One-day FORREX workshop

Reducing windthrow with

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In coastal areas of British Columbia, winds blow at speeds of over 60 km per hour several days a year, and at 80–130 km per hour at least once a year. Windthrow, or the uprooting of trees by wind, has therefore always been an important issue for coastal forest companies.

Modern logging practices have seen an increase in the use of retention patches, which means that more stand edges than ever are affected by wind. Although some impact from strong winds is unavoidable in these situations, steps can be taken to decrease the effects of the wind.

Windthrow was the focus of a recent one-day workshop in Campbell River. Hosted by FORREX and the Forest Engineering Research Institute of Canada (FERIC), with funding from the BC Ministry of Forests and Range Forest Science Program, this meeting brought together resource professionals to discuss various management strategies to reduce windthrow. These discussions, summarized below, focussed on the importance of good cutblock design to reduce the effects of wind.

Forest engineering and planning

Windthrow is usually predictable, so cutblock design plays an important role in reducing the impact of wind in wind-prone areas. Forest planners must consider the following:

- Dominant wind direction: Retention patches should be oriented to reduce the fetch lengths (i.e., the distance travelled by wind across an opening). Topographical features such as rock bluffs can naturally shelter edges.
- Slope position: Upper slopes and ridge crests have the highest rates of windthrow incidence.
- Tree species: Some are more tolerant to windthrow than others, and these are preferable at the edge of the stand. Research shows that tapered, deep-crown trees, or trees with a lower ratio of height to rooting depth, seem the most windfirm. For example, the roots of Douglas-fir penetrate deeper into the ground than those of western hemlock so they are generally more wind-tolerant. Western hemlock, however, may be windfirm if an edge is exposed for a significant period of time. These edges will often "self-prune" with winds helping to remove some foliage.

Pruning as a strategy

Even with effective cutblock design, exposed timber is often severely affected by wind. Riparian values, visual quality, and terrain stability commitments can also make it difficult for forest planners to leave windfirm edges.

Heli pruner with pruned tree in centre of photo.

Ed Proteau photo

planning, pruning, and topping

In these situations, pruning or topping trees is recommended. By removing some of the trees' foliage or "sail," these methods can significantly reduce the effect that wind has on exposed trees. Pruning or topping can also protect the ecological well-being of the stand edge. Most windthrow damage occurs within 2–3 years of harvest. Therefore, stand edges that best withstand winds are those that receive treatment following harvest and before the first winter of exposure.

Several types of pruning are effective but, generally, pruned edges need to penetrate 10–15 m into the stand. Most pruning should occur on the exposed edge; less pruning should occur within the inner few metres of the edge. A stand-by-stand analysis should be done to determine the pruning prescription that provides the most beneficial results in terms of wind resistance and cost-effectiveness. Various types of pruning are discussed below.

Aerial pruning

This method is effective in removing crowns in old-growth timber, and in quickly pruning a large area. Several factors can negatively influence its productivity, however. These include helicopter ferry time (from helicopter base to site) and the need to organize personnel (helicopter pilot) or equipment (mechanized pruner). Weather conditions also dictate whether pruning takes place—wind or fog may prevent the helicopter from taking off, and heat or fire hazards may prevent work during the summer months. Finally, mechanical issues, such as pruner maintenance, must also be dealt with.

Manual pruning

Trees can also be pruned manually by certified climbers who individually prune trees. One technique involves the removal of branches from all four quadrants of the stem. Other methods involve the removal of various foliage around the tree.

Workers often have better access to the areas requiring pruning than do mechanical pruners. This practice is generally not as productive as aerial pruning, however. Weather can also play a role so proper planning needs to be in place.

Manual topping

Tree topping is as effective as pruning in windthrow reduction (Rowan and Mitchell 2003). Workers climb trees and evaluate where topping is required. Species such as western hemlock and amabilis fir can have up to 30% of the upper tree crown removed; western redcedar and yellow-cedar can have up to 35% removed. This method is most efficient in dense second-growth stands, and offers the advantage that the edge can be treated before falling because of the minimal hang-ups that exist. In general, however, this method is slower and more expensive than aerial treatments.

Aerial topping

Aerial topping, although not used as commonly as the other methods described here, is often the most effective practice in less dense stands. This process is quicker than pruning, which in turn results in reduced costs. Tops larger than 15–20 cm in diameter, however, cannot be topped aerially, which often limits the practicality of this method in old-growth stands.

Future research

Over the past four years, Canadian researchers, including **Dr. Steve Mitchell** and **Dr. Michael Novak** of the University of British Columbia, and **Dr. Jean-Claude Ruel** of Laval University, have been working with **Dr. Barry Gardiner** of Britain's Forestry Commission to add Canadian species to the Forest Commission's ForestGALES risk model. This model enables the user to test new cutblock design scenarios. It calculates the critical wind speed needed to overturn or break trees within or on the edge of uniform-canopied stands with or without thinning, and the probability of this wind speed occurring at a specific location. Although the model currently incorporates over 30 years of experiments and is validated for forests in the United Kingdom with data from British yield tables, it will utilize data from TASS (Tree and Stand Simulator) by 2007.

The Campbell River windthrow workshop reiterated the importance of monitoring stands and edges. It is important to both observe edges that have been affected by wind and areas that have remained windfirm. It is also beneficial to use tools such as pruning and tree topping, which have been proven in Forest Investment Account research by **Chuck Rowan** and **Terry Rollerson** as methods that reduce windthrow.

More Information

For more information go to ***http://faculty.forestry.ubc.ca/mitchell/windthrow.htm*** or contact Dr. Steve Mitchell, Windthrow Research Team, Faculty of Forestry, University of British Columbia at 604-822-4591 or ***stephen.mitchell@ubc.ca***

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References

Rowan, C.A., S.J. Mitchell, and H. Temesgen. 2003. Effectiveness of clearcut edge windfirming treatments in coastal British Columbia: Short-term results. Forestry 76(1):55–65. URL: ***http://forestry.oxfordjournals.org/cgi/content/abstract/76/1/55***