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MEASURING THE IMPACTS OF HARVESTING ON WATERWAYS

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INTRODUCTION

In many areas of New Zealand, harvesting is occurring along waterways that have been planted up to the stream edge. In the few areas where a riparian buffer strip exists, it has usually been left because of harvesting or re-establishment constraints.

Forestry companies are managing their streams to minimise any adverse effects of harvesting. This has resulted in a wide range of harvesting practices being used alongside waterways. It is largely unknown whether these practices are achieving the desired result.

Streams in plantation forests have a wide range of values. Forest managers need to know the values of their streams before deciding on the best strategy to manage them. Research shows that riparian buffer strips can be effective in protecting streams with high fish, water supply and recreational use values. Other streams that do not have high values may not require this degree of protection. In these cases, harvesting up to the stream edge may be possible without causing adverse effects on the stream environment.

This report discusses the environmental issues of harvesting near streams, the role of riparian buffer strips in streamside management, as well as outlining a LIRO study to quantify the effect of harvesting on streambank disturbance and slash volumes in the waterway.

Figure 1 - Harvesting across a waterway

IMPACTS OF STREAMSIDE HARVESTING

Harvesting operations have the potential to impact on water quality and flow, streambank stability, channel morphology and stream life. These effects are usually caused by logging slash and/or sediment entering the stream channel (Visser and Fenton, 1994).

Sediment can be swept into the stream channel when hauling across streams, as well as from bank collapse. Streambank erosion processes may continue for sometime after harvesting as these features can be slow to stabilise. Suspended sediment contributes to water discolouration and lower oxygen levels. This can impact on fish and aquatic insects, reducing their feeding ability and blocking their gills. Sediment may also displace aquatic insects by smothering their habitat.

Slash material can be both beneficial or detrimental to the stream ecosystem (Figure 2). This depends on the slash materials size, composition and position in the stream channel. Large stable woody debris can reduce stream flow velocity, create turbulence which aerates the water, and provide a habitat for stream life. It has a shading effect which can compensate for the removal of shade at harvesting, maintaining the temperature of the stream.

However, large quantities of slash material can reduce oxygen levels in the water as the material decomposes. It may also prevent the migration of fish . In addition, small mobile slash can accumulate as debris dams, particularly in periods of high flow. This material can divert water flow toward the streambanks undercutting them (Graynoth, 1978/79; Toews and Moore, 1982).

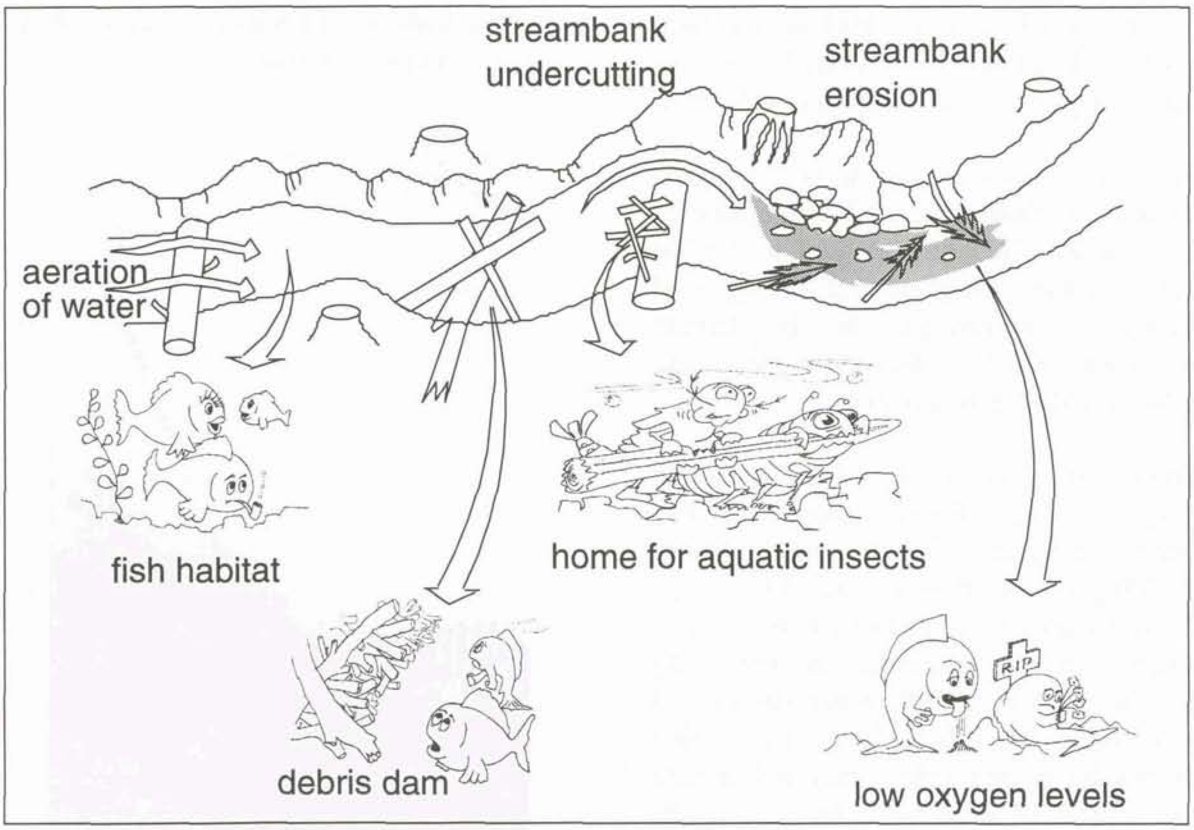

Figure 2 - Potential effects of harvesting on a stream

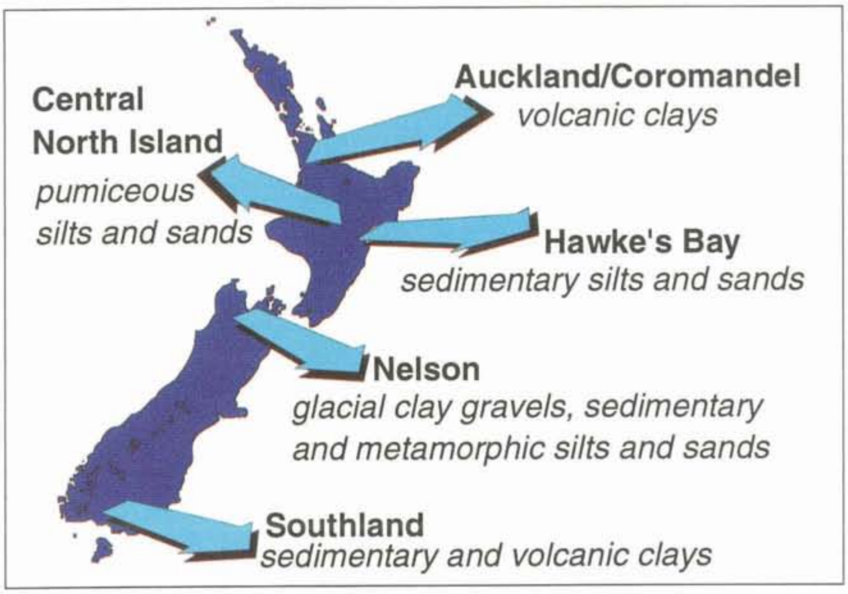

Figure 3 - Regions selected for the streamside harvesting project

RIPARIAN BUFFER STRIPS

A riparian buffer strip is one management technique which can be used to protect waterways. Riparian buffer strips have a number of beneficial functions. They regulate temperature and shade, and maintain conditions for stream life. They can also assist in maintaining water quality by reducing the movement of sediment, slash and nutrients into the waterway (Graynoth, 1979).

Loss of productive land is one of the main concerns arising from the use of riparian buffer strips. Incorporating riparian buffer strips has the potential to reduce average setting size, increase roading and landing costs, and lower logging productivity (Visser and McConchie, 1993). Riparian buffer strips increase the number of edge trees, reducing timber quality because of heavy branching and tree lean. Maintenance is an extra cost where pests, weeds and pine regeneration are a problem.

The additional protection and cost of a riparian buffer strip can be justified for streams with high value. The industry is questioning what level of protection is necessary on streams with lower values. Harvesting practices which minimise impacts on the stream ecosystem may be an acceptable alternative to riparian buffer strips.

STREAMSIDE HARVESTING STUDY

The effectiveness of current harvesting practices at protecting lower value streams, provided the impetus for an ongoing LIRO study. This is an area where little data is currently available.

The aim is to evaluate the effects of harvesting practices on streambank disturbance and slash input volumes. Where the opportunity exists, this study is being carried out in conjunction with other ongoing stream monitoring and biota research programmes.

Study Sites

Five regions were selected from around New Zealand (Figure 3) to represent a range of soil and geology types, as well as stream channel shapes. A minimum of five study sites have been established in each region to cover a variety of cable and ground-based systems. A representative 100m of stream reach has been selected at each site. Stream width ranges from 0.5 to 3.0m. Data on catchment and stand

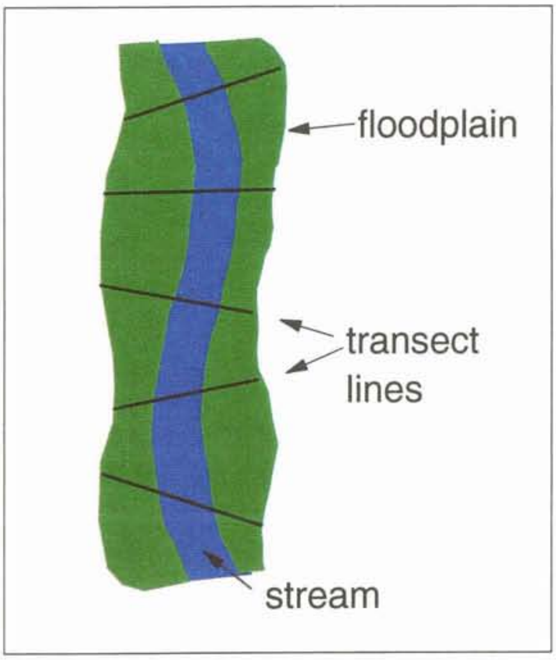

Figure 4 - Random orientation of transects along the stream reach

characteristics is being collated for all sites.

Methods

Changes in streambank disturbance and slash volumes will be identified by comparing pre- and post-harvest conditions. The pre-harvest measurements will provide the control data for each site.

- Streambank disturbance

Both sides of the stream will be assessed for changes in streambank disturbance. Shallow surface disturbances will be classified, and discrete collapses measured, to estimate the volume of material that has been displaced. To monitor long term changes, streambanks will be reassessed annually for several years following harvesting.

- Slash volumes

Slash volumes within the streambanks are measured using an adaptation of the transect method developed by Van Wagner (1968) for wood waste assessment. Transects are randomly orientated across the stream channel at 5m intervals along the 100m stream reach (Figure 4). All woody debris less than 10cm in diameter, which intersects the transect line, is measured.

For all material greater than 10cm in diameter, stem volumes are calculated for each piece to give a total volume along the 100m stream reach.

Preliminary Results

Preharvest slash volumes show a wide variability (ranging from 10 to 187m^3/ha of stream reach). This reflects differences in channel shape, streamside vegetation, water flow and climatic factors. These volumes appear large compared to volumes found in cutover assessments, because cutover assessments only measure merchantable timber. In contrast, all material ≥ 1cm in diameter was measured in this study. Figures 5 and 6 show the range of slash volumes. The higher pre-harvest slash volumes recorded were due to either a large number of windthrown

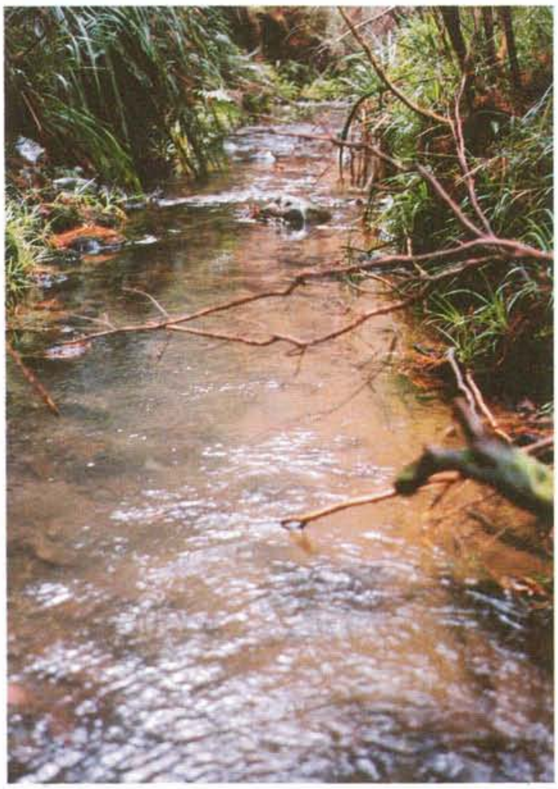

Figure 5 - A stream with low pre-harvest slash volumes

trees in the stream channel (Figure 6) or remnant indigenous hardwood. This variability is similar to that found in previous New Zealand and overseas studies (Froehlich, 1973; Sedell, Bisson, and Swanson, 1988; Evans, Townsend, and Crowl, 1993).

Figure 6 - A stream with high pre-harvest slash volumes

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