CABLE LOGGING HOOP PINE PLANTATION THINNINGS IN SOUTH-EAST QUEENSLAND

J. P. WARD

Department of Forestry, G.P.O. Box 944, Brisbane, Queensland 4001, Australia

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ABSTRACT

There are four types of cable yarders in current use in south-east Queensland plantations of hoop pine (**Araucaria cunninghamii** Ait. ex D. Don) on terrain classified as "unconventional" because standard equipment and methods are not suitable. This classification is important both economically and from a forest management point of view. Cable yarding also has environmental advantages over crawler skidding.

Current skyline productivity is 5-6 m^3/productive hour and is affected by such things as topography, whether the skylining is uphill or downhill, organisation of racks and landings, and crew training.

INTRODUCTION

Up to 15% of the 41 000 ha of hoop pine plantations in south-east Queensland are on steep slopes. At present the total hoop pine plantations produce 90 500 m^3 sawlogs/year, and 8300 m^3 pulpwood/year as thinnings; this level of production can be expected to increase significantly in the near future with the clearfelling of mature plantations and increased thinnings from the expanding merchantable plantation estate.

Hoop pine plantations are capital-intensive, high-value forests in which green crown pruning to 6.4 m has been carried out on 400 stems/ha. Logging damage to the residual stand must be minimised as the species is subject to insect and fungal attack when bark is removed.

The two major hoop pine plantation centres are the Mary Valley near Gympie, and the Brisbane Valley incorporating the Yarraman and Murgon areas. Plantations of this indigenous species are established on cleared subtropical rainforest areas. Plantable land in the Mary Valley tends to be on the lower slopes, extending uphill until dry sclerophyll forest, rock, or excessive steepness renders the site unplantable. This location of plantation areas, plus a history of downhill skidding by horse, has resulted in a network of gully roads. Slopes in the Mary Valley tend to be short and gullies are steep-sided and relatively inaccessible. Plantations in the Brisbane Valley are on long, more predictable slopes, and ridges are either roaded or roadable.

All early logging was by horse skidding, but since 1971 areas with slopes up to about 36% (20°) have been logged with agricultural tractors with winch while steeper areas have been serviced by small crawler tractors with winch. In the Mary Valley these

units have also been used in association with forwarders for longer skid distances. Slopes over 46% (25°) or featuring a high percentage of rock have always posed a problem.

In 1972 a skyline was introduced to the Mary Valley for trials by the Forestry and Timber Bureau Logging Research Section at the request of Woodland Ltd and the Queensland Department of Forestry, because it was apparent that much of the area was not readily logged by conventional means and the practice of "shooting" barked stems downhill was causing significant damage to both the stems themselves and the residual stand. The trial established that cable logging had potential in hoop pine plantations and opened the way for the introduction of other cable systems (Table 1) to south-east Queensland.

TABLE 1—Current cable logging equipment

Location	Yarder	Mounting
Mary Valley	Locally designed high-lead	Tractor mounted
Mary Valley	Jones Mini-Alp	Tractor-drawn trailer
Mary Valley	Jones Mini-Alp	Truck with knuckleboom
Brisbane Valley	Timbermaster	Truck with knuckleboom

Although early trials established that cable logging was potentially a satisfactory way of harvesting thinnings on slopes, it was also recognised that:

(a) The capital cost of cable systems is higher than that of conventional logging systems;

(b) Because of the adverse effect of slope on productivity, unit logging costs are higher on steep country regardless of the system used.

Extraction costs are deducted by the Forestry Department in stumpage calculation. The extraction allowances for areas which are not suitable for logging by conventional means ("unconventional" areas) are about A$6/m^3 greater than for conventional areas, and so the classification of an area as unconventional is a very important decision in economic terms for both the Forestry Department and the purchaser.

CLASSIFICATION OF TERRAIN

Areas to be logged are currently classified as unconventional on the basis of degree and quality of slope, and presence of rock or stone.

Slope: All areas over 46% are classified as unconventional. It is judged that conventional equipment such as a small crawler tractor with winch can log most areas up to 46%.

Slope quality: If slopes are steeper than 36% and broken by short steep-sided gullies they are regarded as impassable by crawler or agricultural tractor.

Rock: Areas with less than 46% slopes but with excessive rock present major access problems to a crawler or agricultural tractor and may have to be logged by cable system.

Stone: Areas with less than 46% slopes but with sufficient loose stone present to endanger the operation of a crawler or agricultural tractor are classified as unconventional.

As an aid in defining conventional and unconventional areas, a system of allocating points to these and other parameters on a sliding scale has been developed. When the points score reaches a certain level, the area is classified as unconventional terrain.

As well as a reduction in stumpage, the classification of an area as unconventional permits the location of 3.0- to 5.4-m-wide parallel racks (or corridors) running up or down hill 35 to 40 m apart, or 3.0- to 5.4-m-wide racks extending radially from a landing point such that the distance between racks at their perimeter end is 35 to 40 m. The classification also allows a greater reduction in the basal area of the stand to:

(a) Permit an economic quantity for removal by cable system – currently 50 m^3/ha is regarded as absolute minimum economic yield;

(b) Reduce the number of thinnings per rotation;

(c) Increase the stem size of later thinnings.

PERFORMANCE OF CABLE SYSTEMS IN SOUTH-EAST QUEENSLAND

The development of high-lead logging in the Mary Valley is still in the early stages and, although much of the following is relevant to high-leading, the data are mainly from skyline logging in the Brisbane and Mary Valleys.

Table 2 summarises the results of studies conducted by M. A. Smith and E. J. Rees (unpublished report to Queensland Plantation Harvesting Research Committee, 1978) on the Timbermaster skyline hauling uphill in the Brisbane Valley.

TABLE 2—Productivity of Timbermaster skyline in first thinnings

	Stems/ha removed	
	316	249
Predominant height* (m)	18.1	19.4
Average stem volume (m^3)	0.17	0.18
Average daily production (m^3)	19.4	25.5
Average productive hours per day	6.4	6.6
Volume per productive hour (m^3)	3.0	3.9

* Average height of tallest 50 trees/ha

C. Wells, in an unpublished report to the Queensland Plantation Harvesting Research Committee in 1976, noted productivities of operations involving a Jones Mini-Alp Skyline as 3.3 m^3/productive hour and 4.5 m^3/productive hour for downhill and uphill yarding respectively. Wells studied a relatively inexperienced crew and estimated that, as the crew became more experiencd, productivity would rise to at least 5.0 m^3/productive hour.

Current levels of productivity on the Timbermaster skyline yarding uphill in the Brisbane Valley are an average of 150 stems/day (average stem volume 0.21–0.25 m^3) or 5–6 m^3/productive hour. Productivity of skyline yarding has increased steadily as both

the logging crews and the local forestry staff have become experienced in the management of cable logging operations.

Environmental Advantages of Cable Thinning

Apart from cable systems, the only other safe and economic way of logging areas classified as unconventional would be by small crawler using side-cut tracks. Such tracks are not desirable in hoop pine areas because:

(a) The large amount of soil displaced, coupled with the high rainfall of these areas, would certainly lead to erosion and silting of streams;

(b) The soil disturbance at thinning would create an ideal seedbed for lantana (*Lantana camara* L.) and other pioneer weed species which are a significant problem in hoop pine areas.

Cable thinning involves some soil displacement when new roads or landings are constructed but this is insignificant compared with the amount of soil displaced by side-cut tracks. Racks, which represent the skid tracks of a cable system, become covered with debris and have little exposed soil on them after operations cease. Erosion has not been a problem and the amount of seedbed available to lantana is minimised.

MANAGEMENT FACTORS AFFECTING PRODUCTIVITY OF CABLE SYSTEMS

Uphill and Downhill Skylining

Although topography does not always permit a choice between uphill and downhill skylining, uphill is the normal procedure in the Brisbane Valley and the preferred method in the Mary Valley. There are various factors involved in this decision.

Productivity: C. Wells (unpubl. data) found downhill skylining to be significantly less productive than uphill skylining and this is the general consensus amongst crews. The reasons for lower productivity when skylining downhill are:

(a) The tendency for logs to spear behind standing trees on the way down a rack, mainly because machines in current use have limited braking capacity and it is difficult for the operator to react in time to regain control of the log;

(b) The increased difficulty and therefore time consumed in pulling cables out uphill when setting up at each new location.

Residual stand damage: Wells (unpubl. data) found 30 residual trees/ha damaged by downhill skylining as compared with 13 residual trees/ha damaged by uphill skylining. This increase in damage results from the lower degree of control over the log (or logs) when skylining downhill and is an important factor in a damage-sensitive species such as hoop pine.

Roading: Road location will dictate the direction of yarding. Roading, particularly in the Mary Valley, has been in the gullies and difficult topography often prevents ridge-top roading. Ridge-top roading is generally possible in the Brisbane Valley but many of these roads are not constructed prior to logging. The development of an efficient method of downhill yarding would significantly reduce the cost of road construction or upgrading in both areas.

Racks

Rack location is a particularly important factor in a high-value plantation such as hoop pine because selectively pruned growing stock on the racks are lost at the first-thinning stage. Maximum spacing of parallel racks has been determined as 40 m (i.e., a maximum lateral skid of 20 m) although this may be reduced to 30 m spacing on very steep areas because of the difficulty of pulling out wire ropes on steep slopes. Radial racks are located with 40 m separation at their perimeter end. This flexibility of rack espacement is an advantage to an experienced forestry supervisor; for example, by moving a rack 10 m in one direction an encroaching ridge may be avoided, thereby eliminating the time-consuming process of setting up an intermediate support to clear that ridge.

Rack widths are twice the inter-row spacing (2 × 2.7 m, or 5.4 m) if the rack represents an outrow (i.e., if the rows are parallel to the direction of the yarding) and 3.0 to 5.4 m if the rack is not parallel to the rows. Rack width is kept at its maximum (5.4 m) for downhill yarding or at gully crossings where decreased load control may increase residual stand damage. Although maximum rack length can reach 350 m, where cables are manually extended 150 m is preferred.

Landing Size and Organisation

Landings are generally 200 m^2 for a skyline and 100 m^2 for a high-lead because of the latter's greater mobility and the smaller volume of logs involved. Good landing organisation is probably just as important as landing size, if not more so, because it allows more volume to be stacked on landings of fixed size, and truck loading is made easier and quicker. Two of the skylines in south-east Queensland are mounted on a truck incorporating a knuckleboom loader which can keep the area immediately below the yarder free of logs, sort logs, and stack them neatly for easier subsequent truck loading. The knuckleboom is operated by the skyline operator while the next skid is being hooked up.

The yarders without a knuckleboom crane must have relatively small volumes to yard at each site as often happens in high-leading, or have large cleared areas in front of the yarder to store logs, or be constantly serviced by an additional machine such as a forwarder or perhaps a Bell Infield Logger which has been evaluated for this purpose in south-east Queensland.

Crew Selection and Operator Training

Experience has shown that crew selection is critical. It is not satisfactory to substitute a crawler or agricultural tractor operator for a skyline or high-lead operator. The best results may even be achieved by using an operator who has never skidded thinnings before.

Members of the crew should be physically fit, intelligent positive thinkers, and receptive to new ideas. Training is essential and should be carried out with an experienced productive crew on good equipment. A new operator started off in a productive crew with good equipment has the incentive to surpass the training crew's performance.

Very disappointing results have been achieved at times in south-east Queensland when these crew selection and training requirements have been neglected.

CONCLUSIONS

Up to 15% of the hoop pine resource in south-east Queensland is growing on "unconventional" slopes. These areas must be thinned in a way that will be economic to the purchaser, and satisfactory to the Department of Forestry in terms of effect on the residual stand and on the forest environment.

Cable logging, in particular uphill skylining, has been recognised as a satisfactory method of carrying out this thinning, provided a sufficient level of skill can be achieved by the operators and adequate co-operation is maintained between the operators and forestry staff.

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