

**Report of the  
Accident Investigation Team  
for the  
Poplar Log Fire  
Redbird Ranger District  
Daniel Boone National Forest**

**October 31, 2001**





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## **I. Executive Summary**

On October 31, 2001, a firefighter was struck and seriously injured by a snag on the Poplar Log Fire. The Poplar Log Fire was located on the Redbird Ranger District of the Daniel Boone National Forest. The victim was a member of the Plumas Interagency Hotshot Crew. This was the second fireline shift for the crew since they had arrived in Kentucky from California.

The Poplar Log Fire had begun the previous night; however, no suppression actions were taken until the next day. The fire occurred in hardwoods with the primary fuel being hardwood leaf litter. Most of the leaves had fallen from the trees by this point in the season. Average tree height is approximately ninety feet with little mid-story vegetation. The final fire size was approximately eighty acres.

The victim was at the front of the crew, constructing handline. He was operating a chainsaw, cutting small limbs and saplings. Immediately behind him was a swamper, pulling the fallen brush from the line. Behind the swamper was a firefighter running a leaf blower. This section of the line had been previously treated by an aerial retardant drop and a helicopter with a water bucket. The leading edge of fire in this area had been extinguished. The aerial retardant drop occurred at approximately 1300 hours.

At approximately 1500 hours, a black locust snag burned through at the base and fell across the line, striking the head and back of the victim. Evacuation measures were implemented and the victim was airlifted to the University of Kentucky Hospital. There it was determined that he had broken ribs, clavicle, and spine.

The investigation found that the causal factor of the incident was that the snag was not identified and mitigated prior to the accident. Other contributing and influencing factors are outlined in the report.

## **II. Review Team Members**

Tony Tooke – Team Leader, District Ranger, Talladega NF-RD, Talladega, AL; USDA Forest Service

Jim Spano – Team Member, Region 8 Health and Safety Unit, Atlanta, GA; USDA Forest Service

Kent Davenport – Team Member, Fire Staff Officer, NFs in Alabama, Montgomery, AL, USDA Forest Service

David Stamey - GIS Editor, NFFE Union Representative, Nantahala NF, NFs in North Carolina, Murphy, NC, USDA Forest Service

Dave Mertz – Team Member, Fire Management Officer, Daniel Boone NF, Winchester, KY, USDA Forest Service

Bill Lang – Team Member, HIDTA Special Agent, Unicoi RD, Cherokee NF, Unicoi, TN, USDA Forest Service

Don Minton – Team Member, Civil Engineer, Daniel Boone NF, Winchester, KY, USDA Forest Service

### III. Sequence of Events

The following approximate time frames represent events leading up to and beyond the accident. The following sequence is supported with disclosures taken from interviews, dispatch logs, law enforcement reports, logs from incident personnel, on-site visits, and other information and documents.

<u>Date</u>	<u>Time</u>	<u>Event Description</u>
10-31-01	0700	Crew started travel from London, KY to Redbird RD.
10-31-01	0900	Crew receives briefing at ICP.
10-31-01	1203	Retardant drop is requested at Poplar Log Fire.
10-31-01	1207	Hann to Peabody, need bulldozer at Poplar Log.
10-31-01	1218	Air Attack to Poplar Log IC – go to air/ground.
10-31-01	1300	Aerial retardant dropped on fire.
10-31-01	1310	Helicopter 973 to perform bucket work on Poplar Log.
10-31-01	1334	Air Attack to be used with Helicopter to coordinate drops.
10-31-01	1500	Poplar IC requests ambulance.
10-31-01	1509	Poplar Log to Air Attack – injured individual on ridge, need Stokes litter, oxygen and longline.
10-31-01	1520	Helicopter 973 – return to London to refuel.
10-31-01	1520	Determining if basket evacuation or Medavac unit needed.
10-31-01	1527	Cannot land helicopter. Longline in medical supplies. Ambulance about 12 minutes out.
10-31-01	1534	Oxygen enroute from law enforcement (Barry Bishop). Indicating victim has pain in lower leg.
10-31-01	1545	Ambulance on scene. Requested backboard, packing materials, blanket, and Stokes litter to top of hill.
10-31-01	1604	Looking for location to land helicopter on road; problems with powerlines.
10-31-01	1610	Indicated there was a suitable field near junction of HWY 1524 and Poplar Log Road.
10-31-01	1615	Helicopter has landed at incident to assemble basket and longline.
10-31-01	1627	Helicopter attempts to extract injured firefighter.
10-31-01	1655	Injured being removed on foot; did not want to use basket.
10-31-01	1703	Air ambulance (UK) requested to land at Goose Rock Elementary School.
10-31-01	1705	Daniel Boone Dispatch requests UK Lifeline. Question as to whether it had to be UK or would service from London be acceptable.
10-31-01	1708	B2 responds UK because of head injury.
10-31-01	1715	UK Lifeline enroute from Jackson to pickup site.
10-31-01	1723	Ambulance transporting injured to landing zone.
10-31-01	1730	All resources off the line of Poplar Log Fire.
10-31-01	1815	Injured firefighter arrives at UK Hospital.

## IV. Notification Record

The following synopsis represents who was contacted and when regarding notification of the accident. These notifications are not shown in the sequence of events disclosure.

<u>Date</u>	<u>Time</u>	<u>Event Description</u>
10-31-01	1459	Accident occurs.
10-31-01	1500	Daniel Boone Dispatch, District FMO, District Ranger all notified.
10-31-01	1745	R-8 Fire Director notified.
10-31-01	1830	R-8 Safety and Health Manager notified.
10-31-01	1900	WO Safety Manager notified.
10-31-01	2030	Forest Supervisor notified.

## V. Analysis of Potential Causal and Contributing Factors

The following factors were evaluated in terms of possible causes or contributors to the accident occurring:

<b>ELEMENT</b>	<b>Did not Contribute</b>	<b>Influenced</b>	<b>Contributed Significantly</b>	<b>Unknown</b>
<b>#1 - Fire Behavior</b>				
Intensity	X			
Flame Length	X			
Rate of Spread	X			
Spotting	X			
<b>#2 Weather</b>				
Wind	X			
Temperature	X			
Relative Humidity	X			
Fuel Moisture	X			
Drought	X			
<b>#3 Environmental Factors</b>				
Terrain	X			
Vegetation/Canopy		X		
Snag Conditions			X	
Slope	X			
Elevation	X			
Soil Type	X			
Soil Condition	X			
Rocks	X			



<b>ELEMENT</b>	<b>Did not Contribute</b>	<b>Influenced</b>	<b>Contributed Significantly</b>	<b>Unknown</b>
Litter Layer	X			
Aspect	X			
Visibility (i.e., smoke, clouds, haze, etc.)	X			
Fuels	X			
<b>#4 Incident Management, Organization, Control Mechanisms</b>				
ICS	X			
Communications	X			
Chain of Command	X			
Briefings	X			
<b>#5 Qualifications, Training, Certification(s)</b>				
Victim	X			
Victim's Crew Supervisors	X			
Incident Personnel	X			
<b>#6 PPE, Equipment</b>				
Nomex	X			
Shelter	X			
Hardhat	X			
8" Leather, Non-skid Boots	X			
Chainsaw Chaps	X			
Eye Protection	X			
Equipment Noise and Ear Plugs		X		

<b>ELEMENT</b>	<b>Did not Contribute</b>	<b>Influenced</b>	<b>Contributed Significantly</b>	<b>Unknown</b>
<b>#7 Condition of Personnel Involved</b>				
Work-Rest Ratio	X			
Shift Lengths	X			
Shift Breaks	X			
Number of Consecutive On-Duty Days	X			
State of Readiness	X			
<b>#8 Assignments, Strategy and Tactics</b>				
Instructions, Assignments	X			
Strategy and Tactics Implemented	X			
<b>#9 Decisions/Actions Taken by Involved Personnel</b>				
Decisions	X			
Actions	X			
LCES	X			
Lookout	X			
Situational Assessments/Awareness		X		
Size-ups (i.e., snags)			X	
Briefings	X			

## VI. Evaluation of 10 Standard Fire Orders, 18 Watch-Out Situations, and Five Common Denominators of Fire Behavior on Tragedy Fires

The 10 Standard Fire Orders were evaluated to determine both their application and any violations in terms of the Poplar Log Fire and the accident occurring.

	Did not Contribute (Order was followed)	Influenced	Contributed Significantly (Order was not followed)	Unknown
<b>10 Standard Fire Orders</b>				
#1 – Fight fire aggressively but provide for safety first.	X			
#2 – Initiate all action based on current and expected fire behavior.	X			
#3 – Recognize current weather conditions and obtain forecasts.	X			
#4 – Ensure instructions are given and understood.	X			
#5 – Obtain current information on fire status.	X			
#6 – Remain in communication with crew members.	X			
#7 – Determine safety zones and escape routes.	X			
#8 – Establish lookouts in potentially hazardous situations.	X			
#9 – Retain control at all times.	X			
10 – Stay alert, keep calm, think clearly, act decisively.	X			

The 18 Watch-Out Situations were evaluated in terms of their application and contribution to the Poplar Log Fire and the accident that occurred.

	<b>Did not Contribute (Not applicable and/or was considered if applicable)</b>	<b>Influenced</b>	<b>Contributed Significantly (was applicable and wasn't considered)</b>	<b>Unknown</b>
<b>18 Watch-Out Situations</b>				
1 – Fire not scouted and sized up.	X			
2 – In country not seen in daylight.	X			
3 – Safety zones and escape routes not identified.	X			
4 – Unfamiliar with weather and local factors influencing fire behavior.	X			
5 – Uninformed on strategy, tactics, and hazards.	X			
6 – Instructions and assignments not clear.	X			
7 – No communication link with crew members or supervisor.	X			
8 – Constructing line without safe anchor point.	X			
9 – Building fireline downhill with fire below.	X			
10 – Attempting frontal assault on fire.	X			
11 – Unburned fuel between you and fire.	X			
12 – Cannot see main fire, not in contact with someone who can.	X			
13 – On a hillside where rolling material can ignite fuel below.	X			
14 – Weather becoming hotter and drier.	X			
15 – Wind increases and/or changes direction.	X			
17 – Terrain and fuels make escape to safety zones difficult.	X			
18 – Taking nap near fireline.	X			

The Five Common Denominators of Fire Behavior on Tragedy Fires were evaluated in terms of similarity/relation to the Poplar Log Fire and the accident that occurred.

<b>NOMINATOR</b>	<b>Not Similar</b>	<b>Somewhat Similar</b>	<b>Very Similar</b>	<b>Unknown</b>
1. Most incidents happen on smaller fires or isolated portions of larger fires.			X	
2. Most fires are innocent in appearance before the “flare-ups” or “blow-ups.” In some cases, tragedies occur in the mop-up stage.	X			
3. Flare-ups generally occur in deceptively light fuels.	X			
4. Fires run uphill surprisingly fast in chimneys, gullies, and on steep slopes.	X			
5. Some suppression tools, such as helicopters or air tankers, can adversely affect fire behavior. The blasts of air from low-flying helicopters and air tankers have been known to cause flare-ups.	X			

## VII. Findings

These findings support and are a written analysis of the Potential Causal and Contributing Factors, the 10 Standard Fire Orders, 18 Watch-out Situations, and the Five Common Denominators of Fire Behavior on Tragedy Fires. They are based on interviews, visits to the accident site on Poplar Log Fire, and reviews of numerous documents and other associated items.

**#1 Fire Behavior** – Based on witness interviews and a site visit by the Investigation Team, fire behavior did not contribute to the accident. There were no active flames in the area of the fire where the accident occurred. Retardant and bucket drops had both significantly reduced the fire intensity. The fire in the accident area was smoldering.

**#2 Weather** – The weather did not contribute to the accident. Interviews of fire personnel assigned to the Poplar Log Fire revealed that winds were light on the area of the fire where the accident occurred. There had been wind increases during the day on

top of the ridge, at the highest point of the Poplar Log Fire. These observations would be reasonable expectations based on the daily weather forecast.

**#3 Environmental Factors** – The terrain (typical of the Redbird Ranger District), slope (moderate), elevation, soil type and conditions (stable), rocks (not very rocky), litter layer (typical hardwood leaf litter in the Appalachian Mountains during the fall), aspect, and overall visibility (light smoke conditions, daytime, sunny and clear) did not contribute to the accident. The vegetation/canopy of the hardwood stand in the area did have an influence on the accident occurring. For example, the accident occurred during “leaf off” and the stand of trees consisted all of hardwood. These two factors increased the difficulty of detecting the snag that caused the injury. In addition, detecting this specific snag was made more difficult by the height of the snag (approximately 70 feet) and the only absence of bark being at the very top. In other words, without intensive survey of the area, this snag could have easily been mistaken for a live hardwood tree that wasn’t hazardous.

The condition of the snag that caused the accident and the injury directly contributed to the accident. It was tall, dead but still solid, and was weakened at the base.

Findings for environmental factors are based on witness interviews, intensive site visits by the Investigation Team, and conditions usually associated with a typical hardwood stand in the Appalachian Mountains during the fall of the year.

**#4 Incident Management, Organization, Control Mechanisms** – Incident organization, management, and control did not contribute to the accident. Communications were well established on the Poplar Log Fire as was chain of command. The communication link to the ICP was through Air Attack. In addition, briefings (inclusive of numerous hazards that also included snags) were given on three occasions at various levels. For example, during orientation (“Welcome to the Redbird”) by the IC, during the morning shift briefing (by SOF and IC), and during a briefing at the Poplar Log Fire (by the Hot Shot Superintendent for the Plumas Hot Shots).

**#5 Qualifications, Training, Certifications** – The injured firefighter (a member of the Plumas Hot Shots), the supervisory personnel for the Plumas Hot Shots, and others assigned to the Poplar Log Fire on October 31, 2001, were fully qualified to carry out the assignments they were given and were conducting.

**#6 PPE, Equipment** – The injured firefighter had the required PPE for the assignments that were given and carried out. This included hard hat, ear and eye protection, nomex, fire shelter, long-sleeve shirt (with sleeves down), gloves, chainsaw chaps, and 8” leather non-skid boots. This finding is based on witness interviews and inspection of PPE by the Investigation Team.

The noise around where the injured firefighter was working influenced the accident and injury. For example, the injured firefighter was using a chainsaw, and was wearing earplugs. In addition, a nearby firefighter was using a leaf blower. Therefore, the noise influenced the injured firefighter’s ability to hear the warnings that were shouted about the falling snag.

**#7 Condition of Personnel Involved** – Fire personnel assigned to the Poplar Log Fire were physically ready and “fit for duty.” The personnel involved had worked a minimal number of shifts prior to October 31, 2001. Proper work – rest guidelines were implemented on the entire incident. Therefore, the condition of personnel did not contribute to the accident.

**#8 Assignments, Strategy, and Tactics** – The strategy and tactics employed by the personnel assigned to the Poplar Log Fire were appropriate for the assignments given and site-specific conditions encountered on the fire. In addition, assignments given were clear and understood. Witness interviews revealed a clear understanding among firefighters of the assignments to be carried out. Therefore, assignments, strategy, and tactics did not contribute to the accident.

**#9 Decisions/Actions Taken by Involved Personnel** – The decisions made and actions taken by the personnel assigned to the Poplar Log Fire were appropriate for the assignments given and the site specific conditions encountered on the fire. LCES was established. The IC, SOF2, and Plumas Hot Shot Superintendent were all serving as lookouts. Communications were well established. The escape routes and safety zones were “the black” (direct attack). In addition, briefings were conducted.

Although proper decisions were made and appropriate actions were taken overall, the Plumas Hot Shot crew’s awareness level of the hidden dangers associated with hardwood snags and hazard trees in the Appalachian Mountains in the fall of the year wasn’t complete. For example, these snags and hazard trees are difficult to detect during these conditions at this time of the year. The crew’s familiarity of these type conditions and circumstances influenced the accident.

In addition, no “size-up” and detection was made by anyone of the snag that caused the accident and injury. Lack of size-up and detection of this snag directly contributed to the accident.

### **Ten Standard Fire Orders**

Orders 1, 4 through 6, and 8 through 10 applied to the Poplar Log Fire. They were all followed. The fire was fought aggressively and the Investigation Team feels that safety was provided for first (the crew was being very effective and efficient during line construction; air support was requested and utilized; good communications were established and used; all PPE was worn and used; briefings were held and hazards were covered; a “line safety officer” was assigned to the Poplar Log Fire and was performing duties reasonably expected during line construction assisted by air support; a proper chain of command was established and understood; and lookouts were in place).

Instructions were given and understood all the way down to the firefighters. There was good communication within the Plumas Hot Shot Crew and among all resources on the Poplar Log Fire. LCES was established. Personnel assigned to the fire were in control. They were alert, keeping calm, and displayed clear thinking and decisive actions.

## **18 Watch-Out Situations**

Situations 1 and 5 through 7 were applied to the Poplar Log Fire. They were all appropriately considered. The fire was scouted and sized up the night before the day of the accident. The strategy, tactics and hazards were given during briefings and were covered in the IAP. Instructions and assignments were clear and understood by all personnel assigned to the Poplar Log Fire. Communications were well established and good communication occurred among resources on the fire. Examples include briefings, multiple “face-to-face” contacts, utilization of radios, and good utilization of air support.

## **Five Common Denominators of Fire Behavior on Tragedy Fires**

The accident that occurred on the Poplar Log fire on October 31, 2001, was an incident that happened on a small fire. This is the only similarity to any of the fire denominators.

## **VIII. Conclusions**

A member of the Plumas IHC sustained multiple injuries caused by a falling black locust snag of approximately fourteen (14) inch stump diameter and a height/length of seventy (70) feet. The snag was thirty-five (35) feet from the line being constructed at its closest point. The snag fell uphill, at an angle, striking the firefighter at a point sixty-eight (68) feet from the stump.

The crew was constructing direct fireline at a rapid pace in relatively light hardwood litter. The Investigation Team determined the snag would have been very difficult to identify from the fireline location for the following reasons:

- Leaf-off conditions.
- Snag was almost 70 feet tall.
- Bark on the stem was still intact.
- Stand was a pure hardwood stand.
- There was residual smoke in the area and evening shadows may have contributed.
- The tree was burning at ground level. While difficult to determine precisely, the consensus of the Team is that the fire was no higher than 24 inches.
- Visibility to the snag at ground level was obstructed by light understory and timber litter.
- Crew was not familiar with snags in Eastern Hardwood Forests.

The Division Supervisor had directed bucket drops along this flank of the fire during a time period estimated at less than one hour prior to the accident. No other fire personnel are known to have scouted or worked this flank of the fire before the Plumas crew came through constructing line.



It is the collective opinion of the Team that the only way this accident might have been prevented is if someone had been specifically assigned to do an intensive search for hazard trees ahead of the Plumas IHC.

Such intensive (tree by tree) snag identification is not routinely done. Absent extraordinary circumstances, it is understandable that this assignment was not made on the Poplar Log Fire.

The plastic hardhat (replaced this season) almost certainly deflected what would have been a fatal blow to the firefighter's head.

## **IX. Recommendations**

1. Develop a training module for fire personnel coming to the Eastern United States who may be unfamiliar with eastern tree species (hardwood in particular). Present the information during orientation to the incident and prior to fireline assignment. A photo series of snag identification and characteristics might be useful.
2. Consider a requirement that all line construction be preceded by an intensive survey for hazard trees by qualified personnel. Snag/hazard trees will be mitigated prior to line construction.
3. The Southern Region is experiencing a Forest health crisis from the impacts of gypsy moth, southern pine beetle and red oak borer infestations. An additional, and over-arching concern is a forest age structure which continues to grow older and therefore more susceptible to insects and disease and some types of weather-related damage. We will continue to see large numbers of dead and dying trees in the National Forests of the Southern Region.

This is the second known snag-related serious injury in Region 8 in the last twenty-four (24) months.

The Team recommends the Region develop a safety strategy addressing snags for our employees and visitors. Awareness of the scope of this problem is seen as a logical first step.

4. This report should be reviewed by all Region 8 firefighters.

## **X. Commendations**

The Type III Incident Management Team appeared to have been well organized with basic elements in place and functioning.

The actions of several individuals following the accident showed leadership, clear thinking and decisive action, under stressful conditions. Among those individuals were the Plumas IHC Superintendent Jack Sevelson, Division Supervisor Jeff Robinson, and Safety Officer Jim Stephens.

The Forest issued a letter on firefighter safety on 10/05/01. Although the letter was issued due to southern pine beetle impacts on more western Ranger Districts, the emphasis of the letter has been accepted by Redbird Ranger District personnel and incorporated into Fire Operational Planning.

## **XI. Appendices**

Appendix A: Vicinity Map, Fire Map, Accident Sketch

Appendix B: Photos

Appendix C: Persons Interviewed

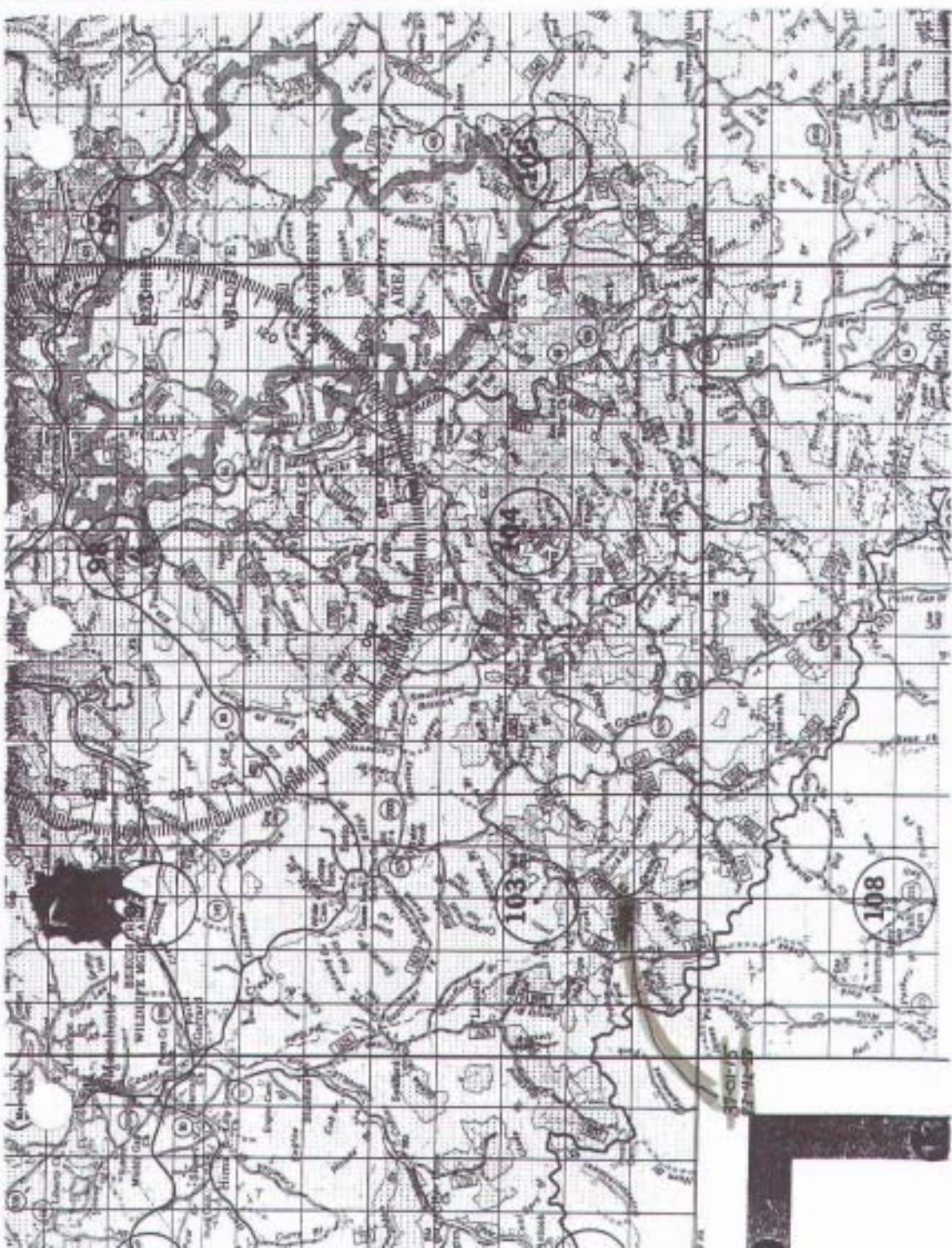
Appendix D: Letter "Firefighter Safety on Daniel Boone National Forest,"  
October 5, 2001, File Code 5100

## **Appendix A**

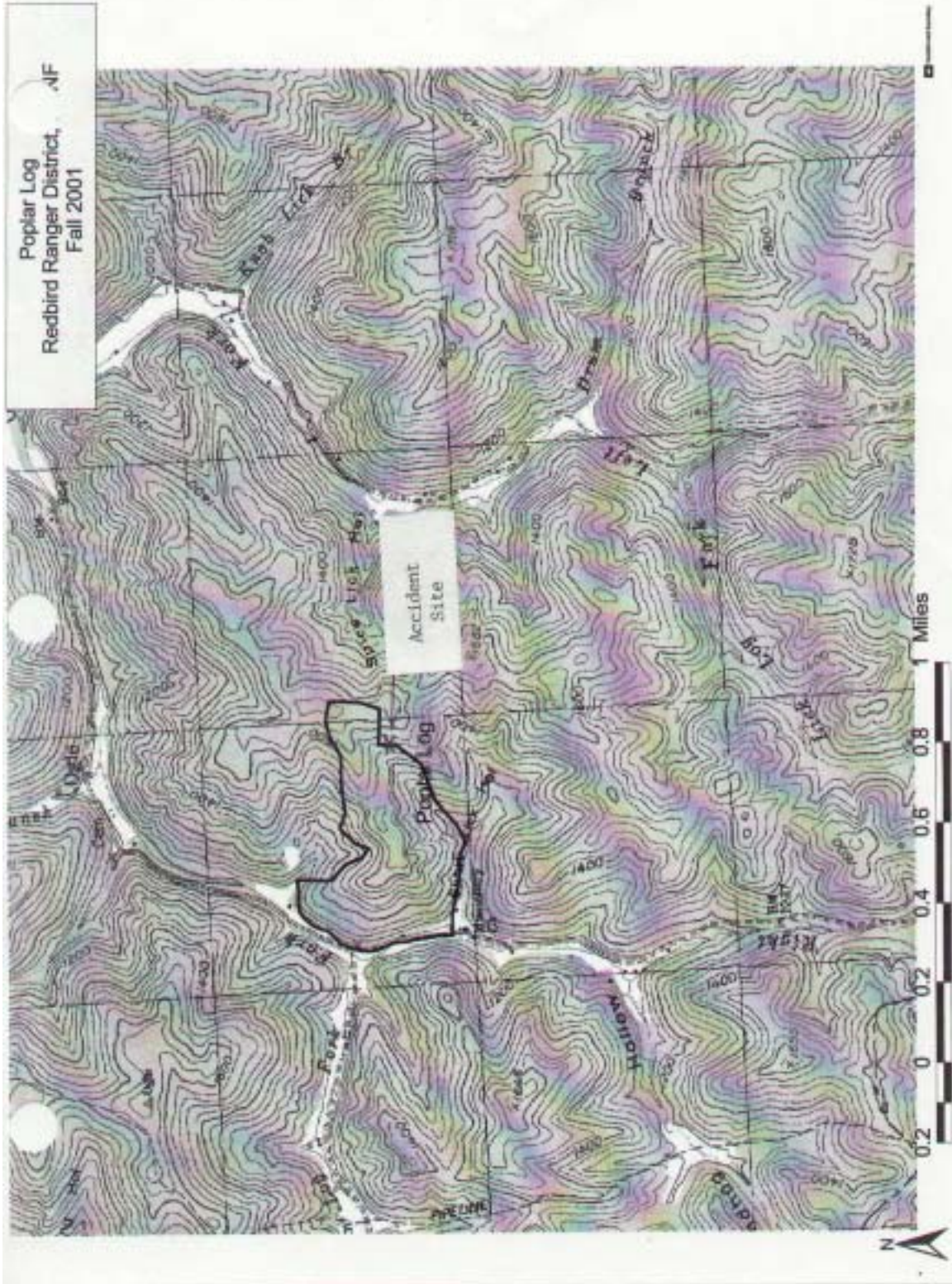
**Vicinity Map**

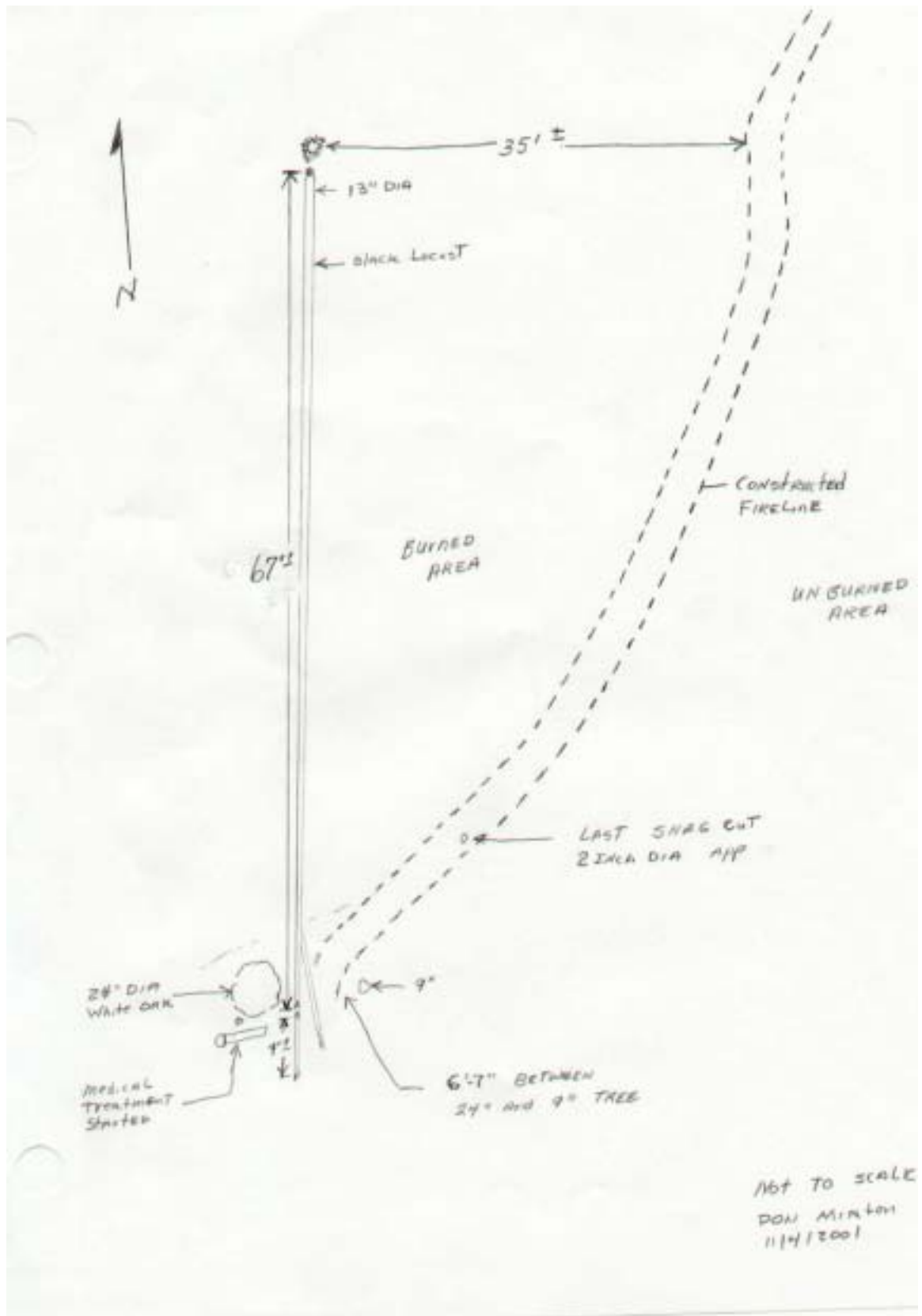
**Fire Map**

**Accident Sketch**











## Appendix B



Photo #1-14 – Photo of burnt stump approximately 24 hours after accident.



Photo #1-7 – Looking at burnt end in a southward direction to point of impact, approximately 67 feet.





Photo #1-15 – Photo of point of impact looking in a northward direction.



Photo #3-5 – Photo looking northward on fire line where other crewmembers were working.





Photo #1- 8 - Diameter of snag at point of impact.



Photo #2-2 – Photo of broken snag at point of impact.





Photo #2-9 - Photo of place of impact. Victim fell to the left of the larger white oak tree.



Photo 7 – Helmet worn by victim. Rear view of helmet, photograph showing the scratches made from the falling tree.



Photo 10 – Helmet worn by victim. Inside of helmet, view of broken headliner strap on left front side. Also, photograph shows the retaining strap band (yellow plastic headband retainer) receded to top of helmet.





Photo #2-13 – Photo of road from where victim was loaded on 4X4 Blazer and carried to ambulance.



## Appendix C

### Persons Interviewed

1. **Howard Hann, Incident Commander**
2. **Jeff Robinson, ICT3, Safety Officer**
3. **Frank Abel, Medical Unit Leader**
4. **Dave Manner, Operations**
5. **Jeff Lewis, Plans Chief**
6. **Jack Sevelson, Superintendent**
7. **Jeremy Kroeker, Swamper**
8. **Eric Atherton, Leaf Blower**
9. **Pete Duncan, Captain**
10. **Don Minton, SOF**
11. **Jim Stephens, Safety Officer**
12. **Kim Novak, Paramedic**
13. **Mike Colgan, Air Attack**

## **Appendix D**

**Letter “Firefighter Safety on Daniel Boone National Forest, October 5, 2001, File Code 5100 – see following pages.**