

# THE COSTS AND RETURNS OF LOGGING DIFFICULT TERRAIN

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## Introduction

New Zealand is a country which is as diverse a landform as the people who inhabit it. Forestry may be found on ground ranging from the pumicelands of the Central Plateau to the steep erodable terrain of the North Island's East Coast.

Production forestry, while having a number of desirable attributes, must be financially viable. Logging in difficult country may have the effect of reducing net returns to the forest owner.

Too often we limit ourselves to analysing specific costs of production in isolation - however it is the total cost delivered to the mill door which is of greatest concern.

This paper will discuss the major cost differences of logging difficult terrain from a total perspective - the cost of each operation is determined by the quality of the operation preceding it.

## Major Cost Differences

Difficult terrain can be defined in many ways. Topography, soil conditions, location, environmental constraints and other

physical features. The responsibility of determining the amount of difficulty that is encountered is placed squarely on the shoulders of forest managers and planners of all disciplines. We will often "create" difficult logging conditions through lack of planning and poor forest management.

The logging contractor and forest owner are the victims of operations in difficult terrain.

## Log and Load Costs

The contractor is the one who day after day has to pull wood through whatever country that is demanded of him.

Difficult conditions are immediately reflected in total daily production. The greater the difficulty, the lower the production. A forest owner will see low production reflected in the high cost of wood loaded "on truck".

However, production does not necessarily have to be low. High daily tonnage can be achieved through good planning and adequate selection of machinery to perform the operation.

The machinery used in difficult terrain is often

specialised and expensive.

The typical log skidder has a capital value of between \$NZ200,000 and \$NZ300,000. But a new generation medium sized cable hauler required for skyline operation will cost in excess of \$NZ800,000.

Ground based equipment may be standard rubber-tyred or tracked machinery. However, certain conditions, and certainly environmental considerations may demand low ground pressure systems. Equipment may range from wide tyres, extended track framed tractors, to the "fast track" skidder. The capital cost of this equipment increases the further the machine deviates from "normal".

As the capital cost of equipment increases so too does the daily cost of the logging operation. This high cost reduces the net stumpage to the forest owner.

### Access

The difficulty of a region's terrain will often be reflected in the cost of internal forest roading and log landing construction.

Forests of the Central pumice plateau would have some of the lowest construction costs in New Zealand, due to the nature of the soils and topography. The East Coast of the North Island with its clay soils and steep terrain exhibits high road construction costs. Initial construction of these roads is expensive, due to the amount and type of earth to be moved.

After the road is constructed, road maintenance in many of the difficult areas is expensive due to the cost of road metal. Metal is necessary for traction and as a maintainable running surface. The amount of metal required will depend on the type of subgrade, traffic volume and road alignment. The lack of suitable metal pits in many forests will determine the cost of laying metal both in the construction and maintenance of roading. Metal can be imported to the site at great expense, although usually the forest makes do with whatever material is on hand, the quality of the material determining road service life.

Difficult terrain will place heavy demands on internal roading networks and a high level of maintenance will often be required. The cost of this maintenance is often not easily identifiable, but can represent a large proportion of total cost of production.

It may be that metal alone is not enough to form a stable running surface. Certain soils and conditions will demand alternative techniques. One of these "Corduoying" is expensive and labour intensive, however it can be highly effective and may mean the difference between production and stand-down.

Lime stabilisation, in the right soils is also an option, and is being used at many sites throughout the country.

Any additional work which is

required to maintain a road beyond the usual techniques is additional cost to the forest owner.

Log cartage is difficult due to poor road alignment and road surface qualities. The wet season brings with it difficult cartage conditions on steep, low volume roads and it is not uncommon to have logging crews devoid of trucks for periods of time. The interruption in log supply is costly to pulp mill inventory and the forest owner is at the mercy of the weather if attempting to supply customer quotas. If the logging operation is still able to extract logs, production will be affected as the log landing gradually chokes with stacks of uncarted logs. As production is hindered, the cost per unit of wood increases.

If the terrain is steep and soils are not free draining then there is the added cost of allowing for adequate road drainage. Culverts, culvert walls, fluming systems, grassing and planting of fills, and so on are time consuming, labour intensive and costly exercises. The increasing emphasis on the environment will force forest owners to employ more of these techniques to reduce pressure on forest waterways and soil systems.

### Log Landings

The processing of Radiata pine logs on the log landing will continue to occur barring a major shift in philosophy.

The log landing is an area of concern to most forest managers. Landings are seen by many, as a waste of productive land and costly to construct.

The cost of construction in difficult terrain is often high and more likely than not the manager will aim for the smallest landing possible.

However, market conditions will demand the contractor to process logs into high numbers of sorts, maintain quality, high production and ensure the safety of his workers. All this on a so called optimum sized landing - a meagre square 40m x 40m. There have been a number of occasions in Hawkes Bay where the added cost to build larger landings has paid off - production and quality of processed logs was higher and safety was maintained on the landing at all times. There is a point when increasing demands for production and quality on limited landings will result in lower quality products, lower utilisation of the forest stand, and decreased safety. The recognition of this declining return has not often been identified by most managers and needs to be addressed. Forest management must recognize the affect of increased pressure on limited log landings and take measures to maintain productivity, efficiency, and the safety of log landing workers.

Intensive processing of logs requires much machine movement and this places pressure on landing surface construction. The cost of building landings to cope with these conditions has

turned attentions to alternatives. Excavator loaders are one answer. These machines have many advantages, however mobility between sites is limited and the operation must work to this shortcoming.

## Marketing

Difficult terrain is as affected by market constraints by as much again as it creates them. Log cartage in difficult conditions will determine the supply of logs to the customer. Logging production may cease during wet weather purely from lack of machinery mobility or log landing difficulties. The high cost of log cartage in regions with difficult terrain can be attributed to actual truck operating conditions and often long lead distances. It is not the terrain which directly affects haul distance, rather, the location of many of the forests located on difficult terrain. The forest is often situated at a remote locality which did not support profitable farming and the forest developed on the site as an alternative.

The export boom in Radiata has recently provided many forest owners with the opportunity to sell large quantities of logs. Radiata pine will sapstain readily in a short period of time given the right conditions. Hauler operations will fell the trees up to a week prior to extraction, and by the time the log has been processed and carted to the wharf, and

stored, there is every chance that sapstain is in an advanced state. Sapstain has the affect of devaluing the log and in the case of the pruned log this can be considerable.

Anti- sapstaining procedures are really the only solution here and are being actively used at the port of Tauranga. The added cost of the debarking and chemical process further reduces the return to the forest owner.

The regions who do not have the volume necessary to warrant this facility must pay the extra cartage cost of transporting the logs to ports which do.

Export markets have created opportunities for forests located in regions which do not support a local timber industry. In fact there are forests which are almost completely reliant on the Radiata export trade. If the industry does not approach export responsibly, and the market slumps due to poor quality or glut, the cost to these forest companies would be great. Many of these forests are located on difficult terrain.

## Site Rehabilitation

Because forestry is a cycle of operations rather than a set of isolated activities, the logging of difficult terrain will determine the establishment techniques required for the next crop.

Generally, land logged by cable hauler is relatively

easy to plant through and little site preparation in the form of mechanical disturbance is necessary. However, there are forests on difficult terrain in this country which are a great distance from an arising or pulplog user. This type of log will be left on the hillside unless a market can be found. The debris is difficult to plant through and fire as a site preparation technique is gradually losing favour. The forest owner is faced with high planting costs, and lower tree stocking or using techniques such as gravity rolling. Whatever the outcome the costs are identifiable and considerable.

Of course prior to site preparation the logged cutover may require a clean out of streams and waterways of debris. Debris will enter into the most inaccessible places no matter how careful the logging operation was carried out. It is not the place of this paper to decide what debris should be removed - in most situations common sense and practicality would prevail. However, if a clean up is required it is far more costly in difficult country. The machinery deployed to clean up the cutover, and its movement about steep slopes and stream edges may be far more detrimental to the environment than the reason for operating it there in the first place.

Riparian zones in difficult terrain will present problems of their own. Cable hauling across gullies in a manner to avoid these zones may force the operation into sub optimum hauling techniques

increasing the logging cost and probably increasing soil disturbance. There are ways around these problems and researchers and operational staff are endeavouring to overcome the hurdles which will be encountered.

### Planning

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The amount of time spent planning logging in difficult country is often overlooked. The factors which create the difficult terrain whether they be topography, soil conditions, and others, reflect the difficulty of planning. Combine the operational constraints with the increased environmental pressures, and, planning becomes a full time job. Consent applications, public presentations, and discussions with local bodies will add to the costs of the logging process.

The greater the difficulty, and the more environmentally sensitive an area is the larger the planning cost.

The quality of logging planning will determine the total cost of the logs produced. Lowest cost of production delivered to the mill door will be affected by the following planning factors -

- choice of logging system
- spur road and landing location
- planned arterial road network
- exposure of the logging

plan to local body  
representatives

- coordinated team work with  
operational staff
- quality of planning  
personnel
- planned seasonal operations

While the above factors could apply to successful planning of all forests. However in difficult terrain there is usually little flexibility, and conditions are so unforgiving, that there is no place for poor planning.

### Safety

Difficult terrain in its nature often places greater demands on the human element. The three D's of logging as described by one author -

- dirty
- difficult
- dangerous

become more apparent when logging difficult terrain. Risks increase when falling and trimming trees on physically demanding terrain. Machine operation encounters further risks, not otherwise associated with easier terrain.

Hawkes Bay logging operations are conducted in predominately steep terrain. Recent accident statistics from CHHF operations in Hawkes Bay, indicated that over twenty five percent of lost time accidents could be attributed to rough terrain. Logs rolling, loggers slipping, planters falling off

hillsides and similar descriptions point to terrain as a risk factor.

As a comparison, the LIRO Accident Reporting Scheme suggests a figure close to ten percent as a national average for this risk factor in 1991.

Lost time accidents have a considerable cost. If difficult terrain exhibits greater risk to the worker, then the physical and financial costs will be forthcoming. It is up to the forest industry - contractors and companies alike to create conditions to reduce the risk.

### REDUCING THE DIFFICULTY

#### Grow a Sound Crop

To reduce costs and hence increase returns in difficult terrain is not approached from any one angle. It is a total concept and requires a quality approach in every aspect of the operation.

Forests located in difficult terrain are costly to log and develop. However, tree growth and tree quality is generally excellent, Radiata site indices on the East Coast of the North Island, for example are often exceptional. Total volume per hectare is high and stand silviculture has generated large quantities of pruned log volume.

Many forests have been planted on farm land with a history of fertiliser application. The extent of malformation and large branch sizes on these sites can

lower eventual log quality yield, and hence total return per hectare. These effects can be reduced by selecting appropriate tree stock and applying adequate silvicultural regimes.

### System Development

When steep terrain has been encountered, most forests have leaned towards cable hauling as the predominate logging system.

It is accepted that Ground Based (GB) logging systems are usually the simplest and cheapest of logging methods. GB operations are quite capable of logging steep terrain, and can handle a variety of difficult conditions. The selection of the appropriate machinery for the physical conditions and tree size will determine production levels and unit costs.

GB techniques in difficult terrain are specific to the conditions which determine the land to be difficult. The logging contractor and company people must work as a team to ensure that the maximum quantity of wood is extracted prior to relinquishing the remainder to more costly methods such as the cable hauler.

Unfortunately, the public image of GB logging is one of scarred hill sides, high levels of sedimentation and the "log it to you drop" attitude. This image may place pressure on local bodies to reject GB logging in difficult terrain. The forest industry must endeavour to be self

regulating when employing GB systems and innovative in its approach. This will ensure future choices of logging system in difficult terrain will not be limited.

### Contract Management

Innovation in difficult conditions is the key to increasing returns. Company planners and supervisors will do their best to improve a sub standard situation.

However, the contractor will often have many of the answers to increasing production and hence lowering costs.

Current management practice is to allow the contractor a daily cost to run his/her operation. The concept is sound and fair to both parties. However, the company really plans the operation and may indeed limit the capabilities of existing systems. There have been many cases where this company planner has under-estimated the ability of some operations to perform, and has accepted higher costs, only to be humbled by the enterprising contractor.

If Contract Management was to develop further, it is inevitable that development would occur and that the industry would benefit. There is no better place to start than on many of the new forests coming on stream. The local region often not having an existing logging industry. Many of these forests are located on difficult terrain and capital investment required by the logging

contractor is high.

Adequate forward planning should allow the forest owner to develop a long term contract with the contractor. Selection of the appropriate machinery, and financial commitment would become a simpler task with this approach.

Innovation and development will naturally proceed without fear of contract cessation.

### Legislation Management

With the implementation of the new Resource Management Act the costs of complying to the various local guidelines will be met by the forest owner.

Company staff need to know the rules as good as if not better than the people who enforce them. This is essential to successful negotiation with local body staff. For that is what it is - negotiation, there are no hard and fast rules. The added costs if one does not achieve a workable agreement can be extreme.

### Opportunities

Opportunities must never be passed up to improve returns when growing forest on difficult terrain.

Production thinning is an entirely viable operation, and profitable if a customer is available for the produce. Production thinning greatly improves flexibility and clearfell system choice.

Roading and any soil disturbance caused through thinning operations will have less significance due to the fact that a tree canopy still exists.

Any form of mid rotation revenue should be encouraged. Grazing of stock, as one example provides a financial return, and in many cases improves stand access by reducing weed growth.

### Research

Research must continue to be encouraged in the area of developments for difficult terrain.

There are many systems and techniques currently being used in New Zealand which would not have been introduced nearly as effectively, had industry not supported development.

Cost reduction or the maintenance of current costs will determine future research direction.

### Mechanisation

Difficult terrain does not often encourage mechanisation of the logging operation.

The forest industry will be concerned with the impact of the new Health and Safety in Employment Bill. The Bill is similar to the Australian situation, where mechanisation has developed to counteract high accident compensation rates.

The area of development which



pertains to difficult terrain is log processing. Trimming and cutting to length at roadside or on a landing by a delimeter/processor must be a viable alternative to current operations.

### Training

The quality of the man on the ground cannot be over emphasized. From day one, when a stand is first viewed for potential logging, the attitude and experience of the contractor, supervisors and management will determine the returns to all concerned.

Exposure of staff to as many operations throughout the country as possible will pay dividends. The wider this exposure, the greater the individual's ability to develop their own operation to suit local conditions.

Training and development of all people involved is essential. While this is sound management in any language, it is especially so in difficult terrain, where skills are always tested to the limit.

There is a need for management staff to develop sound management skills and provide a professional approach to forest and logging management.

The extent of the reduction in costs and increases in efficiency will be determined entirely by the skills of the people involved.

### Conclusion

There is no doubt that a greater proportion of the total NZ forest cut will originate from forests on difficult terrain. The only way that forest owners from these areas will compete with others on easier country is through intelligent management.

Difficult terrain demands a planned and efficient approach. Appropriate systems, and top quality people to implement them will determine a company's success.

The industry must support the research and development of systems to perform in this type of terrain. Innovation and continual assessment of current practices will force the forest owner and contractor to log the terrain economically and wisely.

Without this approach difficult terrain will always be as described - costly and hard work.

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