Grade Level:
5th

Time:
Part 1- 30 min.
Part 2- 60 min.
Part 3-30 min.

Season:
Fall

Objectives:
Students will be able to...

- Understand different management strategies for the prairie.
- Understand how diversity affects the health of the prairie.

Key Concepts:
- Native
- Non-native
- Density
- Diversity

Materials:
- ❑ 3 ft Diameter Hula Hoop
- ❑ Large-mouth Mason Jar Lid (or other 3 in sampling circle)
- ❑ Meter or Yard Stick
- ❑ Data Sheet
- ❑ Clipboard
- ❑ Pencil
- ❑ Wire Flag (to mark & number each plot)

Native Prairie Diversity and Density of Grasses and Forbs

Summary

Students will learn about prairie ecosystems while visiting a nearby native prairie grassland. They will learn what prairie is, conservation management strategies, and the difference between native vs non-native plants. Students will learn how to determine the density and diversity of prairie plants.

Background

What is prairie?

Prairie is a large treeless area covered with grasses and forbs (wildflowers). Native prairie plants in the North Dakota have evolved to survive in areas with low amounts of precipitation, long, cold winters, hot summers, and strong winds. Many native plant species are deeply rooted and can survive frequent fires and grazing.

What are the benefits of native prairie?

- Superior erosion control
- Ground water recharge
- Less long-term maintenance
- Greater resistance to weeds
- Increases soil organic matter
- Rebuilds the soil
- Provides wildlife habitat
- Provides clean air and clean water

Facts about North Dakota prairies.

- Over 80% of North Dakota's prairies are gone.
- Prairie grasslands are the most endangered ecosystem in North America.
- Tall grass, mixed-grass, short grass prairies are all found in North Dakota. Devils Lake is in the mixed-grass region.

Background (continued)

How the U.S. Fish and Wildlife Service and other land managers manage prairies

- Grazing
- Fire
- Idle
- Mowing
- Biological pest control
- Restoration

Partial list of grassland plant species

Grasses: big bluestem, smooth brome, Kentucky bluegrass

Forbs: stiff sunflower, white sage, northern bedstraw, lead plant, purple prairie clover, prairie rose, bergamot

Shrubs: western snowberry, silver berry


Big Bluestem


Leadplant


Smooth Brome


Bergamot


Kentucky Bluegrass


Northern Bedstraw


Purple Prairie Clover


Western Snowberry

Photo credits:
Big Bluestem- Jennifer Briggs/USFWS
Leadplant – Lynn Miller/USFWS
Smooth Brome – Gordon Dietzman/NPS
Bergamot – USFWS
Purple Prairie Clover - USFWS
Western Snowberry – Kitty Kohout/FS
Photos not listed - Kentucky Bluegrass, Northern Bedstraw

Incorporating the Scientific Method

Students will apply the Scientific Method to assess and monitor prairie health and response to management.

Make observations – Review a photo of a specific piece of native prairie or visit a native prairie nearby. Prairie ecosystems are made up of both grasses and forbs.

State the question – Is the prairie made up of more forbs than grasses or more grasses than forbs? What percent of ground cover is forbs?

Gather information – View the North Dakota Native Prairie PowerPoint. Available upon request from the refuge manager (currently colleen_graue@fws.gov) . At the White Horse Hill native prairie 19 species of grasses and 72 species of forbs have been identified.

Form a Hypothesis – There are more grasses than forbs on the prairie but there are more different kinds of forbs than grass.

Perform an experiment – Test the hypothesis. Write up the procedure and perform the experiment. “Study of Native Prairie Data Sheet”, hula hoops, large canning lid, meter stick, native prairie.

Analyze the results – Instructor compiles a spreadsheet of all students’ data. “Analysis of Plant Data” sheet. Average all sample plot total stem estimates. Average forbs/plot. Average diversity of forbs per plot.

Draw a conclusion – Example: “The prairie we sampled is made up of less than 2% forbs. We did not identify diversity of grasses in the plot. The average number of different forbs/plot was 7”.

Ask Questions > Repeat – How many kinds of grasses are in each plot? Would our results be different during a different growing season? Spring vs. Fall?

Procedure Part 1 – Gather information

1. Introduce students to prairie ecosystems using the North Dakota Native Prairie PowerPoint. Available upon request from the refuge manager (currently colleen_graue@fws.gov).
2. Review vocabulary.

Set-Up Part 2

1. Scout a nearby prairie and identify a suitable sampling area. Leave enough travel time to and from your native prairie unit.
2. Gather materials listed on page 1 – You will need one set per group of 2 students.
3. Make copies of the "Study of Native Prairie Data Sheet" (1 per group)

Procedure Part 2 – Form Hypothesis, Experiment

1. Students will incorporate a 2-step data collection process to complete the field portion of this lesson and record their observation on the "Study of Native Prairie Data Sheet"

Process 1

1. Identify sample plot locations by placing a hoop over a piece of prairie and mark the number of the plot with a wire flag.
2. Each student pair will be assigned to a plot. Using the 3-inch sampling circle (jar lid) placed randomly in the hoop circle.
3. Students will tally the number of stems inside the sample circle and record that number on their data sheet.
4. Repeat for a total of 3 sample counts.
5. Students will determine an estimated stem count for the entire hoop circle by averaging the 3 stem counts and multiplying by 10 squared.

Process 2

1. Determine the density of forbs in the plot. Students will count the total number of forbs (broad leaf plants) in their sample hoop plot.
2. Use the meter or yard stick to divide the plot in two equal sides.
3. Students will take turns recording and counting.
4. One student will count side **A** the other will tally and record.
5. Then switch roles and do the same for side **B**. Add side A and B for total stem count.
6. Next determine the diversity of forbs in the plot.
7. Students will count the number of **different** forbs in the total plot and record this on their data sheet.

Set Up Part 3

1. Compile data from the completed Study of Native Prairie Data Sheets into a spreadsheet grouping the data for each plot if you had multiple observation.

Example:

1	2	3	4
	Total Estimated Stem Count (Stem Density)	Total Number of Forbs per Plot (Stem Density)	Number of Different Kinds of Forbs per Plot (Plant Diversity)
Plot 1			
Rhiley	3600	30	4
Morgan Cambree	1700	101	10
Plot 2			
Max/Caleb	2566	73	3
Carleigh/Addison	2966	31	2
Plot 3			
Jax/Kire	1300	120	3
Cordell/Garrison	4600	51	5
Plot 4			
Kaden/Dustin	2500	43	6
Plot 5			
Alan/Brandon	2500	28	XXX
Jenna/Mathea	7366	44	6
Plot 6			
Nora/Emily	4133	40	10
Kaylee/Gabby	1500	36	6
Plot 7			
Cambre/Linsey	7633	28	4
Wylee/Zach	2500	20	8

Procedure Part 3 – Analyze, Draw Conclusions

1. Allow students time to complete the Analysis of Plant Data Worksheet.
    - In column 2 above students found the total stem count in their hoop plot. In column 3 they recorded the total stem count of forbs. What is the percentage of forbs in each student's plot: Divide the total A + B in column 3 by the calculated total stem count in number 2. Compare the percentage of forbs in each plot.
    - Density and diversity counts could be replicated in the same location from year to year to compare and evaluate the effect of management treatment.

Vocabulary

- **Native:** Plants that are part of the original vegetation of an area.
- **Non-native:** Plants not native to North America, intentionally or unintentionally introduced to an area
- **Sod Forming:** A grass that forms sod by means of rhizomes.
- **Bunch Grass:** A grass that takes the characteristic shape of a bunch or tuft.
- **Cool Season:** A plant that grows and flowers in spring and early summer, grows slowly or becomes dormant during the hot part of the summer, and may resume growth in the fall as the weather cools.
- **Warm Season:** A plant that grows in spring and summer, flowers in summer or fall.
- **Density:** The total number of stems in a plot.
- **Diversity:** The number of different species of plants in a plot.
- **Litter:** Dead vegetation that has fallen over and lies horizontal on the ground.
- **Rhizome:** The horizontal, underground plant stem capable of producing the shoot and root system of a new plant.

North Dakota Curriculum Standards

This lesson helps support the following state standards:

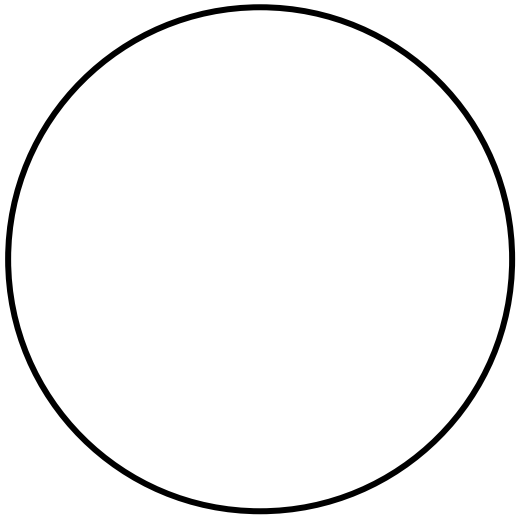
5-PS1-3 - *Make observations and measurements* to identify materials based on their properties.

5-ESS3-1 – Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Study of Native Prairie
Data Sheet

Name(s) of Observers: _____ Plot # _____

1) Take 3 samples from your plot. Mark the location of each sample in the circle with an X. Tally the number of **stems**, then record the total per sample:

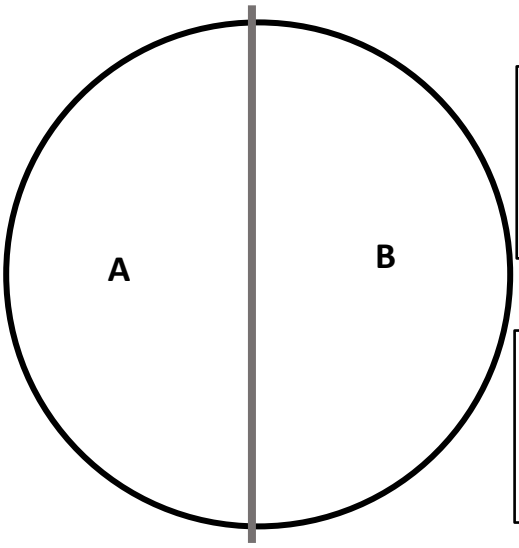


Sample 1 Tally Marks:	#1 Total
Sample 2 Tally Marks:	#2 Total
Sample 3 Tally Marks:	#3 Total

2) Find the Average of your 3 samples.

Add to find the total in All 3 Samples	Divide the Total by 3 to Find the Average	Multiply the Quotient by 10^2
	$3\overline{)\ \ }$	

3) Find the <u>total</u> number of **<u>forbs</u>** in your plot.



Side A Forb Tally Marks:	**A** Total
Side B Forb Tally Marks:	**B** Total

4) Find the diversity of your plot. Record the number of **<u>different kinds</u>** of forbs in your plot?

5) Questions/Observations:

_____

_____

_____

_____

Name_____Date_____

Analysis of Plant Data

1. Find the data on the spreadsheet from the Plot you were assigned. Calculate the average stem count, average number of forbs and the average diversity of forbs from all samples in your plot.

   Plot # _____

   Average Stem Count _____

   Average Number of Forbs _____

   Average Diversity of Forbs _____

2. From your calculated averages above, determine the percentage of forbs in your plot. (Average number of forbs divided by the average stem count multiplied by 100)

   Percentage of Forbs _____