

Private Native Forestry – Silviculture, Sustainability and Incentives for Vegetation Management

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Abstract

Timber supplies from public native forests have declined significantly in recent decades. Consequently, wood processors are increasingly dependent on private land to maintain their throughput of native species logs.

In some regions of Australia, more than 50 per cent of native forest industry log supply comes from private property. There is concern that this increased demand brings with it the increased risk of high grading in private forests – repeated removal of only merchantable stock, leaving an increasing proportion of poor quality trees which may be detrimental to both future timber yields and habitat quality.

Nevertheless, this market situation also represents a commercial opportunity for private landholders and some additional incentive for them to better manage their forests for long-term sustainability. However, this needs to be supported by a policy and regulatory framework that provides incentives for private forest owners to manage their forests sustainably. Environmental policy settings and broader economic drivers can over-ride this opportunity.

A range of biodiversity/habitat sustainability indicators have been developed to gauge the impacts of clearing for agriculture and in some states, for forestry operations in native forests. In Australia, these have principally been developed with a focus on public land, but, as additional scrutiny is brought to bear on private landholders, they are increasingly focused on private native forestry (PNF).

Implementation of indicators may increase both the direct costs and the constraints on private native forest managers. It seems likely that returns from timber production alone may be insufficient to ensure best practice silviculture in private native forests. Incentives, available to the landowner, which recognize the public environmental goods being provided by well managed forests, may be one solution to the problem. This will require some quantification of how alternative forest management systems impact on those ‘public good’ values. Others suggest that government price setting arrangements for public forest timber maintain artificially low prices which reduce private forest management incentives.

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This paper is a progress report on several linked projects funded through RIRDC JVAP, which field test sustainability indicators, investigate the tradeoffs between commercial timber production and habitat/biodiversity conservation and examine options for improved private native forest management through commercial incentives.

The Project

This project is run through the Joint Venture Agroforestry Program (JVAP) and funded through the National Heritage Trust via the Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF).

It involves the field testing of sustainability measures at PNF sites in Victoria, Northern NSW and Tasmania. Field work at these sites is carried out by staff from DPI Victoria, Southern Cross University and the NSW Department of Natural Resources (DNR).

Key project objectives include:

- The field testing of sustainability indicators in native forests being managed for timber production, including their ability to evaluate the sustainability of alternative silvicultural systems and their transferability across forest types and regions;
- Examining the trade-offs between commercial wood production and biodiversity objectives in private native forests;
- Investigating how to integrate the management of environmental and economic issues at the landscape scale with private landholder planning and management at the site level;
- Providing PNF management information to landholders and policy makers;
- Identifying critical knowledge gaps.

Integration of project results will be achieved through an Over-Arching project, comprising a diverse team of researchers and consultants with skills in native forest silviculture, economics, natural resource and wildlife management and forest policy.

The project is due to report to JVAP at the end of May 2006.

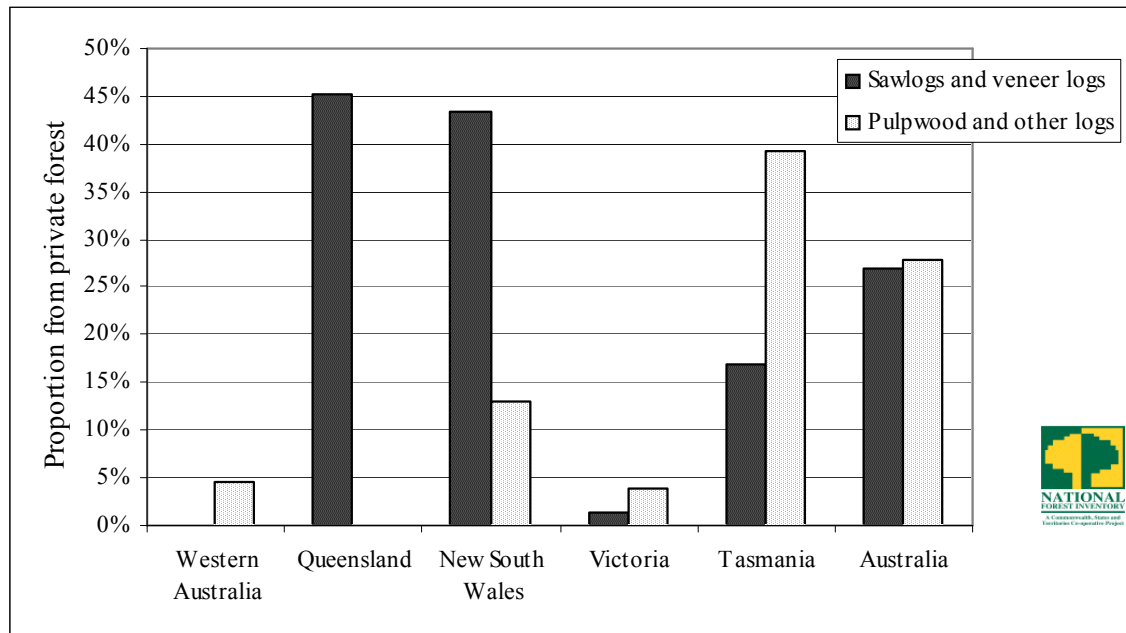
The Situation

Public opinion relating to the perceived value of biodiversity in Australian native forests has resulted in significant changes to the way in which the public forest estate is managed.

The Regional Forests Agreement (RFA) and Regional Assessment processes in many states have seen a large contraction in the volumes of timber harvested from the public estate. This has significantly increased the importance of private native forests as a source of log supply to industry in many forestry regions.

Figure 1 represents the current best estimates from a range of sources of the timber harvest quantities from private land for various States and regions and the proportion of total timber sourced from private forests.

Figure 2. Contribution of PNF to Industry Log Supply (Source: BRS 2006)



In some States and regions, PNF is a critical component of industry supply. For example on the north coast of NSW, 66% of sawmills are entirely reliant on private property logs (NNSW Forestry Services & NRPFDC 2005). In the Northern Tablelands/Liverpool Plains area, seven of the eight key hardwood mills source timber only from private land. In the Brigalow region of NSW, recent decisions to reduce cypress harvesting in public forests has seen industry urgently turning their attention to private supplies.

With similar declines in the available commercial hardwood resources on public land, the private native forest resource has gained importance in Victoria, as in other states. The Victorian government implemented legislation to guide the strategic direction for the management of native vegetation in both public and private estates.

This policy framework for the management of private native forests provides legislation regarding regional level planning, adherence to the Code of Forest Practice, the Native Vegetation Management Framework (NVMF) and the Flora and Fauna Guarantee. Each of these is required for operational private native forest management to occur.

The NVMF uses conservation assessments which are based on Ecological Vegetation Classifications (EVC's) to determine conservation significance. EVC's are classifications of plant communities based on combinations of life forms, floristics and ecological characteristics of recognizable groups of native vegetation. Generally only

private native forests with low or medium conservation significance will be available for timber harvesting. Harvesting may be allowed on other lands of higher conservation significance if harvesting is currently allowed on public land in the same bioregion.

The approach aims to assess the likely effects of forestry operations within the EVC's on habitat quality. ESFM principles underpin the various regulatory processes and the new Habitat Hectares (HH) assessment strategies are required to be applied to all managed private native forest. The implementation of the NVMF requires the development of a reliable and consistent vegetation assessment procedure and this has led to the development and testing of the Habitat Hectares approach, although it is already a requirement in the Act.

Expectations of biodiversity outcomes are now spilling over onto private land with increasing recognition that actions on private property are required to secure the conservation of biodiversity and habitat (eg Prest 2004). Moreover, strategically located corridors and pockets of native vegetation on private land can enhance the effectiveness of public conservation areas. For example in NE NSW private forests are half of all forests total i.e. equal in area to SF and NP combined (Flint *et al* 2004). PNF is an integral part of the matrix of reserved and non-reserved lands that provides fauna habitat. It would be difficult to sustain either viable fauna populations or viable industry without the contribution from private forests.

Defining sustainability in the forestry context

Our project has narrowly avoided becoming involved in a lengthy debate about precisely how 'sustainability' is defined. Early discussions within the research team identified the fact that many have tried and failed on this issue and that the term means different things to different people and that with the resources available this project was unlikely to add a lot.

Nevertheless, Australian forestry policy has been developed against the backdrop of 'Ecologically Sustainable Forest Management' (ESFM). The sustainability goals encompassed in the ESFM framework were first adopted in the National Forest Policy Statement (Commonwealth of Australia 1992) and later re-iterated in the RFA process.

Statutory definitions of ecologically sustainable development include (i) Sect 6(2) of NSW Protection of the Environment Administration Act 1991 (POEAA) and (ii) Sec 3A of the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBCA). They encompass

- (a) the precautionary principle - if there are threats of serious or irreversible environmental damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- (b) 'inter-generational equity' - a full range of options should be available to future generations

- (c) conservation of biological diversity and ecological integrity- improved valuation, pricing and incentive mechanisms- environmental factors should be transparently valued in pricing of assets and services

The sticking point in the debate has been the extent to which ESFM principles, which were largely developed or adapted for Australian conditions with the public forest estate in mind, are now being applied to private forests, and the legal, policy, and economic instruments for application.

The outcome of this debate is critical to at least four of the five 'big questions' at the heart of the Vegetation Futures 2006 forum, namely, and in approximate order of importance:

1. How do we integrate conservation and production?
2. Who pays for native vegetation management?
3. What are we doing about threats to native vegetation?
4. What is the role and value of native vegetation in the regional landscape?

The challenges

1. Switching to plantation timbers

Of significance to both the Australian timber industry and private landholders is the desire on behalf of some sections of the community to replace native forest harvesting with plantation grown timbers.

This new direction opens up opportunities for farmers and other landholders to expand their income streams to include commercial forestry enterprises while generating some of the environmental gains related to putting more trees back into the landscape if trees are strategically located and configured.

However, a recent study by Nolan *et al* (2005) reveals that the present rate of hardwood plantation expansion is insufficient to replace the withdrawal of log supplies from the public native forest estate. Key statistics from this study include:

- 62 per cent of these plantations were planted after 1995 with an expected rotation length of 20-35 years;
- By 2035, hardwood plantation logs will represent less than 15 per cent of the 2001 native forest harvest levels;
- By 2035, hardwood plantation logs will represent just 18 per cent of total log availability;
- The plantation log supply will replace only half the supply loss from public forests between 2000 and 2035;
- It is unlikely that plantations currently being managed for wood fiber production can be effectively converted over to sawlog production. (unless consumers accept more expensive and energy-intensive reconstituted engineered products).

This situation suggests that, in Victoria, NSW and Qld, if the hardwood and cypress pine industries in key regions are to maintain their present size and structure, private property timber will play an important role.

2. *The High-Grading issue*

In many instances, private native timber harvesting is a rather *ad hoc* and opportunistic activity. During periods of poor cash-flow from their mainstream farming enterprise, landholders allow local sawmillers or contractors to harvest timber from their forests. Generally, the best commercial logs are taken, with no silvicultural treatment applied to promote the future productivity of the forest. Over time a selectively logged forest can become fully stocked with non-millable stems (crooked, defective, low vigour). This appears to be happening for a number of reasons including:

- Sawmillers/contractors have little incentive to undertake costly silvicultural operations during harvesting;
- Landholders lack an understanding of good silvicultural practice or the technical skills/financial resources to implement it;
- The financial incentives for good silvicultural practices in private native forests appear to be lacking from a timber production viewpoint. Thinning over-stocked forests can be a very costly operation (upward of \$450 per hectare in some cases), while forest growth rates and stumpage prices are relatively low in many areas;
- Financial maturity is reached when the annual increase in value of a tree or a stand of trees falls below the manager's discount rate (e.g. 5% p.a.). For most trees in native hardwood forests in NE NSW, this occurs when the diameter (DBH) reaches about 50cm, or even earlier for some pole products;
- There is no financial incentive to promote sustainable forest management or avoid running down the genetic, productive or environmental values of these forests.

3. *Regulation and the environmental credentials of PNF*

PNF advocates have correctly pointed out that the environmental credentials of a well managed PNF operation compare favourably with many competing land-uses in terms of:

- No or minimal additional inputs (e.g. fertilizer, seed);
- The retention of high levels of native vegetation;
- Involves infrequent traffic, nutrient recycling, maintenance of organic matter and groundcover to prevent erosion;
- A well managed PNF site is a net consumer of carbon dioxide.

Moreover, they have argued that using (rare) pristine or relatively unmodified public forests as a benchmark against which private native forestry operations are judged is unreasonable. It has been suggested a more reasonable benchmark for private forests

may be a cleared paddock used for cropping or grazing and that even poorly managed private forests significantly outrank these alternatives on the habitat/biodiversity scale.

Despite these positive attributes, PNF as a land-use attracts increasing (some would argue unfair) environmental scrutiny and regulation following many years of ‘falling through the regulatory cracks’.

Much recent attention on PNF ‘sustainability’ is focused on habitat and biodiversity issues. Commentators with a broad understanding of forestry production, ecological systems and regulatory processes have suggested that the present and proposed regulatory approach to achieving increased sustainability in private forests has a number of shortcomings including:

- PNF is now regulated in NSW, Qld, and Vic through legislation designed to stop native vegetation clearing, not to facilitate good resource use;
- The legislation in each case has strong undertones of reserve-based conservation which seems to inevitably lead to a black and white landscape of areas that are "no-go" and areas where "anything goes". There is plenty of evidence that that is far from optimal for the environment (or for productive resource use);
- PNF in particular does not fit the reserve-based model well. The current vegetation frameworks do not really address questions of temporal and spatial dynamics that lie at the core of "good" PNF;
- It is hardly surprising that the clearing legislation does not address dynamics well - few legislative/policy frameworks ever do. By their nature, the political processes and the people involved in them seem incapable of dealing with the sort of uncertainty that is required to adequately reflect the dynamics of the environment;
- Where this really fails within the current vegetation frameworks is in their reliance on static benchmarks defined in terms of structure and composition of long undisturbed vegetation.

These views capture one of the key concerns of experienced foresters where inflexible rules are applied to forestry (and indeed all) ecosystems – lack of recognition of their dynamic nature. Some regulatory instruments do not allow for a disturbance which results in a temporary decline in those forest structural attributes thought to be correlated with good habitat features; the regulations thus ignore the potential for a longer term improvement in both forest structure, health, vigour, habitat value and timber production, and the habitat benefits of a diversity of forest structures across the broader landscape.

4. *Measuring ‘sustainability’ in a forestry environment*

A number of sustainability ‘metrics’ have been devised by various agencies to assess the biodiversity value of existing sites and to predict how this might change under alternative land uses or management systems. According to Cawsey and Freudenberger (2005), these all have their origins in the Habitat Hectares (HH) approach described by Parkes *et al* (2003) and include the Biodiversity Benefits Index (BBi) (Oliver *et al* 2005) and BioMetric (Gibbons *et al* 2005) scoring systems, both of which have been developed for

use in NSW (BBi is also being trialed in South Australia and investigated in Queensland). The metrics include site, landscape and regional considerations.

Rather than directly measuring biodiversity, which is a costly exercise and provokes much debate amongst ecologists about which species should be monitored, these metrics typically measure habitat attributes. Habitat attributes are deemed to provide an indication of the suitability of the site for various species based upon the presence/absence or level of desirable habitat features.

These metrics involve measuring various site-based parameters such as:

- a) Number of large trees;
- b) Canopy health;
- c) Lack of weeds;
- d) Understorey cover, life forms and species diversity;
- e) Tree recruitment;
- f) Organic litter;
- g) Species recruitment;
- h) Fallen logs;
- i) Ground cover;
- j) Canopy cover at various heights;
- k) Native plant species richness;
- l) Exotic species;
- m) Trees with hollows.

In addition to site based parameters, the metrics also account for larger scale issues such as the regional significance of the site in a biodiversity context (rare vegetation has more regional significance) and connectivity (the habitat value of an isolated patch of vegetation is less than for a patch in close proximity to other patches).

The parameters are usually scored, given various weightings according to their perceived importance for habitat and the weighted scores are combined in various mathematical configurations to produce a total score for the site. This becomes the basis for comparing different sites and estimating how the 'sustainability' will be modified by management actions. In most cases, the biodiversity 'worth' of a site or action is based upon its deviation from some type of ideal benchmark.

Not surprisingly, such scoring systems have attracted a considerable degree of comment from both ecologists and landholders. Much of this has focused on the 'worth' of the parameters measured as an indicator of habitat desirability for different species and the scoring and weightings used.

As suggested above, the validity of benchmarks on private land has also attracted some criticism. 'Benchmarks' are defined in HH as "representing the average characteristics of mature stands of native vegetation of the same community type in a 'natural' or 'undisturbed' condition" (Parkes *et al* 2003).

Of particular importance to forestry advocates is the concept of snapshot versus dynamic scoring of indicators and the recognition that a temporary decline in habitat scores below some ideal benchmark need not be viewed as a totally negative event.

The need to consider the dynamic nature of the forest ecosystem in assessing the impacts of forestry operation is a key component of this project.

5. *The issue of scale*

The impact of private forestry operations on biodiversity and habitat attributes depend not only on what happens on a particular site, but also on the nature of the surrounding landscape. For example, activities at a site level may have no impact on the resilience of a particular species population if there is adequate surrounding native vegetation to buffer the effects.

The JVAP project is examining the issue of scale in the PNF context and the extent to which current sustainability metrics address landscape and catchment as opposed to site scale features. A ‘checklist’ for biodiversity conservation in private native forests (Lindenmayer 2005) which is compatible with, or forms a framework of principles for a range of other sustainability metrics is being assessed. The checklist is based around the following key ecological principles:

- The maintenance of connectivity;
- The maintenance of landscape heterogeneity;
- The maintenance of stand structural complexity;
- The maintenance of aquatic ecosystem integrity;
- The use of natural disturbance regimes to guide human disturbance regimes.

Some key opinions already emerging from this work include:

- While many kinds of indicators and criteria have been proposed to assess sustainable forest management, the scientific validity of these surrogates remains highly uncertain for the assessment of management practices which aim to integrate production with biodiversity maintenance; the overarching goal for conserving forest biodiversity is the maintenance of suitable habitat;
- Forestry codes and standards do not account for many of the issues in the checklist which covers a hierarchy of scales from large spatial scales (e.g. large reserves) to stand level silviculture (stand structural retention);
- There are no forest biodiversity conservation ‘recipes’ that can be applied uniformly to all regions, landscapes and stands;
- A key element of ESFM should be rigorous monitoring and commitment to change when negative impacts are identified. (However there are issues of who will perform/resource the monitoring, what is monitored and who decides what is monitored in different areas and at different times, and inherent uncertainty in relating a given outcome to a wide array of possible

causes. These raise concerns about the practicality of monitoring and the potential additional burden on landholders);

- Reserves alone are insufficient to conserve forest biodiversity – maintenance of habitat on both public and private land will be critical for the persistence of some species;
- Ecological sustainability is not an endpoint but an overall direction in forest management;
- Most indices of forest fragmentation provide a snapshot static measure, whereas temporal dynamics may be more important;
- Forest management should follow a risk-spreading approach (don't do the same thing everywhere);
- Structural retention without active management of dense regeneration can lead to limited habitat value for biodiversity;
- It is typically not necessary to manage every hectare of a private forest for biodiversity values.

6. Integrating conservation and production – market failure, incentives and who should pay

The issue of market failure and who should pay for native vegetation conservation is critical to achieving improved vegetation management on private land at a scale that will make a real difference. As one project team member commented:

'...large scale sustainability cannot be achieved without the positive and co-operative attitudes of individual landholders.'

Current regulatory tools to protect native vegetation in most Australian states appear to be based on the premise that private landholders are under-investing in native vegetation conservation from a social welfare perspective. This is viewed as a form of market failure warranting government intervention.

For native vegetation in farming systems, intervention has taken the form of both regulation (e.g. restrictions on land clearing through State Government legislation) and incentives for conservation, management and re-vegetation (e.g. Catchment Management Authorities investing NHT funds).

Almost universally, this intervention has ignored the economic requirement that true market failures only exist if intervention is able to deliver net social benefits. That is, the total benefits from intervention (both public and private) should outweigh the total costs (again, both public and private). Rarely has any form of cost-benefit analysis been performed to weigh up the private and public costs of intervention and to ascertain if public funds are being well spent on vegetation conservation, or if they might be better invested elsewhere. Where such analyses have been performed, they have usually occurred after the intervention, rather than before and hence opportunities for more cost-effective natural resource management policy have been missed.

This concept is critical to two of the ‘big questions’ to be discussed at Vegetation Futures 2006. To reiterate:

1. Who pays for native vegetation management? – clearly, the answer depends on who reaps the benefits and the size of the benefits relative to the costs; and
2. How do we integrate conservation and production? – again, the answer depends on who benefits and by how much.

If native vegetation can be managed in a manner which generates private benefits (i.e. profits) to landholders, then this represents an opportunity to reduce the demand on the public purse. This is why some economists have argued for more public funds to be invested in R&D on new agricultural systems which are both profitable AND environmentally friendly, rather than trying to patch up the holes in existing systems through investments which produce only small-scale, often largely private benefits.

Well managed private native forestry offers a real opportunity in this respect where vegetation can be managed for timber production while maintaining the essential ecological integrity of the forest. If this activity is profitable, public expenditure on private forest conservation can be minimized, and the ‘cost’ to owners avoided (Brennan *et al* 2003).

Some members of the community might take a fairly dim view of reducing the decision about investing in native forest management down to a discussion about costs and benefits, however, governments have a limited pool of public funds with which to pay for public goods (e.g. schools, hospitals, roads, native vegetation) and so responsible decisions need to be made about the effectiveness of expenditures.

It is noteworthy that some CMAs in NSW have taken this concept on board and are now carefully considering how much public benefit accrues from conservation activities and how many public funds they are willing to commit. For on-ground works to enhance native vegetation protection/rehabilitation and biodiversity, one CMA has deemed that 75% of the benefit accrues to the public, 25% to the landholders. This proportion is combined with an Environmental Benefits Index (EBI) which ranks the magnitude of the environmental benefit to be achieved to determine the amount of public funding to be provided and the amount which the private landholder will need to invest.

The figure of 75% has important ramifications for PNF. If new regulations to protect public goods in private forests impose a cost burden on landholders, it could be argued that at least 75% of those costs should be reimbursed in recognition of the fact that landholders are managing their forests for the greater good. As well as this cost-sharing example, market-based approaches and instruments to obtain conservation benefits from private land might include tender schemes, direct-fee-for-service, and biodiversity credits or banking.

In the PNF context, virtually all government intervention to date has been in the form of regulation. The payment of incentives for improved forest management has been

noticeably absent from the policy toolkit, due probably in part to the belief that any forestry activity is detrimental to environmental values.

As discussed in the project findings section below, this conclusion is very debatable. We have also drawn some preliminary conclusions about the capacity of regulations to deliver ESFM, the value of sustainability measures and the role of incentives for improving private native forest management.

Findings to Date and Implications for the Five ‘Big Questions’

1. The SCU study on the North Coast of NSW

Assessing the Effects of PNF regulation

This work has involved the use of a mixed species/mixed size native forest growth model called EUCAMIX (Jay 2005, unpublished) to simulate the effects of different silvicultural regimes and alternative environmental rules on forest productivity, structure and profitability. Using data on existing forest structures, floristic types and site quality distribution, some key conclusions to date derived from the model and site-scoring assessments are:

- Many private native forests in the region are in poor condition as a result of historical high-grading activities. Additional regulatory rules which restrict tree culling or require the retention of some quantity of trees are unlikely to improve this situation. Indeed landholders may be able to meet the requirements by continuing to high-grade their forests, removing as many commercial timber trees as allowable while retaining poorer quality stems to meet the tree and/or basal area retention limits.
- Current timber stumpage prices are not high enough to warrant costly tree culling activities. In northeast NSW there are at present no viable markets for the fibre, bioenergy potential, carbon storage, or biodiversity values of trees. Markets for fencing material are limited and have low margins. Without market signals to suggest otherwise, high grading without culling is likely to continue. Continued high-grading without culling will score highly in any ‘sustainability’ index where large trees and structural diversity are important. However it will also result in substantially reduced standing timber values and future economic harvests.
- High-grading plus culling is more effective than not culling, for generating standing value and cash flow after 30 years. This outcome depends on intensive harvest and cull to achieve vigorous stand renewal, but will likely be affected by regulations to retain hollow-bearing trees. To date, the long payback period rather than regulation has been the principal deterrent to silvicultural investment
- EUCAMIX predicts that after 30 years, the total standing merchantable volume is almost the same regardless of whether the forest experiences high-grading with culls, or experiences a do-nothing (benign neglect or nil-harvest) future (stock ~9.2M m³ on 180,000 ha active portion of northeast NSW PNF estate). This

suggests that industry supply volumes can be sustained by high-grading, provided it is accompanied by stand renewal through culling (and also subject to some caveats regarding size and quality of logs). However the merchantable stock and its potential sustainable flow (yield, or annual growth rate) will be very substantially depleted if culling is constrained or not undertaken.

- Improving the productive condition of many private native forests requires the application of restorative silvicultural methods. This can be done by high-grading with culls, or by other methods which maintain the attributes that provide for high habitat value scores. Presently, financial incentives and agency support to facilitate these methods are lacking.
- To comply with likely tree retention regulations or maintain high site-value environmental scores, landholders have a stark choice between (i) obtaining immediate cash flow from commercial high-grading (logging without culling), or (ii) making a substantial net outlay (i.e. culls in excess of stumpage received) and forgoing the harvest of many large commercial trees. In the former choice, productivity and output to industry as a whole will be very substantially reduced within the next one or two cutting cycles. If the latter choice is to be made, financial incentives and/or new markets are needed.

Sustainability metrics

To date, results are only available for the performance of the BioMetric indicator in PNF settings on the North Coast of NSW (results for Habitat Hectares and BBi are pending).

The BioMetric score was calculated for a range of sites with various management histories on four properties. Up to 6 sites were selected on each property so as to best match the following forest structures :

1. big old trees;
2. regrowth;
3. recently logged;
4. disconnected patches;
5. regrowth near riparian zones; and
6. nearest to next harvest event.

Preliminary results from bio-metrics assessment

Most sites fared well with a BioMetric score of around 80%. For sites that scored significantly below this level, the main reason is that they score below the benchmark for hollow bearing trees (HBT). HBT for a Clarence Lowland Spotted Gum site has a benchmark of 10 trees per hectare and is a heavily weighted, comprising up to 41.3% of total component in the BioMetric score (DEC 2005 website).

The implications of using a measure like BioMetric to assess the sustainability of PNF operations are as follows:

PNF appears to be ‘sustainable’ as assessed by a relatively high BioMetric score across the trial sites, though the result is very dependent upon HBT which, because of the lead time for natural hollow development, are unlikely to change much over a 30 year period. So, when measured via a general scoring of vegetation structure, PNF has little negative impact on site conservation values.

Also noteworthy is that many sites in this study have essentially been high-graded, but still score well in BioMetric. This illustrates a key problem in using scores of this type in a forestry setting – they do not appear to discriminate between good and bad silviculture. This is probably due to the attributes used and the weightings which were intended for use in assessing the impacts of clearing rather than forestry operations. Given that the principles of ESFM explicitly note the need to maintain the future productivity of the forestry ecosystem, this suggests the use of scores which omit measures of future forest productivity will not ensure the principles of ESFM are being met.

On the ‘Big Question’ of integrating conservation and production in a forestry setting, it seems that BioMetric (or similar simple, static vegetation-attributes focused scoring systems) when applied to in these forests of northeast NSW with a long history of forestry activity, may be useful only for the detection of gross change.

The solution to maintaining and improving both environmental and forest production values while adhering to the concept of ESFM appears to require restorative silvicultural actions, which in turn require a competitive market return from silvicultural thinnings and/or from the delivery of non-timber forest benefits. The latter requires the community to pay for specific outcomes such as retention of large trees & HBT and high structural and floristic diversity. Incentives such as tender schemes are a likely efficient mechanism for this purpose. Payment for specific outcomes would support rather than impede ecologically sound restorative silviculture. On the other hand, rules which actively discourage sound silvicultural activity may be providing no additional public benefit (no improvement in habitat), while creating additional costs at the landholder, industry and regulatory agency level.

2. The DPI Victoria study in East Gippsland

The Habitat Hectares metric

The HH approach is a measure based on weighted scores using 3 landscape and 7 site criteria. To satisfy the HH criteria, following a clearfall operation (common in Victoria, but not allowed in NSW), the habitat score of the regenerative forest must be 50% of the original HH score after 10 years. Following a selective harvesting operation, the HH score must be less than a certain percentage as set by individual regional native vegetation plans, which have been created by Victoria’s Catchment Management Authorities. The Department of Sustainability and Environment (DSE) is developing a set of operational guidelines that seek to link the goals of the NVMF, local government planning procedures, CMA regional vegetation targets and the Habitat Hectare’s assessment approach across the state.

The aim of the process is to provide a simple to use approach to assessing habitat quality that is reliable, repeatable and appropriate to all forest. It does not provide a statement or records of individual species, but provides a comparison between current vegetation condition of a single EVC and those of 'benchmarks' of the same EVC or community type. EVC benchmarks are derived from average, apparently long undisturbed stands (Parkes *et al*, 2003).

The Habitat Hectares tool has recently been reviewed by McCarthy et al (2004) and some concerns with the HH approach have been raised are:

- The appropriateness and definition of EVC benchmarks;
- Subjective nature of measurements affecting repeatability; and
- Combinations of attributes can lead to inconsistencies between similar HH scores.

The Victorian study (East Gippsland PNF Project) aims to evaluate the ease and appropriate of the application of the HH tool. The project focuses on 3 EVC's (29 (Damp Forest), 21 (Shrubby Dry Forest) and 16 (Lowland Forest) within private native forest with medium to low conservation significance and available retrospective clearfall areas. Study sites provide a range of ages of regenerated forest since the known clearfall events across a number of private properties.

Preliminary results from application of the Habitat Hectare score

Preliminary results have shown that the HH approach returns a similarity of scores across the three EVC's despite the range in forest types and time since disturbance and this appears to be caused by an 'evening' out of the attributes determining the score, even though particular structural and habitat 'attributes' can vary considerably (e.g. log debris, understorey layers, number of mature trees).

Although the Victorian study does not provide a range of silvicultural systems, it suggests that the sensitivity of the measures and weighting (of the various components) is not sufficient to provide anything but a general, structural, value for habitat change and condition. The project will give insight to the issues of sensitivity within the measure and the appropriateness of the attainment of the 50% score after 10 years. The HH approach in its use as an 'easy to apply' tool to indicate sustainable management favours structure of the forest as more important than species.

The protocols and practical application of the '10 year rule' under this Victorian system are not yet finalized within the framework. This study will provide some insight into its use and application. Plots within the Victorian project were required to adhere to the Code of Forest Practice when treated and the project area will test, the premise that the Code of Forest Practice ensures reasonable management and are therefore likely to achieve 50% of the HH score within the 10 years.

The application of the HH scoring system could be made by knowledgeable landowners, extension officers or consultants but currently requires trained consultants. For all users the approach is an ‘averaging’ tool, and care needs to be taken with location and sampling strategies as there is considerable variation both within EVC’s where the benchmarks are derived and on site variation can be considerable within many treated stands in the private native forest resource.

The relative cost of application of the various policy requirements and assessments under the NVMF (including HH assessment) in private native forests is also being investigated. At this stage, those costs could be quite high if the PNF owner is required to or needs to employ a consultant to carry out the HH assessments.

Preliminary project outcomes from field application of metrics

In summary, the preliminary results from the Victorian and SCU studies highlight sampling and “sustainability” issues which need to be considered and will be evaluated more thoroughly when projects are complete.

- Preliminary results for the sustainability metrics and other habitat measures examined to date suggest that general habitat values are not greatly impacted across this range of silvicultural treatments. Caution is needed here as it could be concluded that PNF is ‘sustainable’ when in fact, it is likely that the metrics tested to date are not suitable in a forestry environment because they ignore forest productivity. More work is required to develop a set of metrics or measures which, in addition to habitat, address silvicultural sustainability and the principles of ESFM. The tradeoffs between protecting specific habitat features and wood production is the critical issue. The irony is that, when compared to competing landuses, even exploitative forestry regimes rate well for habitat retention;
- Because many forests are already in poor silvicultural condition, it is financially rational for landholders to ‘mine’ their forests under exploitative management regimes - ‘high grading’. Although this will reduce future forest productivity, such actions have no major or long-term negative impact on habitat values when measured using BioMetric or Habitat Hectares. Many of the sites assessed in N NSW had a history of high-grading, but still scored well;
- Silvicultural treatment which culls undesirable trees while retaining larger commercial trees beyond financial maturity can “maintain or improve” both timber supply AND some key habitat features (structural diversity and large tree indicators) which are not captured in BioMetric or Habitat Hectares. However, financially, this option is not appealing to landholders;
- The payment of financial incentives may be needed to promote sound silviculture and forest growth while retaining adequate scores according to measures such as BioMetric and Habitat Hectares. Broader measures of ‘public benefit’ based on the full scope of ESFM principles will be needed in order to prioritize investment between target sites for forestry improvement.

- Rules which require retention of some basal area or standing tree numbers in various size classes may improve some structural diversity (habitat) indicators under exploitative forest management regimes, but will further reduce financial incentives for sound silviculture. So, while such rules improve the environmental credentials of forestry regimes which are unsustainable in terms of timber production, they reduce the likelihood of adopting regimes which have more favorable productivity and habitat attributes than the current regime. That is, they may perpetuate a second best option in terms of ESFM.

The application of metrics (scoring systems) may need to provide a more detailed assessment of habitat and productivity indicators than is presently used to achieve the required 'sensitivity' analysis to evaluate the range of silvicultural strategies applied to native forests. However, the current tools can provide insight to the gross effects of clearing and forestry operations in private native forest and the level of compromises that may be required to provide both production and biodiversity in the local and regional resource. When projects are completed review of the 'sensitivity' and appropriateness of the methods will be compared and evaluated.

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