Traditional Ecological Knowledge

Traditional Ecological Knowledge as a Means to Understand What Makes a Healthy Ecosystem

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Diné Institute for Navajo Nation Educators (DINÉ)

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Author's Note

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Context

This unit is written for third grade students at Kinsey Inquiry and Discovery School. A part of Flagstaff Unified School District, Kinsey is a Title 1 public school in Flagstaff, Arizona. Flagstaff, Arizona is a community of approximately 78,000 people. Flagstaff sits at the base of the San Francisco Peaks, Doko'o'osliid. One of the four sacred mountains of the Navajo people. Flagstaff borders both the Navajo and Hopi reservation land. It also is the home to many that are studying or working at Northern Arizona University. Due to this and the bordering of two Indigenous nations, it is a very diverse community with many different people calling it home. The school serves 349 students from grades Pre-K to 5th grade. Native Americans are the largest subgroup that make up Kinsey at 50% of students, followed by Hispanic at 22% then White at 20%. Other nationalities that students identify as at Kinsey include multiple races, Asian, and African-American. Most Native American students are either primarily from Navajo or Hopi families, with students coming from families with a wide range of adherence to cultural traditions: some very traditional and some much less so. Students that come from low-income families make up 55% of our student population (AZ School Report Cards).

Kinsey is a place-based magnet school. The place-based magnet program's intention is to provide students with experiences, mostly in the outdoors, that connect students to their place: Northern Arizona. Excursions and partnerships are experiences that help our students foster the connection between themselves and their place. Some of these excursions include trips to Red Rock State Park to see examples of erosion first hand, Museum of Northern Arizona to learn about cultures of Northern Arizona, Grand Canyon National Park, and Walnut Canyon National Monument. Partnerships that Kinsey has fostered throughout the years include Willow Bend Environmental Education Center, Terra BIRDS, and Grand Canyon Youth. Through these partnerships, Kinsey is able to provide engaging, high-quality experiences that complement content learning that happens in the school building.

During the 2020-2021 school year, Kinsey was wanting to rebrand and redefine our school mascot and core values. Through the brainstorming process, several ideas were brought to the table. In spring of 2022, the Tunnel and Pipeline fire were two fires that had a severe impact on Flagstaff and the forests that surround our city. The Tunnel fire was north of Flagstaff along highway 89A and was approximately 19,060 acres. The Pipeline fire was reported in June of 2022. It burned 6 miles north of Flagstaff and was approximately 26,532 acres. (InciWeb, 2024) These fires threatened natural, cultural resources and human life. Hotshots, a type of wildland firefighter hand crew that are specially trained to fight fires and perform, became a suggestion for our school mascot. As previously mentioned, Kinsey is a place-based magnet school and with that comes an effort to prepare students in understanding how they can connect with their place and become stewards of the land. The committee that finally decided on our mascot and rebranded with the understanding that Hotshots are brave individuals who work together to protect the places that we value most. We created a new logo for our school that included a firefighter badge with elements of nature and Indigenous artwork. Our school colors also changed to colors that are significant to the cultures that we serve such as turquoise. Finally, our Positive Behavior Intervention System (PBIS) core values were altered to match our new mascot, thus using F.I.R.E to promote the values we want to see in our students: Friendship, Integrity, Respect, and Empathy. This connection to the role of a Hotshot and being a steward of the land

connects to this unit in the sense that students learn about the importance of protecting natural resources and how Indigenous peoples have used fire to do that for many generations.

The group of students that this unit is written for are unique because we are looping together as a class, meaning that students and myself were together, as a class in second grade during the 2023-2024 school year. I am excited and fortunate that I am able to continue teaching and learning with this group of students. Thus, when writing this unit, I have a solid understanding of the learning styles and personalities that make up the class that will be completing this curriculum unit.

Rationale

Traditional ecological knowledge (TEK) is the growing wealth of knowledge, practices, and beliefs about the relationship between living beings and their environment passed down through generations. It is also the way in which Indigenous peoples relate to their ecosystems both culturally and spiritually" (Ramos, 2021). Traditional ecological knowledge is many things. It is the notion that all living things are interdependent. TEK is the understanding that everything in the universe is connected "--between the forests and prairies, the land and the water, the sky and the soil, the spirits and the living, the people and all other creatures" (Simard, 2021, p. 283). Taking care of the land and preserving the culture is also vital when considering traditional ecological knowledge.

When teaching science or social studies, traditional ecological knowledge should be integrated into the curriculum and teaching of students who are Indigenous and to those who are not. By incorporating TEK, it directly fosters cultural connections and allows students to connect or reconnect with their cultural identity. There are many examples of TEK that can be incorporated into classroom experiences for students. Examples of TEK include traditional practices involving agriculture, forestry, wildlife management, fire ecology, and plant medicine or food. In a science classroom, students may mostly be exposed to Western scientific practices. To be clear, traditional ecological knowledge is a term coined by Western scientists. Because in the perspective of an Indigenous person, TEK is their way of knowing and it is their way of life. It is the information that has been passed down to them from generations of family. Simard provides examples such as "a way of knowing the earth… It speaks of being attuned to the blooming of the bitterroot, the running of the salmon, the cycles of the moon. Of knowing that we are tied to the land— the trees and animals and soil and water– and to one another, and that we have a responsibility to care for these connections and resources, ensuring sustainability of these ecosystems for future generations and to honor those who came before" (Simard, pg, 294). Historically, Western science has excluded TEK or has used their knowledge without acknowledging them. A specific example of this would be the use of Indigenous plants for medicinal or commercial purposes such as the use of wild stevia leaf as a natural sweetener. This plant is traditionally used by the Indigenous Pai people in Uruguay, but their native plant sources have been taken and commercialized by the government. Now their once native growing wild stevia leaf is no longer available for them (DW Documentary, 2023). Additionally, Western science has viewed new knowledge as advanced, but then does not look closely at the potential or current impact with inventions like plastic or the use of coal and natural gasses (Ramos, TEK Lessons). TEK strives to sustain the environment when harvesting food, medicine and materials from the Earth while garnering a longer lasting and fruitful environment for all living things.

Another important reason to introduce TEK to students is that it can promote stewardship and connection to one's place. As current students are the next generation that will be responsible for solving problems related to climate change, TEK is an approach that students can take that ensures the sustainability of the Earth. TEK is a mindset in which one does not take more than one needs from the land. Since it aims to keep nature in balance, using TEK to solve problems related to fire, climate, and wildlife endangerment places healthy ecosystems at the forefront. Teaching students about Indigenous knowledge and TEK demonstrates that there are practices that have been used for generations that do not put the Earth in crisis and rather lend to the relationality between natural things. As Simard explains, "We can continue pushing our earth out of balance, with greenhouse games accelerating each year, or we can regain balance by acknowledging that if we harm one species, one forest, one lake, this ripples through the entire complex web. Mistreatment of one species is mistreatment for all" (Simard, pg. 294). It is an important lesson for students to differentiate between Western science and TEK, so that they can analyze the impacts of both approaches.

Incorporating traditional ecological knowledge into teaching is also a response to decolonization and supports nation building. As many ecosystems and food systems were lost due to colonization, revitalizing TEK practices helps to preserve cultural foods as well as strengthen the abundance of species and organisms that were once degenerated. Food insecurity is a result of colonization efforts, as either Indigenous peoples were moved to an area that had limited growing potential or to a region in which was very different from their ancestral lands. A solution to food insecurity is using TEK planting practices and growing heritage crops. Seed saving practices are also used in response to climate change to protect bio regionally adapted plants. These plants have learned to survive in different conditions and then their seeds are saved to protect those cultural plants to be used for future generations (PBS Terra, 2023).

Content Objectives

In this curriculum unit, students learn about what makes a healthy ecosystem through classroom activities that introduce topics through the lens of traditional ecological knowledge. In this unit, students will specifically work towards understanding ecology and science of the 3rd Grade life science standards using TEK in addition to Western science.

Interdependence in Ecosystems

A crucial theme in traditional ecological knowledge is that living things depend on each other. Nature and all parts of nature are interconnected and interdependent. In an ecosystem, living things can be characterized by the fact that they all need energy to survive. The way in which these living things obtain energy further separates them into producers, consumers, and decomposers. Producers are organisms that use the sun to make their own food through the process of photosynthesis. Consumers are organisms that eat other plants or animals for energy. Decomposers are organisms that get their energy from feeding on dead organisms and the waste of living things. Decomposers play an important role in the ecosystem as they release the nutrients back into the soil thus becoming available for producers (PBSLearningMedia). A healthy ecosystem has the markers of diversity. Diverse species of plants and animals strengthen ecosystem health. When an ecosystem, specifically a forest, has diversity in the types of trees

that grow there, the benefits can include pest and disease resistance and climate change resilience (Smithsonian Environmental Research Center, 2023).

Trees

Trees hold both cultural and ecological value. Trees have and continue to provide much cultural value to Indigenous peoples in food, medicine, and for ceremonial purposes. Pinyon nuts from pinon trees provide nuts that are rich in calories and protein, an important food source for Native peoples in the southwest. Turquoise stones were cemented to silverwork using boiled down resin or pitch from the tree. Alongside pinon trees, junipers often grow. The berries of a juniper tree have been used for food, especially during stretches of famine, as well as for medicinal purposes. Juniper is also a tree to use for building a sweathouse. Willows have been used for many medicinal purposes, as the bark and roots contain salicylic acid, the main ingredient in aspirin. These trees are commonly found along washes and irrigation ditches and were the preferred wood source for starting fires before matches. Cottonwood was also wood that was used to create weaving looms and cradleboards (National Park Service, 2015). Trees add to air quality in a given place by taking in gasses like carbon, nitrogen and sulfur through their stomata or tiny openings in their leaves. The gasses are then broken down within the tree and either stored to limit the amount in the atmosphere or released as oxygen (Stancil, 2015). Older trees store more carbon than younger trees, so it is important to protect older growth trees in addition to planting new ones. Trees provide habitats to wildlife. Old growth forest trees create habitats at the canopy level, down to the forest floor and everywhere in between. Trees provide shade which can benefit people and plants. Shade of course can benefit a human in a greenspace or even to cool their home, but shade can help certain plants thrive under them by allowing water to stay around longer. Trees also help filter pollutants and sediments in rainfall, then slowly releasing it back into waterways and aquifers (The Nature Conservancy, 2020).

The Role of Fire

Fire is an essential ecological process. It can reduce dead vegetation, stimulate new growth, and lead to the improvement of habitats for wildlife (National Park Service). Fire is a natural part of a cycle that affects the allotment, organization, and operation of many biomes around the world. When dead and decaying plants on the forest floor build up, it can prevent animals or organisms from accessing the nutrients in the soil. During a prescribed burn, nutrients are released from the burned material more quickly than if they had decayed over time. Thus, increasing the fertility of the soil. Some plants even depend on fire to move along in their life cycles (National Geographic, 2023). Many Native American tribes used fire to improve the resources and habitats that were valuable by carefully planning and conducting burns. These burns were for different reasons, in different areas, during different seasons and different frequencies. Native American tribes used fire for a variety of traditional purposes. Those purposes included hunting, improving crops, controlling pests, diversifying habitat, range management, fireproofing, maintenance of travel routes, clears of riparian areas, communication, and ceremonies. Thus, a traditional ecological knowledge approach can inform fire management practices to reduce fire risk, reintroduce fire, and maintain or restore cultural landscapes (Lake et. al, 2017). Historically when early Europeans settlers came to areas like Flagstaff, the practices surrounding fire involved fire suppression solely due to the need for animal grazing and logging practices. Fire is a necessary practice for healthy forest regulation, “Without regular, low-severity fire to regulate the growth of pine saplings, tree densities in these forests have increased between 5 and 100

times the density of historical forests" (Stotts, 2019). Thus limiting the traditional practices of Indigenous peoples and cultural burning has had a direct effect on the health of many forests, However traditional knowledge can inform managers, researchers and the public about how fire can affect natural and cultural resources such as traditional foods, cultural materials, landscape heritage and cultural resources (Lake et. al, 2019).

Animal and Plant Adaptations

Animals and plants have adaptations that have kept their species alive during the changes that take place in their ecosystem. One of those big changes is the rise in wildfires and overall temperatures rising. Ponderosa pine trees have a deep rooting habit that provides insulation and increases the amount of water the tree can take in even if surface roots have been killed by a fire. The open crown structure allows for heat to dissipate and air to flow during a fire while the long needles contain a lot of moisture. A ponderosa can also lose 90% of its needles during a fire, but since the buds are protected by the needles they can regrow new needles the following year. Quaking aspens are a species of tree that needs fire to out-compete conifers like ponderosa pines and western junipers. Aspen stands sprout after a wildfire, allowing them to prosper compared to slower growing species (Strong, N. 2019).

Trees also can send help to each other. In Suzanne Simard's book *Finding the Mother Tree*, a doctoral student she worked with started a greenhouse experiment with seedlings: two kin and one stranger. One of the kin seedlings was designated as her "Mother Tree". Once the Mother Tree was injured, she would have a choice of where to send the last of her energy. She would need to choose to send it to either her kin, the stranger, or into the earth. To find where the Mother Tree sent her energy, she traced where the carbon she pulse labeled went. She found that the data showed that injury caused the Mother-Tree seedlings to transfer even more carbon to her kin. As Simard writes, "Facing an uncertain future, she was passing her life force straight to her offspring, helping them prepare for changes ahead" (Simmard, pg. 287).

Animals have also adapted to changes in their ecosystem. Animals have adaptations that allow them to survive against predators and find food. In terms of fire, some animals are able to fly away from fire however other animals use their external structure to burrow deep underground. Animals such as squirrels, frogs, or ants will find refuge underground or under a down rock or log. After a fire has taken place, some animals will return and depend on dead standing trees or snags both as a structure and source of food. The black-backed woodpecker relies on the dead standing trees for nesting and to forage for insects that are attracted to the recently dead tree. Thus, woodpeckers have adaptations such as a beak to obtain food and zygodactal feet to grip trees (Strong, N. 2019).

Ecosystems Shift Due to Climate Change

There is no doubt that ecosystems are changing due to the current climate. The Navajo Nation is a very hot and dry place. When there is precipitation, it has a difficult time sticking around. Prior to colonization, many tribal groups moved around with their animals and migrated during the seasons. Regeneration and plant growth was possible due to animals not grazing in the same place repeatedly. Since being limited to a certain area on reservation land, overgrazing has become an issue for many ranchers. This continuous grazing has changed the landscape and the grassland has become lost or the roots have become weaker. (Johnson, Lecture, 2024) Due to

there being less precipitation and overgrazing, the combination has created a desert-like ecosystem where it is difficult to grow food and continue the traditional farming practices that have been passed down from generation to generation. (Fule, 2024) Suzanne Simmard offers guidance in using traditional practices to manage future forests, "..elders that survived climate changes in the past ought to be kept around because they can spread their seed into the disturbed areas and pass their genes and energy and resilience into the future." (Simmard, pg. 288)

Teaching Strategies

Videos

Videos are an engaging tool to use with students to demonstrate science content. Using videos can provide students with first hand examples of field experience. Specifically, one video that students will be viewing is a time lapse which clearly demonstrates how fire can kick start regeneration on the forest floor. Other videos are helpful to illustrate topics for students who need visuals to understand varying science topics.

Jigsaw Protocol

The Jigsaw Protocol is a collaborative learning protocol that requires students to critically think about a given question in a small group, but then be responsible for sharing what they learned with another group of students. For example, students will examine a specific ecosystem in a small group and make observations together. Then will then come back to a new group of students that all looked at different ecosystems and share their findings. In this group, they will find similarities to determine what an ecosystem exactly is. This protocol is helpful for students becoming responsible and having a role, which helps students stay accountable.

Making Observations

Making observations is a teaching strategy that is valuable for making students the generators of information. Instead of teachers just sharing facts or information with students, allowing them to make observations places the action on students. They are the ones supplying the information for themselves and their peers. Making observations also has a low floor and high ceiling, meaning that the task can be accessed by all students but can be extended to higher levels.

Models

Using models to demonstrate thinking, learning, processes and concepts is an important teaching strategy that helps reach many students. Whether it be teachers creating a model to demonstrate a scientific concept or students creating a model, the benefits are worthwhile. Oftentimes, students enjoy tactile tasks and building things. Using models as a choice for product creation to demonstrate learning opens up the door for students who are visual and experiential learners.

Outdoor Learning

Getting students outside for learning experiences is an important teaching strategy to myself and my school. There are so many instances of connections that students can make when learning outdoors. For some specific students, the connection can only be made with experiential learning that reading a text or watching a video, just can't compare to. Specifically, teaching about forestry and science requires visits outside so students can connect the concepts to actual examples.

Collaborative Learning
Collaborative learning is a teaching strategy utilized to teach students how to work together and that we can learn so much from our peers. There are many opportunities for collaborative learning in this unit, whether it be in small groups or partner pairs. Collaborative learning allows for students to safely share their ideas before sharing as a whole group, which can be stressful for students or make them less willing to participate. By creating the opportunity for students to collaborate in either partners or small groups first, it helps them broaden their knowledge.

Classroom Activities
What is an ecosystem?
In this activity, students will begin to create a definition of what an ecosystem is. Separate students into small groups (ecosystem A, B, C, D, and E) . Provide each group with an image of a different example of an ecosystem that has various plants, animals, geographic features, living and nonliving things. Set a timer and ask students to make observations of what they notice in the image that they have. Students should record their observations on a recording sheet. Once time is up, students will form a new group with students who each observed a different ecosystem. Students should take turns sharing their observations and recording any similarities such as animals, plants etc. Once students have each shared their observations, come back together with a whole group and discuss what we think an ecosystem is based on the observations collected. Create a class definition for this important vocabulary word and concept. Display this somewhere for students to recall upon throughout the unit.

Parts of an Ecosystem Jeopardy
In this classroom activity, students will play a game in which they determine which organisms make up specific parts of an ecosystem. Review with students the previous learning from 2nd grade regarding food chains. Remind students that all organisms obtain their energy from the sun when energy is passed from one organism to another. Different living things play different roles in an ecosystem. Review the terms and definitions for the vocabulary concepts of producers and consumers with students as well as primary, secondary, and tertiary consumers. Display these terms and definitions on cards in a pocket chart for students to reference as they play the game. Introduce the new term- decomposer: an organism that breaks down organism material (bacteria soil, fungus, or invertebrate) Explain that these organisms are an important part of an ecosystem because they break down dead or decaying organisms and release important nutrients back into the soil. Ask students why having nutrients in the soil is important? Help them understand how decomposers help recycle and keep an ecosystem going so the plants and animals can thrive. Then play the Ecosystem Jeopardy game with students. In teams, students will choose a question. An example may be, “This red-tailed hawk gets its energy by eating squirrels and rabbits”. Students would then respond with the correct part of the ecosystem, “What is a tertiary consumer?” When that Jeopardy question has been answered, the card will then be organized in the pocket chart next to the correct vocabulary term. Continue the game until all questions have been answered and organism cards have been organized.

Adaptations of Plant or Animal
In these activities, students conduct a research and writing experience by investigating the adaptations of their favorite plant or animal. Begin by modeling choosing an animal or plant that is interesting. Make predictions about what adaptations that animal or plant may have to survive

and obtain food. Review what living things need with students in order to remind them why plants and animals have adaptations. Provide time for students to research their plant or animal and add their notes about two adaptations it has. Students will then use this information to write a research essay about their plant or animal. In their essay, they should include facts and details about how their plant or animal adapts to its environment. Students can then use the Sketch App to draw a picture of their plant or animal with labels to connect to their writing.

Tree Walk

Before completing this activity with students, pre-walk around your campus and take inventory of the different types of trees around where students may observe. Number the trees so students have a reference point and when together, can discuss the same tree. Students complete a tree walk to make observations and experience naming a tree based on those characteristics. Remind students that there are names for different living things based on specific cultures and languages. Oftentimes, these names are based on the characteristics. Provide some examples for students and how that plant is used for medicine or food. Split students up into small groups or partner pairs. Students should then complete the tree walk, in no specific order by finding the numbered tree on the map and drawing an illustration of it. They should also record any specific characteristics of the tree and then assign it a name based on their observations. When the tree walk has been completed, gather together as a whole group and have students share their findings.

Fire Investigation

In this learning activity, students learn about how fire has a role in a healthy forest ecosystem. First students will discuss their understandings of fire. In this first discussion, students may share interpretations that fire is a bad thing, it can hurt people, resources, or animals etc. Students will complete a graphic organizer with three areas to record ideas. They will fill out "I used to think.." about their ideas of fire. Then, students will make comparisons using photographs taken at the Living Laboratory at Diné College in Tsalie, Arizona. Students will make observations about which forest they believe to be healthy and unhealthy. Students will then watch the video about what happens to a forest after a burning. Students will see the forest regenerate after the fire. There will be opportunity for discussion and why students are seeing what they are seeing. Then information will be shared with students about historical implications of Smokey Bear and the use of Indigenous cultural burnings. After students will then fill out the last two sections of their graphic organizer, "I now think…" and "I still wonder"

Outdoor Observations

Students will visit Ft. Tuthill forest thinning project, so they can see a first hand example of a healthy forest. At this site, students will have the opportunity to make observations about the pre-thinned part of the forest vs. the part of the forest that has been thinned. They will be able to see more diversity in plant growth as well as less fuels on the ground. They can then connect the organisms they are seeing to their understanding of producers, consumers, and decomposers. Students can complete a scavenger hunt, in which they work with a small group to find examples of each part of a food web. Students can sketch these organisms in a field journal that they can use back at school.

Create a Class Food Web

In this activity, students use their knowledge of parts of the ecosystem to put together a class food web. Organisms are displayed with names and pictures and students will determine their place in the food web through discussion and research. These organisms are producers, consumers and decomposers that are present in our Flagstaff forests. Students determine which organisms rely on which for a food source and track the energy flow. The connections are demonstrated through the use of yarn connecting animals that are dependent on each other. Students work together to correctly organize the organisms and determine their place in the food web.

Healthy Ecosystem Product
In the final activity of this unit, students create a product that demonstrates their understanding of what makes a healthy ecosystem. Students should first create a plan of what they will include in their product as well as what materials they would like to use. Examples of product types could be a 3D model using paper or clay to create organisms, a digital or paper drawing, or a written response. Provide a rubric for students demonstrating clear guidelines for information that should be present in their product.

Alignment with Standards
Arizona Science Standards
3.L1U1.5 Develop and use models to explain that plants and animals (including humans) have internal and external structures that serve various functions that aid in growth, survival, behavior, and reproduction.

3.L2U1.7 Develop and use system models to describe the flow of energy from the Sun to and among living organisms.
3.L2U1.8 Construct an argument from evidence that organisms are interdependent.

Writing Standards
Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
a. Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.
b. Develop the topic with facts, definitions, and details.
c. Use linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information.
d. Provide a concluding statement or section.

Diné Standards
Concept 3: I will implement and recognize the Diné lifestyle
PO. 3: I will name the various plants within my surroundings.

Assessment Plan
Students are assessed formatively throughout the different learning experiences in this unit. For example, student responses on the Jigsaw activity will be used to formatively assess students' understanding of what an ecosystem is. Student observations are used to assess students' grasp of the different parts of an ecosystem in the Jeopardy game. Student collaboration and observations of trees are used to assess students formatively during the Tree Walk activity. In the fire

investigation portion of the lesson, the students' graphic organizer is used to assess if students learned new information from the learning experience.

The writing task about animal and plant adaptations is assessed using the following writing rubric. The following descriptors come from the Arizona's Academic Standards Assessment (AASA) ELA Item Specifications.

1- Emerging	**2-Developing**	**3-Proficient**	**4-Distinguished**
Writes an explanatory text that lacks organization and attempts to use facts to examine a topic: a. does not include an introduction or includes an ineffective one; does not group related information together or ineffectively groups information together; occasionally includes illustrations when useful to aid comprehension. b. provides irrelevant facts, definitions, and details to support the topic. c. inconsistently uses linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information. d. does not include a concluding statement or section or includes an ineffective one.	Writes a moderately organized explanatory text to and generally conveys ideas and information clearly: a. includes a simple introduction and generally groups related information together; includes illustrations when useful to aid comprehension. b. provides limited facts, definitions, and details to support the topic. c. uses some linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information. d. includes a simple concluding statement or section.	Writes an informative/explanatory text to examine a topic and conveys ideas and information clearly: a. introduces a topic and groups related information together; includes illustrations when useful to aid comprehension. b. develops the topic with facts, definitions, and details. c. uses linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information. d. provides a concluding statement or section	Writes a well-organized, multi-paragraph explanatory piece and conveys ideas and information clearly: a. effectively introduces the topic and groups related information together; includes illustrations when useful to aid comprehension. b. provides facts, definitions, and details that effectively support the topic. c. uses linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information. d. provides an effective concluding statement or section.

Students are assessed summatively on their final product of what makes a healthy ecosystem. In their final product, students are able to choose a product type to demonstrate their learning. No matter their choice, they are assessed using the same rubric. See rubric below.

Standard	1- Emerging	2-Developing	3-Proficient	4-Distinguished
3.L1U1.5	Does not create a product with any adaptations that an organism has to help it survive.	Attempts to create a product with one adaptation an organism has to help it survive	Creates a product with two adaptations that an organism has to help it survive	Justify why an organism has a certain adaptation to help it survive
3.L2U1.7	Does not describe the flow of energy from the sun to and among living organisms	Attempts to describe the flow of energy from the Sun to and among living organisms	Describes the flow of energy from the sun to producers, consumers and decomposers	Applies what is known about the flow of energy to other organisms in an ecosystem
3.L2U1.8	Does not demonstrate how organisms are interdependent and support each other	Attempts to demonstrate how organisms are interdependent and support each other	Demonstrates how organisms are interdependent and support each other	Demonstrates more than one example of how organisms are interdependent and support each other

Resources

Arizona School Report Cards (2024) https://azreportcards.azed.gov/

DW Documentary (2023) How big companies cash in on Indigenous knowledge and biological resources https://www.youtube.com/watch?v=9Fuumv8xfK4

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