Fire Management *today*

Managing Wildland Fire in a Pandemic

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IN THIS ISSUE

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GUIDELINES for Contributors

The Multiplication of Risk Related to the COVID-19 Pandemic

By Bill Avey
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Fire and Aviation Management
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Over the last 2 years, we have continued to characterize fire activity across the country as unprecedented and recordbreaking; it has challenged our wildland fire response system and all of us who are a part of it. Of course, another factor over these past 2 fire years has added dramatically to that challenge, the likes of which we have never had to address before in the modern era—the COVID-19 pandemic.

The pandemic has posed many challenges to our wildland fire management operations, from the health, staffing, and adaptability of day-to-day operations on the ground to impacts on the global supply chain, which have caused intermittent shortages of fire equipment, vendors, and materials.

This issue of *Fire Management Today* contains articles discussing how the Forest Service and its partners have found solutions to these challenges. One article ("How Covid-19 Tested the Forest Service's Wildland Fire Learning System") looks at how organizational learning played a critical role in adapting best practices and procedures for day-to-day operations. The 2020 fire year was truly a test of a learning system and culture that have evolved from the agency's inception. Since none of us had

experience with fire operations in a pandemic, wildland firefighters had to adopt new ways of managing landscape-scale wildfires at a pace and extent never seen before in a single fire year. The collective wildland fire organization and its people learned and adapted in realtime. As our understanding of the challenges of fighting wildfire while responding to COVID-19 continues to evolve, the Forest Service's learning system and our ongoing efforts to communicate, overcome roadblocks, innovate, and share and integrate innovations into the organization will become more important than ever.

> **The 2020 fire year was truly a test of a learning system and culture that have evolved from the agency's inception.**

Another article ("An Applied Process for Learning During the COVID-19 Pandemic") examines how we communicate and gather timely, effective feedback and observations about the pressures of dealing with COVID-19. The pandemic was

bound to complicate wildland fire management during what promised to be a difficult fire year, and the Interagency Wildfire Risk Management Assistance (RMA) team and senior leaders in the Forest Service needed information from the field to help make executive-level decisions and mitigate COVID-19 risk. To improve decision making and chart a course forward, Forest Service leaders employed focus groups to gather extremely valuable data regarding field conditions; changing situations; and the impacts of executive direction, both intended and unintended. The RMA suggested developing a continuous feedback loop to ensure that information could flow quickly and directly in realtime between leaders in the wildland fire organization and field-level employees.

During the last 2 fire years, we have adapted by increasing the role of virtual support in our operations. The article "Incident Management Remote Response" analyzes the impact of the new virtual technology being incorporated into our operations and

ANCHOR POINT

how it has the potential to mitigate the spread of COVID-19. Virtual support increases the personnel pool available to support wildland fire management by tapping into a virtual workforce that might be available only after hours or on weekends. The increased connectivity associated with a virtual workforce has also resulted in increasing the quantity and quality of knowledge sharing. In the recent past, we would gather twice a year to exchange notes. Now we are sharing information on a weekly or biweekly basis. Another efficiency gained through Incident Management Remote Response was applying real-time lessons learned. When the first team went out in March 2020, teams across the country waited to hear how fire operations in the context of the pandemic would go. They didn't have to wait long. Representatives from every geographic area coordinating center across the country were able to get timely information on what to expect.

As the pandemic continues, we continue to respond to fire under elevated risks. We have taken great precautions to mitigate these risks by following the CDC Community Levels with respect to mask wearing, testing implementations, keeping records electronically instead of on paper, supplying hand-washing stations, and arranging for food catering with physical distancing. We all know that mitigating COVID-19 risk does not mitigate all of the risks related to wildland fire management, but COVID influences many areas of our operations. Being cognizant of mitigating COVID-19 will not only ensure the health and safety of our firefighters and their families and communities but also serve to help keep us better staffed and ready to respond when and wherever we are needed. ∎

Fire Management today

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Incident Management Remote Response

Telegraph Fire, Arizona. Photo: Andrew Avitt, USDA Forest Service.

Bea Day and Jason Kuiken

During the 2020 fire year, the COVID-19 environment presented incident responders with novel challenges. Incident Management Remote Response (IMRR) was born out of the need for rapid information sharing.

NATIONAL INFORMATION-SHARING CALL

In April 2020, a number of COVID-related planning efforts were going on across interagency entities, including among area command, geographic area coordinating centers, and risk management assistance teams. Leaders were trying to figure out how the national wildland fire response could and would occur in a COVID-19 environment.

In incident commander calls across several geographic areas, everyone was asking the same questions and doing the same planning. However, the suggested best management practices were just ideas at that point. No one knew whether they would work.

The need for a regular national call to facilitate real-time information sharing soon became apparent. A call would let teams going out on assignments share what was working and what was not. The national call became a grassroots effort that took on a life of its own, with everyone embracing the forum for information sharing. When the first team went out, everyone on the call waited with bated breath to hear how things went.

The first incident commander call had every geographic area coordinating center represented. The grassroots effort has since grown to over 2,000 interagency participants across all functional areas. The national information-sharing call is a central part of IMRR, which is made up of a core group that includes command and general staff positions, agency administrators, and medical unit leaders. Although IMRR is not an officially chartered organization, the core group and functional areas met regularly throughout 2020 and 2021.

BENEFITS

IMRR has created an environment where incident management personnel can share, communicate, and collaborate on issues facing the incident management community. The forum also offers opportunities to engage subject matter experts and leaders as issues develop. IMRR has expanded beyond pandemic issues and has become a platform for sharing and solving problems throughout incident management.

Bea Day is an incident commander for the Forest Service, National Incident Management Organization, Washington Office, Washington, DC; and Jason Kuiken is the forest supervisor of the Stanislaus National Forest, Sonora, CA.

Three key benefits came from the 2020 IMRR calls:

1. More consistency between incident management teams (IMTs);
2. Real-time applied lessons learned; and
3. Added capacity through virtual and remote technology.

Since IMRR began, IMTs have increased the consistency of their processes. For example, check-in processes used to vary from team to team; it was a point of consternation for many wildland fire personnel because the check-in process changed every time they moved to a new incident or worked for a new team. In the past, IMTs tried to be different and better than other teams. Through IMRR, they started coming together collectively as practitioners to make a difference, creating new efficiencies in their work.

Another efficiency gained through IMRR was applying real-time lessons learned. People on the calls would describe how they were dealing with a situation, and others would take notes and learn from what they were hearing rather than having to reinvent the wheel. That virtual ability was something that the wildland fire community never really had before, opening up new avenues of communication and information sharing. The ability to network, solve problems, and adjust course within days rather than months was revolutionary.

IMRR SURVEY

Throughout a severe fire year, IMTs used IMRR to learn on the fly, think outside the box, and do things that had never been done before, including using virtual and remote personnel to support operations on incidents as well as distributed operations. In fall 2020, after peak fire activity, the IMRR group conducted a survey with over 400 responses.

Eight themes emerged from the survey, which the IMRR group presented to the National Incident Commander/ Area Commander Council during its 2021 meeting:

1. *Virtual integration:* How people operated in the virtual/remote environment and how they integrated with the IMT they were working for.
2. *Distributed operations:* How people conducted operations when they were not located at the incident command post and how they can make operations efficient and sustainable in future incidents.
3. *Consistency:* How people did their best to get through the fire year and the extent to which everyone was doing things differently, with multiple transitions resulting in inconsistencies.
4. *Continued IMRR calls:* Whether people were in favor of continuing the calls.
5. *Standardized electronic process:* Whether electronic processes were standardized in all functional areas.
6. *Technology infrastructure:* Whether people found shortfalls in the capacity for technology within IMTs.
7. *Personnel continuing education/ training:* How wholesale changes in programs, technology, and processes highlighted the changing environment and the need for more training.
8. *Personnel retention:* How to counter uncertainties related to changes in incident management and how to keep people engaged and IMTs staffed.

The results, including the eight themes, were shared with almost 900 people in an all-hands call with the interagency wildland fire community.

RECOMMENDATIONS FOR CHANGE

In early 2021, the National Multi-Agency Coordinating Group (NMAC) asked the National Incident Commander/Area Commander Council to work with the Coordinating Group Advisory Council and the Predictive Services Oversight Group to:

- Consolidate the IMRR findings;
- Evaluate the remote situation unit in the Predictive Services Oversight Group for possible assimilation into IMRR;
- Develop recommendations for each finding;
- Prioritize the findings/ recommendations; and
- Deliver the results to NMAC by March 15, 2021.

During facilitated breakout groups at its national meeting, the National Incident Commander/Area Commander Council discussed recommendations for future change in the Incident Management System. The group came up with five recommendations and prioritized them for NMAC so it could determine which organization should receive the recommendations (whether the National Wildfire Coordinating Group, the Fire Management Board, or another entity). Recommendations were in the five areas described below.

Common Themes from Survey

Virtual Integration	Distributed Operations	Consistency	Continued IMRR* Calls
Standardized Electronic Process	Technology Infrastructure	Personnel Continuing Education/ Training	Personnel Retention

*Incident Management Remote Response

IMRR Findings

1. Remote Incident Support Team (RIST) Framework
2. "Distributed Operation Strategy" Definition
3. Technology
4. Virtual Status within Interagency Resource Ordering Capability
5. "Virtual" and "Remote" Definitions
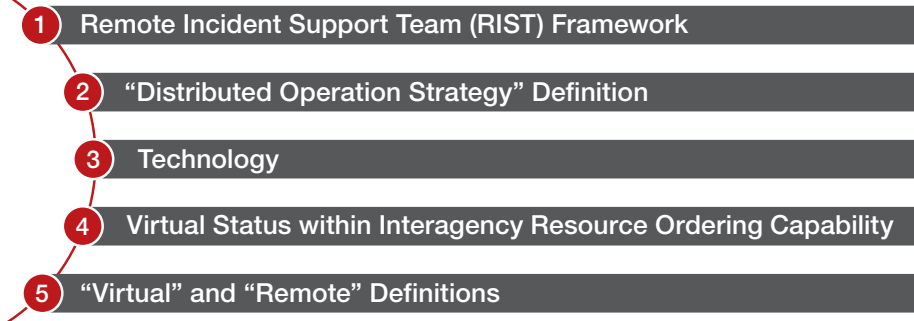
The Remote Incident Support Team

A Remote Incident Support Team (RIST) is designed to augment and support IMTs when they can't fill rosters, find resources, or complete work due to ever-evolving incident needs. The RIST is led by a coordinator who brings in support staff from functional areas as needed on incidents or by IMTs. Flexible in composition, a RIST might include both remote and virtual resources to support single or multiple incidents, IMTs, and organizations at various geographic scales (local, regional, and national).

In summer 2021, a Southwest RIST was launched as a pilot program, an opportunity to begin developing a national RIST framework. Drawing on the existing Northern Rockies remote situation unit model, the RIST model offered expanded support services, including additional plans functions, information, and finance support. A virtual workforce can tap into personnel not traditionally available for field assignments, increasing workforce capacity. It sets the stage for broadening discussions about changing the way we do business in the future.

Distributed Operations Strategy

In 2020, the COVID-19 virus forced wildland firefighters to disperse from traditional large incident command posts into smaller camps using the "module as one" concept. Support for remote camps has been practiced for many years; in early 2020, the IMRR group searched for a systematic approach but could not find a definition or description of the system. Instead, the group borrowed the term "distributed operations" from the military; it applies to the distribution of troops in theaters of operation, including systematic coordinated support. Definitions of "distributed operations strategy" and "drop point" were submitted to the National Wildfire Coordinating Group for its glossary of terms, along with updated definitions of "base" and "camp" to logically align with new terms.

Additionally, tactics to support the distributed operations strategy are being formulated, including field logistics, options for meal distribution/supplementation, resupply workflows, camp sanitation/infrastructure, real-time operational adjustments, and so on. Risk management discussions related to distributed operations strategy are being planned, including strategic mission-based risk assessment, tradeoff analysis, incident-within-an-incident plan implementation, and so forth. In addition, plans are underway for technology and development of alternative, supplemental, and modified (hybrid) subsistence (shelf stable food boxes, military rations, self-sufficient feeding systems, enhanced movement/delivery systems, and so on) in conjunction with the end users (operational resources).

COVID has given the Forest Service a new perspective on risk management, augmenting the progress made in recent decades. Sometimes, you have to step back to see how far we have come in the agency. Ten to 15 years ago, the Forest Service expressed zero tolerance for fatalities, but we have now moved away from that. However, we still have a long way to go in defining the risk we are willing to take.

The Forest Service began talking more about risk 5 to 10 years ago, but the difference between risk and exposure wasn't well defined. The pandemic has highlighted the differences between and among real-time risk as well as operational, strategic, and enterprise risks. COVID has helped to refine and accelerate the risk program within the agency and with its interagency partners.

The challenges ahead are most daunting when we face them alone. They're not as daunting when we can look at them collectively through IMRR. We can then lean more into the idea of a "team of teams" and change our approach.

Technology

Various concerns arose regarding the availability and adequacy of the technology needed to meet agency and responder expectations, including:

- Inadequate connectivity at the incident command post and spike camps;
- Service interruptions during transitions between IMTs;
- Failure to meet host unit expectations because IMT members do not have training or expertise in the areas needed;
- Limited funding for infrastructure, equipment, staffing, and contracts; and
- Lack of agency support for personnel and equipment.

Related recommendations include asking the Wildland Fire Information and Technology program to adopt a national contract for internet connectivity. An order for a data contract would then come automatically with an order for a type 1 or type 2 IMT (in the same way that teams use caterer and shower contracts).

> **If you're standing back and looking at a dense forest, you might not believe there's a pathway through. But once you start talking to other people, you begin to realize that there's not only a path but also a way to get through.**

Changes in the USDA Chief Information Officer organization and policies have affected the ability of IMTs to support agencies and the public. Proposed solutions include:

- Internal messaging for use in case of an incident-within-an-incident emergency;

- Obtaining and maintaining the minimum bandwidth needed to support an incident, including transfer rates and total bandwidth;

- Using specific apps that are not currently available to IMTs; and

- Finding ways to provide continuity during IMT transitions, such as assigning licenses to an incident and not an individual, using consistent email systems and maintaining mailing lists, using consistent meeting protocols, and identifying methods to reduce data transfer during transitions.

Interagency Resource Ordering

In the interagency resource ordering capability (IROC) dispatching system, a resource's availability area is recorded as local, State, regional (a geographic area), or national. If personnel are working in a remote capacity, they are typically required to travel to a work location. However, the system can't account for responders who are available to support incidents virtually without traveling.

As recommended, a request went to the IROC change board to add "virtual" as a resource availability area, a change that was accepted. Adding "virtual" as a status to IROC:

- Gives a more realistic picture of resource availability, which might possibly also include full- or part-time availability;

- Improves resource availability in functional areas that are in highest need, such as finance, planning, public information, liaison, and logistics;

- Reflects current reality in incident support and involves more of the workforce in incident management;

- Improves efficiencies and reduces cost and risk for some incident responders;

- Reduces the burden on local dispatches of tracking the availability of virtual resources;

- Reduces the burden on IMTs of finding resources through word of mouth to fill unstaffed positions on rosters or in support functions; and

- Allows virtual work, thereby promoting employee physical and mental health by reducing exposure to risk and alleviating concerns about safety and health.

Through IMRR, people are figuring out how to work together in new ways, creating teams from various agencies and organizations. The IMRR functional groups are finding ways to gain efficiencies and improve the system. Virtual work can change the business of supporting suppression operations for the better. Remote or virtual resources can help make teams for risk management, public information, finance, and buying more efficient.

Virtual and Remote Definitions

In addition to adding "virtual" as a status in IROC, formal definitions for "onsite," "virtual," and "remote" were proposed for the National Wildfire Coordinating Group glossary. During the 2020 fire year, language describing remote and virtual responders continued to be misunderstood and used interchangeably.

A clear distinction between the terms allows IMTs to clearly delineate how incident responders staff their organizations and where resources are located. After the 2020 field season, new definitions were proposed for all three categories. The proposed new definitions are under review.

NEW WAY OF DOING BUSINESS

In the wildland fire community, we are not going back to how we did business in the past. People are figuring out a new way of doing business with tools and capacities that we've never had before, but we need to strike a balance between the virtual and face-to-face sides of our work. We are human, and we need human connections. We don't yet know the longer term consequences of not meeting together in person for advanced leadership and incident management training.

However, as we move through 2021 and beyond, IMRR calls continue to bear fruit. Collective knowledge is growing as various functions join the incident commander and other kinds of calls. Instead of sharing knowledge twice a year, we are sharing it on a weekly or biweekly basis. As painful as coping with COVID during a severe fire year was, we came to realize that we had more capacity, individually and collectively, than we might have thought. Now we can see pathways forward that we did not see 2 years ago.

If you're standing back and looking at a dense forest, you might not believe there's a pathway through. But once you start talking to other people, you begin to realize that there's not only a path but also a way to get through. We've learned how to stand on each other's shoulders in a different way to get past hurdles.

We can keep building a team of teams. Operating together rather than alone, we can find a path forward, if we keep the synergy going, knowing that our teams will not look the same in 5 years. Five years from now, we'll look back and think how far we've come in incident management. ∎
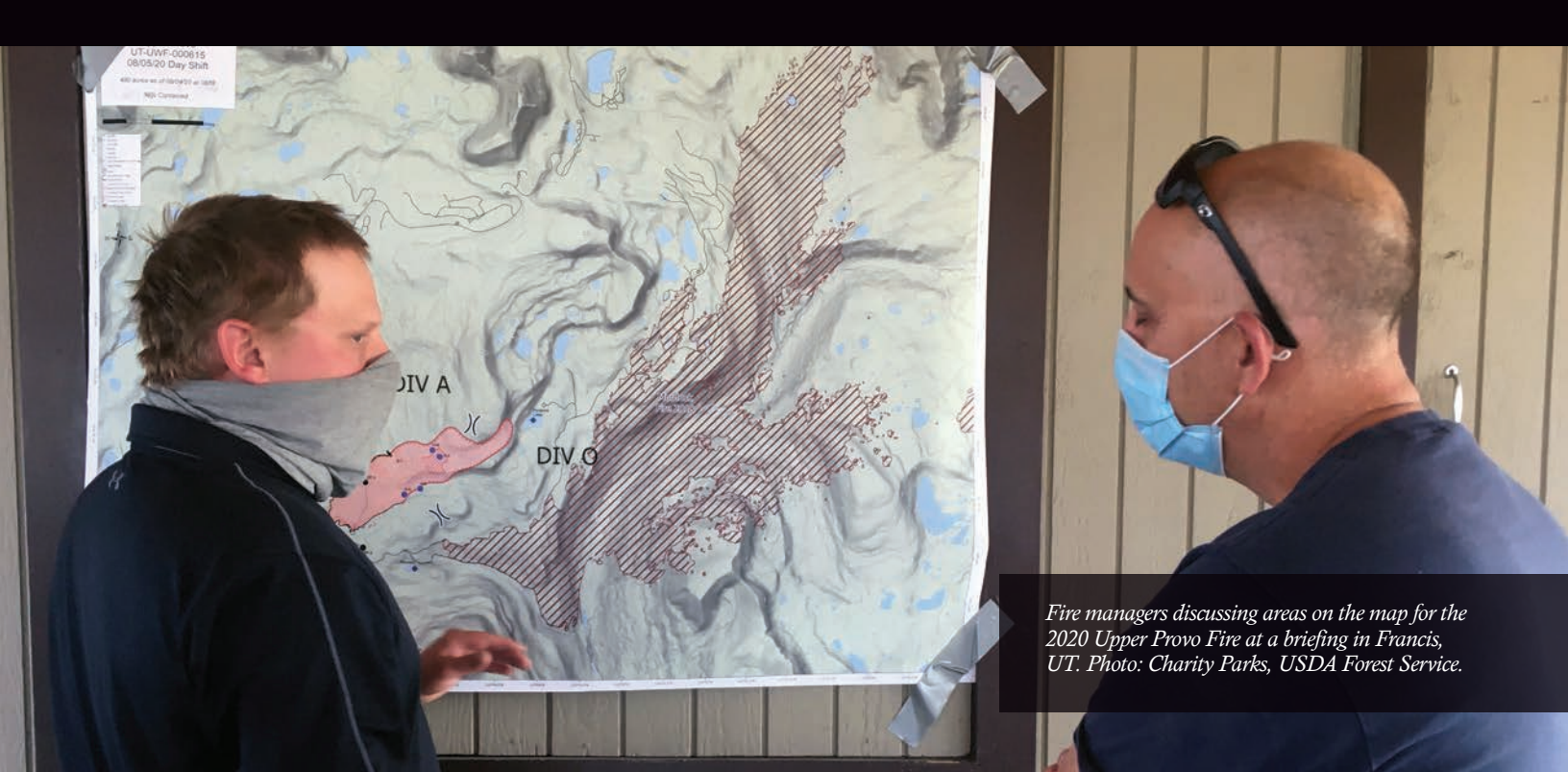
Fire managers discussing areas on the map for the 2020 Upper Provo Fire at a briefing in Francis, UT. Photo: Charity Parks, USDA Forest Service.

COVID-19 and Wildland Fire Management: Toward Solving a Wicked Problem

Satoris Howes and Rebekah Fox

On January 9, 2020, the World Health Organization reported the presence of a new coronavirus-related pneumonia. Eleven days later, the United States reported its first case. Ten days after that, the World Health Organization issued a global health emergency. By March 11, COVID-19 was declared a pandemic.

At the national level, it was unclear what should, could, and would be done. However, two things were clear to wildland firefighters:

1. The evolving pandemic could not be ignored, and
2. Wildfires would continue to grow in intensity during the 2020 fire year.

With this in mind, in March 2020, the Forest Service began to stand up working teams to address the threat posed by COVID-19.

INITIAL QUESTIONS

During the early days of the pandemic, Forest Service employees struggled to understand the threat posed by COVID-19 and how it might affect the agency's fire management goals. The Centers for Disease Control and Prevention (CDC) posted a unique document intended to help wildland firefighters ask (and answer) specific questions related to wildland firefighting and the risks posed by COVID-19 (CDC 2021 (revised from 2020)). For example:

- "What precautions should wildland firefighting personnel take when they come off assignment and return back home to their families?"
- "What about exposure to wildfire smoke and COVID-19?"
- "What precautions should be implemented for protecting firefighters and other personnel at fire camps?"

The answers to the CDC's three questions were not simple, and the steps taken to mitigate the threat from COVID-19 occasionally seemed to be at odds with the goals associated with efficiently managing wildland fire. For example, one way to reduce exposure to the virus was to limit the number of people who could travel together to a fire in one vehicle; but this meant that more vehicles would arrive, creating congestion and parking problems. It was as if attending to one problem complicated or even undid efforts to solve a different problem within the system.

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THE WICKED PROBLEM

Almost 50 years ago, the label "wicked" was first applied to problems that are particularly "malignant, vicious, tricky, or aggressive" (Rittel and Webber 1973). The "wickedness" lies in the unusual difficulty of finding solutions to problems that are hard to describe, unprecedented, and extraordinarily complex; have innumerable causes; and seem to have no correct solution, thereby making them difficult to predict or address with any degree of certainty.

Three key features help determine whether a problem is indeed wicked (fig. 1) (Head 2008):

1. One defining feature is the *complexity* of the problem—that is, the degree to which it has subsystems and interdependencies.

2. Another feature is the degree of *uncertainty* regarding risks, consequences of actions taken, and changing patterns.

3. Finally, *value divergence* also defines the problem, which is associated with viewpoints, values, and strategic intentions that can be rather disconnected.

Most persistent problems will likely demonstrate some degree of each of these characteristics; however, when all three features are at a high level, the problem becomes wicked and requires a new approach to finding solutions and making sustainable progress.
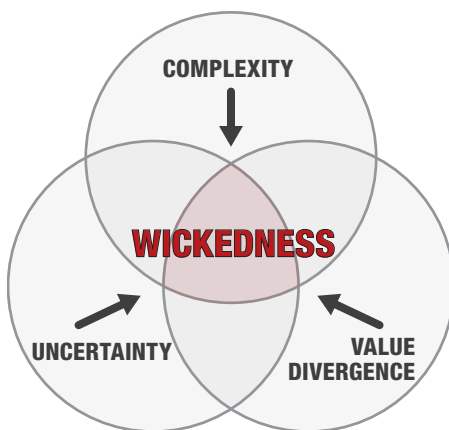
Figure 1—Wicked problems have high levels of all three defining features ((Head 2008).

> **What fire managers have come to expect about managing wildland fire is turned upside down by COVID-19.**

The features can be used to pinpoint ways of addressing such problems.

Based on Head's (2008) conceptualization, the impact of COVID-19 on wildland fire management resulted in a wicked problem in that the levels of complexity and uncertainty were high and viewpoints on solving the problem were very fragmented. In this article, we address the complexity, uncertainty, and value divergence that created a wicked problem regarding managing COVID-19 during the 2020 wildland fire year. We also discuss attempts by the Forest Service to solve this wicked problem through weekly focus group discussions with wildland fire personnel.

THE WICKEDNESS OF MANAGING COVID-19 AND WILDLAND FIRE

Wildland firefighters are used to handling fast-paced situations with a certain amount of complexity, uncertainty, and value divergence. Although the risk assessment process works to manage these variables, fire managers have limited knowledge about how a fire is going to behave and how effective firefighter responses will be. For example, although the wildland fire community has great tools for predicting fire behavior, the increased intensity of climate-driven fires has challenged its capabilities.

Complexity

However, what makes managing COVID-19 and wildland fire so exceptionally complex, from a wicked-problem standpoint, is the difficulty of managing them both simultaneously when they require different approaches. What fire managers have come to expect about managing wildland fire is turned upside down by COVID-19.

The management of wildland fires:

- Occurs in an environment with a fast operational tempo;
- Includes mitigating fairly standard fire-related hazards; and
- Is compartmentalized in such a way that firefighters work to achieve goals and can tell when the goals are reached within a larger system.

However, COVID-19 unfolded very differently:

- As opposed to the fast-paced tempo of firefighting, COVID-19 emerged only slowly (Americans heard about it long before the shutdown and quarantine) and has been enduring (people are still working to manage it).

- Early risk management assessments accounted for the virus as hazardous, but the hazards were not well understood, so the mitigations were not always known or easy to implement. Early on, for example, conflicting information appeared about what personal protective equipment (PPE) was needed and how to purchase and use it. Fire personnel also had no clear information about driving or flying to get to a fire and which was more hazardous.

- COVID-19 challenged expectations about compartmentalizing work because the virus is endemic and ubiquitous. It has to be taken into account in every decision and at every level of decision making. In wildland fire management, intra- and interorganizational personnel often work together to accomplish a common goal, but not all units were interpreting messages about PPE use or social distancing in the same way. Accordingly, an employee might leave a home unit in full PPE compliance but not be in compliance with the receiving unit.

Participants in a Zoom meeting for residents of No Name, CO, to discuss the 2020 Grizzly Creek Fire. Photo: Tom Story, USDA Forest Service.

Uncertainty

The COVID-19 pandemic brought extreme uncertainty in terms of both its magnitude and its duration. Regarding magnitude, the widespread use of social media and the internet to share information led to extreme confusion as personnel tried to sort misinformation, conspiracy theories, and trolls from valid and reliable information (Manganello and others 2020). Even information from sources deemed credible by many (such as CDC) changed over the course of the pandemic, adding to uncertainty. For example, as new scientific insights emerged about how COVID-19 was transmitted, CDC changed its views about the efficacy of wearing face masks and the likelihood that the virus could spread through aerosols. The duration of the global crisis also contributed to uncertainty, surpassing the predictions of analysts on several occasions as they learned more about the disease.

Within the wildland fire community, uncertainty during the pandemic was compounded by the severity of the 2020 fire year. Extreme fire activity in the United States, Australia, Brazil, and the Arctic resulted in the fifth most expensive year for wildfire losses on record (Masters 2021). The Western United States saw what many considered an "unprecedented year of fires," filled with intense wildfires of incredible size and ferocity, leading one fire historian to describe it as an "ancient plague" reawakened (Singh 2020). Although the fires themselves and the ways in which to manage the fires were not necessarily unpredictable, one cause of such extreme fire behavior—global climate changes—has been referred to as a wicked problem in its own right (Peters 2018), particularly with regard to wildland fire management (Chapin and others 2008).

Thus, the heightened uncertainty that emerged due to the combination of the COVID-19 pandemic and the 2020 fire year led to a situation that could easily be described as a wicked problem. Given that uncertainty can lead to poor decision making, negative moods and emotions, and diminished well-being (Anderson and others 2019), the wicked problem that arose was (and remains) an area in need of focused attention and problem-solving in order to ensure proper fire management while also safeguarding the health and well-being of fire personnel and community members.

Value Divergence

Early conversations about COVID-19 revealed dramatic differences in how employees perceived the threat of the virus. To some, COVID-19 was a crisis; to others, it was just another hazard in need of mitigation through a risk assessment matrix.

The discrepancy was partly due to the difference between the problem that fire personnel were used to (wildfire) and the problem that no one was used to (COVID-19). Depending on how people judged the magnitude of the threat, they would respond in different ways. Until clear guidance was handed down about PPE and social distancing, people could interpret messages in different ways, which led to both misunderstandings and conflict.

However, values didn't just diverge at the level of personal comfort and PPE. At the beginning of the pandemic, Governors and other officials encouraged the public to enjoy the great outdoors, including the national and State forests. They wanted to help ease the tension associated with people being quarantined at home for so long. The problem was that agencies lacked the personnel to keep many recreation areas open. Closures led to conflicts between the public and the employees who had to turn people away.

TACKLING THE WICKEDNESS OF COVID-19 THROUGH CONTINUOUS FOCUS GROUPS

On March 13, 2020, the President declared COVID-19 a national emergency. In response, based on CDC guidance, experts in the field, and the best available science, the Forest Service and other agencies adopted emergency action plans to keep the

virus from spreading. To help manage COVID-19 during an active fire year, Forest Service senior leaders asked for information from the field to aid in executive-level decision making and in mitigating COVID-19 risk. Employees in Research and Development suggested a continuous feedback loop to send information quickly and directly in realtime between leaders in wildland fire management and field-level employees. Given the uncertainty associated with a novel and highly contagious virus, leaders wanted continuous data about conditions faced by field personnel as well as about changing situations and the impacts, both intended and unintended, of executive direction.

Continuous feedback would simultaneously reveal the complexity and uncertainty of the situation and highlight potential areas of value divergence. Accordingly, the Forest Service's Human Performance and Innovation and Organizational Learning program initiated weekly focus group discussions with wildland fire personnel representing diverse occupations and positions in the wildland fire system and each Forest Service region. A total of 194 focus groups were conducted. Questions raised for discussion pertained to:

- New information, guidance, and policies related to COVID-19 mitigation and wildland fire management;

- Lessons learned, published on the Wildland Fire Lessons Learned website; and

- Emerging themes and issues from previous focus group sessions.

The focus groups and their learning results are discussed in other articles in this issue, including Flores and others and Conley and others.

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Chumash Engine 802 crewmember cooling the fire's edge during a burn operation on Henness Ridge, Sierra National Forest, CA. Photo: Kari Greer, USDA Forest Service.

The South Zone Gifford Pinchot Fire Crew at the 2020 annual preparedness review. All levels of fire management gather annually to show proficiency in wildland firefighting preparedness, operations, and safety; in 2020, proficiency in COVID-19 mitigation strategies was added. Some of the proceeds from each mask worn in the photo went to the Wildland Firefighter Foundation, which provides logistical support to wildland firefighters and their families in times of need. Photo: USDA Forest Service.

An Applied Process for Learning During the COVID-19 Pandemic

David Flores, Jim Gumm, and Theodore Adams

Wildland fire management is an extraordinary work environment highly influenced by environmental, social, economic, cultural, political, and psychological conditions (Putnam 1995). The office of Human Performance and Innovation and Organizational Learning (HP&IOL) focuses a critical lens on learning and how the multiagency wildland fire community can learn from significant events. HP&IOL is tasked with capturing, analyzing, and describing the complexities that unfold during fire operations and with turning the outcomes into learning opportunities for improving the interagency fire organization. The primary focus is on learning from unintended outcomes.

Beginning in March 2020, the COVID-19 pandemic changed the meaning of work for HP&IOL (fig. 1). The pandemic was bound to complicate wildland fire management during what promised to be a difficult fire year, and the Interagency Wildfire Risk Management Assistance (RMA) team and senior leaders in the Forest Service needed information from the field to help make executive-level decisions and mitigate COVID-19 risk. Given the uncertainty associated with a novel and highly contagious virus, leaders wanted data about field conditions; changing situations; and the impacts of executive direction, both intended

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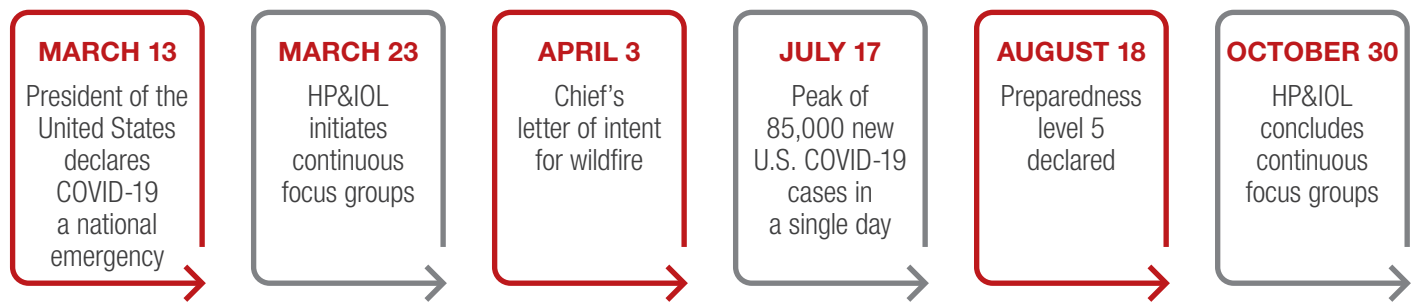
MARCH 13	MARCH 23	APRIL 3	JULY 17	AUGUST 18	OCTOBER 30
President of the United States declares COVID-19 a national emergency	HP&IOL initiates continuous focus groups	Chief's letter of intent for wildfire	Peak of 85,000 new U.S. COVID-19 cases in a single day	Preparedness level 5 declared	HP&IOL concludes continuous focus groups

Figure 1—*Sequence of significant events during the 2020 fire year.*

and unintended. The RMA suggested developing a continuous feedback loop to ensure that information could flow quickly and directly in realtime between leaders in the wildland fire organization and field-level employees.

VARIOUS LEVELS OF LEARNING

To provide continuous feedback in realtime, HP&IOL built on its experience in collecting information to produce learning reviews and the wildland fire meta-review (see HP&IOL publications). Continuous feedback can flow in multiple ways and with varying levels of reliability, depending on time and available resources. To meet the demand, HP&IOL developed an applied process for communication, learning, and decision making. The process includes information collection, data analysis, and report writing, with reliability ranging from low (with limited time) to high (with unlimited time and resources) (fig. 2).
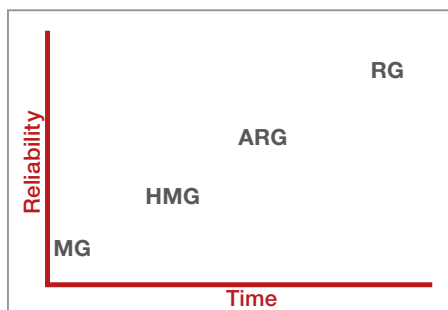
Figure 2—*Levels of reliability and time for HP&IOL research to support communication, learning, and decision making, from low (management grade, MG) to high (research grade, RG). The intermediate levels are high management grade (HMG) and acceptable research grade (ARG).*

Figure 2 depicts the various possible levels of communication, learning, and decision making in response to the COVID-19 pandemic during the 2020 fire year. The y-axis represents the level of reliability of data collection, analysis, and decision making. The x-axis reflects the amount of time available for data collection, analysis, and report writing for decision making. The following four categories outline the structure adopted by HP&IOL to collect, analyze, and distribute information for learning and decision making during the COVID-19 pandemic:

1. Management grade (MG) is the simplest form of data collection and decision making. The director of HP&IOL asks the longest tenured employee for an opinion based on the information collected, and the director makes a decision based on experience. MG is quick and inexpensive; depending on level of expertise and the complexity of the issue, the outcomes are often positive. However, MG is low in reliability because data is limited.

2. High-management-grade (HMG) data collection and decision making involve HP&IOL employees in collecting information, conducting a brief analysis, and writing a rough draft of the results. We increased the reliability of the information by conducting 9 focus groups (with 8 to 15 participants), and we included note takers, reviewers, and writers who developed the HMG document. Reports were provided within very short timeframes, and data collection and communication were as close to realtime as possible.

3. Acceptable-research-grade (ARG) data collection and analysis were conducted by the HP&IOL sensemaking branch, a group of fully trained social scientists who were given more time than the HMG group but significantly less time than a normal research project would entail. This group either confirmed or refuted HMG findings and also discovered "hidden gems" of information and learning through a deeper analysis. The sensemaking branch also teased out the issues unheard and/or voices missed during earlier analysis. Findings were close enough to realtime to offer valuable insight into next steps in the decision-making process.

4. Research grade (RG) is the gold standard, entailing data collection, analysis, and writing with unlimited time and resources. The benefits of RG are extremely diverse; deep thought is invested in an issue, with rigorous learning objectives. Though not infallible, RG has the highest reliability possible in a complex environment. However, the financial cost of RG and the time it takes are both very great.

During the 2020 fire year, HP&IOL determined that reliable information was often needed beyond the MG level. However, limited time restricted the amount of analysis and review available for a full RG level of reliability in weekly reports. To increase the level of reliability and learning, additional research social scientists were invited to provide ongoing long-term data analysis at the RG level. Though not carried out during the 2020 fire year, RG analysis and writing are now being applied to long-term organizational communication, learning, and decision making.

> **The importance of virtual meeting applications cannot be overstated: recent advances in video telecommunications have greatly improved the capacity for networking and organizing.**

FOCUS GROUPS

To support each of the four categories, HP&IOL initiated ongoing focus groups, which were active through October (fig. 1). We reached out to a network of lower level and midlevel Forest Service employees who work in wildland fire management, deliberately seeking participants who represented wildland fire personnel from each Forest Service region and from a variety of occupations. Though broadly representative, the focus groups were not a sample of all Forest Service employees working in wildland fire. A total of 194 focus groups were convened. Notably, no single occupational perspective was under- or overrepresented.

The focus group is a social science method for collecting information from a subset of the population (Krueger and Casey 2009). HP&IOL adopted the focus group approach to collect data with higher reliability than MG. Focus groups were beneficial in collecting HMG data for several reasons:

- Focus groups gather indepth knowledge about a particular "focus," problem, or issue. In this endeavor, the focus groups conducted indepth conversations about new challenges that COVID-19 posed in the everyday work environment of wildland fire management.

- Focus group participants can be recruited to represent either uniform or diverse perspectives. In this case, participants represented diverse experiences, occupational roles, and management positions within the Forest Service's fire organization. The variety of organizational positions exposed participants to different perspectives across the organization.

- Focus group participants express multiple perspectives and a nuanced understanding of a topic or issue, and they typically have multifaceted responses to a particular issue. Because the focus group is an interactive conversation, participants also cue one another to create additional or enhanced insights. In this case, focus groups provided rich feedback to RMA members and senior agency leaders, helping them understand how COVID-19 challenges—and ways of mitigating the associated risks—unfolded in the field and how they might incorporate the knowledge into their executive direction.

- Focus groups often benefit the participants themselves. In this case, the focused conversations let participants voice their beliefs and concerns in a safe setting among colleagues and share their respective lessons from the field with one another. They shared their experiences without a direct supervisor present, empowering them to engage in meaningful conversations.

Figure 3—The Eisenhower Decision Matrix.

Focus groups are typically conducted in person. In this case, however, physical distancing guidelines and telework requirements motivated HP&IOL to conduct the focus groups virtually using the Forest Service's Microsoft Teams platform. The importance of virtual meeting applications cannot be overstated: recent advances in video telecommunications have greatly improved the capacity for networking and organizing.

PROTOCOL FOR HMG DATA COLLECTION

In March 2020, HP&IOL decided to conduct one focus group for each Forest Service region. Within 10 days, HP&IOL assembled a team of focus group facilitators, recruited participants from across the country, designed focus group questions, conducted nine regional focus groups, analyzed the data, and delivered a written report to RMA.

RMA wanted to know "what incentives would encourage the field to engage in COVID-19 mitigation strategies during the 2020 wildland fire season." Although mitigation strategies were indeed a concern, the open-ended nature of the focus groups allowed participants to make other observations about the pressures of dealing with COVID-19. Their insights exposed overlooked and emerging issues, pinch points, and weaknesses in Forest Service wildland fire management.

Following the first set of nine focus group reports, HP&IOL gathered all suggestions in the field and prioritized them using the Eisenhower Decision Matrix (fig. 3). The matrix helped HP&IOL separate immediate from long-term challenges (Krogerus and Tschäppeler 2012), providing a template for presenting focus group data to RMA.

RMA found the focus group information extremely valuable for decision making, so it asked HP&IOL to continue the HMG focus group process throughout the 2020 fire year. To develop a sustainable and ongoing focus group process, HP&IOL implemented a detailed production schedule (table 1). The schedule outlined roles, processes,

and protocols for convening nine weekly focus groups, conducting analysis, and writing a consolidated weekly report.

The focus group facilitators sent email invitations and reminders to their respective groups and led their respective sessions. A separate note taker initiated the Microsoft Teams recording, used a template to take notes on the session, conducted initial analysis of the notes, and posted a summary for the writer/editor. Each regional focus group session was scheduled for the same time each week. To the extent possible, facilitators and note takers remained with the same groups throughout the year. Incoming HP&IOL temporary assignment detailers who became facilitators spent at least one session as an observer before taking on the role of focus group facilitator.

DEVELOPING FOCUS GROUP QUESTIONS

The focus groups were designed to establish an HMG feedback loop between RMA, Forest Service senior leaders, and field-level employees. HP&IOL focus group facilitators expected to serve as a conduit for communication. After providing data from the field, the facilitators expected RMA and senior agency leaders to raise questions and give answers based on what they were hearing from colleagues and what they were learning from the weekly HP&IOL reports.

However, RMA and senior agency leaders rarely offered questions, comments, and answers to the field. Although HP&IOL provided a structure and process for a bidirectional information flow, information from leaders did not flow back to the field through the focus group process. Instead,

senior leaders communicated with the field mainly through the national Office of Communication and through official letters from the Chief and Deputy Chiefs. Senior leaders often announced policy and issued guidance through "Inside the Forest Service," for example by posting weekly videos and writing "Leadership Corner" thought pieces.

As a result, HP&IOL assumed responsibility for developing focus group questions, adding it to the planning process. Questions were formulated based on new information, guidance, and policies related to:

- COVID-19 risk mitigation and wildland fire management,
- Items posted on the Wildland Fire Lessons Learned website, and
- Emerging themes and issues from previous focus group sessions.

Table 1—*Weekly report production schedule, March 23, 2020, to October 30, 2020.*

Day	Team	Task	Purpose
Monday	Focus group facilitators & writer/editors	Group status check-in and discussion	Organize personnel and discuss administrative issues.
Monday and Tuesday	Focus group facilitators	Administer focus groups	Facilitators administer one focus group per region to capture information from the field.
Wednesday	Focus group facilitators & writer/editors	Debrief among facilitators, note takers, and the writer/editor	Resolve procedural issues and identify initial broad themes that emerge. Note takers complete analysis and summary.
Thursday	Focus group facilitators	Facilitator meeting	Develop focus group questions for the following week.
Thursday	Focus group facilitators & writer/editors	Content analysis and writing	Conduct a broad analysis of the data and identification of general themes for the weekly report.
Friday	Focus group facilitators & writer/editors	Writing and editing	The writer/editor leads the writing for the weekly report, with assistance from the facilitators and note takers.
Following Monday and Tuesday	Sensemaking	Sensemaking team analysis	Sensemaking team members analyze previous week's focus groups.
Following Tuesday	Writer/editors	Deliver weekly report to HP&IOL director	Deadline for final edits and completion of weekly reports.
Following Wednesday	Sensemaking	Sensemaking team leader consolidates analysis	Consolidate and edit all individual team member analyses into one report.
Following Thursday	HP&IOL director	HP&IOL director presentation to RMA	Deliver report results at the weekly RMA meeting and disseminate to other Forest Service leaders and focus group participants.
Following Friday	Sensemaking	Sensemaking team meeting	Finalize weekly sensemaking report and deliver to director of HP&IOL.

REGIONAL FORESTER AND SUBJECT MATTER EXPERT INTERVIEWS

To support HMG communication, data collection, and decision making, HP&IOL scheduled individual interviews with the Forest Service's nine Regional Foresters, some of whom were interviewed multiple times. Each received the weekly report from the focus groups. The Regional Forester interviews were facilitated by the HP&IOL director and assistant director.

The interviewers asked the Regional Foresters to comment in general on the weekly reports. They also inquired specifically about recent challenges, unaddressed issues, innovations, and learning opportunities from peers. In addition, the interviewers asked the Regional Foresters what they wanted the field to know, and they raised open-ended questions about the wildland fire organization and COVID-19.

Although the interviews offered a higher level perspective, the Regional Foresters were also dealing with many of the same issues as the field: uncertainty, communication challenges, challenges with direction, and not having time to pause and think more deeply about issues. Identifying Regional Forester challenges in realtime furnished data for comparing how events were unfolding at the level of senior leadership with how they were affecting the field. For example, it helped to determine how guidance was being interpreted and how it was useful, and it also helped in identifying gaps in perspectives and understanding of issues and priorities as well as of doctrine versus direction.

Subject matter expert interviews were conducted with incident commanders, medical doctors, and specialists in human resources, critical incident stress management, and risk management. The interviews shed light on how specialized groups in the agency were thinking about wildland fire management in the context of COVID-19. In addition, the subject matter experts helped answer specific questions from the field, which allowed

As of June 2021, the sensemaking team was producing high-reliability research grade reports for peer-reviewed publication in academic outlets.

focus group facilitators to loop information back to focus group participants.

Even as subject matter experts were advising senior decision makers, focus group facilitators were using their advice to develop weekly focus group questions. For example, interviews with human resources specialists and medical doctors helped in formulating questions about COVID-19 testing guidance and compensation, and interviews with specialists in critical incident stress management and risk management were used to develop questions about how additional fire management resources were or were not being used.

HMG DATA PROCESSING AND REPORT WRITING

To make sense of the large amount of data collected each week, facilitators, note takers, and writer/editors identified the most pressing challenges and concerns from focus group participants. Focus group facilitators and note takers adopted a coding scheme to filter information into four categories (Richards 2009):

1. Specialized concerns,

2. Suggested actions,

3. Lessons learned from focus group participants, and

4. Operational innovations.

Facilitators, note takers, and writer/editors worked collaboratively to key in on creative topics in the focus groups, separating notes into complaints, legitimate concerns, and actual innovations. After separating the notes, more time was spent thinking and

writing about creative thoughts than on complaints in developing the weekly reports. Writer/editors also created headers, which outlined the report and became the stable template for the following weekly writeups.

Throughout the process of analysis, writing, and editing, HP&IOL and the sensemaking team worked diligently to stay true to the story and language of the participants, neither judging, correcting, nor editing them. Instead, separate reflection boxes in the weekly reports captured thoughts by HP&IOL that were not directly expressed by focus group participants.

ARG DATA ANALYSIS AND REPORT WRITING

A sensemaking team of outside social science researchers conducted additional data analysis of the weekly focus groups, comparing their own independent findings with themes from the HP&IOL weekly report. This ARG process of data analysis and report writing took place 1 week after production of weekly reports (table 1).

The sensemaking team met on a consistent weekly basis to validate report themes and findings, ensure reliability across the data, and explore broader systemic and cultural issues for longer term learning and decision making (Richards 2009). The sensemaking team consisted of Ph.D.-level social scientists with experience in risk management, communication, and qualitative data analysis.

Individual team members were assigned to specific focus groups. Each week, they read the full notes, analyzed the recordings of focus group sessions, and compared their findings to the HP&IOL report. The sensemaking team discussed common threads, identified innovations and outstanding questions, and delivered their own weekly report to the HP&IOL director. The team also consulted with the Forest Service's Washington Office and RMA leadership to assist in making ARG-informed decisions and strategize about ongoing communication techniques.

RG DATA ANALYSIS AND REPORT WRITING

RG data analysis and report writing began immediately upon completion of the focus group process on October 30, 2020. The sensemaking team produced an internal Forest Service report titled "Learning From Crisis: Making Sense of COVID-19 During Fire Year 2020." In the report, the sensemaking team identified common themes and lessons learned that were consistent throughout the 2020 fire year.

Hundreds of lessons learned emerged from the 194 focus group interviews, synthesized into 22 broad lessons learned and corresponding tactics suggested by field personnel. The sensemaking team grouped the 22 broad lessons learned into three overarching categories:

1. Communication (message quality and information flow as well as communication technology and tools);

2. Organizational culture (leadership, employee mental health and wellness, and employee work and staffing); and

3. Organizational learning (learning about COVID-19 safety and reflections on real-time learning).

Each category included a higher level discussion and long-term recommendations suggested by members of the sensemaking team.

As of June 2021, the sensemaking team was producing high-reliability RG reports for peer-reviewed publication in academic outlets. Preliminary findings reveal that decision uncertainty arising from the pandemic will likely have widespread and lasting impacts on wildland firefighters at all levels. Moreover, the pandemic introduced new uncertainties in three broad areas:

1. Policies and procedures, including a tension between guidance from the Centers for Disease Control and Prevention and the demands of wildland fire operations;

2. Decision space—the need to make decisions without clear administrative guidance; and

3. Personal life—the overlap of work with personal life.

The intersections between and among these three broad challenges created uncertainties and opportunities that are likely to shape wildland fire operations well into the future.

A FLEXIBLE AND VALUABLE TOOL

In 2020, the COVID-19 pandemic added complexities to the work environment for wildland fire management, including the need for information to be collected, synthesized, and communicated both vertically and horizontally throughout the Forest Service's wildland fire organization. Throughout the 2020 fire year, decision making was fraught with uncertainty.

However, the agency made significant efforts to base its decisions on the most reliable information at the time. The HP&IOL's applied process for communication, learning, and decision making serves as a flexible and highly valuable tool for the collection of information, data analysis, and report writing, with products at a range of reliability levels.

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How COVID-19 Tested the Forest Service's Wildland Fire Learning System

Craig Conley, Christina Anabel, Joseph Harris, and Benjamin Iverson

The Forest Service's wildland fire organization faced an enormous challenge during the 2020 fire year: mitigating the dual risks of an unprecedented pandemic and extreme fire behavior, with little time to adapt. As the impending fire year loomed, the fire organization collectively faced the reality that fighting fire would look very different. Those working within the system began developing new practices and procedures to address the real and perceived risks associated with COVID-19, all within a context of uncertainty. As one firefighter noted early on, "This year, there's a whole new set of rules, and we don't exactly know what all the rules are yet."

No one had experience with this novel virus, and only a few within the Forest Service could claim some expertise in the logic and language of epidemiology. This forced wildland firefighters to adopt new ways of doing things while managing landscape-scale wildfires at a pace and extent never seen before in a single fire year. New ways of doing things were created daily as the wildland fire organization and its people learned and adapted in realtime. As our understanding of the challenges of fighting wildfire and the COVID-19 response continues to evolve, our ongoing efforts to communicate, daylight roadblocks, innovate, and share and integrate innovations into the organization will become more important than ever.

The 2020 fire year was truly a test of a learning system and culture that have evolved for more than a century since the founding of the Forest Service in 1905. The learning system responded to the challenge with a flood of operational innovations and adaptations as well as with a genuine effort to meet the numerous challenges to its organizational culture posed by COVID-19, such as losing face-to-face

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contact, conflicting perceptions of the risk from COVID-19, and changing perceptions of Forest Service "family."

This article describes how the Forest Service wildland fire organization's learning system responded to this unique challenge by exploring:

- The main elements and functions of an organizational learning system,
- Capacities that facilitated innovation and operational learning, and
- How or whether innovations and operational learning will become long-term organizational learning (that is, learning that exceeds the term of any single employee and becomes a permanent fixture within the culture, policies, and overall system).

Through this discussion, the article also presents the idea that the wildland fire learning system is made up of two different but complementary and intertwined learning processes.

ORGANIZATIONAL LEARNING: A PRIMER

Nevis and others (1995) defined organizational learning as "the capacity or processes within an organization to maintain or improve performance based on experience. Learning is a systems-level phenomenon because it stays within the organization, even if individuals change."

The creation of an organizational learning culture and participation in it depend on a variety of learning processes and platforms. An organizational learning culture has the capacity to adapt (through adaptive learning) to new circumstances but also to connect new experiences to existing knowledge (through generative learning). Both require flexibility and open-mindedness.

In the context of wildland fire management, organizational learning consists of two integrated long-term learning processes: *operational learning* and *systemic learning.* Operational learning is about finding better ways to accomplish daily tasks, sometimes referred to as best management practices

What Is a Learning Organization?

"An organization that learns (i.e., a learning organization) is a particular type of organization that intentionally develops strategies and structures for maximizing productive learning with a view to achieving its goals, to investigate thoroughly which factors promote it (such as, what organizational structure, what kind of culture, what leadership)."

(Rebelo and Gomez 2008).

or single loop learning (Argyris 1976); it is largely a bottom-up process based on experience and trial and error. Operational learning is typically incremental. It extends to the social field of the wildland fire organization as well, including how individuals approach stress, mental health, communication, and team cohesion. This article focuses on operational learning.

Systemic learning—or double-loop learning (Argyris 1976)—is largely a top-down process led by leadership to steer the organization in particular directions, such as emphasizing certain aspects of culture, organizational structure, purpose, vision, and goals. This process is typically implemented through policy, direction, and guidance. Systemic learning can be both incremental and transformational.

The challenge for any organization is to ultimately bring these two learning systems together so that innovations can spark long-term organizational change. Because the wildland fire system is complex and uncertain, the difficulty in this is determining which innovations will yield the highest probability of positive outcomes; a single positive outcome is not automatically a good predictor of future outcomes. Thus, being a learning organization is a function of (1) its capacity to learn and

foster innovation, and (2) the processes in place to convert those innovations into long-term learning.

In many ways, the act of learning and the learning system itself are both products and drivers of organizational culture—unique to each organization and even to subsets within an organization. These two functions are illustrated in the sidebar on the next page in terms of three phases:

1. Knowledge acquisition,
2. Knowledge vetting and sharing, and
3. Knowledge integration.

THE FOREST SERVICE'S WILDLAND FIRE LEARNING SYSTEM

A system is defined as a whole that contains two or more interacting parts (Ackoff 1999). We often think of the wildland fire system as consisting of many interacting parts, including equipment, personnel, policies and practices, and relationships for managing wildland fire. However, the learning system is rarely thought of as being a part of the wildland fire system, even though it facilitates and institutionalizes innovation, adaptation, and learning.

The stresses on the Forest Service's wildland fire system resulting from the COVID-19 pandemic revealed both strengths and weaknesses in the capacity of the organization to adapt and learn—that is, in its learning system. It is not yet clear how many innovations stemming from adapting to the pandemic will lead to future "best practices" and how many instead will be regarded as useful experiments at that moment but of no future use. Deciding which short-term solutions should be incorporated into long-term organizational learning and which should be tossed aside is not a straightforward process.

To better understand how the Forest Service's wildland fire organization learning system responded to the COVID-19 pandemic, let's view the system in four of its dimensions

The Operational and Systemic Learning Process

In order to move from short-term innovation to long-term organizational learning, an effective organizational learning system must have three processes in place (Nevis and others 1995):

5. *A way to acquire knowledge.* Knowledge acquisition occurs during a phase of developing new skills, relationships, and insights and experimenting with and testing new methods and approaches. This process, found in most organizations, is well documented in research.

6. *A method for sharing what has been learned.* Knowledge sharing throughout the organization includes vetting ideas both horizontally and vertically and developing consistency, where appropriate. This process is less common in organizations, and research describing how it occurs is harder to find.

7. *The ability to integrate new knowledge into the organization in the long term.* Knowledge integration makes knowledge broadly available, transferring it to new employees and applying it to new situations. Operational learning intersects here with systemic learning, with attempts made to close the gap between work as performed and work as designed. Integration also means balancing diverse practices based on local conditions and needs against a common vision for the whole. Senge (2006) referred to this as team learning or unified diversity. This process is the least common in organizations and available research is therefore scarce.
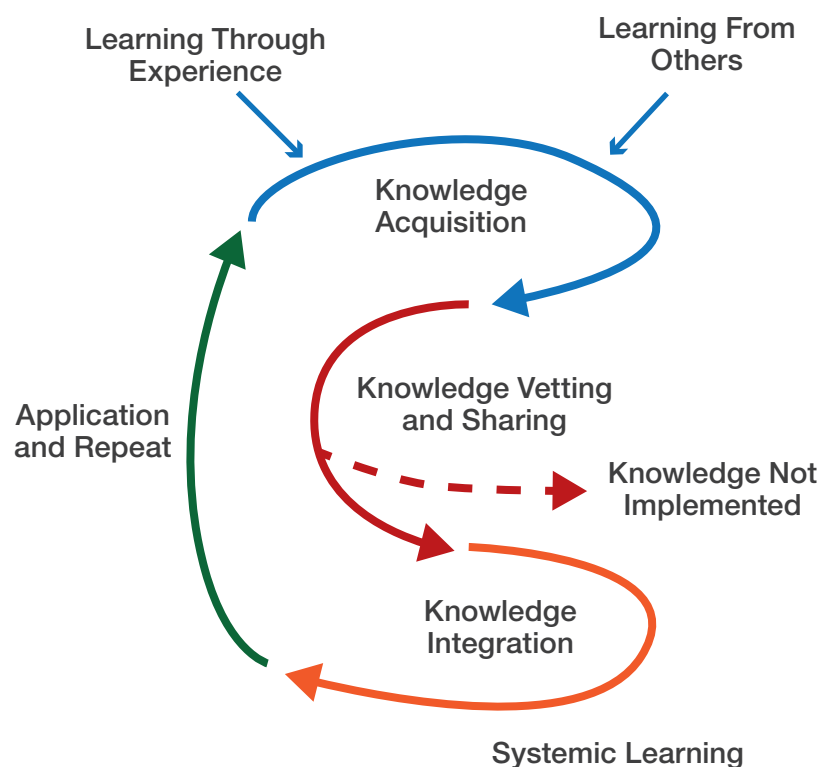
to identify some key strengths and weaknesses:

1. Purpose,
2. Structure,
3. Process, and
4. Change.

Purpose

All complex systems have structure, process, and change. Only human systems, such as organizations, need purpose (Ackoff 1999), which provides the glue that holds the organizational system together and moves it forward in a common direction. The purpose of an organization is often represented in its vision, mission, and—ultimately—policy. Organizational purpose determines both the structure of its subsystems and the evaluation of its parts, defining and shaping the whole.

Each subsystem has its own purpose as well. In theory, its purpose should support—and be evaluated in terms of how well it supports—the larger organizational purpose. That is often how success is defined and evaluated. An organization's ability to deliver services and products—that is, its organizational capacity—is also determined and directed by its purpose.

COVID-19 challenged the Forest Service organization to redefine its purpose in a new and unfamiliar context. In response, the April 2020 Chief's Letter of Intent for the fire year defined and communicated purpose and success as follows:

> *We will be successful when we meaningfully weigh the risks of each action; listen, learn, and change quickly as the need arises; and work together with the communities we serve to best keep them and our employees as safe and healthy as possible during this uncertain time.*

The Chief's directive did not prescribe actions or specific goals. Instead, it promoted a process founded on the existing risk assessment framework, which is based on a feedback loop of continuous communication. Although there might be disagreement about the meaning of success in this context,

this purpose was consistent with the overall goal of a learning organization: to improve over time. The directive left room for adapting national guidance to local conditions.

As the Forest Service learned its way through the pandemic, the Chief released a revised Letter of Intent for the fire year (June 2020), in which she recognized the fire organizations' challenges, adaptations, and shared learning that had occurred since her original letter was released. She also updated the purpose to emphasize reducing short-term risk at the expense of increasing long-term risk by "aggressively initial attack[ing] all fires." In some ways, the letter retreated to a perceived "safer" mode of operation to minimize the spread of both COVID-19 and wildfire as much as possible.

Structure

Structure includes the physical (that is, human) and organizational (that is, ranger district and other lines of communication and authority) components of a learning system and the relationships between those components. The structural elements of the Forest Service's learning system for COVID-19 drew largely from existing practices, competencies, relationships, and entities, though some were modified to meet the specific needs of responding to COVID-19. However, the Incident Management Remote Response (IMRR) groups are an example of a new, innovative structural element of the learning system created specifically in response to COVID-19 (see the article in this issue by Day and Kuiken). These groups were created to both share information and increase the organization's learning capacity. The contribution of IMRR to long-term organizational learning has yet to be seen.

Unlike the Forest Service wildland fire organization's facilitated learning analysis, coordinated response protocol, and learning review, the process of exploring adaptive responses to COVID-19 new "normal work" conditions was very unstructured. In

an attempt to provide structure and capacity for the sharing and vetting of innovations to occur organizationally, the Forest Service set up focus groups to get field-level feedback on COVID-19-related concerns, challenges, issues, and innovations in realtime (see the article by Flores and others in this issue).

Johnson (2011) described various sources of good ideas. One of them is the "adjacent possible"—ideas and opportunities that are "hovering on the edge of the present state of things," waiting for the right moment to emerge. Other good ideas come from trial and error or from "3 a.m. inspirations." As people navigated the world of COVID-19, they drew upon a variety of sources for good ideas. However, as one Forest Service fire focus group participant wisely noted about the various responses to COVID-19:

> I think some of these ideas need to be vetted and not automatically implemented. All of our modules have done things a little different, and it hasn't really gummed anything up. I think you have to think about those downstream effects and consider the broader context. What that vetting process would be and what that approval process needs to be would take some work.

In other words, the wildland fire learning system needed to have a more formal structure to turn the collection of experimental, individual, and local innovations garnered from the focus group sessions into long-term organizational learning.

An example of structured sharing and vetting is the ongoing IMRR groups, which serve as a bridge between knowledge vetting/sharing and knowledge integration and include multiple agencies. A fully developed structure and process for integrating new knowledge into the agency and closing the gap between work as designed and work as practiced is still needed.

Process

In any organization, process provides the procedures for accomplishing

specific objectives and the means for getting all stakeholders on the same page. The weekly focus groups and subsequent reports became a core element of the COVID-19 learning process, serving a number of purposes (see the article by Flores and others in this issue). Participants in the focus groups provided detailed and often personal insights into how a substantial cross-section of the wildland fire community was responding to the challenges presented by COVID-19.

Though initially intended as a way to gather field-level issues and communicate them to senior leaders, the focus groups provided an important mechanism for sharing strategies for dealing with specific COVID-19-related challenges, both within and between Forest Service regions while also communicating personal challenges and concerns. The weekly focus group process became a forum for group dialogue and collective problem-solving. Missing from this process, though, was a reciprocal feedback loop from senior leaders to focus group participants.

Change

Organizational change for the sake of change is not usually desirable; but change, when needed to improve the performance of the system to meet clear organizational goals, is. The challenge in distinguishing between the two is understanding how a change in structure or process relates to the overall vision and goals of the organization. The evaluation of how a change to a part of the system might affect the performance of the whole is a critical aspect of systems thinking.

As with most organizations, the Forest Service must change in response to a constantly changing external environment (forest conditions, societal expectations, and so forth). Slow change in the external environment often goes unnoticed from year to year. Examples of slow changes include the accumulation of fuels, the rising number of people living in the wildland/urban interface, and climate change. Rarely is the need to change as rapid as it was

with COVID-19. A learning organization should be able to pick up on and adapt to both long-term slow changes as well as short-term crisis.

AGENCY CAPACITIES THAT FACILITATED LEARNING

In some ways, the response to COVID-19 presented a challenge well suited to the Forest Service's wildland fire learning system. Obvious logistical challenges included acquiring appropriate personal protective equipment and scheduling aviation resources, as well as office and field personnel to minimize exposure. Developing and implementing the "module as one" concept (working with the same group to avoid disease transmission across groups) and using forward operating bases or spike camps instead of large camps located at an incident command post also drew on familiar skills. More challenging, though, was learning how to cope with "invisible" stresses associated with:

- Increased uncertainty in decision making,
- Isolation,

- The cumbersome and often less effective nature of communicating remotely rather than face to face, and
- Work/life balance.

What characteristics of the Forest Service wildland fire organization helped it adapt to these challenges? We often think of capacity in terms of physical resources and personnel. The ability of a learning system to meet the challenge of rapid change depends on a number of more subtle capacities that can facilitate learning. Just as with physical resources, these capacities can be managed and improved over time.

Nevis and others (1995) described facilitating factors in organizational learning, which include both structures and processes that "affect how easy or hard it is for learning to occur." They also include more subtle individual and group attitudes about change, risk, pragmatism, and cooperation. Quotes from focus group participants below reflect a variety of factors that facilitated learning:

- Both **formal and informal relationships** between individuals and between groups were called upon

to create information management networks. These networks sorted, sifted, screened, and interpreted the deluge of information about COVID-19 coming from both inside and outside the organization. As one focus group participant put it, "The mass emails and videos—the same information over and over again. The main information I am paying attention to is coming from my direct supervisors and the contracting officers. The rest is just noise."

- A **"can-do," experimental mindset** paired with a **high degree of practicality** in the field served the learning and adaptation process well. Together, the two characteristics allowed a no-nonsense approach to keeping what worked and quickly abandoning what did not. A high degree of autonomy at the line officer level generated a multitude of ways to manage COVID-19 mitigation and response. The amount of autonomy given to engine captains and battalion chiefs might have been more variable: some leaders were very flexible, whereas others were more rigid in their approach. This high

COVID-19: An Unfreezing Event

Change in a large Federal agency like the Forest Service can often seem glacially slow. During the COVID-19 pandemic, however, change seemed to happen rapidly. Ever stopped to wonder why that might be?

COVID-19 created a major disruption that tested the capacity of the wildland fire system to adapt, innovate, and learn. It also provided an opportunity for the wildland fire system, and those who operate within in it, to look deeply at how each subsystem (such as normal work) typically operates and to examine whether those operations are meeting the goals of the wildland fire organization. The disruption allowed people, at least for the moment, to abandon some conventions, take a few risks, be creative, and test new ideas.

This disruption created an environment within the agency that encouraged the

use of new approaches and innovations; it was facilitated by what organizational theorists describe as an "unfreezing event" (Schein 1996). COVID-19 provided a reframing for assumptions about normal work, creating a strong motivation to change key operational practices or risk compromising successful wildland fire management. An unfreezing event creates the need for change, opening the system to new information or ways of conducting business.

For learning to occur, the unfreezing event must be accompanied by the psychological safety to experiment: what some perceived as chaos, others saw as

opportunity. Although an unfreezing event opens the door to change and learning, too much openness creates chaos. Innovations and the innovation process had to function within what Johnson (2011) called a "liquid" network (a place between "frozen" stability and "gaseous" chaos). Just as COVID-19 affected all aspects of the wildland fire system, innovations and adaptations appeared in every part of the system, including communications, use of technology, organizational culture, and health and safety. The impact of many innovations created in this unsettling period will likely be lasting.

degree of autonomy and the practical problem-solving attitude caused one Regional Forester to comment, "If we go too slow, everyone will end up making it up on their own." While operational innovations marched on, however, questions about long-term organizational learning arose more than once. As one focus group participant observed, "The biggest fear that I have is that we put this in the rearview mirror and move on without incorporating the learning opportunities we have encountered."

- **Readiness and willingness to change and learn from others** facilitated the learning and adaptation process." There are EMS [emergency medical services] and other fire organizations out there that are dealing with this somehow," observed one focus group participant. "… We need to look as an organization at how they are doing it."

- The **focus group dialogue model and risk assessment conversation process** were familiar practices used to solve problems and get everyone on the same page. They created a safe and familiar place to share and foster a climate of openness. As one focus group participant put it, "These [focus group sessions] are really helpful to prepare us for what we might ultimately face this summer—being willing to be flexible, ask the hard questions, and understand if we are not able to meet the intent of the Chief's letter."

- The **ability to plan and work through potential system failure scenarios** served the organization well in this process. "It's a situation where we have to have backup plans for our backup plans," observed a focus group participant. "We can't rely on a particular resource type to meet our objectives if we are having a hard time finding someone to accept that assignment." This attitude kept the inevitable surprises to a minimum. Ultimately, safety depends on an ability to be honest and face the reality that things won't necessarily go the way they are planned. Delusion and denial do not survive well in the fire environment. As a focus group

participant stated, "We are still stuck in the ideal version of the world where we have fully hired modules that can go out as a pod together. That is going away here soon. We are lacking a discussion of when are we going to transition that thought process and what is the best way to do it."

- A **systems perspective**—that is, looking at problems and solutions in terms of larger systems and relationships among structures and processes both within and outside the organization—was evident in many focus group discussions. Participants also acknowledged that there is no root cause and no one to blame when some part of the system doesn't work as expected. "Everybody has come up with how they think they can make this work," noted a participant. "The real stress is going to come when, on very short notice, some piece of that falls apart."

ONGOING LEARNING CHALLENGES

During the 2020 fire year, the wildland fire organization focused on exploring and testing new ways of doing things (knowledge acquisition). These practices and procedures affected virtually every aspect of wildland fire operations as well as the personal lives of firefighters. Since then, the organization has focused on consolidating its experience (knowledge sharing and vetting) and integrating what was learned (knowledge integration and utilization).

The 2020 fire year revealed at least two challenges in the current complex learning system:

1. *The need to better integrate operational with systemic learning.* Although the operational learning process is highly transparent within the agency, the systemic learning process is much less so. As those familiar with complex organizational systems frequently remind us, the way to deal with complexity is through transparency (Senge 2006).

2. *The need to function within increasingly open and interconnected systems, including climate change, misinformation,*

and social networks. Working with partner agencies and communities in this context presents ongoing learning challenges for the Forest Service. The 2020 fire year was just a warmup, with much still to learn in these areas.

The Forest Service will continue to learn from COVID-19 for some time to come. This "unfreezing event" (see the sidebar on the previous page) and the adaptive response permanently changed many facets of the wildland fire system in obvious and not-so-obvious ways. It certainly helped the agency better understand the operational and organizational adaptation and learning capacities it needs to cultivate as it moves into a world of rapid social, technical, and ecological changes.

Although an unfreezing event opens systems to change and the accompanying instability, it cannot last forever and is ultimately followed by "refreezing," which brings the system back into a more stable state. Before refreezing occurs, the agency and its wildland fire organization need to ask themselves, "What innovations and adaptions learned should be solidified in organizational processes?"

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Strategic Foresight:
Applications for COVID-19 and Wildland Fire Management

Long Term Outlook Illustration. Photo: AdobeStock.

Lynne M. Westphal, David N. Bengston, and Jason Crabtree

Strategic foresight, also known as Futures, is an applied field that uses a suite of methods to explore possible, plausible, and preferable future states in order to support today's decision making and management. Strategic foresight is widely used by (among others):

- All U.S. military branches and intelligence agencies,
- Many companies from the Fortune 500 as well as smaller businesses, and
- The United Nations and International Monetary Fund.

Because the work tends to be proprietary or classified, the results are rarely made public, making strategic foresight less well known than its widespread use would suggest. The Forest Service's Northern Research Station's Strategic Foresight research team (see the sidebar) has been building a strategic foresight program to address issues in forestry and natural-area management and to broaden the understanding of these methods within the public sector.

In March 2020, when the COVID-19 pandemic was declared to be a national emergency with the fire year heating up and the field season imminent, our team was asked to quickly develop scenarios to help plan for and manage the impending compound disaster. We did so by providing a set of scenarios that

fire teams used as this unprecedented fire year unfolded (as described in other articles in this issue).

This article:

- Describes the scenario development process we used for COVID and wildland fire management and how it could be applied in other contexts; and
- Discusses additional ways that strategic foresight could benefit wildland fire management.

APPLYING SCENARIOS

Although many different methods are used in strategic foresight, scenarios are probably the best known, with the Millennium Ecosystem Assessment being one well-known environmental application (Carpenter and others 2005). Scenario planning is a way of grappling with fundamental uncertainty and helping decision makers by exploring a range of plausible paths that an uncertain future could take (Alcamo 2008). The Intergovernmental Panel on Climate Change defines a scenario as "a coherent, internally consistent, and plausible description of a possible future state of the world" (IPCC 2008). Scenario planning can help identify robust options and actions that would be appropriate and effective under a wide range of potential future conditions. It can also support creative thinking about novel situations.

Want to learn more about the Forest Service's strategic foresight research?

- Our unit page outlines the basics
- Ten Principles for Thinking About the Future:
  - » Short version (online summary)
  - » Full writeup (about 20 pages)
- Federal Foresight Community of Interest
- Drivers of Change in U.S. Forests and Forestry (general technical report)
- The Forest Futures Horizon Scanning Project (general technical report)

Strategic foresight is typically used to identify and explore possible futures. Ten, 20, or even 50 years hence, the methods might also be usefully applied to immediate concerns. For example, Machlis and McNutt (2010) worked with a team to develop scenarios to

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guide decision making in the wake of the Deepwater Horizon oilspill in the Gulf of Mexico in 2010. In our case, the immediate issue was the imminent compound disaster of the coronavirus pandemic and the 2020 fire year (de Ruiter and others 2020; Sutanto and others 2020).

In mid-March 2020, the Forest Service was faced with the rapidly growing threat of the pandemic as the 2020 fire year intensified. The agency's Executive Leadership Team activated an enterprise risk management response team to guide its thinking about wildland fire management in the midst of the novel coronavirus pandemic. The response team asked us to rapidly develop scenarios that would help in wildland fire planning and decision making. In 3 days, we worked with a member of the response team to create scenarios that were then presented to the Executive Leadership Team in Washington, DC.

Our Approach to Rapid Scenario Development

Scenarios can be developed in many different ways (Bishop and others 2007), but the best known approach is often called "the 2x2" because it is built from two axes presenting two different critical uncertainties, creating a matrix with four combinations of possible future conditions (Schwartz 1991). When the response team contacted us, it had already decided both to use the 2x2 format and on which axes to use. The team requested scenarios based on high and low impact of COVID-19 and high and low fire year severity (fig. 1).
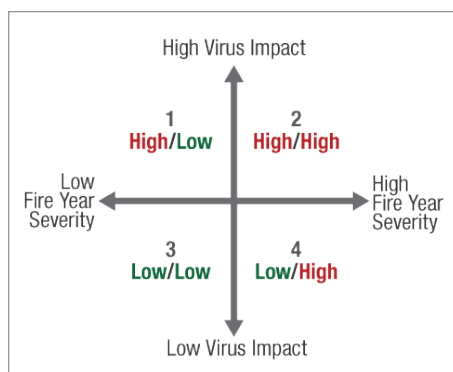
Figure 1—2x2 scenario matrix for coronavirus impact and fire year severity.

Figure 2—Interview guide for gathering information to generate the four scenarios, designed to elicit ideas about the first- and second-order implications of each scenario. Scenario 1 is shown; the same approach was used for all four scenarios.

Given the unusually short timeframe for this assignment—just 3 days—we outlined a rapid scenario development method, similar in intent to other rapid social science methods (such as Machlis and McNutt 2010; Schrekenberg and others 2010). In our approach, our team framed the issues and questions on the first day; the second day was devoted to gathering information to shape the scenarios through telephone interviews and email requests for input. On the third day, we analyzed the input to identify key drivers, drafted the short scenarios, wrote an executive-summary-style report, and created a set of slides summarizing the scenarios and findings. A summary of the scenarios was presented to the Executive Leadership Team on the following day.

If we'd had more time to carry out the analysis, we would have used the "futures wheel" method to explore the interaction of a pandemic with fighting wildfire. The futures wheel is a structured brainstorming process that explores the first-, second-, and third-order implications of any given change or event (Bengston 2016).

Since we did not have enough time to run futures wheel sessions and analyze the results, we instead used the basics of the implications framework to guide our questions (fig. 2), eliciting ideas about the first- and second-order implications of each of the four scenarios (fig. 1). We asked for the first-order implications of each of the scenarios (for example, high COVID + high fire) and then asked for the secondary implications of each of the first-order implications.

We interviewed or requested written input from nine Forest Service employees with considerable expertise in wildland fire management, along with two forest supervisors. (A forest supervisor is the official in charge of a particular national forest.) We also spoke with two wildland fire experts from outside the Forest Service and

with a number of professional futurists, several of whom had participated in a previous strategic foresight project on wildland fire (Olson and others 2015). We divided the scenarios among the three of us, then shared our drafts with each other and refined them together. Scenarios are typically named in a way that sums up their main points or their ethos and impact; we decided on the scenario names together.

Results: Scenario Sketches

We generated four scenarios (fig. 3), one for each quadrant in the 2x2 matrix:

1. High-COVID-19 impacts and low fire year severity,
2. High-COVID-19 impacts and high fire year severity,
3. Low-COVID-19 impacts and low fire year severity, and
4. Low-COVID-19 impacts and high fire year severity.

We kept the scenarios brief to meet the needs of high-level policymakers and because rapid turnaround was required.

For clarity, the scenario sketches below have been lightly edited from the original report. Each includes the scenario name, key drivers, a short narrative, and potential long-term implications. The scenarios were written as the pandemic was just beginning in the United States, and little was known about how COVID was transmitted. As typical for scenarios, each narrative is written from the perspective of the future, as if the scenario had actually occurred.

SCENARIO 1: Necessary Redirection (high COVID-19 impacts, low fire year severity)

Key drivers:

- Mild fire year (less severe than recent average year).
- Severe COVID impacts across society nationally and globally.
- Massive economic recession and Government response.
- Forests perceived as safer than cities.

HIGH-COVID-19 Impacts
LOW fire year impacts

Necessary Redirection

HIGH-COVID-19 Impacts
HIGH fire year impacts

Compound Disaters

LOW-COVID-19 Impacts
LOW fire year impacts

Enlightenment

LOW-COVID-19 Impacts
HIGH fire year impacts

Normal Interrupted
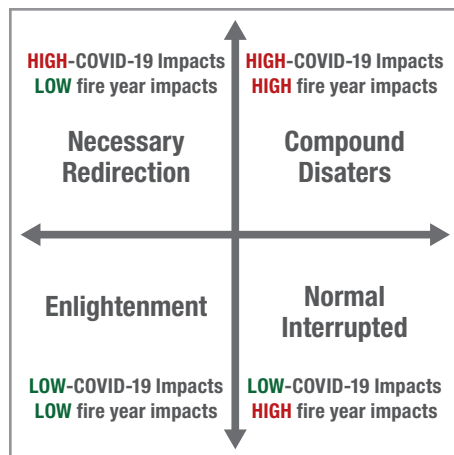
Figure 3—The four scenarios by name, each reflecting a quadrant in the 2x2 matrix.

Scenario narrative: Drastic precautions were necessary to reduce disease transmission rates among firefighters and support crews. Mandatory testing was enforced before firefighters were deployed; additional hygienic measures were required, such as laundering of soiled clothes and hand-washing stations. Large fire camps were eliminated, and difficult choices were made as to where and how to deploy small teams. Thankfully, the mild fire year allowed smaller crews to work fairly effectively in response to wildfires, primarily focusing on rescuing people rather than containing fires. However, the crews had less ability to conduct fuel management activities such as prescribed burns.

With fire less of a concern, response to the pandemic took precedence in terms of funds, resources, and workforce. Funds previously allocated to wildland fire management were diverted to combat COVID-19; in many cases, firefighters were asked to support law enforcement and pandemic relief efforts. Widespread implementation of social distancing policy increased visitation of public lands because cities were seen as dangerous. Panic and despair also drove people to take up residence on public lands, legally or not. Unsanitary makeshift communities became viral hotspots, and some rural communities refused entry to outsiders, including firefighters and support crews.

Potential long-term implications:

- Fewer prescribed burns could result in larger fuel loads and more large wildfires in the future.
- Hygiene improvements in fire camps could become permanent.
- Fire management budgets could be cut because diverted resources caused little increase in damage from wildfires.
- Massive long-term recession could displace many from homes onto public lands, heightening the risk of future wildfires and increasing the difficulty of rescue.

SCENARIO 2: Compound Disasters (high COVID-19 impacts, high fire year severity)

Key drivers:

- Fire year more severe than recent average year.
- Severe impacts of COVID-19 across society nationally and globally.
- Economy in severe recession, bordering on a depression in terms of unemployment.
- Support services severely curtailed (including commercial flights, supply chains, and contractors).

Scenario narrative: Dealing with two simultaneous and interacting disasters was an unprecedented challenge. A pandemic during a severe fire year created cascading effects that stretched every aspect of wildland fire management to the breaking point or beyond. From hiring and training to transportation and support, all essential aspects of wildfire response were impaired. Traditional local partners were often unavailable because they were already struggling to respond to the pandemic, and fire crews from other regions and countries were unable to help. Many wildfires burned with little or no response from firefighters.

Some counties without confirmed COVID-19 cases blocked entry of crews for fear that they could be carrying the virus. In other places, people refused

to leave their homes for fear of the virus, even in the face of approaching wildfire. Loss of lives and property was significant. Staff morale hit an all-time low and staff burnout an all-time high, affecting job performance and employee safety and well-being.

Potential long-term implications:

- Fully embrace the shift to a new fire management paradigm: from the "war on fire" paradigm, with the goal of extinguishing all blazes, to a "fire resilience" or "learning to live with fire" paradigm.
- Trust in Government and in experts who failed to curb both the pandemic and wildfires could rapidly decline.
- Hiring firefighters and support crews could become much more difficult in the future due to the devastating and terrifying fire year.

SCENARIO 3: Enlightenment (low COVID-19 impacts, low fire year severity)

Key drivers:

- Fire season less severe than recent average year.
- COVID-19 response moderately successful in flattening the curve in the United States.
- Economy in short-term recession.
- Support services curtailed (such as commercial flights, supply chains, and contractor services).

Scenario narrative: Mobilizing fire crews was difficult, but the relatively low size and number of wildfires softened the impacts. Because COVID-19 containment was relatively successful, the greater use of "spike camps" (temporary secondary camps for individual fire crews, accessible from base camp) improved hygiene, and other tactical options were also largely sufficient to manage COVID-19.

Wildfires were carefully studied and monitored to decide where to best deploy resources, with more fires allowed to burn in areas where risk

to life and property was low. Use of wildfires offset the reduction in number of prescribed burns to reduce fuel loads; prescribed fires were curtailed early in the year for safety reasons, although concerns about future fuel loads rose.

Forest Service employees were able to deliver important fire and illness prevention messages to campers and other forest visitors. Due to the relatively low severity of the fire year, some fire funds were redirected to pandemic response.

Potential long-term implications:

- Public confidence in Government and science could rise in response to the effective management of the pandemic and fire year.
- Future epidemics might not be taken seriously if the Government is seen as overreacting to relatively low COVID impacts.
- Funds that were redirected from agencies responsible for wildland fire management due to low fire year severity could be lost permanently.
- Any additional national or global disruptions (such as war or extreme weather) could rapidly change this scenario.

SCENARIO 4: Normal Interrupted (low COVID-19 impacts, high fire year severity)

Key drivers:

- Fire season more severe than recent average.
- COVID-19 response moderately successful in flattening the curve in the United States.
- COVID-19 resources (including funds and equipment) redirected to wildfire response.
- Economy in recession.
- Support services curtailed (such as commercial flights and supply chains).

Scenario narrative: Public health efforts to slow the spread of COVID-19 proved moderately successful, slowing the rate and severity of infections. Nonetheless,

the realities of fighting fires—with firefighters sharing close quarters in camps and vehicles and with many shared high-touch points (like truck door handles)—meant that firefighters continued to be at increased risk of COVID-19 even as complacency set in regarding the risk. Smoke exposure increased the risks for fire crews and residents alike. Because of disruptions in support services, decisions about which fires to fight—and how—were based almost exclusively on threats to life rather than property. More fires were left to burn.

Potential long-term implications:

- If the agencies responsible for wildland fire management announce a decreased firefighting capacity due to COVID-19—and if a severe fire year brings significant losses to people and communities—then the agencies could lose credibility.
- The necessity of fighting fewer wildfires could result in stakeholders assuming that the agencies responsible for wildland fire management can fight fewer fires in the future.
- Changes required to manage COVID-19 could result in long-term safety and hygiene improvements for fire crews.
- Public health lessons learned from the pandemic response could offer insights into improving wildland fire management.

Scenarios like these are typically developed to guide decision making in situations that might be possible for 10 to 20 years or more. By exploring widely varying plausible futures, decision makers are able to think about preferable futures and take actions leading to them (and preventing undesirable futures). In the case of the imminent compound disaster of a pandemic in a severe fire year, scenarios were useful in tracking the situation as it unfolded and in guiding actions while preparing for what might come next. (The use of the scenarios is described by McCarthy and Calkin in this issue.)

STRATEGIC FORESIGHT AND FIRE: APPLICATIONS BEYOND COVID-19

David Bengston and others led an expert panel study in applying strategic foresight to wildland fire management (Olson and others 2015; Olson and Bengston 2015). The study highlighted the "level of uncertainty about external developments and future conditions that will set the context for wildland fire management," noting that the level of uncertainty is "significantly greater than is recognized in current planning" (Olson and others 2015). Exploring possible impacts of different critical uncertainties from outside an area of focus is a hallmark of strategic foresight, and greater application of its methods could strengthen wildland fire management.

One example of a critical uncertainty from outside the realm of wildland fire management was the threat of a pandemic. Public health experts had long been warning of a global pandemic, and the outbreak of Ebola in western Africa in 2013 motivated some to plan for a global pandemic (Osterholm and Olshaker 2017; Khan and Patrick 2016). We were able to apply strategic foresight methods to the imminent issue of fighting wildfire during a pandemic.

But how might strategic foresight be used in wildland fire management to be more prepared for a future disruption? Let's take a look.

We discussed rapid scenario development, noting that scenarios are one of the best known methods in the strategic foresight toolkit. Other strategic foresight methods include the futures wheel, backcasting, gaming, and visioning (Bengston 2019). Foundational to strategic foresight is horizon scanning, a process of gathering and analyzing "weak signals" of change from many fields (Hines and others 2019). An example of a weak signal of change from long ago is Henry Ford's tinkering with a horseless carriage; in time, the car completely transformed access to public lands and what people wanted from them (Sutton 2002), even though many initially scoffed at Ford

and his experiments. Weak signals often apply to the other methods of strategic foresight as well, including the development of scenarios. The use of horizon scanning can find "wild cards" (low-probability, high-impact events; Bengston, in press) and other signals of potential change and can point to very different futures than today's business as usual would suggest. Consideration of a broad array of possible futures—in the plural—distinguishes strategic foresight from other future-looking methods, such as forecasting, which tends to focus on a single future outcome (fig. 4).

We developed a horizon scanning program and have been gathering "horizon scan hits" with forestry implications since 2016 (Hines and others 2019). Scan hits are signals of change, often weak signals. Our dataset has nearly 3,000 horizon scan hits to date, each tagged for pertinent topic areas and also for three horizons. Horizon 1 (H1) comprises scan hits for changes that are emerging now or are imminent. H1 scan hits reflect the current trajectory of the domain (in this case, forestry and wildfire) and can already be affecting the domain. Horizon 3 (H3) scan hits are further in the future, even decades away, and are the most uncertain. H3 scan hits are new and can even sound laughable and strange, like Ford's horseless carriage. H3 scan hits are the disruptors: if they come to pass, they could transform the domain. Horizon 2 (H2) scan hits are in between in terms of both time and level of uncertainty, reflecting a transition (rather than transformation) in the domain (Hines and others 2019). As Hines and others (2019) put it, H1 is "now" (or near), H2 is "next," and H3 is "new."

To illustrate how scan hits from outside a specific topic of interest can be important, let's

look at three scan hits related to forest products, one for each horizon:

1. **H1:** Mass timber products, including cross-laminated timber (CLT) and nail-laminated timber (NLT), are increasingly used in construction worldwide (Domanska 2020). At least one company is making class A fireproof CLT by infusing the wood with surfactants (Pollock 2018), thereby creating an even more fire-resistant form of CLT. Increased attention to lowering construction's carbon footprint could build demand for CLT, NLT, and similar wood products, potentially increasing demand for wood.

2. **H2:** Transparent wood that can replace glass and other materials in certain applications has been developed but not yet deployed commercially. Home construction, cell phones, and other products could all someday be made essentially from wood (Androff 2021). This and related advances could also increase demand for wood.

3. **H3:** Lab-grown wood is in the earliest stages of development (Bengston 2021). Scientists are prototyping methods to grow wood in the lab without ever harvesting a tree, not unlike the production of lab-grown meat. If lab-grown wood follows a similar development path as lab-
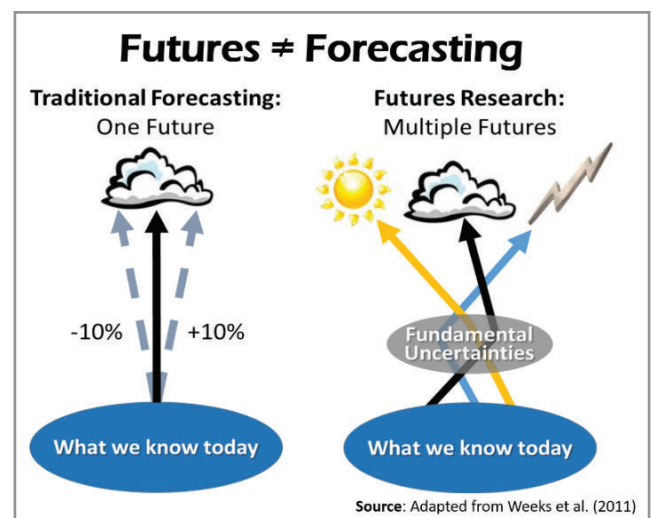

Figure 4—Strategic foresight (or Futures) considers a wide array of possible future states, whereas forecasting typically focuses on one future state. (Adapted from Weeks and others 2011.)

grown meat, then we could see lab-grown wood products going to market in 10 to 20 years. Unlike the H1 and H2 scan hits, this one could point to a significant decline in demand for wood from forests.

These three scan hits suggest forces that could initially increase and then rapidly decrease the demand for wood, with potential dramatic changes for the timber industry. The demand for wood has implications for wildland fire management: Is there a market for wood thinned to reduce fuels? Will a drop in demand increase fuel density, thereby escalating the severity of wildfires?

Of course, these are just three scan hits out of thousands; before any attempt could be made to guide decision making, a fuller analysis would be needed, including scan hits from many other domains, from climate change to demographic shifts and more. But these three examples show the range from now (H1) to new (H3) and how emerging issues and developments from outside the domain of wildland fire management can have meaning for fire managers.

Scan hits can be the data for other strategic foresight methods, including scenarios to guide planning (Hines and others 2019); futures wheel exercises to explore the possible positive, negative, and transformational implications of any given change (Bengston 2019); and backcasting analysis, which traces from a desired (or undesired) future state back to the present (Bengston and others 2020). Wildland fire managers and policymakers could use the futures wheel, for example, to explore the possible effects of any given change (such as a sudden decline in demand for wood) to help frame preferable futures in order to guide decisions today. Playing serious games, such as our *IMPACT: Forestry Edition*, can help people break out of cognitive ruts while providing a look at possible future states. Together, these and other strategic foresight methods can help managers and policymakers think outside business-as-usual trajectories to consider mid-range to long-range futures that

could be quite different from the world we live in today and to plan accordingly.

PREPARING FOR THE FUTURE

In 2020, the need to simultaneously combat actual wildfire and the wildfire-like spread of the coronavirus was an unprecedented challenge for the agencies responsible for wildland fire management. Rapid development of scenarios helped frame possible trajectories for the 2020 fire year. In the longer term, the application of strategic foresight methods—including scenarios, futures wheel exercises, and focused horizon scanning—could expand thinking on what could change in wildland fire management, enabling managers and policymakers to better prepare for whatever future we find ourselves in.

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Understanding Limits:
Wildland Fire Response and Pandemic Interactions in 2020

Nicholas McCarthy and David Calkin

Wildland fire management is a complex system with various scales, modes, plans, and operations. As with any system, fire management can be subject to stresses and strains that are, in some cases, easy to identify in isolation but highly challenging to diagnose at a system level. A suitable analogy is the homeostatic range in the human body— that is, the limits on levels such as body temperature, pH, and blood level. Modern medicine has a quantitative understanding of the normal, extreme, and fatal ranges of these indicators.

The 2020 fire year that unfolded concurrently with the COVID-19 pandemic was an exceptional example of interacting stresses on wildland fire management as a system. As such, it is useful to examine the 2020 fire year in terms of the "homeostatic range" not of human bodies subject to the pandemic but of the equivalent range in wildland fire management.

It was known early on that the emergence of the COVID-19 pandemic in the spring of 2020 could have a significant impact on suppression resource availability and the capability to manage wildland fires in the United States. Led by the Northern Research Station, a rapidly facilitated futuring exercise with a number of fire management stakeholders illustrated four potential scenarios for the upcoming 2020 fire year (see the article by Westphal and others in

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this issue). The sidebar highlights the four scenarios; the objective of the analysis (see Westphal and others) was to characterize each scenario from a diverse set of perspectives and to understand the primary, secondary, and tertiary implications.

The scenarios represented unprecedented challenges. One scenario represented systemic failure defined by:

- COVID-19 transmission within fire camps and the associated health outcomes;
- The potential for transmission across fire camps as the fire year progressed;
- Transmission from infected first responders to communities at large, especially hazardous in remote and vulnerable communities; and
- Diminished responder capacity over time.

With the emerging severity of the COVID-19 pandemic and the bleak seasonal outlooks for the coming fire year, it became clear that a "high COVID, high fire year" scenario in some form was not only possible but likely, as was the need to prepare for it. A structure was needed for moving the interagency fire suppression capability through the five preparedness levels far more rapidly than usual. The implications and the risk of systemic failure called for addressing the corresponding issues as the signals first emerged. Specific triggers were needed for changes in strategic actions beyond the scope of the preparedness level system.

THE DEGRADATION TREND ANALYSIS TOOL

The Degradation Trend Analysis Tool (DTAT) was developed in late March 2020 at the request of the Risk Management Assistance program.

Its purpose was to analyze and relay the status of interactions between the COVID-19 pandemic and wildland fire management. More specifically, the DTAT was designed to detect any degradation in the wildland fire response system nationwide while tracking its effects on COVID-19 spread and impacts.

The DTAT was to be used on a rolling basis to track status, predict short-term future status based on trend, and provide a rolling evaluation of predictions. The intended outcomes were to:

1. Bring focus to emergent dimensions/ issues at the geographic-area level;
2. Assess trends in the pandemic, incidents, and other factors at the geographic-area level; and
3. Provide a short-listed "menu" of strategies based on an aggregation of COVID-19 impacts (or "C level"), thereby furnishing a structured analysis.

The toolset was designed to inform strategic decision makers at the national and geographic-area levels, including the Geographic Area Multi-Agency Coordinating Group (GMAC), the National Multi-Agency Coordinating Group, senior agency leaders, forest/ district/county leaders, and local partners. Additional ad-hoc users were incident managers, in anticipation of constraints and changes that might be possible on a 2-week horizon. The second sidebar shows the outputs of the structured analysis by COVID (C) level.

Degradation Trend and Analysis Tool

COVID-19 impact/interaction level and associated triggers

Level	COVID Transmission Within the Wildland Fire Community in a Geographic Area
C1 (level 1)	➤ Incident management teams and county health departments can manage the workload without significant degradation.
C2 (level 2)	➤ Incident management teams and county health departments are overloaded.
C3 (level 3)	➤ Widespread degradation and loss of capability.

Pandemic Dimensions

COVID-19 PPE availability	Screening	Testing	Exposure Assessment and Management	Fire to Community Transmission	Public COVID-19 Cases
Available	Consistent & Effective	Available	Capability maintained	No known or limited transmission	Low to no increase
Shortages, variable use	some screening failures	Not widespread	Limited capability	Significant in local trends and context	Upward trend designation, sufficient health resources
No availability, little use	Screening Ineffective	Little to no availability	Little to no capability	Major impacts to sensitive communities	Upward trend designation, insufficient health resources
Lag: Report based	Report based	Days	Days	Report based	Weeks
Comments: Feedback indicates PPE not made mandatory with variable compliance	Difficulties in self-reporting and screening inconsistency in FFTs are apparent.	Confusions around testing type, responsibility.	Reports indicate local/state health unable to assist in contact tracing, Federal fire/non-fire support not in place to support tracing.	No reported instances of fire response staff transmission from to families or community.	As of 06/22/2020, 2:17 P.M. E.T., cases are on a clear increase in AZ on a 7 and 14 day average. NM now has an increasing cases of the 7 day ave. Increasing 14 day average in 3-4 W. Texas counties is substantial. Based on JHU & NYT dashboards.

Pandemic Dimensions Assessment: **LEVEL 2**
Comments: Initial DRAFT assessment. While data is still incoming on hospital/health system capacity in AZ, reports suggest significant strain and trend continues positive.

Trending Towards: **LEVEL 3**
Comments: Initial DRAFT assessmnet . As hospital and facilities with critical care fill up, the pandemic environment could substantially worsen in the SWGA.

Incident Dimensions

ICS206 form submissions	LODD	Smoke-related COVID-19 Case Severity	COVID in Fire Camps
At or below average	At or below average	Symptoms are less than or equal to "normal" COVID symptoms	Adaptations and precautions working adequately
Above average	Above average	Outcomes are worse than "normal" COVID symptoms on a widespread scale	Minor outbreaks, handled effectively
Well above average	Well above average	Mortality-rate is significantly higher in fire/smoke related cases	Despite precautions fire camps become hotspots.
Lags: Unknown	Days	Weeks	Weeks
Comments: Data Unavailable, currently assessing sources	None reported to date	Not reports on topic to date, though lags will apply	No known cases to date, screening and testing to improve. Lags of a few weeks will apply.

Incident Dimensions Assessment: **LEVEL 1**
Comments: Initial DRAFT assessment. Data and reporting limitations apply, in addition to lags apparent.

Trending Towards: **LEVEL 1**
Comments: Initial DRAFT assessment.. No significant incidents reported, although lag times of 2 -3 weeks will likely apply to COVID in fire camp. A major outbreak in a camp could rapidly escalate this to level 2 or 3.

Geographic Area Dimensions

Unable to Fill	MEDL UTF	IMT UTF and IMT functions	Vendors and Contractors	IA capacity	Digital Infrastructure	Dispatch	Smoke Impacts
At or below average	At or below average	At or below average UTF, adaptation and functioning adequately	Routine availability	Routine availability in all regions	Comms and remote command functioning adequately	Adaptations and functions working adequately	At or below average
Above average	Above average	Above average UTF, IMTs unable to mobilize with full rosters	Some UTF of critical vendor (e.g caterer) due to C19	All resource engaged, little to no IA capacity	Minor comms failures and remote command handled effectively	Localized outbreak handled effectivity, contingencies work effectively	Above average
Well above average	Well above average	Struggle to meet mobilization minimums, zoning of fires	Large incidents have UTF of critical vendor.	Unable to respond to new incidents	Comms and command failures are ongoing regionally	Multiple outbreaks with failures in contingencies	Well above average
Lags: Days	Days	Days to Weeks	Weeks	Days	Days	Days	Days
Comments: No Data	No Data	Limited data, reports suggest meeting functional standards	No Data	No Data	Based on available reporting	No known reports of outbreaks in dispatch	Moderate and Unhealthy in AZ

Geographic Area Dimensions Assessment: **LEVEL 1**
Comments: Initial DRAFT assessment. Data and reporting limitations apply, in addition to to lags.

Trending Towards: **LEVEL 2**
Comments: Initial DRAFT assessment. As data becomes available, it's possible to encounter adjustment issues and increasing smoke impacts.

Figure 1—*An early version of the analysis performed with the Degradation Trend Analysis Tool for the Southwest Area. PPE = personal protective equipment; FFTs = firefighters; NYT = New York Times; JHU = John Hopkins University, AZ = Arizona; NM = New Mexico; SWGA = Southwest Geographic Area; ICS = Incident Command System; UTF = unable to fill; MEDL = medical unit leader; IMT = incident command team; IA = Initial attack; C19 = COVID-19; Comms = communications systems.*

The structured analysis had three focus areas:

1. Pandemic dimensions,
2. Incident dimensions, and
3. Geographic-area dimensions.

Figure 1 shows an early iteration of the analysis side of the tool.

DTAT USE IN 2020

Through the Risk Management Assistance program, the DTAT was recommended for trial use by GMAC and evolved considerably throughout 2020. Championed by the Southwest Area and later by the Great Basin Area and Northwest Area, two simple outputs emerged for use:

1. Consolidation of the pandemic category to intersect with the preparedness level system, and
2. Use as a communication tool.

An additional conceivable use was to influence the preparedness level system, but in practice—without engagement by all 10 geographic area coordination centers—the potential for this use was limited. In the absence of national consistency, application for national coordination in the 2020 fire year was ultimately limited. Additionally, concurrent transitions in dispatch reporting technology made the real-time capture of quantitative data, such as UTF (unable to fill) resource requests, reliant on manual reporting.

The tool evolved into a standard online form for data input, but data was collected through a structured conversation with one or more contacts from each geographic area coordination center. Feedback from the Northwest Area highlighted two benefits from the weekly DTAT check-ins:

1. The structured conversations were in an explicit format for revisiting each dimension to examine emergent weakness and strategize response; and
2. The data collection process was worthwhile for capturing the qualitative narrative of what became a historic fire year.

Ultimately, hindsight provided a more quantitative opportunity to review the interactions of COVID-19 with wildland fire. Figure 2 indicates key COVID-19 metrics within the two geographic areas where the DTAT was tried out; figure 3 shows the time series for a selection of DTAT indicators.
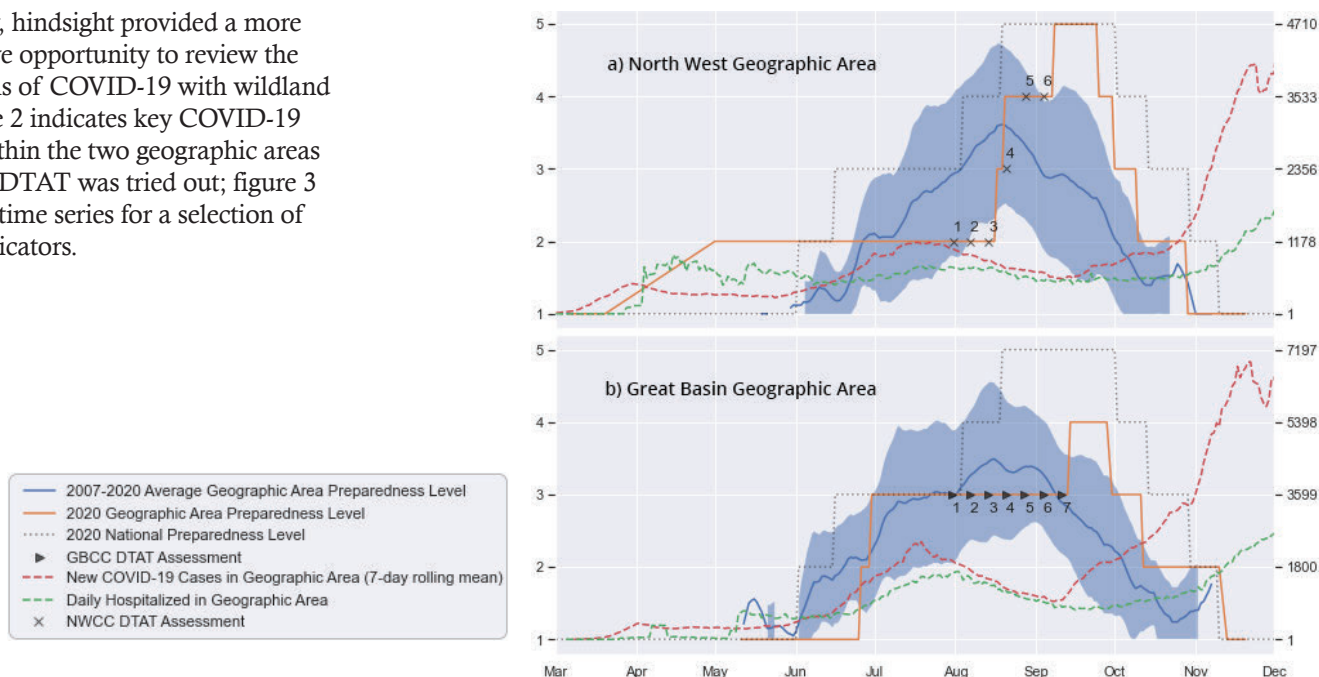
Figure 2—(ABOVE) National and geographic-area preparedness levels in 2020 compared to the 13-year mean and standard deviation (blue shading), along with the 7-day rolling mean of daily total cases hospitalized with COVID-19 and daily new (positive-increase) cases of COVID-19. Data are shown for (a) the Northwest Coordination Center (NWCC) and (b) the Great Basin Coordination Center (GBCC), with symbols to indicate the dates of DTAT assessment made by the respective coordination centers.
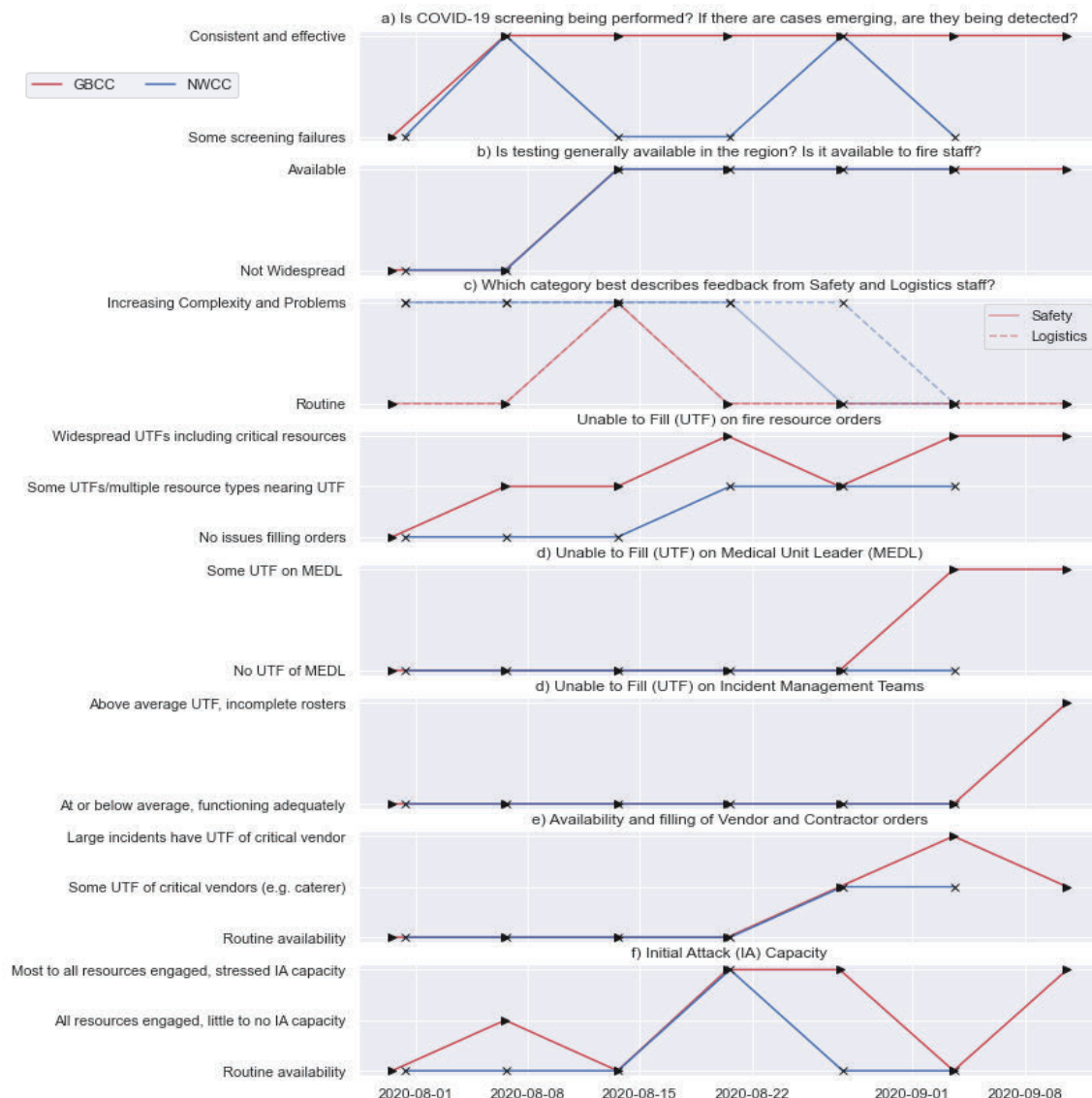
Figure 3—(LEFT) A selection of DTAT metrics (not all shown) for the study period, as assessed by the Great Basin Coordination Center (red) and Northwest Coordination Center (blue). Symbols (crosses and triangles) match the data collection dates indicated in figure 2

The preparedness levels did not reflect obvious correlations with the COVID-19 caseloads during the 7 weeks in which data for the DTAT was consistently collected. Throughout the period of data collection, the reported stresses on the logistics and safety functions of incident management were generally substantial, given the additional requirements of managing the COVID-19 risk.

Reporting stopped after the spike in fire activity in early September. Until then, COVID-19 exposures in fire camps were reported as relatively minor and managed within the capabilities of health departments. Resource orders came back as "unable to fill" for multiple weeks at a time of critical resource needs, but this was described as typical for the amount of fire activity at national preparedness level 5. The late-year spike in fire activity occurred between COVID-19 "waves" at the geographic-area scale; despite many notable challenges, health departments and fire management capabilities were not simultaneously overwhelmed.

LESSONS FROM THE DTAT

Many lessons were learned during the 2020 fire year, and a systemic failure did not occur. COVID-19 transmission occurred within a small number of fire camps but was poorly quantified, and transmission across fire camps as the year progressed was not possible to detect. Similarly, it was not possible to know whether transmission from infected responders to communities occurred at any significant scale. Diminished responder capacity over time did occur; despite DTAT data collection, however, the data was insufficient to describe the extent to which diminished capacity was directly caused by the pandemic.

Rapidly designing and implementing an analysis tool requires strong foundational datasets. With well-established functions and tools, analysts perform the tasks of analyzing domain-specific information, such as fire behavior and landscape risk. The 2020 fire year forced the requirements of analysis to be interdisciplinary to

an extent not previously encountered. In a testament to the problem-solving abilities of incident and geographic-area managers, the system did not fail. However, the limitations of data capture keep us from knowing how close the system came to failure and from documenting how the system responds to such levels of stress.

Returning to the analogy of homeostasis in the human body, the DTAT approach was an attempt to profile the system-level indicators of health in wildland fire management. As a tool for decision makers, the DTAT proved to be able to do so only qualitatively during the 2020 fire year. The year hopefully left the fire management system more resilient in the event of future shocks, stresses, and strains. However, lack of quantitative indicators, such as those collected by the DTAT, qualitatively leaves the system vulnerable in the future. Whether the next episodic stress is a new strain of the same virus or simply an unprecedented level of fire activity, the limits of a system must be understood in order to recognize when the system is approaching its limits so that an appropriate reaction can keep the system intact.

ACKNOWLEDGMENTS

Firefighters masking while working on a fireline on the 2020 Cameron Peak Fire in Colorado. Photo: USDA Forest Service.

Wildfire, COVID-19, and Enterprise Risk Management in the Forest Service

Matthew P. Thompson, Donald G. MacGregor, David E. Calkin, and Joel O. Iverson

The COVID-19 global pandemic created dramatic change in nearly every facet of life, including how the Forest Service worked to fulfill its mission despite facing multiple unknowns fraught with risks. Preparing for and responding to wildland fire while reducing the likelihood that wildland fire responders would be exposed to COVID-19 created an unprecedented challenge.

Responding to the challenge required a means to understand and respond to complex emerging risks. Application of enterprise risk management (ERM) helped the agency navigate through the unique threats, challenges, and learning opportunities associated with the concurrence of a catastrophic fire year and a global pandemic.

ENTERPRISE RISK MANAGEMENT IN THE FOREST SERVICE

ERM is a forward-looking process based on risk management principles that helps ensure the sustainability of an organization through adaptation of its strategy and objectives to meet future conditions. ERM can provide the framework and perspective to help organizations better anticipate and prepare for a rapidly changing world.

In principle, ERM helps organizations create and protect value, make high-quality risk-informed decisions, and align strategy with performance. In practice, ERM helps organizations improve their business practices, assess threats and opportunities that could

affect the achievement of organizational goals, and continually improve (fig. 1).

In 2016, the Office and Management and Budget required Federal agencies to implement ERM capabilities and to coordinate them with strategic planning, strategic review, and internal control processes (OMB 2016). So began the Forest Service's ERM journey, initiated

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ESSENTIAL ELEMENTS OF ENTERPRISE RISK MANAGEMENT (ERM)

Align ERM process to goals and objectives	Identify Risks	Assess Risks	Select Risk Response	Monitor Risks	Communicate and Report on Risks

Figure 1—Essential elements of Federal Government enterprise risk management (GAO 2016).

in part by leveraging existing capacity and seeking strategic consultation with both internal and external experts. The agency established the position of Chief Risk Officer and undertook compiling some of the recommended ERM components, including a risk registry and risk profile (CFOC/PIC 2016). Risk management has, in fact, long been a focal area for the Forest Service's Fire and Aviation Management program (Thompson and others 2016), and ERM provided the impetus to consider risk more systematically and holistically, for instance by examining factors such as climate change and workforce well-being.

PUTTING ERM INTO ACTION: WILDFIRE RESPONSE DURING A GLOBAL PANDEMIC

By March 2020, the onset of the global coronavirus pandemic was rapid and unsettling. Under conditions that were unfamiliar if not unprecedented, Forest Service leaders had to make high-impact decisions under considerable time pressures and with limited and changing information. In response, senior agency leaders assembled an ad hoc ERM Team to help them navigate the complex and uncertain terrain and to support risk-informed decision making. This expansion brought additional subject matter expertise and capacity, as well as urgency, to the agency's existing ERM program.

The coronavirus posed myriad systemic risks for Forest Service mission delivery.

Early on, the ERM Team identified failure to implement organizational social distancing measures (with respect, for example, to facility status and telework) at the appropriate pace and scale as the predominant and immediate enterprise-level risk to workforce capacity and mission delivery. The team developed protocols for decision making and documentation to support decentralized decision making, with streamlined and timely implementation. The protocols supported rapid, flexible, and adaptable decision making at a time when it was critically needed.

In addition, the ERM Team identified near-term mission-critical risks (to workforce health and safety, wildland fire management, and law enforcement), in addition to potential medium-term and long-term issues (such as recreation pressures, telework adjustments, and virtual mission delivery). Due to the magnitude of the problem and relevant expertise on the team, team members spotlighted wildland fire management as an opportunity to gain experience with ERM principles and practices. In so doing, the team engaged agency leaders in discussions about:

- Potential future scenarios;
- Identification of risks and mitigation options; and
- Development of strategic alternatives grounded in real-world challenges like hiring and housing seasonal employees, moving suppression resources across geographic

boundaries, and articulating strategic intent for wildfire response.

At the time, COVID-19 risk to fire personnel was poorly understood, essentially a "known unknown." The ERM Team wanted to corral the appropriate expertise to better understand the issue and support risk-informed decision making. A key tool in the ERM toolkit is scenario analysis, which essentially is a systematic approach to asking "what-if" questions and exploring potential consequences.

Initially, Forest Service scientists from the Northern Research Station helped with high-level scenarios exploring how the severity of the fire season and the severity of the pandemic could interact. As fire activity began to pick up in the Southwest in May and early June, questions emerged regarding whether resources from other regions would be allowed to travel or even be welcomed in the Southwest, and it became apparent that guidance from forest supervisors and Regional Foresters lacked consistency.

The ERM Team helped agency leaders explore the tradeoffs in risk between:

- Fully restricting fire responder movement across geographic boundaries and dealing with the associated implications for fire management outcomes; and
- Allowing unrestricted movement to support fire response while coping with the increased exposure of responders to COVID-19.

As a result, leaders were able to recognize that a consistent agencywide (enterprise-level) response was necessary requiring that resources travel out of area. The corresponding elevation of the coronavirus risk further highlighted the need for developing and adhering to risk-informed COVID-19 mitigation strategies.

In response, the COVID-19 Fire Modeling Team was formed to bring epidemiological modeling into an exploration of how disease dynamics could vary based on incident characteristics (such as assignment timing, number of personnel, and duration) and on interventions (such as requirements for social distancing) (Thompson and others 2020). Key findings underscored the importance of adhering to prevention and mitigation guidance from the Centers for Disease Control and Prevention and the Wildland Fire Medical and Public Health Advisory Team. Additionally, the Fire Modeling Team developed a COVID-19 Incident Risk Assessment Tool that was used operationally throughout the 2020 fire year (Thompson and others 2021).

Beyond seeking to better understand the nature of the risk and available mitigations, the ERM Team also sought to support adaptation, innovation, rapid information sharing, and organizational learning. Several articles in this issue highlight discussions and activities initiated through the ERM Team in pursuit of its goals (see, for example, the articles by Westphal and others and by McCarthy and others).

For example, the ERM Team brought in external experts to support development of a risk communication strategy. The experts recommended communicating early and often, along with continuous engagement between agency leadership and the workforce in a "top-down/bottom-up" approach to monitor and adapt to emerging and unforeseen issues. The ERM Team also recognized the need for a system to facilitate peer-to-peer knowledge transfer and learning through rapid, widespread, and structured sharing of information, building on the workforce's capacity for innovation and creativity as keys to success. This effort included activating focus groups to share key findings and cultivate a community of practice among decision makers in fire management (see the article by Flores and others).

MOVING BEYOND THE ISSUE OF THE DAY

The ERM Team intends to help the Forest Service become more anticipatory, planning and preparing beyond next year's budget cycle. For example, an emerging high-profile issue is the pay gap between Federal and non-Federal wildland firefighters, which diminishes the agency's ability to recruit and retain wildland firefighters, particularly in high-cost-of-living areas. A traditional risk management approach would be to explore opportunities to create new job series and other financial incentives to close the gap and make Federal jobs more competitive.

By contrast, an ERM approach would recognize these issues but also explore what the future fire management workforce *should* look like. Various factors indicate that the workforce of tomorrow could look very different from today, including:

- Emerging technology,
- Increasing recognition of health mitigation strategies,
- The need to align fire response and fuels mitigation,
- The expansion of the fire year,
- The ability to provide many functions remotely, and
- Changes in the skills and desires of the future workforce.

If the Forest Service doesn't sufficiently plan for the future workforce, it could not only fail to take advantage of opportunities to improve the efficiency and effectiveness of the agency's suppression response but also continue to have issues recruiting and retaining high-quality employees.

Wildland fire management will likely increase in complexity over the next decade. Climate change will escalate the frequency and severity of drought, lengthen the fire year, and elevate the volume of synchronous fire activity. Societal issues such as expanding human development, the soaring need for water in growing Western States, and rising demand for outdoor recreation will increase societal expectations for the Forest Service to deliver on its mission. Furthermore, a backlog of emerging

Firefighters masking and social distancing on the 2020 Cameron Peak Fire in Colorado. Photo: USDA Forest Service.

systemic fire management issues remains, including uncertain long-term health impacts on responders, an overworked and stressed workforce, evolving labor markets, and emerging needs for increased technological competencies.

ADAPTING TO CHANGE

The story arc ends here with "to be continued"—which, of course, reflects the entire "journey" of ERM. The sidebar summarizes some of the key lessons learned along the way. If we had written this article before the pandemic, the most salient lessons might have been different, and the story next year will certainly evolve. ERM, like its employees, aspires to lifelong learning.

ERM can provide the forward-looking, anticipatory lens to help organizations sustain mission delivery in the future. The challenge facing the Forest Service and other public forest management organizations around the globe will be to sustain both forest and workforce health in the face of a future of increasing volatility, uncertainty, and complexity. Preparing for, responding to, and recovering from increased extremes, disturbances, and disruptions while also attending to human pressures for goods and services will require agility and adaptation. Through its focus on practices like scenario planning and structured monitoring and feedback, ERM can help keep the Forest Service on track toward a sustainable future.

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Enterprise Risk Management:
Key Themes and Lessons Learned in 2020

- **Adopt Systems Thinking**:
  Seek to understand the entire organization's "ecosystem," how functions and programs interact with each other, and how information flows. Emphasize not only decisions and decision makers but also the contexts in which decisions are made.

- **Pursue Continual, Flexible Improvement:**
  Begin with a manageable scope of work, then develop acumen and expand the program from those foundations. Build in feedback loops to adapt and adjust to your organization's context. Expect that different organizational aspects will mature at different paces and scales.

- **Engage Leadership:**
  Cultivate leadership awareness, participation, and understanding of enterprise risk management. Meet people where they are at, and spotlight early "wins" and milestones achieved to build support.

- **Measure Performance:**
  Meaningful performance metrics are critical for evaluating the impacts of enterprise risks on strategic objectives. Commitment to acquiring and managing the appropriate information can accelerate the cycle of enterprise risk management and organizational learning.

- **Keep an External Focus:**
  If we learned nothing else from the pandemic, it is that external events can dramatically affect the workforce and organizational ability to achieve objectives. Although internal issues such as reporting and compliance remain important, it is essential to periodically scan and assess the external operating environment.

- **Stay Forward Looking:**
  We are not suggesting that we could have predicted the scope and scale of the global pandemic. However, moving forward we can adopt these lessons by building anticipatory foresight skills, investing in mitigating those risks that are foreseeable, and designing continuity of operations plans with adaptation in mind.

COVID 'Shots:

Hotshot Superintendents Reflect on the COVID Fire Year of 2020

Emily Haire

Almost half of all Americans (45 percent) reported that their lives were affected a lot by COVID-19 pandemic conditions in 2020 and experienced a lot of worry and stress on a daily basis (Gallup, Inc. 2021). Nevertheless, even more said that they thrived. The study of human populations is rife with such paradoxes, especially during moments of change, when habits are shaken but values are clarified. Even in relatively uniform social groups, the same event can spur a wide variety of responses.

In June 2021, Interagency Hotshot Crew (IHC) Superintendents Jerry Hoffman (Midewin IHC), Devin Parks (Zigzag IHC), and Matt Prentiss (Wyoming IHC) discussed their experiences with the COVID-19 pandemic, its significance as a moment of change, the challenge of moving on in 2021, and what comes after that. They often had very different insights about work/

life balance, operational and cultural adjustments, how crisis enhanced their values, and the coalescence of fire behavior and firefighter labor. Their insights, lightly edited for readability, appear below following each question asked during the interviews.

A DELINEATION

The pandemic of 2020 was a watershed event in global history. Does 2020 mark a clear "before-COVID" and "after-COVID" moment for you, whether in your work life or your personal life?

Matt Prentiss (Wyoming IHC):

The first few months of COVID, when things were really locked down—that was very bizarre and challenging and stressful. Those first 3 months were pretty demanding on us as parents, when we were fully teleworking, and also demanding on the kids to figure out how to navigate school on an online

Before the pandemic, the maskless Zigzag Interagency Hotshot Crew poses at a barbeque held for former crewmembers in 2019. For some, the arrival of COVID was just another example of incorporating a new type of risk into an already dangerous job in a dynamic environment. As the risks mount in the wildland fire environment, the Zigzag crewmembers are preparing to fight, as Superintendent Devin Parks puts it, "whatever today's fire is." Photo: Zigzag Interagency Hotshot Crew, USDA Forest Service.

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NOTE: The views expressed in this article are those of the interviewees and do not necessarily represent the views of the USDA Forest Service.

platform. Trying to figure out how to have the personal space to do what we needed to do was extremely challenging, especially with the kids. At first, the kids thought it was great, and then they realized they were missing out on the social aspect of school, plus trying to figure out how to get their schoolwork done. COVID definitely impacted my normal day-to-day personal life more than my work life.

Jerry Hoffman (Midewin IHC):

It was very distinct in early February of 2020. Back then, we knew something was going on, but COVID hadn't really taken hold in the United States yet. To me, it seemed like nobody really knew how bad it was going to be. My girlfriend and I were sitting on a plane. She had an aisle seat, and across the aisle from her was a woman who had a mask on, who was eating a sandwich with gloves on—no exposed skin at all, basically. And we were thinking, "She is taking this way-way seriously." A month later, the whole country was like that.

My crew hit the road the first week of March and headed to the Mark Twain National Forest in Missouri, for both initial attack and prescribed fire, which is what we typically do. Everything was absolutely, perfectly normal. But we knew at that point: COVID is in the country, it is spreading, and it may highly impact us.

Then that trip was cut short. The agency made a decision to cut us loose to get out of there and get home. The agency was busy trying to figure out what 2020 was even going to look like and how we were going to function.

We ended up sitting for 6 weeks, because there was no more prescribed fire at that point. That really impacted the operations of the crew, impacted getting prescribed fires done, keeping burn units on cycles. For our crew, it really, really identified how much our crew relies on prescribed fire to keep busy. We are easily one of the busiest crews in the country, but we need to do a lot of prescribed fire for that to happen in the Eastern Region.

Devin Parks (Zigzag IHC):

I couldn't say 100 percent that it is going to be that certain, with large pre-COVID and post-COVID shifts in work, operations, life operations, and cultural operations. I couldn't say for sure that there's going to be that shift of "before" and "after," as starkly as you were asking. Part of that is: we're still right there. It's like trying to comment on something being the biggest ever while you're still at the concert. I wouldn't say it's no big deal. It obviously had a huge impact on a lot of different things.

Within fire [the fire organization], there were some adjustments that were made in 2020—some of them really, really good breakthrough adjustments to manage fire both logistically and administratively. Some of the good ones are being carried forward, and we might've actually backed off some of the other good ones. I hope we come through with a little bit of a balance.

The Midewin Interagency Hotshot Crew in action. Prescribed fire operations were disrupted due to concerns about smoke impacts on respiratory health during COVID. In March 2020, the crew was called off of the Mark Twain National Forest during its first assignment of the year, making crewmembers realize how much they relied on prescribed burning as part of their work. Photo: USDA Forest Service.

OPERATIONAL AND CULTURAL CHANGES

Comparing 2020 to previous fire years, what aspects of your work have changed because of COVID?

Matt Prentiss (Wyoming IHC):

We were asked to be more self-sufficient in 2020, and that was definitely different. Our goal when we sat down in the spring of 2020 was to make sure that we were self-sufficient and could take care of the crew better than we ever had before. It was about, "How can we make this our own and really take care of the crew?"

That's when the [kitchen] trailer was born. To be completely self-sufficient with our food program was beneficial to the crew, not just eating MREs [meals ready to eat] or junk food the entire time. We wanted to eat better than we ever had on a fire, and we took care of the crew that way.

At the same time, it would not affect us on an operational level: it would not affect the way we fought fire and how we operated on a typical shift. We had to keep our operational tempo the same and not compromise that. And I feel like we accomplished that last year. It was more just taking care of the crew without the logistical support of a Fire Op Team.

We were able to be more operational; we had more time out on the fire to do our job. Prior to 2020, typically the fires that we would go to were large fires which would have a team [incident management team] on them, and there would be a large fire camp. We would usually have to travel longer distances, up to an hour's drive just to get out to the fire to work and then back to camp.

Once the 2020 season started and we were actually more self-sufficient, we could be closer to the fire, so we had less travel time and spent more time doing fire operations. We also didn't have to worry about the longer briefings in camp. We just got the information we needed for the day so we could be operational and safe, and we just went out to the fireline and got the job done.

There were times in the past where we were in the middle of an operation—a firing operation or critical piece of line that we needed to put in—but we were pulled off the line because we needed to get back into camp because of logistical constraints, the caterer, or whatever it was.

In 2020, that wasn't the issue. We handled all of our own logistics, so that wouldn't dictate how we operated out on the fireline. We could just focus on our job more. That was pretty consistent throughout the fire season. There was never a time that logistics overran the fireline operation.

We could also work a little later in the evening because we were not dependent on catering services. We ate healthier because that was our goal, to provide highly nutritious food to the crew. The crew never got sick last year; we never had camp crud. And we were very fortunate that no one on the crew got COVID during our season.

Jerry Hoffman (Midewin IHC):

We used to all get together in a conference room, sitting right next to each other during the daily briefing. Since 2020, we do daily briefings differently—not getting together, done by conference call. Everybody separated, nobody in the same kind of room. When certain groups are together, we get together in an outside setting. So that's actually becoming very, very normal now, which is very different than what it used to be. It has become so normal that it works. A year ago, it wasn't very clean; we didn't feel like we were getting the information. But now everybody's so used to it, that we figured it out and it's working.

Last year, we would ask—actually pre-establish with people as we were traveling again last year—what their comfort zone was when making a game plan for a fire. I absolutely respect their comfort zone, and we'd figure it out somehow. Prior to COVID, that was never a question that you would ask somebody. Some people just are not comfortable being in close quarters—they don't like shaking hands or they don't like being close to people they don't know. But it was never anything that was asked. And now, it kind of is. I think it's more respectful to people, you know, just rather than assuming that they're good with you being next to them. Asking shows that you have respect for that person and their personal space.

Devin Parks (Zigzag IHC):

Some of the remote things that were implemented last year—the remote check-in; using online tools; remotely submitting times; and a more remote demob [demobilization] process, as opposed to walking into a building or a tent with a piece of paper—that was a big change. The main briefing being over the radio or, at small scale, having well-spaced breakout briefings for each division—these resembled some things we had done in the past but not to the scale that we did it in 2020. It was fairly standard across the landscape.

Some of the beneficial changes were done in order to have less exposure to each person.

One of the outcomes that we had from that was measurably better sleep because we were sleeping in better locations, not brought into a centralized camp-type location. We were getting the food that we were getting—but we always get the food that we were getting—but we picked up food and drove it to our remote sleeping location, whether it was hotels or spiking in remote locations or using campgrounds near fires to have more spacing.

> **Our goal when we sat down in the spring of 2020 was to make sure that we were self-sufficient and could take care of the crew better than we ever had before.**

One noticeable detrimental change was less time speaking with people. It means less connection, less knowing of people, less networking. There was less personal interaction, like up-close personal interaction.

Prior to 2020, in a morning briefing, people walked up to each other and had little mini conversations, little bite-sized conversations. And we'd have several of those, both touching base with people that we know through the years in the fire organization, as well as going to touch base with someone from a different type of resource about something. But each of those connections then leads to knowing each other in the future and a closer network of fire responders.

Last year was much more separated—intentionally separated. Didn't sleep in the same vicinity, didn't eat in the same facilities, didn't have breakfast conversations with other fire resources. Didn't have very much [opportunity] for the prebriefing conversations, which is part of the way we do an ICP [incident command post], with a briefing area and people coming into the briefing area a little bit earlier and having conversations. So, a lot of those pieces didn't occur—I would say in multiresource AARs [after-action reviews] weren't a common occurrence. And if it was, it was because of something fairly major.

Some of those pieces, I would say, have some effect. I have been part of incidents where there have been different sorts of interactions, less-than-positive interactions, that needed to be worked through and discussed later among people from different resources. Whether it was additional stress from the last year-and-a-half that everybody lived through or very isolated to those specific incidences, but those incidents have given us something to pay attention to—something that may need to be addressed or worked through, as people are back to sharing the same space and having more interaction face to face.

CONSISTENCY DESPITE COVID

What has not changed in how you work? What has been consistent regardless of 2020 COVID issues?

Matt Prentiss (Wyoming IHC):

The fire environment. I always say, "Fires don't care about COVID." As far as being out on the fireline doing our job, none of that changed. Fire dictated a lot of what we did, and that hasn't changed from previous years. Yeah. Once we got out on the line, that felt very similar. That's why I say my work life didn't really get impacted too much by COVID, versus my personal life, which really got impacted. Fighting fire didn't feel that much different, operationally. Logistically it did, but operationally it felt very, very much the same.

Jerry Hoffman (Midewin IHC):

Effectively communicating, throwing a map on the hood of the truck and coming up with a game plan for a fire was very, very difficult to do when standing 6 or 10 feet away from each other or just by phone. We tried it and it just was not successful, in my opinion.

The vast majority of people were like, "Yep, absolutely. If something's going on, we have to be working in close quarters together." I'd much rather be shoulder to shoulder with somebody, looking at something on the hood of a truck or a tablet and say, "Here's what we need to do." So we continued with that.

Devin Parks (Zigzag IHC):

So far in 2021, the experiences that we've had are back to the previous model in a lot of ways. There is much more of a return to the social interactions now and much more face-to-face contact with people. Briefings are in the same format that they were prior to 2020, is what we've been experiencing. There have been a few pieces with more access, whether remotely submitting our CTRs [crew time reports] and the more remote demob process. But a lot of the interactions that we have with other prior resources—they resemble what they were prior to the 2020 year.

> **Fires don't care about COVID. As far as being out on the fireline doing our job, none of that changed.**

COMPARATIVE MOMENTS OF CHANGE

Are there other significant moments—moments unrelated to COVID—that you consider times of major change that marked a clear "before-and-after" transition in your life and work?

Matt Prentiss (Wyoming IHC):

My career has been primarily hotshotting. And trying to have that work/life balance has been challenging. This job is very demanding; it takes me away from home; and my personal life coincides with that.

Sometimes, there's crossroads where things happen, whether it be the birth of my kids, struggles in relationships, you know—death of parents. All those things kind of intertwine at times; it's not very clean. Those things cross paths, and not so much the positive way. It can be a very challenging time.

I've definitely struggled with things that happen at work and things that happen at home and those things colliding. Trying to not let them affect one another is very challenging, in the role that I play as the superintendent or the role that I play at home as husband and father. Fire in general is very similar to the military in that way, where this job really impacts your personal life. The things that we have to deal with definitely have conflicts with things that are going on at home. Wearing two different hats at times is difficult.

Being a superintendent, you have 20 people that you're in charge of 24 hours a day while you're out on assignment. You're having to manage things that are happening on the fireline, but also you're there to support crewmembers' personal lives.

Then you come home, and you have to put that stuff aside and help focus on what's going on at home and be there for them too. So, it's just a very unique balance. And sometimes it's hard to take off that superintendent hat and adjust to home life. Being gone impacts the family at home; and the things that they're having to deal with while you're gone, you're not there to help with. When you come back home, you have to try to integrate into their lives. I can't think of any other job except maybe the military or law enforcement where you have to wear these two different hats and try to balance that.

Jerry Hoffman (Midewin IHC):

We were a crew that did drink while we were on travel status. It would depend on a situation; like if we had a good shift, we would let somebody have a beer with dinner. Nothing crazy. If we were done with the fire assignment, while traveling back, we would—depending on where we were and what was going on—let the crew let it rip a little bit. And that was fun, but it definitely created a lot of headaches.

In 2004, we had a fatality on our crew. We were coming back from Florida. It was an after-hours death in which one of our crew members was struck by a vehicle and killed.

We were shut down after that. We had to really, really rework the program and what's important to us. After the fatality, we went to completely dry on the road. Portal to portal, we do not drink. We really, really stress that. We owe the country and we owe the taxpayers: being professional firefighters on the road, and that's all we are. Be professional at all times.

So that was a big, big change. I've been part of leadership of the crew, before and since then. Workwise, that was definitely a really big change. I take the responsibility of being a professional firefighter for the country seriously.

On the personal side is: failed relationship, after failed relationship, after failed relationship, broken heart, broken heart, broken heart.

A hot topic right now across the country is work/life balance. My work/life balance was completely outta whack. I was a workaholic. It was crew first, no matter what. Missing important events because it was fire season and that's all that mattered. And so, personal relationships were failing.

And after my last failed relationship, I was like, "Okay, I'm done with this, it's time to change things." Now I'm successfully 3-plus years into a great relationship. We recently got engaged. I'm extremely excited to spend the rest of my life with her. That's because I finally found that balance.

Devin Parks (Zigzag IHC):

There was an event that comes to mind. Prior to this, there was a mentality that fires would hit an old burn scar and would then stop progressing and would become an opportunity maybe to pick the fire up or use it to suppress or slow down a fire growth.

But in 2017, I believe it was, I was on a fire that hit an old burn scar and burned across the old burn scar, which was standing snags—heavy dead and down [trees] and brush—and burned across it for a long way, at a fairly rapid rate for the local fuel type. It was a fairly rapid-burning large fire across an old burn scar, and it didn't slow it down at all. Until that happened, burn scars were thought to set you up for success. But this didn't.

We're having to make up new terms to describe the extreme events we're living through.

I am sitting in under a "heat dome" right now with temperatures so far beyond anything ever measured that, um, I hope there's a lot of alarm about those kinds of differences. We're having, right now in June [2021] in the

Northwest, the hottest temperatures ever measured. That sounds bad if it's a single event, right?

In March [2021], I was in Alabama and Tennessee and went through what they were calling at the time "historic" tornadoes through the area. That was pretty rough. That was pretty bad. Five months before that, we had a "historic" wind event in the Northwest, with unheard of fire growth for the Northwest—incredibly destructive, tragic fires all over the Northwest. And what was it a year earlier? We had a "historic" fire season in Australia.

In no way am I diminishing these events. I keep saying "historic" because it's never been this bad. When we talk about a "heat dome," that's a 50- to 100- to 200-year heat dome. When we speak of "major change," is that something that we have another 100- to 200-year heat dome, 2 years from now? And when we have an additional wind event like the Northwest had within the next 10 years?

Then it stops being "historic." It just becomes what we're having. So there appear to be these extreme events escalating, and whether it's freezing events, historic snows—the events are bigger.

VALUES DURING TIMES OF CHANGE

Many hotshot crews have a social media presence where they post their status and photos, but also mission, history, or values. For example, the Wyoming IHC says it values camaraderie, a strong work ethic, and mutual respect. The Midewin IHC notes dependability, hard work, crew cohesion, pride, respect, diversity of ideas. The Zigzag IHC upholds a strong work ethic, great teamwork, and a commitment to safety.

> I take the responsibility of being a professional firefighter for the country seriously.

The Midewin Interagency Hotshot Crew in action. Prescribed fire operations were disrupted due to concerns about smoke impacts on respiratory health during COVID. In March 2020, the crew was called off of the Mark Twain National Forest during its first assignment of the year, making crewmembers realize how much they relied on prescribed burning as part of their work. Photo: USDA Forest Service.

Did working through COVID change or challenge your crew's mission or values? What strengths did they draw on to get through 2020?

Matt Prentiss (Wyoming IHC):

I think it reinforced our mission and our values. I think the [kitchen] trailer brought us closer together in that team cohesion environment that we try to foster.

Looking before COVID and the way we operated out on the fireline, we'd be tight, and we'd work really close together. But when we were back at the traditional fire camp, we would go to the caterer, and once we went through the caterer, everybody kind of just went their separate ways and did their own thing.

The trailer kind of forced us to bond over a family-style meal, when at the end of the day, the family comes together and they all sit and eat dinner together.

Having the trailer forced us to work together outside of the fireline, to prepare this meal and gather around this meal and interact more than we had in the past. That reinforced all those values we try to foster in the crew—camaraderie, strong work ethic, mutual respect—which is really cool to see.

That was not expected to happen. Our thought was, "Hey, let's provide these really good meals to the crew and see how we function outside of the norm." We didn't really anticipate the camaraderie that would come from having the trailer and having to make this meal together for 20 people, and how it all came about. That was pretty cool. I think it definitely helped us with those values.

Jerry Hoffman (Midewin IHC):

I don't know that working through COVID really challenged our identity and values as a 'shot crew. I think it

enhanced everything. We didn't know what the 2020 fire season was even going to look like; we didn't know if we were going to get out at all. We're a crew that's pretty well used to getting a thousand hours of overtime. And people were a little bit worried about that because when overtime becomes the norm, you make life plans based on that. So we were very, very transparent with that kind of stuff. But we worked to all get through it and committed to working together to get through it.

We've also been a crew right from the start who believed this was going to be a team effort in decision making, from the squad leaders on up. We were going to be a five-person team that's going to make decisions together, if time allows. Like with COVID—this is something that none of us had experienced before. So we opened it up all the way down to the crewmembers. There's flexibility in that. We went down to Region 3; we

got everything figured out on how they were handling everything. Then we headed up to Oregon; start it over. We get up there and Region 6 is handling it differently than Region 3 or Region 9. Start over again.

So it was always just an extremely flexible thing, trying to be as patient as possible and not freaking out over all this change. But also having everybody on the crew have a voice and be able to say, "We got this, and this is how we're going to do it. It's going to be perfectly fine. It's going to work."

You run into people both young and old who are resistant to change. And they either got weeded out in 2020 because they couldn't handle all the change; or they've had some life-changing events and now they can handle change. Because that's how the past 18 months have been, just nothing but change on a daily basis.

Devin Parks (Zigzag IHC):

It was not just the COVID-related stress for the season, but it was also a long fire season. We had a busy fire season, as most resources did. That in itself had its own sort of level of stress.

Then piling that onto the other pieces of home stress, of society stress—being unable to go to the places they would like to go in their spare time, being unable to do some of the things that they would prefer to do in their spare time—puts everybody in a heightened level of stress. I observed that our crew treated each other well, treated each other respectfully, had a good season of firefighting, were busy, and were able to continue with the level of respect within the program to have a good season.

Also, from my level and interpretation of how people spoke to risk management, there was a lot of focus from a lot of levels on COVID, like suddenly COVID was the only threat to firefighters. That was 100 percent of the focus. A ton of effort went into COVID-specific mitigation, which is important but it's just another risk. When we pile on all of the risks that hotshot crews and all modules experience in a season—

between the driving risk, the hazard tree mitigations, the flames on the fire, and the actual firefighting mitigations—there's a lot of risk management that's happening all day, every day.

There wasn't very much messaging on the fact that, "Yes, COVID is an additional risk; have an appropriate response to it; put mitigations into place to lower the level of the risk." Mitigations like personal spacing, washing our hands a lot, wearing masks when we're in the presence of others, keeping personal space even though you're wearing a mask, not having unnecessary contact with others, significantly increasing our cleaning of just surfaces—but you're doing all of the mitigations that you can do at that point.

Continue those, but there's still everything else. We definitely communicated a lot, in-house, about not losing sight of the fact that we have an incredibly dangerous job in a dynamic environment, where you don't have all of the information. But you're still taking on projects and working to develop the situation and accomplish the mission.

Situate COVID as an additional risk. Don't have it as the only risk. Don't lose sight of all the different variables. I tried to emphasize that because of all of the other hazards within our environment.

PANDEMIC CHALLENGES

What challenges, stress points, or fragilities did your crew experience during 2020?

Matt Prentiss (Wyoming IHC):

For the most part, in our work life we were really isolated from most other people. When we were out in the public, we were very conscious of our interactions with other folks and respected the public with mask wearing and social distancing. I think in public was where we felt stress the most.

Once we got to a fire, we set up our own camp, and we isolated ourselves from other people, which was really unique. There was not the social aspect of being in a fire camp and being around other people. We didn't have that. And at

times that was challenging because all we had was each other to be around. There wasn't that break from each other.

But—as far as COVID—the isolation really sheltered us from the stressors of COVID. COVID wasn't a huge impact on our daily lives, at least our work lives.

Jerry Hoffman (Midewin IHC):

At the tail end of our season, I think cumulative fatigue with everything just caught up with us. Everybody was over it at that point. Everybody wanted to get home and be with done with fire and get COVID mitigation and try to just kind of like normalize a little bit.

But 2020 was a difficult and a long and busy fire season for us even after the initial sitting for 6 weeks. It was crazy, the amount of hours we ended up with, as much fire that we ended up on. I think the stress of all that change, operating differently, always having it in the back of your mind, wondering, "Are we going to get COVID going rampant through the crew? Are we going to quarantine for two weeks? Am I the reason that we're looking at 2 more weeks of the crew not getting overtime? Am I asymptomatic, and am I going to bring it home to my loved ones?" I think that was constantly on our minds. That really, really contributed to mental fatigue by the end of the season, where everyone was just done with it and wanted to go home.

Also stressing the value of crew cohesion and teamwork was that pressure of days off. We were just asking people to keep the team in mind. Keep the crew in mind. Reminding them they have the responsibility now of continuing to use hand sanitizer, to wear masks and avoid situations that could potentially expose you and bring it back to the crew. It put a lot of responsibility on people, because I think no one wanted to be that individual that potentially brought it back to the crew and shut us down again.

Devin Parks (Zigzag IHC):

Obviously, there were challenges in that things were changed.

But within the crew, things operated much closer to normal—as far as interactions, procedures, processes that we follow, in how we communicate with each other or timing of how the day unfolds for us most of the time through a fire season. A lot of those things were the continuation to prior seasons.

Then we had to make our adjustments in that we weren't going to locations where we were exposed to other people. We were doing more things just within the crew's footprint, without very much interaction with others.

FORECASTING CHANGE

Moving forward, if you had to forecast the next big moment of crisis or change, positive or negative, what do you see?

Matt Prentiss (Wyoming IHC):

I'll focus on what I'm comfortable with, and that would be the Fire and Aviation [Management] side of things.

I would say there's probably going to be, in the next few years, real challenges in the Forest Service when it comes to hiring and retention. We're already seeing some of the effects of that right now in 2021. I believe there's 25 or 30 type 1 crews that weren't able to keep their hotshot status because of hiring issues and retention issues. I don't see that going away. And I believe it's going to probably get worse before it gets better.

There have to be some changes in the hiring process and a real need to look at addressing the retention issue in the Forest Service, on the fire side of things. It's going to really impact the fire operations side of things when there's a lack of resources. So I think that's going to be a huge issue moving forward in the next several years.

In the hotshot group, they definitely recognize there's a problem. There are a few folks speaking out about it to raise awareness of this issue, of the struggles that crews are having with the retention problems. I think that needs to continue—continue to build our awareness and really look at why this is happening and why we're having these issues with our hiring and retention.

Jerry Hoffman (Midewin IHC):

I think we're in the middle of the next crisis right now, with this hot topic of our huge salary and retention and morale issues. The Forest Service is by far the most looked-upon agency when it comes to wildland firefighting, and our retention issue is horrible. We are so shorthanded right now. I really feel like we're going to have a difficult time maintaining the seasonal work force.

So many people are not raised in the outdoors or even raised with a hard-working work ethic. We are going to be shorthanded for years and years to come when it's so much easier for somebody to do something and make more money. When California can use the State budget to devote $2 billion to improving their wildland firefighting agency and they're looking to hire 1,400 more people, those 1,400 people are going to come from the Forest Service, maybe the BLM [Bureau of Land Management].

It has a lot to do with hotshot crews, but I think it's fire in general. Last year, we increased our crew to 14 career positions. So now we have nine GS-5 positions on the crew, and we can't keep them filled. It's easier for people to resign and go do something else than it is to maintain the career. They can go make more money doing something else and not have to be away from loved ones for 6 months out of the year.

Devin Parks (Zigzag IHC):

Oh, man, I definitely don't want to be a forecaster of crisis. An AFMO [assistant fire management officer] that I worked with, that I had both respect and really like, recently said, "I'm sick of living through historic events." He said that very recently. And I think, if anything, my forecast is probably the continued historic events that negatively impact the fire environment.

One thing has come up multiple times already this year is, "I can't believe it's burning like this in June" type of talk. Or, "I can't believe it's burning like this in May" when it is more like it would burn in July or August. We've been trying to communicate, when

that comes up, that it's no longer the season that it was early in our career. May isn't the same as May was 10 years ago, 15 years ago, 20 years ago. To fight today's fire—under the fuel conditions, the weather conditions, and the fire behavior conditions—regardless of what the month is. So, we're trying to speak to that, to not be surprised if a fire exhibits extreme fire behavior. Because they are, and they do, and they're going to. No matter what month we're in, be prepared to fight whatever today's fire is.

Wildland firefighters and hotshot crews are traveling to fires in these "historic" events. These events have a large effect on both the personnel as well as the fires on the ground. In my mind, the COVID mitigations were no way easy. But we don't have mitigations put in place for "historic" weather events and "historic" fires, currently. So that would be one of the pieces that I would say is a major, major change and something to look back on.

And at the same time, there are cracks in the national fire response. We're working through trip wires or hurdles with organizational capacities and staffing issues—at the same time as "historic" events. Maybe our response capacity and the need to respond may be heading in different directions, when we need to be able to have a more robust sort of fire response at the same time. Is this becoming more difficult in the staffing and organizational structure? This could potentially be another non-COVID major, major change. And it's not like having a single event, it's not an earthquake. It feels like more of an escalating situation.

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Social distancing during a briefing outside a school on the Wood Springs 2 Fire in June 2020 on the Navajo Nation in Arizona. Photo: Donavan Albert, USDA Forest Service.

Improvising
Crew Operations During the Pandemic

Jody Jahn

Abstract

Managing the COVID-19 pandemic required all firefighters and fire managers to improvise in some way. Drawing on 16 COVID-related Rapid Lesson Sharing documents, the article focuses on crew leaders, who often face the most difficult challenges in improvising. Although crew leaders are responsible for their crewmembers, they often have limited access to the resources they need to fulfill their responsibilities. Some efforts to improvise worked better than others. The article discusses definitions of improvisation, what is involved, and how it plays out. It also outlines the kinds of resources and structures that need to be in place so that firefighters and fire managers can work as effectively as possible.

Key takeaways:

- Crew leaders benefit from having a flexible, improvisation-friendly decision space.
- Effective improvisation is more than simple adaptation. It depends on the recognition that crew leaders can be spontaneous only in a bounded manner, making adaptive decisions under various resource and structural constraints. Improvisation also requires common ground rules as well as trust and support.
- An improvisation-friendly decision space comes about from having solid foundations for decision making (through cohesive agency guidance) combined with dependable decision support from senior managers.
- Crew leaders can better manage public health emergencies with streamlined options for purchasing approvals and health-related reporting.

National guidance in response to the COVID-19 pandemic in 2020 raised important questions about tradeoffs in wildland fire management. Crew leaders made a good-faith effort to follow COVID guidance while still getting the job done.

MORE FLEXIBILITY NEEDED

However, crew leaders soon discovered the need for more flexibility in following COVID guidance (Juvan 2020). As one crew leader put it in a Rapid Lesson Sharing (RLS) document, "Crew leadership ... determined that we will occasionally find ourselves in positions where all COVID-19 mitigations cannot be met" (O'Loughlin, 2020, p. 2). Multiple RLS documents discussed ways that following COVID guidance affected decision space with respect to:

1. Making situational decisions to break with COVID guidance, and

2. Disengaging or declining assignments.

Crew leaders had to make situational decisions about whether and when to deviate from COVID guidance. In particular, when personal protective equipment and cleaning supplies were in short supply, it was difficult to protect each other and to properly sanitize hands and equipment. Moreover, limited vehicle capacity made it difficult to maintain social distance.

Both the Lion Fire and Shepard Road Fire RLS documents noted that following COVID guidance (Incident Overhead 2020; Juvan 2020):

- Was generally possible if it was not treated in absolutist terms, and

- Presented several unique circumstances requiring crew leaders to make situational decisions to bend or break with the guidance.

In particular, the Shepard Road Fire RLS noted that decisions to adapt to COVID guidance should be made and managed within the crew context (Juvan 2020). This observation seemed

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to help set the stage for the "module as one" adaptation (working consistently with the same crew to avoid disease transmission), which emerged relatively early in the 2020 fire year.

The RLSs for the 189 and Hyndman Fires noted that crew leaders needed the decision space to disengage from or decline assignments if they believed that COVID-related risks were too high (Allalunis 2020; Filbert 2020), including the risk of exposure to COVID and risks arising from following COVID guidance (such as too much vehicle exposure to risk).

For instance, the 189 Fire RLS described an excessive firefighting response (Allalunis 2020). Having too many resources present created social-distancing challenges. The RLS recommended (among other things) that crew leaders should be given the option to scout the incident before committing resources and to consider disengaging if their resources are not needed.

On a similar note, the Hyndman Fire RLS noted that firefighters should accept the fact that COVID will limit crews' capacity to get things done (Filbert 2020). The RLS also suggested that crews consider declining an assignment when they see that the response to an incident might be increasing COVID-related or other safety risks (such as the use of too many vehicles).

The RLS documents show that crew leaders faced situations in which they needed to adapt to the COVID-19 environment while managing wildland fire. Thinking of a crew leader's adaptation in terms of "improvisation" can yield additional insights from the RLS documents, including ways of smoothing crew leader improvisation during any future public health crises.

DEFINING IMPROVISATION

We have all likely been told to improvise on the job at some point in our careers. But what does it mean to improvise? Adapting to unexpected circumstances or making do with the resources at hand might come to mind. Both adapting and

> **During the pandemic, firefighter improvisation involved adapting creatively to new situations and making do with resources at hand.**

making do are ways of improvising, but definitions of the term "improvisation" yield additional insights.

A general definition from Merriam-Webster is as follows:

Improvise: 1. to compose, recite, play, or sing extemporaneously; 2. to make, invent, or arrange offhand; 3. to make or fabricate out of what is conveniently onhand.

Improvisation takes on more specific connotations in the context of theater (such as "comedy improv") and jazz ensembles. Note, respectively, the spontaneity and shared knowledge in the following definitions:

- Improvisation, in theater, is the playing of dramatic scenes without written dialogue and with minimal or no predetermined dramatic activity.
- Improvisation, in jazz music, "is the process of spontaneously creating fresh melodies over the continuously repeating cycle of chord changes of a tune. The improviser may depend on the contours of the original tune or solely on the possibilities of the chords' harmonies."

During the pandemic, firefighter improvisation involved adapting creatively to new situations and making do with resources at hand. In the jazz and theater contexts, effective improvisation depends on everyone working within a set of constraints (bounded spontaneity and common ground rules). Likewise, decision making in wildland fire management requires a series of judgment calls, and decision makers need to know that

senior managers both trust and support their decisions. Bounded spontaneity, common ground rules, and trust and support are all needed.

Bounded Spontaneity

Bounded spontaneity implies extemporaneous action, yet improvisation never comes entirely from scratch. Improvisation is spontaneous, happening on the fly, whether it involves actors performing comedy improv or musicians playing a meandering jazz tune. However, the spontaneity does not truly come from a blank slate. Instead, improvisation involves a bounded form of spontaneity, with improv actors and jazz performers following agreed-upon rules and drawing from shared knowledge.

Wildland firefighters also improvise in a spontaneous but bounded way. During the 2020 fire year, crew leaders could adapt and innovate only to the extent that they had resources and structures in place to do so. Following COVID guidance while managing a crew placed crew leaders in the position of having to adapt their operations because of limited resources (funds, vehicles, cleaning supplies, and personal protective equipment). Crew leader spontaneity was also constrained by new or incomplete structures, such as new rules and procedures (for wearing masks, social distancing, and sanitizing); inconsistent purchasing approval processes; uncertain COVID reporting requirements (forms and agency contacts); and a lack of connections to local health departments. Several RLS documents described the resources and structures that might help a crew leader improvise more effectively in future public health emergencies.

Common Ground Rules

Common ground rules provide a foundation for improvisation. Jazz and comedy improvisation both depend heavily on them. For example, comedy improv depends on actors respecting the "yes, and" rule—that is, accepting and building upon what another actor previously said and did. Comedy improv fails when an actor rejects a previous contribution to the performance.

Common ground rules are crucial for the wildland fire organization as well. The RLS documents show that crew leaders had more difficulty making improvisational decisions when the ground rules were not clear. Several RLSs noted inconsistencies in how (and even whether) firefighting personnel followed COVID guidance on mask wearing, social distancing, and sanitizing, depending on the agency (Federal, State, or local) and geographic location. Without common ground rules, crew leaders had to make judgment calls regarding whose interpretation of guidance to follow. A lack of common ground rules for interagency wildland fire operations also made it difficult for crew leaders to model and uphold leader intent because crewmembers were seeing disparities in compliance with COVID guidance from one incident and crew to the next.

Trust and Support

Trust and support are critical for successful improvisation. Improvisational jazz performers, for example, draw from shared knowledge about rhythms, chords, and melodies, and they are spontaneous to the extent that various combinations of these elements work. Members of jazz ensembles don't necessarily have a set plan for their music, and playing it well depends on the performers trusting each other's judgment about what sounds good and backing up each other's musical decisions. Each musician tries to make everyone else's contributions sound the best they can, knowing that the others will do the same.

Trust and support were also crucial for crew leaders during the 2020 fire year as they adapted their firefighting decisions and logistics to accommodate COVID guidance. Several RLS documents noted that, without common ground rules, crew leaders were uncertain that senior managers would support their improvised decisions. For example, a crew leader might be uncertain of:

- Reimbursement after deciding to isolate the crew in a hotel;

- Ongoing pay for crewmembers during the mandatory social isolation period; and

- Support for declining an assignment because the risk of exposure to COVID-19 was too high due to excessive resources onhand or other crews' lack of compliance with COVID guidance.

How can the interagency wildland fire organization position crew leaders for successful improvisation during future public health or other crises?

CREATING AN IMPROVISATION-FRIENDLY DECISION SPACE

Crew leaders would benefit from national leaders setting clear and straightforward expectations about how to follow national guidance in a public health crisis. They would also benefit from having the flexibility to make small changes, bending the rules situationally when needed. Specifically, crew leaders would benefit from:

1. Solid foundations (or ground rules) for decision making,

2. Support and trust for decisions, and

3. Streamlined authority to act under constrained circumstances.

Solid Foundations for Decision Making

Solid decision-making foundations come from centralized ground rules and expectations for compliance. Problems arose during the 2020 fire year from wide variation in following COVID guidance. For example, the 189 Fire RLS noted that resources from multiple agencies were assigned to the fire, with wide variation in the degree of compliance with COVID guidance (Allalunis 2020). Such wide variation made it difficult for crews to interact because they did not know which practices took precedence. Moreover, crews who followed guidance felt endangered by those who disregarded it. The same was noted in the Hyndman Fire RLS and the Public Medical Response in the COVID Era RLS (Filbert 2020; Holmstrom and others 2020).

COVID guidance also prompted changes to typical firefighting logistics at the local unit level. For instance, the Henry Creek Fire RLS noted that the definition of a module's "availability" to respond to an incident was vague (Faiella 2020), which led to an interagency hotshot crew having to jump

Sanitizing a vehicle on the Wood Springs 2 Fire in June 2020 on the Navajo Nation in Arizona. Photo: Carrie Templin, USDA Forest Service.

through hoops to justify its decision, for safety reasons, to lodge near an incident rather than commute daily from the home unit. The RLS recommendation was for unit management to involve crew leaders in setting new rules affecting routine crew operations.

Another challenge arising from inconsistent guidance and expectations for compliance involved the reporting and documentation of COVID-19 cases on crews. An RLS documenting COVID-19 symptoms in members of the Alta Interagency Hotshot Crew noted that the pandemic raised the need for guidance on reporting positive cases of the virus, both to the affected agencies and to local health departments (Ley 2020). The Alta Hotshots were working incidents on the outskirts of the Salt Lake City metropolitan area, which raised the possibility of spreading the virus in a heavily populated area.

Dependable Decision Support

In addition to solid foundations for decision making, crew leaders need decision support. They need to know, without any ambiguity, that senior managers trust and support the improvisational decisions they are being asked to make.

One important example of decision support (and a foundation for decision making) came from an RLS (Symonds 2020) published by the Forest Service's Fire and Aviation Management medical officer early in the 2020 fire year (on May 21). The RLS explained the meaning of the "module as one" idea: the module's membership remains consistent, with the same people exposed only to each other, so they can sidestep COVID guidance on social distancing, mask wearing, and other activities within the group, as they see fit. The RLS thereby affirmed the value of an important innovation by crews and crew leaders in the field; it also clarified the idea and its implementation (establishing a solid foundation for decision making).

Decision support also comes from the agencies engaged in wildland fire management when they set up the needed network connections ahead of time to support a crew leader's ability to improvise. For example, the agency must anticipate the local agency contacts needed under various circumstances.

Accordingly, the Humboldt–Toiyabe, Seep Ridge Fire, and Bush Fire RLSs emphasized the need for Forest Service connections to local medical-care providers and health departments so that crews can get specialized support when health disasters affect wildland fire operations (Humboldt–Toiyabe National Forest 2020; Szulc 2020). The Bush Fire RLS also emphasized the importance of supporting crew leaders' ability to get COVID testing for crews in local areas rather than have it denied (Szulc 2020), thereby leveraging Federal authority in local areas in support of wildland firefighters.

Streamlined Authority To Act

Finally, crew leaders would benefit from streamlined authority to make quick purchasing decisions when public health emergencies affect firefighting logistics. In emergency situations, crew leaders need to make quick decisions about purchasing supplies and accommodations.

For example, the Durango Helitack 84 Fire RLS discussed several situations in which following COVID compliance raised financial questions (Rudger 2020):

- How should crews pay for COVID testing?
- Will temporary or seasonal employees be paid when they are isolating due to COVID exposure?
- What forms should be used to document COVID exposures?

Payment and reporting issues related to COVID also came up in the Humboldt–Toiyabe RLS.

STRENGTHENING THE ABILITY TO IMPROVISE

Throughout the 2020 fire year, COVID-19 required ongoing improvisation by crew leaders. Multiple RLS documents showed that crew leaders faced serious challenges to their ability to improvise. Senior leaders in the Forest Service can take measures to make improvisation work well, including establishing solid foundations for decision making, offering dependable decision support, and streamlining structures for decision making.

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The 2020 Cameron Peak Fire in Colorado. The fire burned for nearly 4 months, scorching 208,913 acres (84,544 ha) of State, Federal, and private lands. Photo: USDA Forest Service.

Fuels
Treatment Success
on the 2020 Cameron Peak Fire

Andrew Avitt

In the most extreme cases, wildfires can burn as hot as 2,200 °F (1,200 °C), with flames over 150 feet (46 m) tall, consuming entire football fields of wildlands within seconds. Wildfires more than 100,000 acres (40,000 ha) in size became uncommon after fire control took effect in the 20th century. Now they occur every year under conditions exacerbated by climate change and warmer, drier weather (McKenzie and others 2011).

From 1983 to 2020, according to the National Interagency Fire Center (NIFC 2021), the years with the most burned acreage have all been since 2004, coinciding with the warmest years on record nationwide. Today's wildfires across large landscapes are typically big, hot, and hard to fight—which was certainly true of the 2020 Cameron Peak Fire in Colorado, the largest in State history.

The Cameron Peak Fire burned for nearly 4 months across 208,913 acres (84,544 ha) of State, Federal, and private lands. "When the fire moves like that," said James White, a fuels management specialist for the Forest Service, "it's not something you want to get in front of, to try to stop. It's too dangerous."

With over 25 years of experience in wildland fire management, White worked on the Arapaho and Roosevelt National Forests to contain the Cameron Peak Fire. He witnessed extreme fire behavior, watching as the intense flames moved from the ground into the canopy to travel quickly across the landscape and leave mostly scorched earth in their wake.

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But White also recalled some success stories from the Cameron Peak Fire—how areas that had been treated by Federal, State, and private land managers dampened the intensity of the fire and slowed its spread. The treatments involved removing excess fuels from the forest floor and thereby diminishing the potential for extreme and dangerous fire activity.

SHAMBHALA MOUNTAIN CENTER

One case involved a Buddhist temple, the Shambhala Mountain Center, on a piece of private property surrounded by the Arapaho and Roosevelt National Forests. The Cameron Peak Fire moved quickly toward the temple with flames that towered over the landscape.

But as the fire drew near, it crossed into an area of land nearly a mile (1.6 km) wide where the forest floor had been treated to remove excess vegetation. The fire lost its intensity and became manageable to the point where firefighters could get it under control.

"It's hard to know how much farther the fire would have spread, if not for that treated area," White said. "But what is clear, by making sure that burnable materials are scarce, we can mitigate these fires' level of intensity."

White and his team had treated the area surrounding the Shambhala Mountain Center 5 years earlier. They conducted a broadcast burn, with trained personnel igniting dead wood and vegetation on the forest floor. These low-intensity controlled fires remove the excess fuels that would enable wildfires to burn hotter and longer. Eliminating surface fuels also makes it harder for wildfires to climb into the forest canopy, resulting in a slower moving, less intense wildfire on the forest floor.

Forest types like ponderosa pine evolved with frequent low-intensity wildland fires, which reduced surface vegetation and kept the forest in overall balance with limited resources such as water. Broadcast burning not only makes the landscape more resistant to wildfire but also reduces the risk of harmful effects on the ecosystem. For example, extreme fire temperatures can kill trees and damage root systems just beneath the soil. By relegating a wildfire mostly to the forest floor, tree canopies are left intact, which protects soil from erosion during heavy rainfall and enhances a watershed's ability to provide clean water.

"Broadcast burning, mechanical thinning, and other treatments are proven to mitigate wildfire risk," said White, "but they are even more effective


Firefighter conducting a prescribed burn on the Arapaho and Roosevelt National Forests in June 2016. Photo: USDA Forest Service.

when we work together to integrate treatments across the landscape, across borders and ownerships. Up until about 5 years ago, we were implementing projects as the opportunities arose."

JOINT CHIEFS' PARTNERSHIP

The result of this fragmented approach could be seen from the air in patches of treatments scattered across the landscape. In recent years, the Forest Service has teamed up with the USDA Natural Resources Conservation Service (NRCS) to take a more focused and collaborative approach through a national program called the Joint Chiefs' Landscape Restoration Partnership. This program brings Federal, State, and private land managers together to improve the health of forests where public forests and grasslands intersect with private lands. By creating interconnected landscapes that are resistant to wildfire, the USDA agencies hope to better protect communities, infrastructure, cultural sites, and natural resources across the country.

Sam Adams, with the NRCS field office in Fort Collins, CO, described the partnership like this:
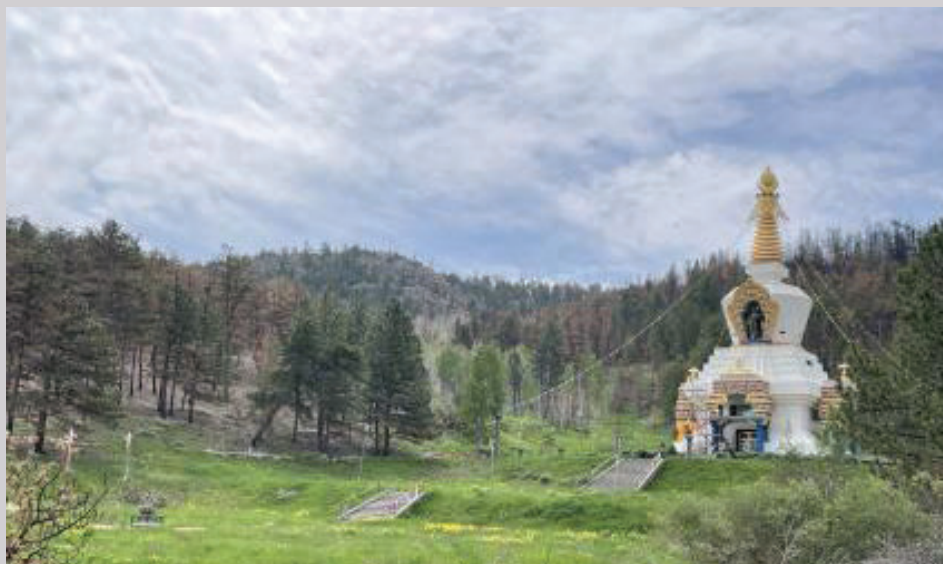
The Stupa (shrine) at the Shambhala Mountain Center, surrounded by forest partially burned by the Cameron Peak Fire. Forest treatments around the mountain center reduced fire severity, possibly saving structures in the area. Photo: USDA Natural Resources Conservation Service.

While the Forest Service has more control on how to manage the landscapes within national forest borders, NRCS is primarily focused on private lands and coordinating with landowners. As we connect with the community and provide information on how to maintain resilient forests, a private landowner will come to us and we'll work on a plan together. Then we'll work together to implement that plan. In the meantime, the neighbors are watching, and they're curious and they'll have questions and the cycle continues, and that's something we want to see.

When NRCS works with private landowners, it is trying to reach ecological objectives for the landscape but also to fulfill the desires of individual landowners. For the manager of the Shambhala Mountain Center, a bountiful forest with a healthy ecosystem was the top priority, whereas wildfire mitigation was towards the bottom of the list.

"We were really interested in being good stewards of our land," said Michael Gayner, the executive director of the Shambhala Mountain Center. "And we realized that when we take care of our land, that really contributes to the health and resilience of the surrounding area."

The Shambhala Mountain Center staff began working with NRCS in 2017. Of the 650 acres (263 ha) of land owned by the center, 122 acres (49 ha) were treated by mechanical thinning to reduce the number of trees by 40 to 60 percent. This type of treatment helps to support greater biodiversity and better wildlife habitat. Mechanical thinning also makes forests more resistant to wildfire.

That would play a critical role when the Cameron Peak Fire approached the center on September 26, 2020.

TREATMENT SUCCESS

"The winds were blowing at 80 miles an hour [130 km/h], causing the fire to spread at a horrific rate," said Mac McGoldrick, senior director of built and natural environment at the Shambhala Mountain Center. "The fire zoomed up to the center. The fire coming off the ridgeline from the west was pouring down into the valley like water."

Soon after the Cameron Peak Fire entered the area where the Forest Service and NRCS had conducted treatments, the flames dropped from the canopy to the forest floor and the fire slowed its rate of spread, giving firefighters room to attack the fire, get the flames under control, and ultimately contain the blaze.

Of 75 structures on the land owned by the Shambhala Mountain Center, 19 burned; without the treatments, the entire property, including structures and forest, would likely have been destroyed. Later, a forestry class from Front Range Community College conducted a tree mortality study in the area around the Shambhala Mountain Center. The assessment found that 72 percent of the trees in untreated areas had died from extreme heat, compared to 8 percent in treated areas.

Gayner said that the forest treatments were not just about protecting the assets of the Shambhala Mountain Center but part of a much larger picture:

We are really happy to have played an important part in getting the fire under control and potentially saving our neighbors to the east. It was amazing that we had an opportunity to be of service, and that is what the world needs.

White put it this way:

Most people think preventative treatments such as broadcast burning or mechanical thinning are ugly. They don't want to see their nearby forest burned or thinned. The irony is that these unpopular treatments have saved many areas. The areas that were treated where the Cameron Peak Fire had burned through managed to keep many of their trees.

Forest management best practices and partnerships between the Forest Service and NRCS are being shared across the country to restore landscapes, protect water quality, enhance habitat, and reduce the effects of extreme wildfire. Visit the Joint Chiefs' Landscape Restoration Partnership website to learn more.

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Location of the Shambhala Mountain Center in relation to the final periphery of the Cameron Peak Fire. The fire was contained in late September, partly due to the forest treatments that the NRCS and the Shambhala Mountain Center worked to complete.

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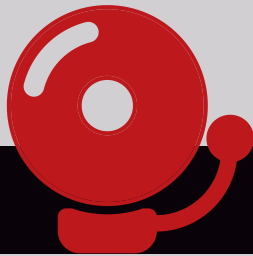
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