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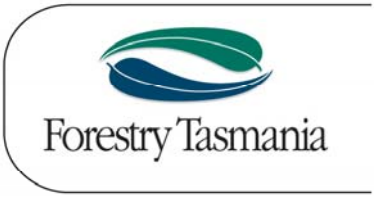

Phasing out clearfelling of old-growth forests on public land by Forestry Tasmania

A commentary by Prof. Jürgen Bauhus, University of Freiburg, Germany

Background

Forestry Tasmania (FT) aims to reduce clearfelling of old-growth forest on public land. The specific goal, under the Tasmanian Community Forest Agreement, is to achieve non-clearfelling silviculture in a minimum of 80 percent of the annual oldgrowth harvest by 2010. FT has undertaken extensive research to investigate and develop alternative silvicultural systems. The focus of this research has been on the tall-wet eucalypt forests, since old-growth in drier forest types can already be regenerated without clearfelling using shelterwood systems, advance growth retention or other methods. The tall wet eucalypt forests (E. obliqua, E. regnans and other species) require the most intensive ecological disturbance to facilitate the regeneration of the eucalypt component. Owing to the impressively tall trees and the structure of these forests, they are a very prominent public focus of the forest conservation debate. However, according to nationally agreed criteria, both old-growth forests as well as the forest types in question are adequately represented in the reserve system.
Under the Tasmanian Community Forestry Agreement, FT has established a process of review of its approach to phase out clearfelling of old-growth forests and invited comment on its efforts from a number of external forest scientists. As part of the review, this report will comment on the process of the selection and development of alternative silvicultural systems, its underpinning by research, the efforts taken so far to operationalise the system as well as future research and development needs.

The selection and development of alternative silvicultural systems

Clearfelling is a regeneration method that removes essentially all trees from a stand to provide optimal establishment and early growth conditions for shade-intolerant and frost-tolerant tree species. This system in combination with the burning of forest residues and the sowing of eucalypt seed has been proven a very effective method to regenerate eucalypt forests. The Clearfell-burn-and-sow (CBS) system was developed in the 1960s when it was recognised that eucalypt regeneration required bare mineral soil and sufficient light, which necessitated the removal of harvesting slash, understorey and litter to bare the mineral soil. The previously practised selective harvesting of wet eucalypt forests did – in most situations – not provide adequate conditions for eucalypt regeneration. These fundamental principles of the silviculture of wet eucalypt forests must also underpin any new or alternative silvicultural system designed to provide an alternative to clearfelling.

Alternatives to clearfelling can be principally achieved either through selective logging (single-tree or group selection) or retention of structural elements on site (from single trees to patches/aggregates). The entire spectrum of retention and removal has been implemented in the Warra Silvicultural Systems trial, which was set up to research the feasibility of alternative regeneration methods. The selection of silvicultural systems to be included in the trial has been done on the basis of extensive consultation, also incorporating overseas experience, in particular from the Pacific Northwest, where there has also been a recent imperative to phase out clearfelling. These silvicultural systems are being evaluated against a set of criteria, which comprise productivity, operability (safety), fire safety, biodiversity and public acceptability. This set of criteria is sufficiently comprehensive to evaluate different silvicultural systems, however, they are in part not easy to quantify. The evaluation of these criteria so far has shown that aggregated retention appears to be the most promising alternative to clearfelling in tall wet eucalypt forests. In other, drier old-growth types other forms of retention such as single tree retention may also be suitable. Therefore the system has been called “variable retention” to cover the whole range of old-growth types. My comments will focus on the aggregated retention system. The selection of this system does however not mean, that

aggregated retention will be the “perfect” system, which will not evoke further criticism by parts of the public. For example this system will still have a visible impact on the forest landscape, and burning and resulting smoke may still be a nuisance.

In terms of the development of an alternative silvicultural system, it was an important decision/step to move beyond the Warra experiment and to trial the system in an operational setting in the landscape and to further monitor the outcomes in relation to the above set of criteria. In hindsight, it has been recognised that the aggregated retention system could be much improved above the form of its application in the Warra trial. In particular the information which has since been gathered to optimise the burning of residues, the size and location of aggregates and the area in aggregates has proven to be very important to operationalise the system.

Research undertaken so far and future research and development needs

The research that has been undertaken to assess the performance of different silvicultural systems has aimed specifically at quantifying the effects and consequences of these systems against the set of criteria mentioned above. This has included an economic analysis, the assessment of acceptability by the public, a number of studies on the environmental performance (e.g. edge effects, understorey and rainforest vegetation, etc.) and the success of eucalypt regeneration. Worker safety has been monitored through recording the views and assessments of contractors, but it has not been systematically researched. The results of these efforts have been published in a number of peer-reviewed papers.

The most problematic assessment is that of biodiversity and the naturalness of ecological processes, since these need to be evaluated to a large extent at the landscape and not the coupe level. The aim of this is to demonstrate that (some level of) biodiversity can be maintained within coupes and that the disturbed area is more easily recolonised from the retained structures. Addressing these questions for flora is onerous but from a monitoring point of view not difficult, whereas for elements of the fauna, it is very difficult. Focussing only at the coupe level carries the risk, that one might assess the impact of silvicultural systems on some species or species groups that can be monitored, but which may not be important for the ecosystem or may not be threatened. In addition, the monitoring of biodiversity at the coupe level can so far capture only the immediate or short term effects. These two limitations indicate that modelling approaches are required to upscale the assessment of different silvicultural systems in space and time. This is often difficult in the absence of adequate data for the habitat requirements and population dynamics of certain species and how these may be influenced by certain forestry practices and landscape changes (as has been shown by previous efforts in this regard). One way forward may therefore be to model population viability of “dummy species”, which represent a wide range in habitat requirements, mobility/home ranges, population dynamics etc. Rather than focussing on some select known species, about which little is known so far, this approach may provide some insight into which type of species may be vulnerable in the long-term and hence help to focus future research and monitoring efforts.

FT has commenced work on assessing the outcomes of forest management at the landscape scale (work by Marie Yee). It is obvious that this work is in the initial stages and that much more work needs to be done, to be able to evaluate different silvicultural systems, rotation length etc. in the landscape. A next important step will be to link the information about landscape metrics to important ecosystem/landscape properties and processes such as population viability, migration patterns, invasibility by exotic species etc. This will be a tremendous research task which cannot be carried out by FT alone. I believe that this is therefore an area in which strategic collaboration with external research groups will be very important to make significant progress.

The landscape level assessment should also include an analysis of the consequences of different retention levels attained in coupes. In the recently established aggregated retention coupes, the level of retention has been higher than the actual goal of having 50% of the har-

vested area under the influence of mature forest. This will have consequences at the landscape level, since more coupes need to be harvested in the same period of time to achieve the stipulated goals of timber supply to industry. Therefore “overachievement” of retention may have benefits at the coupe level, but it may also have undesirable consequences in terms of overall harvesting disturbance, roading etc. at the landscape level.

One, if not the most important determinant regarding the feasibility and operability of a silvicultural system in the tall wet eucalypt forests is the way in which logging slash can be disposed of to create a suitable seedbed for the eucalypts and to reduce the risk of wildfires. In the absence of a market for residues, fire is a necessity. While burning the slash following large-scale clearfelling is a well established technique, the burning of slash in coups with retained trees and aggregates requires a completely different approach in order to protect the retained elements. I was impressed about the progress that has been made to adapt burning practices to the new silvicultural system. At Warra, it was attempted to carry out “cool burns” to protect trees, aggregates etc. The result of these efforts was in most cases not satisfactory (although in the medium term regeneration reached acceptable standards). In simple terms, it has now been recognised that the fire itself should be a “hot burn” to dispose of the slash, but that the conditions under which to burn should be very different from those of clearfall situations to avoid spreading of the fire into retained aggregates and adjacent forest. That this can work has been well demonstrated in operational variable retention coupes. The close monitoring of relative humidity, fuel moisture etc. during the burning period and the assessment of fire behaviour during the burn will help to further optimise the system.

I found it very interesting and encouraging to observe that the system design requirements for fire management now converge with other considerations. Experiences so far suggest to retain larger aggregates (> 1 ha) to ensure that these do not dry out too much and maintain a moisture difference to the fuels in the coupe so they do not get burned. This trend to larger aggregates will also be beneficial from a biodiversity point of view owing to reduced edge effects and larger habitat patches. Similarly from a fire management point of view, the distance between aggregates shall not become too big (< 120 m) to ensure that fuels can be lit by one ignition line to prevent interactions between the fires. This is consistent with the idea that in the aggregated retention system the majority of the coupe area should be under “forest influence”, meaning within the distance of one tree height to forest edges. From a fire management perspective longer and peninsular aggregates, best located in moist environments (riparian strips) are favoured over insular aggregates. These new insights open many opportunities for a flexible design of aggregated retention coupes to consider landscape features, and to protect ecologically important patches and riparian zones within aggregates.

Plans to use a large proportion of slash for the generation of bio-energy might provide opportunities to regenerate these forests without fire and through mechanical scarification of the surface soil to create a receptive seedbed. While this is certainly desirable to reduce smoke pollution, it raises a number of other questions that would have to be addressed in future, and which shall only be mentioned here. Fuel wood harvesting carries the risk of increased machine traffic in the coupe area and hence the potential for additional soil compaction. Therefore harvesting systems minimising soil compaction would be required. Presumably the fine fuels would still remain on site in order to constrain nutrient removals from harvesting of wood for bio-energy. Therefore the harvesting systems should be set up to create a suitable fuel bed to burn these fine fuels. If this is not intended, the question needs to be asked whether it is advantageous or disadvantageous to keep fire out of the system. Recent findings from other parts of the world show that fires are very important to maintain certain ecosystem processes, in particular in relation to nutrient cycling and vegetation succession.
Related to this issue is the important question of retention of coarse wood debris (CWD), a key structural element in most forest ecosystems. FT has carried out some excellent research to investigate the importance of CWD in these forest types. The research on CWD has been very strategic and guided by a conceptual model in order to determine the effects of different harvesting practices on the pools of CWD in different stages of decomposition.

This model can now show the consequences of different silvicultural systems and harvesting intensities. The next step in the process should be the development of some simple guidelines for CWD retention. While these must specify CWD levels to be retained at the coupe level, they may or should consider the landscape context and the specific retention of aggregates as the long-term source of de novo CWD over the next management cycle.

Research at Warra has shown that in retained aggregates the understorey in particular is susceptible to windthrow. This is not surprising given the slender (light-limited) growth of these stems. So far, wind-throw has not appeared to be a problem in the operational aggregated retention coupes. However, wind-throw is not a phenomenon constantly occurring in time, thus this may still happen and should continue to be monitored. At the same time, the wind-throw risk should be considered in the planning phase of aggregated retention coupes, so that wind funnelling effects are being avoided.

Currently the aggregated retention system is not being implemented on steep slopes and it is envisaged that these will continue to be clearfelled. According to local managers, the continuation of clearfelling on steep sites is not caused by restrictions of cable-harvesting systems but by the difficulty to burn the slash without burning the aggregates, in particular in the upper part of the coupe. Given that the visual impact of clearfelling of steep slopes is in most cases far greater than in flat or undulating terrain, where the site cannot be seen from as far and as many locations, it would appear that the aggregated retention system should also be trialed on steep slopes, once the approach to slash burning has been optimised.

The silvicultural research so far has focussed on the regeneration of eucalypts and rainforest species. Successful regeneration is the most elementary sustainability criterion for any silvicultural system, and it has been rightly chosen as one of the criteria used to compare the different silvicultural options for tall wet eucalypt forests. It has been demonstrated that successful regeneration can be achieved in aggregated retention systems, when the slash is appropriately burned and browsing is adequately controlled. For the future, it will be important to quantify, what effects the aggregated retention system may have on forest productivity, not just in terms of volume or biomass but also tree quality (stem taper and straightness, branchiness, etc.). It was good to see, that the silvicultural research officer, Robyn Scott, is intending to investigate this issue. I recommend that the focus of these investigations is on the medium to long-term suppressive effects of retained trees and edges and not the short-term effect on very young regrowth from recent aggregated retention harvesting operations. These effects can be assessed for older, existing edges from previously clearfelled coupes.
Currently, the yield predictions by the model FT uses for the whole forest estate are surprisingly insensitive to the level and growth of regeneration achieved in the new aggregated retention coupes. I suggest that this should not deter the attention from this important issue. If the native forests are to be managed in the long-term for multiple uses, then they also need to be managed profitably, which requires the regeneration of forests today, which meet the future demands for products in terms of volume and quality.

Operationalisation of the variable retention system
FT must be commended on the very strategic approach taken to identify and investigate an alternative silvicultural system and to move the system to implementation. The progress that has been made is the result of an effective combination of own research (initially at Warra), excursions to evaluate overseas experiences with similar challenges, collaborations with national and international experts in various fields of research, and the timely implementation of the aggregated retention system accompanied by further operational research. In particular the last step shows that the system could be much improved over its initial implementation at the Warra site. It is also obvious that the routine application of the aggregated retention system requires a cultural shift in forestry practices in the different management districts. The type of coupe planning and slash burning for example are very different from current practices associated with the CBS system. The problem with adopting the new system by local managers has been illustrated by the establishment of fire breaks around each retained ag-

gregate and the coupe boundary at one of the recently harvested aggregated retention coupes. Obviously this leads to a very high proportion of the coupe area that as been trafficked with the associated problems of compacted soils. In addition, it should be recognised that it is not a problem if some aggregates burn. While this is only an example, it illustrates that a considerable effort is required to clearly communicate the aims and requirements of the new silvicultural system in the different management districts to adopt the new practices. Some of the problems that have arisen during the implementation of the aggregated retention system in the recent past appear to have resulted from a lack of integration of the different planning steps, e.g. aggregates have become islands when they should have remained a peninsular from a biodiversity point of view, or the distances between aggregates have become to wide from the perspective of slash burning. Therefore it may be advisable to establish a planning team comprising a local harvesting planner, and the fire, biodiversity, and silviculture experts for a transitional period until the new practices have been satisfactorily adopted in the different districts.

Future research and development needs

The implementation of the aggregated retention system in tall wet eucalypt old-growth forest seems to require very little additional research. However, much more research is required to demonstrate the benefits of the new system over CBS. The public will not be satisfied to know that FT is practising a new system, which is not clearfelling but has another name. It will want to know, in which ways the new system is different and better than the previous CBS. This entails a plethora of research questions. FT cannot do all the research itself (despite having a good and effective small team). In the past, FT has been very good in establishing collaborative research with external scientists. In order to investigate the consequences and benefits of the change in silvicultural system, everything should be done to continue and strengthen these collaborations. However, to be attractive for external collaborators FT will have to maintain an own credible research profile in the relevant areas.

The major research tasks for the future will be related to demonstrating biodiversity benefits. This will have to include a strong approach in landscape ecological modelling. It must be clear whether FT wishes to manage forest structure or populations of species in the future. To demonstrate the consequences/benefits of the change in silvicultural systems it would be helpful to model the distribution of old-growth forest (incl. small patches) over time and across all forms of forest tenure assuming different risk scenarios for wildfires.

While the driver for the development of alternative silvicultural systems has been the concern over biodiversity, there are other issues that need to be addressed when evaluating different silvicultural systems. In particular the question of carbon (C) storage and sequestration has recently gained more prominence in the “old-growth debate” and requires a thorough whole system analysis including risks owing to wildfire associated with different alternatives. The tools for this kind of analysis are largely available, for example those developed by the Australian Greenhouse Office. It is unlikely that there will be a substantial difference in the “greenhouse effect” between clearfelling and aggregated retention as long as both systems employ slash burning and the same products are derived from harvesting. However, this kind of analysis might further stimulate the search for and development of alternative wood products (with greater longevity when compared to pulp) from old-growth forests.

While the water supply from native forest catchments may not have received the attention this issue has been given in Victoria, in particular the Melbourne water catchments, different silvicultural systems may have a real influence in this regard. Aggregated retention, owing to the reduced transpiration of old-growth, may help to maintain higher catchment run-offs, which may prove critical for aquatic systems in times of drought. This issue could be assessed using modelling approaches.

Once FT has demonstrated that old-growth forests can be harvested and regenerated without clearfelling, the public will most probably ask why this “better” system is not also applied to regrowth forests. While the application of the aggregated/variable retention system to regrowth forests is unlikely to require additional research for the implementation at the coupe

level, it may be advisable to already consider this switch in landscape level scenario analyses and yield models.

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