Unit C: Forest Management

Lesson 4: Understanding the Role of Fire in Forest Management

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Explain the purpose of prescribed fire.
2. Describe the different types of forest fires.
3. Identify sources of forest fires.
4. Explain the fire triangle.
5. Explain various factors that effect fire behavior.

Recommended Teaching Time: 2 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed with use of this lesson plan
- http://www.montana.edu/cybertour/science/6to12/hallauc/index.html
- http://forestry.about.com/cs/forestfire/a/prescribe_burn.htm

List of Equipment, Tools, Supplies, and Facilities

Writing surface
PowerPoint Projector
PowerPoint slides
Transparency Masters

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide #2):

- Crown fires
- Crowning out
- Fire behavior
- Fire season
- Fire triangle
- Ground fires
- Ignition temperature
- Incendiary fires
- Prescribed fire
- Surface fires
- Updrafts
- Wildfire

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Ask students if all fires are bad. Allow students to share their thoughts with the entire class. Ask them to defend their responses. After several students have given their answer, lead discussion to lesson objectives. At the conclusion of the lesson, ask the students the same question. Ask why some students changed their answer from their early response.

Summary of Content and Teaching Strategies

Objective 1: Explain the purpose of prescribed fire.

(PowerPoint Slide #3)

I. A ***prescribed fire*** is a managed, intentional fire set by humans for a specific purpose. A prescribed fire is usually controlled and contained within a specific area.

(PowerPoint Slide #4)

A. A properly controlled prescribed fire produces several benefits for the forest, wildlife, and people. Some of the benefits are:

(PowerPoint Slide #5)

1. Reducing the hazard of wildfire by removing fuel from the forest floor. A ***wildfire*** is a fire that endangers people or property, which is not within an area designated to be managed by the use of fire, or that, in conjunction with weather or other conditions, may threaten to expand, thus endangering people, property, or non fire-management areas.

(PowerPoint Slide #6)

2. Preparing sites for seedlings and planting. A prescribed burn can remove other plants that will act as competition for nutrients and water to the new trees.
3. Removing undesirable trees and brush cluttering the forest understory.

(PowerPoint Slide #7)

4. Assist in controlling forest diseases.
5. Improves the quality of grass for grazing by removing brush and dried weeds.

(PowerPoint Slide #8)

B. The use of prescribed fire as a management technique should only be conducted by a trained forester. It is a difficult task to perform safely. Here are some factors that should be adhered to in the safe use of prescribed fire.

(PowerPoint Slide #9)

1. Weather conditions—Only a small area should be burned at a time. The humidity and moisture content in the forest must not be too low. There should only be a slight breeze.

(PowerPoint Slide #10)

2. Fire intensity—The fire must not be allowed to get too hot. High heat intensity can cause the leaves of trees to wilt, damaging the trees. The heat can also cause the cambium layer under the bark to literally cook.

(PowerPoint Slide #11)

3. Fire containment—The fire must not be allowed to get out of control. If a prescribed fire breaks containment, it becomes a wildfire and can cause great damage.

**** Refer back to the interest approach. Have the students raise their hands if they still think all fires are bad. Have students tell you now why they do or don't think all forest fires are bad. Also if there is a specific example of a prescribed forest fire that was done in your area share that with the students.**

Objective 2: Describe the different types of forest fires.

(PowerPoint Slide #12)

II. Forest fires are categorized into three general types: surface, ground, and crown fires. More than one of these types of fires may occur within the same forest fire.

(PowerPoint Slide #13)

A. ***Surface fires***—These fires burn surface litter such as needles, leaves, and twigs on the forest floor and small vegetation. These are the most common kind of fires.

(PowerPoint Slide #14)

B. ***Ground fires***—These fires burn the organic materials beneath the surface litter of the forest floor. They burn organic materials in various stages of decomposition that have accumulated on top of the mineral soil. In peat bogs or swamps, ground fires may burn many feet below the ground surface in the deep, organic material.

(PowerPoint Slide #15)

C. ***Crown fires***—These fires burn from top to top of trees or shrubs, sometimes independently of a surface fire. However, crown fires almost always start as surface fires. When an abundance of surface fuel is present, fires may burn into the upper portion of trees. This is called ***crowning out***.

(PowerPoint Slide #16)

Crown fires are the fastest spreading of all types of fires. They are more common in coniferous forests than deciduous forests because of the higher flammability of the coniferous foliage.

****Use TM: B3–4 or PowerPoint Slide # 17 can be used to aid in discussion on this topic. If you have pictures of forest fires, hold them up and have the students tell you what type of fire this is. Is it more than one type?**

Objective 3: Identify sources of forest fires.

(PowerPoint Slide #18)

III. Forest fires can be caused natural, often by lightning strikes. However, people cause the majority of forest fires. Some of the major sources of forest wildfires are:

(PowerPoint Slide #19)

A. ***Incendiary fires***—This category of fires included malicious burning or arson. This also includes fires that were set as prescribed fires, but got out of control.

(PowerPoint Slide #20)

B. Debris burning—The burning of trash, brush, tree tops, and branches after harvest often gets out of control and causes a great deal of damage.

(PowerPoint Slide #21)

C. Smokers—Smokers were once a much more serious problem than they are today. Through education campaigns, the number of fires started by the careless discarding of a match or cigarette has been reduced.

(PowerPoint Slide #22)

D. Railroads—Like smokers, the number of fires started by railroad locomotives has dramatically been reduced. In the time of the steam locomotive, fires were more common as these machines produced sparks that often started fires. Also, fire was used to clear brush and grass from railroad tracks and right-of-ways.

(PowerPoint Slide #23)

E. Lightning—This is the main natural cause of forest fires. A bolt of lightning produces great heat, but during a rainstorm there is little danger of forest fire.

Ask your students if they recall any forest fires that have started in Afghanistan. Have them talk about what started them. You may have to give an example if their hasn't been any recently.

Objective 4: Explain the fire triangle.

****Before starting this objective, ask the students what is needed to start a fire? What needs to happen for a forest fire to occur? When they give you a good list of what they think, move on to this objective.**

(PowerPoint Slide #24)

IV. Fire is both a physical and chemical process. It is the result of quick combustion of oxygen with another substance. For a forest fire to occur, three things are required: fuel, oxygen, and heat. The relationship between these three can be illustrated as the ***fire triangle***.

(PowerPoint Slide #25)

For a fire to start all three factors within the fire triangle must be present. If one factor is removed, the fire goes out. This simple idea forms the basis for the very complicated and difficult processes of fighting forest wildfires and controlling prescribed fires.

(PowerPoint Slide #26)

A. Fuel—Fuel is something that can burn. Trees, dead leaves, grasses, forest litter, and many other things in the forest are combustible.

(PowerPoint Slide #27)

B. Oxygen— Oxygen gas makes up about 20 percent of the surface atmosphere.

(PowerPoint Slide #28)

C. Heat—For a combustible material to burn, it must reach its ***ignition temperature***. Most forest fuels have ignition temperatures of 316° to 471°C. The ignition temperature of an item is the same whether the material is wet or dry.

(PowerPoint Slide #29)

However, since water boils at a lower temperature, wet leaves and wood exposed to open flame do not get much above the boiling point of water until all the water evaporates.

****Use TM: B3–4B or PowerPoint # 30 to aid in discussion on this topic.***

Objective 5: Explain various factors that affect fire behavior.

(PowerPoint Slide #31)

V. ***Fire behavior*** relates to what a fire does. Forest fires are capable of doing many things under a wide range of conditions. Some may burn very slowly while others may whip quickly through the tops of trees or brush at up to 8 kilometers per hour.

(PowerPoint Slide #32)

For this reason, a knowledge of fire behavior is essential to fire management activities. The behavior of a fire is related to its intensity and speed. Several factors must be considered in understanding fire behavior. These include:

(PowerPoint Slide #33)

A. Fire Seasons—The ***fire season*** refers to the time when the buildup of fuels and the occurrence of extended dry periods are greatest.

(PowerPoint Slide #34)

B. Air Movements—The speed and direction of the wind at different levels, including both horizontal and vertical movements, govern the duration and speed of a fire. Wind adds to the severity of a fire by drying out the vegetation and fuel.

(PowerPoint Slide #35)

Also, because hot air rises, fires tend to create their own winds, or ***updrafts***. These updrafts may carry sparks into upper winds, which then scatter them into unburned areas and can cause the fires to grow.

(PowerPoint Slide #36)

C. Topography—The topography of the land has an important influence on the rate at which a fire spreads. The steeper the terrain, the more rapidly the fuel comes into contact with the flames. Steep slopes also increase the updraft, further speeding the fire's spread.

(PowerPoint Slide #37)

Generally, fires move up slopes, but some have also spread downward. Streams, highways, fields, and other areas serve as natural barriers to fires.

**** Ask the students what is the most logical seasons for fires in Afghanistan? Remind them that it might not be that same all over the country. When does it get the hottest and the driest in the areas?**

Review/Summary: Use the student learning objectives list on PowerPoint #38 to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle.

Evaluation: Use the following sample test to evaluate the students' comprehension of the material covered in this lesson.

Answers to Sample Test:

Part One: Matching

1. d
2. e
3. b
4. f
5. a
6. c

Part Two: Completion

1. up
2. ignition temperature
3. Lightning

Part Three: Short Answer

1. Heat; Oxygen; Fuel
2. See Objective 1 in lesson for scoring this question.
3. Fire seasons, air movement, and topography

Sample Test Name_____

Test

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Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

a. Crown fires	c. Ground fires	e. Updrafts
b. Fire season	d. Prescribed fire	f. Wildfire

_____ 1. A managed, intentional fire set by humans for a specific purpose.

_____ 2. Winds created by a forest fire.

_____ 3. The time when the buildup of fuels and the occurrence of extended dry periods are greatest.

_____ 4. A fire that endangers people or property, which is not within an area designated to be managed by the use of fire, or that, in conjunction with weather or other conditions, may threaten to expand, thus endangering people, property, or nonfire-management areas.

_____ 5. These fires burn from top to top of trees or shrubs, sometimes independently of a surface fire.

_____ 6. These fires burn the organic materials beneath the surface litter of the forest floor.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. Generally, fires move _____ slopes.

2. For a combustible material to burn, it must reach its _____ _____.

3. _____ is the main natural cause of forest fires.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

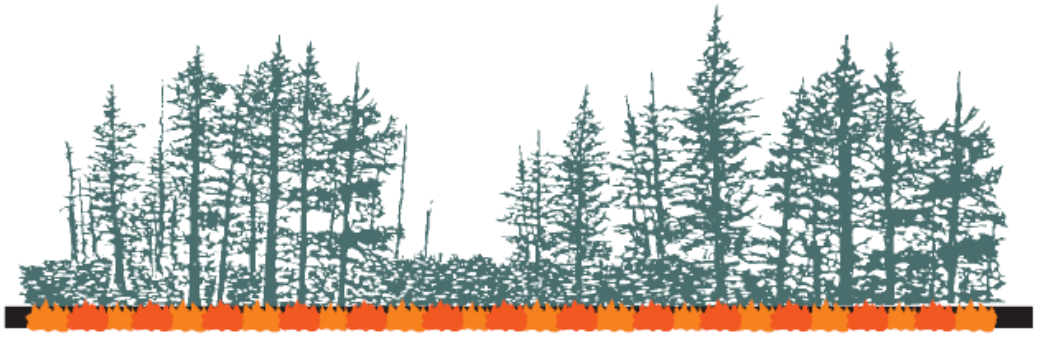
1. List the three factors that make up the fire triangle.

2. List at least three benefits of prescribed fires.

3. List three factors that affect fire behavior.

TM: C4–1

SURFACE FIRES

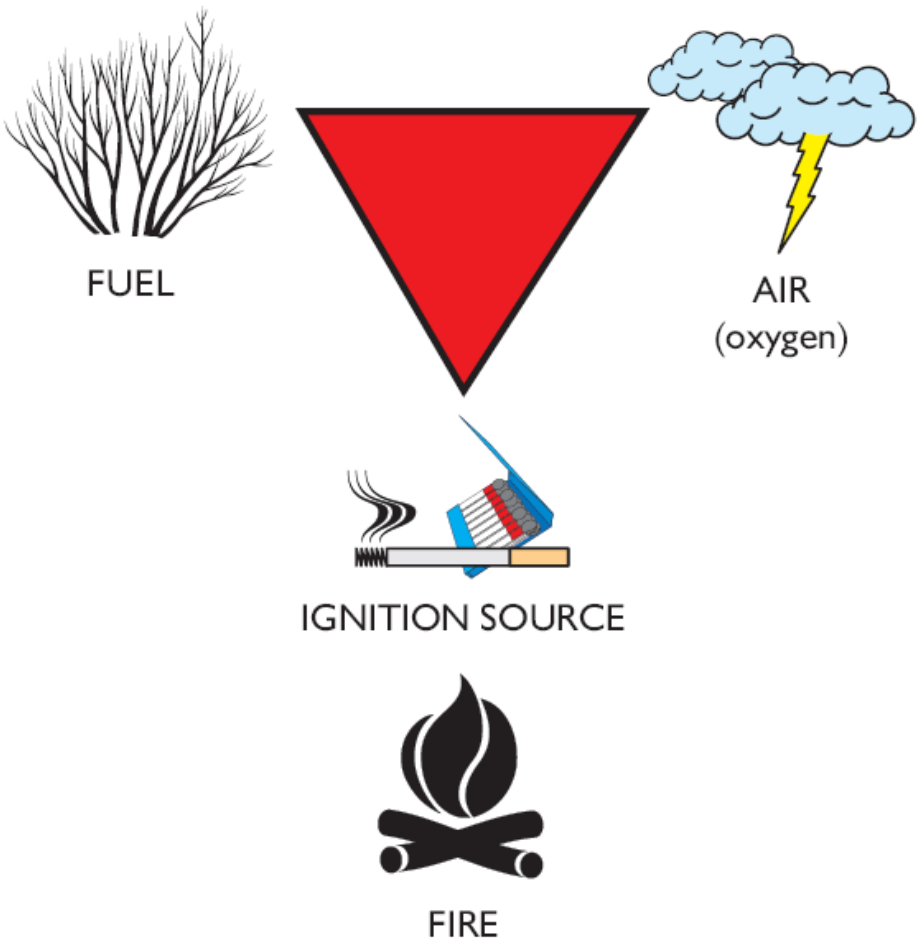


GROUND FIRES

CROWN FIRES

TM: C4–2

WHY A FIRE BURNS



REMOVE ANY ELEMENT ABOVE TO STOP FIRE

By cutting a firebreak — separating fuel
By swatting or spraying
By cooling with soil or water