Lesson Title: Fire Ecology and *Prairie Management*		
Grade Level: *11th-12th grades*	**Scale:** *Regional - Great Plains*	**Keywords:** *prairies, biodiversity, ecoregions, fire ecology*
Author and School: *Kyle Tredinnick - Zoo Academy (OPS)*		
Time Requirement: *2- 85 minute block classes*	**Overview:** *Students will be examining the role of fire on biodiversity and the development of healthy grass ecosystems by visiting an active prairie restoration site and then making recommendations for the preservation and restoration of different prairie ecoregions. Through combining field exploration with scientific literature students will be able to look at practical applications of scientific studies in promoting biodiversity in prairie ecoregions.*	
Required Materials: *Field Guide to the WIldflowers of Nebraska and the Great Plains* *Field Guide to the Common Grasses of Oklahoma, Kansas, and Nebraska* **Suggested Materials:** 1mx1m frame	**Objectives:** 1. Students will understand the role that fire ecology has in the shaping of landscapes and the management of invasive and native species and develop a management plan for a specific prairie ecoregion. 2. Students will compare the role of fire in grassland ecosystems to forest ecosystems and the modern management techniques used to prevent uncontrollable ecological disaster-level events by making suggestions based on usage of appropriate scientific literature	
Nebraska State Social Studies Standards: SS HS.3.2.a Analyze physical and human processes that shape places and regions. SS HS.3.3.a Explain components of Earth's physical systems and evaluate the impact of natural processes on human environments.		

Suggested Procedure:

Pre-Lesson

Scientific Review - Students read “Study shows importance of biodiversity to grasslands” article by Tom Simmons (2008) and write short explanation of why biodiversity is important in prairie ecosystem and what should be the “benchmark” for a “healthy” prairie ecoregion

Establish a Control - Students go out into their own yard with a 1mx1m frame to measure biodiversity in their “urban” environment. Students should select an area with the presumed most biodiversity in a grassy area (no gardens and such). Students should try to identify the number of different species in their plot, and preferably identify the species located within the plot. (see Chris Helzer’s photography of his Square Meter Hidden Prairie project for inspiration)

To prepare for field experience students will need to read Biota & Physical Environment sections of UNO's Glacier Creek website - https://www.unomaha.edu/college-of-arts-and-sciences/nature-preserves/preserves/index.php#biota

Day 1 - Field Expedition to Glacier Creek
Guiding Inquiry - What role does fire have in the shaping and maintaining the prairie ecosystem?

Standards addressed - 3.2.a, 3.3.a

Day's Objective: Students will examine the role that fire ecology has on prairie biodiversity by conducting a field experiment in which they will test the biodiversity of recently burned plots of prairie against less recently burned plots to check for biodiversity of plant and animal species.

Students will start at the Glacier Creek research barn where they will get a brief overview of the project out there from one of the staff there. The presentation would involve materials\s on the growth of the project, the goals, the research being done, an overview of fire ecology, and the outreach aspects of Glacier Creek. After the talk students would head into the burn research plots with their 1mx1m biodiversity measurement tools. Using Survey 123 students will collect data on the amount of different species located in different plots at the research sites. They would record the genus of different plants (preferably species), amount of litter, types of species (woody vs grass vs forbes) and then also collect a picture of each of their research sites.

Before heading to the plots we would cover the procedure and goals of the field activity and orient students to the technology they will be using in the field. Students will be working in pairs to hopefully develop more consensus for each study plot. Before going out students will develop a hypothesis about the connection between length since the last burn and biodiversity.

Using shapefiles of the research plots (provided by Glacier Creek) students' records would be matched to each of the plots to determine the biodiversity of each plot. Multiple groups will hopefully have visited each plot allowing for more data points to be examined. Students will analyze the data collected by all of the groups to test their hypothesis and come to a conclusion about the linkage between biodiversity and burns.

Students will be assessed on their usage of the scientific method for data collection and their usage of data in the development of their conclusions. In the inquiry path today would cover the *ask, collect, organize, analyze*, and *display aspects* of the geoinquiry process. Tomorrow students will apply their knowledge of burns and biodiversity to answer the *act* element of the geoinquiry process.

Day 2 - Making Recommendations for Prairie Management
Guiding Inquiry - What role do humans and the introduction of native species have on the preservation of prairie ecosystems?

Standard addressed - 3.3.a

Forum: As a review/assessment students will answer and discuss "What is the importance of fire ecology in the preservation of a prairie ecosystem?" We will use this as a check for understanding and a way to debrief the field experience.

For today's activity students will work be given a different grassland (oak savanna, established prairie, and reclaimed cropland with encroaching woody plants) and need to develop a fire regiment, plan mechanical management strategies, and make suggestions for the native mammals and birds that would need to be paired with each particular situation. The goal for each would be the preservation of a tall-grass prairie ecoregion that should be present in the Omaha area.

The teacher will provide the explanation of the situation and resources that will aid students in developing their management plans. Resources will be authoritative research articles and organizational websites that cover the three situations described. With each situation students also will need to describe the potential ramifications for not following the suggested management strategy. Students will especially be focused on the human intervention strategies that are needed to help preserve "native" landscapes.

Students would be given a majority of the class period to develop their plans and then the last bit of class we would see the different suggestions that each pairing came up with for the different prairie ecoregions. We will address their suggestions ecosystem by ecosystem. Each pair will present their plan, explain the rationale for their plan, and then support their rational with evidence from the associated research.

Additional Resources:

Bragg, Thomas B., (2011), "Encyclopedia of the Great Plains: Fire Ecology" http://plainshumanities.unl.edu/encyclopedia/doc/egp.pe.025

Oklahoma Ag in the Classroom (2008), "The Role of Fire in Healthy Prairie, Brush, and Forest Lands." https://cdn.agclassroom.org/ok/lessons/upper/fire.pdf

Prairie Plant ID Resources, https://docs.google.com/document/d/1I-YAxQjZARK3Abv51IctbYdb43VoTD6k09h-HCKIAW4/edit?usp=sharing

Prairie Project, "North American Patch-Burn Grazing Research 1964-2020," https://www.theprairieproject.org/project-information/solutions/patch-burn-grazing

Rickel, Bryce (2005), "*Assessment of Grassland Ecosystem Conditions in the Southwest United States: Chapter 2 Large Native Ungulates*," U.S. Forestry Service, https://www.fs.fed.us/rm/pubs/rmrs_gtr135_2/rmrs_gtr135_2_013_034.pdf

University of Nebraska - Lincoln Center for Grassland Studies (2002), "Study Shows Importance of Biodiversity to Grasslands," https://grassland.unl.edu/pdf/newsletters/2002WinterNewsletter.pdf

University of Nebraska - Lincoln Institute of Agriculture and Natural Resources (IANR), "Prairie Protector," *https://ianrcommunities.unl.edu/prairie-protector*

University of Nebraska - Omaha (2016), “Glacier Creek Prairie Flora”
https://www.unomaha.edu/college-of-arts-and-sciences/nature-preserves/_files/docs/GCP%20flora%2027%20aug%202016.pdf

Assessment:

Usage of the Geographic Inquiry model (geoinquiry) to ask a geographic question, collect geographic data, organize and analyze data to reach a conclusion, form an action plan using geographic information for the basis of recommendations. Students will hand in their Module notebooks that they will use for days 1 and 2 in which they record different steps of thee process that will include hypothesis, data observations, and their management plans.

Measurement of outcomes through student survey - research question “how effective is usage of inquiry model in teaching biodiversity and fire ecology in biogeography?

Review of effectiveness

- *Students will be asked to answer following questions (likert scale)*
    - *How would you rate your knowledge about fire ecology before this?*
    - *How would you rate your knowledge about fire ecology after this experience?*
    - *How effective would you say this experience was in teaching you about the processes of fire ecology?*
    - *How effective would you say this experience was in teaching you about the importance of biodiversity in grasslands?*
    - *How comfortable would you be in describing the benefits of fire to the prairie ecosystem?*

- *Stort answers*
    - *How have your perceptions of wildfires changed over the course of this unit?*
    - *How have your perceptions of the importance of native species shifted throughout the course of the unit?*

Additional Information: