



Safety Considerations for Forest Windthrow Salvage Operations

There has been a marked increase in damaging storm winds in British Columbia in the past few years. Fall and winter months are peak times for forest stand damage to occur. Storm winds and saturated soil conditions along with rain, snow and ice loading the forest canopy can lead to widespread forest damage including broken branches and tops, destabilized trees, and intermittent or catastrophic windthrow.

In order to preserve the economics of the stand, rehabilitate and reforest the site, and prevent insect and disease outbreaks, forest salvage operations become a key forest management priority.



Drone plan view of catastrophic windstorm damage

The primary focus must be on human safety and stabilizing the site before, during, and after timber recovery.

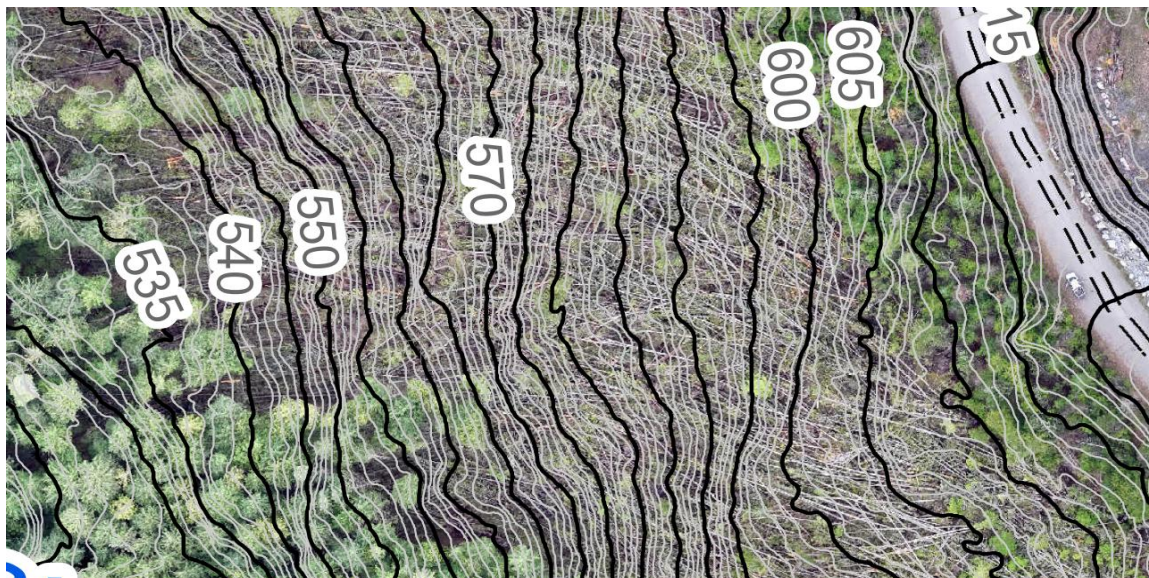
Catastrophic windthrow salvage operations present unique hazards and require specific operational and safety considerations that may differ significantly from “normal” logging processes.

Pre-Planning and Safety Hazard Assessment:

Site Assessment and planning: Utilize the best planning tools available to assess and plan a salvage project. Drone imagery can help to assess windthrow configuration and direction, best access points and skid directions, and, to initially identify risks such as unstable groups of trees, rock formations, and challenging terrain issues before crews enter the site. Terrain hazards must be assessed by qualified professionals. Known and unknown terrain hazards can be created or affected by lack of root strength, more easily erodible soils due to windthrow site disturbance, and altered drainage patterns from windthrown trees and root wads. In many cases, accessing the site on foot for field work activities is extremely difficult and may not be recommended due to stand instabilities, physical tree barriers and elevated windthrow. All of these challenges increase the value of remote drone work. If drones aren't available, aerial reconnaissance with a helicopter may be used.

Early collaboration: Engage with First Nations and other agencies early in the planning process to ensure important values are considered in the salvage plan, to determine any no-go areas and thus minimize major changes to the overall plan during salvage operations.

LIDAR: Use Lidar technology if available to develop accurate contours. Coupled with recent drone imagery this becomes a powerful tool in planning, as the density and direction of windthrow, and ground slope can easily be assessed.



1 metre contours derived from LIDAR

Georeferenced digital plans: These markedly improve operations and safety. Workers and supervisors can more easily track progress and identify hazards ahead of time, and communicate more effectively and efficiently.

Access and Disturbance: A good mapping base will help to optimize access planning and minimize overall ground disturbance.

Retention Areas: Be conservative when planning retention levels and areas as actual stand conditions can be more damaged and unstable than initial indications. If possible, strategically optimize retention patches on terrain types and areas that will not limit access to the stand. This will leave more options open to workers, improve safety, and may limit further damage to standing trees from operations.

Hazard Recognition and Training:

Trained Crews: Ensure all personnel working in windthrown areas are properly trained and equipped for the inherent high-risk conditions. Training should include danger tree recognition, working with compression and tension wood, specialized machine operation, minimizing post logging hazards and other working techniques that will allow salvage while minimizing further stand damage and hazards.

Reliable Communication: Maintain reliable communication systems and increase check-in frequency in hazardous conditions.

Danger Trees: Actively assess and reassess the stability of all potentially dangerous trees (snags, hung-up trees, those with suspect stability) in the work area. Remove danger trees concurrent with operations, or adjust the work plan to avoid them.

Fatigue and Complacency: Supervisors must closely monitor worker fatigue and complacency, as the unpredictable nature of windthrow increases critical decision making and risk. Effectively untangling and salvaging windthrow and trying to maintain reasonable merchantability of a damaged stand demands a lot of focus and patience.

Overhead Hazards: Constantly watch for overhead hazards such as loose limbs, tops, and danger trees.

Stable Footing and PPE: Elevated windthrow trees and loose bark will increase the chance of slips, trips and falls. Make sure cork boots are sharp and consider chin straps on hard hats in case of falls. Proper high visibility clothing is critical.

Maintain Distance: If you enter into a work area, never assume an equipment operator or ground worker is aware of your presence. Maintain a safe distance (at least two tree lengths) until definite contact is made and permission granted to proceed.

Machinery and Procedures:

Mechanized Salvage Priority: Machine felling and bucking should be the first choice for removing windthrown trees. This can include using a feller buncher, teamed with a forestry excavator, or a forestry excavator with power grapple and blowdown saw. Having a grapple skidder or forwarder close at hand is usually necessary to skid away and eliminate snarls and hazards as they develop.

Choose larger machine sizes due to obstacles such as root wads, high stumps, broken logs, interlocked stems, and interspersed windthrown trees in standing timber. Heavy duty, well maintained, properly guarded equipment is required.

Root wads: Bucked off root wads and unsalvageable logs and debris needs to be placed in a stable orientation concurrent with salvage operations to keep site workers safe afterwards. Stand root wads back up if possible. The goal is to stabilize the site and reduce hazards for those that follow, many of whom will be on foot.



Typical windthrown stand – a puzzle to solve safely

Manual falling and bucking in windthrown stands is a much higher risk activity and must be done by specifically trained & assessed personnel with a qualified supervisor. The majority of the trees are loaded with compression or tension and will react suddenly and with extreme force when cut – unless these forces are reduced or removed by mechanized means first.

Butt skidding: Try to set a work direction from the butt ends of the windthrown trees if possible. This may require establishing new work headings as windthrow orientation changes across the stand.

Processing Location: Do only the absolute necessary work in the windthrow area; any further processing is probably safer out of the windthrow sites, such as at the landing or roadside.

Potential for phase congestion issues: This potential is higher in windthrow salvage as they typically demand more team work to untangle and harvest.

Payment method: Consider switching to an hourly rate instead of piece work to avoid a strict production mentality and to encourage safe practices.

On-going Weather Considerations:

Wind Conditions: Suspend operations and evacuate crews if wind speeds exceed safe thresholds or if stand stability is further compromised. There are various guidelines available however, if wind conditions are causing any further instability (blowing small limbs, any stand movement) it is a sign that operations should be suspended until conditions change.

Rain and Snow: Both further increase instabilities and must be considered in daily hazard assessment.

Post-Storm Assessment: After any significant wind event, reassess the area to determine if the wind has destabilized any remaining trees before resuming work.

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