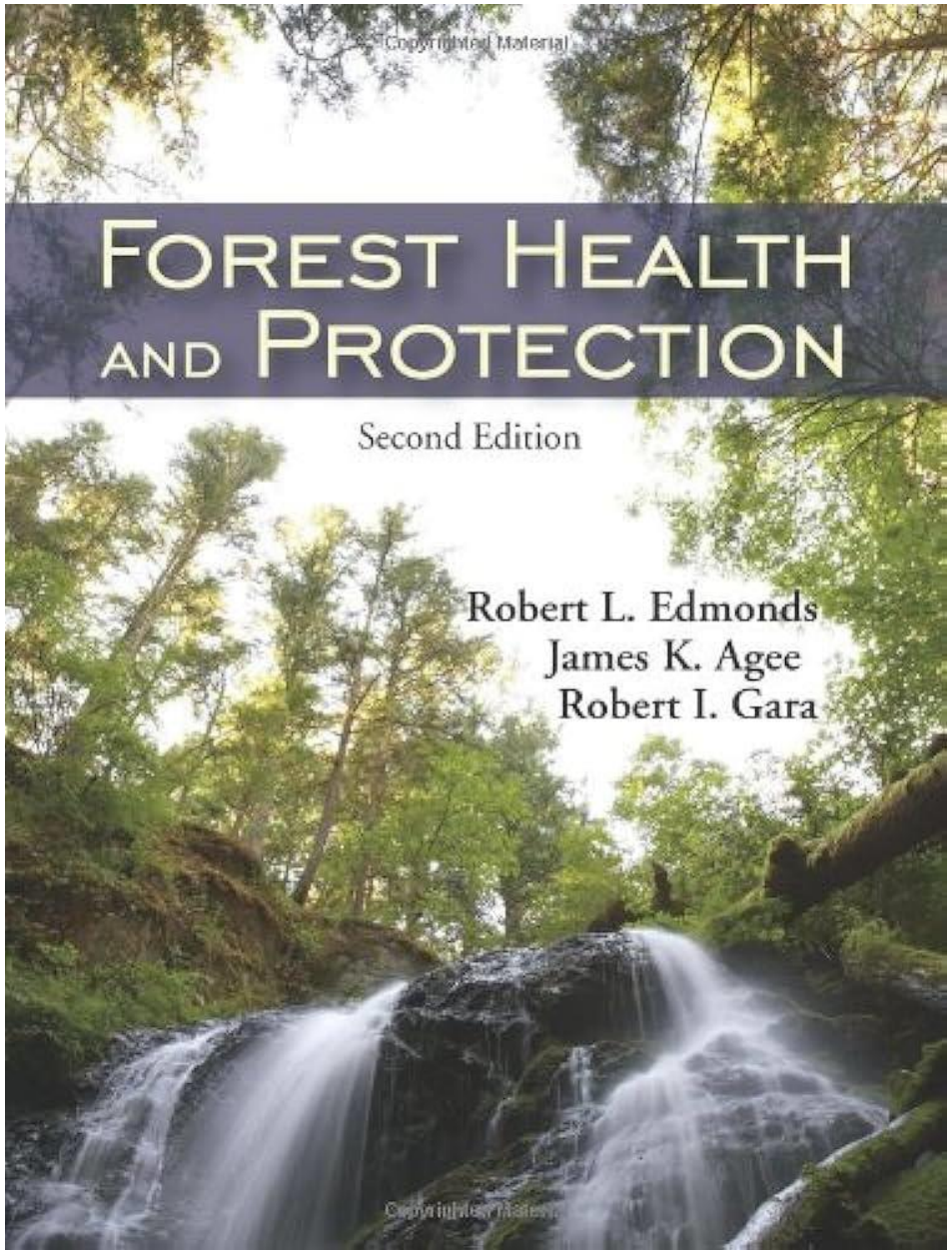


Course in Forest Protection
High Diploma Level
2023-2024

PhD. Dr. Zana Ahmed Lak. Forest Ecophysiology

Forest Fires

Forest fire

is an unplanned, uncontrolled and unpredictable fire in an area of combustible vegetation. depending on the type of vegetation.

Causes?

Natural

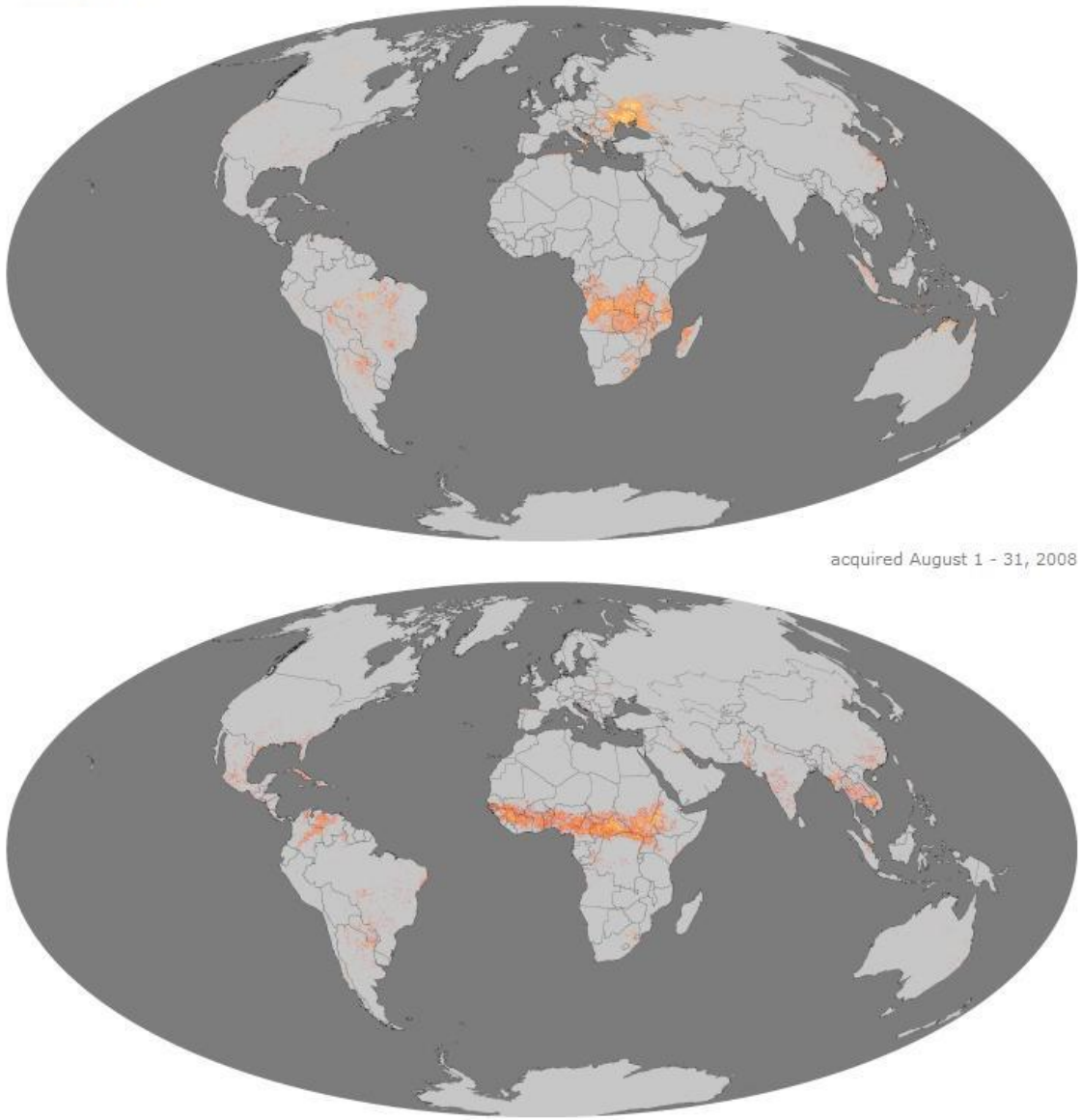
Natural occurrences that can ignite wildfires without the involvement of humans include lightning, volcanic eruptions, sparks from rock falls, and spontaneous combustions.

Human activity

Sources of human-caused fire may include :

- ✓ arson
- ✓ accidental ignition
- ✓ or the uncontrolled use of fire in land-clearing and agriculture such as the slash-and-burn farming.

Global Fires



Carbon dioxide and other emissions from fires

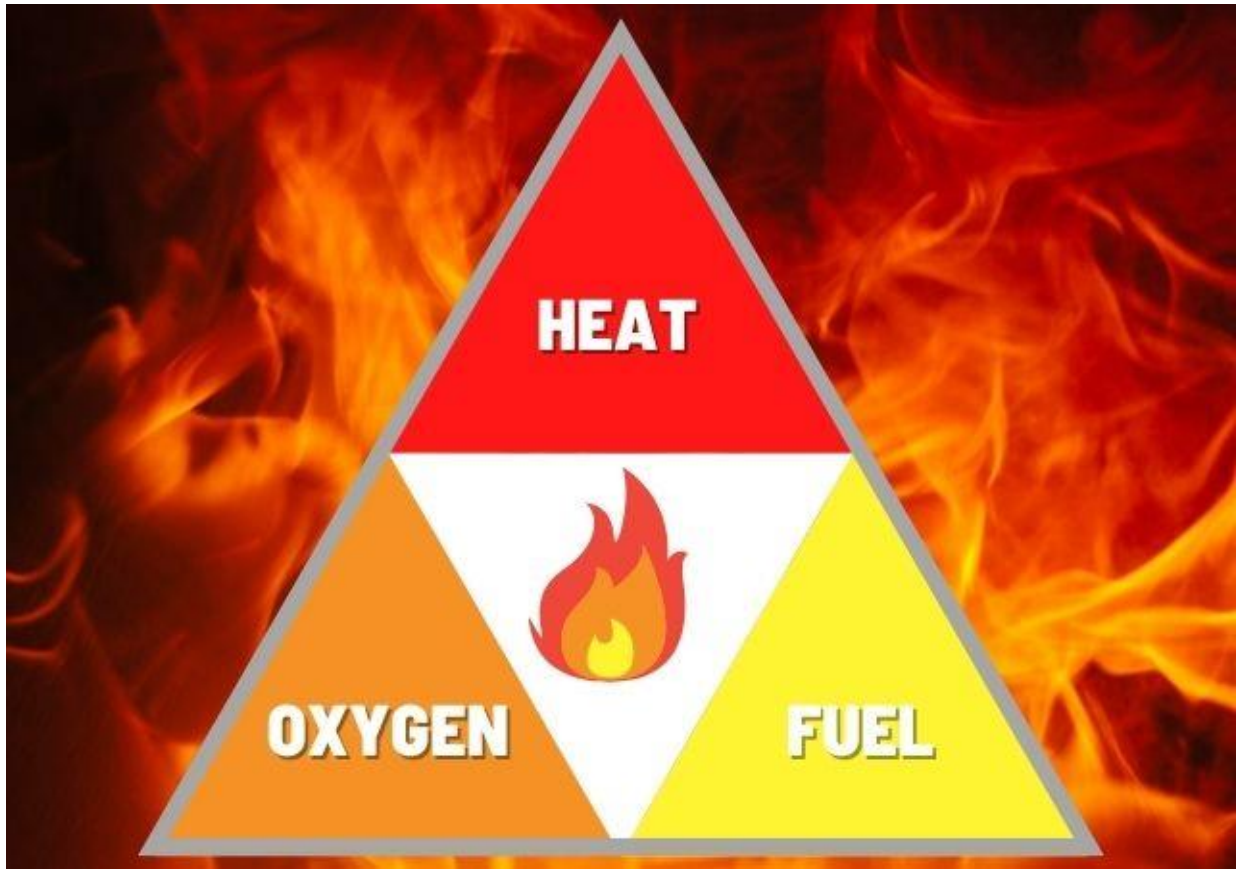
- ✓ Wildfires release large amounts of carbon dioxide, black and brown carbon particles, and ozone precursors such as volatile organic compounds and nitrogen oxides (NOx) into the atmosphere.

- ✓ These emissions affect radiation, clouds, and climate on regional and even global scales.
- ✓ Wildfires also emit substantial amounts of semi-volatile organic species that can partition from the gas phase to form secondary organic aerosol (SOA) over hours to days after emission.

- ✓ In addition, the formation of the other pollutants as the air is transported can lead to harmful exposures for populations in regions far away from the wildfires.
- ✓ While direct emissions of harmful pollutants can affect first responders and residents, wildfire smoke can also be transported over long distances and impact air quality across local, regional, and global scales.

The Fire Triangle

- ✓ The first step in teaching about wildland fire is to begin with the essentials as illustrated by the fire triangle and its three equal components: heat, fuel, and oxygen. The interaction of all three is required for the creation and maintenance of any fire.



Heat

- ✓ A heat source is needed for the initial ignition of wildland fires.
- ✓ Heat is also generated by the fire.
- ✓ Heat transfer is a critical issue in the study of wildland fire.
- ✓ For a fire to grow and spread, heat must be transferred to the initial and surrounding fuel.

Fuel

- ✓ The fuel side of the fire triangle refers to both the external and internal properties of the fuel.
- ✓ External properties refer to the type and the characteristics of the fuel material.
- ✓ Internal properties of fuel address aspects of fuel chemistry.
- ✓ Fuel is characterized by its moisture content, size and shape, quantity, and the arrangement in which it is spread over the landscape.

Oxygen

- ✓ The third side of the fire triangle represents oxygen.
- ✓ Air contains about 21% oxygen; most fires require air with at least 16% oxygen content to burn under most conditions.
- ✓ Oxygen supports the chemical processes that occur during a wildland fire.
- ✓ When fuel burns, it reacts with oxygen from the surrounding air, releasing heat and generating combustion products, e.g., gases, smoke, particles. This process is known as oxidation.

Plant adaptation with Fire

Protection

- ✓ The most common example of fire protection is the thick bark on some species of trees in fire maintained ecosystems, such as ponderosa pine and bur oak.
- ✓ In addition, some species have protective coverings over critical plant parts.
- ✓ Examples of these coverings are the needle and scale coverings over the buds on longleaf pine, and the below-ground meristem tissue (where growth occurs) in grasses.

Growth

- ✓ Some trees, such as ponderosa pine, actually increase their growth rate in the years following a fire.
- ✓ This response is visible in the annual rings in the cross section of trunks.
- ✓ Other growth related adaptations include dormant buds that begin growing after limbs and branches are burned away.

Reproduction

- ✓ Several reproductive-oriented adaptations allow plants to take advantage of, or even require, wildland fire.
- ✓ Fire has been shown to trigger and/or increase seed release in some species, such as lodgepole and jack pines, and to stimulate flowering and fruiting in some shrubs and herbs.
- ✓ Some seeds remain dormant until the seed coat is scarified, or cracked, which can result from intense heat or fire. Some pines have serotinous cones, in which the seeds are sealed in the cone by a waxy pitch that requires fire to remove the seals and free the seeds for germination.

Germination

- ✓ Fire can also prepare seedbeds for germination by burning leaf litter.
- ✓ Some seeds require mineral soil for germination, and fire can release nutrients in the soil and make them available for sprouting plants.
- ✓ Likewise, fire can remove overstory plant material permitting sunlight to reach understory plants.