

MARGINAL TERRAIN - SOME FACTORS AFFECTING THE PRODUCTIVITY
OF GROUND BASED SYSTEMS

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INTRODUCTION

In this paper I discuss a number of factors which I think affect ground based productivity on marginal or difficult terrain. Some variables are well documented and have traditionally been used to describe productivity. Others, which I try to cover more deeply, may be less well known but have important effects on the productivity of both logging operations and the land.

The points made in this paper are mine. Definitions of major terms are necessary and are also mine.

DEFINITIONS

1. Marginal Terrain. A logging area where debate is generated as to whether harvesting can be carried out using ground based methods (ie it is not immediately clear that haulers must be used or that skidders are the obvious choice).
2. Productivity. In the New Zealand scene, using current equipment and methods, productivity describes the level of efficiency reached in harvesting the current crop (given the condition of that crop) and should take account of the effect on the next crop. Productivity can be expressed as volume per time period (the higher the better) or dollars per volume (the lower the better).
3. Ground based systems. Generally at present these are machines based on tracks or wheels, moving with loads on the ground.

FACTORS

1. Soil Type.

Soil type affects traction first and foremost. Rolling resistance, gradeability, soil porosity and soil depth are important. Soils on difficult terrain are invariably affected by weather. Seasonal weather variation and its

effect on soil can be sufficient to force an operation into the "marginal" category.

2. Slope.

A traditional guide to marginality. Given a positive attitude, good soil, good weather and reasonable matching of machine to wood, the length of the slope seems to be more important than the slope angle. For maximum productivity, on steep country, (uphill pulling) the slope length should not exceed rope length. This avoids tracking other than on ridge tops.

3. Piece Size.

Uniformity of piece size is more important than being concerned about maximum tree sizes. The first advantage of a small range in piece size is being able to match the machine to the wood. However assuming that the planner does not have a range of machines at his fingertips at least a strategy can be put together. The machine can carry the correct number of chains; pre stropping or pre emptive cutting can be done; and some attempt can be made to match manpower at the processing site to the flow.

4. Average Haul Distance.

A traditional guide to productivity. In many marginal logging areas wander factor becomes important especially in being forced into ridge top travel. Generally, the longer the haul distance the lower the productivity.

5. Processing.

The greater the degree of processing the lower the productivity. Larger landing requirements, extra machinery, extra manpower add directly to costs. These extra costs must be offset by greater value of the product leaving the operation. Greater scope for errors (in a severe environment) frequent specification changes and difficult product matching reduce the forest owners return. Increasing processing on marginal terrain where cycle times may vary wildly round the average, where logs may be covered in mud or where log makers may be in constant danger on small landings tends to reduce efficiency.

6. Season.

Obvious. Save a steep clay area till March and productivity climbs sharply in that area. But a summer of constant showers on that same site could be a disaster.

7. Equipment Available.

When the machine used is not selected for its suitability to the terrain and crop, but for other reasons (most commonly because it is available) productivity must inevitably suffer. Perhaps the best examples of marginal ground based operations are those on farm woodlots and in areas where insufficient volume exists to support a specialist machine. The machine most frequently used in these operations is a compromise - the crawler tractor: ideal for constructing the roads and landings, and for tracking; the tractor is suitable but not ideal for extraction.

8. Other Work.

In difficult terrain there are a number of measures that can or have to be taken to make logging easier, (cheaper) minimise the effect of logging on the environment, repair environmental damage, or just to get the job done. They all attract a cost, sometimes a benefit, but are less likely to be present in "easy" groundbased logging. Some examples are:

- install and remove temporary crossings. These tend to vary in nature around the country but all have potential impact on "downstream values".
- clean out creeks. In steep areas where crop debris is deposited in watercourses, removal by hand must be considered.
- tracking. A maligned practice but inevitable when slopes are too long or inaccessible.
- pushing trucks. One sure characteristic of marginal ground based logging is awkward roads: steep, narrow, with tight corners, or subject to being plastered with mud.
- install cutouts on trails. Not a practice to be taken lightly, if good water control is to be attained. All steep trails especially those with catchment above should be considered for this treatment.

9. Long Term Soil Damage.

Obviously this factor does not affect the crop being harvested but the next crop is just as important. I suggest that the productivity of the operation should take second place to the productivity of the land.

There are two main sources of soil damage.

a) Compaction. In a well run ground based operation this problem can be minimized by good control. It can not be eliminated. On steep slopes the places a machine can move are confined to ridge tops and tracks. Provided the machine is kept to the same wheel tracks compaction is confined to that small area but the cost is extra rope pulling. On ground that the machine can move over on a more general basis there is a huge risk of "broadcast compaction": note that four to ten passes in the wrong weather (damp) are sufficient to compact the soil sufficiently to restrict future growth. Even on easier slopes, haul trails should be confined, or marked prior to starting.

b) Exposure of soil. This can be achieved by removing the litter/humus layer or by stirring it into the subsoil during wet conditions. The problem with litter removal is loss of insulation. In summer the soil is baked hard and dry; in winter soil temperatures drop and the soil can become water-logged.

Ground based machines are quite good at removing litter: by scratching it off with traction loss, dragging it away with logs being extracted or by the classic: dropping the blade. To avoid these 'opportunities' the machine must not be concentrated and here the operator will conflict with the compaction problem. Spread out to avoid disturbing too much litter (not that you can on steep ridge trails) and you run the risk of compaction. (Some litter disturbance is considered good for the next crop: it is in effect scarification).

The overall effect of compaction and litter removal is reduced tree growth in the next rotation. Whether the concern is smaller trees at an agreed age or a longer rotation age the effect is the same: reduced productivity of the land. A logging manager, responsible for productivity for a period of weeks over a total time scale of say 50 - 60 years (2 rotations) can significantly lower the land's overall production.

Sure these problems can be cured indeed improved beyond the original position, by ripping and litter replacement. But it is better to maintain productivity by avoiding or minimizing the problem during the danger period.

10. Attitudes.

A most interesting but subjective factor. Personalities can turn difficult marginal operations with every problem you can think of into smooth, successful harvesting. On the contrary, disasters are not always caused by 20yr rainfall events or collapses in export markets: defeatism, poor communication and lack of ingenuity can be the root of your classic Kiwi stuffup.

I refer primarily to the mental approach to an operation of the company supervisors on the one hand and the contractor on the other. As a team - there are likely to be more than two individuals as various representatives of both parties are involved - all seem to be indispensable. In the bulk of logging in N.Z. today, (as carried out by major companies and their contractors), marketing, planning, cartage and administration is the realm of the company rep and moving logs from the stump to the truck is generally the contractor's.

Good communications are obviously vital. Informed people make better decisions and can react, ideally telling the others in the team how they reacted. Ten minutes spent telling contractors (and their troops) how sales are going, where the next blocks are likely to be, how their quality is, some research ideas that may interest them is a great investment in attitude. A contractor who transmits his ideas for the future, who says "come and have a look at this dirty gully" or who asks how so & so's innovation is going is also investing in trust.

People with closed minds should not be involved in logging marginal terrain. They lack flexibility, cannot adapt to changes in conditions which call for different methods and are not prepared to try new ideas. These people are recognizable, from the ranks of both company and contractor. They are suspicious of policing authorities (environmental and safety) and prefer not to see them. They refuse the challenge to plan a difficult block, and baulk at the inevitable constraints. In the classic example of pushing skidders "up the hill" they quote the current fashionable slope limit to avoid the difficulties - and the means of overcoming them - that rubber on steep slopes presents.

Positive attitudes are always a joy to work with. Readiness to listen, both to description of problems created and to suggested solutions, leads to confidence in decisions, and to further team effort.

All contractors have some sort of attitude to training for their staff. What that attitude is, is a factor in the productivity of that operation. The training itself is a

factor. Experienced, skilled and careful loggers are generally the result of positive attitudes - on the part of the contractor who is prepared to lose people for periods of time - on the part of the company who must support the training in some way - and on the part of the employee who must recognise a need within himself. Perhaps the best way of making this point is the negative - poorly trained people will for a huge range of reasons be less productive. But this is especially so on marginal country because one of the main reasons why they can be unproductive is because they are injured.

Which leads to the most fundamental attitude of them all: motivation. Why do contractors and their staff day after day proceed in gang buses reeking with odourous gaseous human secretions to logging sites knee deep in mud and exposed to howling gales and rain driving up into their nostrils?. Whatever that reason is, it has an effect on the level of productivity expected or planned for by the company supervisor. It will be down on that level, or it will be up.

CONCLUSION

So then, these are some of the factors that I see affecting productivity on difficult terrain. They revolve as much around people as around physical conditions, and all tend to be interrelated to a greater or lesser extent.

What for the future? As more haulers become available, more difficult ground based areas will slide into the category "hauler country". Planners will react to site specific conditions and harvest accordingly: specialist machines will be used. The most important single driving force behind this swing will be increased environmental awareness and concern within the minds of company land managers.

In those areas where the traditional ground based systems are still forced onto marginal terrain, there will be more detailed planning and tighter supervision at company and contractor level. With suitable machines, apt modification, willingness to adapt, good communications and shrewd manipulation of all resources, these operations should continue to succeed.

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