

# FORENSIC SCIENCE INSIGHTS

Gossman Forensics – Louise Denlinger

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## Investigating Wildfires Cause and Origin

The author recently returned from a trip to Glacier National Park and was able to see some of the aftermath of the Sprague wildland fire. This fire was reported on August 10, 2017 and wasn't contained until November 2017. Approximately 16,982 acres of land were affected and the Sperry Chalet was nearly destroyed. A question worth asking is: with so much land altered and/or destroyed by fire, how can a cause or origin be determined by a fire investigator?

### Causes of Wildfires

In the case of the Sprague Fire, the cause was determined to be from a lightning strike coupled with dry conditions. In many cases, human activities are the cause of wildland fires. Human-caused fires can be accidental or intentional (arson). Fireworks, lit cigarettes, burning debris, campfires, firearms, and prescribed burns that become uncontrolled are all ways a wildland fire can start. Equipment or vehicles with a combustion engine such as logging or construction vehicles, or ATVs are able to eject hot particles from the exhaust which can initiate a fire. Fires caused by railroads can occur from rail operation, cargo and sometimes the employees. A comprehensive list of fire classifications and fire cause categories are listed in NFPA 921.

### Factors that Affect Wildfires

In the same manner that there is a fire triangle composed of heat, oxygen and fuel, there is a fire behavior triangle. The fire behavior triangle applies to a fire that is already ignited and the behavior of the fire will depend on the three factors; weather, topography and fuel. A change in any one of these factors during the fire will alter its behavior. Drought, lightening, rainfall, winds, humidity, and heat can initiate, grow and/or potentially deter a fire. Wind is especially critical in the development of a wildfire since it supplies oxygen and can move and direct hot embers as well as the fire itself.

The topography, or surface features of the land, can affect the fire development and spread. In general, the steeper the slope, the quicker fire can move up a hillside. Radiation and heat transfer typically increase as you move up the slope, making fire increase up a hill or mountainside. Canyons, bodies of water and ridges can also influence fire behavior. In a wildfire, fuel is any material that is capable of burning. Some common examples include vegetation, trees, and human structures. Moisture content, density, and composition of the fuel will affect its overall flammability. Vegetation, trees, needles, grasslands suffering from drought conditions and/or excessive amounts of dead tree debris will act like kindling and have a high degree of flammability. An experienced fire investigator will understand and consider how topography, weather and fuel affect the wildland fire and use that information to help recreate the scene and determine the area and point of origin.

### Finding the Cause and Origin with fire indicators

In many cases, the goal of the fire investigator is to determine the cause, area and point of origin, and ignition sequence for a wildland fire. The point of origin is important to identify because it is the exact physical location within the ignition area where a heat source and the fuel interact, resulting in a fire. The investigator must evaluate the conditions that bring together the ignition source, fuel and oxidizer.

First responders and witnesses are a great resource and can be interviewed at the scene. They can provide the investigator with some insight into the area of origin or critical clues of the fires general origin location. Even though wildland fires can be unpredictable as they blaze through acres of land, their characteristics can be predictable and are generally identifiable by fire indicators. Some important fire indicators are described here.

<b>Type of Fire Indicator</b>	<b>Description</b>
V or U-Pattern	A horizontal ground surface burn pattern that is best seen from above. The fire's area of origin is usually located at the base of the V.
Angle and Depth of Char	The angle of the char indicates the direction of fire spread. An advancing fire will leave evidence of a char angle that is steeper than the slope. The deepest area of charring on the timber or other fuel typically indicates that it was facing the oncoming fire.
Freezing	Leaves can be "frozen" by the extreme heat in the direction of prevailing winds created by the wildland fire.
Curling	Green vegetation curls inward toward the direction of the fire or source of heat.
White Ash Deposits	White ash deposits can be the by-product of combustion. Larger amounts of white ash will be created on the sides of objects exposed to larger amounts of heat and flames. The pattern of ash dispersion can also help determine the wind direction at the time of the fire. Fuels facing the advancing fire can appear lighter on the side facing the oncoming fire.
Cupping	A concave or cup-shaped char pattern can form on small vegetation elements due to the directional nature of heat transfer during the fire spread.
Grass stem	The charred remains of grass stems will have different appearances depending on the fire spread.

An investigator will use fire indicators to work through a fire scene to help identify the area and point of origin. Locating and mapping out the observed V-pattern of the area gives the investigator a field in which to locate and assess burn patterns on trees, ash deposits, vegetation curling, charring of grass and other indicators to help point to the direction of the fires advance and ultimately the area of origin. The point of origin is within the area of origin, typically located in the cup of the V-pattern. The fire at the point of origin will move outward in a circular motion from the ignition point and fire indicators can confirm this movement. There may be more than one point of origin in some fires, so it is imperative that an investigator understand fire indicators.

Utilizing information on weather conditions during the time of the fire, topography and examining the clues (fire indicators), a smaller area containing the area of origin can be located. The point of origin can be elusive and is generally contained in a small area. Pinpointing this area requires investigators to walk the area in specific patterns (grid search) searching the ground for any evidence. Carefully sifting through ash, soil or debris is done in order to attempt to uncover an ignition source. There are cases where the ignition source is consumed in the fire. However, many fuel residues will remain in the ground surface areas and can be collected for evidence and analyzed. Eye witness and first responder accounts can also provide invaluable information about the area and point of origin, and potential ignition sources

## Conclusion

A wildland fire scene and investigation is extremely complex and may present many challenges to an investigator. It is important that an experienced wildland fire investigator is engaged to determine the cause and origin for cases involving litigation. The team at Gossman Consulting employs the scientific method for any fire scene evaluation. We are trained and experienced in tracking and locating fire indicators crucial to determination of the cause and origin of any fire.

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