Bison Across Time: Response to Fire

Environmental Science

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Grade Level	10th – 12th Grade
Subject	Science
Course	Biology II, Environmental Science

Essential Question

How can GIS help us better understand the effects prescribed fires have on bison?

Summary

In this lesson, students develop a GIS map that reflects spatial and temporal responses of bison to prescribed fires that have occurred on The Nature Conservancy's Joseph H. Williams Tallgrass Prairie Preserve. Students will use their maps to draw conclusions about bison's response to fire.

Snapshot

Engage

Students review the history of bison on the plains.

Explore

Students explore basic elements of GIS by developing their own Google maps using authentic sample data.

Explain

Students will define key vocabulary within the field of GIS and environmental science by completing a Frayer model.

Extend

Students will manipulate and analyze the layers of data on their GIS map.

Evaluate

Students will reflect on their learning with an exit ticket.

Standards

Oklahoma Academic Standards (Environmental Science)

EN.LS2.2.2: Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.

Attachments

- Frayer Model—Bison Across Time - Spanish.docx
- Frayer Model—Bison Across Time - Spanish.pdf
- Frayer Model—Bison Across Time.docx
- Frayer Model—Bison Across Time.pdf
- Lesson Slides—Bison Across Time. pptx.pptx
- Map Analysis Teacher Key—Bison Across Time.docx
- Map Analysis Teacher Key—Bison Across Time.pdf
- Mapping Bison—Bison Across Time - Spanish.docx
- Mapping Bison—Bison Across Time - Spanish.pdf
- Mapping Bison—Bison Across Time.docx
- Mapping Bison—Bison Across Time.pdf

Materials

Teacher's Note: Preparing the Lesson

For the Engage activity, you will use our tech tool Google Slides. You will need to set it up ahead of time. Before you begin, select the provided link:

- English version: http://k20.ou.edu/bison
- Spanish version: http://k20.ou.edu/spanish-bison

This will create a copy of the Google Slides in your My Drive. You will need to share the link with your students. Add your new URL as a link (either in full or as a shorter bitly link) and/or QR code to **slide 6**. If you need help, use our QR Code tech tool to find instructions. We suggest making one copy per class period since students will be editing the slides during the lesson. Also, make sure there are enough blank slides based on the number of small groups your class will have. Right click any blank slide and select “Duplicate Slide.”

- Lesson Slides (attached)
- Mapping Bison handout (attached; one per student)
- Map Analysis Teacher Key (attached)
- Caption This slides (linked)
- Frayer Model handout (optional; attached; one per student)
- Chart paper (one per group)
- Marker sets (one per group)
- Chromebook or laptop

15 minutes

Engage

Teacher's Note: Optional Resource

If you would rather not have your students access the "Caption This" slides, you could download the content as a PDF, print off enough copies for group work, and have them fill in the answers by hand.

To download as a PDF, follow these instructions:

1. Open your copy of the provided slides (see previous Teacher's Note for help with access).
2. Select the "File."
3. Select "Download."
4. Select "PDF doc" and save to your computer.

Begin the lesson by showing **slides 2-4** of the attached **Lesson Slides**, which introduce the title of the lesson, the essential question, and the learning objectives. Emphasize that the essential question will be addressed throughout the lesson.

Move to **slide 5** and play the **Bison & Humans: A Shared Story** video (stop at 3:37). Next, display **slide 6** and explain to students that they will be participating in a Caption This activity. Arrange your students into small groups and assign each group a slide number. Have students type in your shortened URL address or scan your QR code to access the **"Caption This"** slides. Once students have accessed the activity and their assigned slide, minimize the Lesson Slides and pull up the "Caption This" slides. Before students begin the activity, make sure to spend a couple of minutes going over slides 1-2 of the "Caption This" slides to review the expectations for the activity as well as an example.

As students begin the activity, feel free to move back to slide 1 of the "Caption This" slides so that students can consult the directions as they discuss the image. Let students know that they need to choose a speaker who will share their ideas with the class. Give students about 10 minutes for discussing and writing their captions into the slides and responding to other captions by copy/pasting emojis.

Have students reconvene as a whole, and as you proceed through the "Caption This" slides, ask a representative from each group to explain their group's image to the class and their reasoning behind their caption. After all groups have presented, ask students if they have learned anything new about bison after participating in this activity. Minimize/close the "Caption This" slide deck and resume using the Lesson Slides.

45 minutes

Explore

Display **slide 7** and ask students about one of the preceding images from the "Caption This" activity pictured on the slide. Discuss the following questions: *What did you notice about the bison? Why do you think it was wearing a collar?*

Student Sample Responses

- It is wearing a big collar to collect data for scientists/researchers to keep track of the movement and location of bison.
- They can use that data to make a data map.

Teacher's Note: Facilitating the Activity

This activity and its resources are adapted with permission from Bryan Yockers. On the JenksFERST site, Yockers added tutorial videos for how to download and prepare data files as well as how to prepare the google map using the files. Consider using these videos in class to model the activity or as a reference for yourself in guiding the lesson.

Explain to students that the next activity uses the data from research conducted at The Nature Conservancy's Joseph H. Williams Tallgrass Prairie Preserve. Use **slide 8** to review the following information about the Prairie Preserve in as much detail as you find necessary. Explain to students that this 39,650-acre preserve located within the Osage Nation north of Pawhuska, Oklahoma, is the largest expanse of protected tallgrass prairie on earth. Around 2,500 bison are allowed to roam and graze freely over most of the 62-square mile preserve. In 2009, many bison were fitted with global positioning system [GPS] collars to study their movement. The data collected from the collars provides lots of information.

One factor affecting the movement of the free-range bison is the fire disturbance occurring there. Fast forward to today. The data is still being collected from bison wearing "bling" on the same tall grass prairie. Ask students the following question: *Can you think of other species with GPS collars?* Some sample responses may be lions, elephants, and even personal pets if you consider air tags/microchips.

Tell students that they will be using some of the 2009 GPS data from tracking the three bison in order to develop a GIS map that shows how bison responded to fires. Display **slide 9** and have students scan the QR codes to download and prepare the data files for March, April, and May. Click on the links below and make copies for yourself.

- TPP - Bison GPS Locations - March
- TPP - Bison GPS Locations - April
- TPP - Bison GPS Locations - May

After students have their files saved to their Google drives, pass out the attached **Mapping Bison** handout to every student and transition to **slide 10**. Using the instructions in the "Student Guide" section of the handout, have students create their GIS map of bison activity. Consider modeling the steps yourself or unhide **slide 11** and have the tutorial playing. Do this by playing the video and pausing after each step as needed and remind students to follow along on their handout. Check in with students periodically to answer questions and ensure everyone is succeeding. Encourage students to explore different layers by clicking the check marks next to each (optional).

Remind students that they will repeat the process outlined on their “Student Guide” for the other two remaining months. Allow students time to complete their maps helping with issues as needed.

30 minutes

Explain

Transition to **slide 12** and have students watch the “What is GIS?” video.

Embedded video

https://youtube.com/watch?v=WpoSofhf9Y0

Break students into small groups (ideally 7 groups total). Give each group one page of chart paper and one set of markers. Display **slide 13** and explain the modified Frayer Model strategy where students should draw and label their models on their chart paper as exemplified on the slide. Then, assign each group one of the following vocabulary terms: prescribed fire, spatial, temporal, GPS, GIS, ecoregion, or Tallgrass prairie. Give students time to complete their models based on their assigned term.

Once groups complete their Frayer Model, have students take turns explaining their model while the others take notes on their own notebook paper. If needed, unhide **slides 14-16** to clear up any misconceptions over the definitions.

Teacher's Note: Frayer Model Alternative

If you do not have poster paper or wish students to have a hard copy of their Frayer Models, then consider using the attached **Frayer Model** handout.

20 minutes

Extend

Teacher's Note:

Additional ICAP Extension

Consider unhiding slide 18 and play the ICAP video highlighting Daniela Spade's work with GIS and her views on what it takes to be successful in this career field: K20 ICAP - Is GIS for me? with Daniela Spade.

Display **slide 17**. Now that students understand the terminology and what GIS is and what it's used for, have them go back to their Google maps they created. Ask students to flip over their Mapping Bison handout and complete the "Map Analysis" side. Explain that students should manipulate the layers of the GIS map they created and respond to the questions on the Map Analysis handout. Once everyone has finished, use the attached **Map Analysis Teacher's Key** handout to facilitate a discussion of the answers.

10 minutes

Evaluate

Transition to **slide 19** and have students use the Exit Ticket strategy to reflect on what they learned throughout the lesson. Pass out paper to every student and give them time to write their responses.

Resources

- Burns, K. (2023, December 19). Bison and humans: A shared story. The American Buffalo: Ecosystem engineers. PBS Learning Media. https://oeta.pbslearningmedia.org/resource/american-buffalo-ecosystem-engineers-video-gallery/the-american-buffalo/kenburnsclassroom/
- Esri. (2024). What is GIS? YouTube. https://youtu.be/WpoSofhf9Y0
- K20 Center. (n.d.). Bell ringers and exit tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Caption this. Strategies. https://learn.k20center.ou.edu/strategy/82
- K20 Center. (n.d.). Frayer model. Strategies. https://learn.k20center.ou.edu/strategy/126
- K20 Center. (2024, December 2). K20 ICAP - Is GIS for me? with Daniela Spade [Video]. YouTube. https://youtu.be/IlVLyQC6hTE?feature=shared
- The Nature Conservancy. (2024). Joseph H. Williams tallgrass prairie preserve. https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/tallgrass-prairie-preserve/
- Yokers, B. (n.d.). Response of Bison to Fire. JenksFERST. https://sites.google.com/view/jenksferst/lessons/gis-lessons/response-of-bison-to-fire?authuser=0