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HELICOPTER LOGGING
An Environmental Logging Case Study

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ABSTRACT

A study to investigate the commercial helicopter logging of Compartment 6 of the Tangoio Soil Conservation Reserve was undertaken. The helicopter used was a Bell 214 ST operating over steep broken terrain extracting 36 year old radiata and corsican pine.

The helicopter system was considered the most environmentally acceptable extraction method due to the minimal ground compaction, reduced road and landing requirements and a short harvesting period. Limited public disturbance on the adjacent state highway further promoted the use of this system.

Flight distances ranged from 200m to 1500m. The average cycle time, flying uphill over the full range of flight distances, was 2.05 minutes. Flying downhill, across slope and short uphill loads, had an average cycle time of 1.50 minutes. An estimated average payload of 2.5m³ gave daily production rates between 700m³ and 900m³ for ten hours flying, depending on flight paths and climatic conditions.

INTRODUCTION

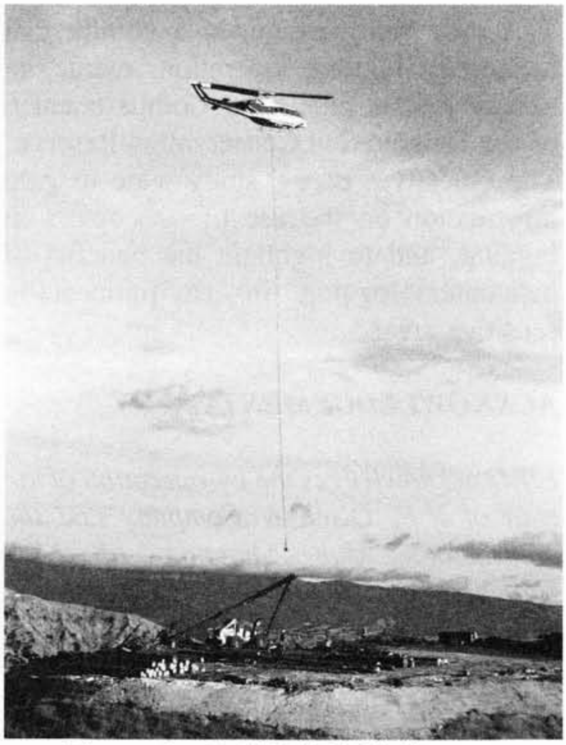

Figure 1 - Bell 214 ST helicopter

Increased environmental awareness has highlighted the need for environmental impacts to be considered at the planning stage of harvesting operations. There has always been debate about the environmental impacts of harvesting operations. Ideally every harvesting operation should have high productivity and low environmental impact. In the past, however, cost and productivity levels have tended to determine the choice of harvesting system.

Helicopter logging is a harvesting system which has the potential to be a low environmental impact, high productivity system. However, extensive operational and administrative planning must be undertaken to minimise costs and ensure the smooth running of the operation.

This case study examined a commercial helicopter logging operation extracting mature radiata pine from Compartment 6 of the Tangoio Soil Conservation Reserve. The objectives of the study were to gain information on the use of helicopters in logging, and to highlight the benefits of helicopter logging in environmentally sensitive areas.

ACKNOWLEDGEMENTS

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BACKGROUND

Compartment 6 of the Tangoio Soil Conservation Reserve is an area of land comprising 34.6 ha located between State Highway 2 and Kaiwaka Road in Northern Hawkes Bay, commonly known as the "Devil's Elbow". The trees, predominantly radiata pine with some corsican pine, were established between 1954 and 1956 in an effort to protect the hillside from erosion and slips. Logging of the reserve coincided with a planned major re-alignment of State Highway 2 at "Devil's Elbow" by Transit New Zealand.

MARVL stand data for the compartment is shown in Table 1 (Perrett, 1991 pers comm*).

	Radiata Pine	Corsican Pine
Area (ha)	25.8	8.8
Piece Size (m^3/Tree)	1.8	0.4
Volume/Hectare (m^3/ha)	824.0	226.0

Table 1 - MARVL stand data

The topography of the block is characterised by sensitive erosion prone soils, steep slopes, unstable limestone boulders, bluffs and several small steep gullies. State Highway 2 runs along the lower boundary of the block.

Figure 2 - State Highway 2 location at the lower boundary.

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* Perrett, Shane : Forestry Advisor, Ministry of Forestry, Rotorua

The method of extraction had to be environmentally sensitive, technically feasible, and not impede traffic flows or diminish public safety on State Highway 2.

Transit New Zealand contracted Kiwi Helicopters Limited to log the Tangoio Reserve. An independent consultant was employed to oversee the landing operation and undertake the marketing of the wood.

Environmental

Helicopter logging in this case was the most environmentally acceptable extraction system. Total load suspension offered several beneficial effects which played an important part in the future recovery of the cutover. These benefits included minimal ground compaction, lack of trenching and quick site re-establishment.

The anticipated slash build up from partial in-bush processing, was expected to act as a rainfall buffer giving protection to the erosion prone soils. However, an accidental fire removed all of this protective cover subsequent to logging.

The duration of the operation, 15 weeks as compared to 12 months for a hauler operation, enabled quick re-establishment of the block. This significantly reduced the period over which the block was exposed to the eroding elements of wind and rain.

The short harvesting period increased the protective value provided by the root strength of the remaining stumps. After logging, radiata pine root systems loose half their tensile strength within 15 months (Watson, 1990).

Economic

While it is difficult to place a dollar value on intangible or intrinsic values, there are definite future benefits for both the immediate site and surrounding region, such as reduced erosion and surface run-off. Such values need considering when dealing with environmentally sensitive logging operations.

The helicopter has the ability to extract wood from areas considered economically unloggable by more conventional hauler methods."Of the total area 76% is to be logged and 24% is to be left as unloggable" (Drummond, 1978). The helicopter operation was able to extract 100% of the area.

Reduced roading and tracking not only reduced the cost of the operation (Figures 3 and 4), but also removed potential sources of erosion and sedimentation. Roading cost for the helicopter operation was $58,827.50 (Anon., 1991) whereas estimated roading cost for hauler and tractor logging of the same area was $93,357.00 in 1989 (Duggan, 1991 pers comm*).

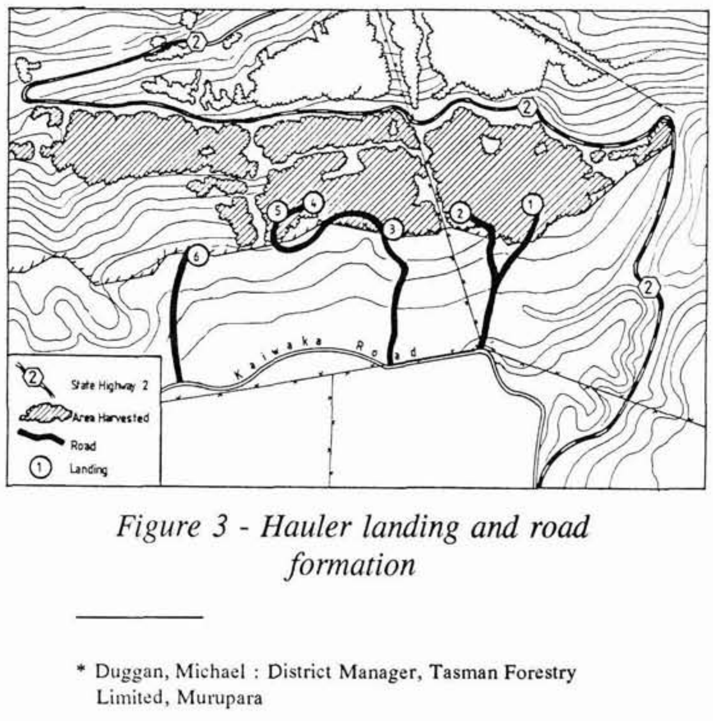

Figure 3 - Hauler landing and road formation

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* Duggan, Michael : District Manager, Tasman Forestry Limited, Murupara

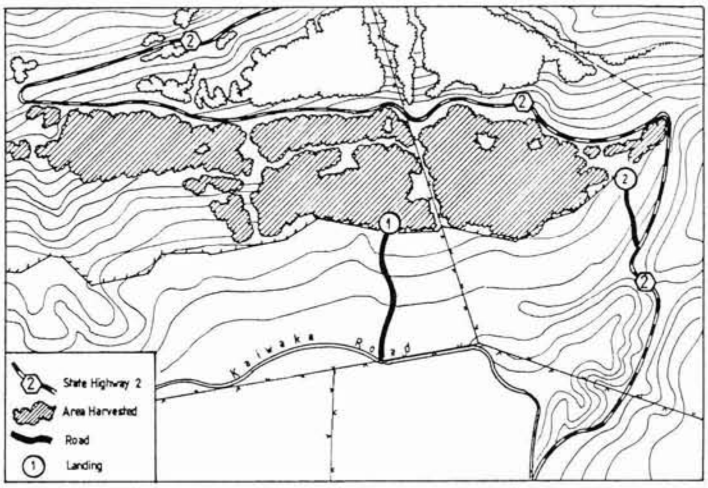

Figure 4 - Helicopter landing and road formation

The most undesirable feature of a helicopter operation is the high operating cost. These operating costs include large fuel bills and regular maintenance checks, and in this case, a full time aircraft engineer. Fixed costs included high insurance, depreciation, wages and equipment hire.

TRAFFIC FLOW

The location of State Highway 2 caused operational problems. The safety of road users and the maintenance of traffic flow was seen as a major constraint to the logging of the Tangoio Soil Reserve. Helicopter extraction largely overcame this problem.

The flight paths of the helicopter and landing locations minimised the number of times suspended loads passed over the road. When such crossings did occur, road closures were less frequent, and of a much shorter duration than the planned 10 minute delays for hauler extraction. Radio contact between the flagmen, fallers, breakerouts and pilots enabled the road closures to be well co-ordinated and kept to a minimum, (30 seconds to 3 minutes).

Limestone boulder displacement on the cutting face posed a serious safety hazard for traffic on State Highway 2. The helicopter system however, with its fully suspended payload, would be expected to dislodge less debris than a partial suspension hauler system. A strip of standing trees was left along the setting boundary. High stumps left along the face restricted any unintentional log and/or boulder movement.

EQUIPMENT

Helicopter

This operation used a Bell 214 ST heavy lift helicopter with twin turbo shaft engines rated at 1212 kW (1625hp) each. The rated maximum external payload lift was 4.3 tonne. A 50 metre tagline with electronic and manual hook release plus a loadcell, for measuring payloads, completed the rig.

Two pilots were needed to operate the helicopter. One flew the machine while the other monitored the instruments. The charge out rate for the helicopter was quoted as $5,000/hour. The helicopter carried a maximum of 400 kg of fuel, giving 40 minutes of operating time and a 20 minute safety reserve.

Flight distances ranged from 200m to 1500m. Average cycle time, flying uphill over the full range of flight distances, was 2.05 minutes. Flying downhill, across slope and short uphill loads, had an average cycle time of 1.50 minutes. An estimated average payload of 2.5m^3 gave daily production rates between 700m^3 and 900m^3 for 10 hours flying, depending on flight paths and climatic conditions.

A bulk fuel storage tanker was located at a convenient landing point enabling quick refuelling. Daily maintenance and servicing was carried out by the aircraft engineer at night. Production data for the Bell 214 ST is shown in Table 2.

Mean values for the period recorded

	Cycle Time Delay Free (Minutes)	Delays (Min/Cycle)	Pieces/Cycle	Refuel (Min/ Cycle)
Day 1	2.06	0.02	1.71	0.28
Day 2	2.03	0.03	1.70	0.22
Day 3	1.50	0.17	1.53	0.25

Table 2 - Helicopter production data

Landings

Two separate landings were used; one located at the highest point of the block (Landing one), and the other at mid slope level adjacent to the block (Landing two).

Landing machinery consisted of three rubber-tyred loaders. A Kawasaki KSS 80Z2 loader for clearing wood from the drop zone to the processing area, a Kobelco LK500 for fleeting and a Cat 950B for truck loading.

Initially a hot-deck system operated on Landing one (Figure 5). This evolved into a cold-deck system (Figure 6), alternating between the two landings. The congestion caused by truck loading in the hot deck system was the main reason for this change.

The heavy lift capacity of the Bell 214 ST combined with continuous operation and short cycle times meant that a large amount of wood was extracted in a very short time. The landing operations for helicopter systems thus became critical in terms of timing and organisation. Any hold up in the landing operation rapidly caused a backlog of wood which proved difficult to clear.

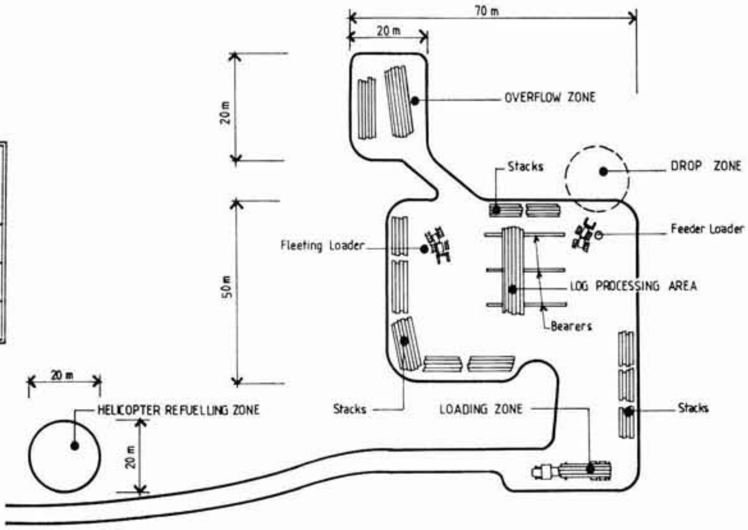

Figure 5 - Landing 1 : Hot Deck situation

It is, therefore, essential that a pattern of wood flow is established. Wood arrives at one end, is moved to a processing area, processed, and then either fleeted or loaded out at the other end of the landing. Any change in direction of the wood as it is being processed across the landing causes interference and results in delays.

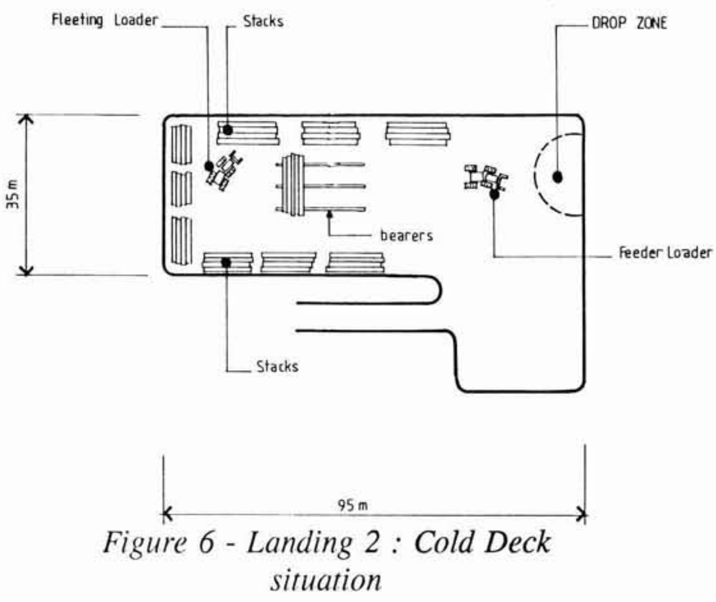

Figure 6 - Landing 2 : Cold Deck situation

In a hot deck situation, truck loading should occur away from the processing area. This enables the landing to continue operating effectively without delays or interruptions. In helicopter operations, landing delays of 10 to 20 minutes, while a truck is being loaded, cannot be accepted.

MANPOWER

Three fallers were used and wherever possible the trees were delimbed and cut to length on the cutting face. To maximise payloads, the fallers carried log scale charts which related log dimensions to weight. Fallers and breakerouts worked together to pre-strop optimum loads ahead of the helicopter. The helicopter extracted wood alternating between three felling faces.

Radio communication allowed the breakerouts and pilot to co-ordinate extraction points and times. Bundles of recovered strops were returned from the landing by the helicopter to the breakerouts upon request.

Landing personnel consisted of four skiddies, two full time log makers, two strop retrievers and two machine operators. The total operation employed 26 people. The large number of people on the landing reflected the high productivity of the helicopter.

CONCLUSIONS

Environmental benefits from helicopter extraction include reduced roading, landings, soil compaction and disturbance, all of which effect erosion in sensitive areas.

In this particular case, the helicopter's versatility, speed and minimal environmental impact, deemed it the most appropriate harvesting system.

There are some cases where the choice of extraction method depends on more than purely economic factors. The short term economic gains of a particular logging system should not eclipse the long term environmental costs that the use of such a system may create.

To utilise the helicopter fully all associated operations must run smoothly. A thorough understanding of the planning, extraction and processing requirements is needed when considering a helicopter operation.

Landing layout combined with suitable machinery is the key to maintaining effective wood flow and reducing production costs and delays.

Commercial radiata pine clearfell operations can be successfully carried out by heavy lift helicopters such as the Bell 214 ST.

The financial gain in such operations, based on economic returns alone, remains debatable. Therefore helicopter operations are unlikely to replace conventional logging methods in environmentally non-sensitive situations.

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