SESSION 1

Paper (b)

PLANNING CONSTRAINTS - THE CROP

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Insofar as it affects planning constraints the crop can be examined from the following aspects :

(i) The tree and stand characteristics
(ii) The forests capacity for sustained yield production
(iii) The topographic types represented within the forest
(iv) Distance from markets.

In this paper it is the first of these that is considered, the tree and stand characteristics :

The potential productivity of both machines and labour can be calculated before logging commences through study of the work content aspects of the stand to be logged. Such aspects are the stems per hectare, the average piece size, limb density, degree of malformation, etc.

Having mentioned these stand parameters it is appropriate to review project work currently being co-ordinated by the Radiata Task Force. They are involved with relining a combination of measurement techniques and operation simulation models which deal with aspects of the forest stand pertinent to logging planning, e.g. :

- Projects MARVL and PROD. Both of these are simulation models concerned with the standing forest and its utilisation. MARVL assessss the forest immediately prior to logging whereas PROD effectively "grows" the forest as well. For this purpose it incorporates other models such as KGM1, the Kaingaroa Growth Model.

- Project HARSIM, as its name indicates, is a harvesting simulation model. In fact the development of HARSIM is effectively in abeyance at present. Ideally the log mix produced by MARVL or PROD could be assigned a cost recognizing both the growing cost of the wood and the harvesting costs. In determining the latter, harvesting simulation, if practicable, would be invaluable. Unfortunately the amount of unpredictable variability within the logging industry makes identification of various cost elements difficult to the point of impracticability. This at least has been the experience overseas, and it is an interesting reflection on the task facing New Zealand's tactical planners that such is the case.

- SIMSAW, MATSAW, OUTBOARD, etc. By comparison with harvesting, simulation of the processing operations for model construction is relatively straightforward as the number of simulations attests.

The MARVL Method

In the context of this seminar MARVL, the Method for the Assessment of Recoverable Volume by Log types, is worthy of further consideration. It supercedes earlier assessment techniques by gathering all raw data in a form which can be immediately processed by computer. The approach used is to observe and record stem quality and size as a sample of standing trees and then to predict the results of crosscutting these trees under the influence of a variety of log specifications and requirements. Sample trees are assessed for 'features' which are basically any variations from a single headered, non-malformed tree. The features recognised are 'Fork', 'Merchantable Branch', 'Short leader', 'Dead Tree' and 'Regions Affected by Sudden Taper'. The whereabouts of 'features' on the tree is recorded and the diameter at a point immediately above.

The optimum cutting strategy is calculated by a computer program which will mimic the activities of the cross-cutter and predict the yield of the various logs from a tree of given size and quality. In order to do this it is necessary to know the preferences given to each log type. The program user indicates such preferences by specifying a list of log dimensions, a list of codes indicating types of stem qualities that may be incorporated in logs of that type and value per cubic metre for the log type.

The actual cross-cutting of each piece is performed by an optimisation routine so as to maximise the total value of the resultant logs for each piece. The relative values of the log types are used to determine which logs to cut, when to downgrade portions, or when to waste otherwise merchantable portions in order to obtain a more valuable log elsewhere. These are exactly the decisions that must be made by cross-cutters working on the skids, ideally by following guidelines laid down by forest management. The following information can be identified from the MARVL program :

The live stocking is stems per hectare
The dead stocking per hectare
The % of live trees malformed per hectare
The total live volume per hectare
The value above breakage points
The merchantable volume which can be extracted
The mean tree diameter
The mean top diameter
The expected production by log type
The expected cutting pattern waste.

The output illustrated refers to stand parameters. However the program can also provide details of the individual trees assessed which include :

The individual piece length (assuming certain breakage factors)
The piece volume
The logs produced by size and quality assuming the optimum cutting pattern.

Recognition of the Tree and Stand Characteristics in Planning

All of the above is eminently useful information and represents crop constraints that the planner must recognise. Of most importance is the individual piece size. This determines machine sizes and power ratings, particularly where the logs are big and must be handled by a machine individually. With small piece sizes there is some capacity to vary load characteristics by varying the number of pieces in the drag.

Studies invariably show that there is a high correlation between piece size and productivity and hence logging cost.

The total live volume per hectare is a critical constraint in that it determines the rate at which areas must be logged if set rates of production are to be achieved. This in turn determines the rate at which new roads and landings must be constructed and the frequency of change in hauler settings or rope shifts.

The mean tree diameter affects chainsaw sizes, choker sizes and felling times. In 'mechanised' operations it is important to know diameters to determine such considerations as whether a felling head has sufficient jaw opening or whether delimbing knives can accept the full stem width.

The tree length may also be important in mechanised operations. Does, for instance, the delimbing boom have the capacity to reach the full utilisable length of the stem? In conjunction with piece size, tree length may be an important consideration in skyline operations - does the slung length of the tree beneath the skyline allow sufficient ground clearance?

The average values for the stand parameters cannot be considered without also recognising the levels of variation associated with them. A logging system may function cheaply and efficiently at mean piece sizes, or lengths, or diameters, but be inefficient or inoperable at extremes in the range. A wide variation in crop characteristics may require a single very flexible system, or perhaps a combination of systems such as seen where a small skidder based wood salvage crew follows a larger feller buncher operation.

The Effect of Log Out-turn on Logging Planning

The characteristics of the crop discussed so far do not necessarily rely on MARVL for their elucidation. A variety of assessment techniques have been used successfully for decades now in determining important crop parameters prior to harvesting.

Where MARVL and its associated developments will become invaluable is in the assessment of log production by quality class. As earlier explained, the MARVL program can predict the optimum log segregation, provided that the preferences for each log type are adequately specified.

Further work by the Radiata Task Force is indicating just how different the various products of the wide spacing regimes are going to be. Being given most priority in the regime design is the rapid accumulation of clearwood on the butt log. Higher logs in the tree will also grow rapidly but are expected to be more coarsely branched than corresponding logs in the older close-grown regimes. Despite the coarsely branched upper logs the tree as a whole will be more valuable; in the first place because the clearwood component should command a considerable premium, and second because all logs should be of greater average size and therefore more efficiently processed.

We can be assured that forest owners do not allocate finance to sometimes very expensive forest tending operations without having confidence that such investment will be adequately rewarded by increased value in the final crop. The forest managers accept the responsibility of recommending and implementing the most suitable silvicultural regimes to meet the forest owners concept of greatest value. The tactical logging planner bears a similar responsibility. Besides ensuring that the logging system produces wood at least cost while recognising a variety of constraints, he must also ensure that the logging system is geared to produce a product assortment to the required specifications. This in turn ensures that investment in tending of the forests has been worthwhile.

Not only is there an unprecedented opportunity, through the application of MARVL, to predict an assortment of products but for profitability reasons there will be an unprecedented requirement to ensure that the optimal segregation is in fact realised, particularly in the tight supply situation predicted for this decade.

Recognitioin of Log Assortment Characteristics in Planning

Of what practical consequence will be the log assortment data produced by MARVL? Given a logging operation in, say, a 25 year old stand of Radiata grown under the board regime the MARVL data can be used in resolving such considerations as :

- What area will the landings have to be insofar as this is related to the amount of product segregation carried out?

- What area of forest will have to be logged to produce, say, 1000 tonnes of peeler logs, or 1000 tonnes of sawlogs?

- What will be the truck scheduling necessary to ensure that the various log types are delivered to their respective destinations, e.g.

  Peelers to the plywood plant,
  Export sawlogs to the port,
  Domestic sawlogs to the mill,
  Pulpwood to the chipper.

  Needless to say, the destinations may be in opposite directions and different rig configurations may be necessary for each type.

- What extra personnel will be required on the skids to ensure the optimal cutting pattern can be carried out.

- What extra training and supervision of the logging gang will be necessary.

- Should the segregation be carried out at the bush landing at all or would economics of scale make it more worthwhile to carry it out at a central transfer yard.

Monitoring and Review of Logging Planning

The tactical logging planner determines the means by which the various wood products will be transformed from standing trees to logs on the skids. Thus he may find himself, with the logging manager, among the first made answerable in the event of a discrepancy between predicted out-turn and actual out-turn. What will be the tactical planner's defence?

In the first place, MARVL is a computer based sytem, and as we are so frequently reminded the computer's output is only as good as the data supplied.

The tactical planner may enquire whether the MARVL assessment crew has performed its sampling and measurement properly (it has been found that the field work requires a certain degree of skill, and this may be lacking). Have the preferences which determine the optimum cutting pattern been correctly specified?

Second, the logging crews may not be performing their operations correctly. The skiddy's, for instance, may be consigning too much wood to the pulp stack and selecting too little as sawlogs. Such a deficiency is the responsibility of the logging manager to correct.

A third possibility is that the tactical logging plan does require some fine tuning to ensure that the logging systems implemented are adequate in producing the optimum log assortment from the forest. By providing a standard, MARVL improves the tactical planners capacity to critically monitor the performance of his logging planning, and make revisions where necessary.

Conclusion

In presenting the tree and stand characteristics as they affect planning the opportunity has been taken to discuss MARVL, a new development in standing tree assessment techniques. The sample printout from the program which has been included shows numerous stand parameters which have also been adequately measured by earlier cruising methods. The constraints that these tree and stand characteristics present in logging planning have been discussed.

Where MARVL offers an unprecedented advantage is in its ability to quickly calculate the optimum log yield from the forest by log quality class and dimensions. In providing this information MARVL improves the tactical logging planners capacity to select logging systems which will adequately recover the products that the forest has been grown for. The responsibility remains with the planner for monitoring and reviewing the logging plan to ensure that this aim is realised.