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THE BATWING - AN OPTION FOR CABLE-ASSISTED DIRECTIONAL FELLING

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SUMMARY

Protecting stream edges during cable-harvesting operations can be a time-consuming and costly process. The physical presence of the stream and heavy leaning edge trees increase the difficulty of felling and extraction.

The batwing (wings attached to a carriage, or a winged device in place of the butt rigging) assists in felling trees against their natural lean. It is used in environmentally sensitive areas such as along stream margins, where safety, physical and operational constraints limit the use of conventional felling methods (scarf, backcut and wedges).

This study evaluated the productivity, safety and environmental performance of a batwing (on a shotgun carriage) when assisting directional felling along a stream edge.

The average cycle time (delay free) to fell a tree using the batwing, was 4.7 minutes.

The main limitation of using the batwing, with a standing tower and skyline system, was the requirement for a mobile tail hold. As with any specialised felling technique, the batwing's effectiveness is also reliant on the skills of the faller in selecting and preparing the tree for felling.

Figure 1 - Felling along stream edges using a batwing

Figure 2 - left - a Canadian batwing; right - a Kiwi batwing

The batwing assisted in controlling the felling direction, reducing the hazards of felling heavy leaning streamside trees. This minimised the environmental impact of harvesting on the stream and riparian vegetation.

INTRODUCTION

Harvesting heavy leaning trees along stream edges can be time-consuming and costly. Falling trees across watercourses that require protection, may be the safest and easiest method, but the impact is often unacceptable.

Some trees can be felled away from the stream edge using conventional felling methods. Most trees, however, require additional assistance to fall them against their predominant lean safely. The most common methods available are tree jacks, portable winches and machine-assisted or cable-assisted falling. An option for cable-assisted directional felling is the batwing.

WHAT IS A BATWING?

The batwing comes in many shapes and sizes. It is essentially a set of wings attached to either side of a carriage, or a winged device in place of the butt rigging in a cable hauler operation. The stem of the tree sits within the crutch of the wing and tension is applied to the main rope, pulling the tree over (Figure 1).

The Canadian designed batwing (Figure 2 - left) has been used in Canada since the 1980s to assist directional felling along stream edges (author unknown, 1991). It was used on a grapple yarder.

Another version of the batwing, developed in New Zealand in the 1980s, was used for a short time in Kinleith Forest, Central North Island (Donovan and Prebble, 1981). The batwing was used in a scab skyline system replacing the butt rigging. It consisted of a spreader bar with a horn attached to each side of it and a rider block attached at either end. The main problem with this system, was the lack of control in positioning the horns against the tree.

Two versions of the batwing have recently resurfaced, and are being used in both Nelson and Northland. The Northland version has two metal wings welded to both sides of a shotgun carriage (Figure 2 - right). This study evaluated the productivity and safety of the batwing being used in Northland, and its effectiveness in minimising environmental damage to watercourses.

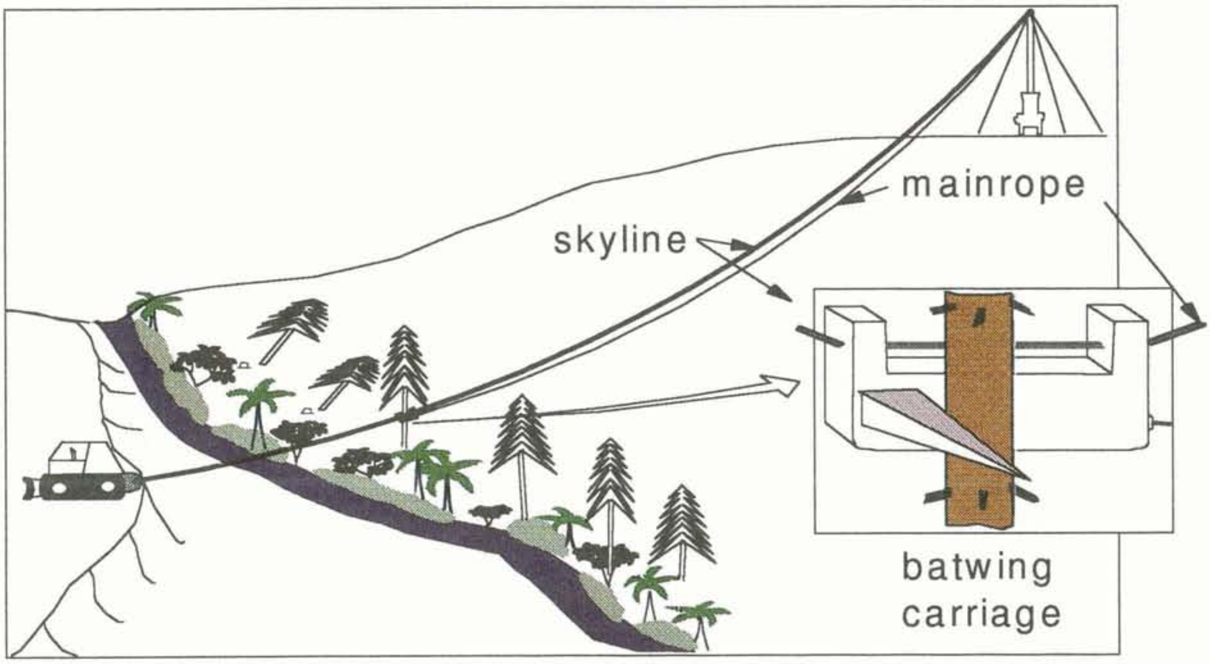

Figure 3 - Shotgun cable harvesting system with a batwing carriage

SITE DESCRIPTION

The hauler setting was in a 26 hectare block of 27-year-old radiata pine. The setting had slopes of 25° to 30° leading down to the stream edge.

Stream and Riparian Characteristics

The stream was approximately three metres wide, with riparian vegetation varying from one to five metres in width.

Along the immediate stream edge, the predominant vegetation was an invasive weed *Ageratina riparia* (Regel) or 'mist flower', silica grass and pampas. Back from the stream edge, Coprosma (*Coprosma grandifolia*) predominated. Other species included pate (*Schefflera digitata*), hangehange (*Geniostima rupestre* var *ligustrifolium*) and pungas.

The stream flows into a wetland which feeds into a major river system. The main environmental concerns when harvesting alongside this stream, were to minimise the entry of sediment and logging slash into the stream.

Stream Edge Prescriptional Requirements

- Directional felling to be used to minimise damage to riparian vegetation.
- Trees adjacent to the stream to be felled using hydraulic jacks or rope assisted directional felling to minimise the number of stems falling across or into the stream.
- Permanent flowing water routes to be left free of slash. All branch and slash material to be removed from the stream once the harvesting of each setting is completed.

Harvesting System

A Madill 071 operating a North Bend system was used to harvest down to the stream edge. Harvesting was along one side of the stream only, the other side had been logged previously. Stream edge trees that could not be felled without assistance were left for the batwing.

The batwing carriage was used with a shot gun system to assist the directional felling of trees along the stream edge (Figure 3). The skyline was anchored to a mobile tail hold (D85 Komatsu) which was positioned on the other side of the stream.

METHOD FOR USING THE BATWING

Using wedges to keep the backcut open, the faller made the felling cuts and retreated to a safe position, before signalling the tractor operator. If the faller was not visible to the tractor operator, then an observer relayed signals between the two. The tractor moved the skyline across to position the batwing carriage against the tree. Tension was taken up on the mainrope to pull the tree over. The batwing carriage was allowed to roll back away from the tree, once it had started to fall. All trees were scarfed to fall away from the skyline.

After approximately every fourth tree the batwing carriage would be hauled toward the hauler and released back out again, to prevent the skyline and mainrope snagging or crossing over on the drums.

Very heavy leaners were pulled over (uprooted) by the batwing.

STUDY METHOD

The study area included the edge trees, riparian vegetation, streambank and stream, along an 80 metre section.

Prior to felling, each tree was measured for diameter at breast height (DBH), height, lean, lean direction and volume (Table 1). Photos of the riparian vegetation recorded its pre-harvest condition. The stream area was assessed for any pre-harvest soil and streambank disturbances.

A continuous time study on the operation determined the average cycle time per tree, and the total production time to fell twelve trees.

Post-harvest measurements assessed the stream and riparian area for soil and vegetation disturbance, streambank disturbance and the presence of logging slash.

Tree No	DBH (cm)	Height (m)	Lean class*	Predominant lean direction**	Tree volume(m^3)
1	43.2	33.3	1	1	1.54
2	52.0	33.0	1	1	2.13
3	45.0	41.9	1	0	2.14
4	42.0	29.0	3	1	1.25
5	46.8	29.6	1	3	1.56
6	53.8	43.8	1	2	3.10
7	52.8	35.7	2	1	2.39
8	45.0	32.1	2	4	1.59
9	61.2	33.4	2	1	2.89
10	36.4	29.7	2	4	1.00
11	57.8	37.5	1	1	2.97
12	42.8	24.2	2	1	1.06
Avg	48.2	33.6			1.97

Lean Class*	
0 - 5 °	1
5 - 10 °	2
10 - 15 °	3

Predominant Lean Direction**	
0 =	no lean
1 =	toward stream
2 =	away from stream
3 =	downstream
4 =	upstream

Table 1 - Summary of tree data

RESULTS

Environmental Assessment

Disturbance of the riparian vegetation was confined to a 16 metre section where trees were within one metre of the stream edge. Along this section, some mistflower weed had been crushed by the faller during tree preparation. There were four branches in the stream and streambank area, ranging from four to nine metres in length. As per prescription requirements, these were removed. No damage occurred to the streambank.

Productivity

The elements that made up the delay free cycle time for the batwing are shown in Figure 4. The total productive time (delay free) to fell 12 trees was 57 minutes, giving an average cycle time of 4.7 minutes per tree (range 2.4 to 6.4 mins per tree). Table 2 shows the time spent on each element in the cycle. Repositioning the skyline and other miscellaneous elements added 0.4 and 0.2 minutes, respectively, to the cycle time (Table 2). There was a delay time before and after the study to change between the North Bend and shotgun systems.

DISCUSSION

Safety

This batwing operated under a set of site specific operational guidelines, developed between the Forestry Health and Safety Inspector (Department of Occupational Safety and Health) and the contractor. Most of the safety rules were similar to those for other machine-assisted or cable-assisted tree felling operations (OSH Safety Code for Bush Undertakings Part 2 - Cable Logging & Part 3 - Logging)

The role of the tractor in this operation was to support the skyline and batwing. The inhauling mainrope pulled the tree over. Under the OSH Safety Code for Bush Undertakings Part 2 - Cable Logging, steps must be taken to ensure that the tractor is incapable of any movement.

To meet this standard, the operational guidelines for this operation required the mobile tailhold to be equal in weight to half the breaking force of the skyline used. In most other operations, it is common practice to immobilise the tractor by positioning it facing toward the hauler with the blade grounded or against a stump.

ELEMENT	AVERAGE TIME (minutes)
Faller clears escape route around tree	0.5
Faller scarfs, backcuts and wedges tree	1.2
Faller retreats to a safe position	0.7
Batwing positioned against the tree	0.6
Tree is pulled over	0.2
Batwing carriage rolls back away from tree	0.2
Faller walks back in	0.7
Faller clears a path to next tree	0.6
Average cycle time per tree (delay free)	**4.7**
Reposition skyline and mainrope	0.4
Other miscellaneous elements	0.2
Average cycle time (including delays)	**5.3**

Table 2 - Elements in the batwing cycle

Because of the skills required in selecting and setting up the trees for the batwing, only tree fallers holding FIRS (Forest Industry Record of Skills) Module 3.4 (machine-assisted tree felling module) were permitted to carry out this work.

One of the main hazards associated with using the batwing is the proximity of falling trees to suspended ropes. This hazard was managed by careful attention to scarfing, backcutting and wedging techniques so that the intended direction of fall was away from the ropes. The batwing provided additional control in guiding the tree toward the intended direction of fall.

The skyline band brake was set to slip at a lower skyline tension, in case a tree fell across the ropes.

To eliminate the hazard of working under a raised object, the faller set up the tree and retreated before the batwing carriage was positioned.

Disadvantages of the system

The main limitation of using the batwing with a standing tower and fixed skyline system, was the requirement for a mobile tail hold. The tail hold needs to provide sufficient lift to position the batwing carriage up the stem for maximum leverage.

The delay time in changing between systems before and after using the batwing made it inefficient to use the batwing for small pockets of trees (four to five trees). These were removed using cable-assisted falling with strops and operating a North Bend system.

The faller's decision on which trees to leave for the batwing can also have an impact on the success of the operation. Trying to fell trees that should have been left for the batwing can counteract the environmental benefits of the batwing, if these trees end up in the stream.

Because the faller cannot work under a raised object, leaning trees were set up without the support of the batwing. Felling trees in these circumstances required the skills of an experienced and trained faller.

Using a wider area of hinge wood to hold the tree can increase slabbing and draw-wood. This is a cost against the safety of the faller and environmental protection of the stream.

Although some degree of slabbing/draw-wood was noticed in other areas where the batwing had been used, nothing was recorded in the trial area.

Figure 4 - Post-harvest condition of the stream and riparian vegetation

Advantages of the system

Positioning the tree within the crutch of the batwing, gave a high degree of control over the intended direction of fall. This minimised the potential hazard of trees falling across the ropes. It also made it practically impossible for the tree to fall backward into the stream. As a result, the stream and stream banks remained intact and damage to the riparian vegetation was minimal (Figure 4).

The batwing could be positioned higher up the tree than the strops used in cable-assisted felling (without tree climbing). This increased leverage and reduced the loading on the skyline.

The main advantages the contractor found in using the batwing, as compared with cable-assisted falling using strops, were time, control and safety (as discussed in previous sections).

Even with the changeover time between the North Bend and shotgun systems, the contractor found the batwing was quicker at felling streamside trees than cable-assisted falling using strops (except for small pockets of trees).

Although this study looked at the performance of the batwing along a stream edge, the batwing has potential in other sensitive areas such as road lines, railway lines, gas lines and residential areas.

ACKNOWLEDGMENTS

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