

Cultural Identity, Relationship to the Environment, and Environmental Restoration

Saving Pinyon /Juniper Trees on the Navajo Reservation

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Context and Rational

I chose to write a curriculum unit that attempts to teach students about their relationship to the Environment, and Environmental Restoration in order to put out a message to save pinyon/juniper trees on the Navajo Reservation. Students will disseminate what they learn in various ways to get the message across the whole Navajo Nation. This unit will address issues of real life concern, relevance, interest, and consequences to the woodlands on the Navajo Reservation. Students need to understand the threats to these woodlands, develop an appreciation for their role in Diné culture historically and today, and learn what they can do to protect these forests for future generations and the betterment of our Navajo Reservation.

Two summers ago I participated in a curriculum writing workshop to learn about the southwest white pine trees (SWWP). Students will research conservation management efforts about white pine trees. I will pass on to my students what I learned from the SWWP tree studies so they can be the change agents that conserve the pinyon /juniper trees on the Navajo Reservation.

To help protect the southwest white pine trees, researchers including, Dr. Waring and Dr. Sniezko, are working with a team to improve our understanding of the natural genetic resistance and environmental tolerance found in these trees and how management strategies can be beneficially utilized. They have concluded that management strategies such as identifying sites where planting seedlings with genetic resistance to the pathogens, pruning lower branches and (Silvi culture), and establishing risk management zones can prove beneficial (Waring and Sniezko, 2017).

By addressing these concerns, the high school students will learn about self- advocacy and determination. This project-based learning curriculum will cover pinyon-juniper tree mortality from climate change, pathogens, and human factors because the Navajo Reservation is located in a small reserved area and the forest plays a vital role in Diné livelihoods through social, cultural, spiritual, subsistence, and economic factors. Students will research management strategies that they identify through research to educate the Navajo Nation about maintaining and preserving trees for future generations.

I chose to develop this unit topic about saving pinyon /juniper trees on the Navajo Reservation because I would like the young Diné generation to feel that they and the land are one again so they can preserve the all the fauna and flora on the Navajo Reservation for future generations.

The Navajos rely heavily on pinyon pine nuts, which had significant nutritional value and contained proteins, carbohydrates, fats, and two amino acids that are present only at low levels in other regional indigenous plant foods (Litzinger, 2003). Pinyon trees give us pinon nuts to eat. Pinyon sap is used to polish and strengthen bows, placed on abscess sores to clean out the pus and dried tree sap as chewing gum. Ceremonial dances such as the Yei' be chei dances use a softer needle conifer to use for the herbal sauna bath for the patient. The Yei'be chei place conifers around their necks during their dances. Mushrooms growing on the oak and other conifer trees are used for cancer treatments as medicine.

The Diné people have found many uses for Juniper. Pinyon-juniper, and associated species of vegetation continue to be harvested and utilized by modern peoples today. Juniper trees were used to make cradle boards. Burned juniper ash was used as a food coloring for blue corn mush. The trees are also used for arrow shafts, weaving tools, and bundles of juniper bark. They take

advantage of the juniper's medicinal qualities, which include the treatment of stomach aches, coughs, and headaches. The dried seeds can be used for beading necklaces and bracelets. Juniper trees are used for firewood, to build hogans, fence posts for the cornfield. Juniper is burned as incense during ceremonies and the leaves boiled for cold remedies. Juniper trees were also used to make cradle boards (Kelley & Francis, 2019).

In sum, the goal of this Diné curriculum is to teach Diné high school students about the status and threats to the pinyon and Juniper trees growing on the Navajo Reservation. This curriculum unit involves hands-on activities and independent research and can be adapted for many different learning groups and abilities. My Diné curriculum is integrated with western science and will address a high school science curriculum that includes biology, geology, math, social studies, language arts, and Diné culture. Additionally, I hope to inspire students to pursue scientific careers such as scientists studying pathogens from invasive species or foresters with the Navajo Department of Forestry where they can protect trees. I also want my students to become Diné culture teachers that continue to share this curriculum and promote learning relevant to real life.

Classroom Demographics:

Pinon ([Navajo](#): *Be'ek'id Baa Ahoodzání*) is a city located in Navajo County, Arizona. Pinon has a 2020 population of 738. Pinon is currently declining at a rate of 0.01% annually and its population has decreased by 18.36% since the most recent census, which recorded a population of 904 in 2010. Pinon reached its highest population of 972 in 2013. The average household income in Pinon is \$57,095 with a poverty rate of 23.98%. The median rental costs in recent years comes to \$473 per month, and the median house value is \$69,100. The median age in Pinon is 30.9 years, 25.6 years for males, and 36.6 years for females. For every 100 females there are 92.7 males. Pinon is located at 36°6'3"N 110°13'10"W (36.100862, -110.219387). Pinon's Navajo Name is *Be'ek'id Baa Ahoodzání* translated into "a man-made dugout well close to a manmade earthen dam." Surprising to say, I reside about a half a mile south of the well. Pinyon trees and Juniper trees feature the landscape. The elevation for Pinon is 6,500 feet. Pinon is also called "where the highway ends and the wild west begins" because the pavement to Flagstaff ends in Pinon. Most of the roads are dirt roads that lead out of Pinon to Flagstaff, Chinle and Kayenta.

Pinon was established in 1830. Clifford McGee Sr. was the first trader at Pinon. Conoco gas station, Bashas, Subway, Pizza Edge, a car wash, a laundromat, and the Post Office make up the economic center of Pinon. Piñon Unified School District serves the area with Piñon Elementary School, Piñon Middle School, and Piñon High School. Pinon Community School Dormitory houses less than 50 students who attend the local public schools and six kindergarten classes. Pinon Health Clinic, Senior citizen center, Pinon Chapter house, an LDS Church, a Mennonite Church, and a Catholic Church completes the community. Two campuses were built by the Navajo Housing Authority for low income families. Kerr McGee's Trading Post has been demolished since 1990 (Kelley and Francis, [A Diné History of Navajoland](#), 2019).

I will be teaching high school algebra and geometry to ninth and tenth grade ESS students who have specific learning disabilities in the ESS Resource classroom for math at Pinon High School. The majority of the students are Diné, with two who are white. Four out of seventeen students fluently speak the Diné language. Most of the students are boys and five are girls. The students are in ESS math class to get math credits for graduation. Three of the boys are 12th graders, five

are eleventh graders, five are 10th graders and four are 9th graders. Most of the Navajo students ride the bus to and from school each day. Three of the students are housed in the dorm.

The curriculum unit will be taught during one of the homeroom study periods that would fit in with the general teaching schedule. The best time of year for which the curriculum unit is well-suited would be during the first quarter.

Content Objectives: Identity, Home and Belonging

One of the Navajo traditions is identification with the land. The reservation is more than a place to live; traditional Navajos feel that they and the land are one (Patricia, 2000). The Diné People have lived off the land for thousands of years, they have managed their natural resources by using only what was needed to survive. By taking care of the land, the land in return has taken care of the Diné people. The Diné lived as one people, providing for each other, learning from elders about unity, living as one people. Hunting, gathering and using resources were important activities for survival, not only as food but as a foundation for their traditional and cultural identity. The ability to continue this way of life has been short lived and was a great concern when new people came. The Diné people used both the traditional and the modern methods to limit their subsistence way of life style and they preserved the way of their culture while adapting to what is useful from the Western world.

Times have changed. These changes are affecting the Diné people, and their cultures in both positive and negative ways. New people have arrived, competing directly and indirectly for resources, such as such as uranium, oil, coal, wood, water and our land, on the Navajo Reservation and changing the way Diné interact with the land:

Our traditional relationship to the land and their environment as the essence of their identity as Diné people is broken because of modern education, many Diné people have moved away from a practiced and conscious relation with place, language ceremony, attitudes, and respecting the land (Cajete, 1999).

Our traditional way of conserving the natural resources is no longer adequate. We live in a shrinking world, and our use of resources, development activities, and politics impact the resources we rely on. State and Federal laws together with traditional Native laws could reduce the impact of our depleting subsistence. We must understand that subsistence is a human right that should not be taken away (Alaska).

A number of contributing factors are important to understand as background information in order to bring about change: assimilation efforts, deforestation, and climate change.

Assimilation:

According to Patricia Cronin Marcello,

Diné children were sent to boarding schools and forced to adapt themselves to a mainstream social, political, and cultural system that is not their own. The white society did not understand nor respect them or their traditional ways. Boarding school meant complying with the government's BIA policy by assimilating us into the white way of life. Students had to comply and adapt to the white man ways many Navajo children

moved away from their relationship with the place and forgot their traditional ways and language. The Diné peoples are exploited and oppressed and suffer the loss of self and culture when dealing with hardly any jobs available on the reservation, alcoholism, one-parent families or grandparents raising their grandchildren. (Patricia Cronin Marcello, 2000).

It is important to understand that environmental degradation from pollution, poverty, and alcoholism is the result of the loss of the interconnectedness with the land (Cajete, 1999). There is a need for Navajo people to work with the forestry department as a way to reverse some of the impacts of assimilation that have separated Diné people from the land.

Students need to understand and realize that all the plants growing on the Navajo Reservation are important and should be preserved for future generations' use, and, moreover, the knowledge they learn can make positive contributions to our Navajo Nation. Students need to understand that if we don't change our behavior, we may lose our pinyon-juniper woodlands. Students will realize that the increasing temperature is causing drought and the trees are under stress and with stress come the pathogens like the bark beetles on the pinon tree and parasitic mistletoe on the juniper trees.

This culturally responsive curriculum for high school students will awaken them to the myriad problems pinyon-juniper woodlands face in this twenty-first century. This hands-on project-based unit will expose students to ways of thinking and scientific tools that will enable them to understand these forests better through Diné culture and western science. This Diné Curriculum is intended to promote Native students' awareness of threats to plants and vegetation on the Navajo Reservation.

Deforestation:

The Diné people were placed on a reserved land that is limited in size. The Navajo Forestry Department has a poster titled: "Navajo Nation Firewood Cutting Season" (Shirley & Shelly, 2011). The poster describes how every year people come to the Navajo forest and woodland areas to harvest their year's supply of firewood. It also details the rule that The Navajo Forestry Department requires any person harvesting firewood for personal use or resale to obtain a forest product permit. However, this announcement does not indicate where to cut the trees and most Navajo people do not go to the Navajo Forestry Department to obtain a permit anywhere on the Navajo Nation. Consequently, trees are cut down illegally (Shirley & Shelly, 2011). The concern here is excessive cutting down of pinyon-juniper trees without a permit and selling the trees for profit. Juniper trees has long been favored for firewood. No forest management strategies, like replanting trees, are communicated to the Navajo people from the Navajo Forestry Department.

Additionally, throughout the southwest and in other countries grazing has impacted the landscape dramatically. When there are too many cattle in one small area the vegetation is depleted, and the soil is altered too much due to grazing, dramatically altering the landscape. The Diné people are placed in a small reserved land with a growing population of Diné people and their live stocks, and the land cannot sustain the vegetation and mineral resources in the same way it once did. Currently, the Diné population is 173,667 according to the 2010 census count. Such population also means that livestock is also causing overgrazing of vegetation. Overgrazing has depleted most of the vegetation, and native trees like Pinyon-Juniper trees are cut down to be sold for firewood and fresh branches cut down for ceremonies.

Climate Change:

We cannot control Mother Nature, though we can learn about the human and industrial impact on the earth. Climate change, for example, is causing drought stress on plants and making them more vulnerable to pathogens and disease (Waring & Sniezko, 2017). Ponderosa Pine, (Nidischii), Pinyon (Cha'ol), fir trees (Choi'), and Juniper (Gad) are conifers that are native to the Navajo Nation. Pinyon-juniper woodlands face more immediate threats from the effects of climate change, livestock grazing, and deforestation. These conifers are habitats for animals and food for wildlife. Pinyon/Juniper trees prevent soil erosion, they are natural windbreakers and gives off oxygen and takes in carbon dioxide. A single tree has different habitats for many different animals. Junipers grow in some of the most inhospitable landscapes, thriving in an environment of baking heat, bone-chilling cold, intense sunlight, little water and fierce winds.

Often they appear to grow straight out of solid rock. On the Colorado Plateau, the Juniper, along with pinyon pine, grows at an elevation between 4,500 and 7,000 feet above sea level Canyonlands (Herbert, 2018). Pinyon/Juniper trees prevent soil erosion, they are natural windbreakers and gives off oxygen and takes in carbon dioxide. A single tree has different habitats for many different animals. Junipers grow in some of the most in hospitable landscapes, thriving in an environment of baking heat, bone-chilling cold, intense sunlight, little water and fierce winds. Junipers grow very slowly. When they are 50 years old they are only 5 feet tall and they live from 350 to 700 years old (National Park Services, 2018). The U.S. Fish and Wildlife Services along with the Navajo Nation Forestry conducted a ten-year forest management plan to work together to develop a range management plan to incorporate conservation measures for the evergreen trees that grow on the Navajo Reservation.

Teaching Strategies for Traditional Knowledge in Class Setting.

The strategies that will be used in this curriculum will incorporate various differentiated techniques using heterogenous grouping participation. Lessons will be delivered to the whole class and in small groups, while the assessments will be completed individually. The week's lessons will make use of the following approach: "I do" (teacher input), "we do" (teacher and students practice), "you do" (student individual work).

KWL is a research strategy. The approximate acronym stands for "What I **Know**," "What I **Want** to Know," and "What I **Learned**." KWL is also used as a reading comprehension aid. The KWL will be used as the anticipatory set to motivate the students and to find out students' prior knowledge of the topic of study.

Differentiating Instruction Using Menus:

Menus will be used for differentiating instruction to provide numerous types of leveled menus that lower- and on-level students can use to select exciting products to demonstrate learning.

Project-Based Learning (PBL)

PBL is a teaching strategy that includes collaboration/interaction/comprehensible input. Students must work in pairs/groups to complete Project Based Learning. On-going communication is fostered between partners and teacher to talk about the project chosen from the menus. Ongoing feedback between students and teacher on a daily basis to revise, modify and elaborate between

students. Students share decision-making in their team, and reflecting on their progress to conduct further inquiry.

Essential PBL project design Elements:

- **Challenging Problem or Question:** The PBL project is framed by a meaningful problem to solve or a question to answer, at the appropriate level of change.
- **Sustained Inquiry:** Students engage in a rigorous, extended process of asking questions, finding resources, and applying information.
- **Authenticity:** the project features real-world context, tasks and tools, quality standards, or impact- to speaks to students' personal concerns, interests and issues in their lives.
- **Student voice and choice:** Students make some decisions about the project including how they work and what they create.
- **Reflection:** Students and teachers reflect on the effectiveness of their inquiry and project activities, the quality of student work, obstacles and how to overcome them.
- **Critique and Revision:** Students give, receive and use feedback to improve their process and products.
- **Public Product:** Students make their own project work public by displaying and/or presenting it to people beyond the classroom.

Graphic Organizers/Comprehensible Input:

Graphic organizers are teaching strategies that provide conceptual clarity for information that is difficult to grasp and used to identify key content concepts and make relationships among them. Outlines are used to equip students with a notetaking skill while reading for research. Study guides lead students through their tasks.

- Compare/Contrast/Venn Diagram
- Concept map: webbing, KWL,
- Project management log (PBL)
- Project work report/individual & team (PBL)
- Presentation day checklist (PBL)
- Project team contract (PBL)
- Project presentation audience feedback (PBL)
- Self-reflection on project (PBL)
- Teacher's post project review (PBL)

Teaching Strategies for Distance learning.

Students will be offered printed lesson material for each lesson. Recorded teacher videos that simulate the classroom lecture or demonstration experience so that students who learn better by hearing and seeing have that opportunity. There will also be dedicated Zoom meetings two to four times a week, in order to offer students a "give-and-take" forum that allow them to ask pointed questions about lesson material. The teacher will be continuously available via email, classroom phone, cell phone, texting, etc. if any student needs to contact us.

STEM Disciplines:

STEM (Science, Technology, Engineering and Mathematics) disciplines will be integrated to address issues of real-life concern, relevance, interest, and consequences in this curriculum unit.

Technology:

- Computers
- iPad
- iPhone
- Tape recorder
- Document Cameras
- Online Virtual lessons, assignment with Google Classroom, Google form, Google lab sites
- Phone calls
- Email

Practice and Application

- Students practice what they learn before presenting product to their Audience (PBL) During the school closure because of the Pandemic. Virtual online learning will be used between the teacher and student.
- ZOOM
- Google Classroom, Google Forms, Google sheets
- Prezi
- YouTube

Supplementary Materials:

- Hands-on manipulatives: hand lens, rulers, poster paper, markers, and scissors
- Realia: pinyon and juniper branch or seedling
- Pictures: pictures of pinyon seedlings
- Visuals: maps, elevation maps
- Multimedia: tape recorders, iPhone, computer
- Demonstrations: oral presentations
- Related Literature: children's books, Robin Kimmerer's essay on sweet grass,

Classroom Activities:

Week 1: Monday:

Challenging Problem or Question: How do we preserve pinyon-juniper trees from pathogens and illegal tree cutting within the Navajo Reservation?

I do. You are a scientist specializing in biology. You will find out what is killing the pinyon-juniper trees and find management strategies to save the trees. Describe the importance of the issue by using the KWL to find out what students know and want to know. It is your job to work together to make sure that you are ready for a presentation, about the need for a tree management strategy, to the Navajo Resource Committee.

Anticipatory Set: Teacher shows a video showing pictures of pinyon/juniper diseases, reads the poster on how to get a permit to cut trees, projects the size of the Diné reservation.

We do. Teacher writes down students' answers to what they know and want to know on a large lined piece of paper.

You do. Students reflect on how the themes connect to their own experience. Students make some decisions about the project including how they work and what they create.

Students choose an activity to complete from these menus:

1. Create a PowerPoint about all the different types of pinyon/juniper diseases. PowerPoint should have pictures, definition and three other pieces of factual information about each disease.
2. Research all the non-native species on the Navajo Reservation and create a board game.
3. Write an acrostic or a poem about Navajo, identity, home and belonging on the Navajo Reservation.
4. Create a collage of pictures about the anatomy of a pine tree and words that represent each part and a sentence that explains each picture.
5. Create a PowerPoint about how pinyon and juniper trees are used by Navajos.
6. Create a collage of pictures about the different evergreen trees on the Navajo Reservation and how they are used by people and animals.
7. Write to a newspaper editor to "Get the Word Out" to educate the Navajo Nation about to save the pinyon-juniper trees on the Navajo Reservation.
8. Show PowerPoint show on climate and elevation where pinyon-juniper trees grow.
9. Create a PowerPoint presentation to assess the short- and long-term management systems in place on the Navajo Reservation and propose to create forest management plans.

Week 1: Tuesday:

I do: The teacher gives directions and models an example on how to do an acrostic using their clan to have student write about their identity theory, home and place. Using an acrostic with clan and family tree. The teacher will read to the students Dr. Jeff Berglund: "A House Is Not a Home": Identity Theory, Belonging, and Ideas of Home" and Robin Kimmerer's "Braiding Sweet Grass."

We do: The teacher and students reflect on the reading. The teacher uses an example of how to use the acrostic with the clan to show identity. Teacher reminds students about their goal to come up with ways to preserve pinyon-juniper trees.

You do: The students write an acrostic using their clan to write about their identity as Diné, and home on the Navajo Reservation. Homework: Use a graphic organizer to obtain traditional ecological knowledge assignment from parents, grandparents or from other resources. Introduce facts about deforestation, pathogen and make it of a more urgent concern.

Week 1: Wednesday:

I do: The teacher will show a PowerPoint presentation on the physiology of a Pine Tree and identify the terminology for parts of a pine tree. Students will write in the correct words on a worksheet. The teacher describe importance of the issue by revisiting the questions. The teacher shows and models the Physiology of a pine and juniper tree. Students reflect and share homework on gathering traditional Ecological Knowledge assignment.

We do: The teacher uses a graphic organizer to record what students' Native cultural/traditional/modern ways pinyon- juniper trees are used by Diné people.

You do: The students work in pairs to list Native cultural/traditional/modern ways pinyon-juniper trees are used by Diné people.

Week 1: Thursday

I do: Anticipatory set: It is your job to work together to make sure that you are ready for a presentation to the Navajo Resource Committee so they can hear about the explanation of tree management. Students are grouped heterogeneously so each student can find ways to contribute to the team effort. Students are given a menu of ways to present their products. Students are given project management log (PBL) worksheet.

We do: The teacher groups students and students are given project management log (PBL) worksheet. From this worksheet, students choose a task from the menu to work on, and the team signs a project team contract. Teacher tells students that working with different people is what happens in the real world, so it is a good skill to practice.

You do: The students are given project management log (PBL) worksheet. From this worksheet, students choose a task from the menu to work on and the team signs a project team contract.

Week 1: Friday

I do: The teacher will review the worksheets that will be filled out by the students.

We do: The teacher walks around to help students to fill out PBL worksheets to familiarize students and to discuss any misconceptions.

You do: Students fill out the worksheets and ask questions. The teacher walks around to check for understanding. Students discuss who is responsible for certain menu tasks using the project management log (team tasks), and project work report (individual). Homework on how pinyon and juniper trees are used by Navajos.

Week 2: Monday

I do: The teacher goes over the menus and the topics for the products and research topics on the pinyon-junipers for the students. The teacher goes over criteria, rubric and topic assignments. Share a list of due dates and other details, including page-length, for the research paper.

We do: Students discuss research topics and the research check list and number of pages.

You do: Students start the research using the computers. Students discuss who is responsible for certain menu tasks using the project management log (team tasks), and project work report (individual).

After the KWL activity, students will get into groups of four or five and each student will choose a project from the menu. Students will be given time to read and process what the menus are about. Students will then be grouped according to the same menus they chose. One student will choose one of these Juniper species common in the intermountain southwestern states to read and gather information using a research rubric: **western juniper** (*Juniperus occidentalis*), **Utah juniper** (*J. osteosperma*), **single seeded juniper** (*J. monosperma*), **alligator**

juniper (*J. deppeana*), **redberry juniper** (*J. eythrocarpa*), and **Rocky Mountain juniper** (*J. scopulorum*). Except for western juniper, these species are commonly associated with **single-leaf pinyon** (*Pinus monophylla*) or **two-needle pinyon** (*P. edulis*).

Students will use Google websites to do their research on the juniper species. Students can go to other websites if they need more information.

Week 2: Tuesday:

I do: The teacher reviews the criteria, rubric and topic assignments. Teacher goes over the rubric for the letter to the newspaper editor.

We do: Teacher and students discuss and go over a sample letter.

You do: (Product): Write to a newspaper editor to "Get the Word Out" to educate the Navajo Nation about saving the pinyon-juniper trees on the Navajo Reservation. Reemphasize the importance of the issue. In your letters to the editor you will need to: 1. Present the problem. 2. Assess the short and long-term management systems in place. 3. Propose to create ways for forest management.

Assessment:

- Project work report: individual & team (PBL)
- Research topics chosen using an outline, checklist and rubric

Week 2: Wednesday

I do: Anticipatory set: Show PowerPoint on climate and elevation where pinyon-juniper trees grow.

We do: Students discuss research topics and the research check list and number of pages.

You do: Students start the research using the computers.

- **Assessment:** project management log (PBL)
- project work report/Individual & team (PBL)

Week 2: Thursday

Research topics. Collaboration in each group, using an outline, checklist and rubric.

Week 2: Friday

Video on climate change, and other human factors, Discuss the video and brainstorm human factors.

Week 3: Monday:

Video on pathogens, discuss which pathogens are common in the area students live. Have students bring in samples of pathogens of juniper trees or have them take pictures to show to the group.

Tuesday:

Students will share the pictures of pathogens and brainstorm ways to get rid of the pathogens to save the trees. Discuss management strategies that are used to preserve trees.

Wednesday: Video on climate change, and other human factors that contribute to invasive species.

Thursday: Discuss and plan how students will present the information to their audience to educate their audience about ways to preserve Pinyon and juniper trees. Review the rubric for the presentation.

Friday: Presentation to audience using posters, power point presentations, poems, etc.

Saturday: field trip to Flagstaff to do phenology on pine seedlings.

Assessments: See these forms in appendix/attachments

Research topics chosen using an outline, checklist and rubric assessment

- Project management log (PBL)
- Project work report/individual & team (PBL)
- Presentation day checklist (PBL)
- Project team contract (PBL)
- Performance task (PBL)
- Scoring guide, collaboration rubric and presentation rubric for 9-12 grade (PBL)
- Project presentation audience feedback (PBL)
- Self-reflection on project (PBL)
- Teacher's post project review (PBL)

Alignment with Standards

Arizona State Science Standards:

- HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- Standard-Arizona State science, math, reading, writing standards 9-12th grade and Diné Standards for 9-12th grade.
- ESL Standards: What to teach: listening, speaking, reading and writing in English

Common Core State Standards Connections:

ELA/Literacy –

- **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. (MS-PS4-3)
- **RST.6-8.2** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-PS4-3)
- **RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-PS4-3)
- **WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. (MS-PS4-3)
- **SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS4-1),(MS-PS4-2)
- **Math:** Mathematics – Measure and graph the length of pine seedlings and needles.
- **MP.2** Reason abstractly and quantitatively. (MS-PS4-1)
- **MP.4** Model with mathematics. (MS-PS4-1)

Navajo Cultural Standards:

The curriculum will reflect on the Navajo Nation educational standards which in turn will be linked to the Arizona standards address in the curriculum. This culturally responsive/relevant curriculum helps me achieve the 9th-12th Diné Character Building Standards: by engaging in the coordination of a plan that shows respect for the environment, students will develop and apply critical thinking to establish relationships with the environment (in alignment with PO 2) and will practice the Diné way of life with confidence (Diné Cultural Standards, Concept 2).

Culturally Relevant Curriculum:

This curriculum unit will address a culturally responsive schooling.

- Native nations’ goals of self-determination through self-education can only be realized if tribal leaders, community leaders, and educational leaders shape, determine, and facilitate the schooling of young people.
- Navajo Sovereignty in Education Act of 2005:

“The Navajo language is an essential element of the life, culture, and identity of the Navajo People...The survival of the Navajo Nation as a unique group of people and developing socially, educationally, economically, and politically within the larger American Nation requires that the Navajo People and those who reside with the Navajo people retain and/or develop an understanding, knowledge, and respect for Navajo culture, history, civics, and social studies.” (Diné Institute for Navajo Nation Educators, Faculty Lecture, Angelina E. Castagno, PhD, Director, DINÉ, Professor, College of Education “Culturally Responsive Schooling, What is it and Why it matters”).

Resources:

1. Cajete, G. (1999). *A people's ecology: Explorations in sustainable living*, Clear Light Publishing.
2. Cajete, G. (1999). *Igniting the sparkle*. Clear Light Publishing.
The book describes a culturally responsible science curriculum, which integrates Native American traditional values, teaching principles and concepts of nature with those of modern Western science.
3. Lee and Cajete, (2014), *Dine perspectives: Revitalizing and reclaiming Navajo thought Critical issues in Indigenous Studies*. Clear Light.
4. Farella. J. (1984). *The main stalk: A synthesis of Navajo philosophy*: The University of Arizona Press.
Farella's search of the myths that brings out the concept that includes the animating principles of the sacred mountains (p106), the pairs of beings within the lights in the cardinal directions.
5. Kelley, K. and Harris F. (2019). *A Diné history of Navajoland*. The University of Arizona Press.
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8. National Park Services. (2018), December, National Park Services. (2018), December 101110_Navajo Forestry Dept PSA - Navajo Nation Firewood Cutting Season
The Navajo Forestry Department requires the Navajo living on the Navajo Reservation to obtain a permit to cut firewood.
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<https://doi.org/10.1111/j.1467954X.2004.00442.x>
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11. Biological opinion on the Navajo Nation ten-year forest management plan, U.S. Fish and Wildlife Service, U.S. Dept. of the Interior, 2004.
12. Waring, K., & Snieszko, R. (2017). *Saving southwestern white pine trees from climate change and invasive pathogens*, USDA Forest Service.
A focus on conserving the Southwestern White Pine (*Pinus strobiniformis*) species, mainly by developing resistant populations and silviculture (forestry) management strategies.
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Factual information about junipers growing in Canyonlands, National Park Utah.

Attachments/Appendix:

1. PBL forms
2. Bud size
3. Ceremonial use
4. Data for recording pine seedling phenology
5. Picture of seedlings

Attachments/Appendix

P R O J E C T D E S I G N : O V E R V I E W

Name of Project: Preserving our Conifers		Duration: Approximately 3 weeks	
Subject/Course: Biology, Geology	Teacher(s): <i>Marjorie Beno</i>	Grade Level: 9-12th grade	
Other subject areas to be included, if any: Math, Reading and Writing			
Significant Content (CCSS and/or others)	<p>Biology Standards:</p> <p>HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.</p> <p>HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*</p> <p>HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*</p> <p>HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.</p> <p>Diné Standards</p> <p>HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.</p>		
21st Century Competencies (to be taught and assessed) augment list with details	Collaboration: Students must work in pairs to complete project		Creativity and Innovation: Development of script, storyboard and film
	Communication: Communication will be ongoing between partners, and		Other:

	with teacher. Students produce a poster			
	Critical Thinking: Analyze maps			
Project Summary / SCENARIO / TASK (include student role, issue, problem or challenge, action taken, and purpose/beneficiary)	<p>Introductory Paragraph Conifers are trees, trees are living species just like us. Plants reproduce like us. Plants are killed by pathogens just like us. Your job is to Your goal as a student is to study pathogens that are killing off our conifers on the Navajo Reservation. You have to find a way to preserve the trees for the future generation.</p> <p>Paragraph 1 – Introduce facts, comparing it to other data. Make it more urgent. (2 sentences)</p> <p>.....</p> <p>Pose a problem – One sentence, and pose one question.</p> <p>We need to understand that there are different types of Conifers that grow on the Navajo Reservation.</p> <p>TASK</p> <p>G Your goal is to locate and research pathogens that are killing off conifers (juniper, Ponderosa, pinon trees) on the Navajo Reservation.</p> <p>A Your audience are high school students</p> <p>S understand how the Navajo people used conifers for food, shelter, medicine, tools, etc.</p> <p>P Your product will be a video presentation along with a poster demonstrating what you have learned</p> <p>S Stories from</p>			
Driving Question /s (essential questions)	Are we the cause of the pathogens? How did our ancestors use conifers for food, shelter, medicine, ceremonies and tools? How might not studying pathogens on conifers affect our future?			

<p>Entry Event</p>	<p>Discuss:</p> <p>Bring pictures and examples of various pathogens on conifers.</p>	
<p>Products</p>	<p>Individual:</p> <p>Students will produce each of the following:</p> <ol style="list-style-type: none"> 1. formal research report 2. video script (6-6 minute video) about various conifers effected by pathogens 3. write letters to the Navajo Resource 4. write to the <i>NavaHopi Observer</i> 5. Create trivial games for Navajo culture teachers 6. Write stories or poems about home and place on the Navajo Rez. 7. create children's books. <p>Multiple Genres</p> <ol style="list-style-type: none"> 8. Poetry 9. Short Fiction 10. Non-fiction essays 11. Novels 12. Documentary 13. Narrative films 	<p>Specific content and competencies to be assessed:</p> <p>The project provided the occasion to assess online research skills for research paper writing, script writing, storyboarding, film-making, and communication through a written report. We discuss several of these areas below.</p> <p><u>Use of library time</u> We gave students a form to determine if there was enough information on their original idea. This form was also used to assess how much work was done in the library (see Appendix VI.2). If the student was unable to find enough information to fill out the form, then he/she had to choose another topic on conifers.</p> <p><u>Script</u> The script was assessed according to how well it included the information presented in the research paper.</p> <p><u>Storyboard</u> Students had to have a storyboard with one frame every 5 seconds on average. The minimum movie length was 5 minutes. Each storyboard frame had to include a picture (cut-out) and a brief description, using the script as a reference, of what was going to be said while that picture was on the screen.</p>

		<p><u>Rough and final drafts of movie</u> A rubric for assessing the movie is included in Appendix VI.4. The same rubric was used to assess the rough draft.</p> <p><u>poster</u> A short checklist was used to ensure that all students were allowed as much creative freedom as they wanted while keeping the posters somewhat formatted. See Appendix VI.5.</p>
	Team:	Specific content and competencies to be assessed:

P R O J E C T D E S I G N : O V E R V I E W

Public Audience
(Experts, audiences, or product users students will engage with during/at end of project)

Students, Navajo people

Resources Needed

On-site people, facilities:

- university library access, Navajo Nation forestry, SWWP Research, NavaHopi Observer, Medicine men

Equipment:

- computers
- audio recording equipment
- Cell phone for pictures

Materials: Poster boards, markers,

Community Resources: Parents, and medicine men,

Reflection Methods
(Individual, Team, and/or Whole Class)

Journal/Learning Log

Focus Group

Whole-Class Discussion

Fishbowl Discussion

	Survey		Other:	
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Notes: Includes organizational processes, brain-based learning techniques, questioning strategies, differentiated assessment, and effective critique

PROJECT DESIGN: STUDENT LEARNING GUIDE

Project: Today's Machines

Driving Question:

Final Product(s) Presentations, Performances, Products and/or Services	Learning Outcomes/Targets content & 21st century competencies needed by students to successfully complete products	Checkpoints/Formative Assessments to check for learning and ensure students are on track	Instructional Strategies for All Learners provided by teacher, other staff, experts; includes scaffolds, materials, lessons aligned to learning outcomes and formative assessments
(individual and team)	Students will understand: <ul style="list-style-type: none"> • The historical • MLA formatting and research methods as well as the inside workings of a university library and advanced search engines. • the importance of storyboarding, scripting and revision in creating a final product 	VI.2 - Library Use Report Form Download PDF	MLA Formatting How to use the library and search engines for research
	Students will be able to: <ul style="list-style-type: none"> • create a 6-8 minute video explaining the concepts behind the historical context in a professional and coherent manner • conduct research and organize information in a coherent research report • to use research to create a script • music editor, recording technology and simple and complex picture editing tools • engage in peer revision and editing • use media to demonstrate learning 	<ul style="list-style-type: none"> • VI.3 - Peer Critique Activity Download PDF • VI.4 - Grading Rubric for Educational Documentary Download PDF • VI.5 - Poster Elements Checklist Download PDF 	

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Project Narrative

1. Select a topic
2. Research
3. Research the lifestyles of the inventors of the part or discovery and prepare to show in the documentary why the invention was necessary to their way of life. (See [Appendix VI.2](#) for a form for students to use during their initial trip to the university library. This form helps students decide whether there is enough information available to continue with their idea.)
4. Create a documentary using still photos and voiceover technologies. Video is optional. During the creation of the documentary, the student is responsible for the following:
 1. Find pictures to use in the documentary
 2. Obtain permission from the person or company that owns the copyrights to the pictures (no picture may be used without written consent from the copyright holder.)
 3. Write a script for the documentary. Possible pre-script writing activities:
 1. research paper
 2. read and analyze excerpts from a play
 3. watch all or parts of a documentary together in class
 4. students script a normal everyday event (e.g., script the conversation at the dinner table.)
 5. write a script that has a narrator and a main character but the main character is limited to the use of a single word.
 4. Create a storyboard for the documentary
 1. Watch a cartoon in class and have the students find examples of perspective (e.g., close up, extreme close up, wide angle, etc.)
 2. Watch a documentary and discuss the methods by which pictures enter and leave the screen. Ken Burns' documentaries serve well for observation and analysis.
 3. Teach the basic storyboard vocabulary (slug line, action line, dialogue, etc...)
 4. Create a short storyboard to match the "everyday event" script from the script writing activity listed above.
 5. Put together the pictures and voiceovers using Flash multimedia technology.
 6. Edit the script and documentary
 7. Engage in peer critique activities (See [Appendix VI.3](#))

8. Write a research paper to accompany the movie stating the research findings and origins of your apparatus
9. Burn the final product onto DVD

For more PBL resources visit **bie.org**

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2. Bud Size





3 Year Old Shoot



3. Ceremonial use

How Pinyon and juniper trees are used for food, ceremonial and other uses.

Juniper Picture	Food	Ceremony	Uses for Animals	Other Uses
				
<p data-bbox="71 883 212 911">Pinyon Tree</p> 				

1. Use the pictures to show to your parents, grandparents, other resources to fill in your answers under each heading.
2. Your chart will be graded using a rubric.
3. Be prepared to discuss your findings with peers at your table and whole class.
4. Share your findings with your group.

5. Picture of seedlings

