OREGON State FACE Program
Fatality Assessment & Control Evaluation
Oregon Institute of Occupational Health Sciences • Oregon Health & Science University
3222 SW Research Dr. L606 • Portland, OR 97239 • 503-494-2281

REPORT#: 2022OR01 **REPORT DATE:** May 28th, 2023

Wildland Firefighter struck and fatally injured by hazard tree—Oregon

INCIDENT HIGHLIGHTS

DATE:
August 18, 2022

TIME:
4:00 PM

VICTIM:
25-year-old wildland firefighter

INDUSTRY/NAICS CODE:
Forestry Firefighting, 115310

EMPLOYER:
Forestry services contracting company

SAFETY & TRAINING:
Basic training completed, recommended additional industry-wide training

SCENE:
Remote location, old growth forest

LOCATION:
Oregon

EVENT TYPE:
Struck by

SUMMARY

A 25-year-old Caucasian male wildland firefighter was killed when a tree fell and struck him. This occurred while preparing to respond to a wildfire in Oregon. The tree appeared to be a live green tree, but had prior fire damage and was further weakened at the base by the current fire. No work was being done on or near the tree when it fell.
READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

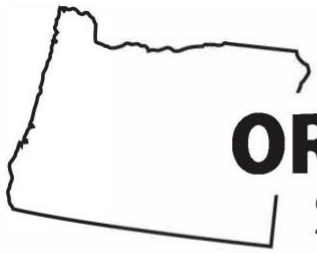
Key contributing factors identified in the investigation include:

- Unrecognized hazards related to previously burned green trees
- Fire crews operating within the fall radius of a hazard tree with low visibility
- Time to reach definitive medical care because of remote location
- Due to high turnover in the industry, many of the crew members were on their first fire response
- Communication and team cohesion barriers among crews
LEARN MORE> (p.11)

RECOMMENDATIONS

Oregon FACE investigators concluded that, to help prevent similar occurrences, employers and agencies should:

- Emphasize training on green tree hazards and situational awareness
- Prioritize risk management strategies, including the potential for hazard trees
- Increase emergency response plan, training, and equipment requirements for work in remote locations
- Invest in strategies to retain wildland firefighters and reduce turnover in this occupation, including a focus on training
- Emphasize effective communication and team building
LEARN MORE> (p.11)



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Oregon Fatality Assessment and Control Evaluation Program

The Oregon Fatality Assessment and Control Evaluation (OR-FACE) Program is a project of the Oregon Institute of Occupational Health Sciences at Oregon Health & Science University (OHSU). OR-FACE is supported by a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH) (grant #U60OH012411) through the Occupational Public Health Program (OPHP) of the Public Health Division of the Oregon Health Authority. OR–FACE reports are for information, research, or occupational injury control only. Safety and health practices may have changed since the investigation was conducted and the report was completed. Persons needing regulatory compliance information should consult the appropriate regulatory agency.

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OR-FACE supports the prioritization of safety interventions using a hierarchy of safety controls, where top priorities are hazard elimination or substitution, followed by engineering controls, administrative controls (including training and work practices), and personal protective equipment.

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INTRODUCTION

On August 18th, 2022, a 25-year-old Caucasian male wildland firefighter was killed after being struck by a hazard tree. Hazard trees are trees that have been weakened by fire, age, or disease and are at risk of falling (US Forest Service, n.d.). The firefighter had just arrived onsite with his crew to respond to a wildland fire in southern Oregon. Several fires in the area had been ignited the previous day by lightning. The state forestry department initiated a response by notifying approved contractors and deploying them to locations to contain the fires. The decedent was one of the contractors hired to respond. He was contacted late on the evening of August 17th, 2022, and had mobilized with his two other crew members by 5:45 am on August 18th, 2022.

The decedent was the owner and individual proprietor of a forestry services business that provided reforestation services and wildland fire response. He, along with his two employees, were part of the group assigned to this specific location. The decedent was the owner and operator of a Type 6 wildland fire engine, a smaller fire engine designed to access remote locations and rough terrain. This would be his first fire response operating the engine to respond to a wildland fire. This crew was one of two Type 6 fire engines assigned to this response.

At approximately 4:00 pm, the decedent and his crew arrived at the location of the fire. They approached the crew boss. The crew boss was close to the fire perimeter, conducting an assessment and formulating a plan, while the other crew members were 50 feet uphill waiting on instructions. The visibility of the fire perimeter was obscured by forest undergrowth and smoke. Within approximately 5 minutes of the three-person crew approaching the crew boss, a loud sound was heard. The crew yelled to look out for the tree, and the crew boss and three crew members ran from their current location. The tree fell uphill towards the crew members.

The decedent was struck by the falling tree and sustained serious injuries on the right side of his body. The incident commander had training as an emergency medical technician (EMT) and responded immediately. He also called for a medical evacuation by helicopter. However, once the short-haul helicopter arrived on site, it was unable to lower the responder due to the canopy height. It took 15 to 20 minutes to find an appropriate area to lower the responder with his equipment. The short-haul responder hiked to the injured crew member and secured him in a device for helicopter retrieval. The crew members and responder then carried him approximately 0.5 miles along the flagged escape route to an area the helicopter could access. The injured crew member had sustained a broken arm, broken femur, and internal injuries. By the time he arrived at the local hospital at 6:30 pm, the firefighter had died of his injuries.

EMPLOYERS

The decedent was the owner and operator of a forestry services company. His company primarily provided contract services for reforestation and wildland firefighting. According to business records, the decedent formed the contracting business in 2020 as a limited liability corporation (LLC).

Due to the decedent being the individual owner of the company, there were few company records, including training history, that could be accessed for this investigation. However, the decedent and his crew members had completed the required training and had the necessary qualifications to be approved as a contract firefighting crew with the state forestry department. Training certificates were provided for the decedent and his two crew members to show that they had recently completed Oregon Occupational Safety and Health Administration (OR-OSHA) required training on basic firefighting and fire shelter deployment.

The decedent was hired as an independent contractor for the state forestry department to respond to this wildland fire. He was contacted late on the night of August 17th, and was expected to mobilize early the following day. He had two crew members working for him for this fire response.

WRITTEN SAFETY PROGRAMS and TRAINING

Oregon OSHA requires that wildland firefighters have initial and annual training prior to working on a fire response. A qualified person must present this training, and the curriculum includes the following topics: fire protection rules, basic fire behavior, basic fire control, basic fireline safety, and fire shelter deployment (OAR 437-007-0135).

The decedent and his two crew members had completed OR-OSHA Basic Fire Suppression Safety Training and Fire Shelter Deployment Training on July 6th, 2022. The training was completed through the state forestry department and consisted of a video training series. They had training certificates for this and met the requirements for annual training.

Other training information and records for the decedent were not available. He had several years of prior wildland firefighting and forestry experience and training. Still, the details of this were not accessible due to the decedent being the owner and individual proprietor of his business.

WORKER INFORMATION

The decedent was a 25-year-old Caucasian male forestry worker and the owner of a forestry services contracting company. His company provided reforestation services and wildland fire response. He was the fourth generation in his family to work in this industry (forestry and wildland firefighting). His primary language was English.

The decedent graduated from high school in Oregon in 2015 and went to work full-time in the forestry industry with his father and grandfather. In 2020, he started his own business as a limited liability corporation. The two other crew members worked directly for the decedent.

The decedent and his two employees had completed the required training for wildland firefighters. The decedent was hired as an independent contractor by the state forestry department to respond to the wildfire where the tree strike occurred. For this response, the decedent was serving as a crew leader for a Type 6 fire engine. He had prior experience working on this type of engine, but this was his first response as an engine lead.

EQUIPMENT

The decedent and his two crew members arrived onsite in a Type 6 fire engine. This type of engine had a 30-gallon per minute pump with a 300-gallon capacity for water. It also had the required 300 feet of hose, a crew of three people, and met the vehicle weight rating of less than 26,000 lbs (U.S. Department of the Interior, 2019). The engine was a new purchase for the decedent and had recently passed the required inspection to be utilized in the state forestry department fire response. This was the first fire that the decedent and his crew used this particular Type 6 fire engine in response. An example of this type of engine is shown in **Image 1**. Type 6 fire engines are smaller than other types of engines, allowing for access on forested terrain. The decedent's engine was built on a Chevrolet 350 chassis (vehicle frame).

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Image 1. Example of a Type 6 Wildland Fire Engine (Fire Apparatus & Emergency Equipment Staff, 2019).

When the crew arrived near the location of the fire, they were unable to drive the engine any further. They parked with the other crew vehicles and hiked the rest of the way. Prior to hiking to the fire location, the decedent and his crew donned personal protective equipment and tools to work by hand. The decedent and his crew wore the required personal protective equipment, including the following items: fire-resistant boots, hard hats with a chin strap, heavy-duty gloves, eye protection, headlamps, fire shelter, and Nomex clothing. Nomex is a fire-resistant material, typical of firefighter clothing. A fire shelter is an emergency device that is used in the event of firefighters becoming trapped by a fire (National Wildfire Coordinating Group, n.d.). The tools that the crew members were equipped with were also typical of wildland firefighters. These tools included radios for communication, two pulaskis (hand tools with an axe and hoe), a hazel hoe (large, heavy hoe for trenching and clearing), and a shovel.

Image 2 shows the typical personal protective equipment and tools of a wildland firefighting hand crew.

Image 2. Example of personal protective equipment and tools typical of a hand crew (U.S. Department of Agriculture, n.d.).

WEATHER

The weather was a contributing factor in the start of the fire, and there was limited visibility at the scene on the day of the incident. The wildland fire had been started by a lightning strike the day before, on August 17th, 2022. There had also been some precipitation in the area that day, which impacted the movement of the fire.

On the day of the tree strike, August 18th, 2022, the temperatures in the area reached a high of 90°F. There were clear skies, and the fire was slow-moving because of rain the day before. The winds were calm at the time, which reduced visibility from smoke generated from the fire. Responders familiar with the weather in this particular area noted that the wind would often increase in the late afternoon. This was a potential concern for the response plan.

INCIDENT SCENE

The fatality occurred during the response to a wildland fire located in the mountain forests of southern Oregon. The fire was ignited by a lightning strike on August 17th, 2022. The following day, the terrain was still slightly wet from rain the day before, and the fire was slow-moving. The incident location was very remote, not allowing the crews to drive their vehicles because of overgrowth. The crew members had to hike to the site near the fire, where they were preparing to respond.

The site of the incident was located in a nature reserve along the west side of the river and was at an approximate elevation of 2,500 feet. This remote area consists of 100,000 acres of old-growth and natural forests. Many of the trees

in this location were approximately 150 feet tall. **Image 3** is a photo taken from the incident site looking up at the forest canopy.

Image 3. View from beneath the forest canopy at the incident site (Oregon Department of Forestry and Bureau of Land Management Serious Accident Investigation Report, 2023).

This particular wildland fire started as a slow-moving fire, and the decedent was part of the initial response. However, within two weeks of the incident, the fire grew and spread very quickly due to wind and dry conditions. By the time the fire had been contained on September 29th, 2022, it had burned over 22,000 acres of forest.

A photo of the wildfire and terrain is shown in **Image 4**. This photo was taken by a local news network on August 23rd, 2022, six days after the start of the fire but prior to it spreading significantly.

Image 4. Image of the fire and terrain from local news taken on August 23rd, 2022 (KOIN 6, 2022).

The tree that fell and struck the firefighter was a 160-foot Douglas Fir tree with a diameter of 39 inches and appeared to be a live green tree. However, upon further investigation, it was determined that the tree had prior fire damage with a weakened base and also had internal decay from a tree fungus. The tree fell uphill towards the group from within the fire's perimeter. The base of the tree had not been visible from where firefighters were stationed.

INVESTIGATION

The wildland fire involved in this incident began on August 17th, 2022. The fire was ignited by lightning, which prompted the state forestry department to initiate notification of contract responders. The decedent was contacted by the forestry department late on the night of August 17th. The decedent then contacted his two crew members at approximately 10:30 pm on August 17th.

On the day of the hazard tree strike, the decedent met with his two crew members prior to mobilization at approximately 5:45 am on August 18th, 2022. They had been instructed to meet with other crews and incident commanders at a local school at 7:00 am. They received their assignment at this meeting location and also programmed their radios for communication. They then proceeded to travel to another meeting point closer to the fire and arrived at approximately 9:00 am. In this staging area near the river, they waited for other crew members to arrive. The crews for this response area included two fire engines and a 20-person hand crew. Once they had assembled at this location, they mobilized towards the fire at approximately 11:00 am. A bulldozer crew had also been assigned to this response area but was further behind the rest of the crews.

The decedent and his two crew members traveled to the site in a Type 6 wildland fire engine. This was the first time that the decedent was expecting to use this Type 6 Engine in fire response. The two crew members working directly for the

decedent would be working on their first fire response. They were part of a response that involved two other contracting companies. The resources assigned to this response area included two Type 6 fire engine crews and a 20-person hand crew. Almost half of all the crew members assigned to this response location were on their first fire response, and many of the hand crew members from the same company had not worked together before. While the decedent, his crew members, and the crew boss were English-speaking, many of the crew members from the other contracting companies were Spanish-speaking.

The group, consisting of two Type 6 fire engines and a hand crew, proceeded toward the fire in a caravan but made slow progress. The access roads in this area were overgrown with brush, and hand crews had to walk ahead of the vehicles in order to clear a path for them to drive through. At one point, it was determined that a wrong turn had been taken, and they were traveling away from the fire. They had to backtrack and adjust their course back towards the fire. When the vehicles were unable to drive any closer to the fire, they had to continue on foot. The hand crew and other Type 6 engine crew members arrived first, parked their vehicles, and cleared a path by hand. The distance from the parking site to the fire response area was approximately 0.6 miles to the northwest. During this time, the hand crew also flagged the escape route, as is required in this type of response. As the crews were hiking towards the fire, they reported hearing trees falling in the area. By the time the crew boss and incident commander visually located the fire, it was approximately 2:00 pm.

A bulldozer and operator were expected to be part of this crew's response effort but had been held back due to the terrain and overgrowth. Because it was getting later in the afternoon and the equipment was unable to travel closer to the fire, the bulldozer and operators were sent to assist with another fire location.

The three-person crew, including the decedent, arrived after the other crews and parked in the same place. They prepared to work as a hand crew, instead of using the Type 6 fire engine they came in, because of the distance from the fire. They donned their personal protective equipment and gear/tools and hiked to meet the rest of the crew. Once they arrived near the fire site, the decedent and his two crew members approached the crew boss, who was close to the fire perimeter to assess the situation. The rest of the crew members were positioned approximately 50 feet uphill from the crew boss. A few minutes after approaching the crew boss, there was a loud sound, and the crew boss yelled to look out for the falling hazard tree. The crew members ran to get out of the way. The falling hazard tree grazed the crew boss, and the decedent (Engine 2 operator) was struck by the same tree on the right side of his body. It was estimated that the decedent was only at this location for 5 minutes before the tree strike occurred at 4:00 pm. This was approximately one hour prior to the end of the workday for the responders.

The hazard tree that struck the firefighter was a 160-foot-tall Douglas fir tree with a diameter of 39 inches. It fell from within the fire perimeter and had not been visible to the crew prior to falling due to the reduced visibility from undergrowth and smoke from the fire. The onsite investigation after the tree strike found that this tree had been previously burned, as noted by past scarring on the tree and surrounding trees. This tree also had a weakened base and internal deterioration from fungus. There was no work being done on or near the tree when it fell.

The diagram shown below in **Image 5** is a drawing of where the tree fell in relation to the crew members, the crew boss, and where the firefighter (identified as Engine 2 operator) was struck.

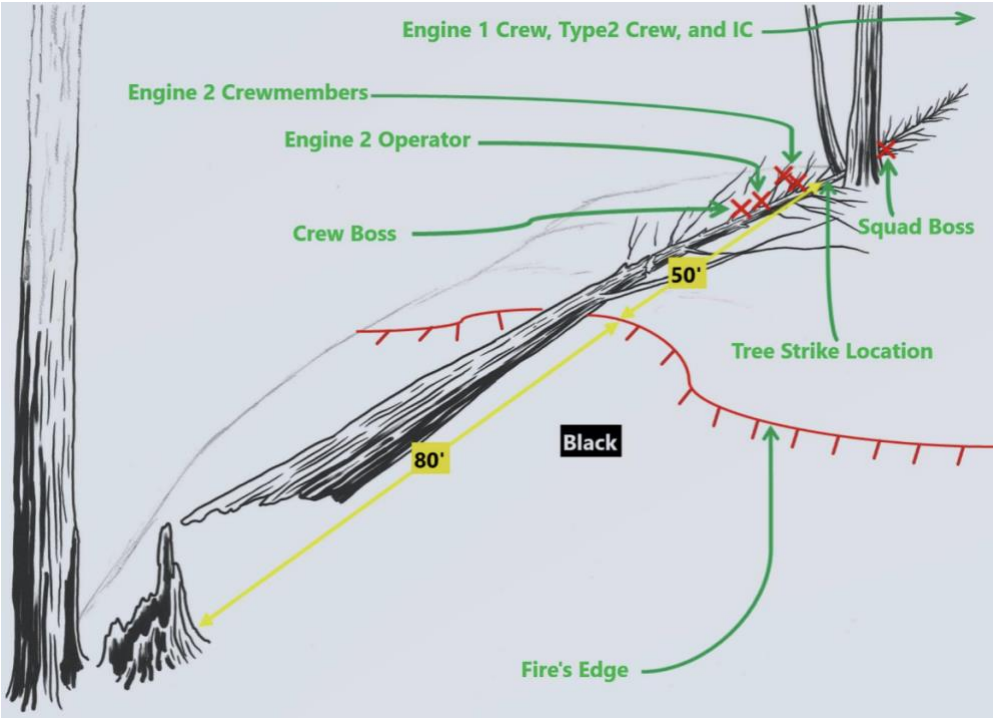

Image 5. Diagram of the tree fall and location of crew members, the decedent's location is identified by "Engine 2 Operator," and his crewmembers are referred to as "Engine 2 Crewmembers," and "IC" is the incident commander. (Oregon Department of Forestry and Bureau of Land Management Serious Accident Investigation Report, 2023).

The incident commander had the highest level of training as an emergency medical technician (EMT) and was able to respond immediately. However, he was not assigned as an EMT for this response and did not have his equipment with him. He assessed the injuries and called for a medical evacuation by helicopter. Through this initial assessment, it was identified that the injured crew member had a broken arm and a broken femur. At this time, it was determined that he shouldn't be moved because of the possibility for spinal injuries.

A short-haul helicopter arrived at the accident site approximately 30 minutes after being notified. This type of helicopter response includes an extraction of the patient by first lowering a responder via a haul line. The patient and responder are both then retrieved back up to the helicopter for transportation. Short-haul lines are typically 100 to 350 feet in length (National Wildfire Coordinating Group, 2020). In this case, the lines that were carried by the short-haul helicopter were not long enough for the responder to descend through the canopy at the site of the tree strike. By about 4:45 pm, the short-haul helicopter was able to find an area with a lower canopy to insert the responder.

The responder hiked to the site of the tree strike and was able to secure the injured crew member in an Air Rescue Extraction System bag, which is a device used to transport and evacuate an injured person for an airlift. It includes a spine board and is able to contain a person weighing up to 400lbs (Air Rescue Systems, 2023).

With the patient secured, the crew and responder had to transport the injured firefighter via the flagged escape route until there was enough of a clearing for retrieval. At approximately 5:20 pm, the crew had carried the injured crew member almost half a mile back toward the area where they had parked their vehicles. It was noted at this time that his breathing was getting slower, and his skin was growing paler in color. He was evacuated by the short-haul helicopter at approximately 5:30 pm. He was then transferred to an Air Ambulance stationed near the river, which left en route to the hospital at 6:10 pm. Cardiopulmonary resuscitation (CPR) was initiated during this flight to the hospital. He arrived at the local hospital emergency room at 6:30 pm but had died of his injuries. The time to reach the hospital from the time of injury was approximately 2.5 hours.

CAUSE OF DEATH

The wildland firefighter was struck on his right shoulder and neck by a falling 160-foot Douglas fir tree. According to the Medical Examiner's report, the cause of death was severe blunt-force trauma to the chest. It was noted that the decedent sustained multiple injuries on the right side of his body, including injury to his right lung, aorta, and subclavian artery (artery beneath the collar bone).

CONTRIBUTING FACTORS

Occupational injuries and fatalities often result from one or more contributing factors or key events in a more extensive sequence of events that ultimately result in the injury or fatality. Oregon FACE investigators identified the following unrecognized hazards as key contributing factors in this incident:

- *Unrecognized hazards related to previously burned green trees*
- *Fire crews operating within the fall radius of a hazard tree with low visibility*
- *Time to reach definitive medical care because of remote location*
- *Due to high turnover in this industry, many of the crew members were on their first fire response*
- *Communication and team cohesion barriers among crew members*

These factors were also combined with the unpredictable and constantly changing conditions that may be encountered during a wildland fire.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Training for wildland firefighters should emphasize green tree hazards.

Discussion: The hazard tree involved in the tree strike was a live green Douglas fir tree that had been scarred and weakened from a previous fire. Hazard trees are particularly dangerous because of their potential for failure. The tree involved in this fatality had burn scars from a previous fire and interior rot from a fungus. But, because the base of the tree was not visible from the assessment site, it was not recognized as a hazard to the crew.

As more forest areas become impacted by wildfires, prior damage to living trees should be part of the assessment to determine the safety of the location for crew members to work. "Snags" or dead trees that are still standing are easy to recognize and are a well-known hazard for wildland firefighters. However, green tree hazards, like the one involved in this incident, are much more difficult to identify because the indicators of these hazards may be less visible. Burn scars and fire scars are notable examples. Burn scar border areas can make taller trees susceptible to higher wind exposure and potential damage. Burn or fire scars on trees indicate that a previous fire has weakened them but not fully burned. This can include catfaces, which are partially healed scars on trees. It may be difficult to identify if the tree appears to be

green compared to burned trees. Another indicator of green tree hazards are fungi conks or resin flows, which can be a sign of interior rot but can also be difficult to see from a distance (Pacific Northwest Wildfire Coordinating Group, 2022).

Given the fatal consequences of this event and other related tree strikes, the Pacific Northwest Wildfire Coordinating Group issued a green tree hazard alert. The information from this alert, along with more detailed training on the topic, should be provided for all wildland firefighters to increase the likelihood of identifying these hazardous trees.

Recommendation #2: Training for wildland firefighters should emphasize situational awareness.

Discussion: Situational awareness is another safety topic that is often covered in firefighter training materials and should continue to be taught, developed, and practiced among team members. Situational awareness is defined as the perception of the surrounding environment and understanding of how current environmental factors can impact events or outcomes in the near future (IFSTA, 2018). There are three phases or levels of situational awareness. Level 1 is the perception of the environment using senses and observation. Level 2 is the understanding of what is being perceived in the environment using prior experience or knowledge. Level 3 is projection or forecasting, which includes being able to predict future events, conditions, or risks. In this case, some of the responders reported hearing trees falling as they were hiking and clearing a path to the fire location, which indicated that hazard trees were present in the area even though they were not visible.

Because of the unpredictable and changing nature of the environment that wildland firefighters are working in, there is a need to be constantly aware of the surrounding environment. Communicating with others and sharing the task of awareness can be used as a strategy to increase situational awareness (Gasaway, R. 2022). This can include an ongoing cycle of observing the environment, communicating with the team, and assessing decisions.

Recommendation #3: Trees and other potential hazards should be included in the risk assessment process, even during the initial fire size-up phase.

Discussion: Because of the inherent risks of wildland firefighting, risk management strategies should be implemented to identify and control hazards during the entire response process, including prior to fireline construction. In many wildland firefighting situations, the fire is not the only hazard that presents a risk to crew members. In this particular case, there were environmental conditions present that would have called for additional risk management, including low visibility due to smoke and undergrowth and having the crews positioned in a location uphill of the fire. Hazard trees, which are weakened trees at risk of falling, were also present in this location. Although the hazard trees were not visible, crew members reported hearing falling trees as they were clearing a path towards the fire. Hazard trees are frequently encountered in wildfire response and should be prioritized in the risk assessment if there is any indication that they may be present.

A commonly used resource for guidelines and procedures in wildland firefighting is the National Wildfire Coordinating Group (NWCG) Incident Response Pocket Guide. Included in this guide are situations where additional precautions and awareness are needed. One of these is responding to a fire from a position uphill from the fire. In this particular situation, the Downhill Fireline Construction Checklist should be utilized to account for increased risk from working uphill from an active wildfire. Part of this checklist includes implementing LCES or Lookouts-Communications-Escape Routes-Safety Zones (NWCG, 2022). Lookouts are designated personnel to watch hazards in the environment and are

primarily used to keep eyes on the fire. However, a lookout or watch can also be utilized for other hazards like tree hazards.

The current guidelines for hazard trees are typically implemented only when felling or cutting trees. Although no work was being performed on the tree at the time of the tree strike, the guidelines provided in the NWCG Standard for Wildland Fire Chainsaw Operations could be applied to protect workers when there is the potential for hazardous trees in the response area. One of the control measures to protect crew members is maintaining a safe distance or a guideline of two tree lengths from the tree being cut (NWCG, 2022).

A study published in 2022 found that tree hazards are one of the top five causes of fatalities for wildland firefighters (Riley, et. al., 2022). Because of this, hazard trees should be prioritized as a potential risk to crew members during the fire size-up phase of the response. A resource that has been developed that can provide additional information when assessing risk and implementing precautions is the Snag Hazard Map, a component of the Risk Management Assistance (RMA) Dashboard. This resource assigns a hazard rating to forest locations across the United States to help responders make more informed risk assessments related to tree hazards. An example of this resource is shown in **Image 6.**

Identification of hazard trees during the risk assessment can include hearing falling trees, noting previous burn scars in the area, or a moderate to high snag hazard level on the RMA dashboard. If there are any indications that tree hazards may be at an increased risk in the fire response area, strategies, including implementing lookouts and safe distance guidelines, should be utilized.

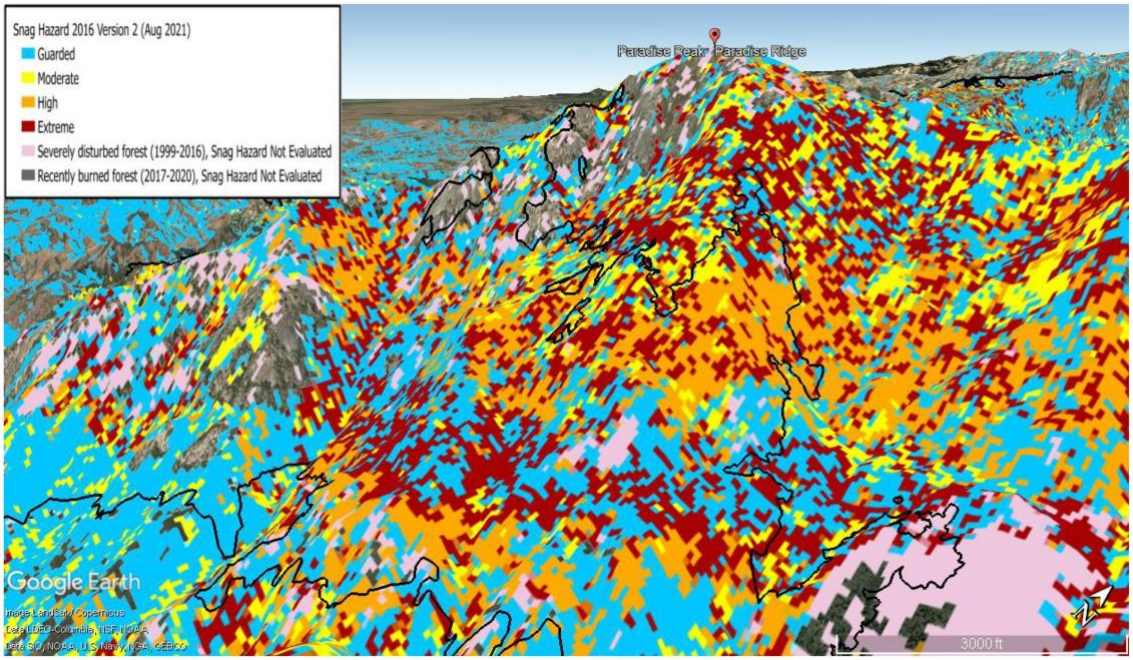

Image 6. Example of the Snag Hazard Map as a 3D representation (Riley, et.al., 2022).

Recommendation #4: Crew medical emergency response plans, training, and equipment should have advanced requirements when working in remote locations.

Discussion: Another inherent risk of wildland firefighting is the location of the work, which typically occurs in very remote locations. If advanced medical attention is needed due to a severe traumatic injury or other life-threatening medical emergency, there should be a plan in place to access definitive medical care as quickly as possible. Definitive care includes advanced medical care typically found in a hospital setting.

According to the Mayo clinic, many traumatic injuries that have access to definitive medical care within the first hour of the injury have better outcomes. This is sometimes called the "golden hour." By increasing the requirements of the response plans for these types of emergencies, crews can potentially minimize the time to definitive care. An example of this could be requiring all crews to have an ARES bag (Air Rescue Extraction System) or other type of transportation device and the ability to have the patient packaged and ready for transportation as soon as additional help arrives.

Currently, all wildland firefighters are required to have basic first aid training and carry basic first aid equipment. However, based on where the crews will be working and the distance to the nearest hospital, the training and equipment requirements should be increased to provide more advanced care other than basic first aid. An article published in *Wildfire Today* advocates for higher levels of medical training for crew members so that crews on remote locations can essentially be self-sufficient for patient care and extraction. This article suggests crews should require a small group of trained medics and more advanced medical supplies (DiZio, 2021).

By improving the medical training of crew members, the response equipment requirements, and overall response plans, crews may be able to reduce time to definitive care for better outcomes.

Recommendation #5: Government agencies and/or private contract employers should invest in strategies to retain wildland firefighters and reduce turnover in this occupation, including a focus on training.

Discussion: On the day of the response, the decedent was part of a crew led by an experienced crew boss and incident commander. The decedent himself also had several years of experience responding to wildland fires. However, many of the crew members, including the two working directly for the decedent, were working on their first wildland fire response. Most of the crew members had also never worked together as a team before. The rates of turnover in the wildland firefighting industry are exceptionally high. In recent years, efforts have been made to determine ways to retain and recruit employees in this industry.

An article published on the Oregon Public Broadcasting website covered the current issues of not only retaining staff but also recruiting for open wildland firefighting positions at the federal level. The article noted that in 2022, there was a 20% vacancy rate in wildland firefighting positions for the state of Oregon (Bustillo, 2022). Low wages and benefits and lack of affordable housing have continued to be factors in these staffing shortages.

A 2022 survey of federal wildland firefighters across the country also found that many respondents were not satisfied with the level of pay for the occupation and expressed a desire for increased training. Other issues like work environment, safety, and work-life balance were reported as additional concerns (Granberg, et. al., 2022). While much of the information on these issues pertains specifically to federal wildland firefighters, the same issues are present even more so with contract firefighters because of the seasonal and unpredictable nature of contract work.

The issues with recruiting and retaining also come at a time when there has been an increase in the number of acres burned each year in wildfires. **Chart 1** below shows the increase in acres burned over the past decades in Oregon.

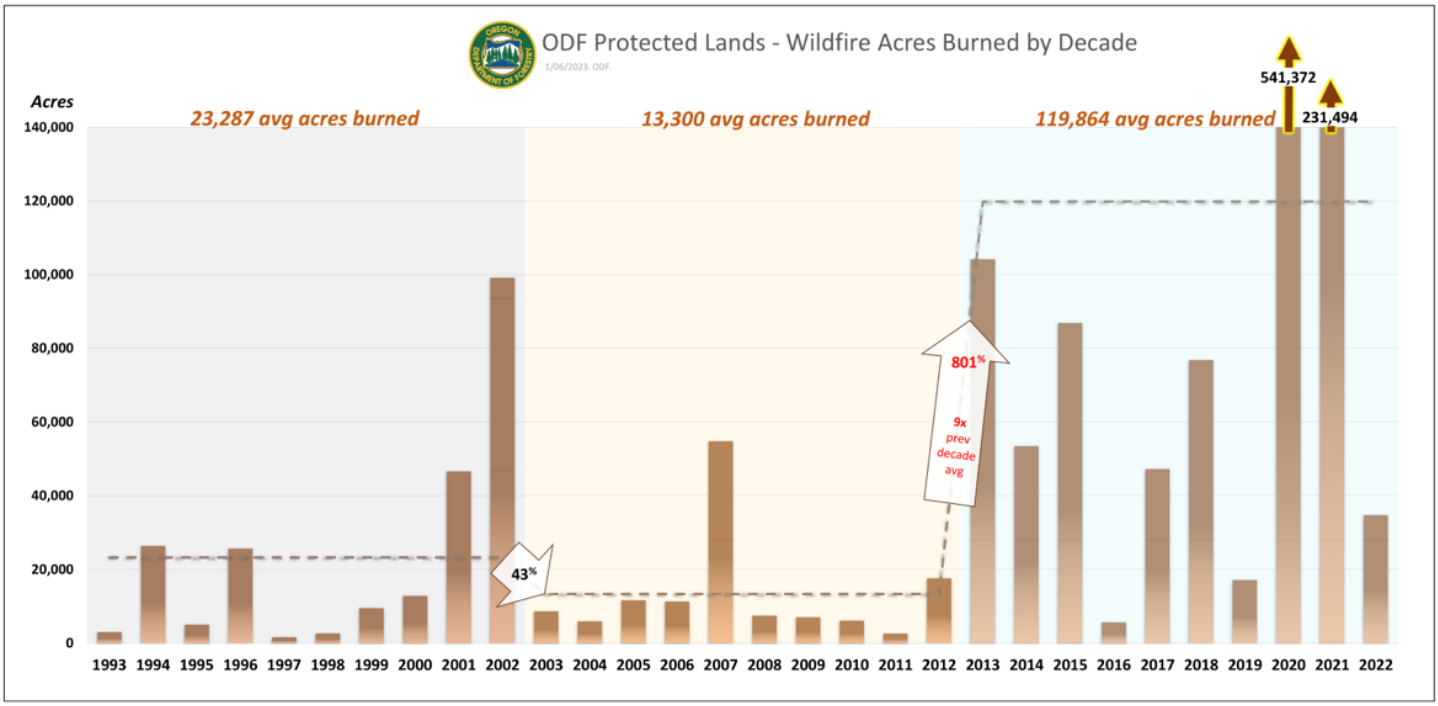

Chart 1. Acres burned by wildfires since 1993 (Oregon Department of Forestry, 2023).

As wildfires continue to increase in size, it is important to have experienced responders for the safety of the crews and communities impacted by wildfires. The identified barriers, including wages and training, should be addressed to reduce the barriers to retaining and recruiting wildland firefighters.

Training improvements should include a focus on onboarding training to ensure that new wildland firefighters have the information and resources they need to be prepared for their first response. An increase in continued training throughout the year could also move wildland firefighting from a seasonal job in Oregon to a year-round occupation with training in the off-season.

Recommendation #6: Employers and agencies should emphasize effective communication and team-building practices.

Discussion: Communication and teamwork are critical for effective emergency response during wildland fires but can be impacted by several factors in this industry. Barriers to effective communication include the need to communicate in remote areas and crew members working together who speak different languages. Part of communicating in these remote locations includes the use of two-way radios. This equipment should be utilized as much as possible to enable crews to communicate at a safe distance from the fire or hazard zone.

Language barriers can also impact effective communication. Of the crew members that were assigned to this particular location, some spoke English, and some spoke primarily Spanish. According to the state forestry department agreement with contract wildland firefighters, there are certain positions and instances where communication language is clearly defined. Any radio communication on government-assigned frequencies is required to be in English. Crew and squad

bosses are required to be proficient in English and communicate with incident commanders in English. Crew and squad bosses are also required to be able to communicate in the language of their direct crew members.

Because multiple crews can be part of the response at a single site, it is important to have communication strategies to allow all members to be able to communicate with each other. When more than one language is spoken in a response location, a strategy to bridge these gaps could include visual indicators for the people who are able to speak more than one language. This could be done through the identification of communication facilitators or designated bilingual individuals who have the task of facilitating communication among crew members.

In addition to communication, working together as a team, or team cohesion, is necessary for effective response. As with this situation, there may be little time to build team connections when the emergency response needs to happen quickly and involves individuals who may not have worked together before. A US Forest Service publication that looked at team cohesion in wildland firefighting found that when there is no cohesion between team members in a response, there is an increased risk of accidents and fatalities (Driessen, 2002). Developing teams should be a priority through encouraging communication and fostering trust both prior to and during a response.

ADDITIONAL RESOURCES

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Risk Management Assistance (RMA) Dashboard. https://experience.arcgis.com/experience/f9d7f7f920494c3db43a23a8dffe4664/page/Instructions/

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