SESSION V
Paper (b)

THE EFFECTS OF TRACT SIZE ON HARVESTING COSTS

William B. Stuart
NRAC Senior Research Fellow
Forest Research Institute
Rotorua

INTRODUCTION

In Spring 1984, I stopped by to visit an independent logging contractor in the Tidewater region of Virginia. The operation is privately-owned and specialises in harvesting hardwood in full tree chip and log form from mixed pine hardwood stands in the bottom lands. The operation consists of a rubber-mounted feller buncher for cutting small stems, a crawler-mounted directional tree shear, four skidders, a 22" Morbark twin-engine chipper, a truck-mounted hydraulic knuckleboom loader, and a fleet of trucks. Normal daily production is 22 twenty-five tonne van loads of chips and 75 to 100 tonnes of sawlogs. All material over 2.5 cm at DBH is removed from the site.

I stopped by around 8.30 in the morning. It had started raining during the night. Water was rising in the swamp at the back of the tract, skid trails were rutting and the haul road was softening. The owner had gone to town for parts. I had another appointment on down the road but told the foreman I would stop back by that afternoon.

When I came back about 3.00 p.m. I met one of the trucks picking up an empty van at a turnoff into the site. The job had moved to a drier site 35 miles away.

Arriving at the new site 45 minutes later, I found the job in full swing. The whole operation was in place and working. By quitting time the job had produced 18 van loads of chips and 6 loads of logs at an additional cost of two hours of overtime for the chipper operator, the loader operator and one skidder operator.

How? By being organised! Moving is a regular part of this operation, and doing it well is a key factor in staying in business. This operation is unusual because of its size, but not exceptional for East Coast loggers.

REGIONAL DESCRIPTION

The Eastern United States is an unusual forest region, spanning 26 States running from Maine through east Texas. Despite several large population centres, 60% of the region is covered with commercial forest. Seventy-three percent of this resource is in

private ownership, 18% in industrial ownership and only 9% publicly-owned. This forest base supports approximately 200 pulp mills, 1000 to 1200 major sawmills and an extensive base of small sawmills, particle board, plywood and medium density fibreboard operations.

Harvest blocks are usually small, in the range of 16 to 20 hectares, even on larger forest ownerships. Environmental and aesthetic considerations are important because of the population density. National forests, usually constituting the largest contiguous ownerships, are under multiple use management. The pressure for water, recreation and wildlife management imposes requirements for small cutting areas often within the boundaries defined by landscape architects!

The publicly-owned forests usually have an all-weather management road network, which, in the past, was upgraded for harvesting. Recent public questioning of sales costs, coupled with the high standard defined for these all-weather roads, has resulted in a trend towards relaxing the all-weather requirement. The underlying assumption is that it is more economical to move the job than increase the investment in roads.

The industrially-owned resource tends to be in parcels smaller than the National Forests. Although there are very large blocks in both Maine and the East Texas regions, again the average cutting blocks are around 16 hectares to minimise insect, disease and fire risks as well as public reaction. Current tax legislation requires capitalization of permanent roading costs, so industry foresters are particularly attentive to strategies which will minimise these expenditures. Again, it has proven more efficient to move an operation when roads start to deteriorate than to invest in all-weather roading.

The private ownerships are a real mixed bag. Tract sizes range from one hectare or less to several hundreds of hectares. Timber on these tracts is commonly purchased on a lump sum basis. Expenditures in access are sunk costs unless the landowner will give a stumpage credit for road construction. Consequently there is a tendency to avoid large expenditures in roading.

The road expenditure, coupled with a recognition that productivity is likely to decrease, and the risk of labour accidents and damage to machinery increase when sites are wet, has led most operators to maintaining a back-up tract for poor weather operation. The wet sites can be operated during dry weather or when the ground is frozen. Moving the job to high ground when the soils and roads start to soften has proven to be a sound operating strategy.

Moving is regarded as an alternative to increased capital expenditure in roads or special purpose equipment. As a result, even the 16 hectare blocks may require several moves before the harvest is completed.

COST CONCEPTS

Standard systems analysis concepts are particularly useful in evaluating moving costs. A system assumes three states over the time it spends on a particular tract; load, steady state, and purge. The load state describes the time spent from the moment the system arrives on the site until all between-machine inventories are loaded and production is flowing normally. Steady state describes the condition of the system between the time it is fully loaded until activities shift from normal operation to those associated with finishing the tract. Purge describes the operation of the system during the clean-up activities on the tract, tearing equipment down and loading it for transport. Transport time represents a fourth, idle, category.

The state of the system alone does not adequately describe the situation. If the assumptions that a system's costs are essentially fixed in the short run, and that variations in productivity determine unit costs can be accepted, the important element becomes how well job supervision can organise the operation to sustain normal output during the load and purge elements. Common strategies involve reserving timber near the landing, or large stems or highly productive blocks for these periods. By careful management, it is possible to have production flowing at normal levels before the system achieves full steady rate status and well after the purge state begins.

Cubbage (1983) analysed the effects of moving costs on 8 representative southern harvesting systems ranging in mechanical sophistication from three men and a truck producing shortwood pulpwood through a fully mechanised whole-tree chipping operation. System capitalisation in 1980 US dollars ranged from 16 to 716 thousand dollars. The systems were modelled as moving between two equal tracts 30 kilometers apart. No special supervision or tactics to minimise the effects of the move were considered and systems were moved as units.

The analyses indicated, as expected, less capitalised systems were less sensitive to moving costs than their more highly mechanised counterparts. Perhaps, more importantly, the efficiencies embodied in the mechanical systems allowed them to compete effectively with the less mechanised systems on tracts much smaller than that required to minimise moving costs (Fig. 1)

Managing throughput to minimise the production loss associated with moving, and moving the system as components could reduce the loss to a level well below that assumed by Cubbage.

This is evidenced in Thienpont's (1976) survey of system applications. His work points out that bobtail truck systems and mechanised skidder systems are found across the entire range of tract sizes and the most frequent tract size logged by skidders was less than 4 hectares larger than the most frequent size for bobtail operations.

This is not to say that small tracts cannot be a problem, only

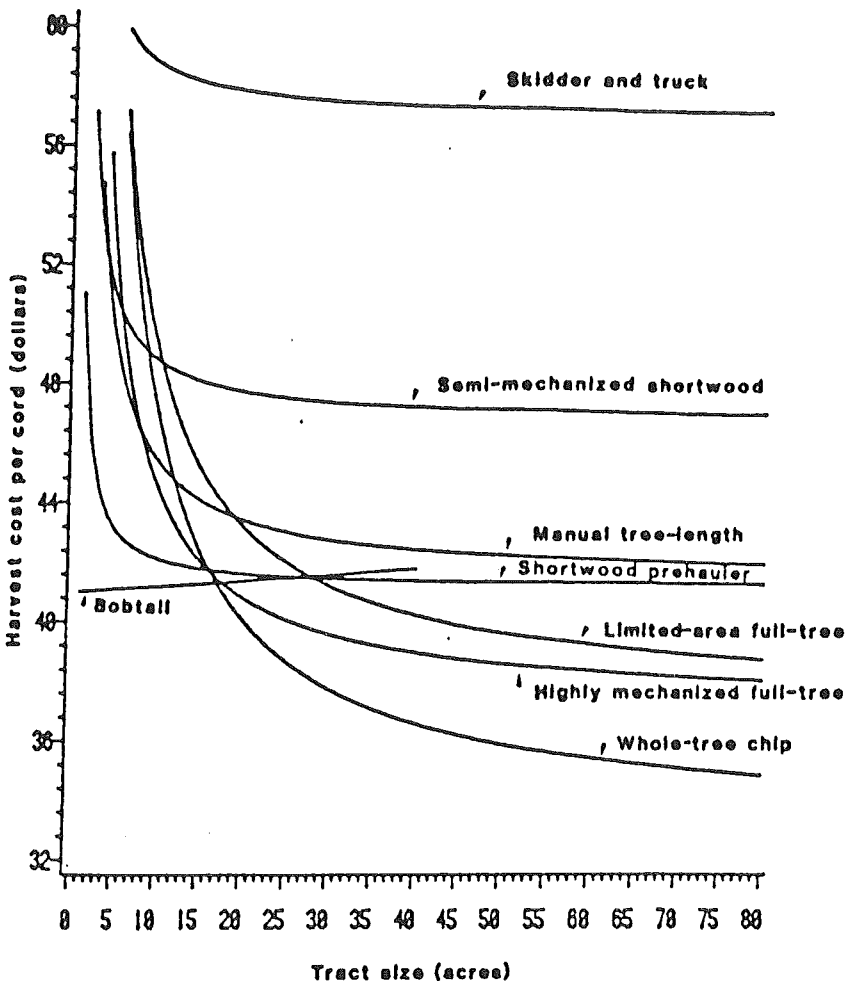

Figure 1. Harvest system average cost curves, 0 to 80 acres, 1980 prices.

(Cubbage,1983)

that they are common and can be worked efficiently if the operation is properly planned and supervised. Small blocks are often the major source of the "rough weather" wood necessary to sustain year around operation. Picking off a small block along the way between two large but distant blocks can help reduce overall moving costs, and a properly-scheduled sequence of small blocks can prove to be as profitable as any large block.

PHASING SYSTEMS

An approximate schedule of the events involved in the move and described in the Introduction demonstrates how important equipment and organisation are to make an efficient move.

As soon as the move was decided upon, the feller buncher and one skidder were brought to the landing. The operators were given chainsaws and sent to the new site to start opening up the landing. One man had been taken to the site earlier and knew where to open the tract up. The next haul truck in was coupled to the low boy, the skidder and feller buncher loaded and dispatched to the new site. The remaining equipment was pulled in on shorter skid distances to compensate for the reduced spread. Production shifted to sawlogs and all chippable material was cleaned up.

The two men on the new site were felling the timber on the new landing area with chainsaws and hand felling larger trees near the landing site. As soon as the low boy arrived with their machines, the skidder started cold decking wood near the landing so it could be brought on as soon as the chipper and loader arrived. The low boy turned around and went back for the next load.

By the time it got back to the old site, the tree shear had been brought out for loading, a second skidder stopped and their crews were sent to the new site. While these machines were being loaded, the chipper was shut down, knives changed and the machine folded up for transport; a second haul truck was hooked to the chipper and both loads dispatched to the new site. Two skidders and the knuckleboom continued loading out sawlogs. As soon as the log inventory was cleaned up, the loader folded up and moved and skidders parked at the roadside for transport. One skidder operator moved the service truck and the second moved the shop van to the new site with the spotting tractor.

As soon as the chipper got to the new site, it was started and bed of chips blown as a truck pad to allow the highway truck to come under the spout. The tree shear and second skidder started up almost immediately. The low boy returned for the other skidders.

When the loader arrived, sufficient material was cold decked to allow it to start loading immediately. The downtime of both machines during the move allowed trucking to catch up with woods operations so the job was able to achieve a short burst of nearly double normal production.

The job was working close to the landing where the loss of two skidders really wasn't felt. Within six hours of the decision to move, the job was relocated and functioning normally. It was decided to keep a three-man crew on for two additional hours to fill the normal daily quota.

The crew had moved 8 major pieces of equipment and two supply vehicles over 50 kilometres, opened up a new landing, and still hit their daily production goal at a cost of 6 hours overtime and 420 kilometres of transporter travel.

There were several key elements which made the move possible :

1. The crew was well-trained and aggressive. Machine operators were willing to pick up a saw and do whatever was necessary to get the job done.

2. Their planning had been done. Key people knew where the new site was and how the job was to be laid out.

3. Purge time was kept to a minimum; every effort was made to keep production up until the last moment.

4. Load time for the system on the new site was minimal. Material was waiting for each machine when it arrived.

5. The equipment was selected for mobility. No major tear down was required. Machines folded up in a matter of minutes and set up as quickly.

6. Job emphasis was on profit rather than cost. The day was expensive and unit costs may have been well above the average, but the contractor's profit was still above what it would have been if he hadn't moved.

CONCLUSION

I don't want to generalise too much from this anecdote, but I do want to emphasise that the limiting factor in most limited-scale logging is planning and organisation. A well-trained, motivated crew blessed with planning and organisation can push the limits on economic operations much further than most would expect.

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