

Forests and Climate Change

Gad (Juniper Tree) in the Black Mesa Region

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Diné Institute for Navajo Nation Educators (DINÉ)

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Introduction

When I was young, my family and I were stranded in the area of Wheatfields Lake. Our vehicle would not start, and we were left to wait with my mother while my father went to get someone to fix or to tow our car back home to Kayenta. My mother cooked near the vehicle and we all slept in and near the car that night. Finally, my father returned and we all went home.

While we were stuck there, I was amazed and ecstatic to be surrounded by green grass and to see the beautiful variety of wildflowers. We had gotten stuck in a forest located in Apache County near the base of the Chuska Mountains. I could smell the freshness of green grass and the scents of pine from the forest. My siblings and I all bathed and waded in the stream nearby and fished in the lake. It rained and the smell of wet grass and pine was exhilarating and refreshing. I was amazed by my surroundings and had forgotten all about our home. It was hard to compare this forest to the semi-arid desert of my hometown of Kayenta.

Today, I am still fascinated with all the different types of forests. I want to instill in my students the desire to explore wooded areas and to use their sense of smell and sight to learn about their surroundings. I like to experience the woods by walking, analyzing, and smelling the various trees, plants, wildflowers, and wildlife. I want them to absorb the forests' sights and smells and to remember them. When I need to rejuvenate, I return to what I consider to be the most beautiful places on earth, the Uinta-Wasatch Forest in Northern Utah. When I visit the forest, I use my senses to get my peacefulness back, like with the practice of forest bathing (Clifford, 2018, p. 2).

Context

Kayenta is a rural town located in the northeastern area of Navajo Reservation in Navajo County Arizona near the border of four states (Arizona, Utah, Colorado, and New Mexico). The town has an elevation of 5,669 feet and a population of 5,129 people (United States Census Bureau, n.d.). The community members are predominantly Diné (Navajo). Interstate Highway 160 and 163 North are the two main streets that run through our small town.

Kayenta has three 3-star motels for tourists and locals to rest and relax. The town has several fast-food restaurants. There are three gas stations and one main grocery store. It also has one hardware store and two laundromats that are used by the community and outlying residents. Included with the tribal chapter house, Kayenta has a self-governed entity known as the Kayenta Township which was established in 1986. The town has one fire station with volunteer firefighters that are recruited from the community. Additionally, it has a law enforcement agency that includes a courthouse and a detention center, as well as the Navajo Police Department that regulates the community's and the surrounding community's safety. There is an Indian Health Service medical facility that serves the community and outlying areas.

Household income and business revenue in Kayenta have decreased after the Black Mesa Mines closed. While bad for the environment, these mines employed much of the community. Many

people who had worked for the mines have relocated or transferred to surrounding cities for employment. Some parents who had previously found work in the mines have left their children with relatives to continue their education out of town. The residents of Kayenta get some of their income from tourism at the national monuments. Second to tourism, the school district employs much of the community.

Kayenta Preschool is one of the four Kayenta Unified School Districts schools (we also have Kayenta Elementary, Kayenta Middle, and Monument Valley High School). There are approximately 1,560 students in K.U.S.D. based on school board minutes from June 9, 2021. Many of the students live within a fifty to seventy-mile radius of Kayenta. The students are bused in from Chilchibeto, Dennehotso, Shonto, Black Mesa, and southern Monument Valley. Most students ride the bus, but some parents who live within a two-mile radius drop their children off at school.

I teach preschool which includes special education. I have twenty students and of these I typically have four to six students who are considered special education. The majority of my students are four years old and most will turn five by the end of the school year. Most of my students are Navajo, and they all live in the surrounding area. Our school is located in the northwestern part of town, a short distance from the other schools (the elementary, middle, and high school).

Rational

Many of my students have experienced learning losses from the 2020-2021 school year due to the Covid-19 pandemic. Many of my students have had to stay home due to the virus, and while at home, they did not explore their natural home environment or venture out to explore other places. As a result, they stayed in their house while receiving their education. A few students did online classes through Zoom, but other students did not have adequate internet service, so they did not attend online class sessions. However, some students completed learning activity packets that contained academic materials at their grade level.

Some of my students had family members that fell ill during the pandemic. The pandemic caused trauma in students' lives. Some of my students experienced the loss of a loved family member or had to deal with the stress of having a family member become hospitalized. Additionally, some of my students caught Covid-19 themselves and it took them several weeks to recover fully from the illness.

Covid-19 took its toll because some days, students would feel better and other days they did not feel well enough for daily routines at home or with their education. When they did not feel well, they did not attend online classes or complete their instructional activity packets. This trauma caused learning losses and the regression of their academic knowledge. For example, one of my students and her entire family caught Covid-19. I was able to see her regress because I had tested her before she caught the virus. As a four-year old, she was able to write her first and last name

very legibly, and after she had Covid-19 and I assessed her again, she demonstrated writing her first name with a couple of letters missing and was not able to write her last name at all.

Another example of the effects of Covid-19 is a male student in my class. I witnessed differences in his alphabet assessments before and after he caught the virus. Before Covid-19, he was tested and was knowledgeable of all 26 upper and lower letters in the alphabet and could make all the sounds of the letters with no difficulty. After Covid-19, I assessed him again, and he struggled to recite 18 upper- and lower-case letters and their sounds and had difficulty using sign language to sign the letters.

During the Covid-19 pandemic, many students and their families experienced trauma from the loss of loved ones in their immediate and extended families. A child who is concerned about losing a loved one cannot focus on their education. As a teacher, I can relate to what these children are going through because I also experienced trauma when I was young. I remember how I would be in class and my teacher would show me words or math problems that I needed to learn, but my mind would linger on my home life and I would wonder what my next meal would be or whether I would have a good night of sleep. My lingering thoughts were due to my father's alcoholism and domestic violence. I remember how I would try to delay going home after school because of my stressful home life. Still, trying to delay rarely worked--I was expected to be home at a specific time. I empathize with my students and understand their traumas because of my own trauma that I experienced at a similar age. Through my own experiences, I know better how to accommodate their distress and educational needs.

Our school district utilizes a "First Things First" platform with many diverse books and teaching methods for young children. However, it does not have any books specifically for or about Diné students or families. As a preschool teacher, I have implemented many standards and teaching strategies to benefit our regular and special needs students. Many preschool students grasp concepts best through hands-on experiences. My Native students are primarily visual and physical learners. They learn through their senses and with repetition and from their teacher's role modeling.

In teaching about the forest, I use many visuals like books about various trees and their growth. This way students can visualize trees in their region to stimulate their innate knowledge. I explain how many older people in our community still utilize these trees in multiple ways. I teach the students that a tree is a plant and about what plants need to grow, like how they need soil to grow roots, and water and sunlight to grow leaves and fruit. My goal is to teach them that we have various plants and trees everywhere and for them to make connections with the plants they see everyday with what I teach them in class.

I also explain to my students that we have certain unique and native trees that grow here in our surrounding environment. For example, we have juniper trees (commonly called cedar) that are unique to the Southwest. Many of our ancestors have utilized the bark, leaves, roots, and berries of the juniper tree for food, medicinal and ceremonial purposes, fire, and as cradleboards for our babies, jewelry, and to build our hogans (a traditional Navajo home). I tell my students that many

other trees will not grow here because it is too arid. That because it is so dry, we have unique native trees that only grow in certain areas.

I want my students to venture out into the world to see and appreciate many types of forests, trees, and plants. I want them to go into the woods and to begin to use their senses. I can show my students various visuals and books about different forests, trees, and plants; however, to be in a forest expands their feelings. For them to feel the variety of plant and soil textures with their hands and feet, see the types of trees and plants, to smell the clean, fresh air, and to hear the quietness of nature is a much more valuable experience. I want my students to experience the sensation of Forest Bathing (Clifford, 2018).

Content Objective

My curriculum is about the juniper tree in the Black Mesa region. The elevation of Black Mesa ranges from 6,000 to 8,000 feet and the region encompasses approximately 4,000 square miles. In Navajo Black Mesa is called Dziłijjin. The dominant species of trees at the base of the mesa is the one-seeded juniper. The one seed is formed within the berry. The tree depends on the unique climate, topography, distribution, and growth conditions found in Black Mesa.

Junipers grow alongside pinyon pines, and what is called the pinyon-juniper woodland is found between 4,500 and 7,000 feet above sea level (*The Indomitable Juniper*, n.d.)). These trees grow in and above the canyons, buttes, and mesas. Junipers grow in some of the most arid landscapes; they thrive in intense heat, cold, winds and sunlight with very little water. Sometimes they appear to grow straight out of solid rock. Junipers can withstand drought conditions that often kill other plants. They are able to survive these harsh conditions because they have a very long and wide underground root system, accounting for two-thirds of the tree's total mass. A juniper's taproot can penetrate about twenty-five feet straight down in search of water. It can also send out lateral roots one-hundred or more feet from the tree. The seeds are exceptionally hardy, and when seedlings are knocked over by strong winds, junipers often continue to grow (*The Indomitable Juniper*, n.d.)).

Junipers typically live for 350 to 700 years, and rarely grow more than thirty feet in height or three feet in diameter (Allen, 2007). No two junipers look alike. Some are bushy, some have multiple trunks, and many have poorly formed crowns with a mixture of live and dead branches. Junipers can conserve water, self-prune, and stop nutrient supply to one branch in order to ensure the tree's survival (Allen, 2007))(*The Indomitable Juniper*, n.d.)).

The bark, leaves, and fruit of the juniper are distinguishable. The bark is gray or light brown and often hangs in loose, fibrous strips. The tree has oddly twisted trunks, with branches pointing in all directions. The leaves are dark green, flat, and scaly and do not drop in the fall. Their thick green foliage provides shade in an otherwise shade-less landscape. The fruit is a pea-sized, light blue berry which is found in a tiny pine cone covered with a drought-resistant, waxy coating. Juniper berries are a staple for jackrabbits, coyotes, and a variety of birds. The relationship

between junipers and these animals is mutualistic, the tree is helped as these animals disperse its seeds and the seeds provide sustenance to the animals (*The Indomitable Juniper*, n.d.)).

Bird species such as scrub, pinyon, and Steller's jays and small mammals like chipmunks and squirrels eat and digest the tree seeds and their digestive system coats and provides the moisture required to begin the seed's germination process. The moisturized seeds are excreted from their digestive systems and deposited onto the soil (*The Indomitable Juniper*, n.d.)).

Juniper Uses

The Diné people have utilized the juniper tree for medicinal purposes, including treating stomach aches, coughs, and headaches. Juniper is also used for aromatic smudges and incense. Many people burn juniper in their homes to purify their dwellings and relieve colds and respiratory problems (Barrie Kavasch & Baar, 1999). Smudges or smoking is a sacred practice used for prayer and purification by burning juniper with other herbs. The smoke is not inhaled, but bathed in. However, caution must be exercised and this should not be done in a closed or confined area and before use people should make sure that they do not have allergies or asthma, which can be aggravated by the smoke. It is also not advised for pregnant women, babies, or young children who might develop respiratory problems (Barrie Kavasch & Baar, 1999).

The juniper berries, leaves, bark, and twigs are used for numerous alignments. The berries are edible when they have turned a purplish color and have a sweet grainy texture, but are not as popular as pinyon pine nuts. Depending on the strength of the brew, medicinal teas made from juniper berries and green sprig are mild diuretics that produce relief for stomach problems, colds, constipation, and even rheumatism (Barrie Kavasch & Baar, 1999).

Another use of the juniper berry is its round, brownish seed. The seeds are dried, and a hole is bored into the seed to form beads, which the Navajos call "ghost beads." Beads are used in necklaces and bracelets to avoid seeing ghosts or having bad dreams (Barrie Kavasch & Baar, 1999). During the day, these can be worn around the neck or wrist as a decorative bracelet and at bedtime it is worn to ward off bad dreams. These beads are strung into cradleboards to ward off evil spirits and protect the baby.

Juniper logs are used to build ceremonial hogans (called cha'oh which means shade house), as fence posts, in the making of corrals, and in other structures. To create these structures, many juniper trees need to be cut down and their bark stripped. The twigs are used as digging and prayer sticks and as stirrers. The shredded bark is used for bedding and for kindling in campfires (Elmore, 1976). The logs can be used for firewood to heat homes and for cooking.

The leaves and small branches of juniper trees are burnt to ash and the ashes are used as a mixture in blue corn mush, blue fried bread, pancakes, blue cornbread and flatbreads. The ash increases the flavor of the blue corn and has a very high calcium content. Many of the Diné people and other minority populations have lactose intolerance and issues with calcium absorption. The ash input into our traditional foods has made it easier for many Diné people to increase calcium absorption. One gram of ash is equal to the amount of calcium in one glass of

milk and so the ash can help many Diné people improve their calcium intake and help their bone density (Christensen et al., 1998).

How Climate Change Impacts Juniper Trees

Climate change in Northeastern Arizona near Black Mesa has affected the majority of the juniper trees. These trees are stressed because of the extreme drought that has occurred with increasing severity in both the summer and winter months. Rising temperatures over the past several years have killed many juniper trees in lower elevations. The dead and dying trees have yellowish, dry, flat, scaly leaves and dry bark. Some junipers that grow in higher elevations are still healthy as long as the soil has moisture throughout the entire year, especially as long as it has moisture during the growing season (Nielsen, 2009).

Kannenberg, a forestry researcher, explains the process of how juniper trees slowly die from the lack of water in an interview about the drought in Arizona for an article in the *Arizona Republic*. In his research, Kannenberg has found evidence of damage to the inner hydraulic systems of the juniper trees. Trees transpire when water moves from the soil, through the plant, and out into the atmosphere (Delgado, 2021). The lack of water causes the soil to get drier which puts more stress on the vegetation's xylem to create the capillary action to push water up into the branches and leaves.

However, if the plant does not have enough water, this strain can cause air bubbles to form within the woody tissue of the plant. As Kannenberg states these air bubbles can "semi-permanently or permanently block water flow through a plant" and "if you are a plant that cannot move water, you are in trouble pretty quickly" (Delgado, 2021). Snow and rainfall create water reserves that build up during the winter and are essential for juniper trees. In the *Arizona Republic* interview, Kannenberg also explains that what we have seen in southern Utah and across the West is a considerable decline in winter precipitation (Delgado, 2021). Vegetation needs moisture reserves in the air and soil to survive the harsh, hot, and dry summers and because of climate change, these reserves are disappearing.

Climate change will continue its process, but we can slow it by reducing our carbon footprint. We can help vegetation like juniper trees by recycling water and practicing water conservation efficiently to reduce unnecessary water usage and waste. There is a water shortage in the West, and climate change makes the lack of water worse. Water efficiency is essential because no place and no one is immune from drought conditions. We need to be more thoughtful in how we use water resources to meet everyone's needs and we also need to think about the needs of vegetation like juniper trees.

Teaching Strategies

I teach pre-kindergartens who are four years old. Most four-year olds have a very short attention span. The longest I can keep them fully engaged is about eight to ten minutes. After ten minutes, I have to transition to another strategy to keep them engaged. I also teach online with Zoom and the Teaching Strategies Gold app. I have ten students in my class and five students who log in online. I begin my Zoom instructions at 8:45 in the morning.

In some cases, I am able to stay after school to accommodate student issues or to have extended teaching time with the students and their parents. In addition, students receive essential packets that assist their learning by using manipulative and visual charts as well as calendars, colors, shapes, numbers, weather charts, markers, crayons, paper, glue, and scissors. These visual and graphic organizers support my strategies and classroom activities.

I will read a book called, *Tree Count* by Trish Holland. The book contains colorful visuals of various trees, seeds, tree cookies, leaves, buds, cones, fruits, and flowers. There are four short sentences about trees and connections to counting one through ten on each page. This strategy is known as choral reading. After employing this strategy, I will transition to the oral questioning strategy. I will ask questions from each page using visuals and stressing the vocabulary and the numbers written on the page. This activity will take about ten minutes.

The next strategy I will employ uses PowerPoint to teach students about juniper trees. I will input detailed information about juniper tree growth, distribution, and the attributes of the tree. I will create only ten PowerPoint slides because these young children have a very short attention span and can only sustain essential information about the juniper tree for approximately ten minutes. Within this PowerPoint, I will add cultural information like how the blue corn mush is made using juniper ash. This strategy is called frontloading background information.

I will also use a strategy in which I share a “Big Book” about climate change and the juniper tree. I created the “Big Book” by taking photos of stressed juniper trees from this area. My “Big Book” will contain six to eight pages with pictures and simple sentences. I will use a repeating phrase (“climate change hurts juniper trees”) throughout my book. I will explain what climate change is to the four-year-old in my class in a way that they can understand.

I will use additional strategies like reading books about trees, singing tree songs (like “tree my size,” “Juniper tree song,” and “number tree song”), and Youtube videos about trees, picture file cards (matching trees, naming tree parts, and grouping tree parts). These strategies are useful as a continuous lesson of oral vocabulary using tier three words.

In addition to these teaching strategies, I will utilize books, posters, and pictures from the internet to demonstrate a visual image of various trees.

Classroom Activities

As a part of the "*Tree Count*" book activity, students will construct an art project of a tree. The critical question students will focus on is: "What does a tree look like?" Students will create a tree diagram using markers, crayons, and other materials found at home. Their drawing will demonstrate their comprehension of what they have learned from the *Tree Count* book. It will be part of my assessment in evaluating their understanding of what a tree is.

In connection to the PowerPoint of the juniper tree, I will send home a recipe for blue corn mush. I will also send home the actual ingredients—the home school connection with parents and children is a part of this learning activity. The assessment will be based on the outcome of their blue corn mush. I will see if it is lumpy, bitter, grainy, watery, and if there is parent involvement.

After reading the “Big Book,” students will create their own “Little Books” about what they know about climate change. They will draw and find pictures of trees that have been affected by climate change. The parents will assist their children by writing down what their child dictates. Their “Little Book” will contain four to six pages. I will use a rubric as an assessment for the completion of the “Little Book.”

Student Assessment Plan

1) 25% completion of booklet	2) 50% completion booklet	3) 75% completion of booklet	4) 100% completion of booklet
<ul style="list-style-type: none"> - Few components of the book completed - No book title - Few pictures were drawn by the student (1) - Few sentences were written by student (1) 	<ul style="list-style-type: none"> - Some components of the book completed - No book title - Some pictures were drawn by the student (2-3) - Some sentences were written by students (2-3) 	<ul style="list-style-type: none"> - Most components of the book completed - Book title - Most pictures on the pages were drawn by the student - The student wrote most sentences 	<ul style="list-style-type: none"> - All components of the book completed - Book title - Pictures on all pages were drawn by the student - The student wrote one short sentence on each page
Accommodations for special education students are taken into consideration and grades will be modified.			

Alignment with Standards

Strand 1: Scientific Inquiry and Application – Concept 1 Exploration, Observation, and Application

The students will observe, explore, and interact with material and their environment. Materials and instructional strategies are culturally and linguistically relevant to the student's lives, support their exploration, observation, and hypotheses about the relationships between objects, people, and events in their world. While teaching my unit, the students will observe and analyze tree cookies, listen to stories about trees, determine large and small tree rings, and count tree rings.

Strand 1: Inquiry and Application – Concept 2 Investigation

Each student will research their predictions through active exploration and experimentation. Children use their skills and a variety of tools and materials to gather information while investigating. Active experimentation requires questioning, refining, and persistence. As children explore answers to their questions, they begin to form more complex conclusions. The information gathered through this process deepens a child's knowledge of the world and their

environment. In my unit, students will look and listen to various literature on plants and trees and will ask questions about the reading. I will then ask them questions about what they have seen and heard within the literature.

Strand 1: Inquiry and application-Concept 3 Analysis and conclusion

The child analyzes data (from their observations and background knowledge) and forms conclusions about their investigation. Children form a conclusion about their investigations by collecting, discussing, communicating, and reflecting upon the information they have gathered. Adults can help children organize their information using graphs, digital media, manipulatives, and other relevant methods. After learning about the Gud (a Navajo word for juniper tree), the students will make blue corn mush and understand the importance of calcium intake and how it benefits the body.

Pre-K Diné Cultural Standards

Concept 1 -Nits1h1kees. Shints1h1kees shi[nil99 go bee 1daa'1konisdzin doolee[.

(I will acknowledge and value my thoughts and personality.)

PO 1 Shits'77s b11'1h1shy32go 1di[nishdl88 doolee[. (I will take care of myself.)

Students will learn that preparing and eating the blue corn mush is healthy for their body.

Concept 3-Iin1. Bits'33d00 bee da'iinlanii baa 1konisin doolee[. (I will implement and recognize the Diné lifestyle).

PO 3. Shinaag00 nanise' dah0l0n8g77 dab7zhi' shi[b44h0zin doolee[. (I will name the various plants within my surroundings).

Students will name plants and trees in the English and Navajo that are in their surrounding areas.

Resources

Educational Tree Video for kids: <https://youtu.be/5I7u5FMQxHA>

Holland, Trish (2010). *Tree Count*. Teaching Strategies, LLC., Bram, Ed.

Learning about Nature on a Hike with Blippi/Educational Videos for kids. Blippi hike

<https://youtu.be/jpQnKYXr1vo>

Nayer, Judy. (1994). *Tree can be...*Houghton Mifflin Harcourt Publishing Company.

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Allen, C. D. (2007). Interactions across spatial scales among forest dieback, fire, and erosion in northern New Mexico landscapes. *Ecosystems* , 10(5), 797–808.

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