Glossary of wildfire hazard and risk terms (from Scott and others 2013)

Asset
An asset is a man-made thing—a building, communication tower, road, *etc*.—of use or value to its owner. By contrast, resources are naturally occurring—wildlife habitat, forage, timber, etc. Assets and resources can be damaged by wildfire, resulting in reduction in value, or loss. Some resources increase in value after fire (a benefit of fire), but assets generally do not.

Benefit
An increase in the value of a resource or asset (although assets generally do not benefit from fire). The benefit to a resource may partially or wholly offset loss due to resource damage. The net effect of benefit and loss is called net value change (NVC), but has also been called net loss or net benefit.

Burn probability (*BP*)
The probability that a wildfire will burn a given point or area during a specified period of time. Burn probability for wildfire management planning applications is often reported on an annual basis—the probability of burning at any time during a single calendar year. Some planning applications report the conditional burn probability given that a fire occurs during a specified "problem fire" weather scenario. Wildfire incident management applications express burn probability for a much shorter time frame, typically one to four weeks. For practical purposes, wildfire simulation systems treat the burning of each pixel, the smallest landscape unit, as a point.

Conditional burn probability
Burn probability given a specific set of defining criteria. The specific criteria can be a weather scenario and a fixed, usually short period of active fire spread. Conditional burn probability is calculated for use in hazard and threat assessments that use FlamMap5 rather than FSIM or FSPro. The flame length probabilities reported by FSim and FlamMap5 are conditional.

Conditional flame length (*CFL*)
The mean flame length at a point, quantified as the mean flame length simulated with a Monte Carlo fire occurrence simulator. Conditional flame length is one of two common measures of conditional wildfire intensity (the other is mean fireline intensity).

Conditional wildfire intensity
The typical wildfire intensity produced by the fire environment at a point, incorporating non-heading spread directions and the full range of weather scenarios. Two measures of wildfire intensity are in common use—flame length and fireline intensity. Flame length is commonly used in contemporary wildfire hazard and threat assessments. When using a Monte Carlo wildfire simulation system, conditional flame length (CFL) is the mean flame length of the iterations that burned a particular landscape pixel. The FSIM wildfire simulation system also produces an output raster for mean fireline intensity—the mean fireline intensity of the iterations that burned each landscape pixel. Conditional wildfire intensity refers to the contemporary, not historical, typical wildfire intensity. *See also*: conditional flame length (CFL), mean fireline intensity (MFI).

Damage
An adverse physical change of an asset or resource. Damage is physical change, not the effect of that change on value (that is *loss*). The consumption of a building, death of desirable trees in a forest stand, and degradation of air quality are example of damage a wildfire can cause. Damage can be direct or induced. Examples of direct wildfire damage include tree mortality and consumption of buildings. Examples of induced wildfire damages include reduction of forest productivity due to soil erosion and sedimentation of a reservoir.

Effects
The anticipated benefits and losses to HVRAs, typically quantified as a function of fire intensity.

Effects analysis
The analysis of likely HVRA response to wildfire (benefits and losses), typically quantified as a function of fire intensity. This analysis can incorporate preexisting HVRA-specific models, or, as implemented here, can rely on expert-based response functions. *See also*: effects.

Exceedance probability
The probability of exceeding a specified quantity of beneficial or adverse effect. An EP curve is a graphical representation of EP for all possible quantities.

Expected loss
See expected net value change.

Expected net value change
Expected net value change, or E(NVC), is calculated as the sum-product of burn probability and value change (to one or more resources or assets) over a range of wildfire intensity classes (usually flame length). Expected net value change is a risk-neutral measure of the wildfire risk to resources and assets, and forms the basis for the quantitative wildfire risk assessment process described in this report. If no beneficial effects are under consideration, expected net value change can simply be called expected loss. The terms value change, response and net response are functional synonyms for net value change; all refer to the net effects of positive and negative changes on the value of a resource or asset.

Expected value
Expected value is the probability-weighted average outcome, a good measure of the central tendency of outcomes. For example, if a system or simulation has a 90 percent probability of producing an outcome of 0, a 9 percent chance of an outcome of 10, and a one percent chance of an outcome of 1000, then the expected value is 10.9, as shown in the table below. Notice that 10.9 is not among the possible outcomes.

probability	outcome	Expected value
0.90	0	0
0.09	10	0.9
0.01	1000	10
1.00		**10.9**

Exposure
The spatial coincidence of wildfire likelihood and intensity with the location of an HVRA. For example, a building (asset) in a flammable forest (hazard) is exposed to wildfire. Exposure can be intentional or incidental. A valuable but flammable forest is incidentally exposed to damage from wildfire, because the forest cannot be physically separated from the hazard. The construction of a residential building in the same flammable forest is intentional exposure to the same hazard.

Exposure analysis
An assessment of wildfire hazard—likelihood and intensity—where resources and assets are located.

Fire modeling landscape
A raster-format geospatial characterization of fuel (fire behavior fuel model, canopy base height, and canopy bulk density), vegetation (canopy cover and stand height) and topography (slope, aspect and elevation) needed to simulate potential fire behavior and fire growth across a landscape. For use in FlamMap5 and FSim, the fire modeling landscape must be in the form of an LCP file (Finney 1998).

Fire occurrence
An instance of a wildfire event; a wildfire incident. Fire occurrence is defined by the characteristics of historical wildfires occurring in a specified area during a specified period of time: frequency, density, start location, start date, fuel type, final size, management objective, and so on.

Fireline intensity (*FLI*)
The rate of heat release per unit length of flaming fire front, calculated as the product of heat content, fuel consumption during flaming front passage, and rate of spread.

Flame-length probability
Flame-length probability (FLP) is the conditional probability of observing fire intensity in a specified flame-length class, given that a fire occurs. The sum of FLP at a point is 1.

Frequency
The number of occurrences per unit time.

Fuelscape
A raster-format geospatial characterization of ground, surface and canopy fuel across a landscape, typically consisting of one or more fuel characteristics data layers. For fire behavior modeling, a fuelscape consists of geospatial data layers representing surface fuel model, canopy base height and canopy bulk density. Other geospatial data layers required for geospatial fire modeling include topography characteristics (slope, aspect, elevation) and vegetation characteristics (forest canopy cover and height).

Grid cell
A grid cell—also called a pixel—is the smallest addressable unit in a raster dataset.

Harm
Injury to a person. Harm is analogous to *damage*. Damage occurs to anthropogenic or natural objects—assets or resources—whereas harm occurs to persons.

Hazard
A physical situation with potential for harm to persons or damage to resources and assets. Wildfire hazard can be described qualitatively as a fire environment—fuel, weather, topography, and ignitions—with potential for causing harm or damage, or quantitatively by two characteristics: (1) the probability of a fire occurring at a specific point during a specified time period, and (2) the expected distribution of intensity given that the event does occur. Wildfire hazard at a given location on the landscape is quantified as: (1) burn probability and (2) conditional wildfire intensity given that a fire does occur. Those two characteristics can be combined into a single spatially resolved measure of wildfire hazard: integrated wildfire hazard. It is important to note that since the definition of risk in the wildfire context is expanded to include beneficial as well as negative effects, the consideration of wildfire likelihood and intensity (in other words, hazard) should be expanded as well.

HVRA
Highly Valued Resource or Asset. Some resources have only modest value and may not be analyzed in an assessment of risk to HVRAs. Likewise, low-value assets like outbuildings are often left un-analyzed so that efforts can be focused on the more highly valued resources and assets (HVRAs).

Ignition density
Number of ignitions per unit area.

Ignition density grid
Raster-format geospatial data representing the relative number of ignitions per unit area.

Ignition frequency
Number of ignitions per unit time.

Ignition probability
The probability of an ignition occurring during the specified time period, usually one day or one year, expressed as a fraction (0-1) or a percentage (0-100).

Integrated wildfire hazard
Integrated wildfire hazard combines two important measures of wildfire—burn probability and conditional wildfire intensity—into a single characteristic that can be mapped. Integrated wildfire hazard is the product of burn probability and conditional wildfire intensity, where intensity is expressed either as the expected flame length or as the expected fireline intensity, depending upon which is used to characterize wildfire intensity.

Intensity
The rate of energy release of a natural phenomenon. Intensity is generally considered to be the effects-causing characteristic of a wildfire and other natural phenomena. Hurricane and tornado intensity is measured by wind speed. Wildfire intensity is measured as fireline intensity or flame length.

Likelihood
Non-technical synonym for probability.

Loss
The reduction in value of a resource or asset. See net value change

Natural hazard
A hazardous natural phenomenon; a peril arising from a source that occurs naturally (as opposed to a technological hazard such as a nuclear meltdown). "Natural peril" is a better term.

Net value change
The net effect of both damaging and beneficial effects on the value of a resource or asset, whether it increases or decreases. Negative numbers for net value change indicate a net loss; positive numbers indicate a net benefit.

Peril
A source of risk. Wildfire is a peril; so are hurricanes, earthquakes, and tornadoes. Also: technological phenomena like icy roads or a nuclear accident.

Pixel
A pixel—for picture element—is also called a grid cell or landscape element. It is the smallest addressable unit in a raster dataset.

Probability
The likelihood that an event will occur during a specified period of time, typically defined as the relative frequency of an event; the ratio of the number of cases that represent the event to the total number of cases.

Resource
A resource is something found in nature and necessary or useful to people—wildlife habitat, forage, timber, etc. By contrast, assets are man-made things—buildings, communication towers, roads, etc.—of value to its owner. Assets and resources can be *damaged* by wildfire, resulting in *loss* of *value*. Some resources increase in value after fire (a *benefit* of fire), but assets generally do not.

Risk
Generally, risk is the potential for realization of adverse or beneficial consequences to HVRAs. Although there exists no single, best measure of risk, in this risk assessment framework we quantify the potential for effects as the expected value of the probability of an event occurring multiplied by the magnitude of the effect, given that and event has occurred.

Risk assessment
An appraisal of the interaction of *hazard, exposure,* and *effects* to a given set of HVRAs in a given area. Components of wildfire hazard include *the likelihood* of burning and distribution of wildfire *intensity* given that a burn occurs; both are a function of the fire environment: fuel, weather, and topography. Components of effects include intrinsic HVRA factors as well as broader environmental factors.

Risk analysis
A detailed examination including risk assessment, risk evaluation, and risk management alternatives, performed to understand the nature of unwanted, negative consequences to human life, health, property, or the environment; an analytical process to provide information regarding undesirable events; the process of quantification of the probabilities and expected consequences for identified risks.

Risk compensation
An adjustment in behavior (exposure) in response to a change in other risk factors (hazard or susceptibility). *aka* risk homeostasis.

Risk estimation
The scientific determination of the characteristics of risks, usually in as quantitative a way as possible. These include the magnitude, spatial scale, duration and intensity of adverse consequences and their associated probabilities as well as a description of the cause and effect links. (source: Society for Risk Analysis)

Risk management
"Risk Management is the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events" (Hubbard 2009, p. 10)

Risk transmission
A situation in which the adverse effects of a natural hazard occur some distance from where the event initiates.

Susceptibility
The propensity of an asset or resource to experience an effect as a result of burning at a given level of wildfire intensity. An asset or resource that is easily damaged by a low-intensity wildfire is susceptible, whereas one that is difficult to damage even with a high-intensity wildfire is resistant. Modifications to a building (changing to a fire-resistant roof covering, screening vents, etc.) make it less susceptible to fire damage. The term susceptibility is used for the propensity to experience either an increase or decrease in value.

Threat
The expected value of loss; nearly synonymous with risk but specifically excludes any potential for beneficial fire effects.

Uncertainty
Imperfect information or a lack of knowledge. Uncertainty can manifest in many forms, and in risk analyses often relates to understanding of the probabilities of events. Uncertainty can also relate more to knowledge gaps, linguistic confusion, or unknown preferences.

Value
The worth or importance of an asset or resource.

Value change
The change in value of a resource or asset arising from an event such as wildfire. Some resources or assets experience offsetting beneficial and adverse effects, so the term net value change is often used to acknowledge that these offsetting effects have been accounted.

Vulnerability
The combination of exposure and susceptibility of a resource or asset to a peril.

Wildfire intensity
The rate of energy release of a wildfire at a point on a fire perimeter, typically measured as flame length (*FL*) or fireline intensity (*FLI*).