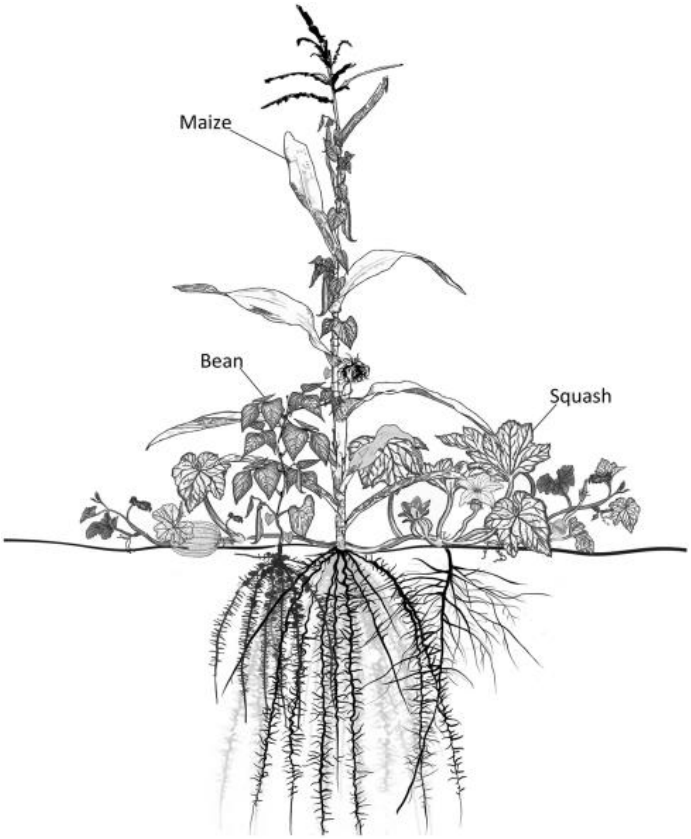

Ethnoecology of a Three Sisters Garden

Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants

Ethnoecology of Indigenous Foods Seminar

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Diné Institute for Navajo Nation Educators (DINÉ)

2025

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Topic

"I hold in my hand the genius of Indigenous agriculture, the Three Sisters. Together these plants–corn, beans, and squash–feed the people, feed the land, and feed our imaginations, telling us how we might live. Planted together, they offer a living example of harmony, balance, and reciprocity."

- Braiding Sweetgrass for Young Adults, page 107
(Kimmerer & Smith, 2022)

This unit will invite students to learn about ethnoecology and to consider how humans and ecosystems are interconnected, specifically in our region. We will read and discuss selections from the book Braiding Sweetgrass for Young Adults (Kimmerer & Smith, 2022) that highlight how human connection to the land is a reciprocal process. The chapter *The Three Sisters* will introduce students to the species within a three sisters garden and how they work symbiotically. We will learn about why these three species are important to humans in the Southwest and have been for thousands of years. In groups, students will research and create detailed plant profiles for each of the sister plants- corn, beans, and squash. These plant profiles will include recipes for preparing each ingredient. Then, students will create a model to diagram the nutrient exchange and relationships among the plants, soil, and humans in a Three Sisters garden.

During the second semester of the year, we will collaborate with community partners and local Indigenous gardeners for students to learn about the methods to plant a Three Sisters garden. They will start growing seeds of all three species inside under grow lights. Once it is warm enough, students will engineer a location in our school garden to plant their seedlings and design a plan for when and how each species should be planted. They will work together to plant their own three sisters garden that can grow over the summer and be gifted to the incoming students of the next year.

This unit will conclude with a differentiated project where students can choose from: using one of their recipes to prepare a dish made of corn, beans, and/or squash to share with the class, interviewing an elder/gardener about their experience growing food, creating interpretive materials for the garden, or making a video to document the process of planting a Three Sisters garden. The final culmination will be a community gathering where we share foods and products from our garden.

Context

The City of Flagstaff is a mountain town with a population of 76,800 humans (U.S. Census Bureau, 2021). This includes the community of students who attend Northern Arizona University, which comprises at least 25% of our city's population (Northern Arizona University, 2023). From Flagstaff, you can travel to different ecosystems and sovereign nations in a short time. 80 miles to the northwest you can reach the south rim of the Grand Canyon. 40-50 miles to the northeast is the Navajo Nation. 30 miles further to the northeast is the Hopi Nation. 30

miles south of Flagstaff is Red Rock Country and the community of Sedona. If you travel any further south, you would descend from the Mogollon Rim into the desert and reach the city of Phoenix 100 miles later.

Flagstaff High School belongs to the ponderosa pine ecosystem at the base of Dook'o'oosłííd (the San Francisco Peaks). We are situated in the southwestern part of the Colorado Plateau, an area of geographic uplift typified by forests and high desert. FHS is one of three high schools in the Flagstaff Unified School District. FUSD has a total of 9,100 K-12 students across 15 school sites (Flagstaff Unified School District, n.d.). This is our school's land acknowledgement: The students and staff of Flagstaff High School would like to acknowledge the sacred land upon which our school is located. We recognize our Indigenous ancestors as the original stewards of the land as well as their descendants who still inhabit the land today, the Havasupai, Hualapai, Apache, Diné, and Hopi. We will respect, honor, and strengthen relationships with Indigenous nations, whose lands and natural resources we benefit from to this day.

Flagstaff High School has been part of the community for over one hundred years, and I have been a teacher there for eleven years. I am actually a second-generation graduate of FHS; my brother, father, and two uncles are also alumni. Our school population consists of 1600+ students and 75+ faculty and staff. Our school mission is: *to empower and prepare students to embrace challenges with resilience, creativity, critical thinking, and strong character. We will develop and educate responsible members of society while encouraging personal and post-secondary success.* Our school's racial diversity is as follows: <2% Black students, <2% Asian students, 3.5% multiracial students, 23% Hispanic students, 25% Native American students, and 46% White students (AZ School Report Cards, 2024).

FHS is honored to serve up to 160 Native American students who choose to live at the Kinłani Bordertown Dormitory one mile north of the school. Students living at the dorm are from throughout the Navajo Nation, Hopi, Havasupai, Tohono O' Odham, and other locations within the Four Corners region (Flagstaff Bordertown Dormitory, 2024). The dorm, built in 1958, has undergone a transition from originally housing K-12 students to now housing exclusively high school students (Flagstaff Bordertown Dormitory, 2024). The Kinłani staff and counselors strongly support their students and offer help with academics, recreation, and residential life. As a teacher at FHS, I acknowledge the assimilatory history, and colonial aims of boarding schools and their impacts on generations of Indigenous People in our community. I have a responsibility to work against the harms passed down from this system and to honor the cultures of my students and their families who have made the decision to live at the Kinłani dorm and attend our school.

Flagstaff High School has a 92.8% graduation rate, and we celebrated 388 graduates at our most recent graduation (AZ School Report Cards, 2024). According to the state of Arizona, our school has an A rating (AZ School Report Cards, 2024).

I teach within the FHS Advanced Placement Academy, a program designed for students to challenge themselves with rigorous courses, have support to find their educational path, and graduate with honors. Depending on the number of honors and AP classes that a student takes, and whether they complete a capstone project, there are three tiers of recognition within the academy: Diploma with Specialization, Honors Diploma with Specialization, and Distinguished Scholar. In May 2025, there were 40 students who graduated with diploma status and 12 students who graduated as distinguished scholars.

This unit is created for my honors Biology students, who are in ninth and tenth grade. This year I will teach three sections of Honors Biology each day. These are typically large classes with 34 students each. We meet every day for 50 minutes, and 30 minutes on Fridays. I truly enjoy teaching this class and I am lucky to work with dedicated and intriguing students.

One unique aspect of this class is that my students are able to be highly involved with designing and maintaining our campus gardens. The gardens are located in three large courtyards and offer opportunities for students to research, implement, and carry out science and engineering projects. Here is a comment from one of my students when asked what future students should know: “That the garden has potential and is a safe place to be in, knowing that other students genuinely enjoyed putting it together.”

Rationale

This is my fourth year participating in the DINÉ Institute. My previous seminars were focused around: Forestry & Climate Change (2021), Wildlife, Plants & Habitats (2022), and Relationality & Kinship (2024). My teaching is informed by these seminars and working in community with the professors and teachers who shared their guidance. My teaching is also informed by my work with the FHS SOARR Committee (Stewards Observing and Advocating Relational Responsiveness). SOARR was formed around the goal of more fully supporting Indigenous student achievement at our school. This committee grew out of a collaboration with NAU and inspiration from the Kia Eke Panuku program in Aotearoa New Zealand, aimed at improving Māori student achievement in secondary schools (Kia Eke Panuku, 2016). A collaborative team of stakeholders helped to create the SOARR model (below), incorporating Indigenous ways of knowing that would be recognizable to many of our students. I have learned from and continue to try to integrate these foundations from the SOARR model with my students: power is shared, culture counts, relationships and connectedness are fundamental, learning is interactive and dialogic.

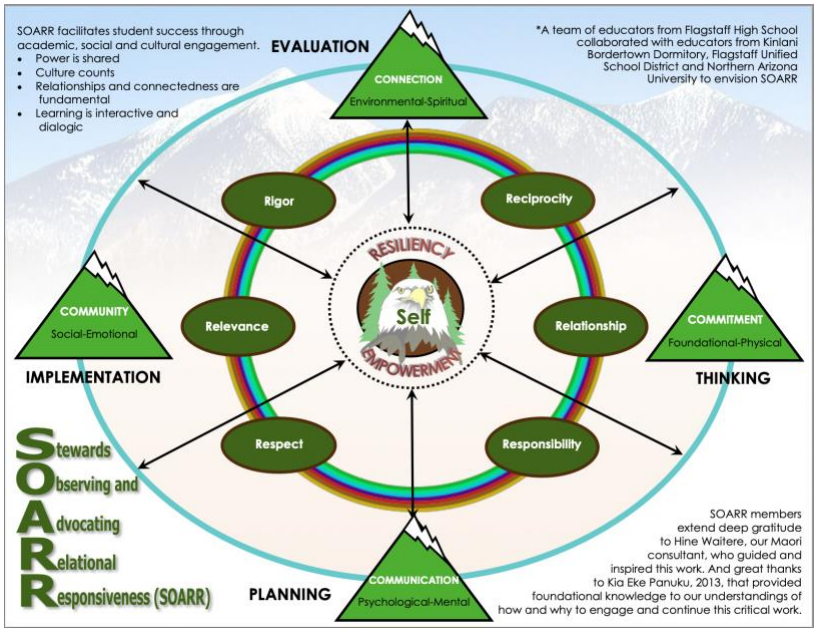

Figure 1: FHS SOARR Model (Lemley et al., 2024)

In 2023, I was able to live in Aotearoa and experience first-hand some of the intentional teaching and learning practices that support Indigenous student achievement. I researched culturally responsive strategies and co-construction by visiting schools, attending faculty meetings, observing classes, and interviewing students and teachers. There were many takeaways from this immersive experience. In terms of encouraging Maōri and Pasifika students to share their cultural knowledge and ways of knowing, these strategies were essential: ensuring Maōri and Pasifika content, incorporating Indigenous language, providing relevant applications, and fostering a whanau/family-like environment.

For this unit, I want to be mindful of following the cultural methods of creating and planting a Three Sisters garden. I will be asking friends and knowledge-holders for information to help us in this process. I also want to be mindful of not oversimplifying or conflating complex topics and histories just to make them fit within the timeframe of my unit.

Why do I write this unit?

I chose the topics of this unit and a focus on the Three Sisters garden because of the alignment and strong connections we can make with the work that my honors biology students have already started in our campus gardens. We have been carrying out stewardship projects in the gardens for almost a decade, and it is amazing to see the long-term, steady progress students have made transforming sterile spaces into thriving gardens where human and more-than-human relatives enjoy spending time. I believe this unit is a way to tie together crucial biological understanding about plant and soil function and symbiosis, along with cultivating a relationship with the land that honors traditional ecological knowledge (TEK). Dr. Megan Bang and Marissa Spang remind us that “facilitating navigation within and across multiple epistemologies can lead to more productive STEM learning, expertise, and career trajectories for Indigenous students”

(Spang & Bang, 2014). Additionally, this unit will incorporate English Language Arts through our readings from Braiding Sweetgrass for Young Adults (Kimmerer & Smith, 2022), a goal that we have across all subject areas in our school this year. Robin Wall Kimmerer's writings made a big impact on me, personally, and the way I view my role as a science teacher. I want to share those lessons with my students and help them view science in broader terms- a braid of Indigenous and Western ways of knowing. I hope this unit will highlight that TEK *is* scientific knowledge and that we can learn much from the long-term inhabitants of our region and their farming practices.

This is a multi-faceted unit that requires community collaboration. We will continue our ongoing partnership with our non-profit partner TerraBIRDS (TerraBIRDS, 2025) to bring experts to the classroom to help guide our field sessions. My students and I have been working with TerraBIRDS across the last decade, and with their guidance (and patience!) I have learned a great deal about gardening, local species, and how to manage student work outside in productive and beneficial ways.

Through our end-of-year celebration, we will engage families and community members by inviting them to the garden and sharing the outcomes of this unit in the form of projects, art, and food. I believe we can emphasize reciprocal relationships in this unit- among the species of plants in a Three Sisters garden, and between students and the land where they live. The gardens created this year will be gifted to students who arrive the following year- an intentional and warm welcome.

Here are some photos of our honors Biology students working in the pollinator and life zone gardens at Flagstaff High School prior to this unit:

Instructional Guide

"Indigenous ways of knowing are not contrary to, but are in fact powerful resources for learning science. STEM instruction can be more impactful for Indigenous students when connections are presented between Indigenous and Western STEM."

(Spang & Bang, 2014)

According to the International Society of Ethnobiology (2024), ethnoecology is the study of complex relationships, both past and present, between human societies and their environment. Ethnoecology emphasizes local peoples' perceptions, knowledge and understandings of their own reality and problems. This interdisciplinary field can provide background, knowledge, and insights into ways of knowing the world. This unit invites students to learn about the history of companion farming in our region and the traditional ecological knowledge that has supported this practice over the course of thousands of years.

The Mesoamerican milpa system shows us the origins of Three Sisters farming. Milpa is from the Nahuatl words *milli* (field) and *pan* (together)- referring to the practice of growing maize, beans, and squash together within a shared plot (Benrey et al., 2024). Indigenous peoples in present-day Mexico and Central America such as the Olmec, Maya, Aztec, and Zapotec developed sophisticated agriculture around these three plants and additional companion plants like amaranth, chilies, and tomatoes (Benrey et al., 2024).

Archaeological evidence indicates the cultivation of squash and corn plants in Mesoamerica as long as 10,000 years ago (Roosevelt, 2023)! Corn was developed through selective breeding of the grass teosinte, eventually developing maize and then modern corn. Around 5,000 years ago, Mesoamerican peoples began to migrate both north and south from their region, adapting the agriculture of la milpa to match local climates and cultural traditions (Benrey et al., 2024). The Three Sisters method of gardening became common in North America in the mid 1500s, with the intercropping of these species able to withstand weather extremes and also support environmental stability and a nutritious diet (Kapayou et al., 2023).

The US government policies of forced removal and assimilation of Indigenous peoples in North America in the 1800s intentionally undermined and attempted to erase Native agricultural practices, including Three Sisters agriculture (Kapayou at al., 2023). These policies removed Indigenous people from the fertile lands where they had perfected companion planting, and boarding schools robbed young people from the opportunity to grow up raising crops and preparing foods with their families (Kapayou at al., 2023).

The milpa and Three Sisters systems reflect the resourcefulness and adaptability that characterize Indigenous agricultural practices and their vital role in sustaining communities and preserving biodiversity. Today, these practices continue to thrive in various regions of the Americas, serving as an example of Indigenous knowledge and “agroecological understanding”. (Benrey et al., 2024).

Figure 2: This figure illustrates a traditional milpa agricultural system, showing the interplay among maize, beans, and squash plants, characteristic of this farming practice.
(Figure partially created with Dall-e).

The companion planting of corn, beans, and squash together in a Three Sisters garden can provide more food per area than monocrops and contains the nutrients and vitamins for good nutrition. However, this style of planting is also labor intensive and requires manual effort to plant, maintain and harvest the foods that are grown (Benrey et al., 2024). I hope that my students will appreciate the opportunity to benefit from thousands of years of ethnoecological knowledge as they learn about the interconnectedness of the plants and develop their own Three Sisters gardens.

Among the three sisters, Robin Wall Kimmerer (2022) reminds us that corn is the oldest sister- to be planted first and the one that forms a tall scaffolding for the younger siblings. Because it is planted early, corn has the whole summer to build carbohydrates that can provide lots of energy when the corn is eaten. Another reason to plant corn early is so that her pollen, which is released during the tasseling period, will occur before the hottest part of the summer. Because corn is pollinated by the wind, plant at least 10-20 corn plants to increase their chances of pollination (Kruse-Peebles, 2016). The roots of corn plants host arbuscular mycorrhizal fungi– soil microbes that recruit nutrients for the corn. These mycorrhizae also benefit neighboring plants and ensure the distribution of resources among root networks (Benrey et al., 2024).

Two to three weeks after planting corn, it is time to plant the middle sister- beans. The corn should be at least a few inches tall in order to stay ahead of the younger sister's growth (Kruse-Peeples, 2016). The bean sister has to be flexible and learn her way around the older sister, corn. Bean will start out leafy but then form vines that will wrap around the corn and allow the beans to take advantage of plentiful sunlight away from the ground. Bean will contribute to the Three Sisters garden through an association with rhizobium bacterium, which needs an environment free from oxygen. Sister bean will create a root nodule where the rhizobium can live, and in exchange, the rhizobium will fix atmospheric nitrogen into nitrogen that all the sisters can utilize to create their roots and shoots (Kimmerer & Smith, 2022). Sister bean also has a few more tricks on her leaves and stems- the production of extrafloral nectar that attracts beneficial insects like ants, and sticky trichomes on her leaves that can trap small herbivorous insects (Benrey et al., 2024). Beans provide protein and essential amino acids that cannot be found in corn (Kruse-Peeples, 2016).

The youngest sister, squash, should be planted last– one week after the beans emerge from the ground (Kruse-Peeples, 2016). Squash will stay low and close to the soil, playing at the feet of her older sisters. Her contribution is large, bristly leaves that will provide shade, deter predators, and reduce weeds that might try to grow near her sisters (Kimmerer & Smith, 2022). Little sister squash is able to grow around the edges of corn and beans, and is skilled at laying down new roots to take advantage of water far away from her siblings. Squash provides important vitamins and minerals that cannot be obtained from corn or beans (Kruse-Peeples, 2016).

There are many variables to consider when planting a Three Sisters garden. Students will need to make decisions about the layout, timing, amount of water, and the varieties of corn, beans, and squash. There seem to be three main methods for how to distribute the Three Sisters within a plot of land.

The Three Sisters mounding method, based on Haudenosaunee gardens, is good for areas with relatively high precipitation (Kruse-Peeples, 2016). Mounds, spaced 3-4 feet apart, should be four inches high with a well in the center. Seeds are planted from the center of the mound to the outside in the order of corn, beans, and then squash (Three Sisters, 2021).

The Three Sisters field method, similar to the Rarámuri fields in present-day Chihuahua, is planted in a square arrangement with a grid of corn plants in the center, a border of bean plants, and squash along one outer side of the square (Kruse-Peeples, 2016).

The Three Sister landscape or rotational method is beneficial in arid climates and requires more space in order to lay out separate areas of corn, beans, and squash (Kruse-Peeples, 2016). In subsequent years, corn will be planted where beans were grown the year before. This allows corn to take advantage of the nitrogen-rich soil developed by her sister (Three Sisters, 2021). The three plants are grown next to each other but not overlapping as in the methods above.

Teaching Plan

"The distinctive features of Indigenous knowledge and pedagogy are learning by observation and doing, learning through authentic experiences and individualized instruction, and learning through enjoyment."

(Vallejo & Werito, 2022)

This table summarizes the teaching plan this unit will follow. Due to the amount of work required and alignment with other units in Honors Biology, the lessons from this unit will stretch over two semesters. The activities shown with an *asterisk are outlined in greater detail below, including related standards and assessment plans.

Semester 1: Fall 2025		
Topic	**Details**	**Purpose**
Intro to Ethnoecology	Introduce the topic of ethnoecology to students, including some background about this field. This introduction will use some of the prompts Mandu taught us in our seminar session, such as "why do we eat the things we eat?" and "what is food?" to promote discussion. If possible, Mandu is invited as a guest presenter.	For students to think about their own relationship to place and to the food they eat. This activity jump-starts student thinking ahead of the next activity.
Where does our food come from?	Students will analyze some of the data provided by the 2024 Community Food Assessment to identify local food trends, learn about who grows local foods, and what needs have been identified (Assessing and Growing, 2024). Students will compare the costs and benefits between large-scale agricultural practices and small-scale farms.	This promotes data analysis skills, and also brings the conversation about food closer to home. It will also invite students to share their own experiences growing or helping grow food.

Braiding Sweetgrass Chapter: *Wiingaashk*	This short chapter will serve as an introduction to the book. For this first section we will listen to the audio version and follow along.	Students will be able to answer the question, “why sweetgrass?” and receive an invitation to the idea that people and land are good medicine for each other.
Braiding Sweetgrass Chapter: *The Council of Pecans*	Students will learn about food foraging and mast fruiting and read about how boarding schools interrupted these practices for many Indigenous youth in our region. We will highlight and discuss the phrase “all flourishing is mutual” and how it relates to our school and community.	This is an ethnoecological story and highlights the relationship between people and land and the food they eat. It also opens an opportunity to talk about the legacy of boarding schools, which comes up later in our class when we learn about epigenetics and how intergenerational trauma can be inherited through the arrangement of your DNA.
*Braiding Sweetgrass Chapter: *The Three Sisters*	This chapter details each of the plants in a Three Sisters garden and how they are interconnected. There are themes of reciprocity and symbiosis. The book asks students to consider- Who might need your help flourishing?	This chapter concludes by adding that there is a 4th sister- you, the person planting the garden. This is an important inclusion for my students and emphasizes their responsibility and participation in their garden work. Additionally, his chapter provides background for the next two activities.
*Three Sisters Garden Nutrient Exchange Models	This is an opportunity for students to really get into the details of how the plants in a Three Sisters garden are interconnected and what is happening behind the scenes that helps these plants thrive together.	This model is meant to go beyond the most noticeable reasons corn, beans, and squash grow well together and get into the relationships, nutrients, messages, signals, and shapes that support the companion planting of these species.
*TerraBIRD Garden Committees to create art, prepare, and plan for the Three Sisters Gardens	In our collaborative work with TerraBIRDS (TerraBIRDS, 2025) over the last few years, we have found that it is most efficient to divide into committees that can focus on specific projects within or related to the gardens. Each committee has an expert from TerraBIRDS to guide their work. The committees we have agreed upon this year are: ● Garden Beds & Soil ● Art & Storytelling	Each committee has an overall goal that relates to our Three Sisters gardens, and this will allow us to make the new gardens a reality. This helps us to divide up the labor and allows each group to specialize. We are also going to include the Native American Club at our school to help guide students in the Art & Storytelling committee to create a mural focused around the Three Sisters.

	• Researchers & Planners • Food farming and Irrigation	
Semester 2: Spring 2026		
Topic	**Details**	**Purpose**
Corn, beans, and squash starts	The seed varieties selected by the Researchers & Planning committee will be germinated in our classroom under grow lights. We may choose to run an experiment and see how different variables (watering, amount of light, etc.) impact the seedlings. Students will use the Native Seed SEARCH website to research and select complementary varieties of corn, beans, and squash (Seeds, n.d.)	Our school ends in May, and if we want to be able to establish and plant the Three Sisters gardens before then, it may optimize time to start the plants indoors. Plus, the larger seedlings are more likely to survive through the hot, dry month of June.
Continued Committee work: research, plan, and engineer the Three Sisters garden spaces and Plant the Gardens!	This work will happen during our spring work days with TerraBIRDS. We will continue in committees and focus on the establishment of three separate Three Sisters gardens- one for each section of Honors Biology.	TerraBIRDS expertise will guide us to plan and prepare the garden beds, amend the soil, and plant the corn, bean, and squash seedlings. Individual groups may also choose to add additional companion plants to their garden.
Braiding Sweetgrass Chapter: *Epiphany in the Beans*	This short chapter talks about finding joy in harvesting food you've planted and how the earth loves us back.	This is a strong epilogue for students to read after they've planted their gardens. We will talk about how they have made a gift for the next year and how they have received gifts from the land throughout this process.
*Summary Project: Ethnoecology of a Three Sisters Garden	In this differentiated assignment, students will summarize their work on this project. They will select one of the following options and be prepared to share it at the garden celebration: • An interview with an elder or relative about planting or preparing corn, beans, and squash • A video about planting a Three Sisters garden	This will encourage students to reflect on this year-long process and what it has meant to them. The differentiated format allows for creativity and honors student choice. There will be motivation to have these projects completed in time for the garden celebration.

	● A piece of interpretive art for the garden or outdoor bulletin board ● Preparing a dish to share with corn, beans, and/or squash and providing the recipe	
Garden Celebration & Community Gathering	We will invite student families, FHS faculty and staff, TerraBIRDS and the Native American club to a garden celebration. It will be an opportunity to bring more people into the gardens and highlight the projects and products that students created. Plus, we will have food to share! And all gatherings are better with food, especially when it is made with good intentions and shared together.	I think this is an element we often miss in my class- taking the time to reflect and celebrate. Students will have put significant time and effort into this project by the end of the year, and this will allow them to share that work with their families and our school community.

*Topics: **Braiding Sweetgrass Chapter: *The Three Sisters* and Three Sisters Garden Nutrient Exchange Models**

Standards

Arizona State High School Science Standards

Essential HS.L2U1.19
Develop and use models that show how changes in the transfer of matter and energy within an ecosystem and interactions between species may affect organisms and their environment.

Plus HS+B.L2U1.3
Use mathematics and computational thinking to support claims for the cycling of matter and flow of energy through trophic levels in an ecosystem.

See below for details about how I will ask students to approach the Three Sisters chapter. The first document is a guide to help students organize their thoughts as they listen to and read along with the audiobook. The second document details the nutrient exchange models that students will make. The models should reflect the interconnectedness of the species in the garden. The format also allows for student choice and creativity.

The Three Sisters: An Investigation into Plant Symbiosis *Name:* _____

As you read or listen to The Three Sisters chapter from Braiding Sweetgrass, fill in details about each of the plant species that are part of this garden in the columns below. Include information about how each plant contributes to the garden and what it offers or provides to the other plants. Drawings may be included. Please write down as many details as you can, as this will help you with the activity tomorrow. You are welcome to look up other information on your own to support what is in this chapter.

Plants in a Three Sisters Garden		
Corn	*Beans*	*Squash or pumpkin*

Thanks for writing lots of details! Quick check- did you talk about **nitrogen** in your notes above?

If you didn't, please look back and add in information about this important element and how it relates to species in a Three Sisters garden.

Three Sisters Garden Nutrient Exchange Model

Please have ready:

- Your copy of the Three Sisters chapter from Braiding Sweetgrass
- Your note sheet from yesterday
- Your ipad
- A legal size/large piece of paper

Your goal is to represent the plant interactions within a Three Sisters garden by creating a model on your paper. You may be as creative as you like, but keep in mind that this is due by the end of the week and your model needs to include the elements listed below. There are assorted craft supplies you are welcome to use on the table in the back of the room.

Here are the elements that need to be included (check them off if you want to be sure you included them):

____ An appropriate title

____ A central image or drawing that includes all three species (corn, beans, and squash)
(Look up some examples online to help you)

At least **three** details about what each species contributes to the garden (either above of below ground) This means there will be a total of 9 contributions either labeled or written around your central image:

____ ____ ____ Contributions from corn

____ ____ ____ Contributions from beans

____ ____ ____ Contributions from squash

____ A quote from the chapter that is meaningful to you. Put quotation marks around the quote and list the page number where you found it.
Example: "The most important thing each of us can know is our unique gift and how to use it in the world." (page 115)

____ Your first and last name on the back of your model

*Bonus points are possible if you incorporate:
Color/extra detail in your image
The vocabulary word **reciprocity** or **reciprocate**

Thank you for working on this! It is not an easy task and I am asking you to incorporate many details into one page. Please be mindful of creating your own, unique model and not a copy of someone else's model.

I cannot wait to see what you create!

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*Topic: **TerraBIRD Garden Committees**

Standards

9th-12th Diné Cultural Standards

Concept 2: Natat'á

PO3: I will practice respect of nature in my daily life.

Arizona State High School Science Standards

Plus HS+B.L4U1.2

Engage in argument from evidence that changes in environmental conditions or human interventions may change species diversity in an ecosystem.

Essential HS.L2U3.18

Obtain, evaluate, and communicate about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.

Ahead of our work sessions with our community partner, TerraBIRDS, I will ask students to select the committee they want to join. They will spend 4 days working together over the month of September. A description of each committee is listed below. After each work day, students will complete a reflection that describes what they worked on and how it contributes to the overall garden project.

From the form where students will select their committees:

Starting next Tuesday, we will have 4 garden sessions with our community partner, TerraBIRDS. We have worked together to create these committees to support our Biology curriculum and to divide up our efforts so we can accomplish many things in a short amount of time.

Please read over these categories carefully before making your selections.

Art and Storytelling

This committee will spend about half the time visioning and planning, and the half the time creating an art installation focused around the theme of a Three Sisters Garden. This committee will collaborate with the FHS Native American Club and is led by a professional illustrator. Choose this committee if you want the challenge of telling a science story through an artistic lens. Creativity and patience required!

Garden Beds & Soil

This committee will work on amending(repairing) soil and designing and preparing some new garden beds. Choose this committee if you are willing to get into the dirt and carry out some labor-intensive projects. Safe use of tools and cooperation required!

Garden Planners & Researchers
This committee will be planning out and designing the new Three Sisters garden and will also choose the specific species of plants and order the seeds that will be planted in the spring. Choose this committee if you are good at making decisions, enjoy doing a little bit of research, and want to learn more about botany. Visioning and wonder required!

Food Farming & Irrigation
This committee will be harvesting a variety of foods that were planted last semester, possibly preparing samples for everyone to try, and learning about culinary garden techniques. This group will also help with irrigation for the garden beds and possibly establish a watering system in our gardens. Choose this committee if you want to learn about local foods and enjoy digging in the soil. Teamwork and problem-solving required!

After each workday in the garden, students are asked to complete a reflection sheet. The four reflection sheets for this semester are shown below. They are structured to follow the steps of the Diné Educational Philosophy (Garrison, 2007) following the four directions and with the sequence of thinking, planning, implementing, and evaluating. This philosophy is referred to multiple times throughout our class and should be familiar to students.

Name: _____

Garden Workday 1: THINKING

Which representatives from Terra BIRDS are working with us today?

Write their names here: _____

Which committee are you on? _____

At the end of class, answer these questions:

Based on what you talked about today, what are some **goals** your committee has for your work together?

What do you think some of the **challenges** might be as you work toward your goals? Why?

Which garden did you work in today? (Pollinator garden or Life Zone Garden)

We are asking you to **commit** to maintaining, restoring, and improving the courtyard.

To support this commitment, what will you think about or notice or research this week so that you can be ready to help your committee next week?

Name: _____

Garden Workday 2: PLANNING

Which committee are you on? _____

Answer these questions at the end of class. If you don't have time, you may turn this paper in on Wednesday.

Imagine that Principal Miller meets you in the garden and asks you what your committee is working on. How would you explain it to her in a couple sentences?

How are **you**, specifically, contributing to the goals of your committee? What did you do today? How did it go?

What plans does your committee have for next week?

Where did you work today? *(Pollinator garden, Life Zone garden, classroom, other)*

What is one thing you think other students at FHS should know about the gardens?

Name: _____

Garden Workday 3: IMPLEMENTING

Which committee are you on?

_____

Answer these questions at the end of class. If you don't have time, you may turn this paper in on Wednesday.

How will the work of your committee benefit our community? Community can be ecological (all the species in the garden) and/or social (all the people at FHS).

Do you think your committee is meeting its overall goals? In what ways?
Have any of the goals changed since the first day?

Which courtyard did you work in today? What did **you** work on? Be specific.

What is one more-than-human relative (mammal, insect, bird, reptile, plant) that you think will benefit from the garden space where you worked today and how?

Name: _____

Garden Workday 4: EVALUATING

Which committee were you on?

_____

Now that we have concluded our work days for this season, please take some time to reflect on our month-long garden projects.

1. What do you think is the most important thing your committee accomplished during this project? **Why?**

2. What will you remember most about what you worked on? **Be descriptive.**

3. In what ways did your committee contribute to the Three Sisters theme? **Explain and give examples.**

4. What are some things you **predict** will happen to the gardens over the course of the winter season? Try to envision the places where you were working and really think about what might happen there. What processes might occur? What animals might make use of the area? How do you think people might have an impact?

5. **Circle** one of these terms and then **describe** how it relates to you and to your work on this project:

Reciprocity Relationship Responsibility Respect

6. Are you interested in staying with the same committee next season or does something else appeal to you? **Explain**. Do you want to propose a new committee now that you know more about the gardens?

*Topic: **Summary Project: Ethnoecology of a Three Sisters Garden**
Standards:

9th-12th Diné Character Standards
Concept 4: T'áá ałtsoní baa ahéédh nisin dooleeł (I will express gratitude in everything)
PO 4: I will express and be grateful for cultural wisdom

Summary Project: Ethnoecology of a Three Sisters Garden

Can you reflect on your involvement with our Three Sisters Garden project throughout this year? What will you offer as a final contribution?

These final projects will be shared at the end of year Community Garden Celebration and so they must be completed by May 12 (one day before the celebration).

1) **Begin by choosing one of these contributions** *(circle your choice)*:

Writing up the results of an interview with a family member or elder about planting or preparing corn, beans, and squash	Submitting a video or stop-motion summary about the process of planting a Three Sisters Garden
Creating a piece of interpretive art for the garden or the outdoor bulletin board	Preparing a dish to share at the Community Garden Celebration and providing the recipe
Volunteering to plan & host the Community Garden Celebration	Propose your own contribution *(please get approval before moving forward)*

2) **Plan and create your contribution:**

You will have in-class time on April 30, May 1, and May 4 to work on this. Other work will need to happen outside of class time.

Turn this paper in WITH your final product.

If your submission is on canvas (because you are making a digital product), place a checkmark here: ____.

Your score will be recorded using the rubric on the back of this paper. Please look over the rubric before you begin so that you know what needs to be included.
Have fun and remember to be productive with your time!
Please let me know what materials you may need so that I can have them ready on our work days.

Criteria	Exemplary (5 pts)	Proficient (4 pts)	Developing (3 pts)	Beginning (1–2 pts)
Content & Accuracy	Work clearly shows understanding of corn, beans, and squash symbiosis. Information is accurate, detailed, and thoughtful.	Shows understanding with mostly accurate details; minor gaps or errors.	Shows partial understanding; some inaccuracies or missing key points.	Little evidence of understanding; significant inaccuracies or omissions.
Creativity & Engagement	Presentation is highly original, engaging, and connects strongly with the audience.	Creative and interesting, with a clear effort to engage.	Some creative elements; limited effort to engage.	Minimal creativity; presentation feels incomplete or rushed.
Connection to Tradition & Purpose	Strongly connects to cultural or practical importance of the Three Sisters. Purpose is clear and meaningful.	Connects to tradition/purpose, though may be somewhat general.	Some connection to tradition, but underdeveloped or unclear.	Little or no connection to tradition or purpose.
Quality of Work & Effort	Work is polished, well-prepared, and demonstrates significant effort.	Work is complete and shows clear effort.	Work is somewhat complete but may lack polish or preparation.	Work is incomplete or shows minimal effort.
Reflects Your Own Work	Project is clearly in your words (not AI generated and not copied from a website) and is unique compared to other projects in the class.	Project appears to be partially AI written or copied from sources and/or is similar to a peer's work.	Project appears to be mostly AI written or copied from sources and/or is very similar to a peer's work.	Project does not reflect original work and is clearly copied from other sources.

This unit incorporates these principles from the Culturally Responsive Assessment of Indigenous Schooling
(CRAIS) Tool and was written with these principles in mind (Castagno et al., 2021):

- Indigenous people are represented as contemporary (not only historical)
- Traditional and/or cultural knowledge is included
- Diverse narratives and perspectives are integrated
- Encourages students to understand themselves within broader communities

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