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## CONFERENCE PAPER



# Past, present and future forest land management practices in New Zealand

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## INTRODUCTION

The New Zealand economy and way of life depends largely on the land resource and what comes from it (Coad, 1975). Plantation forestry is one form of land use that is now a major contributor to the New Zealand economy and social infrastructure.

Since the first plantings in the late 19th century, land for forest expansion has come from alternative use. In the first instance this was indigenous cutover and scrubland of various types. During the mid 20th century it was reverted farmland, typically on steeper terrain and not needed or unsuitable for other uses (albeit not for a want of trying in some instances). The last decade has seen a further change with more productive land being planted in direct competition with other forms of primary produce.

As this change in land-type use occurred, increasing public awareness of environmental values has brought about changes in the attitude of forest managers to the way they manage land in consideration of likely effects of operations.

This paper will present details on past forest management activities focusing mainly on land preparation and harvest-

ing, and describing how these practices have changed. Particularly in the last two decades, changes came through necessity and some through the changes in land type and cover. The effects of these activities will be discussed in relation to water and soil values with the emphasis on sustainability.

Finally what does the future hold? Do we know enough about the effects of our management practices and the effects of plantation forestry as a land use. Is plantation forestry sustainable, are other industries sustainable and where do we as a major land user sit? What are the consequences of getting it wrong?

## PAST LAND MANAGEMENT PRACTICES

The type of land management practices carried out in plantation forestry in past years has in part reflected the type of land being apportioned to the industry. Land for forestry was largely in the hands of the Land Use Advisory Council which tended to mean that it was unsuitable for any other primary production. Forestry has always been recognised as a legitimate land use, but opinions have changed as the size of the industry has increased with attendant social implications (Coad 1975, Baumgart 1975).

The land itself was predominantly steep (the exception being the Bay of Plenty/Volcanic Plateau) with a high content of scrub and secondary growth. Conversion from indigenous forest to plantation forest was also occurring in parts of the country as native timber was extracted for commercial use.

## Land Preparation and Development

One of the major tools in preparing land during this time period was fire. At a FRI symposium on land preparation held in 1969, representatives from virtually all NZFS Conservancies and private companies commented that burning was an integral part of establishment, with one comment that all planning for new establishment be based on the use of fire. Controlled burns were often carried out over large tracts of land, some greater than 500 ha in size.

Land was prepared for burning using a variety of techniques. Firebreaking around the burn area was carried out by tractor, blading down to mineral soil, with cleared widths anywhere from 10 m to 40 m common. If vegetation required treatment prior to burning, machine preparation using crushing or slashing, hand felling and chemical spraying were common

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methods used.

Chemical spraying was carried out using either fixed-wing aircraft or helicopters. In some cases the decision as to which method to use was cost driven, with comparative research stating that both methods had been tested with equally satisfactory results. The types of chemicals used were predominantly the phenoxy-acetics 2,4-D and 2,4,5-T, largely because of their cost. Additives were used (sodium chlorate, ammonium sulphate and monosodium methyl asonate) to hasten and improve "brown out". Results were variable and the additives were bulky to handle. Surfactants were being tested to improve penetration but diesel oil was also used in this role and proved effective on woody vegetation. Quantities of active ingredients varied, depending on vegetation type, but water quantity in the mixed rates were commonly in the range 250-500 litres per hectare. A lot of experimentation was carried out using different water rates, application methods and mixtures of chemicals with additives. One of the summing-up points made at the FRI Symposium was that knowledge of chemical control was severely limited and although it showed great promise it must be used correctly.

Mechanical preparation was also very popular for clearing vegetation prior to establishment. A number of methods were employed: windrowing, blading, V blading, chain and ball, discing, rotary cutters and scalper-rippers. All involved the use of heavy tractors with the aim of completely clearing the existing vegetation or modifying it to allow for effective burning. Some of the methods such as rollers, chain and ball, and V blading were suited to steeper country; other methods depended on vegetation type and cost. One method, V blading, was developed locally in the late 1950s in Baigents' plantations, and by the mid 1960s was a popular method of preparing gorse-covered hills (Chavasse and Balneaves, 1972). It involved clearing a planting line down to mineral soil using the V blade which allowed for easy establishment. This practice was adopted by other regions throughout the country with some preferring a complete blading of the entire site. Roller crushing, discing, root raking and windrowing were more suited to easy terrain.

Hand felling was another method of preparation. This was carried out more typically in areas that were deemed too small for heavy machinery or the material to be removed was too large for the equipment available.

The above methods were mostly used in combination with one another. Cost control was seen as important, but other

factors such as good site occupancy, minimal weed competition and the absence of research, especially into chemical usage, were also factors that were considered. In the late 1960s questions were being asked about the effects of topsoil removal, and in some cases hand felling was preferred, due to concerns on nutrients levels.

### Harvesting

Harvesting has gone through many changes, partly dictated by terrain and partly through the changing nature of plantation forests. The early boom in forest establishment (1920-1930s) created what has become known more recently as the "old crop", whereas the 1960s planting boom is more commonly referred to as the "young crop". This change in tree crop, which resulted in a 4-5 m<sup>3</sup> piece size dropping to 1-2 m<sup>3</sup>, has a considerable impact on harvesting and roading activities.

A survey conducted in 1974 gave a breakdown of logging equipment which is summarised as follows:

#### Ground-based Logging Operations

- crawler tractor	46%
- rubber-tired skidder	35%
- agricultural tractor	3%
Cable-based systems	16%

The predominance of ground-based systems mainly reflected the scale of harvesting operations in the Bay of Plenty region but the same trend existed in other regions, even those with steeper terrain. Where cable logging was utilised during the mid 1970s, it tended to be mainly rigged for highlead operations. Cable logging was still very much in its infancy and it was recognised by the forest industry at the time that there was a considerable skill shortage.

Roading density was high, due to the shorter haul distances of the ground-based machinery with intensive contour tracking carried out on the steep terrain. An extreme example of the effect of ground-based systems on steeper terrain occurred following the Wahine storm event of 1968 in Nelson. Logging machinery had to be brought in from other regions to assist with the harvesting of the windthrow. The machinery available was mainly in the form of rubber-tired skidders which helped speed up the extraction process. These made quite an impact on the landscape as scant regard was given to soil and water values by the need to extract the windthrown wood as quickly as possible. This set the trend of harvesting using rubber-tired skidders working in conjunction with tractors in the Nelson region for the next decade.

Production and costs were major factors in deciding harvesting systems and method. Research conducted at the time

looked at the effect of these activities on site productivity (Murphy 1983), including effects on stream environment and fauna (Graynoth 1979). The results from some of this research appeared unfavourable to the industry but it brought attention to the need for changes to some practices and today it is proving to be a means of demonstrating improvement. In particular the Graynoth study "Effects of Logging on Stream Environments and Fauna in Nelson" based in Long Gully, Golden Downs, illustrated the effects of a logging operation where little emphasis was placed on soil and water values and results reflected this.

### CURRENT LAND MANAGEMENT PRACTICES

Even before "sustainability" was fashionable and before the introduction of the Resource Management Act the forest industry was adapting its management practices to take into account changing public perception and environmental values.

Sustainability is a word now mentioned frequently, by both regulatory authorities and the forest industry itself. Research has been carried out on the effects of removing nutrient from the site and this is ongoing. Water values are being intensively studied, both quantitatively and qualitatively, depending on the likely impacts on the end user.

### Land Preparation

Land considered for new establishment now includes easier rolling country. There tends to be less scrub and weed cover than on the land planted through the mid 1960s to early 1980s. Further, in response to research on the adverse effects of forestry activities, as well as a genuine consideration for soil and water values, the industry has developed new land preparation techniques and modified its selection criteria.

Fire is still used as a preparation method, but the treatment of large tracts of land are now rare. While burning new land areas with high weed content is still common, burning cutover sites is used infrequently. Fires on cutover are not as intensively hot, especially in winter burning, and are usually targeted to smaller areas where slash or weed content is particularly high.

Mechanical preparation is still a widely used preparation technique although modified to avoid or minimise effects on soil structure and nutrient loss as well as downstream water values. Key considerations for mechanical preparation methods are the retention of the litter (humus) and avoidance of soil disturbance.

Rootrakes are only used on the flat to moderately hilly terrain where the



rootrake disturbs little mineral soil. Hydraulic excavators (fitted with a slash rake) are used on steeper terrain, where, as the name suggests, the objective is to remove only the heavier slash, leaving the litter layer intact. Line dozing and windrowing is still undertaken in some areas but not with the frequency of past years and these types of operations are declining. Roller crushing, which helps minimise soil disturbance, is still very popular on new land sites with heavy vegetation. It is now also used widely on cutover sites as a means of breaking down slash prior to establishment.

The greatest advances have probably been made in the use of chemicals and methods of application. There is now a range of selective herbicides on the market which allow for targeting of a particular species before or after the planting phase. Chemicals such as 2,4-D and 2,4,5-T have gone out of production and have been replaced by non-hormone chemicals. Popular brands are the Glyphosates (Roundup, Target, Lion, Touchdown) and Escort as pre-plant sprays with Velpar, Beacon, Gardoprim and Versatil useful in post-plant releasing. Not only has the range of chemicals increased, but there has been a trend from liquid to dry flow-

able granules. Mixtures are common and very effective on selected weed types. There has also been considerable research into the use of surfactants and these are commonly used to improve plant uptake.

Alongside the research into chemical type and effectiveness has been the work on the method of application. All aerial chemical application is now carried out by helicopters which have the ability to vary flying speed, thereby allowing greater control of the operation. This is essential on sites where buffer strips adjoining stands and water courses have important economic or soil and water values. Other improvements have been in the use of foaming nozzles, the ability to control droplet size and the reduction of water rates in mixtures to 50-100 litres per hectare which has increased the chemical effectiveness and control.

Another recent trend has been the use of spot spraying techniques that have huge savings by requiring less chemical, lower application costs, and specific targeting of the application area. This technique is used widely throughout New Zealand in preparing new land sites or during releasing operations. It allows for chemicals to be used in sensitive areas where spray drift or public perception are important.

Oversowing of grasses and legumes is now a widely accepted preparation technique on cutover sites, particularly in the North Island where approximately 21,000 ha is planned this year. The annual grasses provide immediate ground cover to prevent invasion by weed species such as buddleia and pampas. The legumes take control of the site in successive years, improving the soil structure and site fertility through their nitrogen-fixing abilities. Oversowing also has the advantage of "greening up" the site quickly, an important requirement in areas of high public visibility. A lot of research is continuing on this augmentation process, as with most forests the key to successful management of a site is not only to sustain the present yields but through proper management to improve them.

Cost control is important but the change in land preparation techniques has also reflected the growing importance of the environment and the likely impacts that these activities have upon it.

### Harvesting

One of the major advances in the harvesting scene in recent times has been the development of planning systems to aid forest managers in the decision-making

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You could be forgiven for thinking that forestry is  
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process. There has also been a considerable change in focus from primarily a quantity-orientated industry to a greater emphasis placed on quality. Key issues are safety, the environment, and log product optimisation.

There have also been advances in mechanisation which has meant that productivity has increased to the stage that now the skid site is commonly a bottleneck, due to the drive for log value optimisation.

There has been a noticeable switch in extraction systems on the steeper terrain. Cable logging systems are common in some regions. Nelson, for example, has more than 50% of its harvesting capabilities as cable systems. This trend is likely to increase as more wood comes into production. Skill levels have also increased and with this a move towards multi-configuration systems. Most haulers now have an integral tower (telescopic), having at least four drums and are capable of a number of skyline configurations. There have been advances in carriage design which allows for greater flexibility (a local example is the Maki carriage which allows for lateral pulling).

By comparison, harvesting on the more moderate terrain has seen advances

such as feller bunchers and forwarders, although the method of extraction still tends to be orientated around the tractor and rubber-tyred skidder. Even though the machinery may not have changed much there has been considerable improvements in performance, reliability, hydraulics and winches, along with greater consideration of environmental values.

At the processing phase, usually the skid site, delimiters are now commonplace along with Bell Loggers working in conjunction with rubber-tyred loaders or excavators. As mentioned earlier, it is this part of the operation where the bottleneck usually occurs with the drive for production offset by the emphasis on log making, two activities which can be mutually exclusive. Using hauler skids, there is the added complication of waste build up creating birds' nests. Other developments associated with more central processing have been the use of infield debarkers and chippers.

Obviously, cable harvesting systems cost more, due to the capital outlay, but there are advantages; as haul distance is increased roading density decreases. Roading costs are significant and more so on the steep terrain. Of all forest activities, it is roading that has potentially the great-

est impact on the environment. The use of excavators has improved road establishment through their ability to place the material cut into a sound position or facilitate end hauling. Experience in the Nelson area has also shown advantages in using crushed metal rather than river run as compaction and stabilisation is improved, necessitating less maintenance.

In regard to the environment, land-management practices have improved with time and there is a higher degree of environmental care now being practised as part of the forest operations. There have been numerous studies that indicate a decrease in growth rates when litter/humus removal occurs and these trials are still ongoing. We can prove that our land-management practices are more biologically sustainable than those practised in the past. Can we prove that plantation forestry is biologically sustainable?

#### TOWARDS 2000

A definition of sustainable management is given under the Resource Management Act, Section 5(2), which has a single clear purpose "to promote the sustainable management of natural and physical resources". Promotion is a process, not a journey of leaps and bounds.

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The industry can look back with pride on a process of change towards more sustainable forestry practices. The key to the future and promoting sustainable management is knowledge and acting on that knowledge.

There has been an enormous amount of research on "effects" of forest activities and plantation forestry as a land use. More, I would suggest, than many of the other primary industries, but a lot of this research has been targeted to provide specific outcomes and not necessarily related to sustainability in its wider sense. Industry needs to be aware of the dangers of using research out of context, an example being using results on water run-off from a two hectare catchment to define effects of plantation forestry in a district or larger catchment. A more robust way to use information effectively might be found within an Environmental Management System which enables a focus on environmental objectives and targets.

As land management activities change, the effects of these changes need monitoring to identify any improvement, and from this further refinements may be made. There are also benefits for the forest industry to involve the regulatory authorities in this process. Mainly to demonstrate that we as an industry care about "effects", and that we can work to resolve issues that may arise from it. Environmental management carried out using regulation alone is a process which the industry would not want to see introduced to this country. Such reliance on regulation fails to recognise and use the information and experience base that the industry has, and it fails to add positive momentum to the process of change (promotion) towards sustainable management that the industry has already begun and continues to develop.

Looking forward, there are some activities that may require special attention in the future. They are:

- herbicide use and alternatives;
- harvesting and roading planning (logging coupes in regard to catchment sizes, terrain classification, riparian buffers along water courses);
- soil sustainability (effect on fertility of tree cropping);
- visual impacts;
- biodiversity.

There is considerable weight given to Total Quality Management among business and industry today. Quality management is also an approach to consider in environmental management, not necessarily accreditation in a particular system, but defining what our customers, regulatory authorities and the public require, and putting in place procedures to achieve it.

There are examples of where industry

has got it wrong, but these are getting fewer and through the consultative process worked through. It is a wise person who learns from his own mistakes but an even wiser person who learns by other people's mistakes.

Finally a question to leave you with – What if?

What if we find plantation forestry is not biologically sustainable?

- What are we judging ourselves against?
- Are other primary industries sustainable?
- Are "effects" for three to four years over a 30-year cycle better than "effects" on a more regular basis as with some other primary industries?
- Do we know enough about the benefits (i.e. carbon sinks)?

Given the inputs required in the production cycle for plantation forestry I would suggest that we stack up reasonably well. This does not mean the forest industry can relax, but rather continue to gather knowledge and "promote" sustainable management.

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## New study forecasts Australian self-sufficiency by turn of century

Australia is in a position to establish a major export industry in softwood to markets in Japan, China, Taiwan and other Asian countries, says a new study, Sawn Timber in Australia, 1993 to 2008, by BIS Shrapnel.

By the year 2008 Australian firms could be exporting nearly 700,000 cubic metres worth some \$A500 million at today's export price of \$A654 per cubic metre, says the study.

The author and Project Manager, Senior Economic Consultant Bernie Neufeld, writes: "The industry is currently in the midst of established structural changes which will profoundly alter its nature and also market conditions over the next 15 years.

"Supply shortages and rising prices will offer Australian producers of softwood excellent opportunities to export their products."

Mr Neufeld is equally positive on price performance and forecasts a strong increase in Australian domestic softwood prices during 1994, although prices will

rise less rapidly thereafter.

The study is generally highly positive on industry prospects, particularly for softwood producers. By 2007/08, it is expected that total domestic sawn timber production will exceed 5 million cubic metres, 64 per cent higher than the 3.1 million cubic metres produced in 1992/93. This increase will result mainly from a 115 per cent rise in softwood production from 1992/93, while hardwood production is expected to rise by only 5 per cent.

The report notes that in 1994/95 Australia will import 1.04 million cubic metres of sawn timber (some 24 per cent of its requirements), valued at more than \$500 million based on today's import price of \$413 per cubic metre.

Thereafter, however, the study forecasts a gradual decline in imports until, by around the turn of the century, Australia will be in a position to become a net exporter.

Exports could rise to as much as 694,000 cubic metres by the year 2008, depending on the degree of import substitution which has taken place by that time.