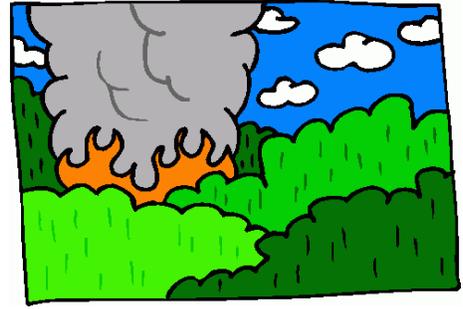

Fire Severity



Objectives:

1. Students will demonstrate, graph and describe ways that different fire severities and fire absence affect the forests of the Klamath-Siskiyou Mountains.
2. Students will describe immediate and short-term effects of fire in forests of the Klamath-Siskiyou Mountains.
3. Students will describe the patchwork mosaic burn pattern of a forest fire and its effects on the plants and animals that live in the forest.

Materials

- **Fire Severity Materials Packet** including:
 - **Fire Severity photos** (3)
 - **Fire Effects photo**
 - **Healthy Forest cards** (38)
 - Laminated **Fire Effects Script and Data Sheets** (4)
- **Quartz Fire Satellite Burn Intensity map** (1)
- **Student Data Packets** (copy for students)
- Pencil/pen or dry-erase marker (not provided)
- Colored pencils or pens for each student (not provided)
- Clipboards (optional, not provided)
- 15 to 35 students (Works best with at least 25 students)

Appropriate Grade Level: 6th-12th

Time Required:

- Introduction and demonstration: 45 minutes
- Data Analysis and discussion: 1.5 to 2 hours

Curriculum Standards: 6.2L.2, 7.2E.3, 8.2E.4, H.2L.2, H.2E.4, 6.3S.2, 7.3S.2, 8.3S.2, H.3S.2. Social Science: 6.11, HS.14,

Background Information

Not all forest fires burn at the same temperature. Fires range from relatively cool to very hot. Relatively cool fires tend to be small and only burn grasses and low-growing plants, whereas very hot fires can burn everything growing in large parts of the forest. While fire can be destructive, it is also an important element of the forest ecosystem because many plants and animals thrive on fire's disturbance.

The mixed-conifer and mixed-evergreen forests of the Klamath-Siskiyou Mountains have mixed-severity fire regimes. This means that the various plants growing in the forest are adapted to survive different levels of severity. Some plants easily resist low-severity (cooler, small) fires, while others need moderate-severity or even high-severity (hottest, largest) fires to release their seeds, or re-sprout from roots. While fire can harm or kill animals, it can also open up new habitat for animals.

When a fire moves through the forest, each plant and animal species is affected differently by the fire. Depending on the severity of the fire, the forest community changes in different

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ways. But fire isn't the only thing that causes change in the forest. The absence of fire can affect the forest just as much as fire itself.

In the absence of fire, low-severity and moderate-severity fires are not as likely to burn because the trees are so close together, and there is more fuel on the forest floor from dead shrubs and trees. Animal habitats will change; animals that need open spaces and forest edges will not live in the forest. With over-crowding and lower diversity, disease can have a larger impact on the forest. As a result of tree crowding, when fire does catch, it spreads from tree to tree quickly and grows large, resulting in a very high-intensity fire. These super-hot fires can “bake” the soil, getting it so hot that all the organic matter burns. It can take a very long time for these soils to recover.

When fire burns different parts of the fire at different severities, it creates a patchwork mosaic pattern of vegetation in the forest by increasing structural and species diversity. This mosaic pattern consists of unburned or lightly burned patches of the forest dominated by tall trees. Nearby, highly burned patches of forest are dominated by grasses and other low-growing plants. This mix of tall and short plant patches adds to the structural diversity in the forest, and provides many different types of animal shelter. Different types of plants grow in these different patches, which increases to total number of different plants in the entire forest, which increases the species diversity, and available food for animals.

Set-up

- Copy the original **Fire Effects Script and Data Sheets**, or use a dry erase marker on the laminated copies.
- Choose a large open place outdoors to conduct the activity.
 - To conduct the activity indoors, move desks and chair to the edge of the classroom.
- Copy a **Student Data Packet** and/or the **Example Graphs** for the students.
- Display the **Quartz Fire Satellite Burn Intensity map** in the classroom

Activity

Fire Severity Introduction

- 1) Show the students the **Fire Severity photos** of low-severity, moderate-severity, and high-severity fires. Ask the class to describe how the photos differ from each other. Ask them to predict the effects of each fire on the species living and growing in the forest, both immediately after and one year after the fires took place. Ask the students to brainstorm ways in which fire might harm some species and help other species.
- 2) Discuss the meaning of the word “severity” and how it can describe fire. Discuss how the amount and type of fuel (things that can burn), humidity, temperature and wind can all affect fire severity.
(Fire requires three elements: oxygen, fuel and heat. Low humidity, fuel accumulation and high temperatures can all cause fire. Wind spreads fire, especially in warm, dry conditions.)

Fire Severity Demonstration

*Use the **Fire Effects Script and Data Sheets** as a guide during this section.

- 3) Tell the students that as a class they are going to act out how the different fire-severities affect the plants growing in a forest. Specifically, they are going to act out how the number of trees, shrubs and ground plants change with low-, moderate- and high-

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severity fire. Tell the students that you will record the number of each type of plant for each type of fire. The class will compare the effects of the fire-severities at the end of the activity.

Note: Each demonstration will generate different data. The activity works best when you use at least 25 students, although the activity can be done with fewer students. Using too few students will result in data that may not truly represent the effects of each fire-severity.

- 4) Have the students stand up and spread out around the classroom, or take them to an open area outside and have them spread out at least one arm's length from each other.
- 5) Tell each student that they each represent one plot of land in a healthy forest. Shuffle and pass out a **Healthy Forest card** to each student. The card will tell them if a tree, shrub or ground plant lives on their plot of land.
- 6) Have the students act out their type of plant; if they are a tree, have them spread their arms above their heads; if they are a shrub, have the students crouch down; if they are a ground plant, have them sit or lay on the ground.
- 7) Count and tally the number of trees, shrubs, and ground plants in the "Before Fire" table on the **Low-severity Fire Effects Script and Data Sheet**.
- 8) Tell the students that you (the teacher) represent fire, and you have a story to tell them. Tell them that if you tap them on the shoulder during your story, then the plant that lives on their plot of land has caught fire, and they must leave the forest (dramatically, if you choose). Designate an area for these students to go; once burned, they can move to the perimeter of the room or sit at the edge of the forest.
- 9) Read the script aloud to the class as you walk through the forest. Tag students as directed by the card.
- 10) Tally the surviving plants and animals in the "Immediately After the Fire" table on the **Low-Severity Fire Effects Script and Data Sheet**.
- 11) Finish telling the story, and record the number of trees, shrubs and ground plants in the "One Year After Fire" table.
- 12) Tell the students that you are moving to a new section of the forest where a different type of fire will occur. Have the students move around and find a new "plot" of land in the forest. Have the students resume the roll of the plant on the front of their card. Repeat the demonstration for the moderate-severity and high-severity fires, as well as the fire absence effects.
- 13) When the class acts out the fire absence effects, tell the students that the forest may not change because of fire, but they will need to listen carefully to the story and follow your instructions.
- 14) Before you bring the students back to the classroom, show them the photo of the forest several years after a severe fire (the **Fire Effects photo**). Have them identify

what kinds of plants dominate the landscape (ground plants, with a few shrubs).

Fire Severity Data Analysis

*Use the **Student Data Packets** as a guide for this section.

15) Return to the classroom and take out the **Student Data Packets**. Tell the students that they will now be analyzing the data you collected during the demonstration to see how the different fire-severities affected the different types of plants.

Note: This section can be done individually, in pairs or groups, or as a class. Copy the appropriate amount of packets accordingly.

16) Fill in the tables with the class data, and then create a line graph for each fire severity, graphing its effect on trees, shrubs and ground plants. Then create a bar graph for each plant type, graphing the population changes for each fire-severity. Don't include the fire absence effects in the bar graph because the units are different.

Note: If you want to skip this step, show the students the **Example Graphs**, which show the data you will get if you use the complete set of **Healthy Forest cards** in the demonstration.

17) Discuss how the different fire severities affected the forest in different ways. Also, discuss how the forest changed in the absence of fire.

18) Determine which plant population benefited the most from each fire-severity type, and which was most harmed by each fire-severity type. Discuss how this might affect the animals living in the forest

19) Discuss these questions, also found on page 6 of the **Student Data Packet**.

- Does fire play an important role in the forest? Why or why not?
Answer: Yes. Without fire, many plants are out-competed, or they get crowded out of the forest. Fire does harm some plant populations, but within a year, many plants have returned to the forest.
- Is one type of fire better for the entire forest than another type of fire? Why or why not?
Answer: Low-severity fire causes the least mortality, but all fire-severities play an important role in the Klamath-Siskiyou Mountains. Fire adds diversity to the whole landscape by affecting different parts of the forest differently. A lack of fire is the most destructive force in this demonstration

20) Show the students the **Quartz Fire Satellite Burn Intensity map**. Discuss these questions, which are also on page 6 of the **Student Data Packet**. For this activity, intensity and severity mean the same thing.

- Did the entire forest burn at the same severity?
Answer: No. Areas of the forest were unburned and other areas experienced low burn, moderate burn and severe burn (which is the same as low-, moderate- and high-severity fire in this activity.)
- How would you describe the pattern of burn severities on the map?

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Answer: This pattern is commonly referred to as a “patchwork mosaic.”

- Look at the entire colored area where the fire burned. If the entire map was one color (if the whole area burned at the same severity), do you think there would be more or fewer species of plants and animals living in the forest? Why?

Answer: There would be fewer species of plants and animals (lower species diversity) because the fire would affect the entire forest in the same way, creating the same habitat throughout. For example, if the entire forest experienced a high burn, the entire map would represent the plants in the high-severity fire demonstration. Ground plants would dominate the plant community, and animals that needed shrubs and trees would not survive in the forest.

- If there were more, smaller color patches on the map, would there be more or fewer species of plants and animals living in the forest? Why?

Answer: There would probably be more species of plants and animals (higher species diversity) because the patches of forest that burned at different severities would represent all the different fire-severity types from the demonstration, and there would be more different types of habitats for animals.

- If you were a fire manager, how would you use this information to deal with forest fire?

Answer: Answers will vary. There are many factors that influence forest managers' decisions: protecting human lives and property, the health of the forest, protecting timber and people's fear of fire.

Assessment Options

- Assess the Student Data Packets. Assess the graphs, and use the discussion questions as essays questions (located on page 6 of the **Student Data Packets**).
- Have the students research a tree, shrub or ground plant and how it is adapted to fire.

Advanced Alternatives

- Assign different students to be a reader, a counter, and “fire” (this person tags the students holding plant-type cards, following the directions of the reader). Give these students the cards describing these roles, instead of a plant-type card.
- Have the students record their own data during the demonstration, rather than giving them the data after the demonstration is complete.

Low-Severity Fire Effects

Script and Data Sheet

Read aloud: It's early June in a healthy forest full of trees, shrubs and ground plants.

Directions: Have the students assume the role of the plant growing on their plot of forest.

Record the number of trees, shrubs and ground plants in the "Before Fire" table below.

Read aloud: A thunderstorm rolls in, and a lightning bolt strikes a rock, throwing sparks into the forest. A dry patch of grass catches on fire and fire spreads along the forest floor. The ground is damp and the fire is cool, so fire only burns a small part of the forest, including some grasses and other **ground plants**.

Directions: Tag about a third of the students holding "ground plant" cards.

Read aloud: Some of the **shrubs** are damaged, but only a few burn completely.

Directions: Tag one or two students holding shrub cards.

Read aloud: All the mature **trees** survive, but a young tree is burned.

Directions: Tag a student holding a tree card. Record the number of trees, shrubs and ground plants in the "Immediately After the Fire" table below.

Read aloud: One year later, the ground is fertile because the fire returned some nutrients to the soil. Surviving plants grow bigger, and new plants sprout and thrive in the place of the plants that were burned.

Directions: If the student "burned" during the fire, have these students turn their cards over, return to their plot of land, and assume the role of the new plant listed next to "low-severity."

Record the number of trees, shrubs and ground plants in the "One Year After the Fire" table.

Before Fire

Trees	Shrubs	Ground Plants

Immediately After the Fire

Trees	Shrubs	Ground Plants

One Year After the Fire

Trees	Shrubs	Ground Plants

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Moderate-Severity Fire Effects

Script and Data Sheet

Directions: Tell the class you are now in a new section of the forest. Have the students shift places and resume the role of the plant on the front of their card. Record the number of trees, shrubs, and ground plants in the “Before Fire” table below.

Read aloud: It's mid-summer and a family is camping in the woods. As they are packing up their camp, they throw a bottle of water on their campfire, but it's not enough. The fire rekindles after they leave, a branch falls on the campfire, and fire spreads into the forest. The fire grows, burning many of the **shrubs** as it grows.

Directions: Tag half of the students holding shrub cards.

Read aloud: Most of the summer wildflowers, grasses and other **ground plants** are burned.

Tag all but a few students holding ground plant cards.

Read aloud: Many of the **trees** survive, and the rest are scarred. Fire-intolerant trees, such as white pine, are burned in the fire.

Tag about a half of the students holding tree cards. Record the number of trees, shrubs and ground plants in the “Immediately After Fire” table.

Read aloud: One year after the fire, more light reaches the ground, and the soil is rich in nutrients from the burned plants. Grasses, fireweed, and wildflowers bloom. Manzanita shrubs sprout from seeds that survived in the soil. Madrone trees regrow from underground roots. A few ponderosa pine trees that love the sunlight take-seed.

Directions: If the student “burned” during the fire, have these students turn their cards over, return to their plot of land, and assume the role of the new plant listed next to “moderate-severity.” Record the number of trees, shrubs and ground plants in the “One Year After the Fire” table.

Before Fire

Trees	Shrubs	Ground Plants

Immediately After the Fire

Trees	Shrubs	Ground Plants

One Year After the Fire

Trees	Shrubs	Ground Plants

High-Severity Fire Effects

Script and Data Sheet

Directions: Tell the class you are now in a new section of the forest. Have the students shift places and resume the role of the plant on the front of their card. Record the number of trees, shrubs, and ground plants in the “Before Fire” table below.

Read aloud: It's early September and hot! It hasn't rained in a month, and the ground is very dry. Clouds gather overhead and it looks like it might rain, but it doesn't. Instead the clouds send lightning bolts to the earth. One lightning bolt strikes a meadow that bursts into flames! Soon all the **shrubs** in the meadow are on fire. One lucky manzanita is only partially burned and survives.

Directions: Tag all but one of the students holding shrub cards.

Read aloud: The fire races up to the tops of the **trees**, burning all but a few lucky survivors.

Directions: Tag all but two or three students holding tree cards.

Read aloud: The fire is hot and all the **ground plants** are burned, as well as all the organic matter in the top layer of soil.

Directions: Tag all the students holding ground plant cards.

Read aloud: One year after the fire, the burned trees are still black and smell like charcoal. But Knobcone pines emerge from the soil. Buckbrush seeds sprout. A few oak trees re-sprout from their roots. And the ground is covered in fresh new grass and wildflowers.

Directions: If the student “burned” during the fire, have these students turn their cards over, return to their plot of land, and assume the role of the new plant listed next to “high-severity.” Record the number of trees, shrubs and ground plants in the “One Year After the Fire” table.

Before Fire

Trees	Shrubs	Ground Plants

Immediately After the Fire

Trees	Shrubs	Ground Plants

One Year After the Fire

Trees	Shrubs	Ground Plants

Fire Absence Effects Script and Data Sheet

Directions: Tell the class you are now in a new section of the forest. Have the students shift places and resume the role of the plant on the front of their card. Record the number of trees, shrubs, and ground plants in the “25 Years After Fire” table below.

Read aloud: Fire hasn't burned in the forest for over 25 years. Occasionally, low-severity fires start, but they are quickly extinguished, or suppressed by firefighters. People feel safe because they know firefighters will protect their homes. They think the forest is healthy because it isn't being destroyed by fire. What they don't realize is that the forest is constantly changing anyway.

Read aloud: There is so much shade in the forest these days that most of the **ground plants** can't get enough light to grow. Trees grow in their place.

Directions: Tag most of the students holding ground plants. Tell them they are now trees.

Read aloud: Many of the **shrubs** can't find enough light to grow and they die. More trees grow in their place.

Directions: Tag most of the students holding shrub card. Tell them they are now trees.

Read aloud: Douglas-fir **trees** love the shade and continue to grow, spreading out in the forest. Fifty years later, the forest has grown very crowded.

Directions: Tell all the students to take a few steps towards the middle of the forest. Record the number of trees, shrubs and ground plants in the “75 Years After Fire” table.

Read aloud: Fifty more years pass without fire. But a careless hiker drops a match in the forest that catches a pile of dead leaves on fire. Because the forest is so crowded, a raging fire catches in the entire forest, burning all the plants and baking the soil!

Directions: Tag all the students. Record “0” in all the boxes in the “125 Years After Fire” table.

25 Years After Fire

Trees	Shrubs	Ground Plants

75 Years After Fire

Trees	Shrubs	Ground Plants

125 Years After Fire

Trees	Shrubs	Ground Plants

Fire Severity

