SESSION 4
Paper (c)

IMPACT OF HARVESTING ON SITE PRODUCTIVITY**

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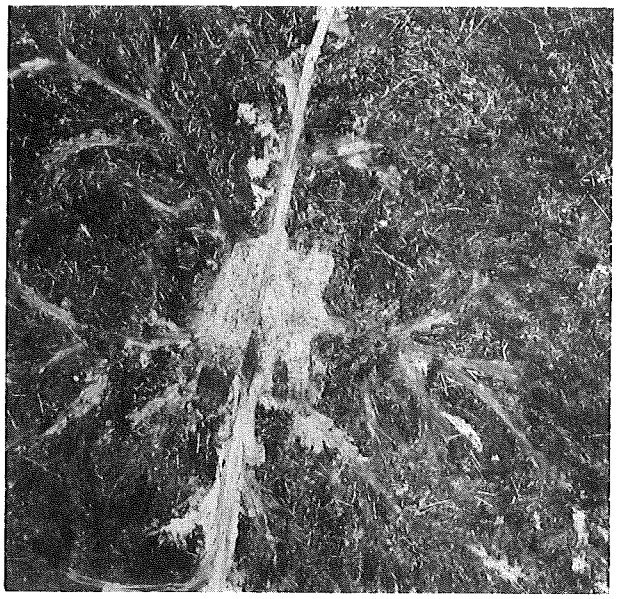
In the next ten minutes I am going to indicate the type of work the Harvest Planning Group, in conjunction with other groups at FRI, is doing on the impact of harvesting on site productivity and then I will highlight some of the questions that still need to be answered. As this session is about "easy" country that is what I'll try to confine my talk to.

1% LOSS IN VOLUME

$2 000 000 – $3 000 000
LOSS IN STUMPAGE

But before I get too far into summarising our work I think now is the time to put into perspective the cost of any site productivity losses. At current day stumpages for each 1% loss in volume on easy country the forest owners will lose about $2 to $3 million in stumpages by the turn of the century each year.



** Taken from the unedited verbal presentation.

Harvesting leaves its mark on the forest in three main forms :

- spur roads
- landings
- and disturbance on the cutover.

SPUR ROADS

	FLAT	ROLLING	STEEP
TAUHARA (pumice)	1.8	2.3	4.0
TAIRUA (clay)	1.5	2.1	3.4

Logging spur roads on average will occupy about 2 to 3% of a forest. The exact figure will vary with such things as topography and roading costs. For example, here are the assessments of land taken up by spur roads in two forests; Tauhara Forest on pumice soils and Tairua Forest on clays. The percentage of area taken up by roads on flat terrain in Tauhara is about half that of steep terrain. You can see the same trend for Tairua Forest but because roading costs are higher on the clay soils they try to do with less roads.

We can expect very little growth on these spur roads.

LANDINGS

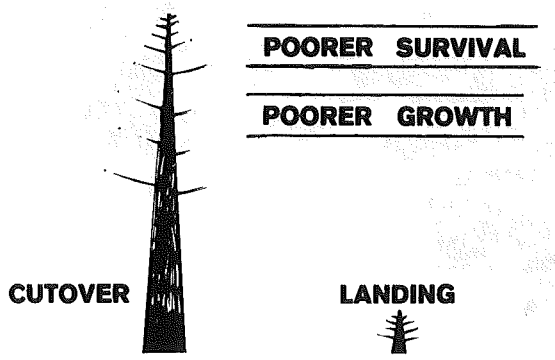
PUMICE PLATEAU	0.37ha	6.7%
NELSON	0.21ha	3.8%
COROMANDEL	0.13ha	2.4%

The size of landings varies considerably around New Zealand. Work by Alastair Twaddle of the FRI Harvest Planning Group has identified some of the reasons for this variation. From his findings I have extracted average areas for skidder or tractor landings in three regions. Landings on the pumice plateau average about 0.37 ha, in Nelson about 0.21 ha and in the Coromandel area about 0.13 ha.

On average, each landing services about 5-6 ha of cutover and on this basis landings occupy from 2 to 7% of the forest estate.

In many areas landings are not replanted; in some forests they are classed as an asset, in others they will be used shortly afterwards for extraction thinning, and yet others have had large quantities of rock dumped on them. In these areas we can expect zero growth on the landings.

The pumice country is one of the few areas where landings are replanted.



Without rehabilitation of these landings however it has been found that survival is poorer and those trees that do survive have considerably poorer growth. Even with some corrective treatment such as deep ripping and fertilisation there is some evidence that these trees just don't quite make it.

So, adding up these percentages we get 5 to 10% of the forest estate is occupied by spur roads and landings. What about the other 90 to 95% - the cutover?

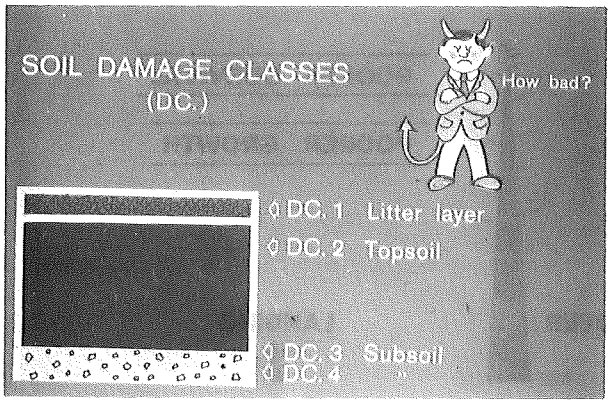
CUTOVER

MACHINES TRAVELLED OVER

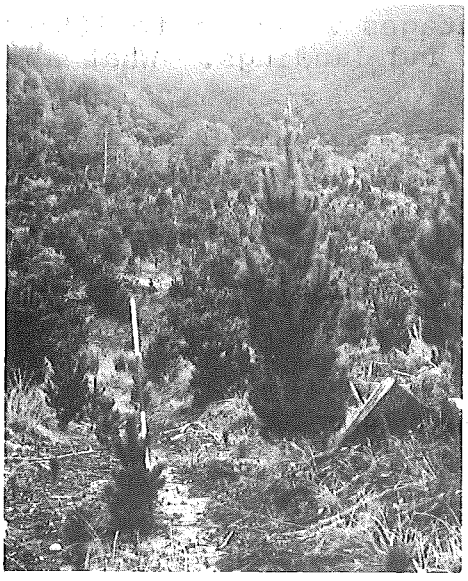
18-66%

Studies around New Zealand indicate that logging machinery travels over between 18 and 66% of a cutover. The actual figure varies with such things as topography, skid trail location, and whether logging was a clearfelling or a thinning, etc.

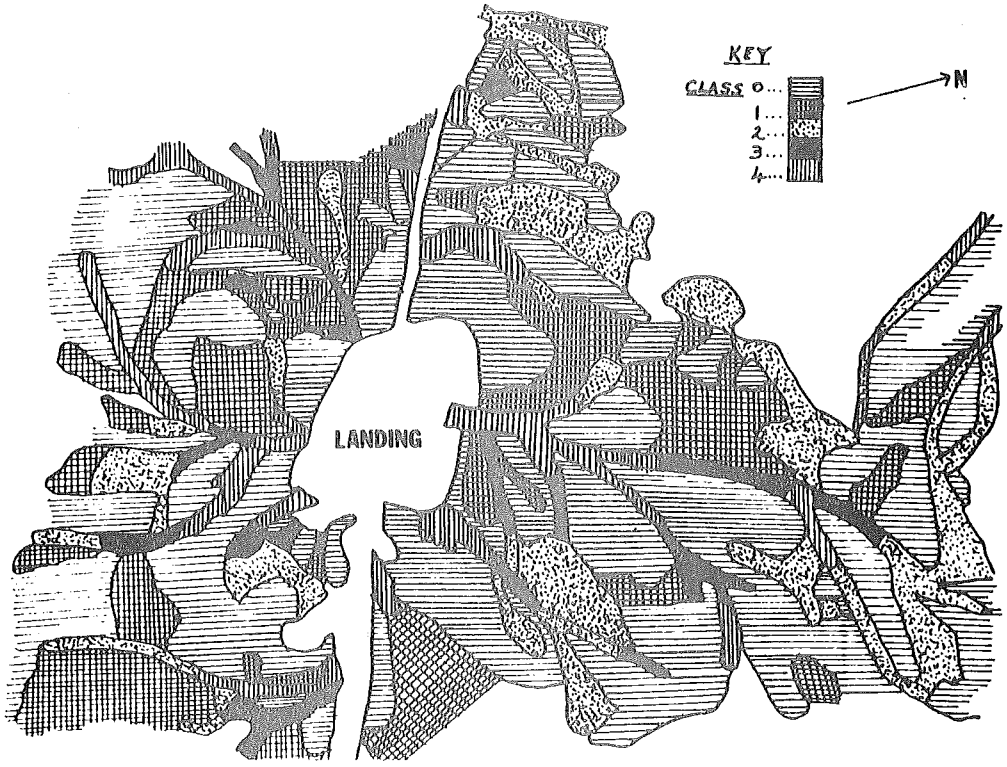
Although the machines may have been on up to two-thirds of the cutover not all of the disturbance created is of the same severity. So to assess the impact of harvesting on the cutover we had to devise a classification system which describes how bad the damage is.



A five class visual system is now used. Disturbance class 0 - the machinery hasen't been over the area. DC1 - machinery has been over the area but didn't break through the litter layer. DC2 - the litter has been broken through and the topsoil is exposed. DC3 - the topsoil has been broken through and the subsoil is exposed. And, DC4 - the machinery has cut deeply into the subsoil.



The first measurements of tree growth were made on skid trails in a four year old stand in Tairua State Forest. These skid trails, on clay soils, were mainly DC3 and DC4 under the classification system I've just described. On average, height growth on the skid trails was only two-thirds that of trees off the skid trails. Compared with off the skid trails, far more trees planted on the skid trails toppled as well.



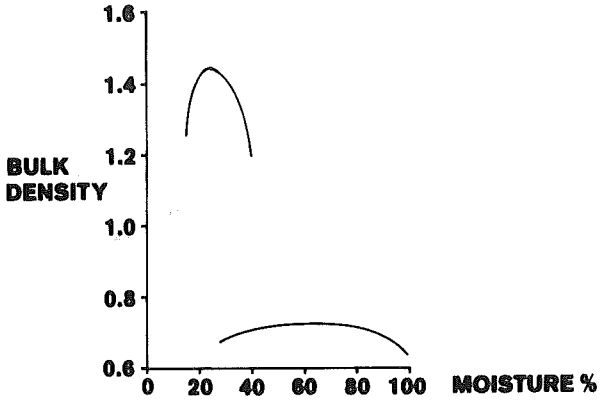
We have also classified part of a compartment on pumice soils in Kaingaroa State Forest. To do this we first had to develop techniques for interpreting soil disturbance on cutovers from aerial photographs which were then used to produce disturbance maps like the one shown above.

	HEIGHT		DIAMETER (0·5m)	
	(m)	%	(cm)	%
DC 0 + DC 1	3.11	100	6.86	100
DC 2	2.98	96	6.29	92
DC 3	2.55	82	5.20	76
DC 4	2.14	69	4.10	60

A month ago we measured the heights and diameters of the four year old trees which had been planted on the mapped area just shown. The preliminary figures indicate there is considerable cause for concern.

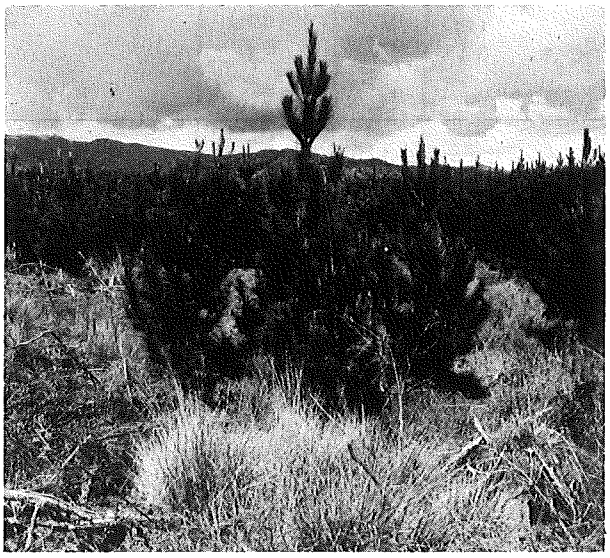
Now onto some of the questions which still have to be answered. Firstly, "What effect does different types of disturbance have on the soils themselves, and on tree growth, form, and survival?" and

"How long are these effects likely to last?" Last year FRI established a large long term trial at Maramarua State Forest to answer these type of questions. The Maramarua trial will also provide information on possible rehabilitative treatments if a cure rather than prevention approach to the problem is taken.



Next, "How do different soils react to logging traffic?". The Soils and Site Amendment Group at FRI have looked at 15 soil types for us so far. These are the sort of charts they are producing for us; they are called Proctor curves. The top curve is for a clay soil in Maramarua State Forest. The bottom curve is for a pumice soil in Kaingaroa State Forest.

"If we approach the problem with the aim of preventing or reducing soil disturbance, what sort of equipment should we be using on flat country? - rubber-tyred skidders, or low ground pressure tracked skidders, or should we even be considering using haulers on our more sensitive soils on flat terrain?"



The last question I am going to pose is one that many of you will probably have on your minds anyway. "If the forest owners are only aiming to end up with 200 to 400 stems per hectare at final crop is it possible to adopt alternative planting patterns to avoid the badly disturbed areas (like the groups of five trees shown here); or

since we are planting 1600 spha should we be worrying anyway?"

The effect soil disturbance has on our ability to end up with a high quality final crop still needs to be answered. It will take considerably more research effort before foresters and loggers have enough information to make rational decisions on this issue.