

Unit E: Forest Management

Lesson 1 – Identifying the Role of Government in Forest Management

Use the slides below to answer the following questions:

Explain the history of the National Forest Service

What is the role of the National Forest Service?



Lesson

Identifying the Role of
Government in Forest
Management



Student Learning Objectives.

- 1. Explain the history of the National Forest Service.
- 2. Explain the role of the National Forest Service.



What is the history of the National Forest Service?

- I. There are 191 million acres within the nation forests of the United States which are under the control of the United States Department of Agriculture Forest Service.

What is the history of the National Forest Service?

- This all began in 1799, when Congress appropriated \$200,000 to buy reserves of live oak along the coasts of South Carolina and Georgia in what was the first acquisition of timberland by the federal government.

What is the history of the National Forest Service?

- In 1881, the Division of Forestry was created within the Department of Agriculture.

What is the history of the National Forest Service?

- In 1901, the name was changed to the Bureau of Forestry, and in 1905, it became the Forest Service.
- The first chief of the Forest Service was Gifford Pinchot.
- Congress established the Forest Service to provide quality water and timber for the Nation's benefit.

What is the history of the National Forest Service?

- Since its creation, the role of the Forest Service has expanded to the management of national forests for additional multiple uses and benefits.

What is the history of the National Forest Service?

- Multiple use means managing resources under the best combination of uses to benefit people while ensuring the productivity of the land and protecting the quality of the environment.

What is the role of the National Forest Service?

- II. The Forest Service manages public lands, known collectively as the National Forest System, located in 44 States, Puerto Rico, and the Virgin Islands.

What is the role of the National Forest Service?

- The lands comprise 8.5 percent of the total land area in the United States.
- The natural resources on these lands are some of the Nation's greatest assets and have major economic, environmental, and social significance for all Americans.

The Job of the Forest Service

- Is to manage the forest in a way that allows people to share and enjoy the forest, while conserving the environment for generations to come.

The Forest Service accomplishes this task through five main activities:

1. Protection and management of natural resources on National Forest System lands.
2. Research on all aspects of forestry, rangeland management, and forest resource utilization.

The Forest Service accomplishes this task through five main activities:

- 3. Community assistance and cooperation with State and local governments, forest industries, and private landowners to help protect and manage non-Federal forest and associated range and watershed lands to improve conditions in rural areas.

The Forest Service accomplishes this task through five main activities:

- 4. Achieving and supporting an effective workforce that reflects the full range of diversity of the American people.
- 5. International assistance in formulating policy and coordinating U.S. support for the protection and sound management of the world's forest resources.

B. The Forest Service is organized into four basic levels.

- Each level has a specific role to play in accomplishing the management tasks of the nation's forest resources.

Ranger District

- The district ranger and his or her staff may be your first point of contact with the Forest Service.
- There are more than 600 ranger districts.

Ranger District

- Each district has a staff of 10 to 100 people.
- The districts vary in size from 50,000 acres (20,000 hectares) to more than 1 million acres (400,000 hectares).

Ranger District

- Many on-the ground activities occur on the ranger districts, including trail construction and maintenance, operation of campgrounds, and management of vegetation and wildlife habitat.

2. National Forest

- There are 155 national forests and 20 grasslands.
- Each forest is composed of several ranger districts.

2. National Forest

- The person in charge of a national forest is called the forest supervisor.
- The district rangers from the districts within a National Forest work for the forest supervisor.

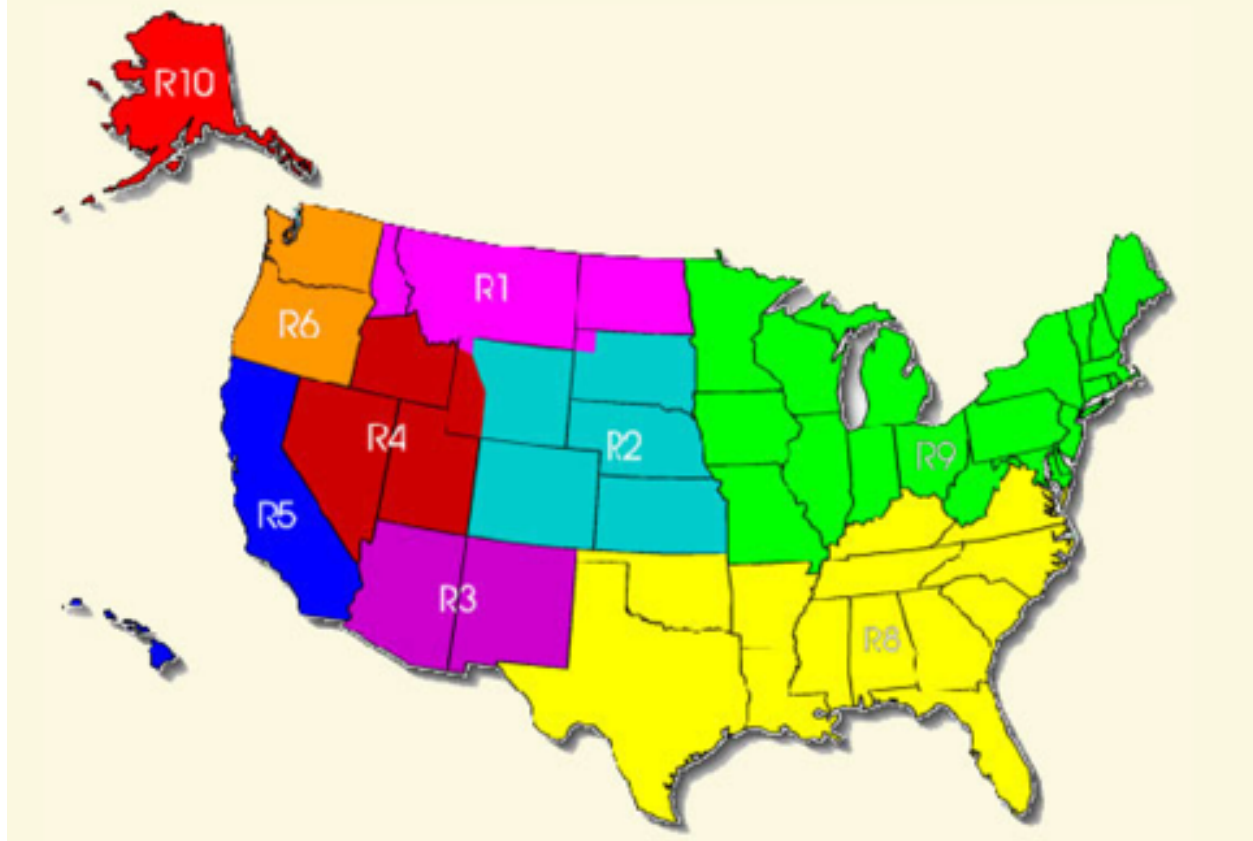
2. National Forest

- The headquarters of a national forest is called the supervisor's office.
- This level coordinates activities between districts, allocates the budget, and provides technical support to each district.

3. Region

- There are 9 regions, numbered 1 through 10 (Region 7 was eliminated some years ago).
- The regions are broad geographic areas, usually including several States.
- The person in charge is called the regional forester.

Regional Areas of the Forest Service



3. Region

- Forest supervisors of the national forests within a region report to the regional forester.
- The regional office staff coordinates activities between national forests, monitors activities on national forests to ensure quality operations, provides guidance for forest plans, and allocates budgets to the forests.

4. National Level

- This is commonly called the Washington Office.
- The person who oversees the entire Forest Service is called the Chief.
- The Chief is a Federal employee who reports to the Under Secretary for Natural Resources and Environment in the U.S. Department of Agriculture (USDA).

4. National Level

- The Chief's staff provides broad policy and direction for the agency, works with the President's Administration to develop a budget to submit to Congress, provides information to Congress on accomplishments, and monitors activities of the agency.

For more information

- The U.S. Forest Service website (<http://www.fs.fed.us>) is recommended.



Unit E: Forest Management

Lesson 2 – Measuring Trees

Use the slides below to answer the following questions:

Describe the common units of measure used in forestry.

Explain how to determine the diameter of a standing tree.

Explain how to measure the height of standing trees.



Lesson

Measuring Trees

Student Learning Objectives.

- 1. Describe the common units of measure used in forestry.
- 2. Explain how to determine the diameter of a standing tree.
- 3. Explain how to measure the height of standing trees.

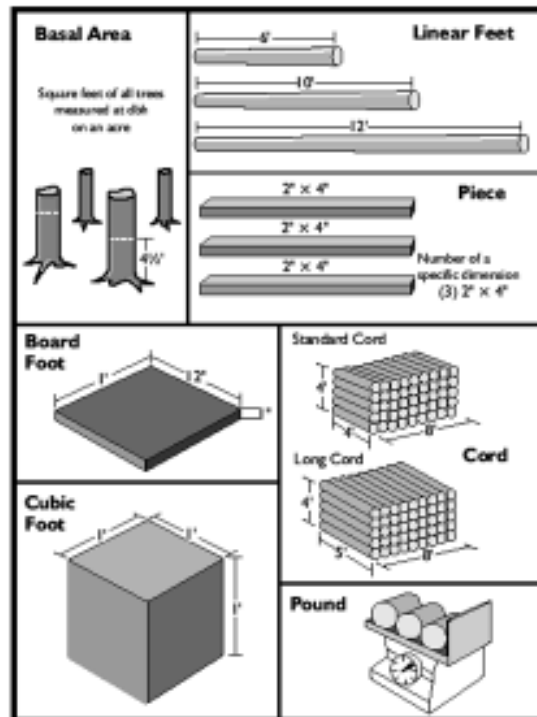
Common Units of Measure Used in Forestry?

- Tree measurements are necessary to determine the volume of wood in each tree.
- The total of individual tree measurements and volumes provides an inventory of the whole timber stand.

Common Units of Measure Used in Forestry?

- Timber trees are measured with a variety of units of measure.
- Some of these units are unique to the wood industry and others are also used for generally measuring.

COMMON FORESTRY MEASUREMENT UNITS



(Courtesy, Interstate Publishers, Inc.)

Board foot

- A unit of measurement represented by a piece of rough wood 1 foot square and 1 inch thick.
- The board foot is generally used to measure sawtimber and veneer timber.
- In surfaced or finished lumber, width and thickness are based on measurements before surfacing or other finishing.

Cubic foot

- A unit of measurement equal to the volume of a cube of rough wood 1 foot in length on each of its six sides.
- A cubic foot contains 12 board feet.
- The unit is used to measure all kinds of timber products.

Cord

- A stack of wood, including air space between pieces, that measures 4 feet x 4 feet x 8 feet, or 128 cubic feet.
- The cord is used to measure pulpwood and fence posts.




Cubit

- A stack of wood containing 100 cubic feet of solid wood.



Piece

- A unit of measurement that refers to the number or quantity of timber products of a specified dimension.
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Linear foot

- A unit of measurement used to express the length of a product in feet.

Basal area

- A unit of measurement applied to standing timber to indicate the level of stocking.
- It is the cross-sectional area of trees at breast height, or 4 1/2 feet above the average ground line.
- Basal area is expressed in square feet. It may apply to individual trees, or it may apply to all trees when it is expressed on an acre basis.

How do I determine the diameter of a standing tree?

- II. In the United States, the diameter of standing trees is most commonly measured at breast height. This is known as dbh. Diameter measurements are taken outside the bark, with deductions made for bark thickness.

How do I determine the diameter of a standing tree?

- Tree diameters are usually recorded in even 2-inch classes to facilitate volume determination.
- Typically diameter classes are 6-, 8-, 10-, 12-, and 14-inch diameters.
- A tree is placed according to diameter in the nearest 2-inch class.

DIAMETER CLASSES

10-inch trees	9.1 to 11.0 inches
12-inch trees	11.1 to 13.0 inches
14-inch trees	13.1 to 15.0 inches
16-inch trees	15.1 to 17.0 inches
18-inch trees	17.1 to 19.0 inches
20-inch trees	19.1 to 21.0 inches

How do I determine the diameter of a standing tree?

- A. A diameter tape is the most accurate tool for measuring a tree.
- It is calibrated so that each inch on the diameter side of the tape is actually 3.1416 inches in length.
- Because the tape is calibrated in this way, taking a measurement of the tree's circumference produces the tree's diameter.

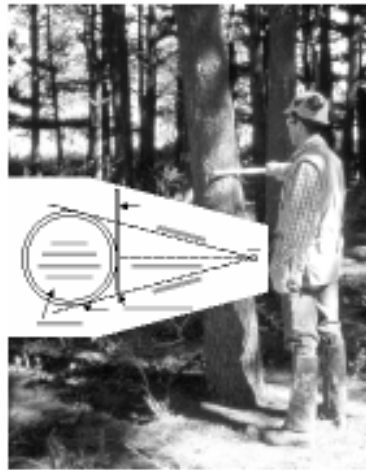
How do I determine the diameter of a standing tree?

- B. A technique similar to the one described for using a diameter tape can be used for roughly measuring tree diameter with a Biltmore stick.
- This procedure is based on the geometric principle of similar triangles, with the scale on the stick graduated to read directly in inches.

STEPS IN USING A BILTMORE STICK

1. **Hold the stick horizontally, at arm's length (25 inches from the eye) and 4 ½ feet above the ground.**
2. **Place the Biltmore Stick against the tree, with the left end of the stick along one edge of the tree. Keep one eye closed.**
3. **Without moving your head, read the diameter where the right side of the tree intersects the stick.**

DIAMETER MEASUREMENT USING A BILTMORE STICK



How do I measure the height of standing trees?

- IV. Tree height may be measured in terms of feet or number of logs or bolts.
- A tree is measured to either its total height or its merchantable height.

How do I measure the height of standing trees?

- This cut-off point is located where the stem diameter reaches a minimum size for the product for which the tree is to be harvested or where excess limbs or forks prevent closer utilization.
- Merchantable height for a sawtimber tree is determined by the number of 16-foot logs and half logs that can be cut from a tree.

How do I measure the height of standing trees?

- The cut-off point for sawtimber trees varies from 6 to 10 inches.
- Merchantable height for a pulpwood tree is usually tallied to the nearest pulpwood bolt of a given length.
- This will be 4 feet, 5 feet, or 5 feet 3 inches, depending on pulp mill specifications. The cut-off point for pulpwood is generally 4 inches.

How do I measure the height of standing trees?

- A. One instrument that is used to measure tree height is a hypsometer.
- Hypsometers (graduated in log length) are normally found on the edge tree scale sticks.
- Most tree scale sticks also have volume tables printed on one of the wide sides.



Unit E: Forest Management

Lesson 3 – Measuring Timber Stands

Use the slides below to answer the following questions:

Explain how to calculate board feet.

Explain how to measure basal area in standing trees.


Explain how to determine tree volume.



Lesson

Measuring Timber Stands

Student Learning Objectives.

- 1. Explain how to calculate board feet.
 - 2. Explain how to measure basal area in standing trees.
 - 3. Explain how to determine tree volume.
- 

How do I calculate board feet?

- A board foot is a unit of measurement represented by a piece of rough wood 1 foot square and 1 inch thick.
- In surfaced or finished lumber, width and thickness are based on measurements before surfacing or other finishing.

How do I calculate board feet?

- Board feet of a piece of lumber can be calculated by multiplying the length of the piece ° — the width of the piece ° — the thickness divided by 12.
- In this formula the length is measured in feet, while the width and thickness are measured in inches.

How do I calculate board feet?

- To determine the board feet in several pieces of lumber that are equal in size, determine the board feet in one piece then multiply that number by the number of similar size pieces.

CALCULATING BOARD FEET

Definition:	One board foot (bf) is a board that is 1 foot square and 1 inch thick. (The dimensions are 1' × 12" × 1".)
Formula:	bf = length × width × thickness divided by 12. (Length is measured in feet; width and thickness are measured in inches.)
Example 1:	The number of bf in a board that is 12 feet long, 6 inches wide, and 1 inch thick is determined as follows: $\frac{12 \times 6 \times 1}{12} = \frac{72}{12} = 6 \text{ bf}$
Example 2:	The number of bf in a board that is 14 feet long, 4 inches wide, and 2 inches thick is determined as follows: $\frac{14 \times 4 \times 2}{12} = \frac{112}{12} = 9.33 \text{ bf}$
Note:	To determine the bf in a stack of boards when all the boards are of equal size, determine the bf in one board and multiply that by the number of boards.

How do I measure basal area in standing trees?

- The basal area (cross-sectional area of a tree at breast height expressed in square feet) is commonly measured to determine the level of stocking of a stand of trees, the amount of timber to remove in thinning an overstocked stand, and timber volume calculations.

BASAL AREA OF TREES BY DBH CLASSES

dbh	Basal Area	dbh	Basal Area
<i>Inches</i>	<i>Square feet</i>	<i>Inches</i>	<i>Square feet</i>
2	0.022	14	1.069
4	0.087	16	1.396
6	0.196	18	1.767
8	0.349	20	2.181
10	0.545	22	2.640
12	0.785	24	3.142

Basal area may be determined in a number of ways.

- A. Basal area may be determined by physically measuring each tree with a Biltmore stick, a diameter tape, or calipers.
- A table is then used to determine the basal area from the recorded measurements.

Basal area may be determined in a number of ways.

- B. One of the easiest methods for estimated basal area is by using angle gauges in optical tree-measuring devices.
- One type of angle gauge is a wedge prism.

Basal area may be determined in a number of ways.

- A wedge prism can be used to determine which trees should be counted and tallied in a timber sample and which should not.
- Prisms are ground to specified basal area factor size. The factors generally vary from 2 1/2 to 50, but the most common size is 10.

Basal area may be determined in a number of ways.

- Multiplying the basal area factor of the prism used at a given point in a timber times the number of trees counted with the prism will directly give the square feet of basal area per acre of the trees around that point.

Basal area may be determined in a number of ways.

- When a series of points is taken in a timber stand, average the figures for basal area per acre from all sampling points to obtain the average basal area per acre for the entire stand.

STEPS IN USING A WEDGE PRISM

1. Hold the prism at eye level directly over the point to be used to sample the timber stand.
2. Look through the prism, and count the number of trees that should be tallied. The face of the largest edge of the prism should be at right angles to the line of sight, and the top edge of the prism should be horizontal to the level ground.
3. Multiply the tree count at this point by the basal area factor of the prism to get the basal area per acre in square feet around this sampling point.

THE WEDGE PRISM



Don't tally



Tally



Borderline
tally every other one

(Courtesy, Interstate Publishers, Inc.)

How do I determine tree volume?

- Tree volume tables are available to facilitate estimating the number of board feet, cubic feet, or cords in standing trees.
- The volume tables are designed to indicate a specific volume for a tree of a certain diameter at breast height (dbh) and height.

How do I determine tree volume?

- Tree volume tables that give the merchantable content of the standing timber are generally derived from log rules, or tables that measure the volume of individual logs.
- Volumes indicated on log rules are derived by formulas or graphic means.

How do I determine tree volume?

- There are over 50 different log rules used in the United States, and the values assigned to trees or logs vary considerably.

The six common log rules are the

- Doyle,
- Scribner,
- International,
- Maine,
- Spaulding, and
- Herring.

Doyle

- The Doyle rule indicates less volume for small-diameter logs than does the other commonly used rules.
 - The lumber overrun, or the production of more lumber than the log rule allows, tends to be high for logs less than 28 inches, but it is excessive for logs less than 16 inches.




Doyle

- In this rule, an arbitrary deduction is made for lumber processing losses from the volume of a cylinder.
- The Doyle rule is most frequently used for the purchase of sawtimber and sawlogs.



Scribner

- The Scribner rule is preferred by forestry agencies in the United States.
 - It is derived by graphic means and estimates the amount of 1-inch lumber that can be sawn from logs of specific dimensions.
- 

Scribner

- This rule, like the Doyle rule, is most frequently used for the purchase of sawtimber and sawlogs.
- Many forest agencies, including the USDA Forest Service, have adopted this rule for timber sale purposes.
- The Scribner rule gives a lumber overrun for large logs.

International log rule

- The international log rule like the Doyle, is derived by a formula and is the only rule that adds volume for taper.
- Taper is a term that describes the gradual diminution of diameter in a tree trunk.

International log rule

- It provides one of the highest estimates of volume of any of the log rules and closely approaches the actual quantity of lumber that can be cut from a tree or log without the normal provision for a slight lumber overrun.

International log rule

- This rule is no longer used for making timber sales, but it continues to be useful for forest survey and research purposes.

Unit E: Forest Management

Lesson 4 – Understanding the Role of Fire in Forest Management

Use the slides below to answer the following questions:

Explain the purpose of prescribed fire.

Describe the different types of forest fires.

Identify sources of forest fires.

Explain the fire triangle.

Explain various factors that affect fire behavior.



Lesson

Understanding the Role of
Fire in Forest Management

Student Learning 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.

The Purpose of Prescribed Fire

- 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.

The Purpose of Prescribed Fire

- 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.

Benefits of a Prescribed Fire

- 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.

Benefits of a Prescribed Fire

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

The Purpose of Prescribed Fire

- 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.

Safe Use of Prescribed Fires

- 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.

Safe Use of Prescribed Fires

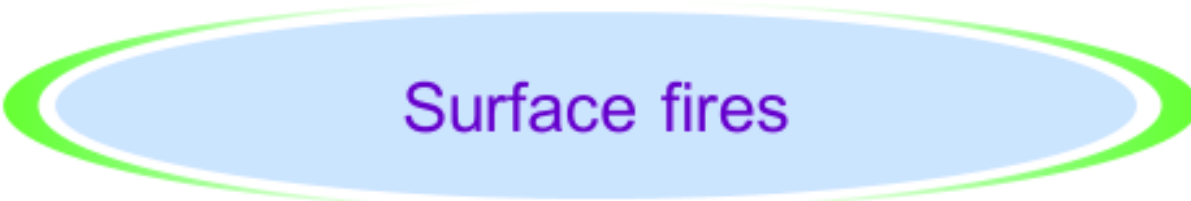
- 2. Fire intensity - The fire must not be allowed to get too hot.
- High heat intensity can cause the leaves of trees to wilt, damaging the trees.
- The heat can also cause the cambium layer under the bark to literally cook.

Safe Use of Prescribed Fires

- 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.

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.



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.



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.

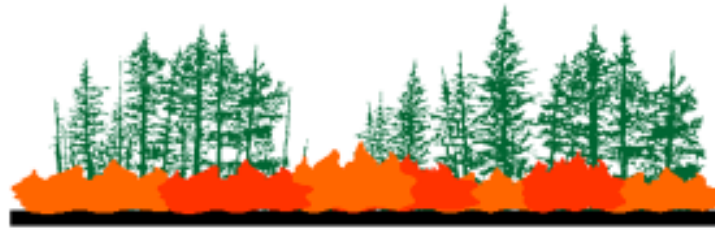
Crown fires

- 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

- 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.

TYPES OF FOREST FIRES



SURFACE FIRES



GROUND FIRES



CROWN FIRES

(Courtesy, Interstate Publishers, Inc.)

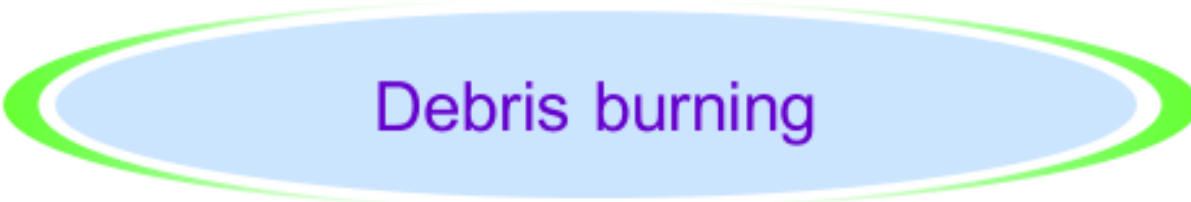
Sources of Forest Fires

- 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:



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.



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.




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.



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.
- 

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.

What is a Fire Triangle?

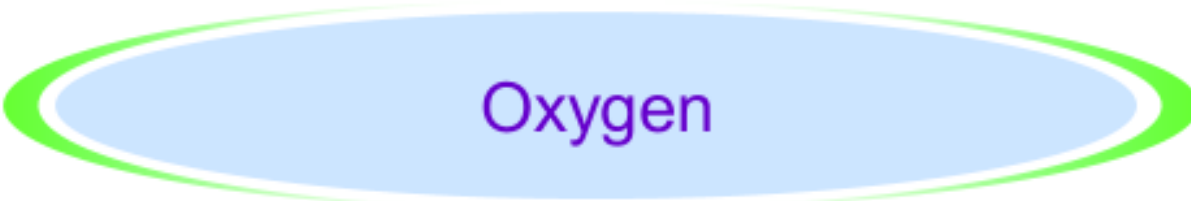
- IV. Fire is both a physical and chemical process.
- It is the result of quick combustion of oxygen with another substance.
- For a forest fire to occur, three things are required: fuel, oxygen, and heat.
- The relationship between these three can be illustrated as the fire triangle.

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.

Fuel

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



Oxygen

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



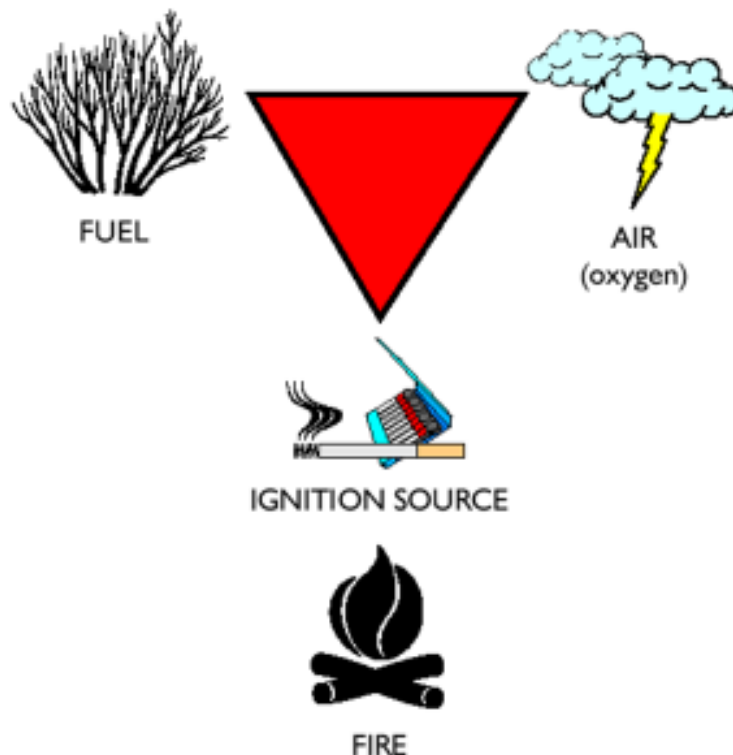
Heat

- 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.

Heat

- 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.

WHY A FIRE BURNS



REMOVE ANY ELEMENT ABOVE TO STOP FIRE

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.

Factors that Affect the Behavior of Forest Fires

- 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:




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.



Fire Seasons

- 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.
- 

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.

Air Movements

- 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.



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.



Topography

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