SECTION VI
Burning Issues: Essential Fire Ecology Terms and Concepts

News stories that sensationalize wildfire events by hyping the danger of wildfires and the drama of firefighting efforts offer little or no scientific or policy context for readers. The goal of this section of *A Reporter's Guide to Wildland Fire* is to provide journalists with key fire ecology concepts and terms they can use to increase the accuracy of their reporting and to raise the educational value of their stories.

Fire Ecology

Fire Ecology refers to the relationship between living organisms, their physical environment and fire. Fire is a natural disturbance that functions as a ***biophysical stimulus*** that renews ecosystems and enhances diversity.

Fire Triangle and Fire Environment

The Fire Triangle refers to the combination of **heat, oxygen and fuel** that is necessary for something to ignite and sustain combustion. Remove any one of these legs of the triangle and a fire goes extinct. The **Fire Environment** involves the interaction between **weather, topography and fuels**. These all influence fire behavior and fire effects.

In general, fires burn more rapidly and intensely in/on:

- hot, dry, windy weather conditions;
- steep, south-facing slopes;
- dense flammable vegetation; and
- high amounts of small-diameter dead downed needles and limbs.

In general, fires burn more slowly and less intensely in/on:

- cool, moist weather conditions;
- flat terrain or gentle slopes;
- sparse or low-lying vegetation; and
- large-diameter trees and downed logs.

Change any one or more of the above factors and it can significantly change fire behavior and effects.

Fire Behavior and Fire Effects

Together, the fire triangle and fire environment influence fire behavior, which includes the **rate of spread** (measured in distance per unit time, e.g. feet per hour), the **fireline intensity** or heat output at the flame front (measured in BTUs or flame lengths), and various qualitative descriptors (e.g. smoldering, torching, running, etc.). **Fire Effects** are affected by fire behavior, and this examines the physical, biological and ecological impacts of fire on the environment, often measured in terms of **fire severity** (see below).

Fire Risk and Fire Hazard

These terms are often wrongly used interchangeably by journalists. There are qualitative differences that are important to distinguish. Fire risk is the **probability of an ignition** occurring by any source (e.g. human or lightning). Fire hazard refers to the **potential flammability** of a given fuel type.

In some cases, a dense tree stand may have a high fire hazard rating but may also have a relatively low fire risk because it is a high-elevation stand in a remote roadless area with a cool, moist environment. Thus, the fire hazard level may be high but may still be tolerable because the chance of an ignition is low. In other cases, a tree stand may have a high fire risk because it is located in a low-elevation roaded area with a hot, dry environment, but it might have a low hazard rating because fire has burned fairly frequently and kept flammable fuel loads to a minimum.

Fire Types: Ground, Surface and Crown

There are three main types of fire: **Ground, surface and crown**, although it is important to realize that on large fires all three kinds of fires may be evident.

Ground fires burn below the ground surface. They are very slow-moving fires that smolder underground in buried fuels, and in the case of peat bogs, can be extremely difficult to fully extinguish. The significance of ground fires is that these can be “sleeper fires” that may escape detection for several days following their ignition until they become an unexpected wildfire.

Surface fire is the most common type of fire. It burns dead fuels and live vegetation located above the ground, including dead needles and limbs, grasses, forbs, brush, tree saplings and poles, but does not include burning the overstory tree canopy layer. Surface fires can range from slow- to fast-moving and from low to high intensity. Firefighting efforts are successful when they can contain or “corral” surface fires within firelines, and then control all visible smokes within a few hundred feet within the perimeter.

Crown fire is the most popular image shown on television newscasts, yet it is the rarest type of fire. Crown fires are normally fast-spreading and high-intensity fires. They can begin by single-tree “torching” that spreads to adjacent stands. Crown fires can be dependent upon surface flames, or in the most extreme type of fire event, can move independent of flames on the ground. In the latter case, fire moves extremely rapidly through the canopy layer ahead of fires burning along the surface. Crown fires are the most severe kind of fire since they kill most or all of the trees they burn. They are also the fires that are near impossible to humanly contain and control until the fire drops back down to the ground and more favorable conditions permit containment. Crown fires are extremely dangerous to firefighters because they can ignite spotfires ahead of the main flame front, thereby entrapping firefighters between two fires.

Fire Intensity and Fire Severity

These terms are also often used interchangeably by journalists, but need to be distinguished and used appropriately.

Fire intensity refers to the amount of **heat output** per unit of time or fuel. Scientists measure intensity in terms of “BTUs,” while managers measure intensity in terms of flame length. The concept of “fireline intensity” refers to the amount of heat emitted at the perimeter of a fire. Flame lengths of four feet or less can normally be approached directly by firefighters; flame lengths of four-to-eight feet require heavy equipment like bulldozers; flame lengths exceeding twelve feet tall cannot be directly confronted by firefighters and require “indirect attack” strategies that construct firelines at a considerable distance away from the wildfire’s leading edge.

Fire severity refers to the **effects of a fire on forest soils and vegetation**. Scientists tend to measure the effects in terms of soil impacts, examining how much soil organic matter (e.g. litter and duff) was consumed based on how deep the heat penetrated into the soil. The more organic matter that is consumed or deeper the heat, the higher the severity of a fire. This has a bearing on the mortality of vegetation and the amount and kind of post-fire vegetation recovery. Managers, however, tend to measure severity in terms of mortality effects on dominant overstory vegetation, which can be trees, shrubs or grasses and forbs. The higher the percentage of dominant vegetation that is killed by fire, the higher the severity.

The distinction between the concepts of intensity and severity is important because in some cases a relatively high-intensity fire may result in low severity if it burns rapidly across the surface but the heat does not penetrate the soil or the flames do not reach the tree canopy layer. Alternately, a low-intensity slow-moving fire that smolders in deep duff layers or downed decayed logs may result in high severity effects on a localized level (e.g. directly beneath downed logs). When the heat resides in one place for a long time, it is able to penetrate deeper soil layers, and can kill large overstory trees by essentially "baking" their roots. In terms of assessing the ecological effects of fire, severity is the main issue to focus on, not size, spread or intensity.

Fire Management

Fire Management includes all agency activities to prevent, suppress or use fire in order to manage burnable wildland fuels. Fire management is fast becoming the most critical area of funding and focus of federal land management agencies as recent severe wildfire seasons have captured the attention of the public, policymakers and the press. Unfortunately, current fire management policies and practices are not based on fire ecology principles, as evidenced by the dominance of fire exclusion and fire suppression in federal fire management agencies.

Fire Regimes

Fire Regime is a concept that uses fire frequency and severity to provide a general description of the role that wildland fire plays in shaping and maintaining an ecosystem or vegetative community. There are five main historical fire regimes in the west:

- Fire Regime I: 0-35 year frequency/low-severity (e.g. old-growth ponderosa pine stands with grassy understories)
- Fire Regime II: 0-35 year frequency/stand-replacement severity (e.g. grasslands and shrublands)
- Fire Regime III: 35-100+ year frequency/mixed severity (e.g. mixed conifer stands)
- Fire Regime IV: 35-100+ year frequency/stand-replacement severity (e.g. coastal chaparral, boreal forests)
- Fire Regime V: 200+ year frequency/stand-replacement severity (e.g. coastal temperate rainforests)

Fire Return Interval

Fire Return Interval is related to fire frequency, and refers to the typical length of time between two successive natural fires in a given area. This can be expressed as an average/mean or a range of years. In general, fire return intervals have been lengthened in many areas because of fire exclusion and suppression policies. In short-interval fire regimes, this has resulted in wildfires of uncharacteristically greater size and severity because of the accumulation of fuels that would have normally been burned. However, in long-interval fire regimes, the period of effective fire suppression has not been sufficient enough to significantly alter fire processes across the landscape, although specific sites that used to be burned by Native Americans (e.g. meadow communities in forests) may have been adversely affected by modern fire exclusion/suppression.

Fire-Adapted Species

Fire-Adapted Species refers to various characteristics that specific plants have developed through evolution in order to survive or thrive from fire events. Any single species may exhibit one or more special adaptations to fire. Dr. James Agee (1993, *Fire Ecology of Pacific Northwest Forests*. pgs.135-136) classifies five different kinds of plants with adaptations to fire:

- Invaders: These are the "pioneer" plants that seek to "colonize" sites where fire has removed the previous vegetation.
- Evaders: These plants have the ability to reseed from serotinous cones that open and release their seeds in the heat of a fire.
- Avoiders: These are shade-tolerant, late-successional plants that are generally killed by fire and do not return to burned areas for a long time.
- Resisters: These plants have adaptations like thick bark that enables them to survive most low-intensity fires.
- Endurers: These plants have the ability to resprout from live roots that survive most fires.

Presenting fundamental fire ecology terms and concepts provides some critical scientific context for readers to understand fire events in the "big picture." To reiterate, in most cases even the largest wildfire incidents are not ecological catastrophes (although they may be social disasters if they destroy many homes that were unprepared for wildland fire), but instead, are natural disturbances in which individual species and whole biological communities have evolved numerous adaptations to naturally recover from fire.

Providing fire ecology science in news stories in no way diminishes the natural drama of wildfires, but it offers a more complex analysis than simply labeling a fire as "catastrophic." More importantly, it increases the educational value of news reporting by raising the scientific and ecological literacy of news readers, viewers and listeners.