The Powers of Plants 3-5 Life Science

Native plants have an important history across Montana. They exist to both sustain and support the various ecosystems and the many Indigenous cultures who call this place home. In this lesson, students will get to know some of Montana's important native plants. Through photographs, drawings, and stories, they will learn about physical structures and ways that tribes/individuals in Montana traditionally use these plants for food, medicine, and materials. Afterwards, students will choose their own plant from their backyard, nearby park, or school grounds to observe, journal about, and guess how it may be used by people.

**This is a three-part lesson. The first part provides an overview of plant structures, the second part introduces some important native plants to Montana and their Indigenous uses, and the third part walks students through a series of journaling prompts outside, using information learned in the lesson. Teachers are encouraged to do all three parts consecutively, on three different days.*

Montana State Science Standards

4-LS1 From Molecules to Organisms: Structures and Processes

4-LS1 From Molecules to Organisms: Structures and Processes		
Students who demonstrate understanding can: **Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.** [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin. ****Each structure has specific functions within its associated system.]** [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K–12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Construct an argument with evidence, data, and/or a model.	**LS1.A: Structure and Function** • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	**Systems and System Models** • A system can be described in terms of its components and their interactions.
Connections to other DCIs in this grade-level: N/A		
Articulation of DCIs across grade-levels: **1.LS1.A**; **3.LS3.B**; **MS.LS1.A**		
Montana Content Standards Connections: *ELA/Literacy –* W4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.		

IEFA Essential Understandings

Essential Understanding 1: Tribal Diversity

There is great diversity among the twelve sovereign tribes of Montana in their languages, cultures, histories, and governments. Each tribe has a distinct and unique cultural heritage that contributes to modern Montana.

Key concepts of Essential Understanding 1

- The twelve sovereign tribes, located in what is now the state of Montana, are distinct from one another in their history, culture, and language.
- Tribal sovereignty is the inherent right of tribes to independent self-governance.
- Tribal governments are fully functioning governments that provide an array of services similar to those of federal, state, and local governments.
- The political, demographic, and cultural landscape of Montana has rapidly changed in the last two hundred years.
- American Indian individuals and tribes are still here with distinct and intact governments, languages, and cultures that contribute to modern Montana.

Essential Understanding 2: Individual Diversity

Just as there is great diversity among tribal nations, there is great diversity among individual American Indians as identity is developed, defined, and redefined by entities, organizations, and people. There is no generic American Indian.

Key Concepts of Essential Understanding 2

- There exists no universally accepted rule for establishing an individual's identity as Indian. However, as a general rule, an Indian is a person who has some biological Indian ancestry and is recognized as an Indian by a tribe.
- For millennia, individual tribal groups successfully educated their children using highly effective indigenous pedagogies that imbued Indian children with all the knowledge and skills they needed to thrive in their world.
- Boarding schools and other federal policies of assimilation brought disruptions to the traditional transference of knowledge in tribal communities and have had wide-ranging and lasting impacts on American Indian individuals and communities.
- Students who maintain a strong sense of pride in their language and culture tend not to experience school failure.
- Ideally, school curricula will offer equal recognition of the contributions students' home cultures bring to the learning situation and will help all students develop the self-esteem and self-confidence that can enhance their learning.

Essential Understanding 3: Oral Histories as Valid as Written Histories

The ideologies of Native traditional beliefs and spirituality persist into modern day life as tribal cultures, traditions, and languages are still practiced by many American Indian people and are incorporated into how tribes govern and manage their affairs.

Additionally, each tribe has its own oral histories, which are as valid as written histories. These histories predate the "discovery" of North America.

Key Concepts of Essential Understanding 3

- The term spirituality within a cultural context can be limiting and misconstrued. Spirituality to Indigenous peoples generally refers to one aspect of their worldview in which all things are connected. Spirituality in this context does not necessarily equate to nor denote religion.
- A complex history of pre-Columbian tribal migrations and intertribal interactions, European colonization and Christianization efforts, and federal assimilation policies have contributed to the broad range of spiritual beliefs held by American Indians today.
- Despite this history, Native people have retained their spiritual beliefs and traditions – tribal languages are still spoken, sacred songs are still sung, and rituals and ceremonies are still performed.
- It is not important for educators to understand all the complexities of modern day American Indian cultures; however, they should be aware of their existence and the fact they can influence much of the thinking and practice of American Indians today.
- Humor plays an important role in American Indian cultures, there was no "stoic" Indian.
- Tribal oral traditions, ideologies, worldviews, and the principles and values associated with them, are as valid as other such traditions from around the world and should be accorded the same respect and standing.
- Educators should be aware that portions of these principles and values are private and are to be used and understood by certain individuals, groups, or the entire tribe. Tribal culture bearers, experts, and others can assist educators in navigating these situations.

Learning Objectives

Students will . . .

- use observation skills in nature and translate those into nature journaling.
- understand important plant structures and how they support survival, growth and reproduction.
- learn about/identify some of South-Central Montana's native plants, including plain's cottonwood, rocky mountain juniper, sage, prickly pear cactus and woods' rose.
- understand indigenous uses of native plants.
- apply learned knowledge of plants in a series of journaling prompts outside.

Background Information

Information on plant structures

Montana Natural Heritage Program Field Guide or USDA Fact Sheets and Plant Guides

For more information on plant uses by Montana tribes, refer to the book *Montana Native Plants & Early Peoples* by Jeff Hart and *A Taste of Heritage* by Alma Hogan Snell.

Materials

- Whiteboard and markers
- Science notebook (or paper and clipboard) and pencil
- Student Handout 1: Montana Native Plants
- Access to school grounds, backyard, or nearby park

Procedure

Part One: Science Knowledge Building – Plant Structures Overview (1 hr.)

Class Discussion

Most plants have a similar set of structures that help them successfully survive in their environment. Although these structures may be similar, they are adapted to fit that plant's needs, and therefore might look different on each plant. For example, most plants have leaves, but they do not always look the same. Deciduous trees, like cottonwoods, grow bright green leaves in the spring, and lose them in the fall when they turn a different color. The leaves of evergreen trees, like the ponderosa pine, called needles, look much different than those of a cottonwood. Today you are going to learn about these basic plant structures and how they support a plant's survival, growth, and reproduction.

Activity

Before going over plant structures in more detail, have students find a partner, go outside, and choose a plant to observe. This can be done on their school grounds or a nearby park. They should draw a picture of that plant, labeling as many structures as they know. If they aren't sure - just guess!

Once back inside, discuss the structures listed below using the whiteboard, having students take notes. If they incorrectly labeled the structures on their plant drawings from outside, have them write in the correct name. *Optional: after discussing structures, show the plant structures video from Montana PBS to reinforce learned concepts*.

Roots – Roots help anchor plants to the ground and absorb both water and nutrients from the soil. Plants can have taproots, lateral roots, or both. Some even have specialized root systems. A taproot is a large, long root that grows directly downwards into the soil (like a carrot). Lateral roots will grow off the taproot in a horizontal, or lateral direction, and are often much smaller.

Stem – The stem provides support for the leaves, flowers, and seeds/berries of the plant. It also connects the roots to the leaves by providing a transport system for water and nutrients. Additionally, the stem produces new living tissue for the plant.

Leaves – The leaves are the "kitchen" of the plant because they provide the plant with important food. Photosynthesis occurs from the effect of sunlight on the leaves and is a process that converts carbon dioxide and water into oxygen and sugars (food) for the plant.

Flowers/Fruits/Seeds – Flowers allow for reproduction. Their petals are often brightly colored to attract pollinators, like birds and insects. Once the pollen is brought from the male part of one flower to the female part of another, the plant is fertilized, and later develops seeds. A fruit grows around the seeds to protect and aid in seed dispersal.

Thorns – Some plants grow sharp thorns or spines along their stem that protect the plant from herbivores (animals that eat plants). These thorns or spines are often modified leaves or other structures that are unique to that plant.

Activity: Plant Structures Charades

Break students into eight groups, each representing a different plant structure covered earlier (taproot, lateral root, stem, leaf, flower, fruit, seed, thorn). Give groups up to ten minutes to review their structure and decide on the best way to act out their structure to the group, without using words. Afterwards, each group acts out their structure (without words) to the group, who then guesses the appropriate structure.

Part Two: Native Plants and Traditional Uses (45 min.)

Class Discussion

Humans use plants in many ways. Can you think of any uses for plants? Three main uses include food, medicine, and materials (have students write these in their journals). For a long period of time, American Indians of our area have used, and continue to use, native plants *(native plants meaning plants that exist and that have evolved on a specific landscape naturally)* in these ways. When Europeans arrived, they brought their own uses and knowledge of European plants. They learned a lot from American Indians. Shared knowledge of native plants has been passed down from generation to generation, especially in Indigenous cultures.

Activity

Pass out Student Handout 1 to each student or pair, depending on what works best in your classroom. Tell students to read the background information for each native plant, then answer the questions in the chart regarding structure and use. Afterwards, pass the answer sheet out to students/pairs to learn more about the structures, and how local American Indian tribes and individuals use some of the plants. Have students choose one use from the answer sheet and fill in the chart appropriately.

Part Three: Plant Journaling (45 min.)

Teacher Tip The instructions in this activity are written such that they could be sent home with students as a homework assignment or done at school.

1. With your science journal, head outside to your school grounds, backyard, or nearby park. Find a plant you would like to study, like a tree, shrub, or garden plant.

2. Open your science journal to a blank page and make up a name for your plant. The name shouldn't be the actual name of the plant, but rather a special name that will help you remember that plant. For example, you could call a plant with five leaves the five-fingered plant.

3. Using your senses, observe the plant. Touch it, smell it, look at it, and listen to it. Notice what is around the plant.

4. Write down at least five observations (do not worry about complete sentences or spelling) in your journal, including a basic drawing of your plant. When you're writing observations, include adjectives to describe the parts you are observing, like a "smooth stem," or "purple flower petals."

5. Using your knowledge of plant structures, label three or more structures on your drawing. Is there a certain structure that surprises you and looks unique to that plant? Write down why that structure looks unique, and how you think it helps the plant survive.

6. How do you think people may use this plant? Write down your best guess. Remember, plants are used for food, medicine, and materials. If you can't think of ways humans may use this plant, write down ways an animal may use it.

Assessment

Part One Review science journals. Points may be awarded for completion of the outside journaling activity as long as the journal entry includes a plant drawing with some labeled structures. The structures can be labeled incorrectly. Points should also be awarded for notes taken during the structures lecture. Participation points may be awarded for the Plant Structures Charades activity.

Part Two Review the charts in Student Handout 1. Points should be awarded for each completed box, even if answers are incorrect.

Part Three Below is a rubric to formally assess each student's journal entry.

Points Earned	**Plant Observations 15 pts total**	**Plant Structures 10 pts total**	**Plant Use 5 pts total**	**Comments**
	Includes a plant name, at least five observations, and a complete drawing. (15 pts)	Includes at least three correctly labeled structures and how one structure helps the plant survive. (10 pts)	Includes logical way(s) that either people or animals may use the plant. (5 pts)	
	Includes a plant name and a drawing, but less than five observations. (11-14 pts)	Includes less than three correctly labeled structures and how one structure helps the plant survive. (6-9 pts)	Includes illogical way(s) that either people or animals may use the plant. (2-4 pts)	
	Includes an incomplete name and/or drawing and less than five observations. (0-9 pts)	Includes three or less correctly labeled structures and no explanation for how a structure helps the plant survive. (0-5 pts)	Doesn't include ways that people or animals may use the plant (0-1 pts).	

Total: ____/30 pts

References

Hart, Jeff. *Montana Native Plants & Early Peoples*. Helena, MT: Montana Historical Society and Montana Bicentennial Administration, 1976.

Snell, Alma Hogan. 2006. *A Taste of Heritage: Crow Indian Recipes & Herbal Medicines*. Edited by Lisa Castle. Lincoln, NE: Bison Books, 2006.

Student Handout 1: Montana Native Plants

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<u>Teacher Tip</u> In some photographs, multiple structures are pictured. Have students write about the structure that appears most prominent.

<u>Plains Cottonwood</u> Plains cottonwood trees grow abundantly in riparian areas (along rivers) across Montana. They provide shelter and food to a variety of animals, including deer, beavers, insects, and birds.

Structure	**Name of structure(s)?**	**Something you notice about the structure?**	**How could people use this plant? Write down one or two guesses.**	**Write down one or two ways American Indians use this plant (using answer guide).**

Rocky Mountain Juniper Rocky mountain juniper is an evergreen, meaning its leaves stay green year-round. It grows across Montana in plains, slopes and rocky areas, and is often mixed with ponderosa pine trees.

Structure	**Name of structure(s)?**	**Something you notice about the structure?**	**How could people use this plant? Write down one or two guesses.**	**Write down one or two ways American Indians use this plant (using answer guide).**

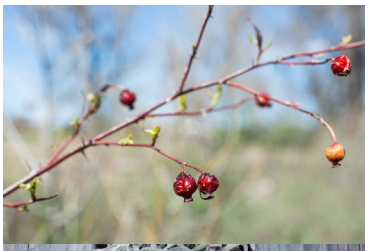
Sage Many species of sage grow across Montana. Big sagebrush (pictured below) and silver sagebrush both have a woody base and grow large and tall. They offer important habitat for sage grouse and pronghorn. Fringed Sage (women's sage) and white sage (man sage) do not have a woody base and grow smaller and closer to the ground. All species are aromatic, meaning they have a strong and pleasant smell.

Structure	**Name of structure(s)?**	**Something you notice about the structure?**	**How could people use this plant? Write down one or two guesses.**	**Write down one or two ways American Indians use this plant (using answer guide).**

Prickly Pear Cactus Prickly Pear is the most common species of cactus across Montana and is found mostly in dry areas across the plains.

Structure	**Name of structure(s)?**	**Something you notice about the structure?**	**How could people use this plant? Write down one or two guesses.**	**Write down one or two ways American Indians use this plant (using answer guide).**

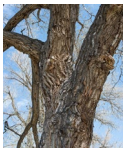
Woods' Rose Woods' Rose is a species of wild rose. The petals, which are not pictured, are pink or white. It is found in grasslands, riparian areas (along rivers), and woodlands.

Structure	**Name of structure(s)?**	**Something you notice about the structure?**	**How could people use this plant? Write down one or two guesses.**	**Write down one or two ways American Indians use this plant (using answer guide).**
				

Student Handout 1: Montana Native Plant ANSWER SHEET

<u>Teacher Tip</u> You will notice that Linwood Tallbull (Northern Cheyenne), an instructor of ethnobotany, Indian healing and tribal history of the Northern Cheyenne tribe, is mentioned frequently. He has given permission to share his teachings on Northern Cheyenne uses of plants. A Taste of Heritage by Alma Hogan Snell, a Crow medicine woman, is also referenced. Finally, Jeff Hart's book Montana Native Plants & Early Peoples, is also mentioned. We want to thank all these individuals for sharing their knowledge on ethnobotany.

<u>Plains Cottonwood</u>

Structure	Name of structure?	Something you notice about the structure?
	Leaves	Cottonwood leaves are heart-shaped, bright green, glossy, and often have serrated edges. The leaves open from pointed buds that first appear in the early spring.
	Bark Trunk	Cottonwood trees grow tall and can have thick trunks. In older trees the bark is gray and brown with thick galleries or grooves.
	Catkin (from a male tree)	Both male and female cottonwood trees grow catkins. The male catkins are reddish purple and consist of many small flowers that pollinate the female catkin.

<u>Plains Cottonwood Uses</u>

In the sacred Cheyenne Sundance Ceremony, the central pole of the lodge is constructed from a cottonwood tree. (Hart 1976 p 130)

"Mary Fisher, a Cheyenne woman, said that the fruits produced various colors - red, green, yellow, purple and white. She tested the colors by marking them on sandstone, claiming that different fruits gave different colors, and with them painted tipis and suitcases." (Hart 1976 p 131) The fruits referred to are the buds of the cottonwood.

William Clark and his expedition constructed canoes from burned out trunks of cottonwood trees for transportation down the Yellowstone River.

Salish, Pend d'Oreille, Kootenai, and Blackfeet used the sweet inner bark and sap of the cottonwood for eating. (Hart 1976 p 131) Deer, elk, and beaver also enjoy this sweet inner bark, known as cambium.

Rocky Mountain Juniper

Structure	Name of structure?	Something you notice about the structure?
	Leaves	Juniper leaves are scaly, long, and pointy. Since they are evergreens, the leaves remain green year-round. They have a pleasant, aromatic smell.
	Bark Trunk Branches	Bark is reddish-brown and stringy. The wood is also reddish-brown. Since juniper is a small tree or large shrub, the trunk isn't very thick. Branches are often close together.
	Berries (actually cones)	The small blue berries are actually cones that contain one or two seeds. Sometimes they are covered in a white powder that protects them from the sun.

Rocky Mountain Juniper Uses

Linwood Tallbull (Northern Cheyenne) says you can make a tea that will relieve coughing or a scratchy throat by soaking the leaves in hot water. *(personal communication 2019)*

Multiple American Indian tribes use juniper leaves for incense. They burn the leaves over a fire to produce a purifying smoke in many religious ceremonies, including the Cheyenne Sundance Ceremony, and in sweat lodges. (Hart 1976 p 78)

Because juniper wood is an attractive and durable wood, it is commonly used in the construction of furniture and fences. Linwood Tallbull says that traditionally, the wood is used as seating material in the sweat lodge and is also used to make flutes. *(personal communication 2019)*

The berries (cones) of the juniper are regularly used in flavoring sauces for meat, including game like venison and rabbit.

Sage

Structure	Name of structure?	Something you notice about the structure?
	Leaves	Sagebrush leaves are silver-green in color, and small. Some, like silver sagebrush and white sage are long and pointy, while others, like the big sagebrush pictured, have 3 small lobes at each end.
	Trunk Branches/stems	The main trunk of big sagebrush is thick, with many smaller branches growing from it. Generally, the branches and trunk are somewhat twisted, and gray brown in color.

Sage Uses

Alma Snell writes that big sage, silver sage, and fringed sage all have healing properties. They can be used to stop both internal and external bleeding. In her book, *A Taste of Heritage*, she shares a story about how she once stuffed sage in her nose to stop a bad nosebleed - and it worked! (Snell 2006 pp 145-147)

Linwood Tallbull says Cheyenne people crushed the leaves of white sage (man sage) to stop nosebleeds and headaches. *(personal communication 2019)*

Northern Cheyenne Indians use white sage, or man sage, in more ceremonies than any other plant. It is placed along the borders of ceremonial lodges, and burned (smudged), producing a smoke used for purification. Many other Plains tribes also burn sage and use the smoke for healing. (Hart 1976 pp 90-91)

Prickly Pear Cactus

Structure	Name of structure?	Something you notice about the structure?
	Spines/thorns	The spines are long and yellowish-brown in color. They cover the entire stem and are actually modified leaves. The spines protect the stem from herbivores.
	Stem Fruit Flower bud	The stem is oval, and almost looks like a leaf. It is green and thick since it holds a large amount of the plant's water in dry climates. The flowers are pink or yellow. Beneath the flower is the fruit which also covered in spines.

Prickly Pear Cactus Uses

Alma Snell writes that prickly pear stems are good for eating as long as the spines are first removed. (Snell 2006 p 50) Afterwards, they can be chopped or peeled. Many people choose to cook the stem first before eating.

The fruit is also edible and can be eaten raw or cooked. Northern Cheyennes split the fruit in half, removed the seeds, and dried the pulp (or inner fruit) in the sun, later to be mixed with soups. (Hart 1976 p 63)

Woods' Rose

Structure	Name of structure?	Something you notice about the structure?
	Berries (called rose hips)	Rose hips are round and red, about the size of a large pea. Inside, they are hairy and full of small brown seeds.
	Thorns Stem	Stems are straight, reddish-brown and gray and covered in small thorns that protect the plant from herbivores.

Woods' Rose Uses

Rose hips are edible as long as the hairy seeds are removed. Alma Snell writes that traditionally, Crow Indians have used the dried fruits to make pemmican (a mixture of dried meat, berries, and fat). She also provides modern recipes that use rose hips in a sauce for meat and ice cream. (Snell 2006 pp 51-54)

Rose hips are considered medicinal because they contain a large amount of vitamin C. (Snell 2006 p 51; Hart 1976 p 35)

The young shoots of rose bushes (stems) are also edible, as are the flowers. (Snell 2006 p 51)

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