

Learning from the Land through Community Partnership

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Abstract

This paper describes a climate education curriculum developed and implemented over the course of the 2025-2026 school year in a high school magnet program for Indigenous students. Co-developed and implemented with Dr. Annette Lee, the project's community partner, the curriculum extended climate literacy education from a single, stand-alone unit to be infused into my students' learning experiences throughout the year as part of a culturally and linguistically sustaining learning experience. Ultimately, the curriculum benefited students, community members, facilitators, and the land.

Keywords

Indigenous science, Indigenous education, community-engaged learning, language reclamation, phenology, plant medicine

Introduction

I teach science in a high school magnet program for Indigenous students. The district where I work, Minneapolis Public Schools, is the first urban district in the United States to have a legal memorandum of agreement that gives Native community members control over the educational experiences of their children. Community control means that our curriculum already centers Dakota and Ojibwe languages, cultures, worldviews, histories, and relationships to land, relatives, and the seasonal cycle. Adding a thread of climate education was natural, given the widespread impacts of climate change on land, seasonal cycles of plants and animals, weather, traditional foods and medicines, ability to exercise treaty rights, and cultural activities.

In developing the climate education curriculum, I partnered with Dr. Annette Lee, Director of the nonprofit Native Skywatchers and Senior Researcher for OSPAPIK (Ocean and Space Pollution, Artistic Practices and Indigenous Knowledges) at the Université de Bretagne Occidentale. Dr. Lee provided resources, training, and opportunities for our students to both carry out bioacoustics monitoring and learn from elders and community knowledge keepers on the land and in the classroom. She is deeply committed to educating students and the broader public about Indigenous science, ecosystem restoration, and caring for our plant and animal relatives. As an Indigenous scientist, her work and research have been positioned widely across the sciences: astronomy, physics, mathematics, astrobiology, geology, chemistry, hydrology, and earth systems science. Moreover, working with Dr. Lee as a community partner ensured that students would have her support as an Indigenous researcher and expert on Indigenous science, as well as the support of elders and knowledge keepers from their community. We have collaborated for several years on Indigenous astronomy projects and land-based learning. Although this curriculum work seemed like a natural extension of what we were already doing, we found that this work was transformative and brought unexpected insights, including expanded research in ecology, conservation, and bioacoustics.

My hope is that this reflection will be valuable to both teachers and community partners to learn about the model of climate education we built together and the ways it impacted our lives and the lives of the students. Below, I provide a general overview of the curriculum, then I share how the curriculum helped to shift student thinking. The conclusions that follow are based on a synthesis of oral interactions with students, student work, and student portfolio presentations.

Curriculum Overview

We previously developed a unit on the impacts of climate change on wild rice, a staple food for Indigenous people in our region. This year, we added climate literacy components into units focused on 1) colonization and biodiversity, 2) food sovereignty, 3) plant medicines and dyes, and 4) phenology. Weaving climate literacy into both Earth Science and Chemistry classes throughout the year had important impacts on both student learning and our own thinking about climate change.

Colonization and Biodiversity

This unit focuses on the wide-ranging impacts of colonization on the land and biodiversity on Turtle Island, with a particular focus on the urban area around our school, our local sacred sites (Figure 1), and culturally important sites in our region. In the past, we focused on studying the mass killing of animals and mass destruction of our state's biomes: prairie grassland, eastern broadleaf forest, Laurentian mixed forest, and tallgrass aspen parkland. Students learn that, for example, less than 2% of our native prairies and old-growth forests remain (Minnesota Board of Soil and Water Conservation, 2026). They also learned about the mass killing of animals and how approximately 98% of mammals and game birds were killed by hunting or died from habitat loss between colonization and the 1890s (Hornaday, 1914).



Figure 1: Student researchers at Mound Springs, MN Valley NWR, Sacred Site, Field Site, Bloomington, MN, 2025.

This year, we expanded our learning to look at the current impacts of our way of life on the land and our plant and animal relatives, including the impacts of climate change. Students learned about phenological shifts and mismatches due to climate change, such as flowers blooming when pollinators are not ready or birds migrating before the insects needed to feed their young have emerged. They also studied the impacts of a changing climate on the spread of displaced relatives that can dominate ecosystems and crowd out the native plants needed for our insects and other animal relatives to reproduce and thrive. They learned that a number of culturally important native species, such as birch, depend on photoperiod (day length) to time their life cycle, and cannot adapt to a changing climate and longer growing season as well as some other plants, particularly some of our displaced relatives (Tarascio et al., 2025). With Dr. Lee's support, they went beyond looking at data on the impacts on birch trees; they spent time with knowledge keeper Pat Kruse, who taught them to make birchbark baskets and florals, and to do quillwork on bark. This experience connected them to embodied cultural knowledge and helped them care about birch as a relative. Pat was able to share with them his changing experiences harvesting bark over several decades, as well as his concerns about the future of this relative in our state.

Including climate literacy in this introductory unit completely transformed the way I view climate change. It became clear to me and the students that climate change is part of a much larger pattern of relationships to land and relatives where humans have forgotten or turned away from their roles in maintaining a healthy and balanced ecosystem. This problem is not one that can be solved intellectually or technically; it requires reclaiming embodied cultural knowledge and land-based practices that reconnect us with land and relatives. Learning in this unit helped students to see that colonization is not a one-time event, but an ongoing way of thinking and living that continues to impact the land, relatives, and their communities in important ways.

Food Sovereignty

During the Operation Metro Surge in the winter of 2025-2026, our students' education was disrupted. Many students experienced trauma as they and people in their neighborhoods were targeted. Members of Indigenous communities were detained by ICE on multiple occasions. During the peak of ICE activity, most students stayed home and did remote learning. Many felt depressed and did not see the point of engaging with school. As ICE activity decreased in spring, many students struggled to return to in-person learning. Our teaching team came together and developed a unit on food sovereignty to promote community healing and help students reengage with school.

Our students have always learned about traditional foods, but we leaned hard into embodied practices of offerings, harvesting, processing, and preparing. Students nixtamalized corn to make hominy and tortillas, learned multiple ways to cook wild rice, prepared teas, made jerky, canned jam, and made applesauce. With support from knowledge keeper Fern Renville, they harvested and prepared foods from plants growing in our urban parks and school garden, including pineapple weed, hackberry, plantain, bee balm, yarrow, nettles, and burdock. Tying this learning to the impacts of industrial agriculture on the land and climate brought home to students how important land-based harvesting and hands-on food preparation are for building stronger relationships to land and relatives. Students learned alternative and more sustainable ways of tending the landscape to grow food practiced by Indigenous communities through resources including *Tending the Wild* (Anderson, 2005) and the accompanying PBS video series (2016), *Wildfire* (Anderson & McPherson, 2024), and *Keeping It Living* (Deur & Turner, 2005). Students noticed that harvesting makes us aware of where plants like to grow and that sustainable harvesting requires that we monitor plant populations throughout the seasons and life cycle, year after year. As they learned about the food sovereignty movement, they came to understand that it is as much about the land and relatives as it is about what we eat. Students saw the impacts of displaced relatives crowding out foods in our neighborhoods. They also realized through work in our school garden and at our restoration sites how humans can help bring ecosystems back into balance through disseminating the seeds of our native food plants, tending, harvesting, and engaging with plants on the land. The embodied practices of planting, harvesting, preparing, and cooking were deeply healing after the trauma they experienced. Students felt a strong sense of community and a greater sense of purpose in coming to school because they were learning skills to help the climate, their families and communities, and the land and relatives.

Plant Medicines and Dyes

We have always had opportunities for students to learn to harvest and prepare culturally important medicines such as cedar, sage, red willow, and sweetgrass for their families. This year, we focused on teaching tobacco offerings, sustainable harvest, and the importance of reciprocity. We were very lucky to work with knowledge keeper Charles Grolla, who taught students about the significance of offerings and their centrality in Ojibwe culture. Understanding offerings as an expression of our proper role on the land and among our relatives, and connecting offering practices to important cultural stories, gave students a new understanding of themselves and their place in the world. They

were able to imagine futures where human activities could contribute to the health of ecosystems rather than their destruction.

We expanded our learning to include more medicines, fibers, and natural dyes. Students worked with knowledge keepers Tanaǵidaŋ To Wiŋ (Tara Perron) and Simone Rendon to practice sustainably harvesting medicines growing at a sacred site. It meant a lot to students to learn to care for these medicines and be able to bring them home to their families. At school, students learned about the importance of our native plants as carbon sinks and phytoremediators (US Environmental Protection Agency, 2017; Wild Ones, 2021). In their reflections, they came to think of medicines not just as plants that help with human health problems, but also as plants that help the ecosystem and planet to stay healthy by keeping the climate in balance and cleaning the air and water.

Students also had the opportunity to learn from elder and knowledge keeper Fern Renville. They worked with her to harvest and process nettles to make fiber and learned about the cultural importance of other fiber plants, such as dogbane and basswood. Students contrasted these fiber-making practices to the unsustainable clothing industry and its impacts on the land, relatives, and climate. For example, they learned that much of the fabric used in our clothing is derived from fossil fuels and puts microplastics into our water, that the dyes used on fabric and leather clothing items are poisoning water, people, and animals in the places the clothes are made, and that much clothing ends up in landfills shortly after being purchased (Niinimäki et al., 2020). This learning caused students to see traditional dyes and fibers as solutions for the future, rather than relics of the past. They were motivated to pursue deeper knowledge of plant fibers and dyes traditionally used in their communities. After researching traditional Dakota and Ojibwe dyes and working with Fern, they dyed nettle fibers, fabric, and quills using a wide variety of plant dyes and mordants. They presented their work to educate the public at the Minnesota Indian Education Association Conference.

Students also learned from Marique Moss, a community knowledge keeper, about how to make salves and balms with medicinal plants and bear grease, further deepening their embodied knowledge and relationships to these medicines. Students planned and requested funding to plant a new dye and fiber garden next year to continue their learning and requested ongoing learning with knowledge keepers to continue to learn more about harvesting, preparing, and using plant medicines.

Phenology

Using the Ojibwe and Dakota languages is a critical part of our program. This year, students kept phenology journals in Ojibwe or Dakota to track seasonal changes in weather and in the life cycles of plant and animal relatives. They observed outside in the schoolyard at least twice a week, made observations at our sacred sites during field trips, and also viewed photos and videos Carmen made at the sacred sites the weeks they did not have access to those spaces. In addition, students accessed bioacoustic data from the sacred sites to learn about when bird and frog species bred last year and compare the dates with historical data (Figure 2).



Figure 2: Bioacoustic recording gear, Native Skywatchers grant-funded research project, "Turtle Island Skywatchers-Research and Data Visualization", LCCMR, 2024-2026.

Students learned how the names of the months in Ojibwe and Dakota hold important information about phenology, such as the time wild strawberries and wild rice are ready to harvest, geese are laying eggs, or the leaves change color. Due to climate change, some of our phenology observations no longer align with this traditional calendar, a stark

reminder of the impact our ways of life are having on our relatives. Students learned that 70% of plants studied have shifted their phenology in the past few decades due to climate change, and that the life cycles of birds, insects, and other animals are also being impacted (Tarascio et al., 2026). Students learned about the many factors that influence the timing of life cycle events, including temperature, photoperiod (day length), and precipitation. They learned about the role of genetic diversity within populations in permitting some adaptation to climate change, while also understanding the constraints that make it more difficult for some species to adapt. Recording observations of bird song, plant life cycle events (sap flow, bud burst, flowering, fruiting), and weather in Ojibwe and Dakota led students to relate differently to the land and relatives around them. Students expressed more care and concern for plant and animal relatives, and a stronger desire to change their ways of living to keep their relatives safe. Using the Dakota and Ojibwe languages tied their experiences to the stories and cultural knowledge associated with their plant and animal relatives. It also helped them think of their role on the land in a different way, as they used language to carry out embodied practices (making offerings, harvesting, singing) on the land. Students developed deep gratitude for the myriad ways our relatives care for us every day. For example, they learned how plants provide oxygen, clean our water, soil, and air, and absorb carbon dioxide from the atmosphere. They learned how trees cool the air both by providing shade and through transpiration. They learned how plants release volatile chemicals into the air through transpiration that can improve human health (La Puma, 2026). They reflected on how little they have done to care for and protect these relatives without whom they could not live. This learning made them seek to develop an understanding of the proper role of humans on the land and how to care for their relatives.

Impacts on Students

Students as Future Elders

Students moved from seeing elders as a source of knowledge and taking a passive role in listening to elders to understanding that they need to engage in embodied, land-based practices in their languages. They realized this engagement is required for them to gain the decades of experience needed to pass this knowledge to the next generation when they become elders themselves one day.

Students as Community Educators

As students learned about the wide-ranging impacts of the climate crisis on land, relatives, and the wellbeing of their communities, they became passionate about sharing

their learning with the wider community. They shared their knowledge formally with community members at several conferences and community events throughout the year (American Indian Science and Engineering Society national conference, Minnesota Indian Education Association Conference, and the University of Minnesota Climate Education Conference), as well as informally with family members and neighbors. In addition, every student presented a portfolio of learning to family and community at the end of the year to share what they took away from their learning.

Connection to Language

Indigenous languages are often viewed in the school system and larger society as irrelevant to modern life, not offering the economic advantages of other world languages, and destined to disappear. The students' learning about climate, land and relatives, and their embodied experiences of using language in that learning, caused them to form deeper personal and community relationships to language and to see language as important for their future. Every student, even those who did not have a separate Ojibwe or Dakota class, spoke their languages in their portfolio presentations. Students began to see language as a map to help them find and enact correct relationships to land and relatives and guide who they should be in the community and larger world. This motivated students to grow their language knowledge and use language beyond the classroom, a key component of language reclamation.

Connection to land and relatives

Many urban Indigenous students have experienced limited access to green spaces and even to their own culturally important places and sacred sites due to myriad structural barriers. Reclaiming relationships to land, both in their neighborhoods and at the sacred sites, was deeply healing for many students. Learning more about the history of their local sacred sites through teachings from Ramona Kitto-Statelty helped students read the landscape around themselves and their own family histories in new ways. Many students went from feeling discomfort and anxiety on the land to feeling comfortable, recognizing and reconnecting with relatives on the land. Storywork, including hearing stories from knowledge keepers such as Hope Flanagan, Charles Grolla, and Fern Renville, and working with texts including *Binesi Dibaajimowinan: Ojibwe Bird Stories* (Grolla, 2019) and *Plants Have So Much to Give Us, All We Have to Do Is Ask* (Geniusz, 2015), helped students connect with plant and animal relatives in culturally sustaining ways. Students were motivated to help restore local sacred sites as well as spaces in their own neighborhoods, in order to provide better homes for their relatives and bring missing relatives back. They also became committed to working to influence decisions about

land management, such as the Minneapolis 2040 plan, and determining how land will be managed at local parks and sacred sites.

Personal Impacts on Teacher and Community Partner

Learning from Storylines Based on Bioacoustic Data

Dr. Lee led multiyear grant-funded projects at two sites (in collaboration with acoustic biologists Anne Simonis and Gary Casper): Mound Springs (part of the Minnesota Valley Wildlife Refuge) and Crow-Hassan Park Reserve (part of the Three Rivers Park District) with funding from Heising-Simons Foundation and LCCMR. Mound Springs is a Dakota sacred site that includes burial mounds, and students have done water monitoring there in the past. Crow-Hassan is a successful example of prairie restoration on land where agricultural activity disrupted the original ecosystem. Students had opportunities to look at raw data and walk through the data analysis process. They then accessed proofed results to learn more about which animal relatives (birds, bats, frogs, and turtles) were using each site.

One important story that came out of the data was that although many common birds are in decline, some of these same birds were nesting and breeding at both the Mound Springs and Crow-Hassan field sites (Figure 3). Examples include: the American Goldfinch or ozaaweshiinh (Ojibwe), the American Crow or aandeg (Ojibwe), and the Blue Jay, or diindiisi (Ojibwe) (Grolla, 2019). Despite their proximity to the Minneapolis airport and the Mall of America, and the associated noise, air, and water pollution, these avian relatives still show up and play important roles in the ecosystem. Similarly, Crow-Hassan, has an abundance of birds, frogs, bats, turtles, and other wildlife. The bioacoustics data were able to tell a snippet of their story through their songs, a story of hope for land transformation and revitalization when humans make better choices based on reciprocity, relationship, and stewardship. A collection of ArcGIS Story Maps was collaboratively designed to weave together the acoustic data, visuals, and context, including impacts of changing land use and restoration on biodiversity (Lee, 2026; see link in references to access these educational tools)



Figure 3: Great Blue Heron, Mound Springs-MN Valley NWR, Photo by Carmen Gavin Vanegas, 2025.

Seeing how these trends are impacting the land and relatives right around us was impactful for us as researchers and for the students. Students became passionate advocates for additional restoration work to support the animal relatives that are on the land, as well as ongoing work to restore missing relatives to these spaces.

Future Directions

The relevance of climate education to students' lives, and their sense that their education had a deeper purpose to help community and support future generations led them to become more engaged in asking questions and seeking knowledge. They began to drive more of the curriculum and request community support for their learning. Some new topics they wish to explore next year are sustainable housing and architecture and the role of cultural fire in maintaining healthy ecosystems. Students also requested elders-in-residence and more ongoing work with knowledge keepers to support intergenerational transmission of language and cultural knowledge. Further, students

requested opportunities to mentor and share their learning with younger students, as many wish they had opportunities to start this learning journey at a younger age.

Personal Reflections

Carmen: I became more committed to supporting language reclamation and engaging students in embodied, land-based learning. I applied for and was awarded a grant to support some of our land-based work next year. I have continued my Ojibwe learning, will be teaching Ojibwe language part-time next year, and am also taking a Dakota class through South Dakota State University in the fall to continue to develop skills to support students using their Indigenous languages in the classroom.

Dr. Lee: From an Indigenous perspective, viewing Astronomy as an isolated discipline has never been sufficient. My work has consistently centered on the concept of *kapemni* (Lakota), which refers to the mirrored relationship between earth and sky. Collaborating with Carmen and her students has heightened my sense of urgency regarding Indigenous Ecology. In addition to my current role as Senior Researcher for OSPAPIK (Ocean and Space Pollution, Artistic Practices and Indigenous Knowledges) at the Université de Bretagne Occidentale, I have chosen to pursue a graduate certificate in bioacoustics through the Center for Acoustics Research and Education at the Institute for the Study of Earth, Oceans, and Space at the University of New Hampshire.

Conclusion

Integrating climate education into our science curriculum with the support of Native Skywatchers transformed the way my students and I see ourselves and our place in the world. It planted the seeds for further learning and growth as we continue to reclaim language and relationship to land and relatives. As an educator (Carmen) and a researcher (Annette), this learning also transformed each of us personally and gave us a deeper sense of purpose in our work. This project shows that climate education does not have to be depressing or lead to a sense of helplessness. Instead, it can motivate deep healing and reconnection, bringing us back into the right relationship with land, relatives, and one another.

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