowing them to more effectively navigate the political and social structures that perpetuate environmental injustice.

Cultural humility is a critical component of environmental education, particularly in the context of working with Indigenous communities to integrate traditional knowledge with Western science and STEM education (Gilbert, 2011). The National Congress of American Indians (NCAI) Policy Research Center & Montana State University (MSU) Center for Native Health Partnerships (2012), argue that cultural humility is necessary to facilitate productive dialogue and collaboration between different knowledge systems, recognizing the value and legitimacy of Indigenous perspectives and knowledge. This involves actively listening to and learning from Indigenous communities, rather than approaching them from a position of superiority or dominance.

Incorporating cultural humility into environmental education can also help to decolonize education and promote a more inclusive and equitable approach to STEM education. By recognizing and valuing different forms of knowledge and ways of knowing, including those that may be marginalized or excluded by dominant educational paradigms, we can work towards a more socially just and sustainable future.

Coproduction of Climate Science Knowledge

The article by Meadow et al. (2021) emphasizes the importance of the coproduction of climate science knowledge. The authors argue that the coproduction of knowledge between scientists and non-scientists, including community members and decision-makers, can lead to more effective climate action. The article suggests that a co-production approach can help build trust and mutual understanding between different groups and can lead to more relevant and actionable climate information. The authors also note that coproduction can help address issues of power imbalances and promote more inclusive decision-making processes.

Banzai-Dodson and McPherson (2021) explore the potential for actionable climate adaptation science to achieve societal impact. The authors argue that climate services, which provide decision-relevant climate information, have the potential to support adaptation efforts and promote resilience. However, the authors note that the impact of climate services depends on a range of factors, including the relevance and accessibility of the information, the capacity of decision-makers to act on the information, and the social and political contexts in which the information is used. The authors suggest that effective climate services must be co-designed with stakeholders and should consider the needs and perspectives of diverse communities.

Steps for Meaningful Collaboration

To promote the coproduction of climate science knowledge, the following steps can be taken to ensure that all partners are engaged, informed, and collaborating effectively.

1. Establish trust and build relationships: Before any collaboration can begin, it is essential to establish trust and build relationships with the community. This can be done by engaging in meaningful dialogue, listening to their concerns and perspectives, and demonstrating respect for their cultural practices (NCAI Policy Research Center & MSU Center for Native Health Partnerships, 2012).
2. Understand your collaborating community's worldview: Indigenous communities have unique cultural values, traditions, and beliefs that should be respected and understood. It is important to take the time to learn about these worldviews, histories, and cultural practices to gain a deeper appreciation of the community's perspective (The Nature Conservancy, 2023).
3. To effectively work alongside Indigenous communities, it is crucial to invite them into the decision-making process early on. This entails considering the input of community members. (The Nature Conservancy, 2023).
4. Be transparent and accountable: Transparency and accountability are essential for building trust with the community. This means being open and honest about the project's goals, potential impacts, and outcomes (UNESCO, 2018).
5. Respect Indigenous intellectual property rights: Indigenous communities have unique knowledge, practices, and intellectual property that should be respected and protected. Acknowledging Indigenous knowledge sovereignty and seeking permission before using the community's intellectual property is crucial (NCAI Policy Research Center & MSU Center for Native Health Partnerships, 2012).

6. Ensure equitable benefits: Collaboration should ensure that the benefits of the project are shared equitably with the community. This means providing opportunities for capacity building, training, and employment, and ensuring that the community is fairly compensated for their contribution (NCAI Policy Research Center & MSU Center for Native Health Partnerships, 2012).
7. Continuously learn and improve: Collaboration with Indigenous communities is an ongoing process that requires continuous learning and improvement. It is good practice to continually seek feedback from the community and adjust the project accordingly to ensure that it meets their needs and expectations (The Nature Conservancy, 2023).

Methods

Bottom-up Approach

A bottom-up approach entails engaging local communities and decision-makers in the curriculum development process. This helps ensure that the curriculum is relevant and responsive to local needs and concerns and that it reflects the unique perspectives and experiences of those who live and work in the place. Second, a bottom-up approach can help build community engagement and ownership of the curriculum. When local communities are involved in the process, they are more likely to feel invested in the curriculum and to see it as relevant and valuable to their lives.

Additionally, this approach can help promote more equitable and inclusive educational practices. By involving diverse voices and perspectives in the curriculum

development process, the resulting curriculum is more likely to be inclusive of all members of the community and will address existing issues of power and privilege (Smithsonian Institution, 2020). Using a bottom-up approach when creating a place-based curriculum can help ensure that the curriculum is relevant, responsive, equitable, and reflective of the unique perspectives and experiences of local communities. This can lead to more meaningful and impactful learning experiences for students and a stronger sense of community ownership and engagement in the educational process.

The planning process was structured to pursue the development of the program and learning objectives, development of tasks to meet those objectives, determine resources needed, and clarify tracking and assessment methods. During this process, my team and I strived to learn from Indigenous students to advance the work previously done in the co-creation process and climate change curriculum.

According to Clavin et al. (2023), there has been an increased interest in understanding how learning occurs within the co-learning process within higher education. To ensure the efficacy of the co-learning process, the authors recommend evaluating group learning by analyzing not only the outcomes but also the dynamics and communication patterns of the group. By broadening the assessment to measure perceptions in the co-learning field, this recommendation can directly address a significant gap in CES education practices.

Co-Creation

Co-creation is a process of collaborative design and development in which key individuals, including local communities, educators, and learners, work together to create a shared vision and approach to learning. Co-creation can be seen as a bottom-up approach when creating a place-based curriculum because it places local communities and key individuals at the center of the curriculum development process. Laursen et. al., (2018) describe knowledge co-production, or co-creation, as, “The collaboration between researchers and managers in all aspects of a project, including the development of research questions, study design, analysis, and ultimately the dissemination and application of the results” (pg. 619).

In co-creation, local communities and key individuals are involved from the very beginning of the curriculum development process. They help identify the needs, issues, and concerns of the community, and provide input and feedback throughout the process (Hampton & Wadud, n.d.). This approach ensures that the curriculum is grounded in the local context and reflects the unique perspectives and experiences of the community.

Incorporating a range of perspectives and voices into the curriculum creation process promotes equity and inclusivity. By addressing potential power and privilege issues and ensuring relevance to all members of the community, the curriculum becomes more meaningful. Co-creation is a feasible approach when creating a place-based curriculum because it involves local communities and key individuals in the development process and ensures that the resulting curriculum is responsive, relevant, and inclusive of diverse perspectives and experiences (Smithsonian Institution, 2020).

Transcribing and Coding

As in the previous chapter, I employed Otter Ai transcription software to transcribe the interviews concerning teaching practices and co-creation. Afterward, I utilized Dedoose to code the transcriptions to identify the most effective teaching practices for Indigenous programs, as well as how the program is customized to meet the needs of the students. Notably, each cohort had the opportunity to participate in the co-creation of the program for their attended year.

Engagement Outline

An engagement plan is a critical tool for ensuring that key target audiences receive significant information. As a qualitative researcher, it is important to identify these audiences and determine what information is most useful to them. Below is the engagement plan used to guide the co-creation process:

I. Identifying key target audiences for information distribution:

- N.A.T.U.R.E Program
- Chapter Houses engaged during the project timeframe
- Organizations and Community Members involved in Talking Circles
- Organizations and Programs seeking to co-create Indigenous-centered climate curriculum (e.g., Canyonlands Field Institute, Bears Ears, Science Moab, Full Circle Intertribal Center)
- Zoom presentations to Rural Utah Project, Women of Bears Ears, and Cooperative Extension System (CES)

- Community organizations involved in similar work nationwide

II. Determining the most useful information for targeted audiences:

- Barriers, processes, learnings, and takeaways in engaging Native Communities
- High-level findings addressing barriers and inequities
- Compilation of Talking Circle data to inform place-based climate curriculum in Southeastern Utah
- Exploration of intergenerational responses, impacts, and climate change priorities

III. Engaging individuals with relevant, digestible, and engaging content:

- Publications on lessons learned in engaging with Indigenous communities, serving as a resource for future researchers and Tribes guiding collaborative efforts
- Comprehensive depiction of community insights, addressing needs and meaningful resources
- Open access materials to remove barriers to access and utilization
- Brief documents summarizing key takeaways (Appendix C) for sharing results at the 2023 Powwow (written and presentation formats)

Developing an engagement plan can be a crucial step in effectively disseminating information to target audiences. By identifying the key audiences and determining what information is most relevant to them, researchers can create materials that are tailored to the needs of those communities. As demonstrated in the engagement plan for the co-creation process, providing digestible and engaging materials that are open access can ensure that there are no barriers to accessing the information. By following these best practices, researchers can help to bridge gaps and promote more equitable communication

with Indigenous communities, ultimately supporting more effective and inclusive research practices.

Question Themes and Examples

This chapter centered around the question, "What can we learn from producing a co-created climate change program involving Indigenous populations?" To shed light on this topic, we conducted one-on-one interviews with the NATURE program staff, providing valuable insights into both successful and unsuccessful approaches while exploring potential alternatives. These interviews took place on the same day as our inaugural talking circle at the Canyonlands Research Center, where we delved into topics such as effective teaching methods, curriculum development, and the collaborative co-creation process.

Education and learning styles:

- a. The purpose of the inquiries was to gather insights on what the participants would like to include in a curriculum for future learners and how to make it more easily accessible.
 - "Do you have any ideas of how we authentically center and integrate place-based Traditional Ecological Knowledge, within a climate change curriculum so that it is useful, relevant, engaging, and sustainable for the next generation? If you could provide an example?"

Program student reflection talking circle questions:

- a. These questions explored what students would like to see in a curriculum for future participants and how to make it accessible to students.
 - “What topics were you most interested in? Why?”

Nature program staff individual interview questions:

- a. The purpose of these questions is to gather input on what students would like to see in a curriculum and how to make it more accessible for future students.
 - “What does co-creation and co-governance (or co-leadership) with Native Communities look like in the NATURE program?”

I have created a code chart for the teaching practices and co-creation topics discussed in the talking circles and individual interviews, which included the NATURE students' first talking circle, the student reflection talking circle, individual interviews with NATURE program staff, and the organizational talking circle. This chart includes a list of parent (broad category) codes and their respective subcodes (if any), code descriptions, and the frequency of each code's application.

Co-Creation Process

The NATURE program is relatively new, having been established in 2021, with only two cohorts having completed the program. We approached the program to request permission to involve students from previous cohorts in the co-creation process, offering a \$1,000 stipend for 5 weeks of work. The program staff contacted previous students, and

some expressed immediate interest. However, we wanted to extend the opportunity to every student. After seeking advice from the program's leadership, we decided to collaborate with the students who first enthusiastically responded. This included two students from the 2022 cohort, and one student from the 2021 cohort, who was also the mentor for the 2022 cohort. We scheduled a few meetings and sent emails over the next few weeks to discuss the co-creation process and expectations.

During the first week of the co-creation process, our focus was on reflecting on their experience with the NATURE program and envisioning an impactful climate change week. We engaged in a discussion with the students about their overall experience, what topics interested them, the desired format, and the balance between Indigenous and Western knowledge. We also identified the tools that the students were already familiar with and comfortable using, such as Google Docs, Slack, and survey software. In addition, we met with the NATURE program staff to learn more about what information would be helpful for them, including content and structural aspects.

To kickstart the co-creation process, we assigned homework for the first week that included an exercise to help students think about last year's program and what they liked the most related to climate change, aside from what we had discussed in our meeting. They were also asked to identify any missing aspects and to suggest readings, speakers, and topics they would like to have included. We encouraged them to share anything that did not resonate with them or that they felt could be left out. To gather relevant resources, we provided a few starting points and asked students to look through the UC Climate Stewards curriculum to see if there were any relevant portions that could be adapted for the NATURE program. We wanted to ensure that the students were involved in the research and resource-

gathering process as much as possible to ensure their voices were heard throughout the co-creation process.

Through the meetings with the program staff, we learned that the NATURE program was undergoing significant changes, including becoming more mobile and visiting other locations in the region. Additionally, the program lost its main leadership without a replacement, making it difficult to nail down specific details. Because of these uncertainties, we sensed some hesitation from the staff about participating in the co-creation process. We clarified our intentions and assured them that we were not creating a fully fleshed-out curriculum for them to implement the following summer. Instead, we were providing place-based resources and activities with a climate change focus for when they are in Moab with a menu-style approach. Given the program's in-depth focus on various topics, we decided to create a climate resilience module in the form of a 5-day week. Although we initially considered a 1-day, 3-day, and 5-day plan, we decided to stick with the 5-day plan, which they could use as a menu to pick and choose activities from and incorporate into other weeks where applicable.

In the second week, we began with each student sharing their findings from the homework assigned the previous week. Some students recommended speakers they enjoyed hearing from in previous years, while others suggested new options for speakers to include in the climate module. Upon suggestion from one of the students, we explored the possibility of partnering with the Canyonlands Field Institute (CFI) for a river trip that would be led by their Indigenous guides. We also discussed topics and segments from a

local radio show and podcast called Science Moab, which features researchers discussing current work happening in the Colorado Plateau, including many Indigenous researchers.

In addition, we discussed potential partner organizations for the program and the importance of networking opportunities and encouraged students to identify skills they hoped to develop during their time in the program. Furthermore, we tasked them with asking potential speakers whether they required travel funds or a speaker fee, which would help the program staff determine whether they could bring them in. We collectively discussed topics of interest and delegated podcasts from the Science Moab website, which features many Indigenous researchers, for students to listen to and identify episodes that could be assigned to the next cohort. To help students gain networking experience and professional development skills, we encouraged them to initiate contact with potential speakers and provided guidance on how to craft professional emails. These emails aimed to gauge their interest in collaborating with the program and their availability during the program's timeframe in Moab.

This brought up another concern by the NATURE staff. They were worried that we were contacting them too soon and wanted to make sure that we were not making any promises to potential speakers. We assured them we worked with the students to make sure the emails were clear and that we were currently in the process of gathering information for the program.

In the third week, we reviewed our progress with potential speakers and dedicated time to structure the climate module. To begin, we discussed the students' motivations for joining the program and the skills they hoped to acquire. However, we felt that the students

needed more time to reflect on their motivations, so we postponed the rest of the discussion to week 4. Structuring the module was a bit of a challenge as we had gathered many resources and ideas that needed to be organized into days separated by theme. After some discussion, we determined that a resilience theme would be the most appropriate for the climate module. We also considered different formats and decided that organizing by theme and research process would make the most sense. Throughout this process, we continued to communicate with program staff to ensure that our work was aligned with their needs. We narrowed down the resources and activities to fit into the five-day module format and even invited program staff to participate in our co-creation session to provide feedback before finalizing the module. For this week's homework, students were tasked with several assignments. They were asked to follow up with potential speakers, consider opportunities for reflection, incorporate program staff feedback into the final module, and review the full module in preparation for the final week of co-creation. The staff also joined us in our fifth and final meeting to walk them through the module and our Indigenous coordinator assisted with all 5 meetings, as well as help with the structural component of the module menu (Appendix E).

After finalizing the module, we conducted a thorough review and addressed any issues that we noticed. We also had a discussion with our collaborating students to determine their preferences for acknowledgment and co-authorship, and payment options for their stipends and ensured that they would have the opportunity to review and provide feedback on any publications before they were published. Additionally, we were able to reallocate some of our grant funding to schedule a day-long river trip for the Indigenous participants, led by three Indigenous guides in partnership with the CFI. We informed the

program that we are also willing to assist with finding funding for Indigenous speakers' travel and speaker fees to ensure inclusivity. However, some concerns were raised about the university's involvement and potential strings attached to the partnership, so we provided transparent documentation to clarify the extent of the partnership between CFI and the NATURE program, including the grant narrative, budget, and the exact amount of funds remaining.

In the next section, I will discuss the outcomes of our co-creation process and the results of our discussions on best teaching practices, program growth, and important topics.

Results

During the coding process, you gain a comprehensive understanding of the discussions and uncover various nuances. This includes delving into the contextual background surrounding different topics, discerning the diverse perspectives of individual participants, and identifying the key themes that emerged. The following code chart provides the names, descriptions, and frequencies of occurrence for each coded element in the material.

Table 2

Teaching Practices & Co-creation Code Chart

Code	Code Description	Code Frequency
Co-Creation (Parent)	References to situations that could be considered co-creation	22

Code	Code Description	Code Frequency
NATURE Survey	Survey given by NATURE program to gauge student interests	8
Cultural Barriers (parent)	Instances mentioned where culture has hindered progress	21
Motivations (parent)	Overall motivations to join the program	0
Professional development	Specific mentions of job and networking opportunities being a motivator, mentions of professional development	22
Outreach (parent)	Vague mentions or mentions of additional outreach methods	0
Application process help	Mentions of helping get rid of barriers to applying for the program	4
Broad approach	Mentions of a multi-method approach for recruiting students	2
Flyer	Mentions of flyers as a form of outreach	7
Incentivize	Mentions of incentives that did or could lead to recruiting more students	2
Intertribal	Mentions of potentially reaching out to more tribal nations for recruitment	8
Job boards	Mentions of publishing flyers on job boards and boards elsewhere (i.e chapter houses)	1
Mass emails	Mentions of using emailing to recruit students across the region	7
Outside institutions	Mentions of other institutions that were or could be contacted for recruitment	9
Social media	Mentions of using social media to expand reach and market the program	2
Word of mouth	Mentions of word of mouth as a way of getting more student recruitment	8
Program growth	Mentions of how the program has or could grow	28

Code	Code Description	Code Frequency
(parent)		
Reflection (parent)	Mentions of moments of reflection	12
STEM (parent)	Mentions of how STEM plays or could play a role in climate curriculum	6
Teaching practices (parent)	Mentions of other teaching practices that are not listed as a subgroup (child)	0
Adaptability	Mentions of having to or the importance of adaptability in place-based projects	12
Communication	Mentions of communication or lack of communication	7
Cultural humility	Mentions of two-way learning	29
Decolonizing science	Mentions of ways to decolonize science or why there is a need to decolonize science	29
Hands on approach	Mentions of hands-on approaches used or desired	20
Knowledge sharing	Mentions of situations or barriers to knowledge sharing	23
Lectures	Mentions of lectures as a teaching method	8
Listening and patience	Mentions of the importance of listening and patience	23
Storytelling	Moments of storytelling or mentions of aspects of storytelling	14
Student mentorship	Mentions of times of student mentorship or the need for it	16
Teaching setting	Mentions of the location where the teaching takes place	12
Traditional/Indigenous knowledge	Mentions or references to Indigenous knowledge	38
Western science	Mentions or references to Western science	24
Topics (parent)	Other topics not included as a subgroup (child)	6
Agriculture	Mentions of agriculture or aspects of agriculture	9
Climate change	Mentions of climate change or aspects of climate change	12
Community	Mentions of community development or aspects of	11

Code	Code Description	Code Frequency
development	community development	
Connectivity	Mentions of connections between topics	5
Ecosystem degradation	Mentions of ecological degradation or aspects of ecological degradation	8
Endangered plants and animals	Mentions of traditional or endangered plants and animals	25
Land Management	Mentions of land management or aspects of land management	22
Policy	Mentions of policy or aspects of policy	11
Restoration	Mentions of restoration or aspects of restoration	13
Soil	Mentions of soil	7
Sustainability	Mentions of sustainability or aspects of sustainability	13
Water	Mentions of water	11

Coding Analysis

By the time I finished coding, I had a total of 577 code applications, 46 unique codes, and 3 descriptors: NATURE program staff, NATURE program students, and the organizational talking circle. Through our analysis of the coding results, several codes emerged as prominent themes. The code application tool identified codes that were applied more than 20 times or more, which included Cocreation (22), Professional development (22), Program growth (28), Cultural humility (29), Decolonizing science (29), Hands-on approach (20), Knowledge sharing (23), Listening and patience (23), Traditional knowledge (TK) (38), Western science (24), and Endangered plants and animals (22).

However, we acknowledge that the results may be influenced by the questions asked during the conversation. For instance, the codes of Traditional knowledge and

Western science came up frequently because we had specific questions related to balancing the two practices. This underscores the importance of qualitative research in identifying under-applied codes that may still be significant. We must be cautious not to overlook notable codes simply because they were not frequently applied. During the organizational talking circle, participants emphasized the importance of education on tribal policy. This was reinforced by the feedback from NATURE students during the reflection talking circle.

“Rural Utah project shows that voting at different levels of government and what each seat’s job description is, what their job is on a day-to-day basis if they take up that seat, and what to expect from them. That type of education, I know for sure really needs to happen.” (P5)

“It’s important. I did take a policy class last semester, and you should know what you can and can’t do. It’s boring but it’s important.” (P2)

A few other under-applied codes found with the code application tool are codes like storytelling as a form of knowledge transfer in Indigenous communities that could be utilized more in the program. This is also backed up by the co-occurrence tool which will be discussed later. It's crucial to spread the word about the program through trusted sources, such as individuals who have already been through it. Additionally, having a student mentor who represents their community can provide meaningful guidance and comfort for participants. Some guidance may be needed especially to navigate a program that combines TK and Western science practices. Both Western and Indigenous knowledges are valid, and they can choose how much of each they want to incorporate into their experience and project. This is also why it is important that the students have a say in how much their capstone projects pull from Western science and TK. The balance is up to them. The project

decolonizes science by showing that if you can ask questions, you can do science. This makes science an attainable pursuit that can adhere to traditional cultural values if the students so choose. The teaching approach is centered around the students, with horizontal teaching and cultural humility. The students are both learning and teaching in this method, as noted by some participants.

“I think one other thing that is cool about these projects, is that I think almost all the students are, the topics they picked, are very different topics than what non-native students might have picked. So it's like the, the topics are all very much like, at the intersection of their traditional knowledge and culture. And science. So, I think that's, and I think for some of them, they that's kind of like maybe a bit of a novel experience or like they it's helping them realize that that's possible.” (P8)

“In our culture, walking into different worlds, you know, we have the Western civilization and then your Native American culture and it's there to completely into the interconnect, like, Western civilization. Western sciences have biological science. With Native Americans, it's the spiritual we, we don't know the biological thing, but we do know something's happening. And then they're like, there are certain practices that we can't do in, in a lot of STEM programs. So, they really, sometimes they clash.” (P1)

To analyze the data, we used a tool called code co-occurrence analysis. This tool tells us how the code and tag system was used throughout all project excerpts. A symmetric matrix is displayed that shows the frequency of code pairings used in the same excerpt and overlapping excerpts. By analyzing the use of two codes together, we can identify both anticipated and unanticipated patterns. These patterns shed light on how the code system represents concepts related to the research questions and how they are combined in the natural schema. This schema is a cognitive framework that helps participants organize and interpret information as they report on the project codes' topic (Analysis and filtering Userguide, n.d., Dedoose.com). The highest co-occurring codes were a) Decolonizing science x cultural humility, b) Indigenous knowledge x decolonizing science, and c)

Indigenous knowledge x Western knowledge. The first two co-occurring codes were not surprising given the conversations I had. Cultural humility is necessary to decolonize science, as science should be open to different perspectives. Incorporating TK into a scientific setting can also have a unique look and approach. NATURE program students often navigate two worlds, which can make it challenging to transition to scientific fields. However, we are hopeful that this is changing. Decolonizing science creates a more inclusive environment and has the potential to generate innovative and effective solutions to climate change and other environmental issues.

“The NATURE program, at least, the approach that I take with the interns is that we're not trying to make it hierarchical. So, we are as much learning from them, as we hope we are teaching them. So, it's not a regular classroom environment or university environment where the teachers or professors are on top, and then they're disseminating information vertically. So, from the professors down to the students. Here, I like to think of it more being a horizontal way. So, the information is coming to both ways. And that I think, what is what is, in the essence of creating knowledge and co-creating teaching opportunities.” (P4)

Cultural humility and decolonizing science are also relevant to the better practices discussed in the individual interviews for an Indigenous and student-centered program. The interviews highlighted the importance of listening with patience, providing numerous opportunities for feedback, and ensuring students' comfort. Co-creation was emphasized through reflection and meetings with prospective students before the program starts to tailor topics. The expectations and policies for the class were also co-created. Getting to know the students and their interests and building relationships before the program starts were seen as crucial in tailoring the program to their needs. Additionally, there are cultural barriers that can prevent potential students from entering the program, such as limited

access to resources, unfamiliarity with the application process, or mistrust of academia. The "Cultural Barriers" code was applied to instances where limited access to resources or difficulty in sharing knowledge from generation to generation hindered progress. Participants mentioned some barriers based on their personal experiences.

“Most of these kids on the rez, sometimes they don't have anybody to turn to, they do not have any resources.” (P2)

“I was pretty happy with the ratio we have of indigenous versus non-Indigenous guest speakers. And talking with our coordinator, we decided that it would be good to have both because I think having Indigenous speakers, it's really cool for the students to have role models that are similar to them. But then also, D mentioned that it's really important for them to get the experience interacting with non-native people, they can kind of be out of their comfort zone, but they know they have to do it in their future careers.” (P8)

“Students from Indigenous communities, Indigenous backgrounds, they can be perceived by Western scholars as less outgoing. But that doesn't mean that they're not interested. So researchers and instructors need to learn patience, and also listen a lot.” (P4)

“Recruiting was huge. What I figured out over the first and second years is that it can't be done business as usual. So what I did was cultivated relationships with students that expressed interest early on— And what I mean by business as usual, is that when I've run other programs, we put our announcement out there and students apply by the date of February one, something like that, and then we've looked at that pool of applicants. There's no relationship developed early on with anyone that expresses interest. I realized over these two years is that any student that expressed interest, I not only got back to them, but I said ‘we would welcome your application.’ If that application didn't come, I wrote back again and I said, ‘Do you have any questions, we would be interested in your application’ because I just think that there are just more barriers for Indigenous students to go through this— writing a personal statement, and providing a resume. Leading them alleviates any concerns or anxiety around that. I was on email quite a bit with students talking to them and making sure that they understood, what the experience would be like, it was a very different recruiting process.” (P9)

“Being non-Indigenous is really hard to connect with Indigenous people and find the way to really communicate with them without offending them. So I think the best practice would be to know your history and Indigenous background and acknowledgment goes a long way. Then getting to know them— being Native American, we close ourselves off because of the trials and tribulations the government has put us through and so we move off from that. Once we get to know someone, then we start opening up and then kind of get a feel of how the people are.” (P1)

The collected insights from participants in this discussion shed light on considerable aspects related to Indigenous communities and their experiences. These include the lack of resources and support available to many Indigenous people on reservations, the value of having both Indigenous and non-Indigenous guest speakers to provide role models and prepare students for future interactions, the need for patience and active listening when engaging with Indigenous students, the significance of personalized and relationship-based recruitment processes for Indigenous students, and the importance of understanding Indigenous history, acknowledging backgrounds, and building relationships to effectively communicate and connect with Indigenous individuals. These diverse perspectives highlight the challenges, considerations, and lessons learned in working with Indigenous communities.

Program growth

During interviews with program staff members, it became clear that program growth should prioritize regional expansion over increasing student numbers to maintain the program's quality and the students' experience. Scaling up the program's size could negatively impact its effectiveness and ability to be tailored. To enhance the student

experience and maintain program quality, previous cohorts or networks of students could serve as mentors for new students, and strategies should be put in place to keep them connected to the program.

We discussed several strategies to keep previous students connected to the program, including newsletters that provide updates on opportunities and developments related to the program. However, while we were able to offer some funding resources for the upcoming 2023 cohort, the program will need to continue seeking grants or other funding sources to ensure its effectiveness and provide more opportunities for future cohorts.

To ensure the program is tailored to the needs of the students and is effective, it is crucial to keep a regional connection to the land. This will help maintain the program's tailored approach and promote a more effective learning experience for students. The program should also emphasize learning from reflection opportunities throughout the program. Encouraging students to reflect on their experiences and share their insights can help improve the program's effectiveness and provide a more personalized learning experience.

“I think there's always a time for the learning process and time to reflect on that learning, to perhaps improve it for next year's or future years. So that whatever we did wrong, or we did best, and push those ideas, and those reflections into actions for later use.” (P4)

Topics

The students found several topics covered in the program interesting, such as watersheds and river systems, issues related to wild horses, and the interconnectedness of topics. It was fascinating to see how each student gravitated toward different capstone project topics, including medicinal plants, soil samples, endangered species, rangeland practices, and educational outreach. The student's passion for their topics was evident, and they had clearly invested a lot of time into their research. Having a student mentor was also highlighted as a valuable resource for research direction.

While climate change was discussed, it was mostly through environmental examples rather than direct references to the issue. The students connected their topics to various areas, including water, agriculture, land management practices, restoration, and topic interconnectivity. They also suggested several interesting topics that were not covered in the program, such as land disturbances like fire, wind, and rain, implementing law and policy, and having speakers from Indigenous-led organizational groups.

*“Climate change really affects land on the Navajo Nation. We've noticed so many plants depleting from our grandmother's land, or her neighbor's land. So, finding the resources and networking with people on how to prevent that ourselves, it's really impactful for the students, because they're the ones that could reverse it.”
(PI)*

Regarding the program's format, the students found it easy to navigate and appreciated the balance between lectures and hands-on opportunities. Overall, the students were highly engaged in the program and found the topics covered to be interesting and relevant to their individual interests. Encouraging reflection on these topics throughout the program could further deepen the student's understanding and investment in their research topics.

When developing the climate module menu, we incorporated many of the results into the module. Additionally, we provided overarching structural recommendations for the program as a whole (Appendix D). While these recommendations may not be fully reflected in the module since it only covers a week, we wanted to ensure that the program benefits from our suggestions beyond the module.

The Module

(Full Menu can be found in Appendix E)

Purpose: Our co-created climate change module provides an opportunity to learn about and engage in building climate resiliency through collaboration, adaptation, and mitigation. By collaboratively drawing from Westernized science and Traditional Ecological Knowledge, including both innovative and inclusive practices from Indigenous cultures, students from the NATURE program cohort can develop sustainable and resilient ways to face present-day challenges brought on by climate change in their communities. The module was co-created by Amber Archie, Nichole Butler, Bayli Hanson, Sara Hink, Roslynn McCann, & Danielle Tso (a combination of past participants in the Nature Conservancy's Native American Tribes Upholding Restoration and Ecosystems program and Utah State University Extension).

Goal: The goal of this Moab, Utah-based climate change module is to empower action and promote community-centric collaboration towards building inclusive climate resiliency through a combination of adaptation, mitigation, traditional ecological knowledge, and

practices. The aim is to encourage cross-cultural practices and bridge the gap between people and nature, so we can nurture a natural world where we can equitably and interconnectedly thrive.

General Topic Themes for the Module

This module focuses on building resilience against extreme weather and adapting to climate change. It covers various topics such as water conservation, ecosystem adaptation, and combating invasive species. The module emphasizes the importance of developing context-specific practices and tools that address community needs. It highlights the coexistence and reciprocity between people and nature and how to implement this knowledge in specific communities. The module also explores environmental stewardship by uplifting Western and Indigenous Science through an intertribal lens.

- I. Adaptation, Resiliency, and Sustainability in the face of climate change:
 - A. How to build sustainable systems and practices against extreme weather.
 - B. Practicing water conservation and reducing water pollution.
 - C. Adaption of biodiverse ecosystems - supporting native vegetation and combating invasive species.
- II. Climate Change Adaptation & Mitigation:
 - A. Learning and developing climate change adaptation and mitigation practices, as well as resource tools that are specific to cohort community needs.

- B. Building environmental sustainability by variables that center the most vulnerable, and resourceful ideology, procedures, and practices.
 - C. Introducing major topics such as cultural fire and land management.
- III. Coexistence of Reciprocity between people and nature:
- A. How people, community, and nature can coexist in a thoroughgoing (fluidly balanced way) of reciprocity.
 - B. From theory to practice, how to implement the information learned within the students' specific communities.
 - C. Upliftment and comparison of Western and Indigenous Science (Intertribal lens) - environmental stewardship.

The menu style module is designed to help users understand how to build climate resilience in their communities. This is achieved by breaking down the themes into daily activities and speakers, allowing users to gain a well-rounded understanding of different approaches.

5-day Climate Module Outline

Day 1: Climate Change and the Colorado Plateau

Day one will lay the foundation of climate change science and projections in the region and preview terms and themes of what will be covered throughout the week.

I. Themes:

- Adaptation & Mitigation
- Cattle & Ranch/Land Management
- Food Sovereignty
- Water (Conservation, Mitigation, Rights, & Activism)

Days 2-3: Climate change adaptation and mitigation research in and around Moab

Days 2 and 3 will provide students with immersive and informative experiences in and around Moab, Utah.

Day 2

On day 2, students will have the opportunity to take a day trip down the Colorado River with the Canyonlands Field Institute (CFI), guided by Native guides and outdoor educators. The Native guides will discuss climate change through their own lens.

Day 3

Fire Mitigation & Management (Western vs. Indigenous Cultural Burning Practices)

The next day, day 3, will focus on fire mitigation and management, with an emphasis on the importance of diverse practices, including Western and Indigenous Cultural Burning Practices. Students will also have the chance to explore cattle grazing and rotation practices at the Canyonlands Research Center and participate in additional options such as climate adaptation plans.

Day 4 Climate Resilience and Action in the Four Corners Region

Day 4 of the climate module will focus on climate resilience and action in the Four Corners Region. Potential speakers include members from Salt Lake City Air Protectors, Rural Utah Project, and To Nizhoni Ani "Sacred Water Speaks". Activities will include permaculture and ecological design for climate resilience, with a community garden tour as well as a screening of the documentary "Powerlands" (2022) by Camille Manybeads.

Day 5 Career Panel - Networking Breakouts / Mentorship, & Gratitude - Hopeful Solutions, Grounding-Healing, Vision, and Outlook

The final day of the module focuses on career development, networking, and mentorship, along with reflection and gratitude. Students will have the opportunity to reflect on their experiences and insights gained from the program through various activities such as journaling, art, small group discussions, and large group talking circles. The day will also feature a career panel with invited speakers from previous days, followed by breakouts for students interested in networking with specific speakers. Additionally, the program recommends inviting all speakers to the capstone project presentations to provide support and mentorship to the students. To ensure the continued engagement of certain speakers in this mentorship program, we plan to provide funding through Visa gift cards. This initiative aims to incentivize their ongoing involvement and commitment to the program.

The proposed module provides a unique opportunity for students to engage in climate change research and action in the Moab region. Through immersive field activities, Indigenous and Western expert speakers, and hands-on learning opportunities, students

will develop a deeper understanding of climate change adaptation and mitigation strategies. The program includes a diverse range of topics, from river trips and cattle grazing practices to fire management and permaculture design. In addition, the module provides students with valuable networking opportunities through a career panel and mentorship with speakers. The reflection period at the end of the program allows students to process their experiences and plan for future actions. Overall, the module aims to inspire and empower students to become climate leaders in their communities and beyond.

Discussion

We have chosen to approach this study through a co-creation process, which emphasizes collaboration and ensures that participants have a say in what it means to be "culturally inclusive" in climate change programming. This process requires an interactive, multi-dimensional approach to knowledge co-production, placing researchers and other knowledge users on equal footing with participants, unlike the traditional approach of researchers producing knowledge and then transferring it to users (Nel et al., 2016). Our aim is to incorporate the cultural identity and knowledge of the participants and give them credit for their intuitive adaptation and mitigation strategies.

While co-creation is a relatively new term and infrequent practice to date, in localized climate change solutions, we believe that working with underrepresented groups, such as Indigenous communities, is critical. However, this has affected our timeline significantly as there is no one-size-fits-all approach to co-creation with Indigenous groups. We are tracking each step and progress, and our intention is to pave the way for future

studies in this area. It is important to recognize that Tribal Nations have vastly different cultures and lifestyles from Western societies, and as outside collaborators, we must adapt accordingly.

To ensure we were on track, we evaluated every stage of this project. After each talking circle, we met in with our advisory board, and I prepare a "takeaways" document to share with participants, reiterating what was discussed and the major points, and expressing our gratitude for their time and willingness to participate (Appendix C). These documents serve to evaluate how we are digesting the information we receive and to ensure that we are not making it fit a predetermined narrative. We encouraged participants to let us know if anything was misinterpreted. In our meetings with chapters, consultants, and organizations, we also sought feedback on the best way to provide access to these materials once they are completed, ensuring that they can reference them when needed.

Once we began generating ideas for the module, we discovered that the momentum continued to build. Collaborating with the students allowed us to gain valuable insights into the existing content and discover additional activities that they were aware of, which could be incorporated. Some of these ideas even focused on downtime activities such as educational games, readings, films, and podcasts. One notable aspect of our approach was our determination to make a river trip a reality, despite previous funding constraints that prevented its inclusion in the program. We invested significant effort into making this activity a standout feature.

Another distinguishing factor of our efforts was that this particular module originated from the suggestions of former students who desired to contribute to the

program's ongoing success. It became evident that water-related topics garnered great interest among the participants, considering the various issues they had personally encountered, ranging from water pollution and drought to infrastructure damage caused by flooding. Our conversations revolved heavily around this prevalent theme. Additionally, we engaged in discussions regarding the module's structure, ultimately deciding to organize it into a day-by-day format that followed a logical progression of information, on-the-ground research, analysis, and reflection, all informed by the valuable input provided by the students.

Through the co-creation process, we recognized the immense value of involving the students in shaping the program. This approach proved particularly effective for the NATURE program, as it enabled continuous growth while consistently meeting the evolving needs of the students year after year.

Lessons Learned

Creating place-based climate programming is of utmost importance when working with Indigenous groups, as it acknowledges and respects the unique cultural and ecological context of each community. Indigenous communities have profound cultural connections to their lands and rely on natural resources for their livelihoods and well-being. Consequently, climate programming must be customized to address the specific needs and priorities of each community.

Place-based climate programming involves collaborating with local communities to identify the most significant climate risks and opportunities in their area, developing

tailored strategies to address them. This approach recognizes the critical role of Indigenous knowledge and perspectives in understanding and responding to climate change. Collaboration and co-creation with Indigenous communities are central to place-based climate programming, with a focus on building trust, respect, and shared understanding.

Creating place-based climate programming with Indigenous groups can also help address power imbalances and promote self-determination. It recognizes that Indigenous peoples have unique rights and sovereignty over their lands and resources and acknowledges their role as stewards of the environment. By incorporating Indigenous knowledge and perspectives, place-based climate programming can lead to more effective and sustainable solutions to climate change that benefit both the environment and local communities. During the discussion, a participant raised a question about how to reintroduce traditional practices and move forward

“We're just trying to figure out where do we go? How do we go from here? I think that's within the educational base, the traditional education part of our communities where we can re-implement those, and really just as our own nation to make that possible for our people within our communities.” (P5)

To ensure the integrity of such initiatives, it is recommended to offer major participants co-authorship in any publications and acknowledge all participants mentioned in the acknowledgment sections. This approach mitigates the risk of the project being perceived as "white saviorism" and demonstrates a commitment to inclusivity and equitable representation. Co-authorship and acknowledgment recognize and honor Indigenous knowledge and ways of knowing, which have historically been excluded or marginalized in research. These actions validate Indigenous agency and control over the

narrative and research process, countering historical power imbalances between Indigenous peoples and non-Indigenous researchers.

Creating a safe research environment is paramount and can be achieved through multiple factors, including the impact on policy and practice. By naming Indigenous participants as authors, research findings gain credibility and legitimacy, increasing their influence on policymaking and practice. This recognition reinforces the significance of Indigenous voices in shaping decisions and actions that directly impact their communities. Reclaiming Indigenous knowledge also plays a vital role in ensuring culturally safe research environments. By explicitly acknowledging and valuing Indigenous knowledge systems through authorship, the research community actively challenges historical imbalances and power dynamics in research. This practice fosters a more equitable and inclusive research landscape while promoting the revitalization and preservation of Indigenous knowledge and cultural practices.

Additionally, it is essential to compensate Indigenous participants in academic research. Historically, Indigenous knowledge and labor have been exploited and undervalued by non-Indigenous researchers. Compensation recognizes and respects the value of Indigenous contributions to the research process, mitigates economic burdens, and addresses inequitable power dynamics. However, it is important to emphasize that payment should not replace building relationships based on mutual respect, trust, and reciprocity. Rather, payment should be part of a broader ethical framework centered on Indigenous leadership and self-determination, aiming to redress historical and ongoing power imbalances between Indigenous and non-Indigenous communities.

“They've been extracting now that they don't want our land. Now they want our knowledge. And it's happening right here, which is fine. But I'm just going to say this. I'm just going to say this right now., I'm well aware of settler colonialist practices. The environmental space here in Utah needs to get a kick in the ass because it needs to change write that in your book and now, they are screwing us because they don't keep their word in the industries.” (P18)

In Indigenous communities, oral tradition and storytelling are central to knowledge transmission and establishing social contracts. Written communication, including forms and documents, may not hold the same cultural significance as in Western cultures. Therefore, non-Indigenous researchers and institutions should be sensitive to this cultural difference and prioritize establishing trust and building relationships through meaningful dialogue and active listening. Relying solely on signed documents may not be the preferred or customary mode of communication for Indigenous participants. Alternative approaches, such as video or audio recordings, may be more appropriate for documenting agreements and establishing trust, promoting cultural sensitivity and inclusivity.

To facilitate effective communication with Indigenous participants, it is crucial to over-communicate and ensure clarity. Providing comprehensive information, action items, and using less academic language can enhance understanding and engagement. By allocating weekly action items and sending out comprehensive emails with assigned tasks, clarity and accountability are maintained. Promoting cultural humility, avoiding the expert position, and encouraging conversational dialogue foster a collaborative and inclusive learning environment. Furthermore, centering the resources on Indigenous students

themselves ensures that their needs are met and that the learning process becomes a mutual exchange of knowledge and perspectives.

Recognizing and addressing power dynamics and imbalances between Indigenous and non-Indigenous partners is essential to ensure ethical research practices. Researchers must acknowledge and respect the different goals and priorities of Indigenous communities and involve them in all stages of the research process. To overcome cultural barriers and limitations, building relationships based on trust, mutual respect, and cultural sensitivity is paramount. Collaboration should involve Indigenous leadership and decision-making, with researchers acting as partners and facilitators. Research should be conducted in a manner that respects Indigenous knowledge and practices, integrating this knowledge into research design and outcomes. Providing resources and support to Indigenous communities is crucial to enhance their capacity to engage in the research process. Continuous reflection and self-critique by researchers are necessary to ensure that research efforts do not perpetuate systemic oppression and colonialism.

By implementing these lessons learned, we can improve Indigenous engagement in climate programming and research, fostering a more inclusive, equitable, and respectful approach to addressing climate change in Indigenous communities.

Conclusion

In conclusion, creating place-based climate programming is crucial when working with Indigenous communities as it acknowledges and respects their unique cultural and

ecological context. It involves collaboration and co-creation with local communities to address the most significant climate risks and opportunities in their area while recognizing the critical role that Indigenous knowledge and perspectives play in understanding and responding to climate change. It is essential to acknowledge and respect the contributions of Indigenous participants in research by ensuring fair co-authorship and payment. This helps to address economic burdens and power imbalances and promote cultural safety. Additionally, fostering cultural safety can involve exploring topics and selecting speakers that are led by Indigenous individuals. Non-Indigenous researchers should also be sensitive to the fact that oral tradition and storytelling play a significant role in the transmission of knowledge and the establishment of social contracts in many Indigenous communities, and they should prioritize building relationships based on mutual respect and trust rather than relying solely on written documents. We aimed for accessibility with our product, initially designed as a standard curriculum. However, after engaging in numerous discussions with the NATURE program and students, we made the decision to adopt a menu-style approach to enhance adaptability. Ultimately, creating a respectful and equitable research environment is crucial to ensure that Indigenous perspectives are valued and that their self-determination is promoted.

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CHAPTER IV

CONCLUSION & RECOMMENDATIONS

Broader Impacts

Our co-creation of this climate module has provided us with numerous opportunities to create broader impacts for the NATURE program. We have identified potential partnerships that we can leverage going forward to enhance the student experience. For example, we may invite speakers to return each year to give a storytelling lecture or lead a hands-on activity, creating a tradition that enriches the program and provides students with valuable learning opportunities. Additionally, we are exploring mentorship programs that would allow for continued professional development for students beyond the program, building connections and networks that will benefit them in their future careers.

By forming partnerships with organizations and securing grant opportunities, we can obtain both financial and material support. This will enable us to broaden our offerings and provide students with more resources. Throughout this project, we have prioritized professional development opportunities, including networking, and payment opportunities, as well as encouraging continued relationships with previous students. We believe that by investing in students' success and creating a supportive community, we can create lasting impacts that extend far beyond the program itself.

According to Clavin, Helgeson, Malecha, and Shrivastava (2023), Indigenous communities have been historically excluded from STEM fields and climate change

conversations, and it is fundamental to improve Indigenous representation and inclusion. The authors suggest that a National Community Resilience Extension Partnership can facilitate a deeper understanding of Indigenous perceptions of community, climate change, and preferred ways of learning by providing Indigenous students with STEM and climate literacy that will strengthen their arguments and prioritize their voice in broad climate change conversations. This project is expected to have a significant influence on local and national Cooperative Extension System (CES) programs that aim to incorporate climate change topics into their programming and/or broaden their reach to underrepresented communities. The authors propose that elements of Diffusion of Innovations theory can be used to understand how certain strategies for community engagement that emerge are successful in increasing participation in environmental behaviors (Skills, 2019). The authors also suggest that the volunteer model of information dissemination allows for broader impact as the volunteers can function as “super spreaders” of information and have the potential to reach hundreds of community members during this project, thus disseminating information at a rate more commensurate with the urgency of addressing climate change.

The participants will be applying methods from the program to influence others and engage them in their projects. This is an engagement strategy that utilizes community connections to gain access to the larger community. Local activists hold local knowledge and experiences. Utilizing this information can help inform strategies that will be more effective in their communities and what values are held by individuals in the community. “These activists are thus able to communicate sustainability issues in a manner that is more meaningful and personally relevant to community members, allowing for a unique ability

to engage the community and encourage behavior change” (Skill, Stafford, & McCann, 2019, pg. 42).

Having broader engagement and participation in Community Engaged Learning programs will help these communities develop the tools for exploring and communicating the coming environmental changes and opportunities. Although they are on the front lines of the climate change crisis, Indigenous communities have experienced extreme levels of marginalization in science, technology, engineering, and math (STEM), which can provide supportive tools and technologies to assist them in their development of climate change solutions (Clavin et al., 2023). Increasing community and youth access to Indigenous and Western knowledges can support future planning and adaptation measures. Pedagogies aligned with Indigenous perspectives on teaching and learning that are place- and community-based, interdisciplinary, involve the oral stories of elders and community members, and reinforce the interconnections between humans and their ecosystems, make our informal STEM climate education initiative a solution for improving Indigenous interests and attitudes toward science.

It is crucial that the module be accessible, so the module could potentially be delivered using mixed methods like online videos or guest presentations, and other teaching strategies like a reversed classroom or interactive experiences. This would be a major advantage in broadening our reach and improving accessibility. In terms of project deliverables, we offered the NATURE program an extensive range of activities, potential speakers, topics, and funding options. Additionally, we have conducted multiple presentations, including a notable one at the National Association of Community Development Extension Professionals (NACDEP) Conference in 2023. Our objective is to

disseminate this research widely, with the aim of assisting other professionals working in this field and contributing to their knowledge and practice.

Recommendations for Research

The following recommendations will offer valuable insights and strategies to ensure that your research is thorough, accurate, and impactful. By choosing the appropriate research methods and effectively analyzing your data, these recommendations will help you achieve your research goals and contribute to this field's advancement.

1. Research how to better understand the perspectives of Indigenous communities. This could include exploring the history and cultural context of these communities, as well as their current challenges and priorities.
2. Investigate ways to amplify the solutions of Indigenous communities in a respectful and effective way. This could involve exploring different communication methods and platforms, as well as building partnerships with Indigenous leaders and organizations.
3. Research knowledge transfer methods that are culturally appropriate and effective for Indigenous communities. This could include exploring the use of traditional knowledge and language in research, as well as developing new tools and resources for sharing information.
4. Study strategies for building community capacity and promoting empowerment in Indigenous communities. This could involve exploring different models of

community development and engagement, as well as identifying best practices for supporting Indigenous-led initiatives and projects.

Knowledge sharing: “Preservation of language, preservation of knowledge of medicine that is not considered pharmaceutical, preservation of songs, there are a lot of songs that only certain elders know now that a lot of people never learned that they can't pass on anymore.” (P15)

“There is also a lack of documentation, you know, normally we would just ask our elders, ‘How do we take care of this?’ ‘How do we restore this?’ A lot of us don't really speak our native languages.” (P2)

Conducting thorough and impactful research on Indigenous communities requires a deep understanding of their history, culture, challenges, and priorities. By amplifying their solutions in a respectful and effective way, and using culturally appropriate knowledge transfer methods, we can contribute to the advancement of this field and work towards building stronger partnerships with Indigenous leaders and organizations. These recommendations serve as a starting point for researchers looking to engage with Indigenous communities in a meaningful way.

Recommendations for Practice

Approach

When working with Indigenous groups in research, it is better to approach the research in a culturally sensitive and respectful manner. Researchers should develop meaningful relationships with the community before starting the research process. This can be achieved by attending community events, engaging in conversations with community members, and taking the time to understand the community's values and traditions.

Community Engagement

Indigenous communities should have a say in the research that is conducted within their community. Researchers should involve community members in the research process by seeking their input and feedback at every stage of the research. Researchers should also respect the cultural protocols and traditions of the community throughout the research process. This includes seeking permission from Elders or community leaders before conducting research and following cultural protocols for sharing information and knowledge.

Methods

Consider using Indigenous research methodologies that are grounded in Indigenous ways of knowing and being. These methodologies prioritize relationships, reciprocity, and respect for Indigenous knowledge and traditions. Finally, ensure that the research benefits the community. Researchers should communicate the findings of the research to the community in a clear and accessible manner, and work with the community to develop strategies for applying the findings.

Acknowledge Historical Context

In practice, being aware of the history and context of the Indigenous community that you will be working with is crucial. This includes tribal history, culture, and traditions. Building relationships and trust with the community is also essential for successful

engagement. This can be achieved through community outreach, building partnerships, and engaging in meaningful dialogue with community members. Involving community members in all stages of the process, from planning to implementation and evaluation ensures that the project is tailored to their needs and that their voices are heard. Respecting cultural protocols, such as seeking permission from elders or community leaders before conducting any work, is also crucial.

When working with Indigenous communities, it is important to prioritize cultural safety, which means creating a safe and respectful environment that responds to the community's cultural needs. Effective communication is key, including using clear language, avoiding jargon, and using culturally appropriate methods. Language barriers and cultural differences can make communication and collaboration challenging, but building trust and understanding is necessary. It's important to recognize that Indigenous communities may have limited resources and capacity for research collaboration. Mistrust and historical trauma between Indigenous communities and non-Indigenous researchers can hinder collaboration.

Improve Recruitment of Students

Something that the program did not implement in the years we worked with them is physically going to communities to promote the NATURE program. To increase program recruitment and awareness among students, visiting tribal communities and addressing their queries can be quite effective. This approach was implemented in 2023 and resulted in a rise in participants from 6 to 8. It can be helpful for both the teachers and

staff from the program and also for the potential students because it would improve the way they build personal relationships with potential students, parents, and community members. This can establish trust and create a sense of community. It would help the program better understand the local context and the unique challenges and opportunities that students in that community may face. This can help recruiters to tailor their messaging and outreach strategies to better connect with potential students. It is an opportunity to overcome barriers to enrollment, such as transportation issues or limited access to information about the program. By providing information and assistance directly to students and families, recruiters can help to overcome these barriers. Creating a sense of excitement and enthusiasm about the program by engaging with potential students in person can help to generate interest and encourage students to apply and enroll.

Create a Safe Space

When working with Indigenous students, it's essential to ensure that the program is tailored to meet their specific needs. To achieve this, the program staff should take the time to get to know the students before they arrive. This may involve talking to them, their families, or their community leaders to understand their expectations and how best to support them during the internship.

On the first day of the program, it's important to create a welcoming and comfortable space for the students to gather. For instance, a Hogan or other communal space that feels like home and is secure can be an excellent place for staff and students to co-create expectations for the summer. During this time, staff and students can discuss the

number of breaks needed, what is allowed during those breaks, and the phone policy. Also, it's crucial to give students a say in the structure of the program. This will help ensure that the program meets their needs and aligns with their goals.

Staff can work with students to co-create expectations and goals for the program, identify the skills they hope to gain, and explore potential projects or activities that align with their interests. By involving Indigenous students in the co-creation of the program and ensuring that their needs are met, staff can create a more meaningful and impactful experience that supports their learning and development. This can also help foster a sense of ownership and empowerment among the students, which can lead to greater engagement and participation in the program.

It's important to prioritize your well-being throughout the process of working with Indigenous groups as an outsider. Establishing a peer support network can help you navigate the unique challenges of this type of research. As a team, you may experience anxiety around working with Indigenous groups, particularly if you're worried about making mistakes. However, remember that mistakes are a natural part of the learning process, and if you approach this work with humility and a willingness to learn, you can build positive relationships with Indigenous communities. In addition, researching and bearing the burden of the historical exploitation of Indigenous populations— and how you or your ancestors may be implicated in systems of oppression—can be emotionally difficult. It's important to practice self-care and seek support from your peers to help you process these emotions, so they don't become the burden of your Indigenous collaborators.

Remember to approach this work with sensitivity and respect for the community and be mindful of any potential harm your research may cause.

Building relationships is a key aspect of qualitative research, and working with Indigenous communities can add an additional layer of complexity. As a Western academic, it's better to approach this work with humility and an open mind. Seek guidance from your peers and community members and be prepared to invest time and energy into building relationships based on mutual respect and trust. With patience and a willingness to learn, you can conduct meaningful research that benefits both your team and the Indigenous community.

Conclusion

A culturally inclusive climate curriculum could potentially increase the efficacy of creating and implementing just environmental policy. The goal of this study was to create a climate curriculum that would benefit underrepresented communities, while also being applicable nationwide. Through identifying key elements, structure, and approach, we determined that this was achievable. When working with Indigenous communities, we have learned to move at the speed of trust and be adaptable. Using a co-creation approach in climate change programming will allow credit for their traditional practices and how important they are to climate mitigation and adaptation. These practices could be utilized at the local level in rural and urban communities in most areas and would bring awareness to Indigenous identity– including their interconnectedness to the land. Some previous climate change studies actively involved Indigenous peoples, but there is still a gap in the

literature of in-depth reviews of first-hand experiences and the threats to tribes (STACCWG, 2021, Pg. 7). Collaboration can be a powerful tool in the hands of environmental stewards and naturalists.

The key to conducting research with Indigenous communities is to approach the research in a culturally sensitive and respectful manner and to prioritize building strong relationships with the community. In practice, working with Indigenous communities requires respect for their culture, history, and traditions, and building meaningful relationships. Involving community members, respecting cultural protocols, prioritizing cultural safety, knowledge sovereignty, and benefits to the community, and effective communication are also key to successful engagement.

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APPENDICES

APPENDIX A

TALKING CIRCLE GUIDE

Question Themes & Example Questions for Chapters and Organizations

Initial Contact Questions for Organizations

Hi ___ (introduce self, study purpose, the intention with results and publications, IRB approval.

1. Do you have concerns about this proposed project?
2. Are there other leaders and/or organizations you recommend we should be talking to (engage with/ center) about this project?
3. We understand there have been many negative experiences with past researchers extracting information from your communities and leaving, how can we respectfully gather - collect information from these talking circles, while also protecting and acknowledging your data-knowledge sovereignty?
4. In hosting talking circles, what kind of incentives do you think would be beneficial to people involved with your organization, for participating in a ___ORGANIZATION NAME___ talking circle?
 - a. Gas cards
 - b. Visa gift cards
 - c. Shopping list (i.e. teaching supplies)

NATURE: Native American Tribes Upholding Restoration & Education

Program Staff: Co-creation process - 1-on-1 interviews

1. What best practices would you recommend for engaging with Indigenous communities in a climate change program like CRC offers?
2. How do you advertise the opportunity - what networks do you use/what strategy do you follow?
 1. What marketing - promotion strategies and platforms - did you use to advertise this opportunity to Native communities? Which outreach practices did you find most effective?
3. What does co-creation and co-governance (or co-leadership) with Native Communities look like in the NATURE program?
4. What methods did you all use to gain insights from the students on how to teach the program? (Content and teaching methods)
5. What topics seem to resonate best with students in your program?
6. What types of teaching practices provide your students with an engaging and transformative experience? (Stories, PowerPoint presentations, field trips, etc.)
7. What course book did you use (if any)- why did you select that?
8. What are your desired outcomes for the capstone projects?
9. What blend of ancestral knowledge, STEM-based technical skills, and practical experience do you desire your students to have at the end of programming?
10. How do you envision the program growing (or evolving) in the next few years?

NATURE Program Students (end of course reflection)

1. What topics were you most interested in? Why?

2. What made you get involved in this program? How do you plan to use what you learned in the future?
3. What do you wish the course would have addressed (at all or more in-depth)?
4. Was the format easy to navigate (why or why not)?
5. Tell us/me about your capstone project. What did you work on, why is that important, and how did it go?

Talking Circle Guide for NATURE Program Students (beginning of course), Organizations and community members

Community

1. What first comes to mind when you think about community?
 - a. What is good about your community?
 - b. How is it important to you?
2. What kinds of activities help you and others build a sense of community?
 - a. Is nature part of any of those activities?
 - b. Do you feel these activities are threatened in any way?
3. What values or beliefs do you think are common in your community regarding...
 - a. Nature and the environment?
 - b. Community health and wellbeing?
4. In what ways does your community help take care of nature or the environment?

- a. Who benefits from these efforts?
- b. Do you have any concerns for your community?
- c. In what ways is your community strong or resilient during difficult times?

Climate Change

1. The Western, white-centered, climate movement often leaves out voices that are most impacted in terms of the climate crisis. What do you wish more people knew about the ideas and practices of Indigenous environmental stewardship and the unique climate challenges that Native communities face?
2. What intergenerational - ancestral teachings and traditional ecological knowledge - are foundational in mitigating climate change issues through on-the-ground solutions for you and your community?
3. What are your community's top priorities surrounding climate adaptation and mitigation, and what role would you like to see science, technology, engineering, and math (STEM) play to support those priorities?
 1. How can we bridge ancestral knowledge - traditional teachings - with STEM to aid your community's climate resilience?
4. How best can we collaboratively integrate these two ways of knowing and being, to build a Traditional Ecological Knowledge Climate Change curriculum that aids in your community's climate change resilience?

5. What are some of the climate change impacts you have experienced (*or been impacted by*) as an individual and have seen as a pressing issue within your Native communities?
6. What have you seen as key tribal resiliency actions and adaptations being taken in response to climate-related threats within your community?
7. What would you identify as some of the top climate change risks and needs in your community, and what are the challenges your community must integrate solutions?
8. Do you think the following should be done to address global warming? (Answer options: Much more, More, currently doing the right amount, Less, Much Less)
 - Corporations and industry
 - Citizens themselves
 - Congress
 - Your Governor
 - Your local officials
7. What does it mean to you and your community to truly achieve climate justice?

Education and Learning Styles

1. How have the different generations within your community gathered and shared knowledge with each other?
2. How can we authentically center and integrate place-based Traditional Ecological Knowledge, within a climate change curriculum so that it is useful, relevant, engaging, and sustainable for the next generation? If you could provide an example.

3. How has your community worked together to adapt and build resilience when facing climate change? Could you describe that for us?

APPENDIX B

RED CANYON POWWOW TALKING CIRCLE FLYER

Tribal Talking Circle

October 23 | 10 am - 12 pm

Red Canyon Powwow: *Old Spanish Valley Field
Outside of Dance Arena*



Who: Tribal participants 18 years and older
Includes: Breakfast • Tea • \$40 Visa Gift Card

This will be a space to hold rich community discussion, with a focus on environmental place-based needs. The cultivation of Indigenous specialized knowledge and practices will be centered to nurture the cocreation of a culturally relevant and inclusive Indigenous climate change curriculum within the Colorado Plateau. All results and the climate change curriculum will be openly available.



An open conversation to share your thoughts about:

- Nature and the environment
- Community health and well-being
- Climate change and your community
- Sharing of science information

This has been approved by Utah State University's Institutional Review Board, #12715

This conversation will be audio recorded, and participants will have the opportunity to opt out of the conversation and recording with no consequence. All participant names and any identifying references will be removed in any sharing of the results.

Questions? Please contact Roslynn McCann, roslynn.mccann@usu.edu/435.797.5116



This opportunity is provided through funding from the National Science Foundation and community donations.



APPENDIX C

TALKING CIRCLE REFLECTIONS SENT TO PARTICIPANTS

Native American Tribes Upholding and Restoring Ecosystems Talking Circle Reflection**Project background:**

Negative impacts on Indigenous ways of living brought on by climate-related issues are heightened because of their interconnectedness to the environment. For example, they find difficulty hunting and foraging on traditional lands that are rapidly disappearing and facing political, social, and ideological marginalization.

Indigenous insight and knowledge are crucial in understanding how place-based information can inform ways to connect with local cultures and move forward with climate mitigation and adaptation strategies that work for them. This project seeks to inform and create a stewardship program curriculum that uses a co-creation framework to make headway in the fight against climate change. I saw a lot of opportunities within the Native American Tribes Uplifting and Restoring Ecosystems (NATURE) Program for the students to reflect and offer guidance on changes that could be made in the program at the Canyonlands Research Center (CRC). It is beneficial to offer a space where students can give feedback on activities, topics, and teaching styles so that the program can adapt each year—serving almost as a guide for future programs. This is what makes this partnership so perfect; it is a space where we can amplify the connection between western science and Indigenous knowledge.

Results

The first set of questions we asked centered around community. I learned a lot about the core values of the participants and their communities in general and in an environmental capacity. Many of the participant's livelihoods were rooted in agriculture, whether farming or ranching and are seeking ways to better some of the practices used in their community. There seems to be a strong support system in these communities as well; the majority of participants mentioned this at some point in the talking circle. This can take the form of trash clean-ups, growing food for their neighbors, taking care of elders, or helping with home improvement projects— in some words; one family. Additionally, I am told that some of the youth in the community see engaging in traditional gatherings and participating in environmental conservation as chores. This could potentially be a barrier to building climate resilience in their communities. We did not get to a section of the questions (centering around climate change) in our first talking circle so I will not be able to report on those in this document, however, I did send out a google form for the students to fill out and can discuss those during my next visit.

A few participants mentioned that housing can be an issue in their communities. Some housing doesn't have running water or electricity and runs on generators. Other participants mentioned a very long housing waiting list while there are boarded-up houses in their neighborhood. Some of the hardships are basic human needs such as access to clean water, adequate food supply, and livable space. I believe the students will be able to take some of the skills they learned in the program back to their communities and continue to exercise them in leading others towards higher well-being in the face of climate change.

“It takes a village to raise a child.”

“Take care of the land and it will take care of you.”

“Nature is ‘kin.’”

“There is only up and forward.”

In our questions relating to education and learning styles, the participants expressed that their community shares knowledge through gatherings, sometimes including Chapter meetings, but these gatherings may not be happening as much as they have in the past—COVID-19 was very hard on the students and their communities. Additionally, these gatherings may need to start to cover a wider spectrum of topics to encourage others to actively participate in planning for the future, together. Storytelling was a common response in how they receive and share knowledge and this can come with a sense of responsibility to keep these stories in the family as well. These teachings offer direction in maintaining resources themselves and access to them, along with helping others in a time of hardship. Many participants have expressed a liking for the more hands-on approaches because they are more applied, and it can be easier to implement once back in their communities.

During the talking circle, the participants had some great ideas on how they can center and integrate place-based knowledge in education in a meaningful way. This could be offering information to members that are weary of change by showing them that these changes could be beneficial for them and their neighbors (i.e. responsible ranching or sustainable farming). Being able to show cultural beliefs in being caretakers of the land,

could mean that they may need to embrace change in order to adapt or limit the impact of the changing climate on their community.

Indigenous groups have historically been stewards of the land and with their place-based knowledge and applying it to western practices, there could be a real opportunity to encourage a positive shift in many aspects of the community's day-to-day lives. Indigenous voices need to be elevated in climate change programming, not only to empower the students but to, ideally, open new doors and connect to new resources. In a lot of ways, I think that the NATURE program does that. There is a recognized potential for students from previous years to return in a staff position as a teacher or coordinator in future years—creating another opportunity for knowledge sharing, supporting new students, and continuing to learn from each other.

Second NATURE Talking Circle Reflection

During my visit to Blanding, we were able to hold our second talking circle in the hogan at the USU Blanding campus. The questions encouraged the NATURE students to reflect on the program including what worked and what could be improved upon, topics of interest, a balance between traditional and Western knowledge, and a balance in lectures and hands-on opportunities. Towards the end of the circle, I was able to learn more about their capstone projects and their experience working through that process.



Walking into the hogan, there were mats to sit on and Dani told me that in the hogan you only walk clockwise, when asked why that is, she stated that “We only move forward, not backward.” That really resonated with me, it shows the steadfast persistence and strength within Indigenous communities. This is a great lesson for anyone trying to help push their community forward when facing an obstacle, including climate change adaptation and mitigation.

Involvement in the program came from word of mouth from previous program students and flyers (Appendix B) in common areas like Chapter houses and on school campuses. As for how they plan to use what they learned going forward, they want to use it to network and meet other professionals in the field that are involved in the program—including presenters. I am confident that the students will effectively teach others in their

community and utilize their skillset; both from their cultural backgrounds and from new tools learned in the program in the future.

Some of the topics that the students found interesting are watersheds and river systems, issues connected to wild horses, and like when the topics are relevant to each other. The topics the students chose for their capstone projects are all so different, it was cool to see what each student gravitated toward. The capstones involve topics including medicinal plants, soil samples, endangered species, rangeland practices, and outreach. When talking about their topics, it is clear that they have put a lot of time into them and were connected to their topic in some way. They all indicated that Alix was a fantastic resource for direction on their research as well!

Topics that were not covered in the program, but students think would be interesting would-be land disturbances like fire, wind, and rain; implementing law and policy, and having speakers from Indigenous-led organizational groups. Regarding the format of the program, the students found it easy to navigate and there is a good balance between lectures and hands-on opportunities.

Lastly, we covered a couple of climate questions that we were not able to get to in the first talking circle. Answers included that though they come together in hard times, they need the money and infrastructure to be able to effectively implement climate projects. Some issues that they are currently facing are lack of documentation due to colonization, elders do not notice climate change, inadequate soil, and getting back to knowledge sharing within

the community. There are all very real concerns that make it difficult to improve the wellbeing of the people.

It was exciting to see that the program did not have any major issues from what I was told and the relationships that have formed through this process as well. I can see a camaraderie between the students and supportive staff, showing that participation and co-creation can offer a supportive space for knowledge sharing in climate change programming. It was an honor to be able to learn from and listen to the students and staff of the NATURE program, their time is greatly appreciated!

Red Canyon Powwow Community Talking Circle Takeaways



My visit to Moab for the Red Canyon Powwow is something I will never forget. I got to experience the beauty of different Tribal cultures as an outsider and could not be more grateful for being welcomed into this space. During the talking circle that took place on the second day of the Powwow, I gained a better understanding that climate issues have been placed on these communities due to the constant growth and destruction caused by colonialism and capitalism. In fact, a main player in putting together the Powwow joined our circle for a short time to share some thoughts, starting with having the group repeat the phrase **“Colonization and colonialism causes climate change.”** This was followed by a passionate speech on the problematic drivers of colonialism being capitalism and making a profit, likely from the theft of Native lands. Having done other interviews and talking circles, I have waited for the topic of settler colonialism to come up but it only had one other time. I am not sure if it is because it can be a sensitive topic and participants didn't want to make outsiders uncomfortable but I think it is necessary and valid! I am glad we were able to discuss it more in depth as it is a vital component to understanding the harm that has been done to Indigenous communities. This includes taking knowledge (data extraction) which we tried to be transparent about by acknowledging that fact but our intentions are to produce something meaningful and give full and free access to it. We understand that this practice of taking knowledge is not usually done ethically– we hope to help change that.

Members in the circle also expressed their concern for degradation of their land from toxins being disposed of, drilled, or left. Through observation and intuition, members have noticed changes over time– For example, the discussions on the mining of Uranium

on native land and the implications that brings on water and soil quality used by Indigenous peoples. There was consensus between participants that if STEM was going to be utilized to support the Native community it should be to test the water and landscapes to make sure the soil and waters are safe. Gas stations have also been abandoned and the refuse left on their property to deal with. Something to keep in mind is that Native people originally discovered the Uranium but took a different approach of leaving it with respect. Just like for generations, according to members, it has been believed that you should only take what you need from the land, never more. Additionally, there was an emphasis on how everything Native's have is sacred. So when significant spaces for native people are defaced or shot at, it is devastating and could be seen as blatant disrespect for Indigenous cultures.

Group consensus was that the foundation of Native Community is not literally orientated and community can be through ceremony. It is about support, tradition, language, way of life, and that connection is part of self-identity. Because of this more holistic view of community, they are not attached to materialism like Western cultures tend to be. When the government gives them money, it is "a slap in the face." They need resources for mental health, for their political votes to not be suppressed, and ways of preservation of medicine. An important point that was made by a participant was that environmental movements are led by White-centric nonprofit organizations 99% of the time. These are the same organizations that control the money, the narrative, supposedly leading the change, and have racist solutions based in capitalism and White supremacy.

There is a need for flipping the script and putting our future into the right hands. With that, an extraordinary statement was made:

“Indigenous people are going to save the world.”

Organizational Talking Circle Takeaways

This talking circle took place over Zoom with members of Women of Bears Ears and Rural Utah Project—where we held a meaningful conversation that both solidified previous participant responses and opened me up to issues I was not



aware of— including some of topics such as education and policy.

The conversation first focused on community dynamics, current strengths, and barriers in pathways forward. A holistic solution offered was the centering of personable public service, for the gain of others/or the collective (ex. helping elders through a food pantry). However, barriers can still arise, as some members might not have the means to access these public services, or can interpret these as acts of charity and rejects the resources even when in need.

Another barrier highlighted was the challenges of communicating with elders and youth on the reservation, given the lack of technological infrastructure and access (ex. Limited cell

phone service and wifi). Thus, it is recommended practice to physically go to the more rural Native communities on the reservation, and engage with individuals who are widely known, who can be a point of introduction. These are access points key members of the Rural Utah Project (RUP) have utilized, serving as a trusted organization for Native communities to bring their concerns to, as well as to help bridge the communication and services gaps.

A topic that was stressed throughout this talking circle was education and the important role it has in both building relationships through collaboration, and how integrating Indigenous cultures and practices into westernized ways of thinking can help Tribal youth. One participant mentioned that education is crucial and it is necessary to assess where and what the needs are throughout the various Native communities– then identify what resources are available now and what can be tapped into later on. Meaningful education about Indigenous communities for non-natives could be beneficial as well. We had a powerful conversation about what the participants wished outsiders knew and also the need for respect from outsiders to not question their traditional ways. Ceremonies are so interconnected to their spiritual, physical, and emotional selves, as well as their language– “We shouldn’t have to expose everything about who we are, our language is our shield and for our enemies to know our language leaves us vulnerable. How much more do we have to give up for you to understand who we are?” These statements bring up the issue of respecting Native Nations & Tribes privacy as well as the importance of valuing and preserving cultural identity.

Tribal community's cultures have been taken advantage of for centuries and they are being exploited through non-natives, governmental systems, and environmental injustices. Participants mentioned that members are treated like they are less than human and that non-Indigenous people impede on to the reservation and do whatever they want—"there is an entitlement and audacity that is so hard to fight against." For example, outsiders driving and camping in the Navajo Nation could be seen as another form of invasion happening now. "Don't come on to native land unless you're invited. We are trying to limit the invasion." Another example is how individuals are claiming to be Indigenous in order to take advantage of the few resources that are offered to members of a tribe. This is blatant appropriation and an act of disrespect.

Government entities are a challenging topic to cover because of the great injustices that have been brought on Indigenous peoples over time. This quote from this conversation shows this well, "My first reaction is fear, what is going to happen. It is never a good thing, as these systems have oppressed us. We have a complex political identity as native people. I don't consider the government my friend. When the government comes in it's their right, and there is an invasion of privacy and natural ownership. You have been taught to think you only own so much dirt- and beyond that is the government." We discussed what should be done and at what level and it seems that the overall consensus is that anyone within the governmental system and at the Utah state level needs to be doing more. Native Nations go against the individuals who only look at things for profit- an example given was how John Curtis said he was going to support native people but helped support coal initiatives instead within the Navajo Nation. This shows the validity of the point that when money is

involved so many people will say they're on the communities' sides, but then pocket the money. "It is hard to see the manipulators before it's too late."

Environmental justice is crucial in building community trust. Tribal land is often exploited for monetary gain from outside entities. For example, on Hopi land, the water is poisonous, because it has lead in it. It was said that a lot of individuals still use it to cook, and are getting sick because they can't afford to drive long distances to get clean water. Even the Navajo Tribal Authority over-chlorinates the water yet claims they have their best interest at heart by providing "clean" water that is over-chlorinated tap water. A participant claims, "It makes you weary of everybody. So we continually ask ourselves who we trust, who we let in, what is this going to cost us, and what this means for us in the long run. We have so many who parachute into our communities, and leave us with nothing." Native people should be treated as people and they expect to be but that is not how current systems of power work and that is why they need to change.

Land in Native communities and on reservations has also been overgrazed, and climate change has impacted the natural ecosystems of the area. Thus, many Native families have sold a lot of their livestock and feral/wild horses. Hopi grow corn in dry deserts, where water is also an issue. There is a desire to learn traditional growing methods but climate change is affecting those— including various Indigenous and traditional plants connected with food sovereignty like sumac and wild rice. Indigenous peoples use that for their food and grow Navajo tea in their backyards, which becomes an important source of Indigenous

food within families. There is also a lack of bees and pollination, which is impacting natural growth in both the city and rural areas.

Additionally, there is a limited economic base on the reservation other than trade and barter, and potentially resource extraction. This poses financial challenges and requires turning to different organizations that can provide monetary resources. Some examples are Dig Deep dig wells on the reservation, solar installment non-profits, and, of course, RUP. However, these entities often don't have any understanding on the board level of Indigenous needs and services so Native communities begin to ask what are you here for? Are you self-promoting? There is a lack of trust, even though the need is there they rather reject it instead due to fear of being taken advantage of. Engagement with Native people should be about uplifting their voices, and not taking advantage as an outsider by reconstructing their narrative for their own agendas.

A few powerful quotes for contemplation:

“Since time immemorial, we have been adapting to progress. We have been told how to live our lives, and once we adapt and how we can thrive they throw something else at us. We are constantly adapting, educating, and fighting to break the barriers. The federal government should have been the first to say, quit attacking Indigenous people, their lands, and their culture. But if you aren't white you aren't important.”

“I didn't want to be resilient but I had to be.”

APPENDIX D

NATURE PROGRAM RECOMMENDATIONS, SHARED WITH NATURE STAFF

In an effort to enhance the purpose, Indigeneity, and co-creation of the Native American Tribes Upholding Restoration and Ecosystems (NATURE) program, Bayli Hanson, Roslynn McCann, and Sara Hinck of Utah State University collected participant feedback from the 2022 program year. The following recommendations include a combination of Talking circle feedback, one-on-one interviews with NATURE staff, literature, and interaction with the NATURE program. Unless otherwise noted, all quotes are from NATURE participants.

1. Projects should be place-based and community-centric addressing and speaking to climate needs and adaptations within specific tribal nations and communities.

- Stewardship should also be introduced in the NATURE program– this enhances the likelihood that the program content can be applied and benefit their communities.

Broader engagement and participation in STEM programs will help Indigenous communities in southeastern Utah develop the tools for exploring and communicating environmental changes and opportunities. Although they are on the front lines of the climate change crisis, Indigenous communities have experienced extreme levels of marginalization in STEM, which can provide supportive tools and technologies to assist them in their development of climate change solutions. Pedagogies aligned with Indigenous perspectives on teaching and learning that are place- and community-based,

interdisciplinary, involve the oral stories of elders and community members and reinforce the interconnections between humans and their ecosystems can improve Indigenous interests and attitudes toward informal STEM climate education.

“Showing the next generation what they can do with career fairs. I think it's hard to get people to actually stay. When we think about growing up on the reservation, we think about how many kids just want to leave. I think they might be interested, or they do find a passion for STEM, but getting them to come back to their communities and help out– I feel like that's always been a problem. I know sometimes they do but we need to be giving them a reason to stay.”

“I think my concerns would definitely be about getting the next generation to be involved in any way. Because when I look back on my whole childhood, I've always kind of just seen me and my brothers as the next generation. We don't really see any other, you know, children that want to be part of it– they don't see the importance behind farming and ranching the way that I feel like they should be seeing. And, culturally speaking, I feel like it's the same way too. I think another concern would be leaders, leaders of our community, because it always falls back to the next generation, no matter how you view it. Because when you lead for something, it's not just for you, it's for children, it's for grandchildren that aren't there yet. And I think it's hard to find good people to do good things, there's always going to be problems, no matter what community you're in. And I guess just finding good people to work through those problems is definitely going to be a challenge.”

“The hands-on approach you'll face being outside and connecting how we do science and actually doing it like doing methods and plant cover, collecting soils and looking at you know, hand texturing soils, looking at mosses like biological soil crusts, mosses and like, how they what they do, and they went up, I think all of those hands-on experiences are really important because this is really more a lab-based lab field course than a lecture-based course.

- Individual interview

“At my last job, we did a lot of extension work. In my own community, we worked with producers, for their own farming and ranching, but we also reached out to other types of communities. So it's kind of just helping them learn new sustainable agricultural practices when it comes to I guess, like anything farming and ranching and just helping them be in contact with the land and learning new ways of maintaining.”

2. Further diversify guest speakers, with at least half belonging to a Tribal Nation

- Younger generations have expressed being less connected to their culture. Hence, it is crucial that they are able to see opportunities combining their cultural background and the Western skills the program aims to teach. This encourages intersectionality within many fields.

Indigenous communities are finding difficulty hunting and foraging on ancestral lands that are being lost rapidly, along with language and traditions (Cozzetto, Marks-Marino, & STACCWG, 2021, Pg. 7). This can make it difficult to pass on their traditional knowledge to younger generations within the community which could potentially threaten their

cultural identity. Indigenous groups have also endured a history of involuntary assimilation, and intergenerational trauma (Cozzetto, Marks-Marino, & STACCWG, 2021, Pg. 7). Not to mention, Indigenous groups have historically advocated for sustainable resource management practices but don't get the recognition that is deserved (Kreyes, et al., 2021). Skill, Stafford, & McCann (2019) discuss that "leaders must model conflict management and create an environment where conflict can emerge and be handled productively. Relationships build a sense of community, connection, hope, and celebration."

"Soul and soil are not separate. Neither are wind and spirit, nor water and tears. We are eroding and evolving at once, like the red rock landscape before me. Our grief is our love. Our love will be our undoing as we quietly disengage from the collective madness of the patriarchal mind that says aggression is the way forward."

- Terry Tempest Williams in *All We Can Save* by

Ayana Johnson and Katharine Wilkinson

"I would have to say that also, our elders don't know anything about "climate change" because they don't know that there are many things around them that are evolving. When I had to ask my great-grandma, what she thought about climate change, we had to reword it in a different way— she had so much to say, but I had so little time to listen to her during the interview that I had with her, and that makes me just think of how much we should have been listening to them."

“There is also a lack of documentation, you know, normally we would just ask our elders, ‘How do we take care of this?’ ‘How do we restore this?’ A lot of us don't really speak our native languages.”

3. Centralize capstone projects around a theme such as climate resilience and include a climate resilience module in the course.

- The scientific community agrees that climate change is one of the most pressing issues of our time, posing major threats to humanity and the ecosystems upon which we depend and are a part of, and Indigenous communities are on the frontlines of climate change impacts.

Underrepresented communities, including Indigenous groups, experience climate change at a more extreme rate due to where they live, despite their knowledge and connection to the land. Due to this interconnection, there have been negative impacts on cultural identities in correlation with environmental degradation. For example, Indigenous communities that continue to hunt and forage on traditional lands are now being met with difficulty and limited resources; including changes in the land itself (Kreyes, et al., 2021).

“Basically viewing the environment, as kin, or as your family. So that means, having the best outcome for your family in ways that you respect, cherish, and take care of it, as everybody else said. It's something that's a part of you and you're a part of it. So it's best not to damage it too much. Or to take what you need and leave the rest as it is.”

“So I think after all these rain storms, I think one thing my community will focus on is land restoration. Just last week our roads got taken out—they're gone.”

“They tried building a garden, but they figured out that the soil within our community is not reasonable because there's so much clay inside of it. So they had to figure out a way to get those gardens healthier within the houses that were studying those gardens. And I think the biggest impact of that is like using sand instead of soil.”

“I would have to say some beliefs that are common within my community are that within the environment and the nature around us, the plants and the herbs will take care of you, if you know, try to help them and keep them in abundance. And that also ties in with our health and well-being of ourselves because I would have to say, the herbs and even the other different plants around us within my community have helped us a lot because there were times when a lot of our people could not go to the hospitals because they were scared and also not being able to get the health care that we need because we have to drive 30 minutes away to the nearest hospital. And within my community, there are no grocery stores or trading posts, or gas stations. So it's a drive, I would have to say. And I just have to say that our community has taken care of these beliefs for a very long time because we still have some of these herbs that were way back then today.”

Additional recommendation based on our interaction with the program:**4. Document and share processes and impacts to both improve visibility and the program moving forward.**

- Most students learned about the program through flyers or educators that were aware of the program.
- Sharing how a bottom-up method has been successful in this program may encourage other programs to adopt a similar approach.

Indigenous communities are underrepresented in STEM careers— showing the need for co-created education design around STEM. Previous studies have found that more engagement between scientists and stakeholders tends to produce more usable science because engagement fosters trust in both the science and the academics performing the research (Meadow, et al., 2015). When working together with Tribal Nations, “it is important that they can support their priorities in ways that honor their sovereignty and rights to self-determination. Tribally led climate planning that is informed by locally relevant data allows Tribes to better prepare for uncertainty imposed by climate factors and their associated risks” (Cozzetto, Marks-Marino, & STACCWG, 2021, Pg. 52). The crucial next step is to clarify our understanding of what specific actions and approaches most effectively produce the trusting, long-term relationships necessary to the coproduction of usable science (Meadow, et al., 2015, pg. 189). Skill, Stafford, & McCann (2019), found that “facilitating and building relationships among [community] members foster problem-solving and improves the quality of life within the community. Also, we are lacking in a

standard set of indicators for the responsible inclusion of Indigenous knowledge and people in environmental sciences, as well as an understanding of the extent to which research projects follow ethical research practices (David-Chavez & Gavin, 2018, pg. 3).

“And so we look at climate change and restoration, and through kind of land coming from a perspective of the land. So I think that these deep connections to the land are also regional.”

- Individual interview

“What I did was cultivate relationships with students that expressed interest early on. So what I realized over the two years is that for any student that expressed interest, I not only got back to them, but I said ‘we would really welcome your application.’ If that application didn’t come, I wrote back again and said, ‘Do you have any questions, we would be really interested in your application,’ because I just think that there’s just more barriers for Indigenous students to go through this, you know, writing a personal statement, and providing a resume. So alleviating any concerns or anxiety around that. I was on email quite a bit with students talking to them— making sure that they understood what the experience would be like, it was a very different recruiting process.”

- Individual interview

“Environmental education programs, or practices held by also school organizations or neighboring nonprofit organizations. These are really helpful because they’re really helpful in maintaining you know the importance of the environment. This could be done

with practices like building family gardens, or greenhouses, and sustainability in general. I also know that our chapter house where works to restore watersheds from flash floods that really affect our waterways, especially from eroding A lot of the dirt roads. So there's a lot of contention on that.”

APPENDIX E

NATURE CO-CREATION CLIMATE MODULE: A MENU

Purpose Statement:

This climate change module provides an opportunity to learn about and engage in building climate resiliency through collaboration, adaptation, and mitigation. By collaboratively drawing from Westernized science and Traditional Ecological Knowledge, including both innovative and inclusive practices from Indigenous cultures, students from the NATURE Program cohort can develop sustainable and resilient ways to face present-day challenges brought on by climate change in their communities. The module was co-created by Amber Archie, Nichole Butler, Bayli Hanson, Sara Hinck, Roslynn McCann, & Danielle Smiley (a combination of past participants in the Nature Conservancy's Native American Tribes Upholding Restoration and Education program and Utah State University Extension)

Overarching goal:

The goal of this Moab, Utah-based climate change module is to empower action and promote community-centric collaboration towards building inclusive climate resiliency through a combination of adaptation, mitigation, Traditional Ecological Knowledge and practices. The aim is to encourage cross-cultural practices and bridge the gap between people and nature, so we can nurture a natural world in which we can equitably and interconnectedly thrive.

Week-long Structure

Day 1: Climate Change and the Colorado Plateau

Day one will lay the foundation of climate change science and projections in the region and preview terms and themes of what will be covered throughout the week.

Themes:

Adaptation & Mitigation

- I. *Topic Description:* This section can focus on building resilience through both adaptation and mitigation strategies. Specifically, this section can explore the role of resource and land management in climate change resilience, highlighting the contrast and collaboration between Western Science and Intertribal Traditional Ecological Knowledge. Students can learn to identify the signs of climate change impacts on ecosystems, and to develop strategies for mitigating those impacts through effective invasive species management. This can include an examination of tamarisk control and the benefits of using native and drought-tolerant species. The end of this section, students can have a deeper understanding of the complex relationship between human activity and the environment, and the importance of sustainable land management practices in promoting climate change resilience.
- II. *Film Options:*
 - A. “[Gather](#)” - documentary film about the growing movement amongst Native Americans to reclaim their spiritual, political, and cultural identities through food sovereignty, while battling the trauma of centuries of genocide.

III. *Potential Speakers:*

A. Darren Parry- Contact: dparry@arrowpoint.us

1. Bio: Former chairman of the Northwestern Band of the Shoshone Nation, Focus ‘An Indigenous Perspective on climate and environment.’ Can mention Ros McCann in communications - he knows Ros
2. Status of Communication: Not initiated.

B. Rob Davies, USU Climate Scientist, robert.davies@usu.edu

1. Bio: His work for more than a decade has been in critical science communication, principally focused on global environmental change and sustainable human systems. Knows Ros very well - feel free to mention her.
2. Status of Communication: Not initiated

C. Nikki Cooley, Co-Director of ITEP at NAU, Nikki.Cooley@nau.edu

1. Bio: She is of the Diné Nation, and the Co-Director of the Institute for Tribal Environmental Professionals ITEP’s Tribal Climate Change Program at Northern Arizona University. She is also the co-founder of the Native American River Guide Training Program. She is the sister of Colleen Cooley.
2. Science Moab Podcast: [Climate Change Resilience within Tribal Communities](#).
3. Status of Communication: Amber reached out to NAU email and did not receive a response.

D. Ann Marie Chischilly, Executive Director of ITEP at NAU, Ann-Marie.Chischilly@nau.edu

1. [Bio](#): As ED, she is responsible for managing ITEP's work with NAU, state and federal agencies, tribes and Alaska Native Villages. She serves on several federal advisory committees.
2. Science Moab Podcast: [Traditional Knowledge & Climate Change](#)
3. Status of Communication: Wants more information about the NATURE program. [Alix](#) next to reach out.

IV. *Potential Climate Change Science Activities:*

1. UC Climate Curriculum

- a. In this exercise, we would like you to explore the [Yale Climate Opinion Maps](#) focusing on the counties in which you have lived.
 - i. Questions for Reflections
 1. What strikes you about the information for your county?
 2. Does it resonate with what you know of your area?
 3. Is it reflective of the communities you belong to, or is it more reflective of a different aspect of your local
 4. communities?
 5. What does this data tell you about the people around you?
 6. How might you use this information to inform how you connect with the communities around you?

- b. Deeper Dive! - [Everything you need to know about climate tipping points](#) (Links to an external site.)
 - i. This blog, co-authored by Climate 411 and Environmental Defense Fund, gives an in-depth but accessible overview of several climate tipping points that climate scientists are tracking.
2. [Project Drawdown Climate Solutions 101](#) - any of the videos in this series.
Each video is 10-20 minutes long
3. Potential Resources:
 - a. [2018 Climate Adaptation Plan for the Navajo Nation](#).
 - b. 2021 [ITEP Report - The Status of Tribes and Climate Change Report](#)
 - i. “The Twenty-Nine Palms Band of Mission Indians (Tribe) recognizes the scientific consensus that the Earth’s climate is changing due to anthropogenic activities on the planet.”

Cattle & Ranch/Land Management

- I. *Topic Description:* This module can focus on cattle and ranch land management and its environmental impacts. It can cover key topics such as cattle grazing and rotation practices, climate change studies in Indian Creek, drought experiments on dry cow grazing, simulated grazing, and the differences between Indigenous and western ideologies and practices. Additionally, the module can explore the comparison of cattle versus bison and the work being done in [South Dakota](#) to

manage grazing practices and their impact on the environment. By examining these topics, the module can aim to provide a comprehensive understanding of how cattle grazing practices and ranch land management can affect the environment and how it is trying to evolve toward more environmentally friendly practices in the face of climate change.

II. *Potential Speakers:*

A. Dr. Mike Duniway, Research Ecologist & Soil Scientist with USGS,
mduniway@usgs.gov

1. [Bio](#): He is a soil scientist focused on soils and soil processes in dryland ecosystems and the interactions between environmental and land-use drivers, vegetation, soils, and geomorphology.
2. *Phenology trial and cattle impact trials could be incorporated into another week where everyone is down at Dugout.
3. Status of Communication: Interested in participating, tentatively available July 10-14th - July 12 ideal date to propose when reaching out.

III. *Immersive Activity*: Opportunity to do Immersive Activity. This option is below in Days 2-3.

IV. *Potential Assigned Podcast*: [Science Moab - Wild Horses of the West](#). Knowing there was interest previously with range and land management, this may be a good talk to work into that week.

Food Sovereignty (Moab or Hopi Permaculture Week)

- I. *Topic Description:* This module can focus on the topic of food sovereignty, which is the right of communities to control their own food systems. It can explore the concept of community gardens as a way to achieve food sovereignty, particularly in areas considered food deserts, where access to healthy, affordable food is limited. This module section can highlight the importance of growing a blend of both culturally significant plants for Indigenous people and adaptive plants that can thrive in climate changing environments. It can also emphasize the benefits of growing and cooking traditional foods as a means of promoting cultural preservation and community resilience. Finally, the module can also acknowledge the challenges associated with growing food, including the use of water, highlighting adaptive plants such as bee balm and currents to reduce water consumption.
- II. *Potential Partners:*
 - A. Youth Garden Project & Full Circle Intertribal Center: Current programs offered, Nourishing Traditions Dinner - Cooking Traditional Foods and Food Is Life Program.
- III. *Film Options:*
 - A. [“Gather”](#) - documentary film about the growing movement amongst Native Americans to reclaim their spiritual, political, and cultural identities through food sovereignty, while battling the trauma of centuries of genocide. (On Netflix)

- B. “[Inhabitants](#)“ - (Focus Desert Dry Farming) Documentary film that follows five Native American Tribes across deserts, coastlines, forests, and prairies as they restore their traditional land management.
- C. “[As both a farmer and a climate scientist: The changes will be dramatic](#)” - This short three minute Youtube video from More than Scientists features Jennifer Phillips, an assistant professor for Bard Center for Environmental Policy. She talks about permanent pasture and how farmers are great at managing climate risk.

IV. *Potential Speakers:*

- A. Reagan Wytsalucy, Extension Assistant Professor - Agriculture & Natural Resources with USU, reagan.wytsalucy@usu.edu
 - 1. [Bio](#): She is a member of the Navajo Nation and she specializes in horticulture (community gardens) and agronomy. Her research interests are native food crops (peach and Navajo spinach), and pinyon pine production.
 - 2. Science Moab Podcast: [Traditional Crops on the Colorado Plateau](#)
 - 3. Status of Communication: Alix can reach out if interested, feel free to mention Ros (know each other well through work/kids)

Water (Conservation, Mitigation, Rights, & Activism)

- I. *Topic Description*: This section can cover a range of important topics related to water, including water conservation, mitigation, rights, and activism. One key area can be on water quality testing, exploring how to assess the safety and suitability

of water sources for consumption and other uses. Additionally, this module section can explore the collection of rainwater, providing guidance on how to use and filter it safely, as well as effectively. Another opportunity is to highlight the vital role of Indigenous communities in protecting water resources, examining their deep connection to water and the crucial work of Indigenous water guides and water protectors. Ultimately, this module can provide valuable insights and tools for the students seeking to understand and address the urgent challenges posed by climate change and water scarcity.

II. *Film Options:*

- A. [Water Flows Together](#): Elevates the importance of acknowledging Indigenous lands in outdoor recreation through the voice of Colleen Cooley, one of the few female Navajo river guides on the San Juan River.
- B. [River of Return](#): Follows River Newe founders and Shoshone-Bannock tribe members Jessica and Sammy Matsaw down the Middle Fork on the Salmon River in Idaho.
- C. [Awake, A Dream from Standing Rock](#): The Water Protects at Standing Rock captured world attention through the peaceful resistance. AWAKE captures the story of Native-led defiance that forever changed the fight for clean water.

III. *Potential Speakers:*

- A. Dr. Crystal Tulley-Cordova, Principal Hydrologist for the Navajo Nation Department of Water Resources - Water Management Branch, Email: tulley-cordova@navajo-nsn.gov

1. Bio: As a Principal Hydrologist, she works on watershed characterization, technical support for water rights, and helps develop sustainable water projects across Arizona, New Mexico, and Utah.
 2. Science Moab Podcast: [Water Sustainability on the Navajo Nation](#)
 3. Status of Communication: Interested in speaking, preferably the 14th of July. She also mentioned that she would like travel funds and does have a speaker fee.
- B. Colleen Cooley, Facilitator & Raft Guide, Email: info@colleencooley.com
- We have been contacting her through Brandi Atene.
1. [Bio](#): She is an advocate and raft guide on the San Juan River and Green River, a facilitator, researcher, educator, and amateur photographer.
 2. Science Moab Podcast: [Born Into These Lands & Waters](#)
 3. Status of Communication: Communicating through Brandi Atene. She is interested in learning more about the NATURE Program, Sara Hinck has set up contact with Alix, Dani, & Ros.
 4. Ideal to participate on river float.
- C. Brandi Atene, Program Manager with Canyonlands Field Institute, brandi.atene@cfimoab.org
1. [Bio](#): She is Diné, of the Bitterwater clan born from the Towering House clan. She is a land & river guide for CFI, as well as the supervisor of Native Teen Guide-In-Training camp.

2. Status of Communication: She is interested in learning more about the NATURE Program, primary contact for connection to Colleen Cooley and Avery Old Coyote. Sara Hinck has set up contact with Alix, Dani, & Ros.
 3. Ideal to participate on river float.
- D. Avery Old Coyote, Guest River Guide with Canyonlands Field Institute,
- Email-** We have been contacting him through Brandi Atene.
1. [Bio](#): He belongs to the Apsaalooke People of the Crow Nation as well as the Qlipse People of the Flathead Nation. Game Developer of Cards for Decolonization.
 2. Status of Communication: Communicating through Brandi Atene. He is interested in learning more about the NATURE Program. Sara Hinck has set up contact with Alix, Dani, & Ros.
 3. Ideal to participate on river float.

Days 2-3 Climate change adaptation and mitigation research in and around Moab

Day 2

Immersive Field Activity Options:

Daily River Trip

- I. *Activity Description*: Take a daily Colorado river trip with Canyonlands Field Institute, led by Native guides and outdoor educators. (Tentative planning in process).

- I. Potential Guides: Brandi Atene & Colleen Cooley
- II. July 11 for daily float with CFI.

Day 3

Fire Mitigation & Management (Western vs. Indigenous Cultural Burning Practices)

- I. *Topic Description:* This module can focus on fire mitigation and management, with an emphasis on the importance of diverse practices, including both Western and Indigenous Cultural Burning Practices. Students can explore the relationships between forestry, fire, and regeneration. To provide an immersive place-based example, the students can visit the La Sal Mountains to see the impact of wildfires and the importance of effective fire management strategies, as well as local regeneration efforts. This module can highlight the need for a holistic and inclusive approach to fire mitigation and management, one that incorporates both traditional and scientific knowledge.
- II. *Film Option:*
 - A. “[Inhabitants](#)” - (Indigenous Cultural Burning Practices) Documentary film that follows five Native American Tribes across deserts, coastlines, forests, and prairies as they restore their traditional land management.
- III. *Location Options:*
 - A. La Sal Mountains, visit wildfire sites and camp at Warner Lake or Gold Basin.
- IV. *Potential Speakers:*

A. Kara Dohrenwend, Director of Rim to Rim Restoration, Email: kara@reveg.org

1. Bio: She started Wildland Scapes, as a desert and riparian restoration company working to remove invasive plants and facilitate native plant

B. Alvin Whitehair, Superintendent of the Zuni Agency, whitehair@bia.gov , Office phone 505-782-7279

1. Bio: He was the first Navajo to be appointed as a district ranger in the Forest Service.
2. Status of Communication: Can potentially participate in-person in the field. Would like to do the same day at Kelly Martin. (ideally July 12)

C. Kelly Martin, Retired as Chief of Fire and Aviation for Yosemite National Park, kmartin02@gmail.com , 208-315-7454

1. Bio: She also founded WTREX, the Women-In-Fire Prescribed Fire Training Exchange.
2. Status of Communication: She is willing and happy to participate via Zoom. (Ideally July 12)

D. Barb Smith, Wildlife Biologist, barbara.smith1@usda.gov , 435-210-4689

1. Bio: Working on a US Forest Service restoration project. USGS post-doc working with Kara Dohrenwend and Kirstina Young on seeding trials, mulching, post-fire experiments, Pinyon Juniper treatments and the burn (interesting patterns observed).

2. Status of communication: Not initiated

E. Brooke Osborne, Biogeochemist, ENVIS department at USU Moab, (brooke.osborne@usu.edu).

1. Status of communication: Ros talked with Brooke in person, she is interested in participating as a speaker/leading a fire activity this day - likely with Barb in the La Sals.

V. Alternate speaker/ Podcast resource

A. Jamie Yazzie, Scientific Analyst - Independent Consultant, jaimeyazzie@arizona.edu

a. Bio: With the Laboratory of Tree-Ring Research at the University of Arizona, she has been asking how traditional knowledge can inform management in Navajo Nation forests. Yazzie's work on Tribal forest emphasizes Diné concepts of kinships.

b. Science Moab Podcast: [Indigenous Knowledge in Forest Management](#)

c. Status of Communication: Not initiated

B. Potential Resources:

a. [The Significance Behind Investigating Indigenous Fire Regimes of the Colorado Plateau](#) document

i. Paragraph 2 of Page 6; "Apacheria"

ii. Section "Benefits of Indigenous Fire Regimes" Page 7

iii. Section "Fire in ARchaeological Contexts" Page 7

Cattle Grazing & Rotation Practices

- I. *Location:* Canyonlands Research Center
- II. *Potential Speaker:*
 - A. Mike Duniway
- III. *Activity Descriptions:*
 - Option 1: Drylands sagebrush field work at the CRC.
 - Option 2: Climate change study at Indian Creek. Simulated dry grazing for cows by drought experiment.
 - Option 3: Bi-weekly phenology experiment using cameras. Could do image analysis near superbowl campground.

Additional Options

- I. Climate Adaptation Plans: [National Tribal Climate Change & Health Adaptation Resources & Trainings Document](#), refer to ATNI Tribal Climate 2019 - Angie Hacker & Shasta Gaughen.
- II. Cards for Decolonization by Avery Old Coyote (Downtime Activity)

Day 4 Climate Resilience and Action in the Four Corners Region

- I. *Potential Speakers:*
 - A. Jacob Crane, Executive Director of SLC Air Protectors, jacobcrane2008@gmail.com
 1. **Bio:** ED of [Salt Lake City Air Protectors](#), a nonprofit organization dedicated to protecting the natural environment, improving air

quality, and supporting the rights and responsibilities of Indigenous People to be stewards of the land.

2. Status of Communication: Dani in contact, wants to know more about the NATURE Program, would like to attend in person.
3. Lives near Midvale and usually drives for this sort of thing. So mileage, hotel for one night, and a \$600 speaker fee is what I would charge for something like this.
4. Potential location: Mulberry grove space or Rotary park

B. Tara Benally, Field Organizer with Rural Utah Project, tara@ruralutah.org

1. Bio: With a long history of advocacy on the Navajo Nation, Tara is committed to issues of health care, education, and economic development.
2. Note: “The Rural Utah Project seeks to empower underrepresented voters in rural Utah through training, education, voter registration, and issue advocacy.”
3. Status of Communication: Not initiated

C. Nicole Horseherder, Executive Director of To Nizhoni Ani “Sacred Water Speaks”, Email: Jessica Keetso (TNA Sec.): jkeetso@yahoo.com, Organizations' email: info@tonizhoniani.org or tonizhoniani@gmail.com

1. Bio: Nicole is Diné, from the Black Mesa region of the Navajo Nation. She began her work interpreting hydrology and legal documents for Diné communities fighting coal-mine impacts. She is

leading efforts towards transition away from fossil fuel development in the Navajo Nation.

2. Status of Communication: Amber contacted Jessica. Unsure whether to contact Nicole through Jessica. Amber will follow up and let us know next steps.

II. Activities

- Permaculture/Ecological Design for climate resilience → Ros' house (walk from Rotary). Community garden tour
- *Film*: Documentary viewing: Powerlands (2022) - Camille Manybeads - <https://powerlands.org/>

Day 5 Career Panel - Networking Breakouts / Mentorship, & Gratitude - Hopeful Solutions, Grounding-Healing, Vision and Outlook

I. Activity Options:

A. Reflection Period:

1. Opportunity for Student Reflection through Journaling, art, small group discussions, and/or large group talking circle.

B. Career Panel:

1. Invite speakers back via Zoom for an additional Q & A and breakouts for students who are interested in networking with one of the specific speakers.

C. Mentorship Opportunity with Speakers:

1. We also recommend inviting all speakers from this module to the capstone project presentations. The hope is that the speakers can see what the students and program have accomplished, as well as provide support, mentorship, or connection for the student's professional next steps.

II. *Potential Speaker:*

A. Sara Heffron, Licensed clinical therapist and eco-chaplain, sarah@openspace-counseling.com

1. Bio: She has a nearing three decades of meditation practice and has taught mindfulness practices since 2000. In 2022, she completed a year long Buddhist Eco-Chaplaincy training to further her work in offering spiritual care in response to the suffering of the climate crisis, whether to those on the frontlines or to the vast majority who experience increasing anxiety or despair. Her passions include plants and regenerative gardening, immersing in nature, and fueling the great transformation from the current paradigm of social and ecological injustice to a paradigm that respects and nourishes all beings.
2. Potential Topic: Climate Change Hope
3. Status of communication: Very interested in engaging. Haven't inquired about her availability July 14.

Other Potential Speakers of Interest:

- I. [Dr. Sasha C. Reed](#) - Research Ecologist with USGS, focused on understanding how our planet's ecosystems work and what factors determine the services they provide. Climate change trials down river road regarding cryptobiotic soil and a warming climate.
- II. Michael Kotutwa Johnson, University of Arizona - Indigenous Resilience Specialist, kotutwa@arizona.edu; cell: 928-313-3936. Featured in the film *Inhabitants*. Ros met at climate summit in AQ, NM, he invited to visit his farm on the Hopi reservation.
- III. Cynthia Wilson - [Nutrition from a Cultural Standpoint](#), Traditional foods that address the environmental, cultural, nutritional and spiritual health of land and people.
- IV. Dawn Davis - Shoeshone-Bannock, [Protecting Culturally Significant Plants](#)