



Minnesota Biomes

In a Nutshell



Students will learn about the study of Natural History and discover threats that invasive species pose to Minnesota's native plant communities. Students will conduct a plant survey and explore the concept of diversity within one native plant community (prairie or woodland). Students will also learn about invasive plant "control" methods used on the National Wildlife Refuge.

Grades	4 / 5
Seasons	Fall
Location	Visitor Center

Learning Objectives

After participating in this activity, students will be able to:

- define the term biodiversity.
- define the term invasive species.
- Give at least one example of how invasive species can harm Minnesota's native plant communities.

Literature Connections

What is a Biome? by Bobbie Kalman (NC830L)

¿Qué son los Biomas? by Bobie Kalman (NC830L)

Mirrors of Minnesota by Mary Hoff, MN Conservation Volunteer Magazine

The Loon's Necklace by Elizabeth Cleaver (560L)

The Legend of the Lady Slipper by Lise Lunge-Larsen and Margi Preus (AD610L)

M is for Minnesota by Dori Butler

Pre-Visit Suggestions

3815 American Blvd. East
Bloomington, MN 55425



15865 Carver Highlands Drive
Carver, MN 55315

Minnesota Valley National Wildlife Refuge

Project WILD Minnesota activity, Habitat Rummy (page 49)

Will help students discover how the habitat requirements of animals found in Minnesota are related to the biome where the animals live.

MN Natural History Research

Divide students into four teams. Assign each team to one of Minnesota's four Biomes (Deciduous Forest, Coniferous Forest, Prairie Grassland, and Tallgrass Aspen Parkland). Allow each team one week to research answers to the following questions related to their assigned biome.

- *What is the predominant plant species that represents your biome?*
- *What animals are characteristic of your biome?* Students should provide at least one animal name for each major animal group: mammal, bird, reptile, and amphibian.
- *Are there threats to your biome? Are these threats natural or caused by humans?* (i.e. insect pest, non-native plant, land use issues, pollution issues)

Who Am I?

Pair students and ask them to guess the identity of a "mystery" Minnesota animal. Using the clues provided on the cards, ask each pair to determine the biome where their Minnesota animal resides.

State Symbols

Often, a symbol is selected based on unique value to the selecting state (the Agate), historical significance (Norway pine- value to the lumber industry), rareness (the lady slipper), or a special human interest or fascination (the Monarch a migrating insect). Use the MN State symbols poster to "quiz" your students' knowledge of Minnesota's State fish, bird, insect, mushroom, and rock. Begin the activity by displaying the illustration of each symbol. As students make a guess for each symbol, reveal the answers one at a time.

Divide students into investigative reporting teams. Each team should work together to uncover the reasons why each symbol was selected to represent our state. To wrap up the activity after students have completed their own investigations, read with students the DNR



Minnesota Valley National Wildlife Refuge
Volunteer Magazine article *Mirrors of Minnesota*, *The Loon's Necklace*,
The Legend of the Lady Slipper and *M is for Minnesota*.

On-Site Activities

Students will be introduced to the concept of biodiversity and invasive species and threats they pose to Minnesota's native communities.

Students will conduct a plant survey in either a prairie grassland or deciduous woodland to estimate diversity and determine the threats invasive species pose to the natural community. In addition, students will search for signs of animals to determine what wildlife may be found in a particular biome.

Classroom Connection

Conduct other Diversity Surveys

Ask students to repeat the plant survey in a natural area, a park near school, or in their own school yard. Compare the diversity findings. Which area had the most biodiversity? Why? Did students find any invasive species?

Start an Invasive Species Education Campaign

Ask students to design WANTED posters for an invasive species found locally. Ask students to include facts that will help other people to properly identify the plant, understand the threat this plant or animal poses to native animal and plant communities, and what people should do if they find the invasive species. Hang the posters around the school, the local library or government center to educate other students and families about invasive species.

Teacher Resources

Mirrors of Minnesota by Mary Hoff, Minnesota Conservation Volunteer Teachers Guide

http://www.dnr.state.mn.us/young_naturalists/teachersguides/index.html

Minnesota's Natural Heritage by John Tester

Minnesota Invasive Non-Native Terrestrial Plants, Department of Natural Resources Trails and Waterways



Minnesota Biomes Pre-Visit Activities

Materials

- *Minnesota Biomes* poster (MNDNR)
- *Minnesota State Symbols* poster (MNDNR)
- *Either*
 - *Animal Cards*, 15 laminated (one per student pair)
 - or
 - *Habitat Rummy Game* (four team “sets”)
- Biomes prop kit including: Loon Audubon bird, deciduous tree leaves, pine needles and cone, agate, etc.

Introduction

Minnesota Biomes

Lead students in a discussion comparing and contrasting the study of human history with the study of natural history.

For example:

- Human history is the study of human *events*. Natural History is the study of the *characteristics* of plants, animals, insects, etc.
- Human history connects people to the past. Natural History may also investigate the process of change over time for particular species.
- Human history often reflects the connection and dependence between people and nature. Natural History more often reflects the effects people have on nature and natural systems.

Explain to the students the study of a State’s “natural history” is generally based on the plants and animals considered to be native to the State.

- Define the term native and non-native.

Explanation: Native plants and animals are species that are known to have been growing and living in Minnesota before Europeans originally immigrated and settled in the State (Pre-1800’s).

Use the poster: *Minnesota Biomes* to introduce students to the four major biomes found in Minnesota. Background information is printed on the back of the poster for teacher reference.

MN Biomes Include: Prairie Grassland, Coniferous Forest, Deciduous Forest, and Tallgrass Aspen Parkland.

Clarify the difference between a biome and a habitat.

Explanation: A “biome” is a term used to describe a biological community that usually occurs over a large area. Biomes include many similar plant communities and the animals that live in them.

Lead students in a discussion of the climate conditions that determine where biomes are located.

Explanation: Climate conditions in a region include average annual temperature, precipitation, average length of the growing season, and humidity. Soil type and terrain also play a factor in the location of a biome.

Within each of these biomes live animals whose survival depends on particular habitats found within the biome. Review the four components of habitat that all plants and animals need to survive- food, water, shelter, and space (in the correct arrangement).

Would you expect to find similar animals living throughout all four of the different biomes? Explain reasons for why or why not.

- **Animals do not all eat the same types of food. Animals live in the biome that provides the proper food necessary for their survival. For example, a lynx primarily hunts and survives on snowshoe hares. Snowshoe hares live primarily in northern coniferous forests. Therefore, lynx are found in northern coniferous forests where their preferred food exists.**
- **Animals depend on different types of shelter. American Goldfinches use the soft, downy hairs found in thistle flowers to build their nests, while a red fox digs an underground den.**
- **Animals have different space requirements. For example, gray wolves need a much larger territory to meet their four habitat requirements to survive, compared to coyotes.**

Animal Connections (Choose One)

Habitat Rummy

Review the instructions in the MN Project WILD curriculum on page 49.

Divide students into teams of 3. Provide each team with a set of Habitat Rummy Cards and 3 Playing Boards (sets are color coded). Explain the rules of play which are similar to the traditional Rummy card game. The student's objective is to complete one set (food, water, shelter, space, and arrangement card) for as many animals as possible found in their habitat. * Note - Only 3 of the original 4 habitats (Coniferous Forest, Prairie Grassland, and Deciduous Forest) are used to represent Biomes in this game. The wetland habitat, referred to in the original Project WILD activity, has been eliminated as a wetland is NOT considered a Biome.

Allow teams to play until at least one person has completed a "set". If time still remains, continue to play until teams have played through all their cards and no more sets can be made. The student with the most complete sets is considered the winner for each team.

If time remains, allow one student from each team to describe the habitat requirements for one of the animals found on their habitat board.

Who Am I?

Ask students to form groups of two. Place one *Who Am I?* card around the neck of one student in each pair. Make sure the card is placed to hang down the student's back to assure that they will be unable to see the identity of the animal. It is OK for their partner to read the information on the card; however, they should not reveal the name of the animal to their partner.

Explain to the class that each pair is trying to accomplish 2 things. First, the person with the *Who Am I?* card is trying to guess the identity of the animal on their card. Give the teams 5 minutes to ask and answer questions. The cardholder may only ask their partner any Yes or No question. Examples:

Do I live in the forest?

Do I have fur?

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Do I eat other animals?

Do I lay eggs?

Once the animal's identity has been discovered the student may move the picture from their back to their front as a signal they are ready to go on.

Ask student teams to determine the most suitable biome for their animal. Clues may be found in the text of the Who Am I? cards. Ask students to organize all the animals into the appropriate biome.

Wrap-up

Explain to students that during their field trip to Minnesota Valley National Wildlife Refuge they will conduct a survey in either a prairie or woodland habitat as a representation of the larger biomes. Students will examine the variety of plants and look for signs of animals that live in the habitat. Students will learn about other plants and animals that can threaten Minnesota's natural history – invasive species!

Minnesota Biomes On-site Activities

Materials

Woodland Sampling Kit (per student team)

- Tape measure – one per student team
- 20 inches of string and 4 flags per student team
- Plant Card (a blank index card with large loop of tape on the front)
- Clipboard, pencil and data sheet
- Flagging Tape
- Buckthorn identification card

Prairie Sampling Kit (per student team)

- One Hula Hoop
- Plant card (a blank index card with large loop of tape on the front)
- Clipboard, pencil and data sheet
- Flagging Tape
- Leafy Spurge identification card

Visual Aids

- *Not all Alien Invaders are from Outer Space!* poster (Dept. of Ag)
- *Plant Survey Classroom Chart, laminated*
- Species Area Curve (draw graph on poster paper as illustrated in the text)

Introduction

(30 minutes)

Briefly review the pre-activity information including the study of Natural History, the definition of a biome, and the names of the four biomes in Minnesota.

Introduce the concept of “native” species. Explain that each biome is being “attacked” everyday by “invaders!” Use the *Not all Alien Invaders are from Outer Space* poster to illustrate examples of a wide variety of non-native species.

What's the difference between a non-native species and an invasive species? **Explanation:** A non-native is a species brought into a biome where it never existed before. This often happens by mistake...

- A gardener imports a plant because the plant appears pretty and will form a nice dense hedge (Buckthorn) or produces an especially pretty purple flower (Purple Loosestrife).
- A pet owner brings House Sparrows from England as caged pets; however, some escape into the wild and are able to survive and reproduce.
- A mussel, native to waters found in Europe, attaches to the bottom of a boat and catches a ride to a new lake or river where it drops off and stays (Zebra Mussels).

The problem isn't necessarily that the species is non-native but that these species often become invasive. Without the natural biological controls found in their original ecosystems, non-native species quickly take over a habitat, crowding out the native plants and animals that are part of the native food web.

Depending on the location where students will complete this activity, highlight one of the two following invasive plants: buckthorn (woods) or leafy spurge (prairie). Advise students to keep a look out for these invasive plants during the survey, encouraging them to reference the identification card in their sampling kit. If a student finds one of the plants, advise him or her to tie a piece of flagging tape around the plant. The Refuge staff will help verify their identification and remove the invasive plant at a later time.

Plant Survey *(incorporated into this lesson with permission from Earth Partnership for Schools, University of Wisconsin – Madison Arboretum)*
(45 minutes)

The most accurate way to inventory the number of different plant species (diversity) on a site is to count each plant; however this is very impractical due to the size of most natural areas. Scientists have figured out that counting plots in a grid system is a much easier way to determine the number of plants found in an ecosystem while still being accurate. The grid system can produce very reliable data as long as the survey plots (any size or shape) are randomly distributed and sufficient in number.



A NOTE ABOUT PLANTS

Stinging nettle, thistle, and poison ivy may be found close to the trails and in the survey area. Before sending students out to conduct the survey, be sure they are able to identify these plants. To point out identification features, use the poison ivy Riker mount, pressed specimens and photos of these plants located in the Refuge classrooms.

Woodland Plant Survey

Ask students to work in pairs. Each pair should lay out a 4 foot square using the flags, string, and tape measure. Reassure students during this activity that it is not necessary to know the names of the plants they find, as they are simply conducting a diversity survey. Students should collect one leaf from every different plant they find in their quadrant and stick it to their woodland card. Since students will not be able to keep the leaves they collect, they should draw or trace the leaves on their data sheet for a record of their collection. At the same time, students should look for and record on their data sheet, any signs of animals living in or using the quadrant. Examples include nests, holes in trees, burrows, scat, signs of feeding, feathers, skin or fur. Allow each team about 30 minutes to work.

Prairie Plant Survey

Ask students to work in pairs. Each pair should randomly toss a hula hoop out into the prairie. Reassure students during this activity that it is not necessary to know the names of the plants they find, as they are simply conducting a diversity survey. Students should collect one leaf from every different plant they find in their hoop and stick it to their prairie card. Since students will not be able to keep the leaves they collect, they should draw or trace the leaves on their data sheet for a record of their collection. At the same time, students should look for and record on their data sheet, any signs of animals living in or using the quadrant. Examples include nests, burrows, scat, signs of feeding, feathers, skin or fur. Allow each team about 30 minutes to work.

For both survey areas:

Back in the classroom, teams will add their leaves to the Classroom Chart (illustrated below) with the following instructions:

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- The first team to complete their survey will add all their leaves to Card #1. The first team should tabulate the number of new species and cumulative total (both numbers will be the same for the 1st team) on the Classroom Chart.
- The remaining teams will repeat this process one at a time adding ONLY the leaves that are different from the ones already placed on the chart. Remove any leaves that have already appeared on previous cards.

Note: As teams "get in line" to add their data there might be some discontent over not being allowed to record everything they found. Explain that their drawings are their record of all the plants they found in their sample plot and this chart is a quick way of calculating diversity. The data from each team is important and valid.

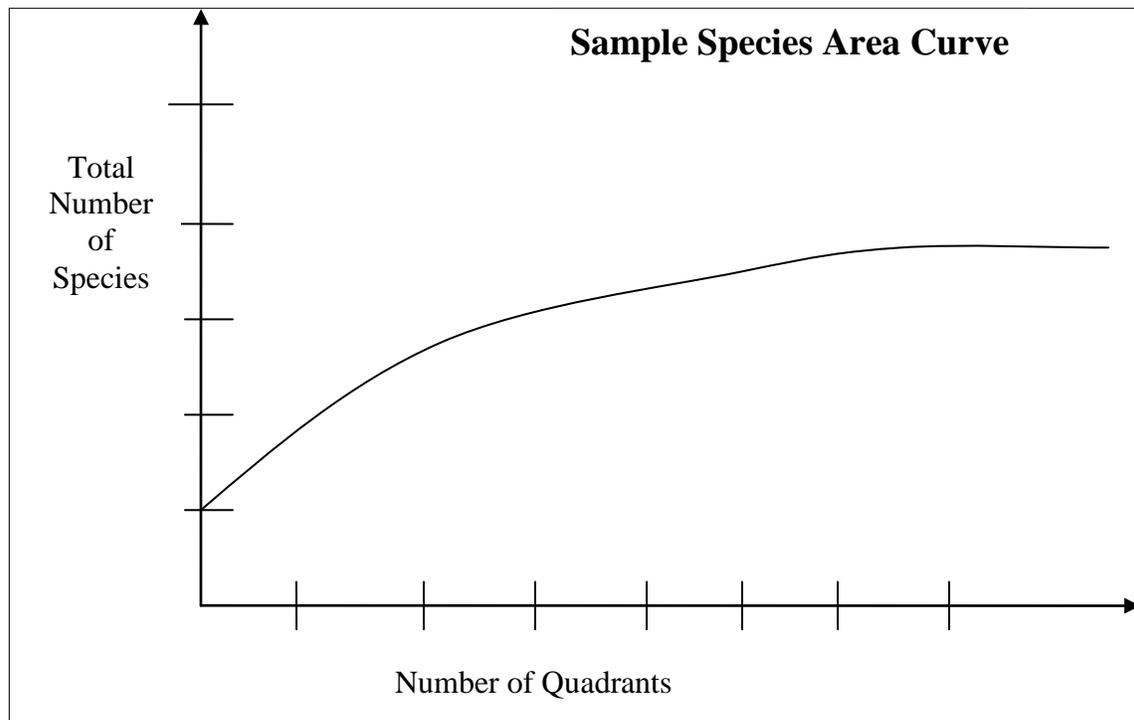
- Each team also completes the # of New Species and Cumulative Total Species columns. This continues until each team has added their data to the chart.

Prairie Plant Diversity Survey Chart					
Prairie		Prairie	Prairie		
Plant Cards		# of New Species	Total # Species		
Card #1					
Card #2					
Card #3					

Woodland Plant Diversity Survey Chart					
Woodland		Woodland	Woodland		
Plant Cards		# of New Species	Total # Species		
Card #1					
Card #2					
Card #3					

As teams add their data to the chart, ask a student helper or chaperone to graph the results (see the example below). How does the graph show us when we have sampled enough plots to accurately assess species diversity? **When the Species Area Curve levels off, a sufficient number of quadrants have been taken.**

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In addition to the plant graph, ask students to begin a class record of their wildlife and/or wildlife sign observations on the board. Ask students to guess what animal(s) may have left the sign(s) they observed. This will help students build a whole plant/animal community for the biomes they explored.

Management Connection- Invasive Species

Minnesota Valley National Wildlife Refuge manages habitat for both Prairie and Deciduous Forest. Refuge staff is challenged to minimize the impacts of invasive species while ensuring that each biome maintains a healthy and diverse plant/animal community.

Refuge biologists closely monitor habitats through techniques very similar to the plot survey that students conduct in this activity. When biologists find invasive species they develop strategies to minimize the spread, and if possible eliminate them altogether. One method many National Wildlife Refuges use to control invasive plant species is controlled burn, also known as prescribed fire. Storms, which frequently swept across the prairies, often ignited raging wildfires. Over time, prairie plants developed adaptations to survive and even thrive under these harsh conditions. Today, biologists sometimes use fire to reduce the growth and survival of non-native invasive species which do

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not have the adaptations necessary to withstand the harsh conditions of the historical prairie environment. Other management strategies include mowing, pulling, and applying chemicals to non-native invasive species.

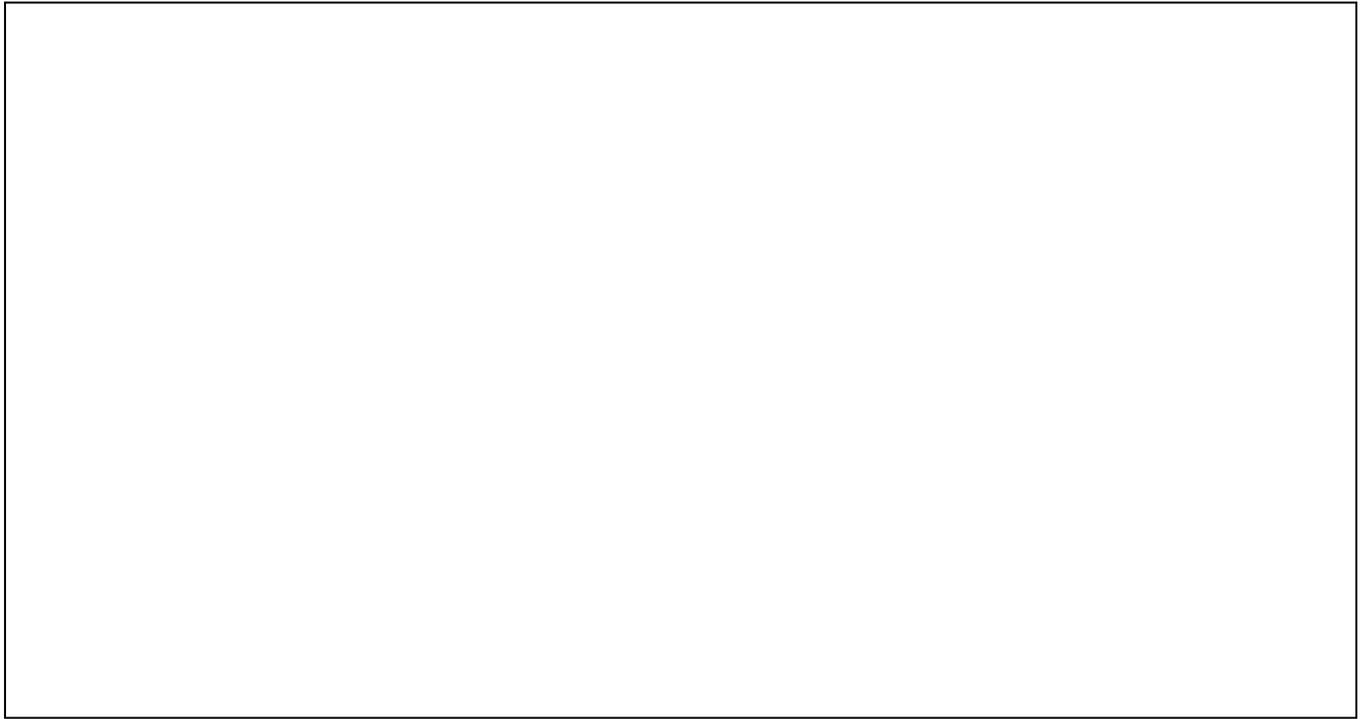
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Naturalist: _____ Date: _____ Location: _____

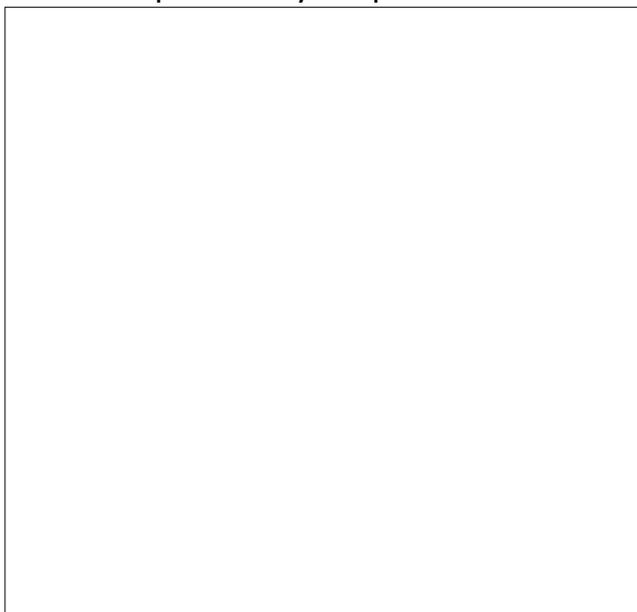
Weather: _____

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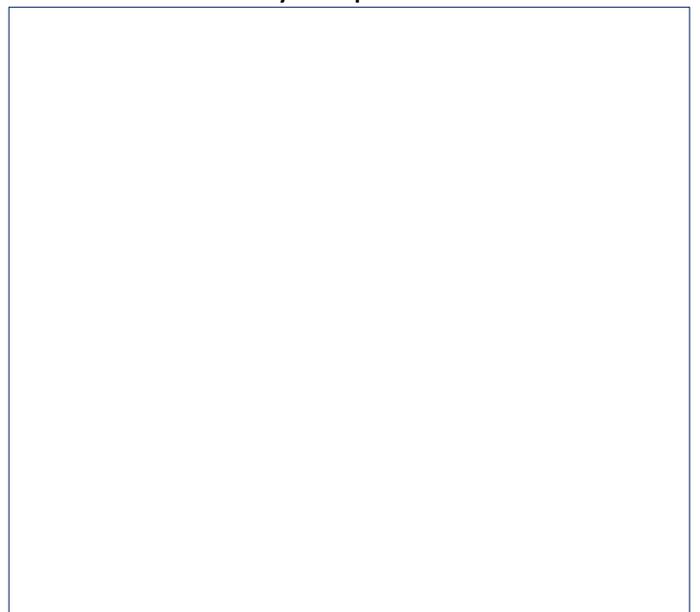
Sketch the leaves in your sample plot.



Sketch or describe the invasive species in your plot.



Sketch or describe the wildlife signs in your plot.



My favorite discovery today was _____.

Minnesota Biomes Rainy Day Alternatives

Biome in a Box

Materials

8 Biome Kits
8 mini-hoops
8 Animal prints / scats keys
Journal pages
Invasive species identification cards

Each kit contains a variety of silk plant leaves, seeds, and flowers that represent “plants” in a biome. Some kits may also contain track stickers, scat and other animal signs. To simulate the variable conditions that exist in real biomes, kits are not identical. Some kits may also contain white silk flowers which represent endangered species or small laminated pictures of invasive plants the refuge staff are trying to control.

Introduction

Follow the directions for the introduction as if you were leading the activity outdoors. Explain how plant plot surveys are conducted outside as described in the field trip introduction. Explain to your students that they will be conducting a simulated diversity study indoors using the Biome Kits.

Assign students to work in teams of 3. Each team should receive one Biome Box, one mini-hoop, a set of animal prints/scats keys, journal pages for each person, and a set of invasive species identification cards.

Students should empty their box within their plot which is the area inside their hoop. Students should then select different “plants” from their sampling plot as if they were conducting a real survey. Teams should place the leaves on their plant cards in the same manner as described in the original activity. Ask the teams to draw what they find as though they were sampling real plants outside. They should also record any animal signs, invasive or endangered species they find in their “plot.”

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Advise students to leave their Biomes Box materials and move to another plot. At the new plot each team should repeat this process on a second data sheet and plant card.

Continue as directed in the outside activity, completing the table and drawing the graph. Did the students sample enough "plots?" The graph will continue to climb if the team has not collected enough data.

Biome Jeopardy

Play a round of Biome Jeopardy. The questions in this game are based on the pre-activity information, the Habitat Rummy Game and what students learned while conducting the sampling plot activity.

MN BIOMES JEOPARDY

Use the game board provided at the refuge or set up as described below.

HOW TO SET UP:

- Using a dry-erase board, write the categories at the top, with the point amounts listed underneath. Then, as the game is played, you can erase each number that is chosen.

Example:

MN BIOMES	BIOME PLANTS	BIOME ANIMALS	INVASIVE SPECIES	SURVEY KNOW HOW
100	100	100	100	100
200	200	200	200	200
300	300	300	300	300
400	400	400	400	400
500	500	500	500	500

- Split the students into two teams.
- Have them choose a team name (preferably a MN animal name).
- Each team needs to choose a captain who will speak for the group.
- Have an adult keep tally of the points for each team.

HOW TO PLAY:

- Flip a coin to see who goes first.
- Explain that the points indicate the difficulty of the question.
- An individual from the first team chooses a category and point value. Take turns asking each student to choose.
- Decide how you want each team to answer: As a group (the team can decide what to answer but **ONLY** the captain can give the answer, after everyone has agreed) OR individually (with no help from their teammates).
- If they get it right, they get the points.
- If they get it wrong, there is no penalty. However, the other team can now try and answer the question. The other team can discuss the question as a group but then **ONLY** the captain can give the answer, after everyone has agreed.
- If the other team gives the wrong answer as well, the question is dropped and the answer is given. The team who was next to pick a question is now able to take their turn.
- Clarify wrong answers!

HOW TO END:

The game ends when either all the clues are chosen, or each student has had a turn to choose a question.

MN BIOMES

100 points:

- MN is divided into how many biomes? 4
- Name the 4 biomes found in MN. Coniferous, Deciduous, Tallgrass Aspen Parkland, Prairie Grassland

200 points:

- What is the definition of a biome? A biological community that occurs over a large area.
- What components of habitat are critical to animal survival within a biome? Food, water, shelter and space in the right arrangement

300 points:

- What determines the type of biomes found in MN? Climate conditions, soil type and terrain
- Give three examples of climate conditions that influence the location of biome communities. Rainfall (snowfall), length of the growing season, humidity, winds.

400 points:

- Which biomes are represented at Minnesota Valley National Wildlife Refuge? Deciduous and Prairie Grassland

500 points:

- How do animals choose the biome they live in? They live in the communities that provide the food, shelter, and space they are designed to use.

BIOME PLANTS

100 points:

- Name one tree species you might find in a deciduous biome
Oak, Maple, Ash, Elm, etc.
- Describe one characteristic that most coniferous trees have in common?
Have needles instead of broad leaves, carry seeds in cones, not shed all their needles at once.

200 points:

- Why do trees in the deciduous biome drop their leaves in the fall?
To conserve water, reduce snow buildup that leads to broken branches
- Forb is the term for what type of plant found in the Prairie Grassland biome?
Showy flowers

300 points:

- Which deciduous tree is part of the Tallgrass Parkland biome?
Aspen
- Which MN biome gets the least amount of rainfall and most wind?
Prairie Grassland

400 points:

- Which MN Biome once dominated the south western part of Minnesota?
Prairie Grassland
- Which biome dominated the north eastern part of the state?
Coniferous

500 points:

- What biome includes wetlands?
All biomes may contain a variety of wetlands
- What is the name of the one coniferous tree that does shed all it's needles at one time in the fall?
Tamarack

BIOME ANIMALS

100 points:

- Moose are typically found in which type of biome? Coniferous Forest
- Which of the following Deciduous Forest animals eat insects as part of their diet? Black Bear, Ruffed Grouse, and Pileated Woodpecker.

200 points:

- In which MN Biome would you find the following community of animals: Red Fox, Meadowlark, Deer Mouse, Bullsnake? Prairie Grassland
- The largest species of owl in MN is a member of this biome. Coniferous Forest (Great Gray Owl)

300 points:

- Which of these members of the Coniferous Forest are predators? Wolf, Moose, Red Squirrel, Great Gray Owl. Wolf, Great Gray Owl
- What type of shelter would a bull snake use? A burrow dug by another animal.

400 points:

- Why can't animals live throughout all of Minnesota's biomes? Different animals have different food, shelter and space requirements.
- Give one additional factor that is part of the habitat requirements of food, water, shelter, and space for every animal? *healthy water, components must be in a suitable arrangement*

500 points:

- Name one herbivore found in each of the following biomes: Coniferous Forest, Prairie Grassland, and Deciduous Forest. answers vary but shouldn't include insect eaters, Coniferous: moose Prairie: insects, Goldfinch Deciduous: Deer
- Name one carnivore found in each of the following biomes: Coniferous Forest, Prairie Grassland, and Deciduous Forest. answers vary but should include insect eaters, Coniferous: wolf Prairie: fox Deciduous: bear

INVASIVE SPECIES

100 points:

- Which invasive species has green deciduous leaves, dark purple berries, thorns and quickly spreads through woodlands? Buckthorn
- True or False: If none of the plants in your hoop were invasive species, you could pick up and move your survey hoop somewhere else. FALSE

200 points:

- Which of the following is not an invasive species: Buckthorn, Canada Thistle, Leafy Spurge, Big Bluestem Big Bluestem
- Which invasive species has yellow-green flowers and a milky sap? Leafy Spurge

300 points:

- Explain the term "invasive species". Non-native plants or animals that quickly take over a habitat.
- Explain the term "native species". A plant or animal historically part of Minnesota's natural plant and animal communities.

400 points:

- Why are invasive species such a problem? Without the biological control that are found in their native habitats, invasive species can quickly crowd out native plants or animals part of the community that other plants and animals depend on for survival.

500 points:

- What methods of control does the refuge use to maintain biodiversity and reduce invasive species? prescribed fire, chemical application, insect controls, and hand pulling / removing.

SURVEY KNOW HOW

100 points:

- True or False: You needed to know the name of each plant in your survey hoop. FALSE
- True or False: If none of the plant in your hoop looked interesting, you could pick up and move your survey ring somewhere else. FALSE

200 points:

- Name one of the invasive species you were looking for in your survey hoop. Buckthorn, Canada Thistle, Leafy Spurge
- Which invasive species has spiny stems and leaves? Canada Thistle

300 points:

- Explain how to use the ring to collect a "random" plant sample. Close your eyes and toss the ring in any direction. Then leave it where it lands regardless of the plants found in the hoop.
- What information did you collect from the sampling plots? wildlife signs, invasive species present.

400 points:

- Explain the term "native species". A plant or animal always part of Minnesota's natural plant and animal communities.
- What is biodiversity? A variety of plant and animals within a community.

500 points:

- When the species area curve finally leveled off, what did that tell you? That a sufficient number of plots had been sampled.
- How might refuge biologist use the data collected in this survey? To monitor changes in biodiversity which may influence how they manage certain lands