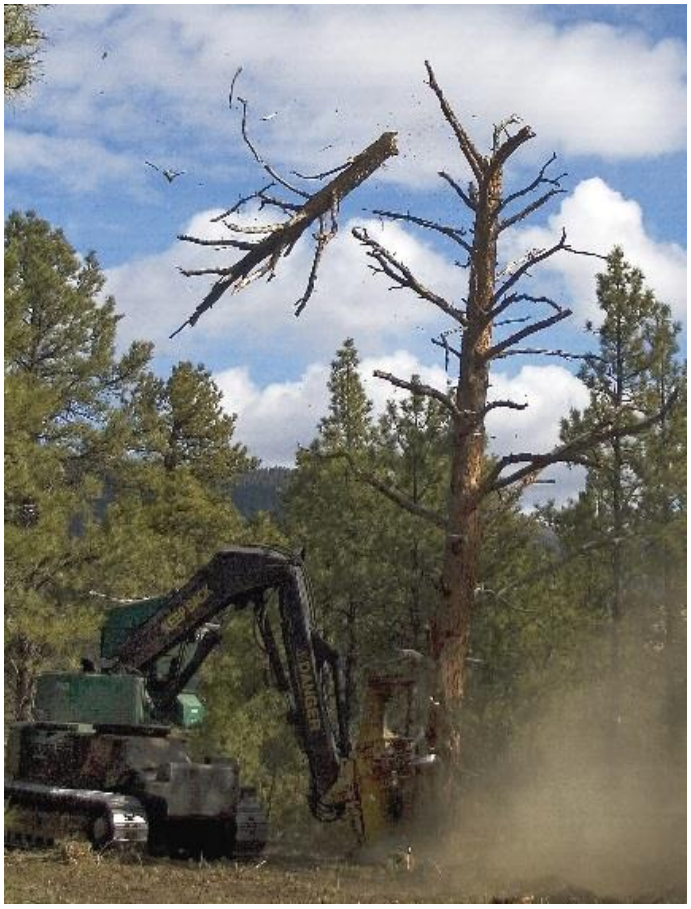
TREES, FOPS, ROPS AND OPS

by James Steele

Overhead hazards from fire-weakened and burnt trees are major causes of accidents and fatalities in forest work, and on the fireline. Wildfire also burns out tree boles, weakens tree limbs and damages tree roots. Erratic winds, induced by fire and post-fire wind streams, shake snags and weakened roots of live trees like wiggling a loose tooth. Openings in the forest, such as roads, trails and continuous fuel breaks can channel air flow, accelerating and twisting wind as in a tunnel. Burnt, rattled snags and over-mature trees create a dangerously unstable forest canopy, potentially fatal to forest workers, recreationalists and wildlife.



Overhead hazard *photo credit: JWare*

MECHANIZED FOR SAFETY

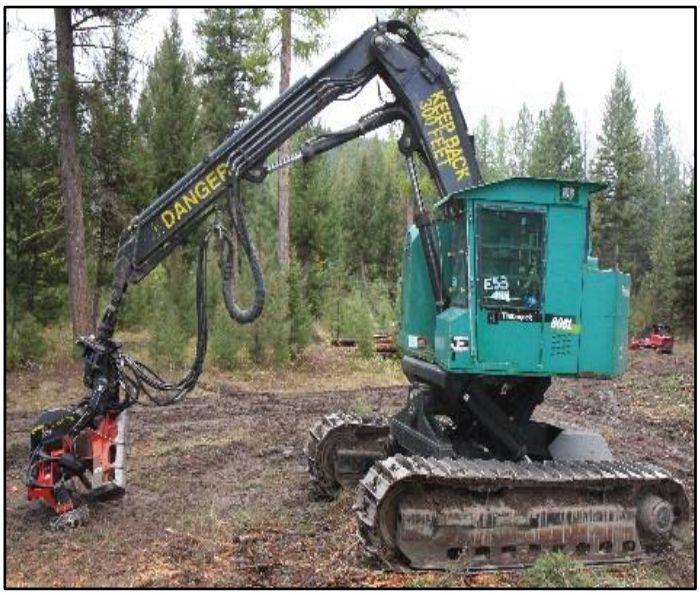
Over more than a century, manual tree felling has been the primary method to reduce overhead hazards, and to buck up downed trees. (1) Although a great improvement over crosscut saws and axes for production, use of the chainsaw tool requires the faller to work under tree tops and limbs. Risk of injury and death in manual tree falling operations increases with the length of time a worker spends under the tree and its limbs. Findings by the national Occupational Safety and Health Administration (OSHA) are common knowledge in the forest industry, *"More people are killed while felling trees than during any other logging activity."* (2)

Accidents from overhead hazards have plagued the logging industry from severe injury, death, high insurance premiums, court cases, and federal and state fines for years. Although the advent of mechanical tree felling since the 1980s has resulted in reductions of frequency and severity of tree felling accidents and injuries.

In 1998, a regional injury statistics study compared manual tree felling to fully mechanized operations. The researcher observed changes in injury occurrences when the same logging companies switched from manual logging practices (hand falling and hand-set choker skidding) to mechanized operations (mechanical felling machines and grapple skidders). The study found that the greatest frequency of accidents, and the most costly ones occurred from chainsaw use by ground workers. Machine operators had significantly fewer injuries than ground workers, most often associated with mounting and dismounting equipment, and performing machine maintenance. (3)

BUILT-IN SAFETY SYSTEMS

The physical and business cost of serious accidents and fatalities prompted the logging m.achine manufacturing industry to develop strong, risk-mitigating cabs and safety structures for logging equipment, now required by OSHA. Equipment manufacturers built in the required safety features designed to ensure an operator survival space within the cab. Forestry machine manufacturers used design criteria and standards from the Society of Automotive Engineers (SAE), and military operational fundamentals of *force multipliers* to offer the logging industry new equipment designs for high risk activities.



Reinforced cab on tracked harvester. *Photo credit: JSteele*

SAE Operator Cab Design Criteria:

- Operator Protection System (OPS): prevents poking hazards by enclosed cabs with cab screening and cross laminated polycarbonate windows, which must resist a 2-inch diameter object forced against the cab with 4000 lbs. of force.
- Falling Object Protection System (FOPS): the cab roof must be able to stop a 10-inch diameter bullet-shaped 500 lb. object, falling from 20 feet above the cab, and must prevent the object from entering inside the operator's cabin space.
- Rollover Operator Protection System (ROPS): must be able to support the dynamic loading of the entire machine should the equipment rollover, preventing the collapse of the cab, or the ejection of the operator from the cab.

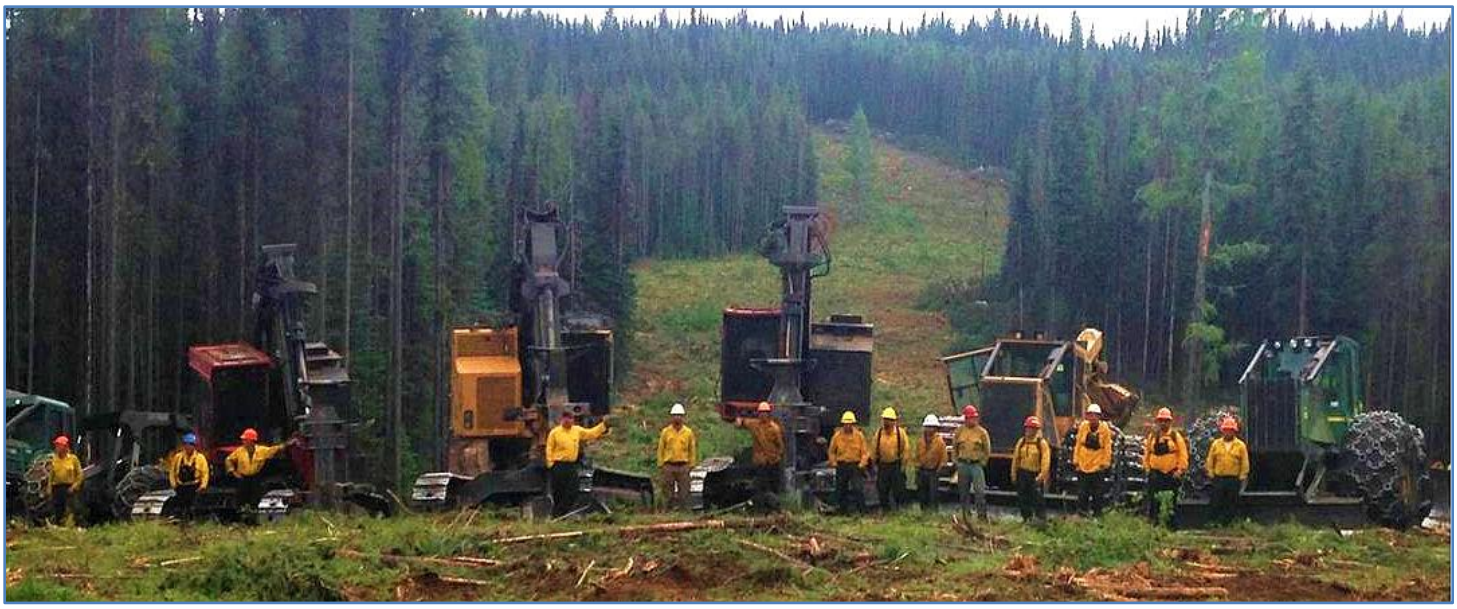
TREE FELLING IN WILDLAND FIRE TACTICAL PLANS

Incident Management Teams use formulas to plan field tactics based on field operation objectives and types of operational actions. Tactics for wildfire suppression operations are formulated by combining the effects of time, space, and purpose (4). These three components enable us to develop a tactical plan describing the work force, determining crucial time frames, and meeting the intended purposes of our actions. A tactical plan includes the *time* required for fire site access, the *size* of fire, and for the *purpose* we might build a fireline.

Tree felling is a common task during wildfire suppression, especially during access route clearing and fireline construction. We, as fire managers, use it to meet control line standards and contain the fire, and sometimes for risk mitigation and personnel safety, i.e. danger tree felling. While fire managers may inadvertently increase risks by allowing for additional time to meet full tactical objectives, the logging industry demonstrates advantageous time management skills worth our consideration in wildfire management. Loggers are accustomed to battling short time frames under difficult conditions, while safely meeting production quotas.

Controlled hazard tree felling, feller buncher. *Photo credit: JSteele*

Use of SAE design and OSHA-required equipment cabs have increased safety for the equipment operators and tree felling operation. Swing machines (360^{o} rotation of cab), coupled with hydraulic knuckle and telescopic booms allow felling machines a long reach (14-30+ ft) and larger working circle. The larger working circle minimizes time required for machine travel to fell a tree. Design and machine features introduced since the 1980s, such as leveling cabs, improved tracks, chains and track bands on feller-bunchers and harvesters have increased the machine's stability on slopes up to 55% (uphill/downhill and 35% sidehill). Ergonomic features installed in the cabs allow operators to work in comfort for longer hours of production. Improved forestry machine design for safety (including 360^{o} site-lighting) and engine efficiencies has created a production machine capable of 24-hour/day operation.



Heavy Equipment Task Force (HETF), Kamiah, Idaho Fuelbreak, 2015. *Photo credit: USFS/JSteele*

MECHANIZED TASK FORCE

A mechanized, or heavy equipment task force is made up of multiple forestry machines, each different and working in concert. The machine combination varies by the tasks at-hand, and requires operators that understand their individual role in achieving the overall objective, i.e. tree felling, tree removal (skidding), brushing and mineral soil exposure for fireline construction.

Using forestry heavy equipment in wildland fire operations comes with its own set of risks. Most risks to personnel can be mitigated by not allowing ground workers to mix with machines, by securing operational paths, and by establishing safe-distance working circles for each machine. Safety features built into felling machines effectively eliminate the risks experienced in manual falling. The falling mediums are completely different between mechanized and manual; there is no migration of risk between the two. These same safety features built into felling machines have reduced the types of injury risks, decreased hazard exposure while increasing productivity in completing the tactical mission of hazard tree removal. Protective structures designed into a feller buncher or harvester far exceed any protection offered by a hard hat, chaps and gloves; mechanized tree felling significantly lowers calculated risk.

Mechanization has its own constraints. Machines must be used on sites that are within the machine's design parameters and physical operating limits to safely fell and handle trees, i.e. ground slope, ground pressure and tree size. Consistently safer operations are realized when workers are properly trained. (3) Mechanized Task Force training must be appropriate for specific terrain, vegetation, and operational objectives. Supporting personnel must train with the equipment to learn the essentials for maximizing efficiency and safety in an inherently dangerous job. To understand the size and forces of large tree felling operations training must be live and in-woods, and include personnel that learn to effectively maximize advantages of time, space, and purpose.

Using mechanization, the risk of felling trees has been mitigated well within acceptable limits set by wildfire management guidelines (5). We have the safest processes for handling the most dangerous job on wildfires, if we include tools and operational techniques from the logging industry. If we are willing to learn how to properly work with forestry machines and their woods-savvy operators, we can deploy machines for safer and more effective wildfire management.

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