UNIT: H17 TITLE: Historic Fire Intervals

TYPE: Lesson Plan

This activity is based on the US Forest Service's "FireWorks Northern Rocky Mountains & Northern Cascades" Curriculum

Overview

Fire has been a part of the history of the tallgrass prairie for thousands of years. Lightning strikes naturally burned the prairie and overtime, humans observed the benefits of fire and intentionally set fires, most often referred to today as prescribed burns. This lesson explores the history of fire on the tallgrass prairie and results of fire suppression on modern prairie landscapes.

Subjects: Life Sciences

Duration: 2 Class Periods

Group Size: Small Groups

Setting: Classroom with opportunity for Field Experiences

Vocabulary: Invasive Species

Lesson Goals:

Students will develop an understanding of the history of fire on the tallgrass prairie and the results of fire suppression and the planting of red cedars for windbreaks in the region.

Objectives:

Students will be able to:

1. Construct a timeline of fire on the tallgrass prairie.
2. Using a satellite image, students will estimate current red cedar canopy cover and estimate the rate of conversion of grasslands to red cedar over time.

Anchoring Phenomena:

Left unchecked, red cedar will encroach and take over prairie grasslands.

Academic Standards:

Standards		High School (9-12)
NGSS – Disciplinary Core Ideas	**HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.**	
	Cross Cutting Concepts	• Cause and Effect, Stability and Change
	Disciplinary Core Ideas	• LS2.A, LS2.C
	Science and Engineering Practices	• Using Mathematical and Computational Thinking
NGSS – Performance Expectations	**Speaking and Listening**	
	Language	• RST.9-10.8
	Writing	

Teacher Background:

https://keep.konza.k-state.edu/prairieecology/TallgrassPrairieEcology%20copy.pdf

Materials and Preparation:

- Copies or digital access to Towne, Gene (2012). "A Historical Overview of Fire Seasonality in Tallgrass Prairie," Symphony in the Flint Hills Field Journal
- Computers or paper and art supplies for timeline creation
- Paper or digital copies of Red Cedar Student Page

Procedure:

1. **Engage:**
   Ask students to describe some ways that fires might be started. Encourage them to think about both natural and human ways that fires start. Provide students with a copy of "A Historical Overview of Fire Seasonality in the Tallgrass Prairie" and in groups of 4, to use the information in this article to provide a timeline of fire on the tallgrass prairie and identify and record at least three key learnings from the reading and timeline exercise. Allow time for groups to share their timelines and learnings.

2. **Explore:**
   Remind students that they learned in the reading burning tallgrass prairie is now an accepted practice for grassland management and necessary to promote growth of native grasses and forbs. They also learned areas that are not burned are susceptible to red cedar encroachment. This was highlighted during periods when scientists advised against burning prairie. Even so, once scientists recommended burning prairie, the common accepted practice was burning prairie in the spring. Research at Konza has suggested that burn times could be varied and still achieve desired results.

   Explain that despite the research, not all prairie is burned on a regular basis. Ask students what might keep a landowner from doing regular prescribed burns on their property? Answers might include, lack of knowledge about the importance, lack of experience with burning, the danger to buildings on the property when burning, etc. The move students into an exploration of what happens when regular burning does not take place in regards to red cedar trees.

   a. Using the groups from the Engage, provide each group of students with a printed copy or electronic copy of the Red Cedar Student Page.
   b. Challenge students to estimate the percentage of current land coverage of red cedar on this plot of land. How could your group most accurately estimate the land cover of red cedars?

Explain to students that overtime, red cedars will continue to spread. One study found that cedar cover can increase in a grassland space by an average of 2.3% per year. (Source: Assessing the Rate, Mechanisms, and Consequences of the Conversion of Tallgrass Prairie to Juniperus virginiana

ForestAuthor(s): John M. Briggs, Greg A. Hoch, Loretta C. Johnson, Ecosystems, Vol. 5, No. 6 (Sep., 2002), pp. 578-586. http://www.jstor.org/stable/3658734)

Given a 2.3% increase of cedar coverage per year, ask students to estimate what the canopy cover of cedars would be if left unmanaged for 10 years. How long would it take to have 100% coverage? Ask groups to document their calculations and rationale.

3. Explain:

After teams have completed their calculations, engage groups discussion of their findings. Some key questions for the land cover calculations might include:

Key Questions to Explore:

How could you do this if you were able to go to the plot of land? Are there any operational definitions your team needed to develop to be consistent? (e.g. We estimated only the area that was densely covered by cedars with little to no visible space between trees, or we looked at each square and estimated the coverage as a percentage for each square, converted to a decimal and then divided that by the total number of squares, etc.)

1. Were the estimations of land cover fairly consistent among the groups? Why do you think this might be?
2. How might you determine cedar land coverage if you were able to go to the plot of land?
3. Are there any operational definitions your team needed to develop to be consistent? (e.g. We estimated only the area that was densely covered by cedars with little to no visible space between trees, or we looked at each square and estimated the coverage as a percentage for each square, converted to a decimal and then divided that by the total number of squares, etc.)

Next discussion the conversion of grassland to cedar calculations—have groups share their findings and how they calculated the changes.

Key Questions to Explore:

1. What potential impacts might the conversation of prairie to cedars have? Consider plant and animal species, human impacts, impacts on adjacent property, fire impacts, etc.)
2. What might slow down the conversion of prairie to red cedar?
3. What additional questions do you have after exploring this scenario?

4. Elaborate:

Explain to students that one of the tenets of the nature of science is "Scientific knowledge is open to revision in the light of new evidence" (Next Generation Science Standards, Appendix H, https://www.nextgenscience.org/sites/default/files/resource/files/Appendix%20H%20-%20The%20Nature%20of%20Science%20in%20the%20Next%20Generation%20Science%20Standards%204.15.13.pdf).

Find another example of how advanced science understandings reversed a previous practice. What obstacles do you think might slow adoption of a new recommended practice? How might you overcome those obstacles?

Teacher Note: The use of DDT as an insecticide in agriculture in the 1940's and its subsequent ban once the science demonstrated the harmful impacts on wildlife and human health is an example of this phenomena.

Extension Opportunity:

Have students explore google earth images on a time lapse of areas where there has been a prescribed burn and note observations from those images. The directions for students to complete this investigation are found in the section entitled *Google Earth Pro Historic Prescribed Burn Activity*.

Evaluate:

Evaluation based on team analysis and explanation of findings of coverage and conversion of cedar.

Evaluation Rubric:

Red Cedar Analysis Rubric

Team Members:

0-5 Points	**6-10 Points**	**11-15 Points**	**Points Awarded**
Team estimates cedar coverage on the example plot, but estimation is not reasonable.	Team estimates cedar coverage on the example plot and estimation of coverage is acceptable	Team identifies and applies an appropriate process for estimating cedar coverage on the example plot and estimation of coverage is accurate	
Based on coverage estimation, team incorrectly completes calculations for cedar succession. Rationale and calculations are not documented.	Based on coverage estimation, team accurately completes calculations for cedar succession. Rationale and calculations are partially documented.	Based on coverage estimation, team accurately completes calculations for cedar succession. Rationale and calculations are documented.	
		TOTAL OUT OF 30 POINTS	

References/Resources:

Prairie Sites for Field Visits

Fire History and Climate Change - The View from Ecosystems