



Curriculum Units by Fellows of the National Initiative

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## **"To 'iina 'ate: Water is Life," Navajo Farming During a Drought**

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### **Introduction**

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Climate change is affecting the entire world. In the Southwest United States, climate change has caused disturbances in forest structures and landscape, precipitation, soil moisture reductions and increases in soil erosion.<sup>1</sup> There is a domino effect of one disturbance to another. If the forest productivity is altered, it alters nearby community environment, the air, the water, the animals, and the people. According to the article, "Rapid intensification of emerging southwestern North American megadrought in 2020-2021," data from tree rings and soil moisture have shown that the southwest is in a climate exacerbated drought and it is not over yet. The data shows that it is the worst 20 year drought since the 1500's.<sup>2</sup>

The effect of climate change on the Navajo Nation are seen every day. There are severe dust/sand storms that cause soil erosion. The nearby lakes that are traditional water sources for farming, are drying up due to not enough rain and reduced snow pack. The vegetation are drying up causing soil to be more exposed.<sup>3</sup> There is a shift in seasonal climate and temperature increases. In this curriculum, students will look at these concerns and create solutions on how to address these issues so that they are able to keep or adapt traditional farming and crops under a changing climate.

### **School Description and Rationale**

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#### **Chinle Unified School District**

Chinle Unified School District's mission is, "... to work as partners within the community; promoting lifelong learning in a multicultural and global environment to serve as a strong foundation for all students."<sup>4</sup> Being a part of the district for eleven years now, as the elementary Navajo culture teacher, I have observed that students are in a community that is dedicated to that mission and they stand behind not just the students, but the teachers, the parents and community to help mold these young learners. I have been fortunate to be able to be given professional development opportunities for the content I teach and I have the support of the district.

Chinle Unified Schools District has seven schools from elementary to junior high school to high school. Each of the schools offer either Navajo studies/culture or Navajo language classes. Two of the schools are located about sixteen to thirty miles from Chinle. Each school have different schedules. The school I teach at is Canyon DeChelly Elementary School and is located in Chinle. We share buses with the other local elementary, junior high and high school. The hours of instruction are from 8:00-3:05. Navajo studies is considered a specials class that all students attend. At Canyon DeChelly, there are five specials classes. Due to the amount of specials classes, we get our students once a week for fifty minutes.

Some students transfer within district. For this reason, as Navajo culture and language teachers, we communicate as much as we can to make sure we are aligned with the curriculum topics we teach. Chinle Unified School District Navajo Studies and Language teachers use the Navajo Nation standards along with the Arizona State Foreign and World Language Standards.

### **Chinle Unified School District Navajo Studies Curriculum**

Many of the topics I teach are impacted by our changing climate. I currently teach a curriculum on traditional Navajo food. From kindergarten to sixth grade the objective focuses on different types of learning about Navajo traditional food. The topics of this unit range from foods that were consumed by the Navajo People years ago to the different types of corn foods, and livestock consumption. Each of these objectives scaffolds from one topic to the next. Every year, I cannot seem to get my sixth grade students to become fully engaged in this unit about comparing and contrasting traditional farming and modern farming. The lack of background knowledge for some students creates a difficulty to comprehend the amount of work it takes, the reasons why people do it and knowing why it's a passed down tradition.

For several years now, I have been expressing concerns to our students about changes we need to make to help our environment and their community. I tell my students to look at the resources we have and how we need to think of ways to preserve them. In this curriculum unit I want my students to look at plant life, the aquatic life and precipitation and how all these affect one another. They live in a rural community where the only habitat they know of is where they live and with the information they receive, they will be able to see how these factors impact their environment.

One of the units that I teach is on farming with my upper grade students. The objective written for this unit is, that students will compare and contrast traditional and modern farming techniques. In this unit, this objective will be more on a synthesis level where students will compile information together from different elements based on data to propose alternative solutions to Navajo Traditional farming in areas that climate driven impacts of soil erosion and drought no longer allow for traditional farming techniques.

## **Content Objectives**

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This four week curriculum unit will be designed for sixth graders who will consider past research, ask questions of their elders and come up with solutions about how they would create a farm, utilizing data of today and the ideas or solutions that their elders once used. I would like my students to learn about innovative ways they could help in sustaining the traditional Navajo foods they grow. Students will focus about how other cultures worldwide are dealing with climate change and the effect it is having on their agriculture. This new

learning is to help them find solutions and gain knowledge about how to farm in their environment and to compare farming techniques. With this knowledge they will gain an insight into other ways of farming and identify plants the Navajo people could grow based on their environment to help preserve their cultural foods. Students will research the weather and climate changes and how it has affected the Navajo way of planting.

This unit will incorporate added math and science skills. From the science standards, life science standards will be used. Students will be using evidence to explain how human activities are positive or negative to the environment. In math students will be using ratios to interpret data on water sources. The majority of regular self-contained class learning is focused on reading, math and writing. Students do take the end of year state assessment and that becomes a main priority. In my content, I can incorporate other subject areas. In doing so, I believe I am helping like an intervention teacher would do when students need that extra help. As I stated above, I will be able to incorporate math and science standards along with the Navajo Nation standards and the Arizona State Foreign and World language standards.

## Water Shortages

### Chinle Water

The Navajo Nation is one of the biggest Native American tribes in the United States. The tribe is located in parts of New Mexico, Arizona and Utah. They are located near the Four Corners of the Southwest in a 17,544,500 acres. The population of the Navajo is about 173, 667. <sup>5</sup>

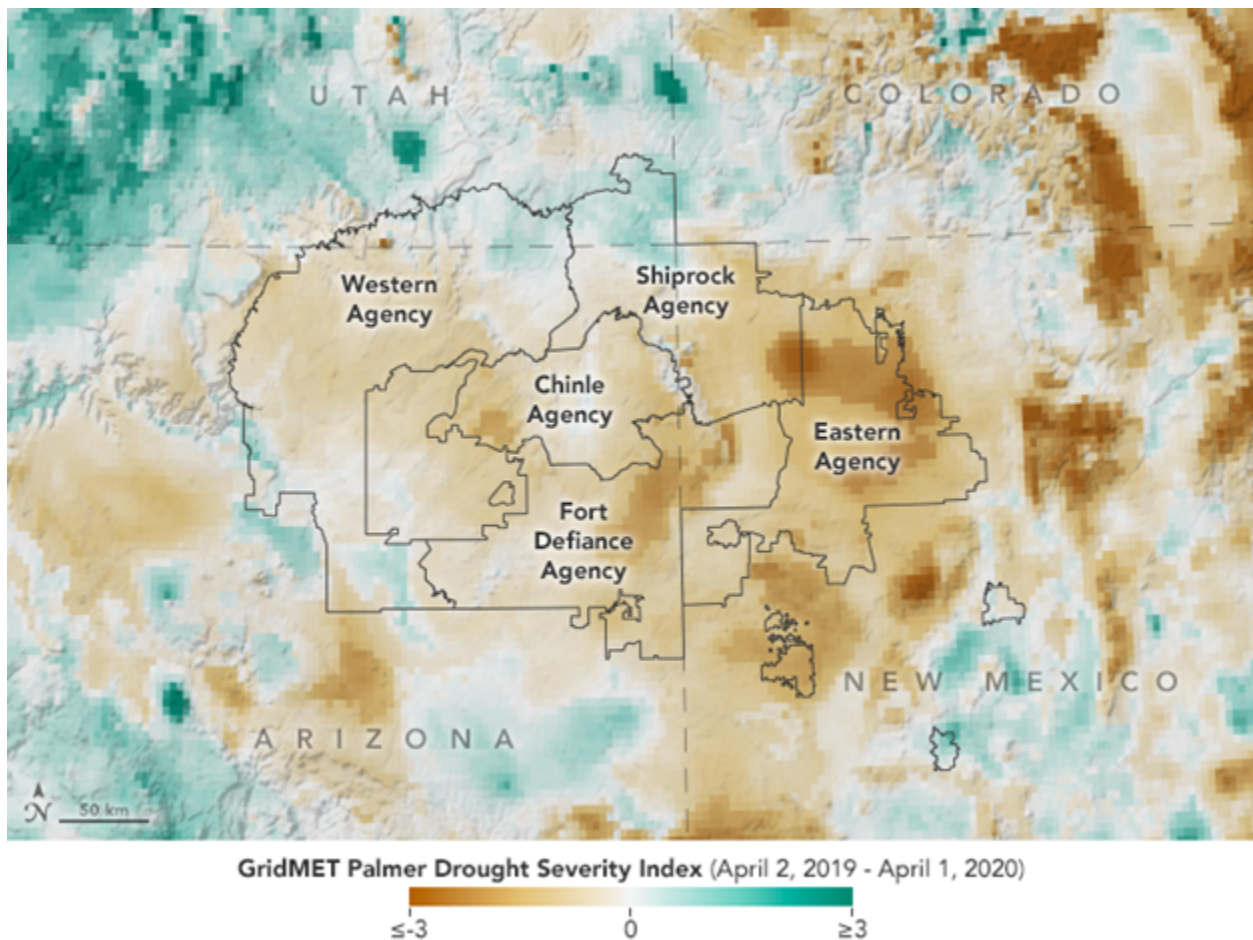


Figure 1: A GridMET Palmer Drought Severity Index. NASA Earth Observatory<sup>6</sup>

Part of the Navajo Nation gets their drinking water source from a tribally owned company that was established in 1959, called Navajo Tribal Utility Authority (NTUA) and the other part of the Navajo Nation obtain water from wells or water is transported to the home.<sup>7</sup> NTUA currently provides electric, natural gas, water, wastewater treatment, solar energy, communication services and other related services. They are currently in talks about wind energy. They have five district offices on the Navajo Nation with four sub-offices. Navajo Tribal Utility Authority maintains and operates ninety two water systems through-out the Navajo Nation. They test water systems to ensure safe drinking water.<sup>8</sup> The Navajo Tribal Utility Authority annually informs their customers where their water comes from. The report informs Chinle residents, the water they use come from different types of water source like ground water, surface water, streams and spring water. The report informs Chinle their water comes from one ground water source. The water is treated to become potable water. NTUA follows the Safe Water Drinking Act.

The rainfall in the desert is focused on two areas of land, the lowest lands and the higher lands. The rainfall average is three to five inches per year in the lowest lands where as in the highest lands, it is ten to fifteen inches per year.<sup>9</sup> The monsoon season generally happen around the months of June to September and it brings much needed moisture to the Navajo Nation. The monsoon occurs when the moisture from the Pacific Ocean and the Gulf of Mexico create a stream that combines with the heat and forms rising air or low pressure. Chinle, Arizona, is located in the northern part of Arizona and is located in the central part of the Navajo reservation. The Navajo name for Chinle is Ch'inili, which means where water flows out. Chinle is located near a national park called Canyon DeChelly. From this canyon, water flows out during monsoon season in the summer and when snow melts from the nearby mountains of the Chuska, Tsaile, Ft. Defiance and Lukachukai in the spring. According to the United States Environment Protection Agency, the community of Chinle receives their drinking water from a watershed that stores ground water. The ground water that is stored in the watershed comes from the streams and runoffs of the melted snow of the mountains.<sup>10</sup>

### **“MegaDroughts”**

The Southwestern US is going through a “*Megadrought.*” (Figure 1). This megadrought is seen in the states of Nevada, Utah, Arizona, California and Colorado. Recorded data from the National Oceanic and Atmospheric Administration (NOAA), used in a Southwest Drought Forum, states for 18 months from January 2020 to June 2021 it was recorded that these states were experiencing historic continuation of drought with low precipitation along with high temperatures. It was noted that Arizona was also experiencing the second season of having the hottest season.<sup>11</sup> Hot air can hold more water vapor and this reduces low level cloud formation.

Droughts cause natural hazards like wildfires, heatwaves, low river flow, dust storms and negatively impact agriculture. It is causing Southwest states to create recommendations that get state and local plans to look at their agricultural priorities. They also recommend relief programs, incentives for conservation activities, green infrastructures, disaster aid and recovery programs. The drought in the Southwest has also had water managements began seeking partners with other larger water utilities in the United States.

### **To 'iina 'at'e, Water is Life**

To' iina 'at'e, water is life. This saying is plastered in many regions of the Navajo Nation, on windmills and posted on local news bulletins in communities. The importance of knowing where Chinle's water source comes from will be of importance for the projects students will be creating. The Navajo People hold water, as a sacred entity, To ' ei 'iina/ To' iina 'at'e. This Navajo word means, “Water is life.” It is utilized in many ways just like

other countries do. In the past couple of years, the topic of water has become one of the issues the Navajo People are trying to solve. Water covers over a majority of Earth and in our own bodies, we need at least three liters of water each day.<sup>12</sup> Water is essential in all living things. It is a substance made up of hydrogen and oxygen. It exists in gases, liquids and solids.<sup>13</sup> On the Navajo Nation, there are people who still do not have access to water. They drive miles with different sizes of barrels to get water from either groundwater with pumps driven by windmills or their local chapter government to get water. The water is used for personal use and for livestock.

It is observed there is a change happening to the environment because of climate change. This observation has the Navajo Nation creating plans for better management, development and secure resources for the present and future generation. The Navajo Nation Department of Water Resources have noted the southwest is experiencing a drought since 1999.<sup>14</sup> They are working collaboratively with other agencies to develop a strategy to meet the water needs of the Navajo Nation.

According to the Climate Science Special report, since 1950's, the global pattern has shown that much of the global land has become wetter and in other areas the land has become drier.<sup>15</sup> The report also states that this trend is human caused global warming. The East coast to Midwest of the United States is getting more precipitation causing intense storms. The heavy rainfall causes more precipitation in the air and when it is warm, it can hold more moisture. From the Midwest to the West coast, the land is becoming drier causing concerns of how water can be attained. (Figure 2.)

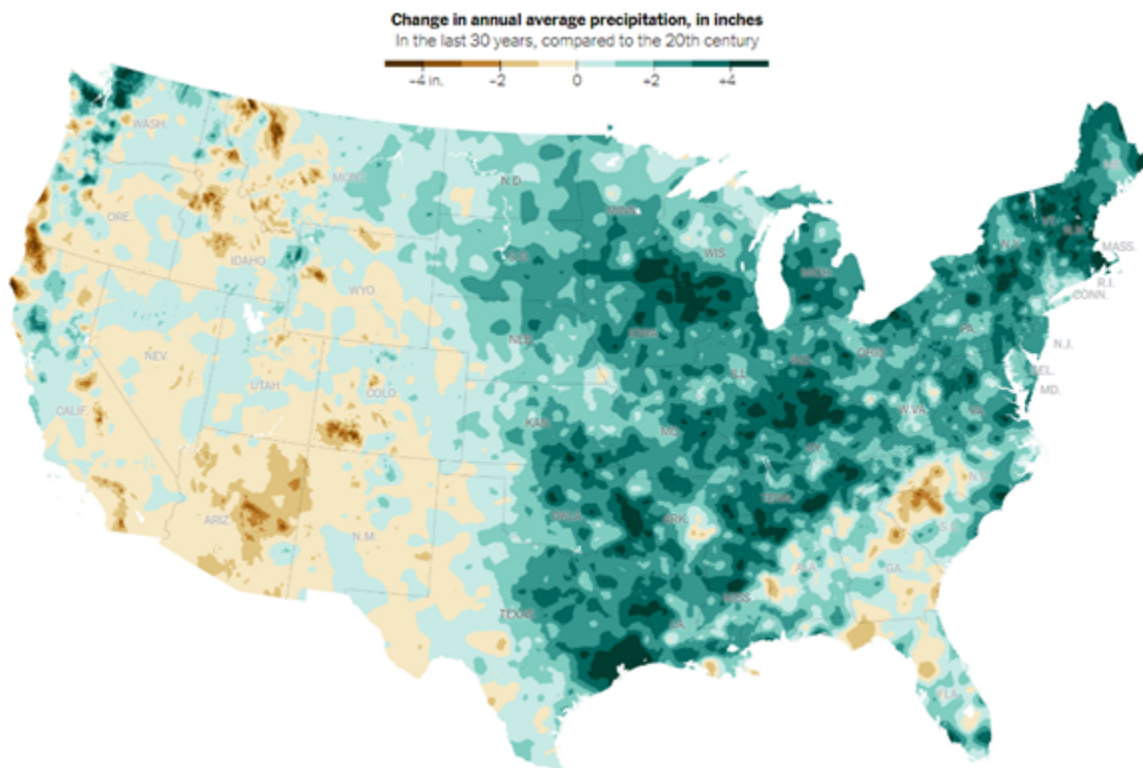


Figure 2: Source is NOAA's National Centers for Environmental Information. Change in annual average precipitation in the last 30 years. <sup>16</sup>

## **Navajo Culture Stories**

Native American cultures are spoken of as having a holistic and interrelatedness with everything surrounding them. The Earth, the sky and all elements are interconnected and they effect one another. In the Navajo culture, the People who are traditional maintain a way of life that balances them with everyone, animals, nature and the universe. Through having this respect, the Navajo People know how to be respectful of all things and to not waste any resource or there would be an imbalance of all things with consequences.

A story will be shared with students to have an understanding of why our People value water. The Navajo story of how water came to be for the Navajo Deities is through the help of Snail Girl. Snail Girl did a very tedious job that required her to return to a previous world they had come from to have fresh water. She was given a shell like bottle container that was placed on her back. In her return and tiredness, she did not realize that the container sprung a small leak. The First Woman of the People had a dream of Snail Girl's return and managed to save some of the water that was still in the container and planted the water seeds which created rivers and streams. Snail Girl was honored and given the container that she brought the water back in. It was to represent her great journey. She was also told that everywhere she went, there would be a trail of moisture to indicate that water is precious and we must take care of it.<sup>17</sup>

Stories presented like this help students to see that in the past the People always found solutions and they found a way to overcome obstacles. Students will also need to know current facts about the region they live in, the Southwest.

## **Climate, Water and Drought on the Navajo Nation**

The Navajo Nation relies not only on ground water/ aquifers but also on snowpack from the Chuska Mountains and Defiance Plateau for their water. They also rely on direct capture of precipitation and surface water. The snowpack is monitored by the Navajo Nation Department of Water Resources. They collect data that gives them information about how much water will be available for the communities, the vegetation, the wildlife animals and the livestock. The data shows there are increased drought, heavy downpour and decreased snowpack. The rise in temperature causes snow melt to happen earlier and causing a disruption in stream water volume, water temperature and runoff timing.<sup>18</sup> Observation has also shown that snow is coming down as rain rather than snow. This results in a decrease in snowpack and there not being enough water resource when it was supposed to be the time for the snow to become a water runoff.

The Navajo Nation Department of Water Resources uses the data to plan for what to do if there is not enough water runoff. The Navajo Nation has four aquifers that has about 700 million acres of storage.<sup>19</sup> They also rely on surface water from the Colorado River, Little Colorado River, San Juan River, washes and other nearby rivers. Not all Navajo People have access to these treated water. The water is used for agriculture in irrigating farms, used in dry farming and ranching and for consumption.

Climate change has raised concerns as to how the Navajo Nation will continue their lifestyle pertaining to water. Methods such as using precipitation gauges have been placed and are continued to be reinstalled each year. Tipping buckets, rain gauges, snow courses and stream gauges have also been placed. Surveys are done manually to measure the precipitation of rain and snow. However, there is no consistent study done yet on how climate is specifically changing water supply in the Navajo Nation.

The Navajo People have endured different hardships since returning from the Long Walk. Along with dealing with drought, the Navajo People have also had to fight for their water. In 1964, the Navajo Nation signed a

contract with Peabody Western Coal Company to allow mineral rights and the use of aquifer on the Navajo and Hopi reservation.<sup>20</sup> The Navajo People along with the Hopi tribe agreed to these contracts in exchange for jobs. The Peabody Western Coal Company strip mined two areas in Black Mesa to extract coal that would be used to power neighboring states. The aquifers were used to wash coal and transport coal from a pipeline to a power plant located in Laughlin, Nevada. It is estimated 3 million gallons of water was used every day for this process. This water source was a main source for the Navajo and Hopi tribes. The pumping of the groundwater affected the Navajo and Hopi tribe. It caused a decline in ground water and natural springs. The tribes demanded an end to the use of the water being used this way. The tribes demanded things to change and set a deadline due to the concerns of the water decline. <sup>21</sup> Peabody Western Coal Company finally shut down the mines completely in 2019 but the depletion of the aquifers remains.

## **Soil erosion**

“Soil is the Earth’s fragile skin that anchors all life on Earth.”<sup>22</sup>

Soil erosion is the loss of topsoil that is caused by wind, water and other forces. In addition to erosion, soil can either become compacted, loses structure, lose nutrients and gain soil salinity. When this happens, it becomes a very severe issue and the land may no longer fertile. The land becomes useless and its water holding capacity is diminished. There are historical reasons for the degradation of soil on Navajo land.

As mentioned before, the Navajo Nation land is 17,544,500 acres located in parts of New Mexico, Arizona and Utah. In 1868, following the failure of imprisoning the Navajo in Fort Sumner, New Mexico, the Navajo People signed a treaty with the United States government to return to their homeland. In this treaty 3,500,000 square miles was allocated to the Navajo People.<sup>23</sup> This treaty also granted any male over the age of 18 to be able to cultivate on the assigned land they were given. They would also be given tools and seeds to rebuild their crops that were destroyed by the US soldiers at the beginning of the removal.

Before the removal, the Navajo people had summer and winter camps. They were able to move from one place to another with their livestock, thus giving the land time to recuperate from planting and grazing from the livestock.<sup>24</sup> Through elder stories of how the People migrated with the animals, they believe because we are allocated to a certain area by the government, “the Plant People were not able to spread anymore.”<sup>25</sup> We are stuck to an area, just like the Plant People. The People knew when to migrate with their flock, going to the lower elevations in the winter and going to upper elevations in the summer. This gave time for each area to replenish in water, vegetation and for soil to recover.<sup>26</sup>

The loss of winter and summer ranges has also led to overgrazing of livestock. Traditionally sheep were the only main livestock of the People. The wool from the sheep produces traditional Navajo rugs. Goats were raised for meat and milk. During the time when the Navajo were forced to Fort Sumner, livestock were taken or slaughtered from them. Upon return, they were given a set amount of livestock to restart their flocks. As time went on, Navajo people began to exceed the amount of sheep and goats they had. The Bureau of Indian Affairs did a land survey and saw there was overgrazing that was causing soil erosion. This forced the Navajo people into a historic traumatic event in 1933 and in 1934 of livestock reduction.<sup>27</sup> The first event was hard on livestock owners who had little flock and in the second event, the livestock was meant for meat packing but the packinghouses could not keep up with amount of livestock that came in. A group of livestock were taken to canyon area where they were slaughtered and left to rot. Navajo matriarchs of families, who were and still are the head of household made decisions. They were concerned as to how they would provide for their families due to their flocks being depleted. The findings of the soil measurement created an equivalent chart

that is used in today's grazing permit. The topsoil was losing soil nutrients making it hard for vegetation to grow. The chart tells how much livestock are permitted in a grazing area. There is a certain amount of sheep, goats, horses and cows that can graze on the land that is being given.

Many Navajo families own livestock grazing permits that state how much livestock one can own in a said area they are given to graze on, but there are many who do not have these permits and still have livestock grazing on land that does not have enough vegetation.

### **Traditional farming methods**

The Navajo people have farmed for many generations. Agriculture has been seen as a source of survival. It was a means to feed oneself and the community. The land the Navajo People lived on was occupied as free roaming, gathering of plants and berries and hunting. Upon return to the Navajo Nation after the signing of the Treaty of 1868, the western concept of having a settlement changed the idea of moving freely. Some Navajo people still farm for survival for oneself and relatives while for some use it is their source of income.

Some Navajo people use dry farming, while others plant as a community near a water source or utilize a drip farming method. Dry farming allows farmers to use less water and plant crops that are prone to the heat and the drought. In planting as a community, farmers help one another and it helps economically. They are saving money and it is not going to off reservation purchases.<sup>28</sup> In drip farming, farmers are making sure the plants are receiving the water, that there is less water wasted and more land can be utilized.

One of the traditional practice of farming is using the constellation, Dilyehi/ Pleiades, to plant. In the spring time Dilyehi goes down with the sun and cannot be seen anymore. When this happens it is time to prepare for planting. During the winter, Dilyehi can easily be seen. Dilyehi has four traditional stories. One of the stories is the seven stars are a representation of seven boys who were impish and followed planters and picked the seeds back out of the ground. In another story they are a mother who carries a buckskin bag who follows her boys. The third story of the stars is, they are a group of young warriors who are healers of summer ceremonies. The fourth story is they are a mother with her children who were traveling back to Earth on a rainbow who were left behind because they were too busy playing. The deity, Black God/ Haashch'eshzhini, was the one who decided and placed these stars. In the Navajo culture stories, every star/stars was/were placed to have a purpose.<sup>29</sup>

Through the songs and prayers of farming, it is mentioned that the Navajo people use to plant in a spiral. This trace of history are pictured on petroglyphs. In the ceremonial songs, the planting soil tells of hearing the whisper of corn stalks coming up and the moisture that comes from the dark clouds.

When planting, the Navajo people use the "gish", the planting stick, to dig in the soil to plant seeds. A gish, planting stick, is made by a selected Greasewood tree. The seeds are placed in the wet dirt then dry dirt is placed on top of it. The planting stick is used to dig four holes. After the fourth dig, the farmer sings the planting songs. When planting is completed, the gish is put away before the last quarter of the moon.

The Navajo people plant corn, squash and beans. These plants are known as the "3 Sisters" with tobacco known as one of the three sisters. The Three Sisters are used in some Native American culture planting. They have found they work well together when planted together. The corn stalk lets bean vines climb them so they do not compete with squash vines. Beans give nitrogen to fertilize soil that plants need as a nutrient for their roots. The big leaves of squashes give shade to help with keeping the soil moist and keep weeds away. The three Sisters, provide complete balance diet with corn giving carbohydrates, beans providing protein and



squash giving vitamins and minerals. <sup>30</sup>

Through the oral traditional stories, the Holy People (Deities) migrated through three worlds. In each world, an event happened that caused them to move from one place to the next. Each time the Deities emerged from one world to the next, they took certain things to utilize in the next world. When the Deities emerged in the final world, the Turkey was the animal that gave watermelon, cantaloupe and pumpkin seeds to the people that fell from both of his armpit feathers. Today the Navajo people still farm these vegetables and fruits.

There are songs and prayers about farming. Harvest God, one of the deities of the Navajo people, dances in the Nightway Ceremony with his “gish” because he is the planter and cultivator. A “gish” is a cane that he uses to dig in the ground to plant seeds. Harvest God in Navajo is called Ghaa’ask’idii, meaning ghaa’, a hump and ask’idii, a hill. He is hunched over as if working in a field. On his back, in his hump, he has a rainbow that has drops of water and in his feathers he has bolts of lightning, clouds, water, dew and light. In another story he carries seeds on his back. Harvest God dances for a good harvest in the ceremony.

During a Nightway Ceremony, there are four main plants used. They are corn, beans, squash, and tobacco. Three of these plants are considered the three sisters of planting. They are corn, beans and tobacco. Corn is never used until it has harvest. Beans are considered to take care of your blood cells. Squash can be reseeded and when eaten it refreshes your family and your roots. Squash can be used to make gourds that are used in ceremonies. Tobacco is used only during ceremonies. It is used to make offerings to the Diyin Dine’e, the Deities.

## Teaching strategies

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### Gradual Release Model

One of the teaching strategies Chinle Unified School District implements is the Gradual Release Model. This model is a release of responsibility from teacher to student. It begins with the teacher modeling the content standard being learned, to teacher and student learning together, to student individually working on the content standard with some observation from the teacher, to total responsibility of student learning. The Gradual Release Model shows interaction of the teacher providing appropriate instruction that helps to target the specific learning. The Gradual Release Model has four components. They are focus lessons, guided instruction, productive group work and independent learning.

When using this strategy I find that it helps to keep focused to the objective and students are able to take ownership of the learning. With good modeling from the teacher of the content, this strategy works. During the focus lessons, students are able to see the teacher’s modeling of their thinking process and how to use background knowledge. In the guided instruction process, students and teachers are able to work together. The teacher ask and prompts questions while facilitating students during their learning. During guided instruction, it can be individual one on one, small groups or whole group. When students are in a productive group, they are taking the content learning and working collaboratively to solve, apply and practice their learning. When students move on into independent learning they use what they learn and independently work on the problem given. The Gradual Release Model does not have to be done in order. It does not need to start with the teacher, I do, teacher and students, We do, and Student independence, You do.

Using this framework of the Gradual Release Model, students will be getting new information about how climate change is affecting the Navajo Nation. Students will take the information and have discussions with their peers to create solutions for the Navajo agriculture. Students will also take data given to them and create a plan of how to grow crops in a drought.

## **Graphic Organizers**

In this curriculum students will be using graphic organizers. Graphic organizers help to identify main concepts, categorize ideas, help to compare and contrast topics and you can use illustrations to help students who are visual learners. Graphic organizers make connections and help to keep information organized. They help with new information being stored in the short term memory to long term memory. When learners use graphic organizers they are able to understand their new knowledge using prior knowledge.

One of the graphic organizers students will use in this curriculum is the KWL (already Know, Want to know, and ultimately Learn) chart. They will start with identifying what climate change is. They will give their prior knowledge of what they know it is and what it is they would like to know. After information and research is given, students will give information about what they have learned.

The next graphic organizer students will use is a Learning Map. Students will learn about Navajo agriculture. They will map out ideas as to what makes an effective agriculture. Students will then be given facts and begin to make connections as to how to create an effective crop while the Southwest is in a drought.

After students have learned about drought in the Southwest, I want them to use a Math graphic organizer where they will chart precipitation, temperature and water levels on the Navajo Nation. Using this data, they will then use their final graphic organizer of Problem-solving organizer. Students will identify the problem of agriculture, and find solutions with their pros and cons. They can work together or individually to create a final project of a type of crop they would have.

## **The 3 Whys**

The 3 Whys strategy is an intrinsic, inquiring strategy that helps a student to achieve a deep level of learning. It is to get them to think about a situation, topic or issue that is global, local and personal and to make connections of them. The 3 Whys are: Why might this matter to me? Why might it matter to the people around me? Why might it matter to the world? These 3 whys get a learner to investigate the topic in a multiple context.

Along with the KWL, this strategy will help learners to dig deep into learning about Climate change and human impacts it creates. The hope is to have students to be able to come up with solutions that will benefit them and their future on Earth. This strategy allows for images, videos and text to help the learner to think about the topic and dig into the 3 whys. There will be images, text and videos students will watch as a hook to the objective.

## Activities

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In the first activity students will get background information about climate change. The teacher will read “We Are Water Protectors.” This book will be an opener to explain causes that affect our water. The teacher will have a set of questions that will open up a discussion about what they know about water. They will receive their KWL charts and the 3 Whys question to start thinking about why water is important. Students will also begin to keep a journal about the weather conditions and describe what they see every day. Students will begin to see the types of weather their environment is having in their climate. Teacher will give the culture stories of how water and agriculture came to be for the people. They will discuss the “3 Sister” and how it is important to their People. Students will turn in their KWL chart.

The second activity will focus on the geography of where water comes from for the community of Chinle. The teacher will open up the lesson with showing pictures of watersheds, windmills, people hauling water, the farm lands and the low levels of water happening on the reservation. The teacher will ask the question, “Why does this matter to the people around me?” The teacher will then show students maps of the Navajo Nation and the geography of where water comes from and how it makes its way into their home and school. Students will locate on the maps where their home is and where their water source is coming from. They will then be given data on precipitation, temperature and water levels on the Navajo Nation that they will chart. They will also get a completed chart of the Midwest where there is more rainfall. From the charts, students will have a discussion about what the data is telling them. The teacher will then present what other communities have done during a drought to plant. They will begin thinking about what they would do and how they would plant in conditions like this. Students will turn in a concept map where they will give their ideas they discussed with one another.

## Activity of soil and planting

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The last activity of the curriculum unit will have students experiment with different types of soil. Students, if they can, will bring soil from home to see how the soil will take to growing a plant. In this experiment, students will plant beans in three types of soil. The soil, students will use, will be the soil that is on school campus, soil from a local corn field and soil from a student’s home area that does not live locally. Students will see the difference in crop yield with the same soil but how much water it gets. Over time, students will check on the bean plants. They will keep a log of each plant and make observations. Students will create a small display that explains the experiment. Students will use the scientific method to explain what soil is best for planting and what farmers could do when they are planting in an environment that is going through a drought. In the display, students will give information about what they’ve learned in how the Navajo People use traditional farming when planting.

## Appendix on Implementing District Standards

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**The curriculum will use the Navajo Nation and Arizona State Standards.**

### **Navajo Nation Standards**

The standard from the Navajo Nation that will be used is: I will develop an understanding of Dine way of life, Concept 3: I will implement and recognize the Dine Lifestyle. The performance objectives to the standard and concept are the following: PO 1. I will classify the Land and Water Beings in my environment. PO 2. I will recognize the edible plants in my environment. PO 3. I will identify the usage of herbs.<sup>31</sup> This standard meets the requirements of the Navajo culture and traditional teachings of the land, water and the vegetation that will be mentioned in the curriculum.

### **Arizona State Standards: World and Native Languages Standards**

The strand from the Arizona State Standard of World and Native Language that will be used will be from Cultural Competencies. It states, *Use the target language to investigate, explain and reflect on the relationship between the practices, products and perspectives of cultures studied.* For this curriculum, the Intermediate level will be used. This level states, the student can investigate and describe similarities and differences in practices, products and perspectives used across cultures to understand one's own and others' ways of thinking.<sup>32</sup> This standard meets the requirement of students being able to understand the oral stories of Navajo farming in the target language.

### **Arizona State Standards: Science**

The standard from the Arizona State Science Standard that will be used is from the Life Science section. It states, students will use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems. Students will be identifying how human impacts can be positive or negative for the agriculture in their community.

### **Arizona State Standard: Math**

The math standard from the Arizona State Standard will be from the number system section. The standard states, students will apply and extend previous understanding of numbers to the system of rational numbers. The performance objective students will focus on is to solve mathematical problems and problems in real-world context by graphing points in all four quadrants of the coordinate plane. Students will graph precipitation, water level and temperature.<sup>33</sup>

### **Assessment**

The formal assessments that will be used for this curriculum unit will be teacher made assessments and District formative assessments. The district gives a pretest and posttest for the Navajo culture and language classes. In the pre-posttest, students answer multiple choice style questions. They answer two questions about the unit they learning about. In the district formative assessment, students answer five questions about the unit. It has three multiple choice questions and two written responses to a question.

For informal assessments, the teacher will be observing, monitoring discussions and having students present an exit ticket after each activity. They will turn in their KWL charts, the three why's questions, the concept map and their journals about the weather. They will be graded using a rubric scale for their science experiment.

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