
“We’ve made huge improvements in how we address firefighter safety. It has been painfully slow, though. All things are doable over time; it’s just the speed of change that is difficult. We will change over time, but do we want to wait 20 years and sustain the 20 firefighter deaths per year and increasing public deaths?”

—Type 1 Incident Commander, Society Focus Group

A 10-year review of accidents and incidents within the USDA Forest Service wildland fire system.

USDA Forest Service photo by Jace Jacobs.
Abstract

This document seeks to describe the wildland fire system and culture within which U.S. Department of Agriculture, Forest Service employees operate. To do so, this review presents a narrative of the Forest Service's wildland fire system based on the opinions, experiences, and perspectives of those who operate within it.

Non-discrimination statement

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer and lender.

Disclaimer

Reference herein to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government, and shall not be used for advertising or product endorsement purposes.
Chapter 3. Conducting this Wildland Fire Metareview

Purpose and Need

“The fire system is as safe as the fire system can be until we change the system itself. Unless you retool the entire system, we’re going to stay here. This is our accident rate.”

—Assistant Regional Fire Director, Fatalities and Injuries Focus Group

The primary objective of this metareview was to detect and study patterns of fatalities and injuries with the intent of proposing system-level changes in wildland fire operations. Recommendations for systemic change were developed by exploring data from existing learning products and through consultation with agency field personnel, external subject matter experts, and Forest Service leadership. The recommendations offer potential ways to improve the safety culture of the entire organization while specifically working towards reducing the number of fatalities and injuries in wildland fire operations. This report also offers a potential framework for a continued learning plan (chapter 13). The framework suggests short- and long-term learning goals that would carry the momentum of learning started here into the future.

To begin the metareview, the wildland fire system first had to be recognized as complex (see sidebar to the right). Doing so enabled the entire system and its dynamic behavior to be looked at rather than just its individual parts. To do this, the importance of context was emphasized in understanding why things happen, what needs changing, and what has already changed. Looking at incidents within the context they occurred allows interactions, conditions, and circumstances that shaped the actions and assessments of incident-involved personnel to emerge (see “Does an Acorn Cause an Oak Tree?” on page 11). Doing so permits others to look past the decisions themselves and into what system features influenced the individuals involved.

Simple, Complicated, and Complex Systems

Simple

Parts and actions are known. Relationship between cause and effect is obvious.

Complicated

Some uncertainty, more than one way to do things. Cause and effect relationships are discoverable.

Complex

Inherent variety and uncertainty in a dynamic environment. Requires continuous interpreting and sensing; may lead to surprise.
Does an Acorn Cause an Oak Tree?
Moving from Root Cause to Networked Causality

On the surface it may seem that an acorn can be labeled as the root cause of an oak tree. But upon close inspection, it becomes evident this is not the case. If an acorn was thrown into the ocean, or planted on a saltwater beach, no oak tree would arise to offer shade. The environment, therefore, has a critical role in whether an acorn is able to grow into an oak tree, meaning an entire network of factors is necessary for an oak tree to come to be.

When you apply this thinking approach to unintended outcomes, even in a situation where you can find a “single seed” to account for an event, the theory of a single root cause does not hold. Accident investigations, like oak trees, are heavily influenced by the surrounding environment. In the simplest of accidents, something similar to a seed may be found, like a decision or action. But finding the “seed” does not tell the whole story of the accident. In more complex accidents, looking for a single seed to tie everything back to is a distraction that can inhibit learning.

The best way we know of to learn from accidents is to look for a network of factors that influenced the outcome. The more nodes of influence we can identify within a network, the more we understand about how the accident occurred and the more likely it is we can find high leverage points within that network to make big changes in the system of work.

This metareview used two complementary processes in a systems-thinking approach, analysis and synthesis, to understand and develop a picture of the wildland fire system. This systems-thinking approach pairs quantitative and qualitative data for a deeper dive that looks at the greater system via its parts and as a whole.

The first process, analysis of incidents and accidents, was used to identify frequency of events and common themes or patterns that might provide opportunities for immediate safety improvements. The analysis looked at the who, what, where, when, and how often of Forest Service employee accidents and injuries that occurred between 2007 and 2016. This analysis, which used a mechanistic view of systems, comprised the quantitative component of this
metareview and provided insight into frequency and types of events by looking at the system’s individual parts.

The second process was more organizational in scope and addressed the how and why of these same events. Instead of just stopping at an action or decision, the bigger context or environment within which the decision or action occurred was also explored. Known as synthesis, this approach comprised the qualitative component of this metareview and allowed the underlying cultural and organizational patterns that influence the wildland fire system to be more deeply understood.

Figure 3-1.—Analysis is a “down and in” approach to understanding the world; it focuses on breaking things down into its parts with the goal of understanding each component. Synthesis is an “up and out” approach to understanding the world; it focuses on what functions or roles parts play within a bigger whole.
Wildland Fire Metareview, 2007-2016

Continued Learning

Want to learn more about the difference between mechanical and systems thinking? Take 70 minutes to watch Russell L. Ackoff’s lecture, “From Mechanistic to Systemic Thinking,” to learn about the evolution of how knowledge and understanding are built and how using both mechanical and systems thinking is important to the learning process. He might just blow your mind!

Opportunity

The Dataset

At the outset, three data sources were considered for this review: the Safety and Health Information Portal System (SHIPS) (in use through December 2014)), e-Safety (January 2015—present), and the Wildland Fire Lessons Learned Center (LLC) database. After carefully looking at each dataset and considering desired characteristics, the LLC database was chosen. Not only did it provide 10 years of continual data, the LLC database also included qualitative information found in case studies, rapid lesson sharings (RLSs), facilitated learning analyses (FLAs), learning reviews, and serious accident investigations. This qualitative data offered opportunities to examine the incidents more deeply within the context they occurred while the other databases provided only quantitative data.

“Reading through every learning product for our dataset was emotionally draining. At times I felt myself mad because there was still no change in some areas; other times I felt sad because the same incident happened even with proactive measures in place. After 2 months of reviewing these vital reports, I was spent and needed a positive project to pull me from the dark place.”

—IOL Team Member

After the database was selected, data points from 2007 through 2016 were collected and compiled directly from learning products hosted on the LLC website. To be included in this review, a data entry had to depict an event that: (1) occurred under Forest Service operational control or (2) involved Forest Service personnel under another agency’s operational control. This filter resulted in 341 entries.

Quantitative Analysis

The 341 event learning products were assessed and categorized by “activity underway” and “mechanism of injury/fatality.” Activity underway is the type of activity the incident-involved personnel were engaged in at the time of the event, such as fireline construction. Mechanism of injury/fatality (accident type) is how the incident-involved person was injured or killed, such as hit by (e.g., rock, tree) or a motor vehicle accident. To understand which activities more commonly resulted in injury or fatality, entries were tallied by category for both activity underway and mechanism of injury/fatality (see figure 3-2 and figure 3-3).
Top 5 by Accident Type (Injuries)

Figure 3-2.—Summary of the top five causes of injuries from the 2007 to 2016 metareview dataset.

Top 5 by Accident Type (Fatalities)

Figure 3-3.—Summary of the top five causes of fatalities from the 2007 to 2016 metareview dataset.

While some patterns did emerge from this analysis, it did not provide much insight into the nature of the system. Rather, it provided a broad-stroke summary of outcomes stemming from the system (see figures 3-4 and 3-5). For more detailed numbers, see the “2007–2016 Metareview Data Analysis” report.
**Figure 3-4.**—Event summary by activity. The black dots indicate the total number of events, while the blue and orange bars depict the total number of injuries and fatalities, respectively.

**Event Summary by Activity**

**Figure 3-5.**—Event summary by accident type. The black dots indicate the total number of events, while the blue and orange bars depict the total number of injuries and fatalities, respectively.

**Event Summary by Accident Type**
Qualitative Analysis

To better understand why the 341 events occurred, IOL team members condition mapped all of the accidents and incidents using the following conditions of influence:

1. Operational influences
2. Signal detection
3. Environmental
4. Individual influences
5. Organizational influences
6. Training/Experience
7. Historical
8. Cultural
9. External influences
10. Guidance, policy, and regulations
11. Communications
12. Equipment
13. Leadership
14. Social relationships
15. Memory items
16. Aviation
17. Assumptive behavior
18. Plan continuation

An analysis revealed over 1,400 conditions across the 341 events. Two social scientists from Rocky Mountain Research Station (RMRS), brought in to assist IOL in mapping trends, used a computer-assisted qualitative data analysis software to recognize high frequency conditions amongst the 1,400 identified. Once the conditions of influence had been ordered, there was an additional analysis of commonalities across accident types and within each condition of influence to uncover major patterns and themes in the data. The detailed results of this analysis can be explored further in the “Wildland Fire Fatality and Injury Analysis” report.

IOL team members then reviewed the qualitative data analysis, noting reoccurring and important themes in preparation for meeting as an internal focus group to combine and prioritize the list of emerging themes.

“The following are the five major themes that emerged from this effort:

1. Fatalities and injuries—why are they continuing to occur?
2. Fiscal incentives—how does the current pay structure affect operational strategies and risk management?
3. Society—how do social and political pressures play into the wildland fire system?
4. Ecological soundness—how do ecological health and land management factors currently play into wildland fire decision making and strategy planning processes?
5. Communication/work environment—what do current successes and failures look like in the context of communication and the wildland fire work environment?
During the internal focus group, discussions reflected on the fact that these themes were not new realizations, but rather had been observed in the wildland fire system in nearly every organizational review previously undertaken.

**Vetting the Themes**

Throughout the spring of 2019, IOL enlisted critical thinkers representing a diverse cross section of the Forest Service (field-going personnel, fire management officers, line officers, regional office staff, and Washington Office staff), along with a select group of academic subject matter experts to participate in five focus groups exploring the themes identified above. Each focus group spent 2 days together discussing the wildland fire system from their perspective, relative to the specific theme of their focus group. All group discussions were audio recorded and transcribed. Additionally, at least one observer captured key thoughts and conversational flow. Discussions highlighted what participants perceived to be working within the wildland fire system and where they saw a need for change. Focus group participants also shared ideas on how to address the challenges in the system. After each focus group, IOL and the academic specialists conducted sense-making sessions in which participants’ observations were discussed in detail to highlight key themes, lessons, and potential gaps.

The transcriptions, first checked for quality and accuracy, were then used to conduct another round of qualitative analysis to identify which topic areas transcended individual focus group conversations. From there a small team was assembled to write a complex narrative based on the quantitative and qualitative analyses, focus group participants’ observations, organizational learning documents, and internal as well as external research contributions. This document is the result of that work.

**Carrying the Work Forward**

While this review serves as a bridge between perspectives of the wildland fire system, it is also a new and distinct step on the organizational journey towards learning; a journey that has been going on for decades in the Forest Service as well as in the broader interagency wildland fire community. One of the outcomes of this work is to encourage more consideration into what the 21st century wildland fire system needs to look like by asking: “what changes, in all aspects of the system, are needed,” just as the participants in the focus groups were asked. As you navigate through this document, nothing should be off limits as challenging questions are asked, because the unimagined has the potential to become the new norm. This chapter, like all others in this review, ends by encouraging you to take ownership in the learning effort and to contribute to the system in your own unique way with the following learning challenge.
Learning Challenge

Gather your work group and discuss the following questions:

Q Which focus group would you have liked to attend and what would you have provided as your perspective? Reference this graphic to see the questions asked in each of the focus groups.

Q Are you surprised by the numbers and accident types shown in the charts in the “Quantitative Analysis” section? How do they compare with the number and type of accidents your unit has experienced?

**Please note that discussing accidents, especially ones that have occurred on their unit or that their personnel have been involved in, may be difficult for some folks.**

Gather your work group and conduct your own focus group discussing the theme(s) (pg. 16) of your choice.

Q From your perspective, describe the “current reality” of the wildland fire system as you see it. How do your “lived experiences” compare to each other’s?

Q What changes could be made to improve the wildland fire system? Don’t limit yourself—think big!

Q Think about changes from the context of: what barriers are preventing those changes from being made, how much effort would it take to overcome them, and then, if implemented, how much change they would create, either locally or organizationally?

Q Draw the quadrants demonstrated in the graphic to the right on a white board and use sticky notes to mark where you think your idea fits. It’s important to not only focus on organizational level changes but also on changes you could make within your own work group.

Once you’ve completed the exercise, as a group choose an idea to invest in. Develop a plan, communicate it, and execute!

Figure 3-5.—Change impact chart. The horizontal axis represents the difficulty of implementing change; the vertical axis represents how much of an impact the change would have if implemented.

Then tell us about your experience participating in this challenge at this team learning link!
Endnotes


4  **Public Law 107–203.** 107th Congress. (24 July 2002)


7  **U.S. Department of Agriculture, Forest Service. 2015.** The rising cost of wildfire operations: effects on the Forest Service's non-fire work. 16 p.


