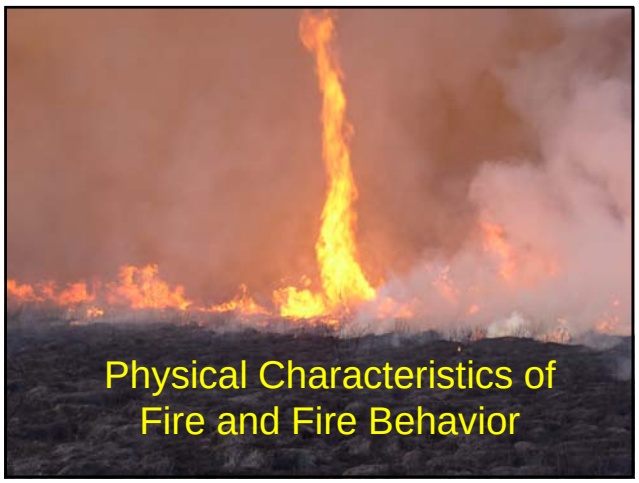
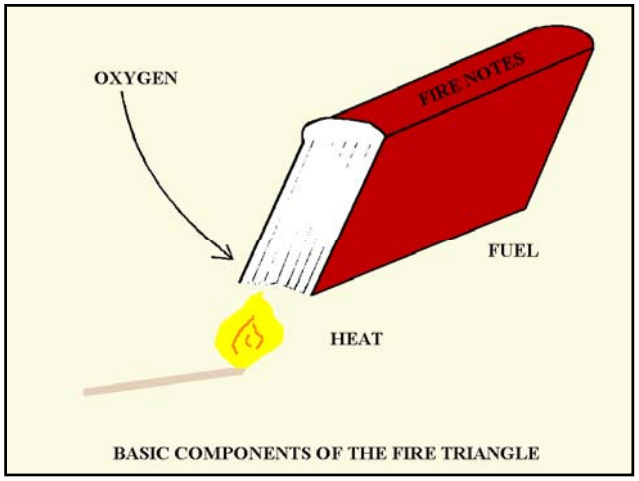


Essential Ingredients

- Fuel
- Heat
- Oxygen

FIRE TRIANGLE

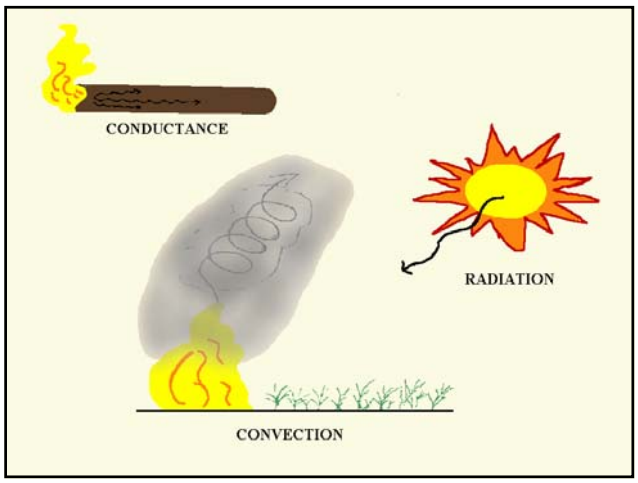
All variations of fire behavior are associated with one or more of the elements of the fire triangle



Heat Transfer

Three transfer processes

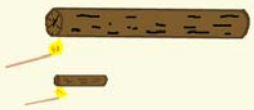
- Conduction
- Radiation
- Convection
- Operate simultaneously



THERMAL CONDUCTIVITY = ABILITY OF FUEL TO CONDUCE HEAT BASED ON TEMPERATURE GRADIENT AND THE AMOUNT OF AREA THROUGH WHICH HEAT FLOWS.

THE GREATER THE FUEL DENSITY, THE HIGHER THE THERMAL CONDUCTIVITY, AND THE MORE HEAT THAT IS REQUIRED TO RAISE FUEL TO IGNITION POINT.

FUEL AREA IS IMPORTANT:



INCREASING FUEL AREA INCREASES ABILITY TO CONDUCT (DISTRIBUTE) HEAT BEFORE IGNITION

Ignition and the Combustion Process

- Fire Converts Stored Chemical Energy into Thermal Energy
- Combustion Requires the Physical Transfer of Heat from Fire to Fuel
- Instantaneous Heat Transfer to Unburned Fuel Must Continue to Perpetuate the Fire

- OPEN FLAME
- THIN ZONE OF VAPOR OR GAS

WHITE ASH - COMBUSTION NEAR COMPLETION

CHAR - COMBUSTION INCOMPLETE

ZONE OF PYROLYSIS - ACTIVE DECOMPOSITION

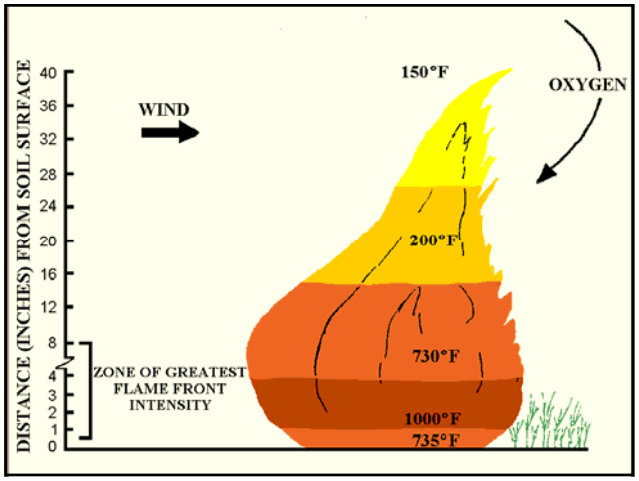
UNBURNED WOOD

Temperatures Required

Temperature	Reaction
<400	Held at 212 until all water is released. Heat Exchange
400 - 600	Combustible Gasses Ignite. Pyrolysis occurs
600 - 800	Direct Oxidation of Fuel Particles, Incremental Heat Increases
800+	Flames apparent

Temperatures

- Wildfires may be as high as 3,500 - 4,000 degrees
- More likely under prescribed conditions 1,800 - 2,400 degrees
- Ignition is Delayed when Fuel Moisture is High



Fuel Influences

- Chemical Composition
- Physical Characteristics
  - Load
  - Continuity and Arrangement
  - Coarseness
- Fuel Moisture

Chemical Composition

- Volatile Fuels - Contain Relatively High Amounts of Ether Extracts (Waxes, Terpenes, Oils, Resins, etc.)
  - McCartney Rose
  - Juniper
- Nonvolatile Fuels - Relatively Low Amounts of Ether Extracts
  - Hardwoods
  - Grasses

Fuel Load

- Generally the First Consideration in Planning a Burn
- Minimal Fuel Load Required Varies
- 2,500 - 3,000 lbs/ac Evenly Distributed, Fine Fuel
- Remember the Fire Triangle
  - Fuel
  - Heat
  - Oxygen

Fuel Load

- Fuel Loads Determine Temperatures to be Achieved
  - Greater the fuel load the greater the duration of exposure to elevated temperatures

Fuel Continuity and Arrangement

- Vertical and Horizontal Fuel Distribution
- As Important as Fuel Load
- Aids in Pre-heating Through Radiation and Convection

Fuel Continuity and Arrangement

- 3,500 lbs/ac will cross 3 - 5 ft Fuel Break with 6 - 8 mph Winds and 20% RH
- 1,800 lbs require 12 - 15 mph
- If RH is 50 - 60 %, 18 - 20 mph wind necessary

Coarseness of Fuel

- Surface Area to Volume
- Aids in Rate of Burning
- Rate of Burning Increases with Increase in Surface Area

Fuel Moisture

- Critical Importance to Fire Behavior
- Delays Ignition
- Retards Burning Rate
- Pyrolysis moves slowly
- Water Vapor Moves Through Char Absorbing Heat

Moisture Content

- Increases Heat Capacity and Ignition Time
- Increases Heat Requirements for Combustion, Dilutes Volatile Gases
- Slows Combustion Rate, thus Retards Rate of Spread

Topographical Influences

- Fire Moves Most Slowly Down Slope
- Fire Moves Intermediately on Level Terrain
- Fire Moves Most Rapidly Up Slope
- Steepness of Slope Increases Preheating of Fine Fuels Ahead of the Flame Front
- Influence of Slope Much Like that of Wind