

on a scheduled and an “as-needed” basis. The Federal aircraft accident fatalities include two lead plane pilots and two helitack crewpersons killed in a helicopter crash that also killed the contractor pilot.

❑ Vehicle accidents while traveling to the fire, at the fire, and while returning from the fire resulted in 25 fatalities (18%) from 1990 to 1998 (Figure 11). Volunteers accounted for 18 fatalities (72%), with a preponderance (total: 12, 48%) occurring in the Southern geographic area. The high rate of fatalities volunteers suffer from vehicle accidents may be a result of infrequent opportunities to drive the engines. Other factors may include volunteers’ areas of response being more congested than the Federal and State wildlands, the heavier weight (and longer braking distances) of rural engines compared to the Federal engines, and possibly the age or condition of engines obtained through the Federal excess property program. A disturbing fact in vehicle-caused fatalities is the number of firefighters killed while riding outside engines: these individuals are often killed by being thrown off an engine (Figure 12) or by being crushed when the engine leaves the road and rolls over them. Four Federal employees died in vehicle accidents related to wildfires. Three were transporting supplies from fire caches to an incident when the accidents occurred, and a fourth was enroute to a fire when his vehicle was struck by a stolen pickup truck.

❑ Falling snags (dead standing trees without leaves or needles in the crowns) killed five wildland firefighters. Although this hazard has resulted in relatively few deaths, and only one has occurred since 1992, the risk of death or injuries from falling snags remains a serious concern. The deterioration of forest health in the Western United States has resulted in enormous areas of forested land becoming susceptible to wildfire. Snags typically have much lower fuel moistures than live green



Figure 11—Vehicle accidents were the fourth-most-common cause of fatalities for persons who died while involved in fighting fires from 1990 to 1998.



Figure 12—Firefighters who ride outside an engine can be killed when they are thrown off or when the vehicle rolls.

trees and burn more readily. In the process, they often throw spot fires far in advance of the main fire, and often burn through more quickly than green trees, falling with little or no warning. The risk of injuries from falling snags increases during the night operational

period when visibility is greatly reduced. While the cooler nighttime period is generally a more effective time to gain control on wildfires, the increased risk from unseen falling snags may limit the widespread use of crews at night in areas of dead and dying timber. 

Burnovers

Burnovers are the leading cause of death. Fifteen separate burnover events from 1990 to 1998 killed 39 firefighters (Figure 13). Twenty were killed in two incidents. Six firefighters died on the Dude Fire in Arizona in 1990, and 14 died on the South Canyon Fire in Colorado during 1994. Both fires occurred during extreme conditions and have been thoroughly investigated and analyzed to learn lessons that will help other firefighters and fire managers prevent such tragedies from recurring. Another 13 burnover events killed 19 firefighters. What can we learn from those burnovers?

Phase of the Fire

Most of the burnover events occurred during the initial attack or extended initial-attack phase. This is when the firefighters are often involved in independent action, either as members of a small crew, an engine, or even as individuals. The higher level incident management teams are not on the scene, communications may be confused, fire weather and behavior conditions may not be widely known or recognized, and the chain of command may not be well established.

Transition Phase

The other dangerous phase of a wildfire is the “transition phase,” when the fire has escaped initial attack efforts and higher-level incident management teams are being brought in. During this phase, some confusion may exist over areas of responsibility; locations of different resources such as crews, engines, or line overhead; or appropriate radio frequencies for tactical operations. This is often the time the fire is exceeding the capability of the initial-attack resources.

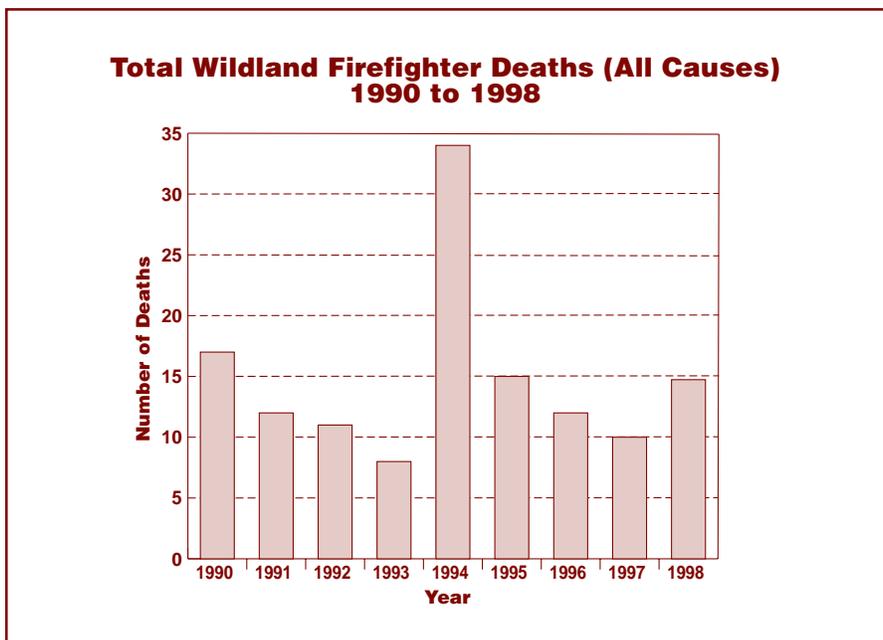


Figure 13—The increasing number of entrapments raises concerns that the number of fatalities might increase as well.

Strategies and Tactics

Many of the wildland fire fatalities from burnovers can be directly attributed to the failure to follow the basic guidelines that are the basis for all wildland fire strategy and tactics:

- 10 Standard Fire Orders
- 18 Situations That Shout “Watch Out”
- 9 Guidelines for Downhill Line Construction

These situations, orders, and guidelines have been synthesized by Paul Gleason, former Superintendent of the Zig Zag (Oregon) Interagency Hotshot Crew, into one easily remembered acronym, LCES. The letters stand for “Lookout, Communications, Escape Routes, Safety Zones.” These guidelines will help firefighters stay out of burnovers on a wildland fire, and should be a key component of future training.

Personal Protective Equipment (PPE)

The lack of PPE, or the failure to use it correctly, has been a direct factor in many of the 39 burnover fatalities. The fire shelter is perhaps the most critical piece of PPE in a burnover situation (Figure 14). In numerous incidents, fatally burned firefighters did not have a fire shelter, and in several others they had shelters but could not readily reach them. Other fatalities have occurred when firefighters attempted to outrun the fire rather than deploy their shelters, or failed to remain inside the shelters after successfully deploying them. The minimally accepted standards for wildland fire PPE can be found in National Fire Protection Association 1977 (1998 version).

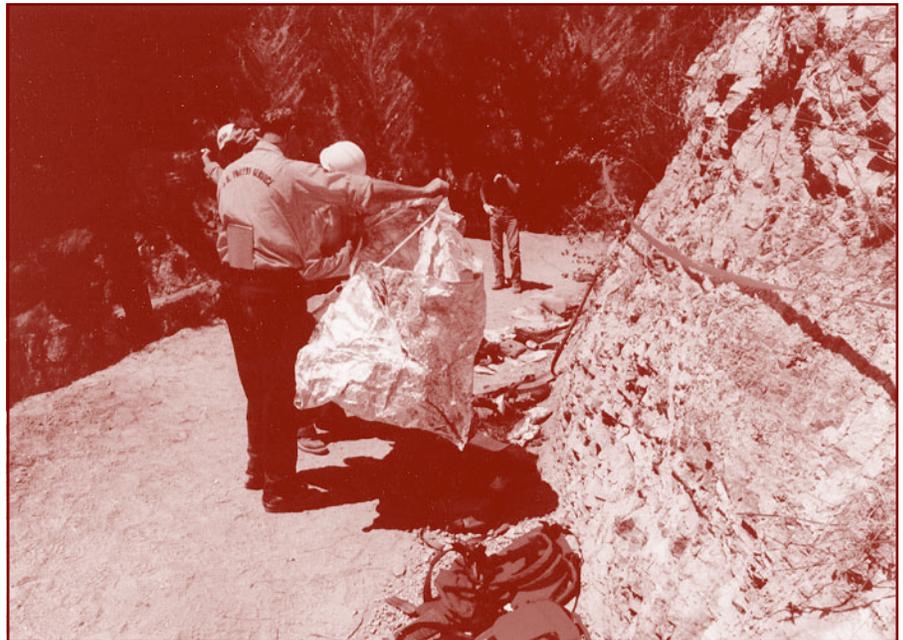


Figure 14—Investigations of fatalities provide information that can save lives.

Discussion and Recommendations

The challenges of wildland fire suppression in the United States are growing with each passing year because of:

- The growing area of wildland-urban interface where increased values-at-risk affect traditional wildfire suppression techniques.
- The changing wildland fuel conditions, often resulting from past fire exclusion policies, make the wildlands more flammable and increase the size and intensity of many fires.

- The implementation of the Federal Fire Policy Review, more clearly defining the areas of wildfire suppression responsibility for Federal and State wildfire agencies.
- The age and experience levels of fire managers and wildland firefighters, combined with the trend to downsize government at all levels.

Because of these factors, it is essential that positive steps be taken to ensure the safety of fire personnel during

wildland fire operations. The main components of a program to successfully reduce fatalities and injuries include:

- Individual responsibility
- Training and qualifications
- Strategy and tactics
- Personal protective clothing and equipment.