

Virginia Reader

Agriculture
in the
Classroom

Fire and Water

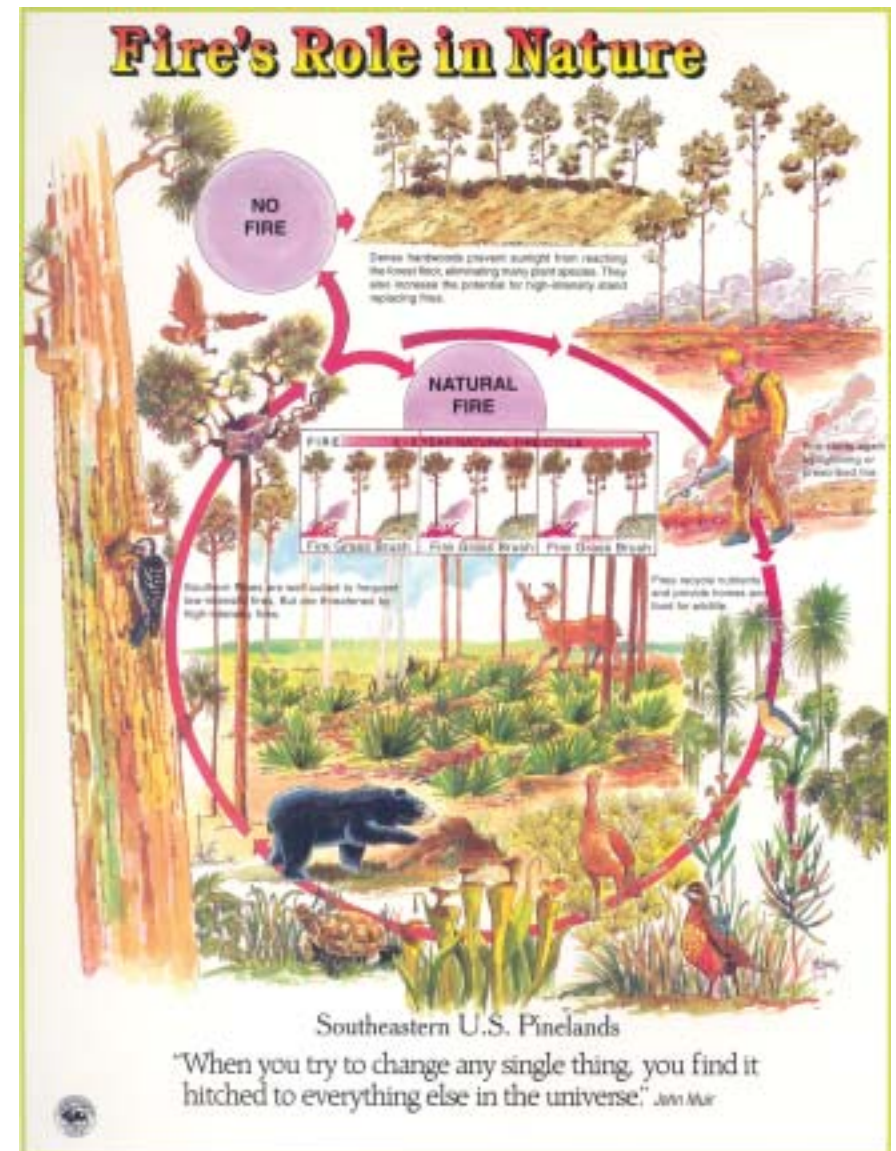
Fire ecology is the study of wildland fires and their relationships on living and nonliving things in the environment. Fire ecology includes the study of fire dependence, fire regime and fire history.

Some plants need fire to make the environment more suitable for their growth and reproduction. These types of plants are called **fire dependent** species. They benefit from wildland fires.

Fire regime is how often fires occur in an area; how intensely the fires usually burn; and the amount of fuel burned by the fires.

Fire history studies how often fire occurs in an area. Today, fire is viewed as a part of the natural environment and is recognized as something necessary for many ecosystems.

*How do we know the fire history of an area?
The trees tell us. The rings on the trees that tell us the age of the tree can also tell us how many fires that tree has survived.*



The Fire Triangle



Three components must be present before a fire can start: *oxygen*, *fuel* and *heat*. At least 16 percent oxygen must be present in the air for fires to burn (the air we breathe is 21 percent oxygen.) Fuel is any living or dead material that will burn, such as: dry plants, dry leaves, pine needles, pine trees, grasses and homes. Heat can come from a lightning strike or a person's careless use of fire.

If one part of the fire triangle is removed, then the fire cannot burn. For example, if water is put on the fire, it is cooled — *heat* is removed. If a forest is thinned or trees are removed around homes, *fuel* for fire is also removed. A fire may be prevented or burn less intensely. Smothering flames with dirt removes the *oxygen*.

Fire Behavior



Light Fuel

The ways fuels ignite, flames develop, and fire spreads are determined by three things:

- 1) quantity and type of fuels available,
- 2) current weather conditions, and
- 3) topography (the slope of the hills).

How flammable fuel is depends on:

- 1) moisture level,
- 2) the type of fuel, and
- 3) the amount of the fuels.

The most important of these three is moisture level, but they all determine how fast a fire spreads and how intense (hot) it is. If fuels are close together, a fire may move more quickly and become more intense.

Some things that affect wildfire are winds associated with the passage of "dry" cold fronts. They can help cause severe fire hazard conditions since they are usually very strong and shift the winds in a clockwise direction. At times, a 180-degree change can occur.



Heavy Fuel

A fire that moves up a tree from the ground burns "ladder" fuels such as shrubs, branches and limbs. A fire that stays low and on the ground is called a *surface* fire. A fire that burns beneath the surface is a *ground* fire. These may occur in bogs and other swampy areas with a thick debris layer above the soil. A fire that jumps through the top of the trees is a *crown* fire.

Weather conditions such as wind, temperature and humidity affect the fire. Wind is especially important, since it can add more oxygen. The moisture of the soil and what type of matter is on the surface determines how much the fire affects the soil. Time of year also affects a fire's behavior. In Virginia, the primary fire seasons are February through April and October through November.

History of Fire

Fire has always been a force in nature. Societies have viewed fire as “bad” or “good” depending on their cultural beliefs, values and lifestyles. American Indians often started fires on the prairies. The native peoples used fire to drive out the game (wild animals) that were hidden in the tall, dead grasses and shrubs. This made it easier to hunt the animals. Fire was also used to clear away possible “hiding places” of their enemies. Sometimes warriors from one tribe would try to “burn out” the camps of another tribe. So fires were also set to remove fuels, to prevent an enemy “burn out.”

Some people of the Southern region used fire to help grow crops. The ancient ones living throughout Virginia and North America would set fire to an area to clear it, and then begin planting their crops.

To the early European farmers of the eastern plains, fire was an enemy. A prairie fire could spread quickly and change direction with just a puff of wind. Fire was

“unpredictable.” It could destroy crops and kill livestock caught in its path. In a matter of minutes, settlers could lose all they owned: their house, their food and their way of life. The smoke of a prairie fire on the horizon would strike fear in these settlers.

In mountainous regions, fire was also viewed an enemy. Fire could destroy whole towns. Buildings made of dry timber would burn quickly, and lives and jobs were lost. So it became policy to control and put out (suppress) fires as quickly as possible.

In 1910, raging fires occurred, mostly in the mining regions of Montana and Idaho. These fires became known as “The Big Blowup.” More than three million acres were burned in the Northern Rockies and two million in other parts of the country. Seventy-eight firefighters were killed, and seventy-five percent of the year’s total burned acres were lost in one 36 hour period.

The total cost to the United States Forest Service was more than one million dollars (more than \$20 million today). This is why the people who manage the country’s forest decided that the best policy was to put a fire out as quickly as possible. Decades of suppressing fires has resulted in dangerous buildups of fuels. When fires do start, they are often very intense and can cause much damage.



Ed Pulaski

and 45 firefighters became trapped by one of the 1910 raging fires. He guided 45 men into the Nicholson adit (mine tunnel) which was cooled by water running through it. Thirty-nine fire fighters survived. Ed later invented an important tool for fighting fires that is called a Pulaski.

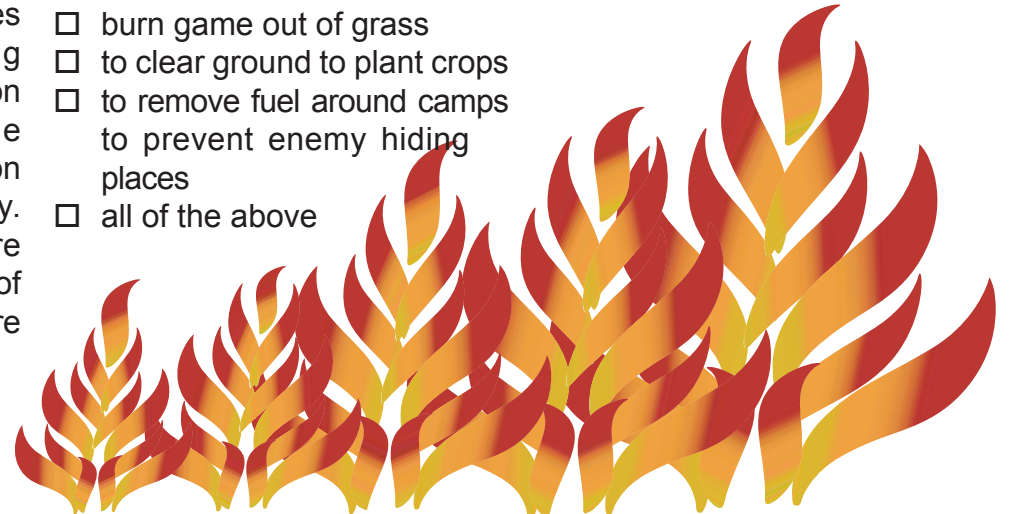
Do you know the answer?

To suppress a fire means:

- to add fuel to a fire
- to stop the fire from burning
- to set a fire on purpose
- to add oxygen to a fire

Fire has been used to

- burn game out of grass
- to clear ground to plant crops
- to remove fuel around camps to prevent enemy hiding places
- all of the above



History of Fire in the US

In the late 1800s, there was a debate among foresters about whether all fires should be suppressed or if fire should be used as a tool as in agriculture. The fires of 1910 answered the question for those who made the laws: fires were to be suppressed.

Fire was seen to be detrimental (harmful) to the health of ecosystems. In the 1930s, the policy of both the National Park Service and the United States Forest Service was known as the “10 a.m. rule.” Any wildland fire was to be extinguished by 10 a.m. the following day.

Fire lookout towers were built all over North America in the early 1900s. (Sometimes the lookout was on a high ridge, not in a tall tower.) The brave men and women who worked, and sometimes lived, in the lookouts packed in 30 days of provisions at a time. One list of supplies included: 25 pounds flour, sugar, ½ crate of eggs, ½ side of bacon, 5 pound tin of jam, canned fruit and vegetables, condensed milk, potatoes, onions and dry beans. Many times the source of water was a spring a mile or more away from the lookout. The lookouts would carry water back to their camp in a five-gallon canvas water bag each day. Any leftover water was poured into the washtub, and

at the end of a week the lookout would have enough water to take a bath and wash the laundry.

A lookout’s duties were to report fires, keep rainfall data, temperature data, wind velocity estimates and report on haze. They were given crank telephones and the tools necessary to keep the telephone lines in repair. Trees frequently fell across the lines and made it necessary to put them back up. The telephone line might stretch 15 miles or more. In their shack would be a map oriented to the points of the compass. They used the map to give exact locations of fires.

Today, very little has changed as far as data collected and firefighting equipment. Tools of data collection are more advanced and are much more accurate, and computers are now used. The one big difference in firefighting equipment is air support.

Lookout planes have replaced the lookout towers. Slurry bombers and helicopters drop water and fire retardant materials. Smokejumpers can get to fires more quickly by parachute. Pulaskis are still used by ground crews. These crews still hike in with all their supplies in their backpacks.

List some of the uses of fire.

In which states did “The Big Blowup” fires of 1910 occur? How many acres did it burn?



Hallie M. Daggett was one of the first women hired by the Forest Service as a lookout in 1913. She earned \$840 per year and stayed on the job for fifteen years. She did her own hunting, rode a horse for transportation and even trapped.

Fighting Wildland Fires

Firefighters are organized into crews. The ground tactical crews are the fire engines and hand crews. There also are helicopter attack teams (helitack) that can dump enormous buckets of water, airtankers that drop a chemical compound known as slurry and smokejumpers. Smokejumpers, hotshot crews and helitack crews are known as Type 1 firefighters. Some helitack crews rappel out of helicopters into the area that is burning. Smokejumpers parachute out of planes into remote areas with no roads. Hotshot crews hike into the area where the fire is burning. These crews act as if they were military units, each having their own responsibility but also being a part of a bigger team. They have to cooperate and support each other in order to keep each other safe.

Hardhat and Goggles



Pack contains:
water & food
first aid kit
fire shelter
flashlight
batteries

Safety Boots



Face Shroud

Radio

Gloves

**Pulaski Tool
or a Shovel**

**Fire Resistant
Shirt and Pants**

We ALL live downstream...

The effects of fire can impact areas many miles away from where the fire occurred. For example, sediment increases in streams and rivers due to soil erosion following fires. Without vegetation to slow down the flow of water, dirt and other materials move down the watershed. In Colorado, after the very hot Buffalo Creek fire in May 1996, heavy summer thunderstorms followed the fires. The burned soils did not soak up the water that fell. Instead the water rushed down the hills faster and harder, picking up more and more sediment along the way.

For two years after the Buffalo Creek Fire, there were a total of 13 floods. Millions of tons of sediment flowed down from the hills, and some of this sediment finally entered the reservoirs used by Denver residents for their water. The amount of sediment that ran into the reservoirs was the amount that would normally occur in 14 years. There was also debris from the fire that needed to be cleaned out. Things such as trees and propane tanks (from upstream residents) had to be removed. Even today, the quality of the water in the watershed is reduced due to the long lasting impacts of the fire.

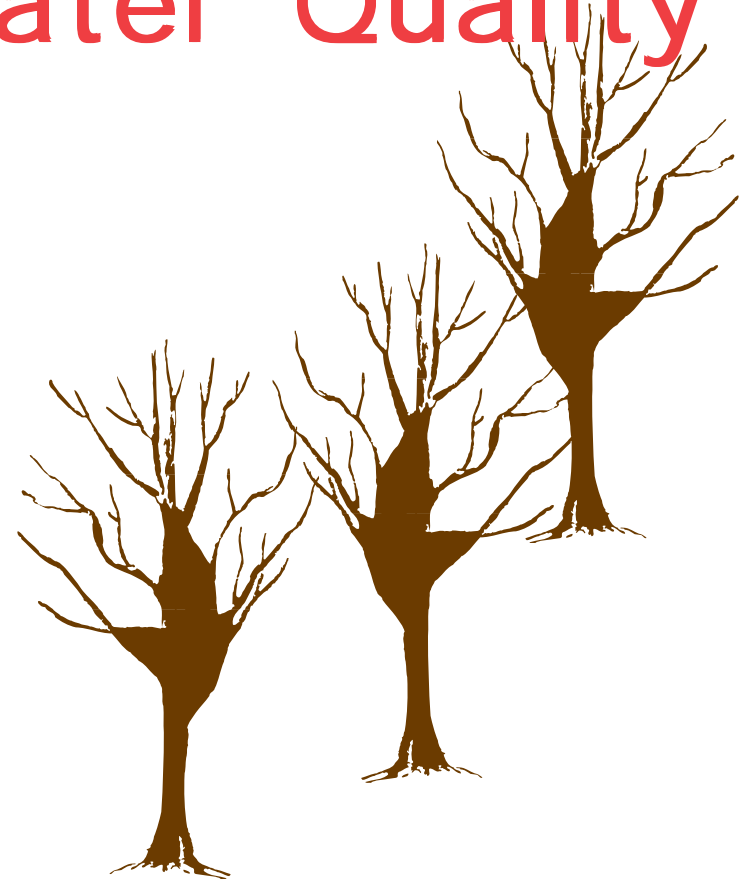
Soils, and the speed at which land “recovers” after a fire in Virginia, are very different than in the Western U.S. However, the potential for similar effects still exists.

Effects of Fire - Water Quality

Fire serves many positive purposes in plant and animal life ecosystems, but it can also damage communities as well. Perhaps the most damaging effect of fire is erosion. Intense fires, especially in small tree and shrub communities, can burn the vegetation down to the roots. Usually these plants help hold the soil in place during rain storms. When fire destroys the network of roots and grasses, landslides and flash flooding may occur. Sediment (soil, sand, rocks) cloud streams, which can affect fish life.

The effects of fire erosion can last for years following a fire. Fire affects water quality in many ways. Changes in water include 1) increase in sediment, 2) increase in stream temperatures, and 3) increase in nutrients. These are all forms of water pollution.

Stream temperatures increase after a fire because the vegetation that usually hangs above the banks, shading the water, is no longer there. The sun heats up the water. These higher temperatures cause problems to fish and other species whose habitat is normally cold water. The increased nutrients in the water can lead to algae blooms. This can also harm aquatic wildlife living in the streams.



There are two types of water pollution:

POINT SOURCE POLLUTION is the type of pollution that can be traced to a specific source. You can see it and easily identify where it comes from.

NONPOINT SOURCE POLLUTION comes from many sources. For example, each time it rains, run-off from the street picks up litter, motor oil, pet wastes, leaves, grass clippings and chemicals. These things are washed into storm drains and make their way to our rivers and streams.

Do you think the water pollution that occurs from a forest fire is a nonpoint or point source type of water pollution? Or might it be both? Explain your answer by writing a complete paragraph.

Effects of Fire - Air Quality

Air quality is one factor a resource manager needs to consider before setting a prescribed burn. If wind would blow smoke into a heavily populated area, the burn would be postponed. If a neighbor in the area is known to have respiratory problems, his/her health needs to be considered. Fire produces smoke, within smoke are both fine and coarse material (particulates), seventy percent of which is fine to very fine.

The coarse particulates are measured to determine the amount of air pollution. There is not much known about the effect of fine particles in the air. According to the air quality index and smoke index charts, if you can see four miles, the effects of the smoke are none. If you can see less than 4 miles, air pollution becomes more serious for people with respiratory diseases. One and one-quarter to two miles visibility, air quality is unhealthy and people with respiratory diseases, the elderly and children should avoid exercise. One-mile visibility is very unhealthy and those with disease, the elderly and children should not go outside. If visibility is less than one mile everyone should avoid going outside if possible and close windows.

We we look into the sky during a fire, we can see that particulates are abundant in the atmosphere during a fire. Five hundred miles away from the 1988 Yellowstone fires, the sun appeared behind a haze as if a curtain were filtering the light. This effect is caused by the particulates floating in the air. Particulates are carried by wind and air currents to areas hundreds of miles from the fire. In 1910, particulates were carried from the Idaho fires across the country to the East Coast. The sun in New Hampshire appeared copper-colored while those fires were burning.

People who live in areas where wildland fires occur need to practice "fire mitigation." Mitigation means to change the environment to reduce the intensity of fire as a way to protect lives and property. Removing trees and brush or keeping grass cut around homes are examples of mitigation.

Prescribed fires can be natural or intentionally set fires. These fires are carefully planned and watched. Weather conditions are closely monitored. These fires are used to manage an area to lower the chance of a larger, damaging wildfire. Prescribed fire may be used to reduce fuels around campgrounds and homes. It may help to increase forage for wildlife by reducing non-native grass and shrubs. The reason it is called prescribed is that it is only set or allowed to burn when environmental conditions allow for controlled burning.

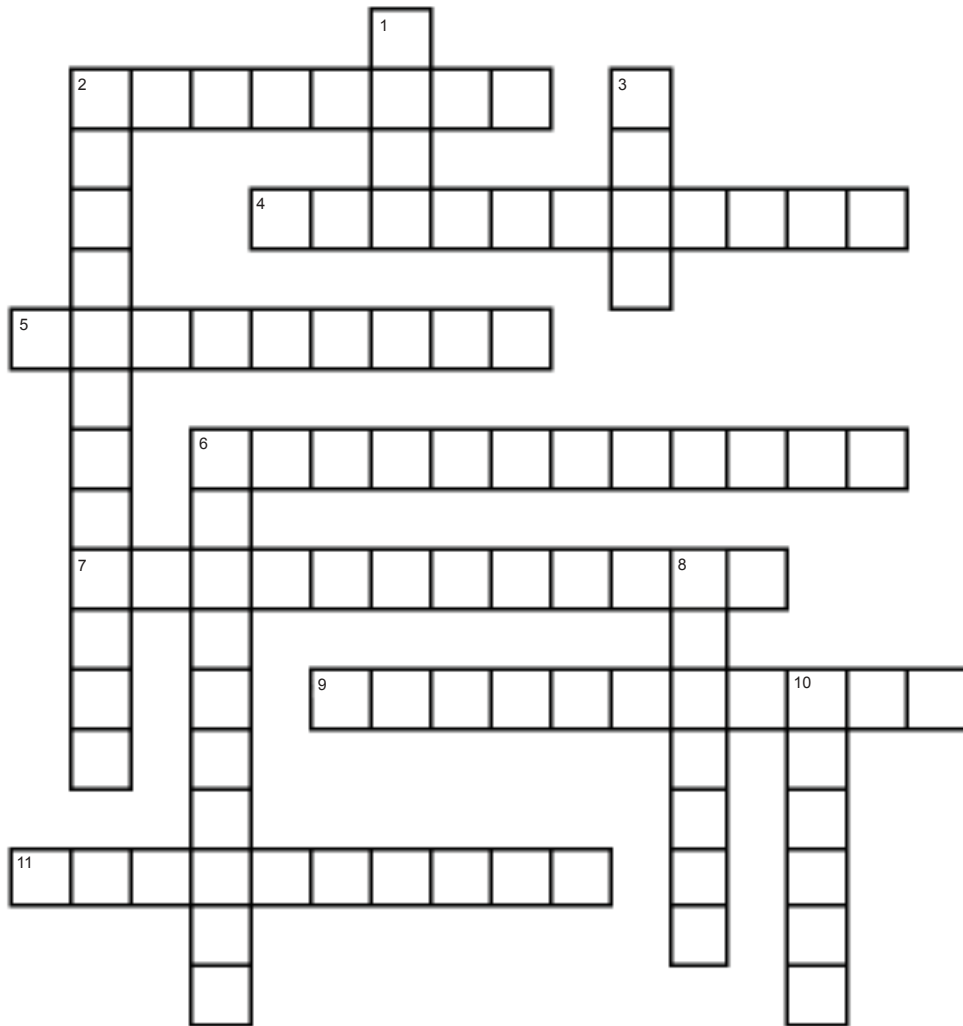


Smoke Index

To determine your own forest fire smoke index:

- 1) face away from the sun;*
- 2) determine the limit of your visible range by looking at targets at known distances in miles (visible range is that point at which even high-contrast objects totally disappear); and*
- 3) after determining the visibility in miles, use the information above to determine health effects.*

Crossword Puzzle



ACROSS

2. To put fires out
4. Harmful
5. Some plants need fire; they are called fire _____
6. People who fight fires
7. Material in the air from a fire is called this
9. The study of wildland fires and their impact on living and nonliving things (two words)
11. To reduce the threat or damage done by fire

DOWN

1. The hot part of the fire triangle
2. People who parachute from planes to fight fires
3. Wood, grasses, etc. are considered this part of the fire triangle
6. How often fires occur, how intense they burn and the amount of fuel burned by fires is know as _____ (two words)
8. When water carries away soil particles it is called _____
10. The third part of the fire triangle is an ingredient of air



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