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**Work Cited**

Weather Effect (in terms of temperature)

<http://www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming/Global-Warming-is-Causing-Extreme-Weather/Wildfires.aspx>

Rain Effect

<https://www.quora.com/What-is-the-effect-of-rain-on-an-existing-forest-fire-Does-it-help-significantly>

General Effects

<http://www.auburn.edu/academic/forestry_wildlife/fire/weather_elements.htm>

**General Effects Article:**

What is weather? It is the state of the atmosphere surrounding the earth at a certain area. The atmosphere is a gaseous mantle (mostly oxygen and nitrogen) encasing the earth and rotating with it in space. Weather is never static. It is dynamic, changing day-by-day, hour-by-hour and even minute-by-minute.  
  
Of the three major components making up a fire’s environment (Fuel, Weather and Topography), weather is the most important, yet it is continuously changing. This unit will deal with the role weather plays in the start and spread of wildfires and in the use of prescribed Fires.  
  
There are several elements of weather that must be considered. They are: Temperature, Wind, Stability of the atmosphere, Relative humidity, Precipitation, Cloud development. In addition drought, a result of certain weather conditions, must be considered.

TEMPERATURE

Air temperature has a direct influence on fire behavior because of the heat requirements for ignition and continuing the combustion process. We discussed radiant heat in the previous unit. Heat from the sun is transferred to the earth by radiation. This heat warms up the surface of the earth and the atmosphere close to the surface is in turn warmed by heat reflecting from the surface. This is the reason that the temperature above the surface is cooler than at the surface of the earth. These temperatures generally decrease about 3.5 degrees per thousand feet in altitude. This decrease is known as the adiabatic lapse rate.  
  
Forest fuels receive heat by radiation from the sun. As a result, less heat is required for ignition. The differential heating of the earth’s surface is the driving force behind most of the influences on the atmosphere. The sun emits short-wave energy rays (radiation). When striking a solid object such as trees or grass, it is warmed. The surface absorbs some of the heat and reflects some in long-wave radiation that is absorbed by the water vapor in the air thus raising its temperature as well.   
  
Arguably, temperature, is the single most important weather factor affecting fire behavior. Some might say that relative humidity is most important but we will learn that temperature drives relative humidity.  
  
Fuel temperatures also affect a fire’s rate of spread. Warm fuels will ignite and burn faster because less heat energy is used to raise the fuels to their ignition temperature. Fuels exposed to sunlight will be warmer than the fuels in shade. They will also be drier. For this reason, fuels not shaded by an overstory will generally be warmer and drier resulting in a more intense fire.  
  
Fires also burn more intensely in the afternoon. The temperature is the highest at that time resulting in higher fuel temperatures. Consequently, less heat is needed to raise the fuel to its ignition temperature. At the same time rising temperatures result in decreasing relative humidity and fuel moisture.  
  
The type of surface will also affect the temperature. The temperature at the surface of a body of water will be cooler because the heat will readily penetrate and spread throughout the water. On the other hand, bare soil will be higher because heat will not penetrate. Instead, it will be concentrated at the surface. In forested areas, the trees will absorb most of the heat. For this reason, fuel in the shade will be cooler than in the sun.  
  
STABILITY OF THE ATMOSPHERE  
  
Atmospheric stability is the resistance of the atmosphere to vertical motion. If the atmosphere is unstable, vertical movement of air is encouraged and this tends to increase fire activity. If the atmosphere is stable, vertical movement of air is discouraged and this decreases fire activity. Parcels of air masses with different temperatures are continually mixing trying to reach the same temperature, much as boiling water. The more difference in the temperatures in the atmosphere, the more unstable the conditions and the more movement--both vertically and horizontally. More unstable conditions result in more vertical movement in the atmosphere. Such conditions act like opening the damper on a stove. A fire will burn more intensely because of the unrestricted updraft of the atmosphere and convective currents. Under stable conditions, fires will burn slowly and the smoke column will not rise very far.   
  
The earth’s surface is not heated uniformly by the sun and this results in unstable conditions. The warmer air next to the ground (heated from the ground) is lighter, since it expands, and tends to rise. Cooler air from an area not heated as much and heavier, will flow in replacing the warmer air--thus, wind. Forested areas will not heat up the adjacent air as much as a cleared field or highways. Water will not heat up as much as land because a larger percent of the radiant heat is readily absorbed into the lower levels of the water.  
  
Cumulus clouds are an indicator of vertical movement. The higher they rise, the more unstable the atmosphere is and with higher vertical movement. The air in the atmosphere mixes readily with updrafts and downdrafts. Winds will be gusty and tend to change direction. With dry conditions, there may be no cumulus clouds to show the unstable conditions. Other indicators are, strong, gusty winds, tall smoke columns, good visibility and dust devils or small whirlwinds.   
  
Because of the radiant heat of the sun, stability changes much the same as the temperature and relative humidity during a 24-hour period. Conditions are usually very stable at night and can become very unstable during the day.   
  
The most important method of cooling air to saturation is adiabatic cooling because of lifting. Lifting may be thermal, orographic, or frontal.  
An inversion is a layer in the atmosphere where the temperature increases with altitude instead of decreasing. With warmer, less dense air, it acts as a lid on updrafts. It is the most stable condition that exists, especially when close to the surface. In the southeast, such conditions occur almost every night. They are close to the surface and with calm winds, high humidity and low temperature, fires seldom start and those still burning at night will be drastically reduced in intensity. Smoke will only rise to the inversion and then flatten out and spread horizontally.   
  
When the sun rises and begins to warm the earth’s surface, the lower atmosphere is warmed and the inversion rapidly dissipates.

RELATIVE HUMIDITY  
  
Moisture in the form of water vapor is always present in the atmosphere. And - the amount of moisture that is in the atmosphere affects the amount of moisture that is in the fuel.   
  
Relative humidity is the term used in prescribed burning to express the amount of moisture in the atmosphere. It is the ratio of actual water vapor in the atmosphere compared to the amount of water vapor that would saturate the atmosphere at that temperature. When the relative humidity is 40 percent, it means that the atmosphere contains 40 percent of the moisture that it could contain at that same temperature.  
  
The lower the relative humidity, the more readily a fire will start and burn; the more vigorously a fire will burn. As will be discussed in more detail later, moisture in the fuel absorbs heat and reduces the fire’s intensity before it is converted to steam and driven off. When the relative humidity is low, the moisture in the fuel is readily evaporated as it rises to the surface of the fuel. When the humidity is high, it’s harder for the moisture to evaporate into the air. Consequently, high humidity acts like a damper on a stove. If the humidity is 100 percent or close to it, the fuel will not dry. On the other hand, the lower the relative humidity, the quicker the moisture will evaporate.   
  
Relative humidity fluctuates widely during each 24-hour period. It will generally be the highest in the early morning hours before daylight and the lowest during the early afternoon; the diurnal cycle. This is because relative humidity is changed by temperature. When air is warmed, it expands and as a result, will hold more moisture. The actual amount has not changed but it is spread out over a larger area, consequently the percent is less. As temperature changes, relative humidity changes but in the opposite direction. As temperature goes up, relative humidity goes down and vice versa.  
  
Rule of Thumb: Relative Humidity doubles with each 20F drop in temperature and halves with each 20F increase in temperature.  
  
PRECIPITATION  
  
Precipitation (rain or snow) has a direct and immediate effect on fuel moisture and relative humidity. Temperature usually drops as well and the winds became calm. When the atmosphere becomes saturated, precipitation usually occurs if more moisture is added. Precipitation will quickly dampen the surface of fuels to the point that fires cannot ignite and no wildfires will occur.  
  
The pattern of rainfall is a big factor in determining the fire season (the period when wildfires occur). In the South the fire season starts in the fall and generally slacks off during December and possibly January as the climate turns cold, with numerous rains, calm winds and overcast skies. Knowing typical weather patterns in an area is essential for the accomplished prescribed burn planner. Typically the last two weeks of February and the first two weeks of March are suitable for late dormant season burns in the deep South. As the rains lessen in the early spring and the winds increase, the fire season is again high until middle or late April. The last two weeks of March and first two weeks of April is generally a good period to plan early growing season burns depending on bud swelling and break of target species.  
  
As the vegetation greens-up, prescribed burning conditions may deteriorate. If, however, a winter drought occurs and continues into the spring, fires will readily burn on into the summer because of the larger amount of dead, dry fuel and low fuel moisture. These fires may be more difficult to control and do more damage due to burning deeper into the litter and consuming larger size fuel. During long periods of dry weather, drought, moisture that is toward the center of larger fuels and deeper in surface litter is able to work its way to the surface and evaporate into the dry atmosphere. As a result, a larger percent of the total fuel becomes available fuel; available to burn.  
  
CLOUD DEVELOPMENT AND FRONTS  
  
When moisture is added to the atmosphere or the air temperature is lowered, the relative humidity increases. When it increases to the saturation point, the moisture begins to combine into droplets. As this process continues, the droplets become visible--as clouds. When the atmosphere is very dry, saturation may not be reached, and no clouds are formed.  
  
Clouds are formed when there is a lot of surface heating from the sun and a lot of moisture is present. As the air close to the surface is heated, it rises to be replaced by cooler air. The heated air can rise until it is saturated and clouds form. As it rises the warmer air cools until it reaches the temperature of the surrounding air. At this altitude puffy type cumulus clouds will form. If they continue to build up, they become darker and rain may occur.  
  
Clouds are also caused by fronts. Fronts and the associated clouds are important because fronts mean changing weather. Clouds are visible indicators of fronts and other weather phenomenon. Cumulus clouds indicate vertical movement in the atmosphere. Clouds are moisture. The more clouds available, the more moisture available and relative humidity will be higher. Overcast skies shade the surface of the earth and less radiant heat is received. Temperatures are lower and winds are more moderate.  
 Clouds and precipitation cover a wide band and extend some distance behind slow-moving cold fronts. If the warm air is moist and stable, stratus-type clouds and steady rain occur. If the warm air is conditionally unstable, showers and thunderstorms are likely. If the warm air above a warm front is moist and conditionally unstable, altocumulus and cumulonimbus clouds form. Often, thunderstorms will be embedded in the cloud masses. Lifting of warm, moist air as it is forced up the slope of a warm front, produces widespread cloudiness and precipitation.If the warm air above a warm front is moist and stable, clouds are of the stratus type. The sequence of cloud types is cirrus, cirrostratus, altostratus, and nimbostratus. Precipitation is steady and increases gradually with the approach of a front. With rapidly moving cold fronts, the weather is more severe and occupies a narrower band. If the warm air is moist and conditionally unstable, as in this case, scattered showers and thunderstorms form just ahead of the cold front. The steepness and speed of cold fronts result in a narrow band of cloudiness and precipitation as warm, moist air ahead of the front is lifted.  
In the South cold fronts usually travel in a west to easterly direction--usually to the southeast. A cold front will generally change the direction of the wind from a southerly direction to the west and on around to the northwest.   
  
The circulation around a low-pressure area causes horizontal converging of air at low levels and lifting of air near the center. For this reason, low-pressure areas usually are areas of cloudiness and precipitation. Frontal lifting is frequently combined with convergence.  
When one mass of air is moving, it will push under the mass of air it is replacing if it is cooler, causing the other mass to lift. If lifted high enough, clouds will form and rain may occur due to cooling. If the air mass is warmer than the mass it is replacing, it will be pushed up over the other mass. In either case, one air mass is lifted causing clouds. This is the reason we have changing weather and possibly rain when a front comes through.  
  
Thunderheads   
  
One type of cloud can spell trouble even though of short duration. As cumulus clouds build higher, they become more turbulent. Such clouds are called thunderheads. Their towering, turbulent-appearing head can be easily recognized. In the later stage the towering top may become anvil-shaped with the point facing the direction the thunderhead is traveling. As they develop, air currents reach a critical height and precipitation begins. The falling rain or hail indicates a strong downdraft below the cloud. The strong downdraft strikes the ground and spreads in all directions producing strong, gusty winds of up to 70 mph in a few seconds. As the thunderhead moves, the wind shifts rapidly.