LAND USE EXPLORERS

An instructor's guide for activities on understanding our world and land use

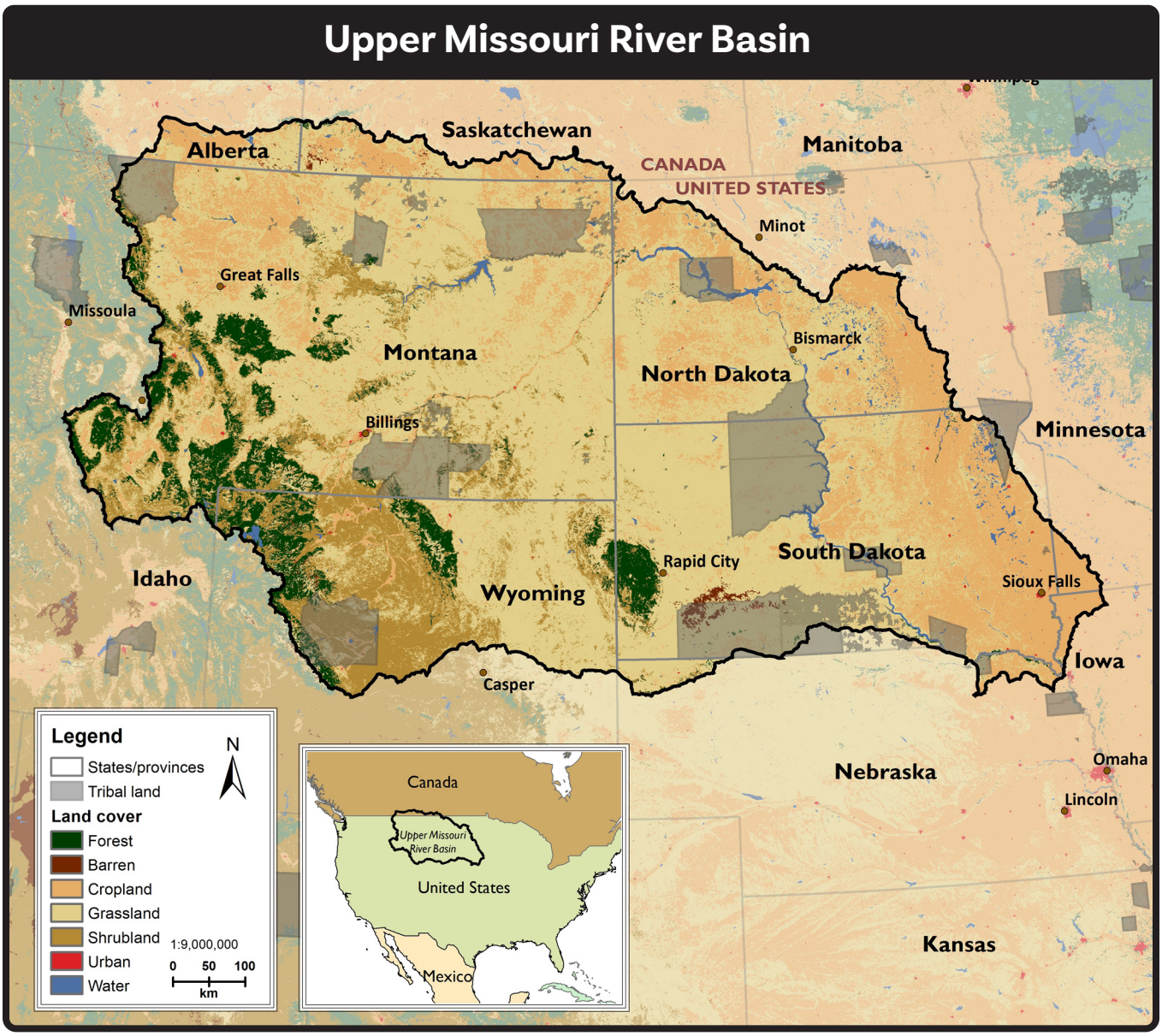
Grades 3-5

WAFERx
Water Agriculture Food Energy Research Nexus

Montana State University

University of South Dakota

University of Wyoming



The WAFERx Project strives to evaluate interactions among food, water, energy, biodiversity, and social systems to inform sustainable climate solutions.

The Land Use Explores Instructor's Guide is a revision of the 2021 Land Use Explores Activity book for students.

Instructor's Guide 2023:
Publication editor: Heather Jameson, Montana Afterschool Alliance. Content contributors: Stacy Laravie (Mecca e'-Star), Traditional Knowledge Keeper and member of the Ponca Tribe of Nebraska; Suzi Taylor, Montana State University Science Math Resource Center; Meghann Jarchow and David Swanson, University of South Dakota; Heather Jameson and Bethany Wieferich, Montana Afterschool Alliance

Activity Book 2021:
Principal investigator: Selena Ahmed, Montana State University. Author: Rose Vallor, Montana State University. Publication editor: Suzi Taylor, Montana State University Science Math Resource Center. Content contributors: Selena Gerace, University of Wyoming; Meghann Jarchow, University of South Dakota; Teresa Warne, Montana State University. Thanks to Peder Nelson, Oregon State University / GLOBE.gov

WAFERx is supported by the National Science Foundation under the EPSCoR Track II Cooperative Agreement No. OIA-1632810. This project is also supported in part by NSF EPSCoR Cooperative Agreement OIA-1757351 and the South Dakota Discovery Center. Any opinions, findings, conclusions, or recommendations do not necessarily reflect the views of the funding agencies.

Welcome to LAND USE EXPLORERS

We are a team of scientists, engineers and educators from Montana, Wyoming, and South Dakota, and we study how food, water, energy, plants, wildlife, humans, and entire communities come together and affect one another. Our goal is to understand how these systems would be impacted by new agriculture and energy systems that might help us fight climate change. We care deeply about our Earth and the people, plants, animals, and micro-organisms who live on it, and we want to share what we do with you!

This book was created to help people— especially young people— to participate in activities that encourage them to think about the land where they live, work, and play and how the land's resources support the life they live.

Just like our team of scientists and engineers, students will study how the production of food, water and energy are connected to animals, plants and humans who live on the land. When one aspect changes, others are affected. And what might be positive for one could be negative for another. These activities give a chance to explore, think and discover!

Inside the Land Use Explorers activity book, there are fun activities to explore the world we live in, both indoors and out.

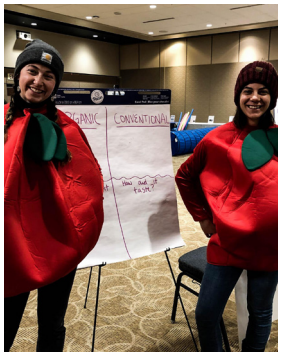
Your group will:

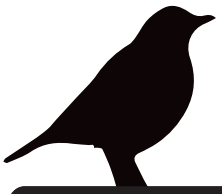
- See what's living on the land around you
- See how you use your own personal space
- Wonder and think about what land means
- Consider how to contribute to learning about our land
- Explore connections to land
- Learn about careers and the people who do this work

How to use this book

Most activities work well for a group of youth in grades 3-5. Youth educators should be sure to read the Prep for Activity and Materials sections carefully prior to the activities to be sure you have the necessary location and items ready to go.

Words in **bold** can be found in the glossary at end of the guide.

Contents

Activity 1:
Micro- and Macro-Habitats: What Do I Notice and Wonder?

Observation is the first step in learning about the world around us. Observing is a skill that we can get better at— we can hone observational powers like a scientist or an artist. As we observe more, we often begin to marvel and wonder about what we see. Asking questions is what scientists do when they see something that interests them.

In this activity, participants will become a scientist by noticing and wondering about what they are seeing around them. Their wonderings will become questions they can seek answers to through research and more observations. Participants will explore a **micro-habitat** and take a look at the **macro-habitat** around them.

Prep for activity:

Find a spot outdoors, in a yard or at a park where growing plants in the soil can be observed.

Time: 20-30 minutes to observe and write, 20-30 minutes or more to research.

Location: A spot that participants find interesting with growing things.

Materials

- Several sheets of paper (8 1/2 x 11 works, but any paper will do, such as a journal or notebook— your observations can also be recorded on a computer).
- A clipboard is handy to take in the field.
- A pencil or other item to write with.
- A hand-held magnifying glass, if available.
- A length of string or surveyor's plastic tape, about 4 feet long. Tie the ends together to form a ring or circle.
- Access to the internet or reference books to find the answers to your wonderings.

Steps:

1. In the yard or at a park, have participants lay down a circle of string around a spot in the grass or ground cover that they think is interesting. The area within the circle is the **micro-habitat**.

2. Have participants lay down and take a close look at all that's living in the circle. Have them pay attention and take note of all the living things in the circle— plants and insects (anything else?). Are there a lot of different types of plants and insects?

3. The number of different things living in this circle is the **biodiversity** of the land around them. A big variety of living things means the **ecosystem** is healthy. How 'bio-diverse' is the **micro-habitat**?

4. Take a look at the soil. How do the larger living things interact with the soil? Instruct participants to rub some soil between their fingertips— what kind of texture does it have (gritty, soft, smooth, chunky, and so on). What else do they notice about the soil?

5. What about water— do they see or feel any moisture in the soil, or on the living things? Where is the moisture, if they feel it?

6. As participants notice what they are seeing, have them ask themselves any wonderings about their observations. Wonderings begin with question words, like Why, How, What is it, What would happen, What if, Where, When, Who. These are questions they will explore later.

7. On one sheet of paper, have participants draw a large T, with the cross bar at the top of the page and the long stem line dividing the paper in two columns. Label the top of the left-hand column 'I Notice;' label the top of the right-hand column 'I Wonder.'

8. Have participants write down the most interesting things that they noticed in the 'I Notice' column. Write down wonderings in the 'I Wonder' column. They can be across from each other, if they correspond.

9. Now have the participants take a look at the **macro-habitat**. Instruct them to stand and slowly turn in a circle while they take a long look at all the **living** and **non-living** things in their view. This big circle is their **macro-habitat**.

10. Ask participants to notice all that lives in the big circle. How 'bio-diverse' is the **macro-habitat**?

11. How does this big, **macro-habitat** compare to the little **micro-habitat**? Are there the same **living** and **non-living** elements? Do those elements interact in the same way in both **habitats**? Do they provide the same functions for the **habitats**? How are the two **habitats** different?

12. Have participants create another T-chart on a sheet of paper and write down what they notice and what they wonder about their **macro-habitat.**

Research habitats

Participants pick one of the wonderings they would like to learn about. Have them decide how they will look for information— from a local knowledge holder, in the library or on the internet and do some exploring there.

Once they have answered their first wondering, have them pick another and do the same thing. As they research and explore, have them look for ways their observations and answers are connected.

When they have researched answers to all of the wonderings that they are interested in, have them write down what they have discovered, and give the discoveries a name, such as 'Our Outside Space' or 'The Wonders of My Neighborhood' or another title that comes to mind.
(adapted from: http://beetlesproject.org/)

Explore more:

Project Wild: What's Wild in Your City? *(https://www.fishwildlife.org/projectwild/step-stem-and-wild-work/urban-nature-search)*

Next Generation Science Standards

3-LS4-3 Biological Evolution: Unity and Diversity
3-LS4-3 Interdependent Relationships in Ecosystems
5-LS2 Ecosystems: Interactions, Energy, and Dynamics

Activity 2:
The View in My Picture Frame

When you frame a specific view and put a boundary around it, you are able to take a close look at what's in your frame. Details stand out because that view is now isolated from all the rest.

When you draw a view, you take note of what is actually in your view— how the land is used and who lives there. In this activity participants will frame a view from a selected spot, draw the view on paper and take a close look at how the land is being used in the view.

Prep for activity
An outdoor spot.

Time: 15-45 minutes

Location:
An outside location.

Materials

- A sheet of cardboard (many possibilities: a cereal box side, a side of a cardboard box, or a sheet of cardstock).
- A ruler or other straight edge.
- A scissors, or sharp utility knife and a surface to cut on.
- A sheet of paper for each participant
- Pencils, markers, crayons, pastels or paints.
- Erasers may be handy.

Steps:

1. Make a frame:
   a. Measure in 1 to 2 inches (2-4 cm) from the edge of cardboard in 2 places on all four sides of your cardboard.

   b. Using a straight edge to connect the measurements to form a box .

   c. Cut along the box lines, so that the inside of the box falls out and leaves the frame.

2. Have participants hold their frame up in the direction that interests them.

3. As they hold up their frame, have them note what is inside it. Have them put the horizon about half way up in the frame.

4. In the lower part of the frame, below the horizon, what is on the ground? Are there plants, buildings, houses, cars, or lawns?

5. Have participants lay the frame on a piece of paper and trace the rectangle of the frame.

6. Instruct them to draw in the horizon line.

7. Have them fill in the lower part, below the horizon line, with drawings of what they see in the frame. Have them focus on being proportional to what is in the frame.

8. Have participants take a look through their frame and note what is above the horizon. Are there clouds, trees, buildings, blue sky?

9. Have them draw on their paper what they see above the horizon in frame.

10. When they are finished, have them take a close look at what they have drawn and evaluate what is in their picture. Is it mostly human-made objects, natural objects, or a mix? Are the objects in the frame mostly for people to use, or are there objects that simply live there? Are there homes of animals? Is there a big mix of plants, or just a few different kinds?

11. Who or what uses the land in your frame the most and for what?

Explore more:

Outdoor science resources at
http://beetlesproject.org/

Next Generation Science Standards

3-LS4-3 Biological Evolution: Unity and Diversity
5-LS2 Ecosystems: Interactions, Energy, and Dynamics

Activity 3:
How Do We Use Our Space?

How do we use our space? How do you use your personal space? How much space do our various uses need?

In this activity, participants will draw the layout of a space to scale, and calculate how much room each activity takes up in the space.

Prep for activity
Decide which area participants will want draw.

Time: 40–50 minutes

Location:
The program location, classroom or another spot with multiple uses.

Materials

- Sheets of paper (at least 8 1/2 x 11, though larger sheets of paper allow you to draw a bigger picture)
- A ruler
- A pencil and eraser
- Measuring Tape
- Grid paper (optional, available on page 28)

Steps:

1. Use grid paper or create a grid on paper (20x20 cm, or 8x8 inch).

2. Decide on a scale, i.e. 1 inch = 2 feet, or 3 cm = 1 meter.

3. Measure the space. It can be an outdoor space, the room they are sitting in or the building the program takes place in or a room in their home.

4. Measure the length of the space and figure out how to draw it to scale for the grid. For example: if the space is 12 x 12 ft, and the scale is 2 ft per inch, they will draw a 6 x 6 inch square on the paper.

5. Measure and draw in the items in the space.

6. Measure the objects in the space, convert the measurements to the scale that was chosen, and draw the objects to scale in the grid.

7. Compare the drawing to the actual space—does it match? Do the proportions fit the scale of the different objects in the space? If not, have them

check the placements and measurements and make some adjustments.

8. Make a list of the different activities done in the space: walk, read, play, eat, etc.

9. Measure how much space each activity needs.

10. Think about activities in the space over a day. How does its use change?

11. Have participants imagine other activities that they would like to do in the space.

12. Decide how much space each activity would need and calculate the amount of space it would need. Would they be able to do that activity in the space?

Explore more

1. Create a dream space: What else would they love to do in their space? Grow a garden? Build a bicycle? Create a castle? Construct a skateboard ramp?

2. Imagine what the space would look like. Decide what the space requirements would be and convert them, using the scale they created, to fit in the grid.

3. Draw the different elements into the grid. How would it work?

Common Core State Standards Connections:

Mathematics -4.MD.A.2

Activity 4:
What Does the Land Look Like from Above?

The patterns of land use can be beautiful— a combination of form and function. When you look at land use from a bird's eye view, you see the intersection of how people use the land with the natural landscape formed by water and rock, soil, and climate.

In this activity, participants will recreate their own personal landscape, seen from above, out of bits of paper— green for grass, dark green for trees, gray for houses, black for streets and pavements, etc. Drawing inspiration from satellite images of where they live, they will decide how to depict the landscape by creating a collage, or mosaic out of paper.

Prep for activity

You will need a flat working surface out of the wind. If you do not have internet access for this activity download and print some maps of your area ahead of time.

Time: About 1 hour

Location: At a table or on a flat surface.

You can make a mosaic that shows the types of land cover in your state.

Materials

- A selection of squares or torn pieces of colored construction, tissue, or other paper— green for grass, dark green for trees, gray for houses, black for streets and pavements, browns for bare fields, blue for streams, rivers and lakes, etc. Pick a special color for your house.
- Arrange the different colors of paper pieces in separate bowls, plates, or bags for easy access.
- Glue sticks, or paper plates with white glue and brushes
- Cardstock for the base of the picture (white would be best)
- Pencil and eraser
- Paper towels and water handy for clean-up.
- Optional: Mod Podge or other acrylic finishing product
- For reference: a photo or map of where they live, either through access to the internet for Google Maps or Google Earth or an alternate option— a map of your town, county or state.

Steps:

1. Assemble the materials.
2. Have participants choose the image they will be referencing.
3. Have them lightly draw the image on their paper.
4. Decide which color will represent what landscape element in the image.
5. Decide where to start for the mosaic (the middle of the cardstock may be easiest).

6. Glue the colored paper pieces down one at a time, following the drawing.

7. If they chose an area that includes their home, be sure to place the home on the picture.

8. When they are finished, you may need to let them dry before it is moved.

9. Optional: paint an acrylic finish coat (like Mod Podge) over the picture to preserve it.

Explore more

Walk outside— what kinds of land cover are there? Download a land cover chart at: *https://observer.globe.gov/do-globe-observer/land-cover/resource-library*

Create a collage of pictures from magazines that represent where they live.

(adapted from: https://thecraftyclassroom.com/crafts/geology-crafts-for-kids/physical-map-collage)

Next Generation Science Standards

4-ESS2-2 Earth's Systems

These are examples of some internet maps you can find and print out.
Vermillion, South Dakota is on the left and Culbertson, Montana is on the right.
Both communities are near the Missouri River.

Activity 5:
Exploring Traditional Ecological Kinships

Indigenous people have been stewards of the land since time immemorial and are holders of **Traditional Ecological Knowledge**. Indigenous cultures are diverse and many believe that plants are more than just a thing. Plants have a spirit, a purpose, and are a relative. This knowledge is the essence of life-ways.

Plants are teachers and can nourish, heal, and give us all we need to live. They also guide us to what we need. That sounds like a good relative! We just have to listen and observe.

In this activity, participants will learn and explore what **Traditional Ecological Kinships** are, what to look for, how to care for your relatives, and how we are related— including what it means to be a **keystone species**.

This is so important because this brings us closer to the land, water, and earth. This will teach us how to care for our planet and help our **ecosystems**.

Materials

- A Traditional Ecological Kinship diagram for each participant (available on page 29)
- A pencil or other item to write with.
- Plant field guides or access to a library or internet may be helpful

Prep for activity

Select an outdoor space. Become familiar with a few of the plants that can be found there.

Time: 30 -50 minutes

Location:

An outside location with a variety of native plants.

Steps:

1. Review the concepts below as a whole group. As you introduce the concepts ask participants to infer, give examples or share their understanding of the concepts with each other.

    a. What is **Traditional Ecological Kinship**?
    Traditional Ecological Kinship is the practice and belief that humans, plants, animals, land, and water are all related and work together to thrive in an **ecosystem**.

    b. What is a **Keystone Plant Species**? `
    A keystone plant species is a plant that is a main component in an **ecosystem**. If we remove this species the ecosystem would change dramatically or not exist anymore. **Keystone species** are the main important **species.**

Examples of **keystone species**:

1. Tree relatives: Boxelder, Bur Oak, and American Plum
2. Shrub relatives: Sandbar Willow, Chokecherry, and Buffalo Berry
3. Flower relatives: Plains Sunflower, Milkweed, Missouri Goldenrod, and Black-eyed Susan
4. Aquatic plant relatives: Water Lilies, Algae, and Cattails

c. Why are kinships important?

- Trees provide shelter, food, medicine, and stability for animals, birds, insects, and humans. Trees help to provide water filtration and protect from erosion. Trees breathe in carbon dioxide that humans and other species give off and turn it into oxygen. Trees purify the air and provide shade for other plants. Trees make a habitat for fungi like mushrooms that help clean the soil.
- Shrubs provide shelter, food, and medicine and can purify the soil and water.
- Flowers can provide food, and medicine, and help pollinators thrive. The native species' root systems keep the soil from erosion and hold topsoil in place.
- Aquatic plants filter the water and create homes for smaller living creatures. Insects like dragonflies lay their eggs there. They can provide food, shelter for fish, and medicines.

Did you know? The number one relative we all need in all life is water!

Missouri Headwaters State Park

Activity 5:
Exploring Traditional Ecological Kinships *continued*

Steps *continued:*

2. As a whole group go through the example below:

a. Identify the plant above: Milkweed

b. Observe: What insect is on the milkweed and what is it doing? I see a monarch butterfly pollinating the flower.

c. Kinship: What can this plant do for the insects? What do they do for humans? What can we do for the plant?

d. Gifts: What gifts can you offer to this plant? I can plant more milkweed, I can learn about our relationship with this plant, and teach others. I can learn about the plant's life cycle and other **species** that need the plant.

3. As a group review and note new findings on the example digram to the right. What do the arrows represent? What additional connections can they add?

4. Hand each participant a copy of a blank **Traditional Ecological Kinship** diagram and instruct them to choose a plant nearby to observe and record observations. Remind participants that every relative has a gift to offer each other and to identify kinships they must observe, make inferences and seek knowledge.

Explore more

Create a food web out of the kinships that they have identified through one of the below activities:

Weaving the Web:
https://forces.si.edu/main/pdf/2-5-weavingtheweb.pdf

Web of Life:
https://www.plt.org/wp-content/uploads/pdf/PLT_Act45_Web_of_Life.pdf

Learn more about Indigenous culture in your State:

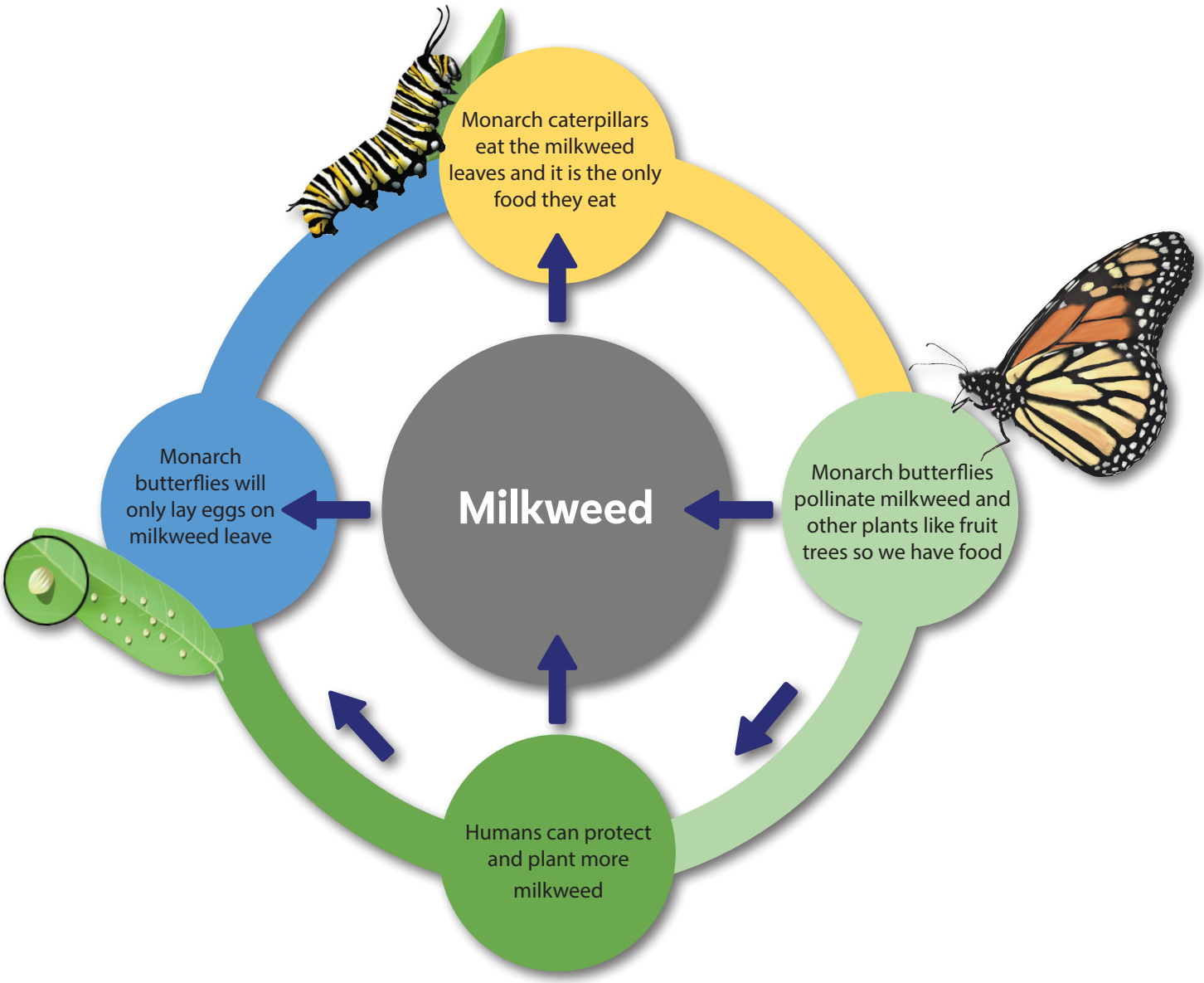
Montana:
https://opi.mt.gov/Educators/Teaching-Learning/Indian-Education-for-All/Indian-Education-General-Information

South Dakota:
https://sdtribalrelations.sd.gov/tribes/nine-tribes.aspx

Next Generation Science Standards

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Traditional Ecological Kinship Example Diagram



Activity 6:
What Do You Value About the Land?

The land we live on has many uses. Some of those uses we may overlook, such as the land our houses and buildings are on. Some uses we appreciate for fun and enjoyment, like parks, scenic areas, or to play sports. Other uses are fundamental to our lives, as when the land is used for growing the food we eat and the food that domestic animals eat. Land provides resources like water, minerals, and oil, gas, coal, and wind that power our world.

Land is also critical to other **living** beings. It's where they find food, shelter, water, and other members of their species; all that is needed for them to survive and thrive. Land that supports a broad range of plant and animal communities has high **biodiversity,** a sign of a healthy **ecosystem**.

The researchers on the WAFERx team study how different land use systems affect one another. If the way we use agricultural lands changes, then wildlife may be impacted. If we discover a new energy source, then human communities may be affected. Of course, every change and decision has a trade-off. Different people value different uses of the land.

Have you ever thought about what uses of the land are important to you? In this activity, participants will consider that question. As they answer the questions and rate the different land uses in the activities to follow, they will gain a sense of the different activities that land is used for. In their answers, they will begin to discover what they feel are the most important uses for the land around them. Different people will have different ideas on valuing the land.

Prep for activity

Consider and discuss the types of land uses that are found around where they live.

Materials

- A complete set of the Land Use Explorer Card Deck per participant or cards labeled with the land use categories download at: https://waferx.montana.edu/outreach_resources.html
- A note book to record students results
- Large chart paper or chalk to draw the results

Time: 30-40 minutes to complete

Location: a location for a group setting

Steps:

Review the Land Use Explorer Cards to gain a sense of the different land uses being considered. If any are unknown, take a moment to do a little research to learn more about that land use. **reference the glossary at the end of this guide.*

1. Land Use Personal Values:
   a. Starting as individuals have the participants lay out their cards in order of least amount of value to what they value the most. This is for their own information and they can share their thoughts and opinions if they choose.

2. Exploring Land Use Around You:
   a. Designate three drop locations labeled always, sometimes, and never. Prompt participants to go through their Land Use Cards and place their cards in the location that represents their response for how land is used around them.

b. Once they have completed their responses go over the results as a whole group. Is there a consensus?

3. Exploring Land Use in the Future:
   a. Instruct participants to create a line. This line represents a "neutral" response. Identify a location in front of the participants (approx five steps). This represents a "strongly supports" response. Do the same for five steps behind the neutral line to signify "strongly do not support" response.

   b. Read aloud the prompt below for each Land Use Card and instruct participants to take a step/s to show their response.

   How important is it to you for *(fill in the Land Use)* to be part of the landscape in the future?

   c. Reflect and pause to discuss the participants responses.

4. Land Use Working Together
   a. Have participants identity the top four land uses from their Land Use Cards that are most important to them.

   b. As a group combine your responses and organize the Land Use Cards on a flat open area to form a bar graph. Land Use cards should be lined up on the x-axis (horizontal). If multiple responses for the same card are present place them above the last card to create a bar chart.

   c. As you review the results of the group. Have participants consider the land around them, where they live, and how their land use choices match the uses of the land around them. What kinds of conflicts do you see between the choices of how land should be best used and how it is currently being used? How could those conflicts be resolved?

Explore more

Not all land uses are compatible with each other; sometimes it is necessary to choose one or two land uses over some or many of the others. The question of which uses should be chosen often has a complex answer. Many factors need to be considered and each factor judged for which ones have the most weight.

Find a recent case of land use decision-making in your area. Determine the different factors that were involved and learn how the land use decision was made. How was the decision made? Who were the people involved and what did each person or group want to do with the land? Could the land have been used for more than one of the proposed uses? Why or why not?

Note:

A self guided version of this activity is available for participants to do on their own through surveys. Visit https://waferx.montana.edu/outreach_resources.html. Look for Land Use Explorers, then choose What I Value About the Land activity under downloads.

Next Generation Science Standards

3-LS4-4 Biological Evolution: Unity and Diversity
4-ESS3-1-2, 5-ESS3-1 Earth and Human Activity

Common Core State Standards Connections:

MP.4 Model with mathematics. (4-ESS3-2)

Meet the Scientist

Name: Dr. Meghann Jarchow

Where did you grow up?
I was born in Wisconsin, but I mostly grew up in southeastern South Dakota.

What do you do for your job?
I am the Department Chair and a Professor in the Department of Sustainability & Environment at the University of South Dakota (USD). My job has three main parts: First, I teach college students about sustainability and I mentor them as they are conducting research. Second, I conduct research about our landscapes— to understand what both our environment and the people who live here need in order to flourish. Third, I oversee the Department of Sustainability & Environment, which includes making sure that people (faculty, students, and staff) have the support and resources that they need, managing the department and grant budgets, and working to increase sustainability efforts at USD and in the region.

What did you like to do as a young person?
I grew up on an acreage in the country. I always enjoyed doing outdoor activities (often with my twin sister, Kate), which included swimming in our pool, jumping on our trampoline, playing with our range of pets, and exploring the land around our house. There were some grasslands with a creek by our house, and Kate and I would often play at the creek, which included building plant bridges over the creek and often falling into the creek and getting dirty.

At what age and how did you know you wanted to be a scientist?
I didn't specifically identify that I wanted to be a scientist growing up— I knew that I wanted to be helpful and I found biology as a way to do that. When I was in the 4th grade, I became vegetarian because I learned more about industrial agriculture and I did not want to eat animals who had not been raised compassionately. I later learned about animal testing on personal care products, and so all through college, my plan was to become a researcher so that I could do research on alternatives to animal testing. I then pivoted, and for my master's degree, I was going to become a vegan dietitian. I pivoted again for my PhD and studied sustainable agriculture. There are so many ways that we can use our passion and good intentions to make the world a better place. For me, being a scientist, an educator, and a researcher has been an extremely rewarding way to do my part.

Who were role models, mentors or other adults who influenced you as a young person?
My parents and twin sister were important role models for me. Kate was always confident, and she was willing to stand up for herself and for who and what she loved. My parents modeled humility and a strong desire to serve others. I always had strong support from my family while also having room to grow to figure out what I wanted for myself.

What advice would you give to a young person who is interested in a career like yours?
Try to find a career that you find meaningful. You will spend many hours of your life working. If you are spending that time doing work that you find meaningful, it will be easier to push through challenges because you will be using your passion and skills to contribute to making the world a better place.

LAND USE EXPLORERS

Meet the Scientist

Name: My Ponca name is Mecca e' (Mecca Aye). My English name is Stacy Laravie.

Where did you grow up?
I grew up in different places and each place taught me valuable lessons on my journey of life. I was born in Yankton, SD and I have a twin sister named Tracy. My hometown is O'Neill, NE but I was raised along the Missouri River in Verdel, NE. My heart is along the Missouri River.

What do you do for your job?
I work in Tribal Historic Preservation. I protect sacred places for the Ponca people. The Ponca is my tribe. I also work with other organizations and protect the land, water, plants, and animals from destruction. I own a catering business that specializes in Indigenous pre-colonized foods. Foods that were here in the Americas before colonization. I teach others how to seed save, preserve foods, and how to use traditional foodways like my ancestors long ago. I am also an artist.

What did you like to do as a young person?
As a young person, I loved to explore and find treasures. I wanted to be an archaeologist and now I work with them even though I'm not one. I love to camp and see what I could gather on the land. I would hunt, fish, and trap with my father and great-grandfather. I always had my sketchbook with me and would draw the world around me as I see it. I love going to cemeteries and finding history on those individuals. I know that sounds strange. My father knew many awesome people so I grew up in a small community with a large worldview.

At what age and how did you know you wanted to be a scientist?
When I was probably a teenager, I started to realize how important my cultural knowledge was in sciences, especially those that have to do with the earth, land, water, and animals. I started to realize the kinships and how each living thing had a job and part to help each other.

Who were role models, mentors or other adults who influenced you as a young person?
Some of my role models were my great, great, great, grandfather Chief Standing Bear. He was one of the first civil rights leaders and won a court case against the Federal Government recognizing Native Americans as human beings. Second, my father and great-grandfather were my heroes. My father took part in the restoration a reinstatement of the Ponca Tribe of Nebraska. He sat on the Restoration Committee and went to Washington DC to fight for this.

What advice would you give to a young person who is interested in a career like yours?
The advice I would give is to work hard, stay humble, and listen to those that are trying to teach you. Even if you already know something you might get a different perspective. Accepting perspectives help you to grow wise like Yoda.

LAND USE EXPLORERS

Meet the Scientist

Name: Dr. David Swanson

Where did you grow up?
I grew up in the small town of Silverton, Oregon, which had a population of about 5,000 people when I was growing up. My parents lived on a small acreage a couple of miles outside of town, so I had lots of room to explore as a kid. The Silverton area also had lots of forests, creeks, and lakes nearby, which made it pretty easy to explore and enjoy the outdoors.

What do you do for your job?
I am a professor of Biology at the University of South Dakota. I teach courses on bird biology and identification and animal function. I also do research where I study how birds and frogs are able to respond to cold temperatures in the winter and how birds use natural and human-modified habitats for nesting, winter and migration.

What did you like to do as a young person?
I always liked being outside and exploring nature. I loved to go fishing as a kid (and I still do) and I was also interested in birds from an early age, although I didn't really get seriously involved in birdwatching and bird study until I took a bird biology class in college.

At what age and how did you know you wanted to be a scientist?
I didn't really figure out that I wanted to be a scientist until I was in graduate school. During college, I figured out several things that I didn't want to be, and I knew that I liked biology, especially of birds and other animals, so I went to graduate school to get additional training in biology. While I was in graduate school, I was exposed to scientific research and I really liked being able to use my curiosity in figuring out ways to do

studies to try to get answers to research questions, so that is really when I knew that I wanted to become a scientist.

Who were role models, mentors or other adults who influenced you as a young person?

My Mom and Dad encouraged my curiosity and bought me books on fishing and birds. They also took me camping. My grandpa loved fishing and he took me fishing and camping a lot as a kid. One of my biology professors during my college years was instrumental in getting me focused on birds and animal function as areas of particular interest and helping guide me to graduate school opportunities. My advisor during graduate school was also a big influence in helping to focus my research interests and in training me to think and write like a scientist.

What advice would you give to a young person who is interested in a career like yours?

My fist piece of advice is to just be curious. Being a scientist is all about making careful observations, then asking questions about why things work like they do, and then figuring out ways to study the reasons why things work like they do. I'd also suggest that you get involved in a wide variety of opportunities like science and nature camps or clubs that focus on the outdoors. For example, I was in Cub Scouts as a kid and really enjoyed some of the nature-related activities that we did there. Last, I'd encourage you to get outside and explore. There are lots of things that you will discover if you get outside and pay attention to what is going on.

LAND USE EXPLORERS

Glossary

Biodiversity:
the existence of a large number of different kinds of animals and plants which make a balanced environment

Biofuels:
fuel made from plant or animal sources and used in engines

Biology:
the scientific study of the life and structure of plants and animals

Biologists:
a scientist who studies biology

Climate Change:
changes in the earth's weather, including changes in temperature, wind patterns and rainfall, especially the increase in the temperature of the earth's atmosphere that is caused by the increase of particular gases, especially carbon dioxide

Development *(new buildings):*
the process of using an area of land, especially to make a profit by building on it, etc.

Ecology:
the relation of plants and living creatures to each other and to their environment

Ecological:
connected with the relation of plants and living creatures to each other and to their environment

Ecologists:
a scientist who studies ecology

Ecosystem:
all the plants and living creatures in a particular area considered in relation to their physical environment

Engineer:
a person whose job involves designing and building engines, machines, roads, bridges, etc.

Engineering:
the activity of applying scientific knowledge to the design, building and control of machines, roads, bridges, electrical equipment, etc.

Environment:
the natural world in which people, animals and plants live

Food chain:
a series of living creatures in which each type of creature feeds on the one below it in the series

Food Web:
a system of food chains that are related to and depend on each other

Habitat:
the place where a particular type of animal or plant is normally found

Indigenous *(of people and their culture)*
coming from a particular place and having lived there for a long time before other people came there; relating to, belonging to or developed by these people

Keystone:
the most important part that other parts depend on

Living:
all living things have similarities. They change in response to their environment, and need energy. They also have specific structures designed for specific functions *(https://astrobiology.nasa.gov/education/alp/characteristics-of-life/)*

Macro-habitat:
large habitat

Micro-habitat:
small habitat

Native species:
existing naturally in a place

Non-native species:
does not exist naturally in a place

Non-living:
not living things

Observation:
the act of watching somebody/something carefully for a period of time, especially to learn something

Organisms:
a living thing

Private Lands:
belonging to or for the use of a particular person or group; not for public use

Public Lands: provided, especially by the government, for the use of people in general

Renewable *(of energy and natural resources):*
that is replaced naturally or controlled carefully and can therefore be used without the risk of using it all up

Scale *(of map/diagram/model):*
the relation between the actual size of something and its size on a map, diagram or model that represents it

Science:
knowledge about the structure and behavior of the natural and physical world, based on facts that you can prove, for example by experiments

Solar Power:
energy obtained from the light and heat from the sun, used to produce electricity

Species:
organisms that can reproduce with one another and produce fertile offspring

Sustainable:
involving the use of natural products and energy in a way that does not harm the environment

Traditional Ecological Knowledge
the evolving knowledge acquired by indigenous and local peoples over hundreds or thousands of years through direct contact with the environment *(https://www.fws.gov/media/traditional-ecological-knowledge-fact-sheet)*

Traditional Ecological Kinships:
is the practice and belief that humans, plants, animals, land, and water are all related and work together to thrive in an ecosystem *(definition from Activity 6)*

Wind Power:
energy obtained from wind, used to produce electricity

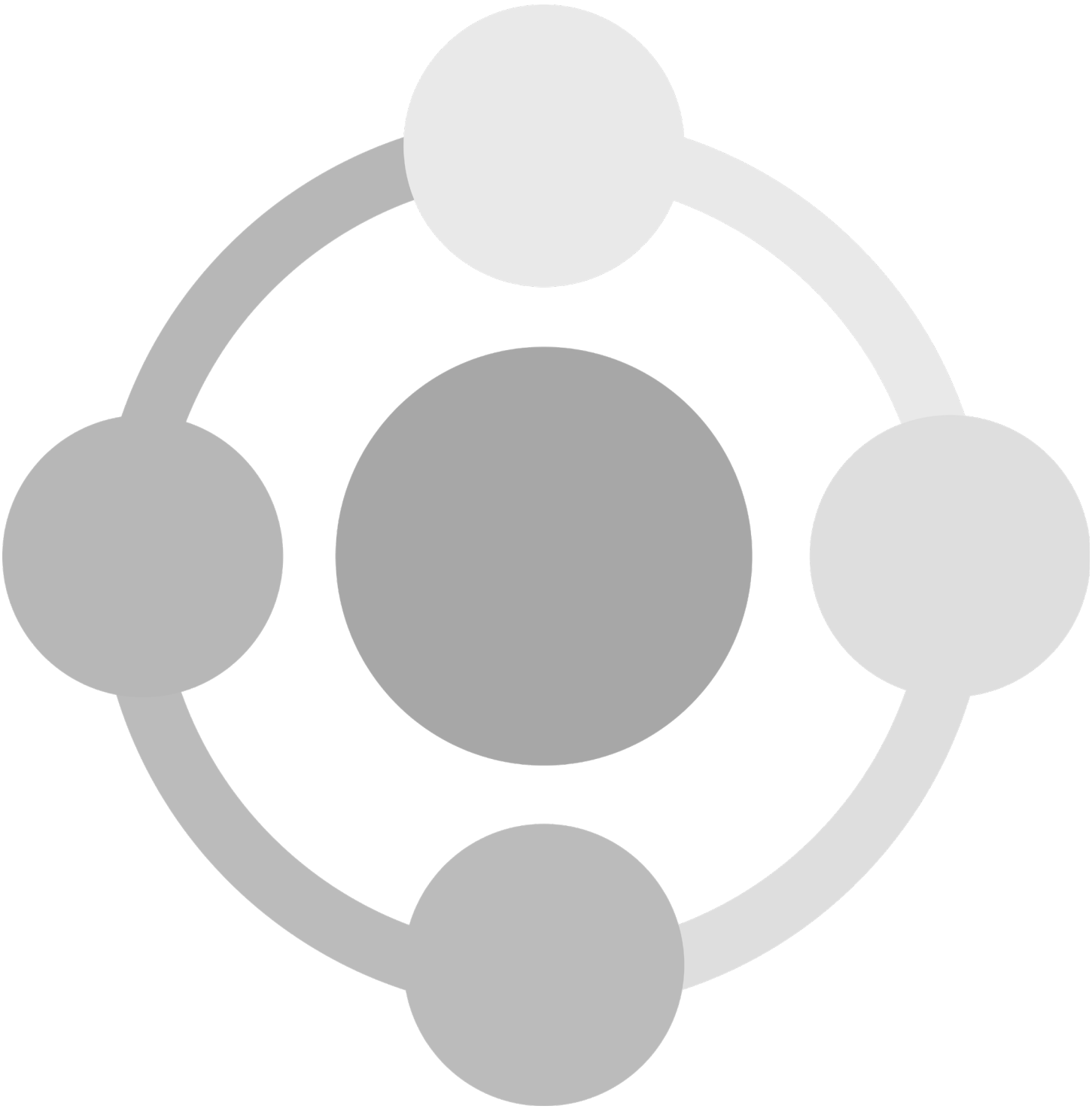
Source *(unless noted)***:**
Oxford Learner's Dictionaries
www.oxfordlearnersdictionaries.com/us/

Activity 3: How Do We Use Our Space?

Name: _____

Name:_____

Activity 5: Traditional Ecological Kinship Diagram




MONTANA
AFTERSCHOOL
ALLIANCE


South Dakota
Discovery
Center


MONTANA
STATE UNIVERSITY
Science Math
Resource Center


MONTANA
NSF EPSCoR