

U4.4 Fire Ecology Performance Task Rubric 2022

Unit DQ: If fire is a hazard, why do so many animals and plants depend on fire?

Summary

Students learn how society's drive to prevent wildfires, for safety and economic reasons, has hindered natural ecosystem processes. They are mentored virtually by fire ecologists in case studies from around the country, learning to gather information, design a controlled burn, and monitor results. By understanding the role of fire in ecosystems, students discover more broadly, the connection between fuels and energy, and how this relationship may be harnessed as a technology for humankind.

Enduring Understanding – *Students will apply the following ideas to explain phenomena or design solutions to problems they experience in their environment:*

Humans engineer **controlled fires** for ecological reasons, including **restoring biodiverse ecosystems** for plants and animals that are specially **adapted** for the **natural processes** of the Earth. When fire, an oxygen-fuel system is present, it transfers energy in the system as heat, sound, light, or kinetic energy, and many plants and animals that are fire-adapted, reproduce or find protection, food, or sun when that transfer occurs. The use of fuels derived from natural resources affects the environment in critical ways. When natural fires are suppressed on a larger scale, the resulting intense fires pose a threat to animals, plants, and humans due to the huge volumes of fuel collected, resulting in hazards. We can plan and design solutions that enable positive and limit negative effects of fire.

Generalizations

Some plants and animals **depend on** hazards to survive.

Using natural resources (fuels) **changes** the environment.

Fuel use involves **energy transfer**.

We can manage environmental **resources**.

Primary PEs addressed in this unit

[4-PS3-2](#) Make observations to provide evidence that **energy can be transferred** from place to place by sound, light, **heat**, and electric currents.

[4-ESS2-2](#) **Analyze and interpret data from maps** to describe patterns of Earth's features.

[4-ESS3-1](#) Obtain and combine information to describe that energy and **fuels are derived** from natural resources and their **uses affect the environment**.

[4-ESS3-2](#) Generate and compare multiple solutions to reduce the impacts of **natural Earth processes** on humans.*

[3-5-ETS1-1](#) Define a simple design problem reflecting a need or a want that includes specified **criteria for success and constraints** on materials, time, or cost.

Secondary PEs addressed in this unit

[4-ESS2-1](#) Make observations and/or measurements to provide evidence of the **effects of weathering** or the rate of erosion by water, ice, wind, or **vegetation**.

[4-PS3-4](#) Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*

[4-LS1-1](#) Construct an argument that plants and animals have internal and external **structures** that **function to support survival, growth**, behavior, and reproduction.

[4-LS1-2](#) Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. -- (light touch)

[3-ESS3-1](#) Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*



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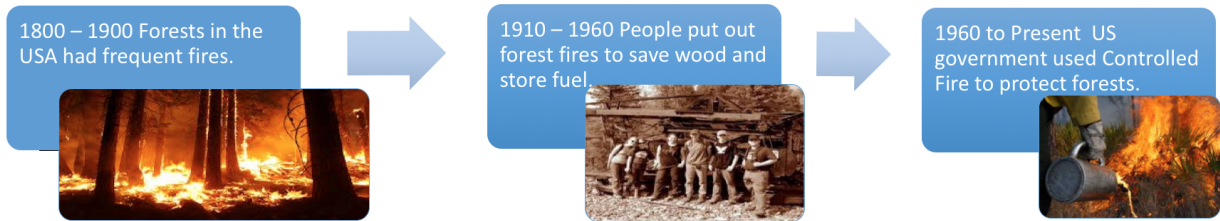
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3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Building a foundation for

5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.

3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. (possible simulation)

Task Item (Rubric)	Evidence Statement	Level 3 Performance	Level 2 Performance	Level 1 Performance	Level 0
Timeline for Forests and Fires in the USA 					
1 (Q1) Look at the timeline above. How do you think the forests, including the trees, the animals and other forest plants, may have changed between 1800 and the present?	Student answer uses the timeline to explain sequence of events, connected by time. They also show knowledge of fire as a natural part of the ecological system. 1) that the frequency of fire was regular and frequent in the past, which has changed due to fire prevention, system of plants, animals and trees depended on fire. 2) This has to do with human interests in economy and disrupted the natural fire cycle, some animals and plants	1) All three stages are described and connected by time, and 2) describes the impact of each stage on all of some of the following: Animals, trees, other plants. 3) Includes the understanding of fire as part of the ecological system, which plants and animals are adapted to; and includes mention of fires being a tool to restore original systems.	1) All three stages are described and connected by time, and 2) describes the impact of each stage on at least one of the following: Animals, trees, other plants. Does not include the understanding of fire as part of the ecological system, which plants and animals are adapted to; and does not include mention of fires being a tool to restore original systems.	1) All three stages are described and connected by time, and there is no description of the impact of each stage on at least one of the following: Animals, trees, other plants. Or describes one stage and mentions of fires being a tool to restore original systems.	Illegible or no answer Or less than a level 1 performance



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	needed fire and were not able to thrive. 3) The student describes the final time line stage where there is fire as an engineering tool to provide the same benefit that fire used to with controlled fire, bring back natural ecosystem.				
Example					
Example					
Example					
Task Item (Rubric)	Evidence Statement	Level 3 Performance	Level 2 Performance	Level 1 Performance	Level 0
2 (Q2) How does the use of controlled fires protect and help communities? Use examples to provide evidence.	Answer describes the build up of fuel when natural fires are prevented, and that can cause massive uncontrollable fires. Includes at least two examples or evidence.	Answer describes the build up of fuel when natural fires are prevented, and that can cause massive uncontrollable fires. Includes at least two examples or evidence.	Answer describes the build up of fuel when natural fires are prevented, and that can cause massive uncontrollable fires. Includes one example or evidence.	Makes a connection (can be implied) between controlled burn and prevention of massive fires. Does not provide evidence.	No answer or illegible. Or less than a level 1 performance
Example					
Example					
Example					
Task Item (Rubric)	Evidence Statement	Level 3 Performance	Level 2 Performance	Level 1 Performance	Level 0



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3 The Jack Pine tree is an example of one tree that was cut down in the 1900's. The Jack pine tree has pine cones that only open under extreme heat, like in a fire. The pine cone seeds are in the cone.

3 (Q3) Think about this specialized structure of the pine cone. (Describe) What would happen to the population of Jack Pines if there were no fire? How does fire help the Jack Pine survive?	The student makes an argument that the pine tree would not thrive as a species without fire . They include the evidence from the text that the pine cones need extreme heat . The reasoning is that the specialized structure requires heat to reproduce one of the needs of all organisms, and that without fire the tree would not reproduce .	The student makes an argument that 1) the pine tree would not thrive as a species without fire. They include the 2) evidence from the text that the pine cones need extreme heat. The reasoning is that the specialized structure requires heat to 3) reproduce one of the needs of all organisms, and that without fire the tree would not reproduce. Includes all three ideas.	The answer includes two of the following: 1) The pine tree would not thrive as a species without fire. They include the 2) evidence from the text that the pine cones need extreme heat. The reasoning is that the specialized structure requires heat to 3) reproduce one of the needs of all organisms, and that without fire the tree would not reproduce. Includes two of three ideas.	The answer includes one of the following: 1) The pine tree would not thrive as a species without fire. They include the 2) evidence from the text that the pine cones need extreme heat. The reasoning is that the specialized structure for heat to 3) reproduce one of the needs of all organisms, and that without fire the tree would not reproduce. Includes one of three ideas.	No answer or illegible or less than a level 1 performance.
Example					
Example					
Example					
Task Item (Rubric)	Evidence Statement	Level 3 Performance	Level 2 Performance	Level 1 Performance	Level 0

The Kirtland's Warblers build nests in the sandy soil on the ground. Look at the Kirtland's nest. It is hidden by smaller plants and grasses. Jack Pine forests **less than 20 years old** allow sunlight to get through for grasses and small plants to grow. An older Jack Pine forest is dense and dark and few plants can grow on the forest floor.



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4 (Q4) Draw a model showing how fire could be used to solve the problem of Warblers not being able to nest. In your model: Show how controlled fire can solve the problem for the Kirtland's Warbler. Show the forest system and how it is related to the survival of the Jack Pines and the Kirtland's Warbler.	The model shows these parts of a system that controlled burns are needed for the bird species to survive: Warbler's nest Small plants - It shows that these are connected bc the plants hide the nest Warblers nest needed for egg protection New forests - Shows that these are connected for the bird to survive. Controlled Fire Small plants - It shows these are connected because the fire allows areas of the forest to be new.	All three components are needed for the model to show the parts of a system and argue that controlled burns are needed for the bird species to survive: Warbler's nest Small plants - It shows that these are connected bc the plants hide the nest Warblers nest needed for egg protection New forests - Shows that these are connected for the bird to survive. Controlled Fire Small plants - It shows these are connected because the fire allows areas of the forest to be new.	Two components for the model to show the parts of a system and partially argue that controlled burns are needed for the bird species to survive: Warbler's nest Small plants - It shows that these are connected bc the plants hide the nest Warblers nest needed for egg protection New forests - Shows that these are connected for the bird to survive. Controlled Fire Small plants - It shows these are connected because the fire allows areas of the forest to be new.	One component for the model to partially argue that controlled burns are needed for the bird species to survive: Warbler's nest Small plants - It shows that these are connected bc the plants hide the nest Warblers nest needed for egg protection New forests - Shows that these are connected for the bird to survive. Controlled Fire Small plants - It shows these are connected because the fire allows areas of the forest to be new.	No answer or illegible or less than a level 1 performance.
Example					
Example					
Task Item (Rubric)	Evidence Statement	Level 3 Performance	Level 2 Performance	Level 1 Performance	Level 0
5 (Q5) What is evidence that there is energy transfer in the	Evidence that there is energy transfer includes three of the following:	1) Evidence that there is energy transfer includes three of the following:	1) Evidence that there is energy transfer includes two of the following:	1) Evidence that there is energy transfer includes one of the following:	No answer or illegible or less than a level 1 performance.



fire-fuel (forest) system? In other words, how do you know that there is energy in the system?	Heat, sound, change in matter, light, movement.	Heat, sound, change in matter, light, movement. 2) Makes the connection between the transfer of energy and energy in the system.	Heat, sound, change in matter, light, movement. 2) Makes the connection between the transfer of energy and energy in the system	Heat, sound, change in matter, light, movement. OR 2) Makes the connection between the transfer of energy and energy in the system.	
Example					
Example					
Task Item (Rubric)	Evidence Statement	Level 3 Performance	Level 2 Performance	Level 1 Performance	Level 0
6 You showed how fire can be one solution for protecting the Warbler.					
6 (Q6) Can you think of a very different solution to the problem? Explain the different solution and how it would help the Kirtland's Warbler.	Student uses a different idea to explain/show how the solution protects the warbler. Different idea + explanation	Student uses a different idea to explain/show how the solution protects the warbler. Different idea + explanation	Student uses the same idea Uses the idea in a different way, or uses a closely-related idea.	Student uses the same idea as the model and a different or the same outcome.	No answer or illegible or less than a level 1 performance.
Example					
Example					
Task Item (Rubric)	Evidence Statement	Level 3 Performance	Level 2 Performance	Level 1 Performance	Level 0
7 (Q7)	Student describes one of the collection methods they used in class in the final artifact, or	Student describes one of the collection methods they used in class in the final artifact, or	Student describes some authentic practice they used in class in the final artifact,	Student answers with something to do with class or the texts	No answer or illegible or less than a level 1



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How would a scientist collect data to show that the solution solved the problem?	that they read about in the texts.	that they read about in the texts. The description has to do with data collection after a fire .	or that they read about in the texts. The description does not have to do with data collection after a fire.	about fire, but does not seem to be valid, accurate, or related to the question.	performance.
Example					
Example					



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