Uneven-aged Forest Management in Tasmania's Dry Sclerophyll Forests

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Abstract

For many years, Tasmania's dry sclerophyll forests were harvested and regenerated using the clearfell, burn and sow technique to produce an even-aged crop of regeneration. Gradually a wider range of management techniques, including partial logging, have been introduced, developed and refined. These partial logging techniques take advantage of natural seeding, may retain useful growing stock or be used to protect growing stock from climatic extremes. Some also incorporate a variety of seed-bed preparations. The various techniques and methods of implementation are identified and described.

Introduction

Until the 1970s, the silvicultural management of Tasmania's forests was based almost exclusively on producing an even-aged crop of regeneration by clearfelling, slash burning and artificial seeding. This technique was first researched and developed in the wet sclerophyll and mixed forests of the Florentine Valley in the 1950s and early 1960s, (Gilbert 1959, Korven-Korpinen and White 1972). The method successfully produced large areas of prolific regeneration.

During the 1970s, the expansion of the pulpwood industry and the advent of the woodchip industry, particularly on Tasmania's east coast, meant that a more diverse range of forest types was being logged and regenerated. The clearfell, burn and sow technique was applied and appeared to give adequate results in most types. It became apparent, however, that conversion of these predominantly dry sclerophyll forests from an uneven-aged structure to an even-aged form was often wasteful of useful growing stock.

In recent years there has been an increased emphasis on protecting and maintaining non-wood values as well as maximising wood values. This has led to the development and implementation of a variety of uneven-aged management practices to tailor regeneration techniques to individual forest types.

Management Practices in Uneven-Aged Forests

1. Overstorey Removal

In wet sclerophyll forests, this practice involves the harvesting of old growth overstorey from a two-aged stand while retaining well stocked, even-aged regrowth as the future stand. This technique is appropriate in forests resulting from heavy earlier harvests or wildfires which do not kill or remove all the overstorey trees, but which open up the canopy enough to allow the development of a new stand. The scattered overwood trees (which mostly provide pulpwood) are removed allowing the regrowth stand to develop as a uniform crop.

In dry sclerophyll forest the structure of these stands is rather more clumped and patchy than is likely to be found in wet sclerophyll forests. The clumping results from fewer trees being removed in previous operations or lower intensity but more frequent fires affecting stand composition. A wide variety of gaps and openings are created during an overstorey removal operation and these gaps need to be filled with regeneration after

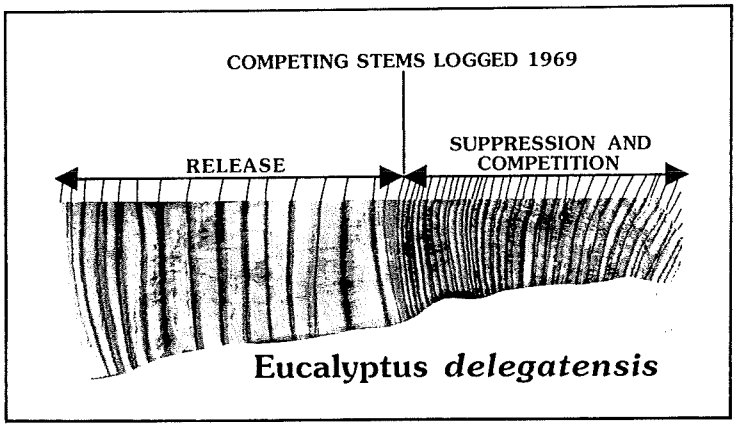


FIGURE 1
Growth increments showing release on a disk cut from a stem retained after overstorey removal

FIGURE 2
A stand before overstorey removal showing old growth and secondary advanced growth

logging disturbance. The end result is an even-aged crop of advance growth released by removing competing older growth, interspersed with a crop of young seedlings.

A pilot study in dry sclerophyll East Coast forest during the 1980s investigated the effect of 'release' on pole size regrowth after overstorey removal and showed significant diameter growth response. (Figure 1).
The cost of this logging method often is greater than average because the volume of timber harvested per hectare may be low. Extra care must be taken during felling and pulling to avoid damage to regrowth. Some damage will be sustained and this is dependent on the size and stocking of regrowth. Removal of 140 m^3/ha of scattered overstorey and 240 m^3/ha of residue from past sawlogging resulted in the stocking of trees greater than four metres tall being reduced from 1 350 to 700 per hectare on an area near Lake King William (Lockett and Keenan 1987).

The retained regrowth will ultimately act as a seed source and will form the two-aged forest structure, with the new regrowth arising on logging disturbance. Figures 2 and 3 show a stand before and after overstorey removal treatments.

FIGURE 3
A stand of retained advanced growth after overstorey removal

2. Seed Tree Retention
The practice of retaining a number of suitable, large crowned seed trees to act as a seed source following logging and burning of wet sclerophyll forests was superseded by aerial seeding in the late 1960s.

Recent work on dry sclerophyll forests has indicated that, on some marginal sites, an ongoing seed source has some beneficial effects. Seed sown during a once-only autumn operation may be ineffective if there are unseasonably dry autumns or springs, particularly severe winters or very dry summers. If the initial sowing fails, subsequent sowings are expensive and success cannot be guaranteed. In contrast, seed trees deposit seed on available seedbed for a much longer period.

Evidence from trials established in low quality, grassy understorey *E.amygdalina* forests and *E.amygdalina* forests on granites indicates that leaving approximately 20 to 25 seed trees per hectare resulted in: an increased stocking over several seasons; reduced re-invasion of grasses; and little suppression of seedling growth (McCormick 1988). Figure 4 shows a typical seed tree retention area in low quality, dry sclerophyll lowland forest.

FIGURE 4
A typical seed tree retention coupe in low quality, dry sclerophyll forest. The retention rate is ± 25 trees per ha.

The retained seed trees lessen the visual impact apparent after a clear felling operation, act as habitat trees, help to maintain a local gene pool and may ameliorate climatic and environmental extremes on the site.

3. Potential Sawlog Retention
This practice is applied in uneven-aged forest stands where a substantial regrowth component is approaching sawlog size. Most of the stand is harvested, but potential sawlog trees (trees which would currently be harvested for pulpwood but have the potential to grow into sawlogs) are retained for 20-40 years to help fill a projected short-fall in the supply of sawlogs. The minimum number of trees required to make a second cut viable is 100 trees on 15 hectares or around seven per hectare. A figure commonly used in district operations is 50 tonnes per hectare retained as a minimum volume. This figure includes potential sawlog material and pulpwood.

Following logging, the area is regenerated by the most appropriate silvicultural regime. On some sites the stocking of natural regeneration and advance growth may sometimes prove adequate without further treatment. In other areas, post-logging burning and possibly seeding is applied. Extra care is taken during logging and burning to minimise damage to retained trees and logging contractors may be paid higher rates to fell the stand. Mild top disposal burns are preferred and reliance is placed on seedfall from the retained trees unless a seed crop assessment indicates otherwise, in which case artificial seeding is carried out.

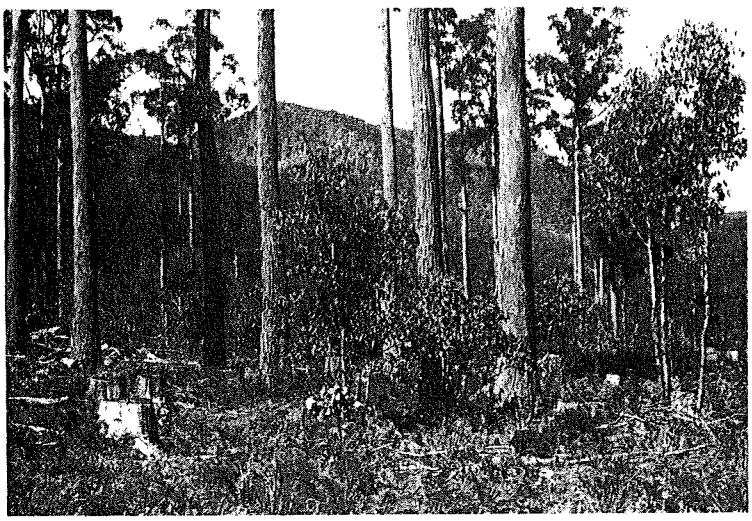
Re-measurement of marked retained trees at regular intervals has indicated that in some cases even suppressed trees will respond markedly after surrounding competing trees are removed (Goodwin 1984). Figures 5 and 6 show typical stands of retained potential sawlogs on logged coupes.

Disadvantages of this practice can be the increased intensity of operations and costs through tree marking and supervision. However, trained logging contractors and penalties for poor performance result in minimal additional costs. An added concern encountered during past operations is windthrow. Some guidelines identified to prevent severe losses include: retaining unlogged ridgelines, particularly those on the windward side of the coupe; leaving groups of poles to self-support; logging outside periods of unfavourable conditions (i.e. wet ground and equinoctial gales); and avoiding the treatment on shallow, erodible soils (i.e. granites and sandstone).

4. Mixed Age Regrowth Retention
This practice involves harvesting all trees above a certain size, usually old growth, and thinning regrowth to remove trees of poor form and to reduce the stocking in dense clumps (Tasmanian Forestry Commission 1987, Cunningham 1988).

This practice is applied in stands where a combination of regular harvesting and/or burning has resulted in a mixture of age and size classes. In dry sclerophyll forests, it can be used where multi-aged stands occur naturally in virgin or previously unlogged forests.

FIGURES 5 and 6
Stands of potential sawlogs retained after logging.



The practice allows operations to cease during harvesting and re-commence at any time without disrupting the normal works programme. As the areas contain sufficient regeneration (i.e are stocked) after harvesting, the necessity to base operations on a schedule which allows autumn slash-burning is avoided thus giving significantly greater operational flexibility. This practice also complements the Forest Practices Code as operations can be relocated and rescheduled when adverse logging conditions prevail. In addition, there is no cost of regeneration establishment by conventional means, resulting in a saving of approximately $300 per hectare.

Regeneration establishment may be from logging disturbance or from burning. The burns are low intensity, top disposal burns which allow regrowth and retained trees to survive. The degrees of burn intensity can be clearly defined by describing the diameter of the material consumed. For example a one cm burn, which may be nominated for a regrowth

retention coupe, will consume all material one centimetre in diameter over at least 50 per cent of the area. The conditions under which such a burn will occur are recorded from previous burns and great care is taken to avoid fire damage to retained regrowth. Fire sensitive habitats such as *Banksia* thickets and *Casuarina* groves are retained undamaged. Low intensity burns are best carried out during the cooler, wetter months so as to avoid fire damage to retained forest. This effectively extends the burning season to nine months of the year, alleviating the pressure during autumn.

An effective limit to this practice appears to be the volume of timber to be removed. Coupes have been treated having up to 350 tonnes of saleable timber per ha. Volumes in excess of this amount will result in unacceptable damage to retained stems during the felling and snigging operations.

The stocking after logging can be assessed using the stocking survey procedures for multi-aged stands (Lockett 1987) and from this information a decision can be made on further regeneration treatment. Figure 7 shows a typical mixed age regrowth stand after logging.

FIGURE 7
A mixed aged regrowth stand containing potential sawlogs, advanced growth and regrowth appearing on the logging disturbance.

FIGURE 8
A typical shelterwood after logging showing a variety of stem sizes and in particular, large bushy crowns.

5. Shelterwood

This practice has not been applied extensively in Tasmania except in high altitude plateau and dry sclerophyll forest with a grass component in the ground layer (Battaglia 1988).

Shelterwood felling is the removal of the stand in two cuts. During the initial harvest 30 to 60 per cent of the stand is retained. This is removed when the new crop of regeneration is well established, perhaps five to 10 years after the initial felling, or when regeneration averages greater than 1.5 metres in height (for high altitude *E.delegatensis* forests).

The objective of the practice is to provide shelter for the new stand from climatic extremes. The level of canopy retention following felling affects regeneration by moderating the environment. An added benefit of the shelterwood system is the provision of a constant seed source from retained trees. This increases the chances of establishing regeneration on available seed bed when good germination conditions occur. There is evidence that after a period of nurturing the regenerating crop, the overstorey suppresses seedling growth, necessitating old growth or canopy removal (Battaglia 1988).

Shelterwood requires increased supervision, planning and possibly marking of trees to be retained, but again contractor training can reduce costs considerably. Extra care must be taken to avoid damage to retained stems and advance growth. Figure 8 shows shelterwood following logging.

6. Canopy Retention
This practice is essentially a thinning treatment to be used where it is desirable to avoid clearfelling.

The Tasmanian Forestry Commission is currently investigating alternative logging and management techniques in a stand towards the wet end of the dry sclerophyll forest type. Whilst clearfell burn and sow practices give good results in these forest types, alternatives to this practice will be useful in special areas such as those with high scenic or recreational value (McCormick 1989).

Selection of the Most Appropriate Silvicultural System

When selecting the most appropriate unevenaged management technique, several factors have to be considered. The composition and structure of the stand before logging dictates the practice which is best suited. Climatic and environmental factors, past history of regeneration establishment success, requirements for various timber products and non-wood values such as landscaping, aesthetics, habitats, etc. will all influence the choice of silvicultural system.

Figure 9 (at the end of this article) contains examples of uneven-aged management in dry sclerophyll forest, showing pre-logging stand structure, the recommended silvicultural system and the result after logging. This model is similar to that designed for use in management of Jarrah forests. (Bradshaw 1985).

Discussion

There is no doubt management of our uneven-aged dry sclerophyll forests in Tasmania will continue to develop. The maximising of wood values in these stands will ensure a continued supply of higher quality, desirable products. The recognition of non-wood values can be more easily addressed and catered for by using uneven-aged management techniques rather than clearing practices.

Clearfell, burn and sow is still an appropriate regeneration establishment technique in some forest types, but we are moving towards more specific forestry. This can be best achieved in dry sclerophyll forests by tailoring our logging and regeneration procedures to suit individual stands. As an example, Triabunna District in 1989/90 will practice some form of uneven-aged management on 900 hectares of forest whilst only 200 hectares or 18 per cent of their annual cut will be by clearfelling. Most of the clearfelling will be on cable-logged coupes where partial logging is not practical.

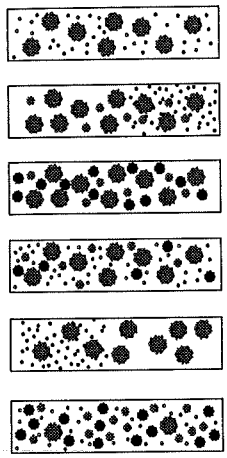
The slower growth rate in these forests dictates that any established regeneration should be retained where possible. The consequences of attempting to convert multi-aged forests to even-aged crops may have serious implications when considering the climate in which they grow and the consequent fire risks. A wildfire in an even-aged crop of regeneration will result in a block requiring at least one artificial sowing and depending on available seedbed, may be very difficult to regenerate by normal practices. An uneven-aged stand having current and potential seed trees will remain stocked with trees and will eventually regenerate naturally.

The sheer cost of forest management precludes investing large sums of money in dry sclerophyll forests with their large component of lower value pulpwood. Uneven-aged management can eliminate many of the accepted costs of establishing and maintaining a crop of regeneration.

The following series of diagrams illustrate the selection of the most appropriate silvicultural system in variable forest

Large Oldgrowth Trees *Potential Sawlog Trees*
Non Potential Sawlog Trees *Seedlings*
Advanced Growth (0.5 – 5m)

Stand Structure and Proposed Treatments



Overstorey Removal: Evenaged advanced growth under old growth arising from previous stand disturbance (low altitude).

Seed Tree Retention: Stand on a site where aerial seeding may not be reliable – may or may not have seedlings established under stand.

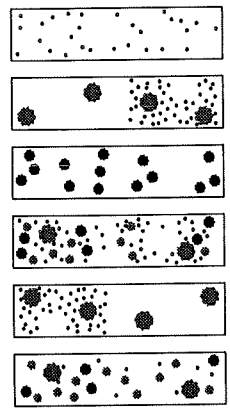
Potential Sawlog Retention: Stand composed of old growth trees, non potential sawlog trees and a specified minimum volume of potential sawlog trees.

Mixed Aged Regrowth Potential: A multi-aged stand.

Shelterwood: High altitude stands which may or may not have seedlings established under the stand.

Canopy Retention: A stand requiring treatment to meet visual landscape or environmental objectives.

After Logging



Overstorey trees removed. Some loss of advanced growth.

Seedtrees retained. Some loss of seedlings.

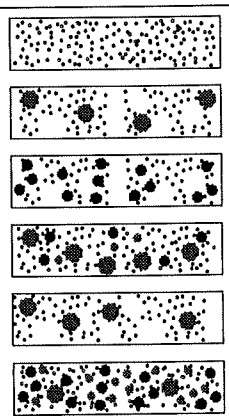
Old growth and non-potential sawlogs removed.

Required timber removed including some thinning. Stems with good growth potential or habit value retained.

Shelter trees retained. Some loss of seedlings.

Percentage of canopy retained. Includes all tree types.

Results of Management Techniques



Advanced growth released. Seedlings arising in gaps on logging disturbance.

Seedlings established under seedtrees. Seedtrees removed after establishment or retained till next harvest.

Potential sawlogs retained and released. Seedlings arising in gaps on logging disturbance.

Seedlings establishing in gaps created by logging.

Overstorey removed when seedlings reach specified height. Seedlings arising on logging disturbance.

Seedlings arising in gaps on logging disturbance. Multi-aged stand to be managed perpetually with canopy retained.

Figure 9

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