

LESSON PLAN - Sandhills

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Introduction:

Public lands in the United States are often set aside for conservation of land and wildlife, but in Nebraska, less than three percent of the land is protected public or conservation land. In order to protect at-risk habitat and species, wildlife conservation strategies that are attractive to private landowners are needed. Private landowners who are committed to sustainability and are interested in innovative approaches to land management have found that the common-interest community model can benefit wildlife populations and increase biodiversity on rangeland in the Nebraska Sandhills.

Prior Knowledge Needed:

Students need to know what is an ecosystem.

Students need to know what are causation and correlation.

Common Student Misconceptions:

1. Grazing is bad for the ecosystem.
2. Non-native animals are bad for the ecosystem.
3. Cattle and wildlife cannot beneficially coexist in the grassland ecosystem.
4. Wind turbines have no drawbacks.

Objective/Learning Target:

1. Students will be able to locate the Nebraska Sandhills on a map.
2. Students will be able to explain how humans are a part of the Sandhills prairie ecosystem and how they affect biodiversity as they modify the landscape.
3. Students will develop a common-interest community model to describe, test, and predict more abstract phenomena (MS-LS2-3).

Time Required:

Three 45-minute class periods.

Material Needed:

- Computer with internet access to Platte Basin Timelapse (LEARN) website
- Printer (optional)
- Pencil
- Paper or Science Notebook
- Chart paper or whiteboard

Grade Level:

7th Grade

Subjects:

Science and Engineering, Math, Environmental Studies

Standards/Indicators:

Nebraska Science

Standards:

SC.7.7.3.d Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.

NGSS:

MS-ESS3-3

PBTL Connection:

The Nebraska Sandhills

Course:

Population Change in Ecosystems.

LESSON PLAN - Sandhills



Vocabulary:

common-interest community model: a wildlife management plan that supports wildlife populations on private lands. Landowners agree to work together to provide all involved with economic incentives through ecotourism, energy production, and/or enhanced agricultural production while protecting wildlife species.

cow-calf pair: In the cattle industry, one 1000-pound beef cow together with its nursing calf is considered one animal unit, which is a standard unit used to calculate the grazing impact of livestock.

ecotourism: tourism directed at natural and threatened environments where visitors can observe wildlife while supporting conservation efforts.

grazing livestock: domestic animals that feed on grasses and other plants in a pasture.

greater prairie chicken: (*Tympanichus cupido*) is an open-grassland bird. It is best known for its mating dance. Males display together on a communal lek where they raise ear-like feathers, inflate orange air sacs on the sides of their throats, and stutter-step while making a deep throated, booming moan.

lek: a traditional place where male animals, particularly birds, gather during the mating season and engage in competitive displays to attract females.

outfitter: a business that provides equipment, supplies, transportation, and experienced guides for hunting, fishing, and wildlife trips.

rancher: a person who owns and works on a ranch or a large farm where livestock such as horse and beef cattle are raised.

transmission line: a conductor that carries electricity or an electric signal over long distances with minimum losses or distortion; also called a power line.

wind power: the ability to make electricity using the air flows that occur naturally in the earth's atmosphere.

wind turbine: a device with blades that turn and capture kinetic energy from the wind and turn it into mechanical energy by spinning a generator



Day 1

Engage:

Physical Barometer Activity

1. Make the statement: **“Humans have a negative impact on ecosystems.”**
2. Ask students to think to themselves if they agree or disagree with this statement.
3. Explain that a continuum will stretch across the room—on one side of the room will be the **Strongly Agree** students, while the other side will be **Strongly Disagree**.
4. Ask students to stand up and place themselves on the continuum depending on their opinion.
5. Ask several volunteers along the continuum to share their thoughts (students may or may not provide any evidence for their position at this time).

Introduce the driving question:

What impact do humans have on an ecosystem and what can be done to minimize these impacts?

Explore:

Introducing the Ecosystem

Guided Visualization of the Sandhills Ecosystem

Introduce the Nebraska Sandhills and the Switzer family that lives there by reading “The Nebraska Sandhills” and “Range Management and Biodiversity” (If you are short on time, you may just read the first paragraph of this chapter) chapters of PBT’s “The Nebraska Sandhills” story aloud to students: <http://plattebasintimelapse.com/learn/the-nebraska-sandhills/>

NOTE: Discuss unfamiliar words or new vocabulary related to human activities as needed for clarity in the reading with students:

1. **grazing livestock:** domestic animals that feed on grasses and other plants in a pasture.
2. **outfitter:** a business that provides equipment, supplies, transportation, and experienced guides for hunting, fishing, and wildlife trips.
3. **rancher:** a person who owns and works on a ranch or a large farm where livestock such as horse and beef cattle are raised.

LESSON PLAN - Sandhills



Explain to students that you will be reading two passages that describe an ecosystem known as the Nebraska Sandhills:

1. While the passage is being read, you should close your eyes and picture the images described in the text.
2. When I'm done reading the passages, take 2 minutes to list on a piece of paper all of the living and non-living parts of the ecosystem mentioned in the story.
3. Before students draw the Sandhills ecosystem, provide guidance by posing the following questions:
 - a. What are the key parts or components of the Sandhills ecosystem?
 - b. What are the key features?
 - c. What is it like there?
 - d. What animals and plants live there?
4. Have student record their answers in their science notebook or on a piece of paper.

Introduce the Human Element

Pose the following additional questions to your students:

- **When you made your lists, did you include humans?**
- **Who are the humans in our story?**
- **What role do humans play in the Sandhills ecosystem?**

5. Have students as a class (or individually in their science notebooks) sketch on a whiteboard, chalkboard, or large piece of chart paper a drawing of the Sandhills landscape based on their lists of the living and non-living parts of the ecosystem.
6. Watch the kangaroo rat video and a video with vertebrate ecologist Keith Geluso to provide students with additional visuals of the landscape and the wildlife that inhabit blowouts in the Nebraska Sandhills.
7. Now have students add components to the drawing as they learn more about the wildlife and humans that live in the Sandhills.
8. Together with your students, locate the Nebraska Sandhills and the Switzer Ranch on the map in "The Nebraska Sandhills" chapter.

Connecting the Sandhills Ecosystem to Human Activities

Have students break into groups. Remind them of the driving question:

What impact do humans have on an ecosystem and what can be done to minimize these impacts?

Facilitate a **Think-Pair-Share activity** where students discuss the following:

Using the Switzer family as an example of humans interacting with the Sandhills ecosystem, brainstorm and record on a whiteboard or large piece of chart paper possible answers to the first part of the question: **"What impact do humans have on an ecosystem?"**



Scaffold student brainstorming with the following questions:

1. How do the Switzer family's activities or actions affect the Sandhills ecosystem?
2. How does ranching interact with the living and non-living components of the Sandhills?
3. How does outfitting interact with the living and non-living components of the Sandhills?
4. How are these components important for outfitting?
5. Do you think the Switzer family's actions are good or bad for the ecosystem?

Day 2

Engage:

Introducing Ecotourism in Africa

Access students' prior knowledge of ecotourism by discussing an African safari as a whole class.

1. **Would you like to go on an African safari?** (Respond with a thumbs up or down.)
2. **What kind of animals would you like to see?** (Have several volunteers share animals found on an African safari.)
3. **Why would people pay to go on a safari to see these animals?** (Have students discuss why people are interested in going on safaris rather than just visiting animals in a zoo. These animals are only found in certain parts of the world, there is something special about seeing these animals in the wild rather than in a zoo.

Explain why people would want to travel to new and unfamiliar places, etc.)

4. **What impact might safaris have on wildlife in Africa?**

(Think-Pair-Share-Ask students to come up with two positive impacts and two negative impacts)

- i. Positives might include: More habitat is protected for wildlife to roam freely; people will help increase the number of wildlife because this attracts visitors; people will help protect the wildlife from hunters/poachers.
- ii. Negatives might include: Tourists will disturb the animals and scare them away; tourists may want to hunt big game animals and this may threaten their populations; tourists may hurt the landscape making it harder for animals to survive there.

Explore:

Introducing Ecotourism in the Nebraska Sandhills

1. Have students view the video "Saving Nebraska's Sandhills" found here: <https://youtu.be/HYzD3Ti8DsQ>
2. Ask students to use what they have learned about the Switzer family's business, Calamus Outfitters, and compare the outfitting business to an African safari in Namibia.
3. Provide students with additional resources (online or in print) to research wildlife found in both Namibia and in the Nebraska Sandhills.

LESSON PLAN - Sandhills



Resources

- a. <https://www.worldwildlife.org/projects/conserving-wildlife-and-enabling-communities-in-namibia>
- b. <http://wwf.panda.org/?200002/Namibia-how-communities-led-a-conservation-success-story>
- c. <http://www.waterbergnamibia.com/nature-and-conservation>
- d. <http://www.namibrand.com/conservation.html>
- e. <http://www.unl.edu/plains/ecotourism-namibian-models.pdf>
- f. http://journalstar.com/lifestyles/recreation/nebraska-has-three-of-top-ecotourist-sites-in-the-great/article_0501c662-3ee5-5991-b4be-14b14686943f.html
- g. <http://www.unl.edu/plains/ecotourism-prairie-fire.pdf>
- h. <http://www.calamusoutfitters.com/>

9. Make a chart to compare a safari business in Namibia to an outfitter business in the Nebraska Sandhills. On the chart, have students fill in their responses to the following questions:

	Safari in Namibia	Outfitters in Nebraska Sandhills
What wildlife (plants or animals) would people pay to see?		
Why would people pay to see these animals?		
What impact might these human activities have on the local wildlife?		



Explain:

Discovering Human Actions that Minimize Impacts On an Ecosystem

1. Introduce students to the term “ecotourism”: tourism directed at natural and threatened environments where visitors can observe wildlife while supporting conservation efforts.
2. Explain to students that both an African safari business and an outfitting business can both be types of ecotourism.
4. Navigate to PBT’s “Ecotourism and Conservation” chapter in “The Nebraska Sandhills” story: <http://plattebasintimelapse.com/ed/chapter/ecotourism-and-conservation/>
5. As you read this chapter aloud to students or provide scaffolding to help students read this material in small groups, ask students to record their ideas about the following question: **What actions does the Switzer family take to minimize negative human impacts on the Nebraska Sandhills?**

Possible Answers:

- a. They **work with their neighbors** to protect the natural resources that are important to all of them.
- b. They **remove invasive species** (Eastern red cedar) from the landscape to protect the grasslands for cattle and wildlife.
- c. They **graze their cattle on grass in the leks** to increase the chance of mating success for prairie chickens.
- d. They **started a prairie chicken festival** to raise awareness about this threatened species.
- e. They **weighed options and made a plan** to balance ranching, ecotourism, wildlife conservation, and wind energy development and transmission lines on their land.

NOTE: Discuss unfamiliar words or new vocabulary, as needed, for clarity in the reading with students.

community-based conservancies: A group of neighbor who work together to manage natural resource for agriculture and ecotourism

greater prairie chicken: (*Tympanichus cupido*) is an open-grassland bird. It is best known for its mating dance. Males display together on a communal lek where they raise ear-like feathers, inflate orange air sacs on the sides of their throats, and stutter-step while making a deep throated, booming moan.

lek: a traditional place where male animals, particularly birds, gather during mating season and engage in competitive mating displays to attract females.

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wind turbine: a device with blades that turn and capture kinetic energy from the wind and turn it into mechanical energy by spinning a generator

transmission line: a conductor that carries electricity or an electric signal over long distances with minimum losses or distortion; also called a power line among all four ranchers.

LESSON PLAN - Sandhills



Day 3

Elaborate:

1. Students will explore the action of weighing options and planning to balance ranching, conserving wildlife, and developing wind energy on their land in this final activity.
2. Introduce students to the idea of a **common-interest community**: a wildlife management plan that supports wildlife populations on private lands. Landowners agree to work together to provide all involved with economic incentives through ecotourism, energy production, and/or enhanced agricultural production while protecting wildlife species.
3. Provide students with an analogy to explain how a **common-interest community is similar to a sports team**.
 - f. Each player has a different role or position and does a different job for the team, but all players are needed to win a game. If they don't work together, they won't win. Not all players score the winning goal, but all players are rewarded when they win a game.
 - g. In much the same way, landowners in a common-interest community work together on a team to accomplish agreed-upon goals that may include: earning money by grazing cattle; protecting natural resources and wildlife on the land to earn money from ecotourism; introducing wind turbines to create energy and new income. They don't all need to do all of these activities, but they agree that the money spent on the projects and the money earned will be shared among the community of landowners fairly.
4. Divide students into groups of four.
5. Introduce students to the setup of the game:
<http://plattebasintimelapse.com/ed/chapter/ecotourism-and-conservation/>
6. Explain to students that they are all neighboring ranchers and they will need to work together to minimize human impacts on ecosystems in a conservation decision-making game.
7. Explain to students that in the real world several things can happen.
(These scenarios are illustrated in the beginning screens of the game.)
 - a. No cooperation between ranchers and no wind energy.
 - b. No cooperation between ranchers and introduction of wind energy.
 - c. Cooperation between the ranchers (called a common-interest community) where income and expenses are shared fairly among all four ranchers.
8. In this game, they will be working together with four other students in a common-interest community (Scenario C) to collectively make decisions about ranching, ecotourism, conserving wildlife, and developing wind energy on neighboring lands. **The goal of the game is to maximize sustainability, biodiversity, and profits.**



ENTER GAME

Scenario A

Business as usual in the Sandhills: Grazing cattle and prairie chickens live on four competing ranches.

Scenario B

Wind energy is introduced on the rangeland. The number of grazing cattle may decrease as access roads and turbines reduce the amount of land available to graze. Research also shows that prairie chickens avoid roads, so wind development could also lead to a decrease in prairie chicken populations.

Scenario C

Design your own “common-interest community” where income and expenses are shared among the ranches to increase sustainability, biodiversity, and profits.

Directions

1. Design your own “common-interest community” to help four ranchers manage their rangeland to maximize sustainability, biodiversity, and profits.
2. Click and drag a total of 6 cow-calf pairs, 5 prairie chickens, and 8 wind turbines on the right and place them on the four numbered ranches on the left.
3. Think about where you place the elements and remember to give your animals some space!
4. Prairie chickens avoid roads. Wind turbines have access roads. Be careful not to place them too close to the wind turbines!
5. The more elements you place correctly, the higher your profits!
6. Each correctly placed prairie chicken earns the ranches \$1,000 in ecotourism profits; cow-calf pairs \$2,000; and wind turbines \$4,000. The ranches can earn a total profit of \$49,000.
7. When you’ve placed all of the elements, click “Get Results” to see the total profits earned by each ranch and their shared total profits.
8. Try again with different scenarios, if you want to increase profits.

LESSON PLAN - Sandhills



Click and drag each icon to the ranch where you want to place it.

NOTE: Explain to students before they begin the game that there are built in limitations to the web-based simulation: Wind developers can only build a certain number of turbines and the rangeland can only support a certain number of cow-calf pairs and prairie chickens. Take note that the total number of cow-calf pairs and prairie chickens decreases from Scenario A to Scenario B with the addition of wind turbines. The common-interest community model used in Scenario C makes it possible to have more animals on the rangeland than in Scenario B.

	Grazing cattle	Greater prairie chicken	Wind turbines
A: Business as usual	8 cow-calf pairs	8 prairie chickens	0 turbines
B: Wind energy + no cooperation	4 cow-calf pairs	3 prairie chickens	8 turbines
C: Wind energy = cooperation	6 cow-calf pairs	5 prairie chickens	8 turbines

9. Have students draw or print their completed common-interest model arrangement together with the results and profit summary.

LESSON PLAN - Sandhills



Group Activity: After the students have had the chance to design their own common-interest community model, have them gather in small groups to discuss their arrangements.

1. Students should discuss the relationships between the four ranches and the elements on each ranch. Have them explain why the total number of animals decreases from Scenario A to Scenario B. And have them explain why the common-interest community model used in Scenario C makes it possible to have more animals on the rangeland than in Scenario B.
2. Have the group choose an arrangement together.
3. They may want to consider the following questions:

Reflection Questions:

1. What was your goal when you arranged the elements on each of the ranches?
2. What considerations did you make when selecting an arrangement?
3. Was this an economically and environmentally sustainable decision?
4. Were you only concerned about your own goals? Did you consider other points of view?
5. What limitations or constraints limited your arrangement choices?

Explain:

Review with students the second part of the driving question: **what can be done to minimize human impacts on an ecosystem?** Ask students to think about the decisions they made in the game and how their decisions helped to minimize human impacts on an ecosystem.

Evaluate:

1. Gather student justifications and arrangements for assessment or evaluation.
2. The following questions will help students to consider how changes to physical or biological components in an ecosystem can affect populations and will in turn help them to design a successful common interest community model:
 - a. Why would it benefit the ranchers to cooperate with each other and share expenses and profits?
 - b. What happens if the ranchers only care about ranching profitably?
 - c. What happens if ranchers balance ranching profits with conservation of wildlife like prairie chickens?
 - d. How does ecotourism rely on conservation of wildlife?
 - e. How does adding wind turbines to the mix affect ranching and wildlife conservation?
 - f. Why is it important to place wind turbines away from populations of prairie chickens?
 - g. Why is it important to manage the number of cow-calf pairs and prairie chickens on each ranch?

Resources: Platte Basin Timelapse Project