

Keepers of Turtle Island

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Abstract

Keepers of Turtle Island, a clan of Indigenous students, was an initiative to learn more about sustainable practices, revitalize Traditional Ecological Knowledge (TEK) with our Native American communities, and actively engage in stewardship of our environment. This NOAA Planet Stewards project was designed to address the damage caused to the environment in terms of the loss of biodiversity and the growing threat to ecosystems and cultural heritage. One of the main challenges that the project addressed was the decreasing number of pollinators due to various factors including the eradication of native plants such as milkweed. The project restored habitats for pollinators by growing native plants, which provide ecosystem services and opportunities for students to learn about them. The project also focused on reducing carbon emissions and sequestering carbon. By braiding Indigenous Science perspectives into environmental education, the project emphasized relations, responsibility, and stewardship towards the environment. The program engaged middle and high school students in calculating their carbon footprints, planting a native pollinator garden, and learning about the local ecosystem and climate through their Indigenous cultures. The project's partners collaborated with the students to design the garden space and donated native plant species. The project also involved cultural educational experiences to bridge learning about Indigenous culture and science and build participants' climate literacy. The Keepers of Turtle Island project provided culturally relevant and sustaining science learning experiences, built community, and limited the effects of climate change by integrating education, culture, and community approaches informed by Indigenous knowledge.

Monarch lands on student at Tribal Alliance of Pollinators Butterfly Sanctuary

Photo credit: Amelia Cook.

Introduction

Our relationship with Earth has deteriorated and much of the traditional ecological knowledge of our ancestors has been lost. Rekindling our community relationships through storytelling, listening, and learning through our Indigenous cultures could help increase the climate literacy and sustainability of our local community at large. Indigenous communities are particularly vulnerable to the impacts of climate change with close dependence on climate-sensitive resources for their livelihoods, cultures, and economies. The intimate

connection with the land and ancestral knowledge of Indigenous peoples accumulated over centuries is a strength. Native people's traditional methods of learning from the land, as well as their practice of passing down these traditions and knowledge through generations, have been recognized by the Intergovernmental Panel on Climate Change (IPCC, 2019) as critical for adaptation. The Panel's report acknowledges the importance of Indigenous knowledge in accelerating societal behavior changes that align with the goals of adapting to and mitigating global warming. Integrating education, information, and community approaches informed by Indigenous knowledge can be an effective means of facilitating widespread adaptation and limiting the effects of climate change.

Today, overuse of chemicals, landscaping, and environmental mismanagement have damaged our lands and deepened the disconnection with nature. This disconnection to the community, both human and non-human relations alike, contributes to the loss of biodiversity and inability to collaboratively solve our environmental challenges, threatening our ecosystem as well as our cultural heritage. It is our responsibility to heal our connection to the land by restoring the native plants that sustain life and rekindling our community relationships. Humans can alter the land to a degree that none before have, but this change does not have to be exploitative. Through community education we have an opportunity to hold ourselves accountable and make an alteration for the better. We must do what we can to foster a relationship of reciprocity with the land and educate youth.

Globally, pollinator populations are shrinking. Several overlapping factors contribute to this disturbing global trend, including habitat fragmentation, pesticide use, and climate change. Pollinators are vital to maintaining healthy ecosystems. Most flowering plants depend on bees, butterflies, and other animals for pollination. Pollinators evolved with native plants, which are best adapted to the local growing season, climate, and soils. Many pollinators depend on specific plant species (e.g., milkweed is critical for the survival of monarchs, without it they cannot complete their life cycle). Milkweed has been eradicated both in agricultural areas as well as urban and suburban landscapes and is one of the reasons monarchs are threatened. Growing native plants adds important habitats for pollinators and supports important ecosystem services.

The level of carbon dioxide in our atmosphere is 419 ppm (NASA, 2023), a level that has not been seen since the Pliocene Epoch. This is due to our ever-increasing emissions and the heat trapping properties of carbon dioxide combined with our vast reduction in carbon sinks from deforestation, monocropping, and the reduction in wetlands ecosystems around the globe. Humanity is committed to some level of climate change, how much the climate changes and how well our communities respond to these changes are up to us and the behaviors we choose. Despite increasing awareness of climate change, our emissions of greenhouse gasses continue to rise.

The Project

Our NOAA Planet Stewards project presented opportunities to explore innovative approaches that blend Indigenous science, community development, and education with Western Science to learn about the local environment. By integrating these different bodies of knowledge, we created new and imaginative community learning experiences that value multiple perspectives, collaboration, and promote sustainability. *Keepers of Turtle Island*, a clan of students, learned about sustainable practices and Traditional Ecological Knowledge (TEK) with our Native American communities, and actively engaging in stewardship of our environment. Reducing our carbon footprints, sequestering carbon, and habitat restoration

for native pollinators are important environmental challenges and the main focus of the *Keepers of Turtle Island* project.

This yearlong program engaged students in culturally sustaining and revitalizing science learning experiences incorporating Native languages, story work, and cultural and science experts from the community. Students calculated their carbon footprints, learned about the local ecosystem and climate, and planted a native pollinator garden. Students learned about culturally significant plants and native pollinators, how to change their behaviors to reduce their carbon footprint, and discovered ways to sequester carbon through campus gardening and greening unused spaces. These educational experiences provided opportunities to challenge students to think in new ways about Indigenous science, community building, and education as a tool for sustainability. Incorporating Indigenous science perspectives emphasized connection with one another and Mother Earth, as well as responsibility and stewardship. The Tribal Alliance of Pollinators, the South-Central Climate Adaptation Science Center, and the Chickasaw Nation collaborated with middle and high school students to design the garden space as well as donated native plant species. The University of Oklahoma's (OU) Beekeepers Association, a student organization that educates and engages with the community to raise awareness about the importance of honeybees, collaborated on native plant research, facilitated learning activities about the importance and role of pollinators, and helped build our raised beds. Norman Public Schools students involved in the project ranged in age from 6th to 12th grade.

Each meeting of the students followed an experiential learning cycle engaging with the Native American cultures of the students to learn science from an Indigenous perspective. Fall activities included visitors from local Native Nations and storytelling. Loksi, is the Chickasaw word for turtle, became a central theme for the club. Students created, *Earth on Turtle's Back*, a paper mâché collaborative diorama art project that modeled the Canadian River valley and local Cross Timbers ecosystem's flora and fauna on the back of Loksi's shell. Stewardship activities included carbon footprint calculations, the International Student Carbon Footprint Challenge, and a biodiversity survey of campus. In Spring meetings, students learned about local climate change impacts, native and culturally significant plants, and designed, built, and planted a native pollinator garden in collaboration with the OU Beekeepers Association.

The club's curriculum followed an Indigenous Science instructional framework emphasizing land-based, student-centered, active learning with Elders and other Knowledge



Image 1. Lawn before the project. Photo credit: Amelia Cook



Image 2. Students built raised beds for pollinator garden Photo credit: Amelia Cook



Image 3. Lawn after. North bed with native plants.. Photo credit: Amelia Cook



Image 4. Lawn After Project. South Bed with new plants. Photo credit: Amelia Cook

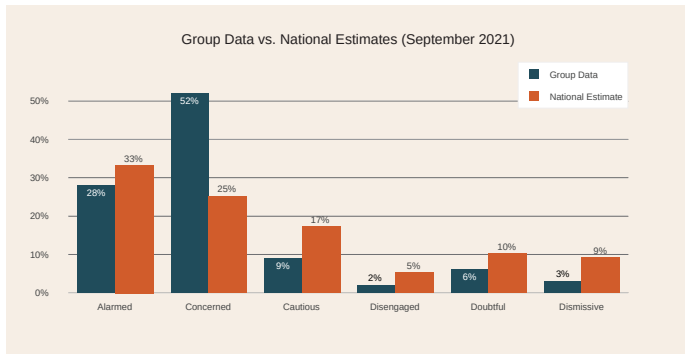


Image 5. Rattlesnake Master blooming during the first growing season.. Photo credit: Amelia Cook

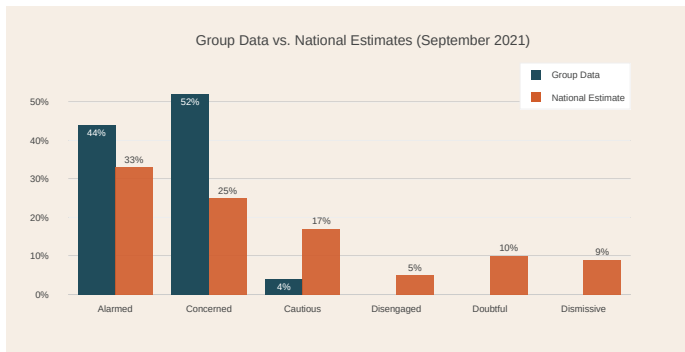
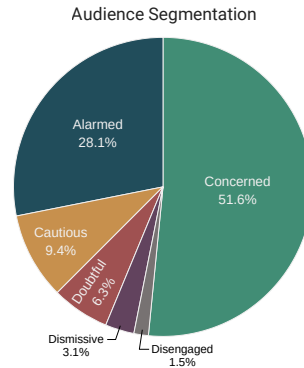
Keepers, science experts, and families in the community, respectfully braiding Western and Indigenous Science perspectives together valuing multiple perspectives, connecting with the past and preparing for the future, building an ecosystem of good relations and practice to investigate and act on a community-based science issue.

Lessons were developed using experiential learning cycles of experiencing, reflecting, making meaning, and acting phases with a 5E instructional sequence. Participants built relationships with the local environment through Nature Journaling (Laws & Lygren, 2020) activities and cultivating personal and cultural connections in scientific investigations

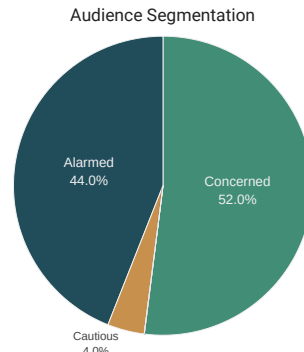
utilizing environmental data (NASA GRACE, 2023) and engaging with community collaborative science programs, Nature’s Notebook (<https://www.usanpn.org/nn/education>) and NASA’s Globe Observer (<https://observer.globe.gov/do-globe-observer>).



Figures 1 and 1a. Climate Change Survey Results Pre-Project



Figures 2 and 2a. Climate Change Survey Results Post-Project



A survey measuring climate attitude and interest was administered at the beginning and end of the school year.

Not all students agreed that climate change was occurring at the beginning of the semester, however, 100% of respondents agreed

that climate change was occurring in the final survey in May. The group's average confidence in that climate change was occurring changed from somewhat sure to very sure. Overall student opinion regarding if the climate was changing due to human activities changed from a majority agreeing changes were caused "equally by human activity and natural events" to "largely or entirely by human activity." The distribution of students changed in the Six Americas categories (Yale 2021) (Figures 1 & 2) with more alarmed students and no one responding as disengaged, doubtful, nor dismissive at the end of the year. Students reported they still "rarely" talk about climate change but also reported they had more information to discuss climate change at the end of the year. More students reported they believed they could do something and were ready to take action regarding climate change at the end of the year.

There were many significant outcomes of the project. Students learned how to calculate their ecological footprints and increased their knowledge of behaviors to reduce their families' environmental impact. Many students (and parents!) reported changes they were making to reduce footprints, an estimated 10-20% reduction in our collective footprints. *Keepers of Turtle Island* made a measurable improvement in the health of the campus ecosystem. Students completed a biodiversity survey of the area on campus where the pollinator garden was planted before and after the project. Species diversity increased from two plant species to 15 species, and two animal species to six; a 650% increase in plant biodiversity and a 200% increase in animal diversity. The pollinator habitat restoration project added Native and culturally significant plants including:

- Compass plant (*Silphium laciniatum*)
- Rattlesnake Master (*Eryngium yuccifolium*)
- Many-Rayed Aster (*Symphyotrichum anomalum*)
- Leadplant (*Amorpha canescens*)
- Butterfly Weed (*Asclepias tuberosa*)
- Indian Grass (*Sorghastrum nutans*)
- Blue Vine (*Ampelamus albidus*)
- Antelope-Horns Milkweed (*Asclepias asperula*)
- Little BlueStem (*Schizachyrium scoparium*)
- Whiteleaf Mountainmint (*Pycnanthemum albescens*)
- Bee Balm (*Monarda citriodora*)
- Sunflower (*Helianthus mollis*)
- Coneflower (*Echinacea angustifolia*)

Approximately 100 square feet of pollinator habitat was restored increasing the carbon sequestration capacity of campus. Students estimated the new garden would sequester between four to eight pounds of carbon in the first growing season, increasing each year as the perennial native plant species grow in size and increase biomass. Students learned of carbon sequestration in soil and plan to "green" more unused spaces on campus to sequester carbon in soil and plant biomass. The native pollinator garden was planted in a prominent location on campus and has generated a lot of interest from the community. There are plans to build more beds in the future. This garden will continue to inspire and inform the community.



Image 6. Students planting native plants.

Photo credit: Amelia Cook

Conclusion

The Keepers of Turtle Island project encouraged Indigenous Science and interdisciplinary learning to address local climate change issues and take action on projects, such as restoring native pollinator habitats. By working alongside Elders, local scientists, and subject matter experts, students designed and conducted environmental science investigations, while also learning about the issues through a curriculum that combined Western science with local Indigenous knowledge. Utilizing the knowledge and data they collected, they implemented a stewardship project that targeted the declining pollinator populations, a core climate change issue within the community. As a result of their efforts, there was a significant shift in attitudes towards climate change in participants, cultural knowledge improved, and the ecosystem health of campus improved remarkably.

This project encouraged us to challenge our thinking and embrace new perspectives in science learning. Incorporating Indigenous Science perspectives into environmental education emphasizes connection, responsibility, and meaning.

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About the Author

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PLANET STEWARDS

