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LOG PROCESSING ON STEEP SLOPES U.S. PACIFIC NORTHWEST PRACTICES

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ABSTRACT

Steep country log processing in the Pacific Northwest PNW) is described and the development of these practices for the PNW second growth (0.7 m^3 to 2.0 m^3 tree size is discussed.

Given the similarity in topography and tree size between the PNW second growth and New Zealand steep country "new crop", these developments are of real interest to the New Zealand industry.

Some variation in second growth processing practices is now seen in response to :

- *the lower value differential within second growth trees*
- *the desire to maximise the piece size skidded*
- *the desire to minimise manual limbing*

Where tree length cable logging is practised, there is normally partial processing at the stump.

To date, only a few companies have been successful in mechanically processing on cable landings. However, the trend to feller-bunching on steeper ground will mean full tree logging and processing on the landing.

The use of computer value optimisation for "at stump" processing is currently being evaluated in PNW second growth. Initial results suggest a gross gain in value recovered of 14%, compared to standard practice, with a net gain of 3% to 4%.

INTRODUCTION

A description is provided here of log processing practices (limb-measure-cut) used on steep ground in the Pacific Northwest of the United States. Because of the similarities in equipment and methods between New Zealand and the Northwest, it is instructive to examine the processing methods used and the trends that are occurring.

The Northwest logging industry has always cut most of its timber at the stump to lengths typically averaging 10 m, with 12.5 m being a common preferred length. This has been necessary because of the large size of most of the timber, but has also become accepted practice in smaller timber.

A transition is now well advanced in the Northwest, from large old growth trees to small second growth trees, and some companies are changing their approach to processing.

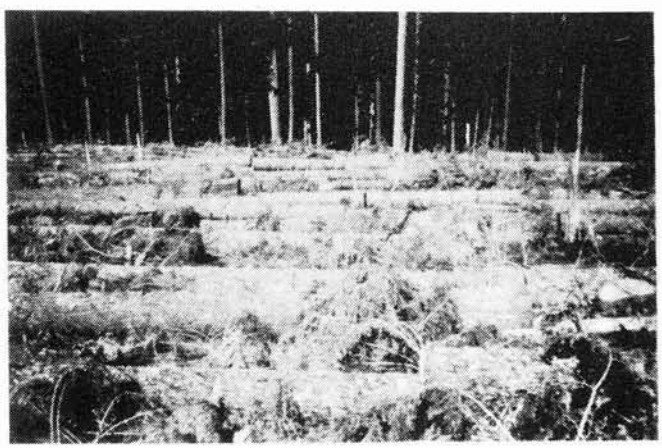

Figure 1 - Conventional Northwest practice has been to process trees at the stump. In a situation like this, with medium-sized timber and "long" or even ground, side-hill falling is usual

OLD GROWTH PRACTICES

All old growth processing is done by powersaw by fallers, at the stump (Figure 1). This is done on all slopes and only in exceptionally difficult circumstances is it considered acceptable to leave a tree uncut. This is facilitated by falling to the most favourable lay for breakage control, which generally is also a favourable position for measuring and cutting. The timber cut in this way includes Douglas fir (Pseudotsuga menziesii), hemlock (Tsuga spp), various pines (Pinus spp) and numerous other coniferous species. The American practise of wearing "caulks" or spiked boots helps to make such processing feasible. There are often few limbs to cut.

In recent decades, old growth fallers have emphasised breakage control (outside the scope of this Technical Release) and "cutting-for-value" because of the extremely large value differentials and absolute values within each tree. The value differential between the most and least valuable parts of an old growth tree may exceed $300 per cubic metre.

Optimal Cutting

Cutting for Industry Grade

There is a highly developed commodity trade in logs in the Northwest, with universally accepted log grades and scaling rules. Many companies design their bucking instructions to maximise the yield of the higher grades, with cutters instructed to cut at grade breaks - typically specific diameter breaks and/or where a threshold in quality (eg knot size) occurs. This strategy makes the most sense for those most heavily involved in trading logs. Of course the lengths preferred by the market are also included in the instructions and many purchase orders require a minimum percentage of the volume within specified lengths. Certain lengths may also be cut to take advantage of the idiosyncrasies of the scaling rules in use.

Preferred Lengths

A different approach has been adopted by companies for species that they primarily use internally. For the purposes of their own manufacturing processes, they may find that industry grades do not match their end uses, since log grades were developed many years ago in relation to the end-uses of the early 20th century. Some mills have found it more profitable therefore to cut preferred lengths than to stick to industry grades. These preferred lengths are dictated by the produce lengths demanded by the market.

Some companies select preferred lengths that permit the log to be allocated to either lumber or plywood manufacture without a loss of conversion. Stump-area processing necessarily involves a time lag from severance to market, but this strategy permits log allocation to be adjusted to market fluctuations.

Sophisticated optimal cutting solutions have been developed, based on the potential product yields from a given tree, and applying a matrix of product values versus length and dimension (for example, different lengths and dimensions of lumber are assigned different values per thousand board feet). Optimal solutions are developed for a representative sample of trees to develop cutting instructions for a specific operation.

It is usual for a compromise to be made between cutting for grade and cutting preferred lengths, depending on each company's marketing posture. Whatever cutting rules are adopted, "cutting-for-value" requires that fallers have an excellent understanding of a multitude of grades or quality characteristics for each species, as well as scaling practices. They carry cutting instructions, expressed in terms of preferred lengths for various species and grades or qualities, either on a plastic laminated card or on a sticker on their hard hat. Lengths are measured with a retractable steel tape carried on the belt, and most companies expect lengths to be accurate within 5-10 cm.

Cutting Quality

There is an emphasis on length accuracy and the quality of cut - squareness, and the avoidance of pull and slabbing. It is also usual, except for some companies using the logs internally, to cut all broken ends square to avoid a scaling deduction.

The techniques used to prevent saw binds and to limit cutting damage to large logs are well-developed, being described in detail by Conway, 1978.

Northwest loggers are highly skilled at maximising value recovery from large timber (Figure 2). Many of their practices are appropriate for larger first-crop plantation wood in New Zealand.

Figure 2 - Traditional Northwest practices use considerable log grading expertise to maximise value in large wood.

SECOND GROWTH PRACTICES

As the transition from old growth began, Northwest loggers used old growth processing methods. However, second growth trees have a much lower absolute value and value differentials within the tree. It is common to cut second growth with an average tree size of 0.7 to 2 cubic metres, typically yielding one to two 12.5 m logs per tree. Also second growth trees have live limbs for typically a third of their merchantable length. In Douglas fir, the limbs are brittle and most break off in skidding. The limbs are persistent in many other species, somewhat comparable with radiata pine in New Zealand.

Some variation in second growth processing practices is now seen in response to :

- the lower value differential
- the desire to maximise the piece size skidded
- the desire to minimise manual limbing

At one extreme is the persistence of old growth methods, which are still the most common. At the other extreme is tree-length logging, either to the landing or sometimes to a sort yard.

Powersaw Methods

Powersaw falling is still most common in second growth on steep ground. Where the "conventional" log length method is used, there is naturally much less emphasis than in old growth on breakage control and cutting quality. An acceptable lay for second growth may usually be had by falling sidehill, facilitating measuring and cutting. When log lengths are processed at the stump, it is usual to require logs to be limbed on three sides by the faller, with the remainder being cleaned up later at the landing.

Where tree length tower logging is practised, there is normally partial processing at the stump. This is done by taking a butt cut off the larger trees. One company requires its cutters to cut all logs at the stump that exceed 10 m long and 30 cm sedib (Figure 4). In another company, butt logs are cut off all trees over 60 cm dbh. This serves to reduce landing size requirements and congestion problems associated with full processing at the landing.

Limbing requirements in partial processing operations vary. In Douglas fir, only the minimum limbing necessary to facilitate cutting large logs at the stump is done (Figure 3). In species with persistent limbs, some companies do only enough limbing to facilitate cutting, while others limb three sides of the entire tree. Some cut the unmerchantable top out at the sump (Figure 4) in order to reduce landing debris, while others, particularly in Douglas fir, do not.

The falling pattern used in tree length operations is for the butts to point toward the landing. This usually means falling downhill. Where a tree is felled with is top toward the landing, the cutter is usually required to cut the tree into logs at the stump to avoid problems at the landing. The heel boom loaders used by American loggers do not function well if they have to take a tree length by the top.

Figure 3 - Partial processing in a second growth Douglas fir stand. Logs over 30 cm sedib, 10 m long are processed at the stump with minimal limbing. All other logs are processed at the landing

Some companies cutting at the landing relax their length accuracy standards in the interests of productivity. Some cut a standard 12.5 m length off all butts for the same reason. This is tolerated because the value sacrificed in suboptimal cutting is small compared to old growth.

Limbing Techniques

The usual Northwest limbing technique is to walk along the log, cutting limbs with the saw. A few companies have tested Swedish techniques where the cutter walks alongside the tree and balances his saw on the log. Scandinavian methods, with some local adaptations, were found to be successful in small wood. They have not persisted, because :

- the companies that trained people in the Swedish methods have switched to contract falling in small wood

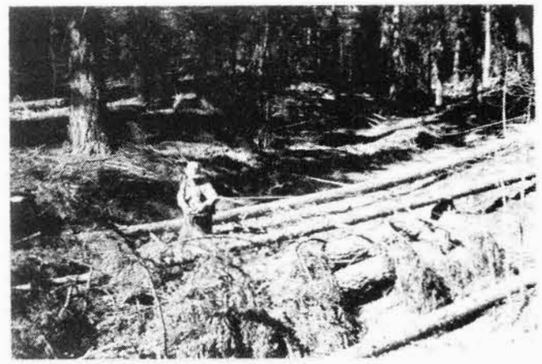

Figure 4 - In species with coarse persistent limbing, such as this white fir (Abies Concolor), partial processing includes limbing the entire tree and cutting the top out at a preferred length

- mechanisation is perceived as the route to go in any case.

Furthermore, the large saws used in the Northwest do not fit Scandinavian techniques. Even in small wood, it is usual to use a guide bar of 75 cm or more, partly to fall the occasional residual old growth tree, partly to eliminate the need to bend when limbing, and partly due simply to custom. Most Northwest second growth fallers could probably raise their productivity and reduce fatigue significantly by using smaller saws most of the time, and their large-saw approach is not recommended for New Zealand.

Mechanisation

Tree length logging with mechanical processing at the landing has been widely accepted on skidder ground. On cable ground, however, only a few companies have been successful in mechanically processing on tower landings. These have used either a specially-designed version of the Hahan Harvester or a boom delimber such as the Roger or Denis, or a feed-roll processor such as the Steyr. No off-landing mechanical processing has been done on cable ground in the Northwest.

There is a trend toward feller-bunching on steeper ground, with many models

operating on slopes to 35%, the Timbco to 60% and the Allied over 70% (Figure 5). This is seen as the key to ultimate cost containment with declining piece sizes. It will of course mean processing on the landing.

Figure 5 - The increasing application of feller bunchers on steep slopes means moving processing on to the landing

COMPUTER OPTIMISATION

Many small log mills in the Northwest feature a merchaniser, in which truck-length logs entering the mill are scanned, and a three dimensional "picture" of the entire log is transmitted to a computer. Based on prices and production costs for various product lengths and dimensions, an optimal cutting solution is developed that maximises the net value of the log. To date, this technology has not been operationally applied in Northwest logging operations outside the mill yard.

There is currently considerable interest in selecting an optimal cutting solution at the stump with a hand-held computer. The program BUCK, developed at Oregon State University, uses network analysis to select the best combination of lengths from each tree, given the dimensions of the tree and the locations of quality breaks. It does not compute product values for each possible combination of logs in a tree, as the sawmill algorithms do. Rather, it uses a matrix of log values by grade and length, which can be derived from product values if desired or else from market log prices.

The program was used by a number of loggers in an operational test in three logging companies. In this test, BUCK was found to yield a gross gain in value of 14%, compared to standard practice. The computer beat the most skilled logger in the test by 7%. It was found to yield a net gain of 3% to 4% in both old growth and second growth, after taking into account the cost of data input, measurement errors, log sale contract constraints, etc. Loggers were trained to use the program in a few days. The operational implementation of such a system would have the additional advantage of supplying management daily with data on the inventory of logs by grade on a particular setting.

REFERENCE

Conway, S J (1978) : "Timber Cutting Practices", 3rd ED San Francisco : Miller Freeman Publications, Inc.

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