



Marble Yard Snag Incident Facilitated Learning Analysis



**Daniel Boone National Forest
Cumberland Ranger District**

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Introduction

Snags can be silent killers. Over the past three years there have been three reported incidents on the Daniel Boone National Forest involving snags. The most recent resulted in an employee being struck on his hard hat causing visible injury to his head which required a trip to the emergency room for what could have been a more severe injury. It is not correct to assume that all dead trees (snags) are dangerous or that all live trees are safe. In 2001 a firefighter working on the Daniel Boone National Forest was struck by a live tree that had been damaged by a previous wild fire that left him paralyzed from the waist down.

A typical facilitated learning analysis looks at a single incident and the circumstances leading up to it. In this document the Marble Yard incident was the tipping point for Forest leadership to take a broader look at the source of near misses involving snags. The Daniel Boone National Forest invited a Facilitated Learning Analysis (FLA) team to review the circumstances involving these incidents. The FLA process was comprised of:

Human performance experts refer to the difference between what administrators think is going on and what is really going on in the field as “The Gap.” The greater the gap between the level of risk-acceptance by employees and risk-acceptability by managers - the more resources, time, and effort should be put into the FLA.

- An on forest evaluation of documentation and photographs of the incidents
- An analysis of environmental factors occurring across the Daniel Boone National Forest
- An open dialog with the employees involved in these incidents

The following analysis is offered to raise awareness in order to continue the safety journey and to provide information to help keep employees and others safe from danger trees.

Description of Events

- I. The most recent incident occurred in November 2012, on the Marble Yard Fire. State resources were the first responders to the fire. Approximately 72 hours later, the USFS District Fire Management Officer was notified of the incident and dispatched two firefighters and a Law Enforcement officer to the location to assess the situation. Upon arrival the Forest Service employees engaged with the state and began to assess the situation. The fire had been contained by a combination of hand line and cold trailing and was in monitor status. The Forest Service firefighters went to check for hot spots, look for the point of origin, and map the fire. While checking an area of heat one of them stated that once he heard the crack of the snag and was able to identify its direction of fall he had no time to move out of danger.

The 8" dbh, 45' tall locust snag became entangled in the tops of two other trees pulling them down on top of him slightly reducing the

"I made myself as small as possible"

direct impact to his hard hat. The firefighter was assessed on scene by his co-workers and taken to the hospital for further evaluation. The firefighter was treated and released to full duty. The firefighter's hard hat sustained significant damage breaking the suspension and leaving a gouge and indentions on the lip of his full brim hard hat.

- II. In October 2012, Forest Service fire fighters were called out to the Bramblewood fire located in the Big Perry area of Daniel Boone National Forest. The Big Perry area is known for having a high number of snags throughout the area due to damage from the 2003 ice storm. A sawyer working with a chainsaw experienced a near miss during snag felling operations. The sawyer attempted to fell a 14" dbh, 50' tall fire damaged oak snag; the top of the snag got hung in an adjacent tree and the butt of the snag remained on the stump. After assessing the situation with another faller, the sawyer decided to buck the snag down. After making the first cut to release the snag from the stump, the butt of the snag hit the ground causing the snag to break half way up, and the top of the snag then fell back directly toward the sawyer. The sawyer had a good, pre-identified escape route but he said it happened so fast he had no time to escape. The top of the tree hit the bar of the chainsaw. No injuries were sustained due to this incident.

"I thought I was moving but my feet never move, I looked like a dancing squirrel"

"I had always imagined that a snag falling toward me would be like avoiding an oncoming train...you see it coming and step out of the way."

- III. October 2010, a hotshot crew was assigned to the Fish Trap fire on the Daniel Boone National Forest. This fire was located in the Red River Gorge Geological Area, an area known for miles of continuous cliff line. As fire activity increased along the top of the cliff embers began to fall across the line at the base of the cliff creating spot fires that crew members began to engage along the bottom of the cliff. There was a 3" dbh, 6' long snag that had been flagged but due to its location over hanging the cliff was unable to be felled. When a sawyer began to work on a slop over below the cliff, the snag became dislodged from the cliff 60 feet above and struck the sawyer on the back lip of the full brim hard hat. The blow to the hard hat shoved the sawyer forward causing the hard hat to roll down his back (between him and the snag) preventing further contact with the snag. As the crew examined the hard hat, they found that the snag had penetrated the brim of the hard hat (cover photo). The sawyer sustained no injuries from this incident.

Conditions

After a discussion with Forest leadership, the Team considered possible contributing factors to these recent snag incidents related to forest conditions.

Significant Events Affecting Forest Health across the Daniel Boone National Forest

Over the past 16 years there have been multiple weather events as well as insect infestations that have seriously affected the health of the standing timber across the forest. These events have precipitated the creation of snags in the affected areas.

January 6-7, 1996 – Heavy snow fell across eastern Kentucky leaving between 14 to 22 inches and bringing down pine tops and hardwood branches blocking roads in the southeast area of Kentucky.

February 3-6, 1998 – Another major snowstorm dumped wet, heavy snows across all of eastern Kentucky. Snow depths across the forest ranged from 12 – 24 inches. The wet heavy snow caused widespread damage across the entire forest.

1998 thru 1999 – An outbreak of Southern Pine Beetles affected an area from the Tennessee border up through the Red River Gorge. The SPB's were likely drawn into this area by the extensive timber damage that resulted from the two previous snow storms in those areas. The infestation killed nearly all of the pine stands leaving huge areas of standing snags.

February 14-16, 2003 – A major ice storm covered an area north of the Mountain Parkway coating the area with 1-2 inches of ice bringing down trees and causing massive canopy damage in areas north of Cave Run Lake. Twenty-four counties in eastern Kentucky were declared Federal Disaster Areas as a result of this storm.

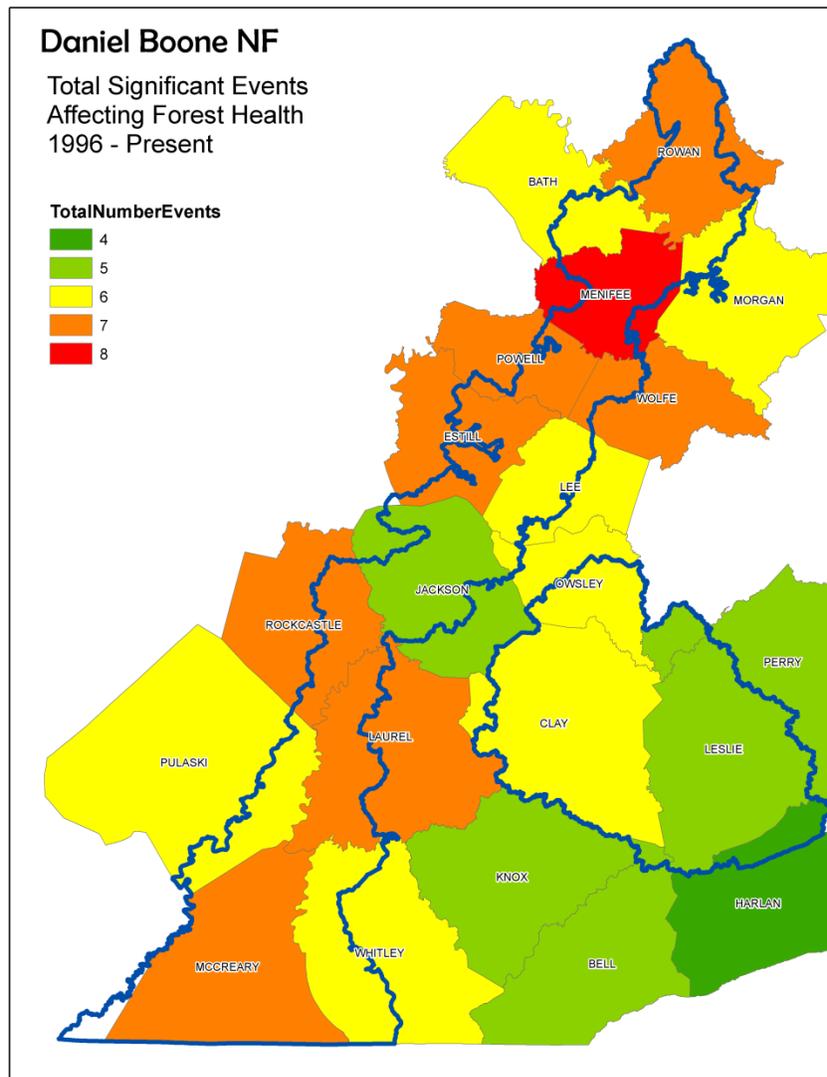
April 3-10, 2007 – An arctic blast of cold air left most of eastern Kentucky at or below freezing for a string of days during the “bud-break” stage of some species (mostly maple, poplar) across the forest.

2007 – Starting in late 2006 the majority of the area covered by the forest started experiencing lower than average rainfall especially throughout the growing season. By late October, nearly all of eastern Kentucky was classified as extreme or exceptional drought. A heat wave also accompanied the drought and August 2007 was the 2nd warmest August on record in eastern Kentucky.

2008 – The drought continued into 2008 becoming the 9th driest year on record. Two years of growing season drought and extreme temperatures took its toll on timber stands likely causing early die-off and weakened root structures.

January 28-29, 2009 – A major winter storm affects nearly all of Kentucky bringing the biggest power outage event in state history. Areas of the forest north of the Hal Rogers Parkway received at least a ¼ inch of ice and areas around the Mountain Parkway received over an inch of ice.

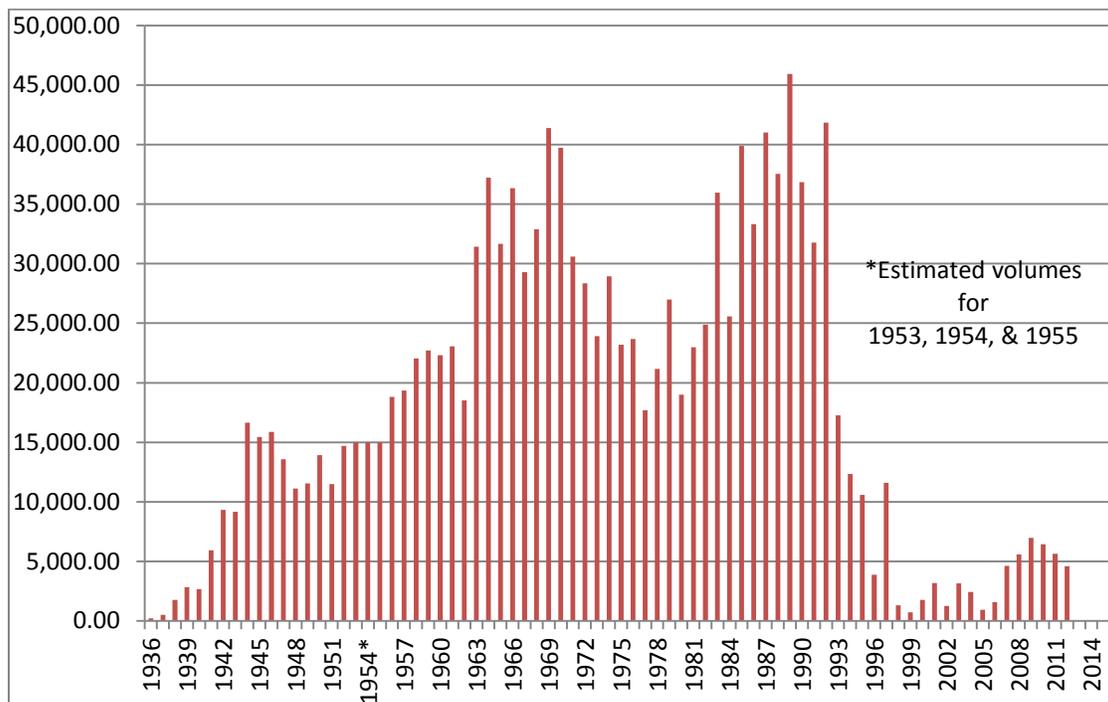
The following map shows the total significant disturbance events which have impacted the health of the forest.



Historical Timber Harvest Volume

Over the past 10 – 15 years, there appears to have been a substantial increase in the number of snags on the Daniel Boone National Forest (DBNF). Forest stands that have not had any timber harvests could have up to 19 times the density of snags as opposed to those stands having a complete harvest (Wisdom and Bate, 2007). Starting in 1994, the Forest saw a sharp decline in timber sales (chart below).

**Timber volume removed from the Daniel Boone National Forest
Shown in million board feet per year**



Present vegetation management activities now recognize the value of snags as a habitat source for many species. The DBNF Land and Resource Management Plan allows for hazard trees (dead or alive) considered to be an immediate threat to human safety to be removed at any time. However, current timber harvesting practices include retaining or creating a minimum of 3 snags per acre greater than or equal to 9" dbh within all timber harvests, regeneration, sanitation, salvage, or thinning projects units when available.

The decrease in harvesting along with the occurrences of significant weather events, the Southern Pine Beetle infestation, changes in timber harvesting practices, and the increasing age of forest stands on the DBNF are all contributing factors to the increase in snag density.

Lessons Learned

- A. We were very fortunate to avoid serious injuries to our firefighters in the three incidents described in this FLA. We may not be so fortunate next time.
- B. State suppression resources had taken the initial attack of the Marble Yard Fire (Wise Farm Road Fire in state database). We went into the fire area with a different approach than we would normally, which is working from the perimeter into the interior. In this case we were inside the burn area without knowing if the normal steps to reduce the snag hazards had been completed.
- C. The fact that we were checking on the fire 3 days after the initial attack should have made us think more about trees being weakened by the fire. Entering a fire that was in monitor status reduced the normal heightened state of awareness that we exercise on an active fire.
- D. A full brim hard hat provides a larger protection zone vs. a standard “cap style” hard hat.
- E. Hard hats should only be in service 10 years from date stamped by manufacturer, not 10 years after they are put into service.
- F. When you realize a tree is falling towards you it is critical to utilize your pre-identified escape route immediately.
- G. When cutting snags, make sure the sawyer is cutting in a position of comfort which enables them to have a better view of the tree they are cutting and the quickest possible escape from the base of the tree.
- H. Question whether cutting a snag is actually more dangerous than flagging and avoiding the snag.
- I. Depending on the age and weakness of the snags, other tactics should be considered to eliminate either the hazard or the threat to the control of the fireline or both:
 - a. Isolation of the snags by raking around them
 - b. Removal of the snags by equipment (i.e. feller-buncher, etc.)
 - c. Decision by the IC to make fire perimeter larger to exclude snag area
 - d. Suspend suppression activities after dark
 - e. Suspend suppression activities during high wind events
- J. Be constantly vigilant in emphasizing snag awareness practices and protocols for all employees and incoming resources in the Daniel Boone NF.
- K. Consider forest conditions in future management activities related to fire suppression and vegetation management to address snag-related public and employee safety.

Commendable Actions

To the fire fighters on the Daniel Boone National Forest for active participation in after action reviews; without their candid discussions these learning opportunities would not have emerged.

To the employees of the Daniel Boone National Forest for sharing their experiences and understanding the end goal of contributing to the broader look into the common denominators of the recent snag incidents.

The Forest leadership for requesting an FLA team look at the series of accidents in an effort to understand what may be causing the increasing number of snag incidents.

Team members

Brian Beisel
Team Lead
Staff Officer
Land Between The Lakes National Recreation Area

Vanessa Ryland
Timber Resource Specialist
Daniel Boone National Forest

Jerry Burk
Assistant FMO
Stearns Ranger District
Daniel Boone National Forest

Tami Buchanan
Southern Area Intelligence Coordinator
Region 8
Fire and Aviation Management

EJ Bunzendahl
Forest Assistant Fire Management Officer
Daniel Boone National Forest

Jerry Wheeless
Fire Management Officer
Cumberland Ranger District
Daniel Boone National Forest

In addition to the team members assistance was provided by:

Shawn Harley, National Weather Service Jackson Field Office.

Matt Wingard, GIS Coordinator, Daniel Boone National Forest.

The FLA team would like to thank the Daniel Boone National Forest for providing the employees the opportunity to share their experiences and to conduct this Lessons Learned and distribute the information to others.

For more information on the FLA process, a complete guide can be located at the following website:

http://wildfirelessons.net/documents/APA_FLA_Guides_2011.pdf

Appendix A – Snag Brochure

SNAG & HAZARDOUS TREE AWARENESS & PREVENTION PROGRAM



Southern Region - 2003

KILLER TREES

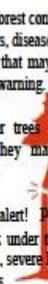
▲ This forest contains trees weakened by insects, disease, weather, past fires, and age that may cause them to fall without warning.

▲ Killer trees are not necessarily snags; they may look green and healthy.

▲ Stay alert! Post lookouts and do not work under trees with dead tops, cat-faces, severe lean or other signs of weakness.

▲ Snags are silent killers.

▲ Learn the indicators for structural defects in trees.



HAZARDOUS TREE PROTOCOL FOR CREWS

• **Identify and Evaluate** – Scout for hazardous trees and flag the tree and a buffer or post warning signs. Not all dead trees are hazardous and many green trees are hazardous.

• **Post Lookouts** – In areas of known or potential snags and hazardous trees.

• **Communicate** – Make sure everyone in the work area knows the presence and location of hazardous trees. **Warning** – Have crewmembers yell “Snag” or “Snag Patch” when they walk by hazardous trees or snags.

• **Removal or Avoidance** – Mitigate the hazards with steps agreed to by you and your supervisor. This would include flagging the hazard, posting a lookout, choosing to work away from the hazard, planning escape routes, etc. Hazardous trees that are too dangerous to cut should be identified and avoided. In areas with numerous hazardous trees, the appropriate decision might be to avoid the area completely and not cut the hazardous trees.

WHAT COULD HAPPEN



▲ Website address for Snag & Hazardous Tree Awareness & Prevention Program: <http://rweb.r3.fs.fed.us/snags>

COMMON DENOMINATORS OF HAZARDOUS TREE ACCIDENTS

- ◆ Working at night or in thick smoke and fog where hazardous trees are not visible.
- ◆ Struck by a tree from behind that was not being watched by the felling crew.
- ◆ Working closer than 2 1/2 tree lengths from dozers or heavy equipment.
- ◆ Sleeping in areas less than 2 1/2 tree lengths from hazardous trees.
- ◆ Safety zones and escape routes have not been cleared of hazardous trees.
- ◆ Crewmembers not briefed on strategy, tactics, or tree hazards.

ENVIRONMENTAL CONDITIONS AND HAZARDOUS TREE INDICATORS

- Strong winds
- Night Operations
- Steep Slopes
- Disease or bug-kill timber
- Trees and duff have been burning for an extended period.
- High-risk tree species (rot and shallow root system).
- Numerous downed trees
- Dead or broken tops and limbs overhead
- Accumulation of downed limbs
- Absence of needles, bark or limbs
- Leaning or hung-up trees
- Roots damaged by equipment or erosion.

HAZARDOUS TREE FELLING – USE ONLY QUALIFIED FELLERS

- ◆ Select and clear escape routes and alternatives before starting the cut.
- ◆ An escape route quartering back from the planned direction of fall is preferable.
- ◆ If possible stand behind another tree of sufficient size.
- ◆ Be aware of other nearby crews or people and notify them when felling in their work area.
- ◆ Ensure adequate traffic control measures are in place before felling trees.
- ◆ When felling trees, station a lookout to watch and warn the Sawyer of falling branches, limbs and tops.
- ◆ Stay clear of butt- be aware of kick back.
- ◆ Felling trees at night or when the tops are not visible is prohibited.
- ◆ If you are not sure a tree can be cut safely, notify your supervisor, mark the hazard, and walk away from it.

PROTECT YOURSELF

- ▲ Stay out of high-risk areas if possible. Modify strategy & tactics to mitigate tree hazards.
- ▲ Be alert to changing conditions, including wind, rain, root or stem burn-through, and retardant drops.
- ▲ Avoid high risk areas at night.
- ▲ Post lookouts or use the buddy system to warn of hazards.
- ▲ Withdraw personnel from hazardous areas when they are too tired to stay alert.
- ▲ Always wear your hard hat and PPE!
- ▲ Use LCES at all times.

