

## Lesson B3–4

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# Understanding the Role of Fire in Forest Management

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**Unit B.** Plant Wildlife Management

**Problem Area 3.** Forest Management

**Lesson 4.** Understanding the Role of Fire in Forest Management

### **New Mexico Content Standard:**

**Pathway Strand:** Natural Resources and Environmental Systems

**Standard:** V: Practice responsible conduct to protect natural resources.

**Benchmark:** V-A: Employ techniques and equipment needed to prevent wildfire.

**Performance Standard:** 1. Demonstrate personal fire prevention precautions while working in natural environments. 2. Participate in wildfire prevention service project.

**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.

**List of Resources.** The following resources may be useful in teaching this lesson:

**Recommended Resources.** One of the following resources should be selected to accompany the lesson:

Rolfe, Gary L., John M. Edgington, I. Irving Holland, and Gayle C. Fortenberry. *Forests and Forestry* 6<sup>th</sup> Edition. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003. (Chapter 12)

**Other Resources.** The following resources will be useful to students and teachers:

Camp, William G. and Thomas B. Daugherty. *Managing Our Natural Resources* 4<sup>th</sup> Edition. Albany, New York: Delmar, 2002. (Chapter 21)

## List of Equipment, Tools, Supplies, and Facilities

Writing surface  
Overhead projector  
Transparencies from attached masters

**Terms.** The following terms are presented in this lesson (shown in bold italics):

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.

**Anticipated Problem:** Are there any benefits of prescribed fire?

- 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.
  - A. A properly controlled prescribed fire produces several benefits for the forest, wildlife, and people. Some of the benefits are:
    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.
    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.
    4. Assist in controlling forest diseases.
    5. Improves the quality of grass for grazing by removing brush and dried weeds.
  - 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.
    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.
    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.
    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.

*There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the purpose of prescribed fire. Chapter 21 in *Managing Our Natural Resources* is recommended.*

**Objective 2:** Describe the different types of forest fires.

**Anticipated Problem:** Are there different types of forest fires?

- II. The USDA Forest Service categorizes forest fires into three general types: surface, ground, and crown fires. More than one of these types of fires may occur within the same forest fire.
  - 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.
  - 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.
  - 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**. 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.

*There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the different types of forest fires. Chapter 12 in *Forests and Forestry* is recommended. Use TM: B3–4A to aid in discussion on this topic.*

**Objective 3:** Identify sources of forest fires.

**Anticipated Problem:** What are the most common sources of forest fires?

- 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:
  - 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.
  - 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.
  - 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.
  - 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.
  - 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. Electrical storms

without rain produce up to 9 percent of the fires on protected forest lands in the United States.

*There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the most common sources of forest fires. Chapter 21 in Managing Our Natural Resources is recommended.*

**Objective 4:** Explain the fire triangle.

**Anticipated Problem:** What is the fire triangle?

- 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**. 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.
- A. Fuel—Fuel is something that can burn. Trees, dead leaves, grasses, forest litter, and many other things in the forest are combustible.
  - B. Oxygen—Oxygen gas makes up about 20 percent of the surface atmosphere.
  - C. Heat—For a combustible material to burn, it must reach its **ignition temperature**. Most forest fuels have ignition temperatures of 600° to 880°F (316° to 471°C). The ignition temperature of an item is the same whether the material is wet or dry. 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.

*There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the purpose of prescribed fire. Chapter 21 in Managing Our Natural Resources is recommended. Use TM: B3–4B to aid in discussion on this topic.*

**Objective 5:** Explain various factors that affect fire behavior.

**Anticipated Problem:** What are some factors that affect the behavior of forest fires?

- 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 5 miles per hour. 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:
- A. Fire Seasons—Fire seasons vary by areas of the United States. In the North and the West, the summer months are generally the period of most fires, while in the South, the fall or the spring may be the “hottest” wildfire period. The **fire season** refers to the time when the buildup of fuels and the occurrence of extended dry periods are greatest.

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

*There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the different types of forest fires. Chapter 12 in Forests and Forestry is recommended.*

**Review/Summary.** Use the student learning objectives 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. Questions at end of chapters in the textbook may also be used in the review/summary.

## **Evaluation.**

### **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

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# Test

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## Lesson B3–4: Understanding the Role of Fire in Forest Management

### 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.

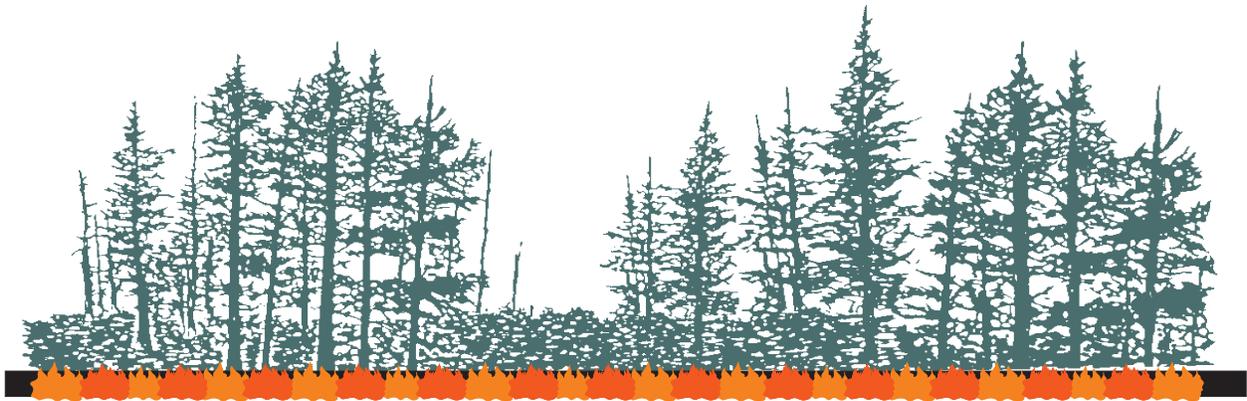
2. List at least three benefits of prescribed fires.

3. List three factors that affect fire behavior.

# TYPES OF FOREST FIRES



**SURFACE FIRES**



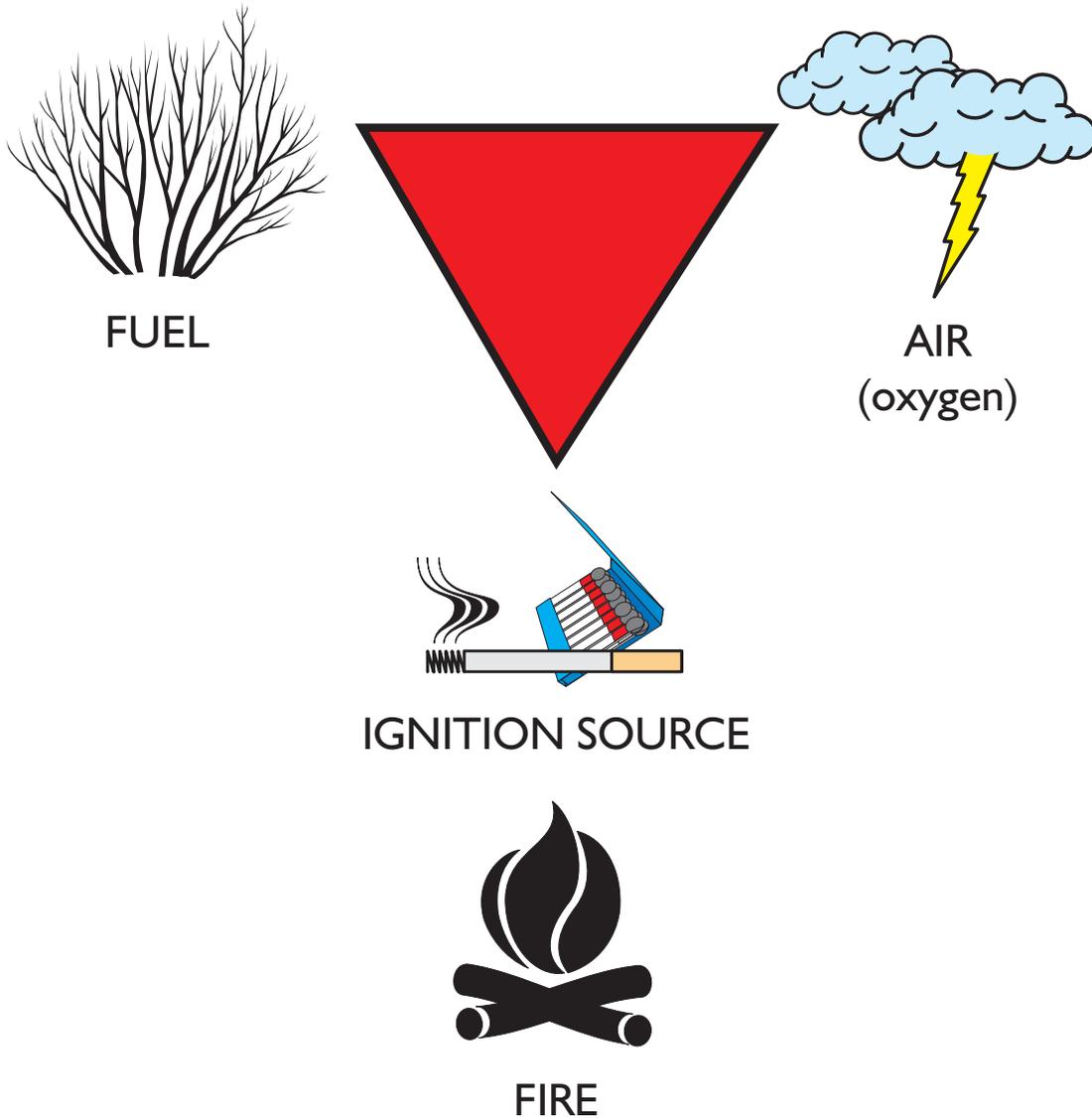
**GROUND FIRES**



**CROWN FIRES**

*(Courtesy, Interstate Publishers, Inc.)*

# 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

*(Courtesy, Interstate Publishers, Inc.)*