FORESTRY TASMANIA'S SUSTAINABLE YIELD UNDER THE AUSTRALIAN FORESTRY STANDARD

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4 June, 2012

A Report Commissioned by NSC International

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EXECUTIVE SUMMARY

1. NCSI commissioned this review to investigate two complaints, one from the PEFC relating to personal comments by Professor West, the Chair of the Independent Verification Group, and the other, a submission by Mr. G Law.
2. The Terms of Reference were as follows:

   Verify if it is appropriate that plantations are included in Forestry Tasmania's sustained yield calculations;

   With reference to the requirements of the Australian Forestry Standard, determine whether the claims of unsustainable harvest in relation to the activities of Forestry Tasmania are valid; and

   Determine whether the assertions made by the Chairman accurately reflect the findings from the IVG (Burgman and Robinson) Report and any other relevant recent reports relating to Forestry Tasmania.

3. In relation to Term of Reference #1, I concluded that:

   I. *The documentation for the Australian Forestry Standard enables plantations to be included in the Defined Forest Area to be certified. The 1997 Regional Forest Agreement and the Tasmanian Community Forest Agreement envisaged that Forestry Tasmania wood supply was to be supplemented and sustained in part by plantations. The documentation for the Australian Forestry Standard certification identified those plantations and their tenure. The provisions of the Standard require that those areas of plantation be taken into account in calculating the sustainability of the harvest for the Defined Forest Area.*

4. Following a review of the principles underlying sustainable yield, the methods of calculation, the Australian Forestry Standard's definitions of sustainable yield, and constrained optimization, I examined Forestry Tasmania's inventory and planning data. These have been the subjects of several reviews and audits, including two since the preparation of the estimates of sustainable yield for the 1997 Regional Forest Agreement. I concluded that:

   II*. With some exceptions, the underlying Forestry Tasmania (2007) inventory and planning data reflected the current and future state of the forest, markets and dependent industries appropriately at that time. Most of the exceptions relate to improvements recommended in the course of other reviews and some, relating to a stochastic analysis, have been elaborated further in this review.*

5. Under the Australian Forestry Standard, risk is a factor that must be considered in calculation of the sustainable yield. Because some of the recommended improvements related to issues about area and volume discounts, headroom factors and a safety margin to take account of various sources of risk, the review examined these matters in greater detail to provide greater clarity, avoid double counting, and point out the opportunity costs of measures involved in achieving desired environmental and wood production outcomes and their impact on future revisions of the sustainable yield.

6. The details of Forestry Tasmania's process of calculating sustainable yield were examined further in relation to risks, including the risks posed by wildfires, *E. nitens* plantations, the legislative provisions requiring Forestry Tasmania to make available a minimum supply of 300,000 m3/y eucalypt sawlogs and peeler logs. In relation to Term of Reference #2, I concluded that:

   ***III**. The Forestry Tasmania (2007) process of calculating sustainable yield meets best practice standards at that time but merits improvement in the course of the 2012 review of the Regional Forests Agreement in order to better address the Australian Forestry Standard principles underlying sustainable yield and the calculation of it.*

   In particular, the constraints imposed by current legislation to make available a prescribed minimum harvest of 300,000 m^3/y of high quality sawlogs need to be amended to enable the Australian Forestry Standard principles underlying the calculation of sustainable yield to be properly implemented. Also, the implied rigidity of a steady annual harvest in the seamless transition of volume involving greater reliance on supply from regrowth forest and plantations needs to be reconsidered, not least in relation to the uncertainty and risk attached to the transition to greater use of eucalypt plantation sawlogs and peeler logs.

   ***IV**. Forestry Tasmania regulated the harvest yield in a manner consistent with the requirements of the Australian Forestry Standard and the 2007 calculation of sustainable yield.*

7. Professor West, Chairman of the Independent Verification Group, made the assertions regarding unsustainability in a personal capacity. My charter was to see whether they accurately reflected the findings of that Group and other relevant recent reports relating to Forestry Tasmania and so to assess whether Forestry Tasmania has breached the Australian Forestry Standard requirements concerning the calculation and regulation of sustainable yield.

   ***V**. In terms of the Australian Forestry Standard, I am unable to determine a rational basis in the Independent Verification Group reports, or related documentation, for the West (2012) assertions about the unsustainability of Forestry Tasmania sustainable yield calculations or practices. They do not appear to be founded on the facts pertaining to the Australian Forestry Standard and the evaluations of the Forestry Tasmania process of calculating the sustainable yield and regulating the annual harvest. From an Australian Forestry Standard viewpoint, they reflect an unfortunate confusion in the use of the term 'sustainable yield'.*

8. Mr. Law's submission regarding the alleged unsustainability of logging of State forests by Forestry Tasmania overlaps the PEFC complaint. Hence in relation to those matters, I concluded:

   ***VI.** For reasons detailed in the main report, the allegation of unsustainable cutting has no basis in fact under the Australian Forestry Standard or PEFC provisions. This allegation is based on a misconception of the provisions of the Standard by Mr. Law.*

9. Mr. Law also raised a specific complaint that the Forestry Tasmania contracts with Ta Ann to supply peeler billets cannot be met sustainably. However, Mr. Law does not seem to have recognized that the contracts allow Forestry

Tasmania to source peeler billets beyond State native forests, including from plantations and/or from private forests, which expands the scope of the supply review that is involved. The present evidence is uncertain and warrants further review.

***VII**. Should Mr. Law's prognostications relating to the ability of plantation material to meet peeler contracts prove well founded during the 2012 RFA review or any later reviews, it will be incumbent on Forestry Tasmania to consider its contractual liabilities and promptly renegotiate the contracts to meet the Australian Forestry Standard provisions for sustainable yield.*

1. INTRODUCTION

Following the release of a report by the Professor West (2012), Chairman of the Independent Verification Group, and subsequent complaints made by several individuals to PEFC, NCS International Pty Ltd (NCSI) received a formal complaint from PEFC regarding allegations of unsustainable harvesting against Forestry Tasmania (see Appendix A). NCSI commissioned this review to investigate the allegation. It later received a submission from Mr. G. Law that overlaps the PEFC complaint and is therefore considered after dealing with the PEFC complaint.

The NCSI Terms of Reference for the review were as follows:

1. Verify if it is appropriate that plantations are included in Forestry Tasmania's sustained yield calculations;
2. With reference to the requirements of the Australian Forestry Standard, determine whether the claims of unsustainable harvest in relation to the activities of Forestry Tasmania are valid; and
3. Determine whether the assertions made by the Chairman accurately reflect the findings from the IVG (Burgman and Robinson) Report and any other relevant recent reports relating to Forestry Tasmania.

The exercise will involve reviewing relevant documents including (but not limited to):

- Forestry Tasmania's response to PEFC complaint (sent to NCSI on 23rd April 2012)
- AFPA letter to NCSI regarding PEFC complaint
- The Report of the Chairman of the IVG
- The Burgman/Robinson report
- The Tasmanian Regional Forest Agreement
- Tasmanian Community Forest Agreement
- Forestry Tasmania's wood review summaries

The report first addresses whether plantations are included in the Defined Forest Area that prescribes the forest areas covered by the Australian Forestry Standard certification of the Forestry Tasmania forest estate. It then reviews the definitions and guidelines pertaining to sustainable yield in the PEFC and Australian Forestry Standard documentation to establish the basis on which a harvest might be deemed to be unsustainable. It examines the evidence pertaining to Forestry Tasmania's calculation and implementation of the sustainability of harvesting. It goes on to report on whether the assertions made in the report of the Chairman of the Independent Verification Group (West, 2012) accurately reflect the findings from the Burgman and Robinson (2012) report and any other relevant recent reports relating to Forestry Tasmania. Finally, it addresses Mr. Law's complaint.

2. INCLUSION OF PLANTATIONS

The Australian Forestry Standard documentation (Australian Forestry Standard, 2007: p11) states that 'The AFS can be applied to any defined forest area being managed for wood production, irrespective of scale or type of ownership, or whether native or planted forest.' It goes on to define the Defined Forest Area as follows (Australian Forestry Standard, 2007:p 12):

> An area of forest (including land and water) to which the requirements of this Standard are applied, and to which the forest manager can demonstrate management control, which allows them to achieve the requirements of this Standard.

And to elaborate on its interpretation (Australian Forestry Standard, 2007:p31)

> The forest manager will need to specify or define an area of forest (including land and water) to which the requirements of the AFS are applied. The defined forest area does not have to be a contiguous block or parcel of land. The forest manager will need to demonstrate management control over the defined forest area, which allows them to achieve the requirements of this Standard.
>
> The intent of the above guidance is to provide sufficient flexibility to allow forest managers to define the coverage of their AFS certificate in a way which reflects their business needs and differing operational situations. Nevertheless, it is intended that this guidance should preclude an organization omitting elements of its operation, which should be properly included in its defined forest area from the scope of its certification/registration.
>
> NOTE: In certain circumstances, two organisations may have forest management interests in the Defined Forest Area with one having a custodial or ownership right whilst the other has a management or operational role. The organisation seeking certification under the AFS will need to demonstrate that it has management control over the forest operations through appropriate agreements or contracts, for the purpose of AFS outcomes.

The last paragraph is noteworthy, enabling inclusion of those areas of native or planted forest held under lease, joint venture agreement, or other similar property rights giving Forestry Tasmania control of the harvest.

Thus there is unequivocal evidence that Forestry Tasmania can include plantations in its calculations pertaining to the sustainability of harvest on its Defined Forest Area.

The formal inclusion of plantations in the Defined Forest Area is set out in the Forestry Tasmania (2011a: p1-4) document headed 'AFS Defined Area Procedure'. Plantations included in Forestry Tasmania's Defined Forest Area are summarized by species, region, year of establishment and designated pruning regime in the Forestry Tasmania (2011b) Final Report to the Signatories of the Tasmanian Forests Statement of Principles and total 36,674 ha.

2.1 Conclusions

The documentation for the Australian Forestry Standard enables plantations to be included in the Defined Forest Area to be certified. The 1997 Regional Forest Agreement and the Tasmanian Community Forest Agreement envisaged that Forestry Tasmania wood supply was to be supplemented and sustained in part by plantations. The Australian Forestry Standard documentation identified those plantations and their tenure. The provisions of the Standard require that those areas of plantation be taken into account in calculating the sustainability of the harvest for the Defined Forest Area.

3. SUSTAINABLE YIELD

3.1 Sustainable Yield – Underlying Principles

Much attention has rightly been focused on sustainability in recent years and on sustainable forest management and sustainable yield in particular. The most widely cited definition of sustainability rests on the definition of sustainable development by the Bruntland Commission (1997):

> Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

The central theme of this definition is intergenerational equity – fairness to future generations. Economists have grappled with this issue for many years because it bears on evaluations of public investment, such as those involved in regulating forest harvesting, where we forego present consumption to invest in future consumption by later generations. Because long time periods of investment are involved, the discount rate plays a pivotal role in these evaluations.

Argument over the social rate of discount has a long history that continues today. Some time ago (Ferguson, 1996), I rationalised that desire for intergenerational equity in valuing utility over time through consideration of the social rate of time preference, the discount rate that measures the relative preference for present over future consumption. I posited a discount rate that followed commercial values over the investment time horizons that are common (i.e. generally less than 50 y), but then declined progressively thereafter until it reached a steady low state founded on our unwillingness to discriminate between the consumption of successive future generations in the long-distant future. Building on earlier contributions, research by Chichilnisky (1996) and Heal (1998) has strengthened support for that hypothesis. Heal (1998) describes this approach as seeking a balance between a 'dictatorship of the present' and a 'dictatorship of the future', and it comes much closer to encompassing the complexity and goals of intergenerational equity.

Boardman *et al* (2011), in their recent book on cost-benefit analysis, expand on this approach, identifying four reasons to consider a time-declining discount rate for intergenerational projects – those with significant effects beyond 50 years. Those reasons can be reduced to three, given the similarity of two of them.

> (1) In practice, individuals generally appear to be 'time inconsistent' in applying lower discount rates to far distant outcomes,
>
> (2) An ethical dilemma exists between being fair to future generations and economic evaluations that indicate that the discounted net benefits received 50 years and more ahead are trivial, and
>
> (3) The further we look into the distant future, the greater the uncertainty that applies to what the discount rate at that point of time should be. If we recognize uncertainty in the form of a probability distribution, the effect is to make the effective certain-equivalent discount rate reduce much below the mean value of the discount rates – more so, the longer the time period concerned.

Based on research by Newell and Pizer (2003), Boardman *et al* (2011) recommend real discount rates of 3.5% up to 50 years, declining progressively to 0% after 400 years. The last value, however, is inconsistent with the geometric product of the underlying marginal social rates of time preference (see Ferguson, 1976) and goes too low, in my view.

Of course there are many other issues concerning the shadow pricing of revenues and cost in public investments to reflect other forms of market failure (Boardman *et al*, 2011; Campbell and Brown, 2003). But the social discount rate is a major philosophical issue in any consideration of long distant public investments because of the impact of discounting.

3.2 Sustainable Yield - Method of Calculation

Not surprisingly, the practice of calculating sustainable yield generally seeks to avoid the philosophical issues associated with intergenerational equity, and sometimes avoids the use of social discount rates, entirely. So let us now move to review the practice.

In Australian forestry, sustainability is normally measured and expressed in terms of the 'sustainable yield'. The term 'sustainable' probably in part owes its origins to an earlier inquiry (Ferguson, 1985) in which I drew a distinction between the then widely used term 'sustained yield' and 'sustainable yield'. The former implied a rigid target to be achieved. The latter implied a potential level, not necessarily a value that had to be attained, but one that should not be exceeded over the long term. The point being that sustainability is not prescribed by a single immutable value in the case of wood production, or indeed other uses (Ferguson, 1996)

The popular connotation of sustainability tends to focus on a constant supply ––

THE sustained yield. It is misleading because the paths of our global, national and regional economies are characterized by constant change, for the most part involving population and economic growth over the long term, overlaid with marked cyclical fluctuations that are very uncertain. Attempts to impose an absolutely steady supply over the planning horizon for a large estate, such as Forestry Tasmania's, equate with trying to stem the tide. However, there is merit in having a set of supply targets that are not to be exceeded in the long run, subject to periodic review in the light of changes in markets, forests and knowledge.

Sustainable forest management is concerned with the intelligent management of forest structures that, as in the case of Forestry Tasmania, are often sorely imbalanced in terms of the uneven distributions of age-classes and other forest conditions. Not every fluctuation can be perfectly smoothed out, nor should they be. The essential question to be addressed at the end of the planning horizon is whether the Tasmanian public forests will then be in a better condition than they are now. How we might best assess that condition is an important and evolving issue, discussed in a later section. A better future condition, nevertheless, is the crux of the intergenerational equity issue – fairness to later generations - that underpins the notion of sustainability developed by Bruntland Commission (1997) and others.

Elsewhere I have expressed personal views on how such calculations of sustainable yield might best be made and these differ, in some respects, to the methods used by Forestry Tasmania (Ferguson, 2009). However, there is no unanimity within

scientific or forestry circles on these matters and they will continue to change as new and better technologies in computing, optimization, geographic information systems, forest inventory and risk analysis emerge. In any event, the issue for this review is what provisions the Australian Forestry Standard stipulates, as they are the criteria by which certification must be assessed.

3.3 Australian Forestry Standard Definitions

The Australian Forestry Standard (2007) defines sustainable yield as 'The yield that a forest can produce continuously at a given intensity of management' and clearly has shades of the old sustained yield notion. However, later references in the standard make it clear that flexibility and adaptation is required. Section 4.1.2 prescribes the development of a forest management plan, in which the rationale for the annual harvesting rates is described.

> 4.1.2 The forest manager shall develop a forest management plan, or equivalent instruments, that—
>
> • identifies applicable legal requirements and other external requirements to which the forest manager subscribes;
> • identifies and assesses the significance of specific aspects and impacts of activities relevant to the full range of forest management performance requirements of this Standard;
> • sets management objectives and targets and establishes a monitoring process for identified significant impacts relevant to the forest management performance requirements of this Standard; and
> • respects stakeholder input provided in accordance with requirement 4.2.2.
> • the forest management plan or equivalent instruments should provide:
>
> • scope and objectives of management;
> • description of the forest estate and values to be managed, including those important for the protection of social benefits;
> • rationale for the annual harvesting rates;
> • description and rationale for silvicultural regimes; and
> • reference to relevant operating conditions and controls for specified activities.
>
> NOTE: The forest management performance requirements given in requirements 4.3.1 to 4.9.5 provide for protection and maintenance of environmental, economic, social and cultural values.

Sections 4.4.1 and 4.4.2 state:

> 4.4.1 The forest manager shall identify existing productive uses of the defined forest area to support the maintenance of the land's long-term productive capacity and ensure it is not compromised by wood production. NOTE: Requirement 4.8.3 relates to the exercise of existing legal or traditional uses of the forest, which may include productive uses.
>
> 4.4.2 The forest manager shall plan forest operations to ensure the productive capacity of the land, (see requirement 4.4.1) is not compromised.

> Planning shall consider:
> a) forest growth and forest products yield estimates;
> b) future land use intentions;
> c) rotation/cutting cycle program;
> d) scale, intensity and timing of operations;
> e) expected markets; and
> f) development and maintenance of infrastructure.
>
> Forest managers managing plantations shall also ensure that planning considers the selection of species for plantation establishment.

Section 4.8.3, while requiring that legal obligations be met, allows some leeway to negotiate outcomes under certain conditions:

> 4.8.3 The forest manager shall allow exercise of existing legal or traditional uses of the forests to continue.
> Where such uses threaten the condition of the forest or the achievement of the forest management performance criteria, the forest manager shall pursue negotiated outcomes.

The present and future condition of the forest can be examined in terms of the present and predicted distribution of age classes, stand structures and forest types and this has been done by Forestry Tasmania (2011b) in recent analyses. In Western Australia (Ferguson *et al*., 2001), structural goals have been prescribed for the end of the planning horizon. However, with the development of more sophisticated geographic information systems and modes of spatial analysis, it may be desirable to refine that process further and examine spatial distribution goals, such as those relating to fragmentation, connectedness and diversity, to be achieved at the end of the planning horizon.

The planning process described above is the heart of the calculation of sustainable yield. Neither the Australian Forestry Standard documentation nor the PEFC documentation provide detailed guidelines on how sustainable yield for wood production might best be calculated. Considerable literature exists on this topic because it is at the core of the sustainable management of almost all large forest estates. The most recent major works on the calculation of sustainable yield are those by Buongiorno and Gilless (2003), Weiskittel *et al*. (2011) and Amacher *et al*. (2009).

So how is sustainable yield calculated? There are basically three methods:

- Sustained yield formulae: these are historic and are generally only used today as very crude gross error checks.
- Simulations: these are techniques that take the present forest inventory data and 'grow' it into the future, based on a set of assumed silvicultural treatments and harvest levels. In practice, the process is repeated several times using a different set of options until an acceptably sustainable path is obtained.
- Optimization; These use a simulation model to develop the data needed to investigate many options at once and to select the best of those mathematically using Linear Programming or similar techniques.

Most large forestry entities use optimization, as does Forestry Tasmania (Whiteley, 1999; Riddell and McLarin, 2003).

The mathematical construction of the model is complex and has evolved into a very sophisticated system as the more detailed inventory data, faster computing systems, and better optimization systems have been developed. Spatial integration with the geographic information systems has also added complexity and much greater accuracy in basic land base data. Most use Linear Programming techniques to solve the constrained optimization problem, for which well-developed commercial software is available.

3.4 Best Practice

Terms like 'constrained optimization' may summarize the mathematics succinctly but obscure the essential elements from the general reader and hence a brief summary of what is generally involved in 'best practice' may help.

The first step is to identify the areas on which wood production is permitted, thereby excluding formal and informal reserves from the calculation of the sustainable yield of wood production. Formal reserves are those created under legislation, such as national parks and the like. Informal reserves are those stipulated under regulations such as the codes of forest practice and involve stream buffers, wildlife corridors and local reserves to protect rare or endangered species

The second step is to identify the nature of the objective for wood production. Is it to maximize the sum of annual wood harvests, or to maximize the sum of the discounted net revenues? More importantly, what constraints are to be placed on this maximization and over what planning horizon?

Most large commercial forestry organizations maximize discounted net revenue because this enables a link to the valuation of the estate for accounting purposes, albeit subject to some peculiarities of the accounting standards (Ferguson and Leech, 2007; Leech and Ferguson, 2011). The Auditor-General of Tasmania (2011) recommended that a risk free rate of discount be adopted and suggested targeted rates of return of two to three percent on assets might be appropriate, given certain conditions. However, the Auditor-General stressed that 'this should not be taken as our agreeing that returns of two to three per cent should be regarded as acceptable particularly over the longer term', noting that the choice of discount rate was a matter for Forestry Tasmania to justify. This opens consideration of the earlier discussion about the social rate of discount.

While the choice between maximizing wood flows and maximizing discounted net revenues may initially seem critical, it seldom is, because the constraints placed on the objective dominate the solution, especially where those constraints deliberately ensure that the condition of the forest at the end of the planning horizon is improved over that at the start.

As argued elsewhere (Ferguson, 2009), extending the planning horizon beyond 50 years seems to stretch credulity, given the uncertainties attached to predictions beyond 20 year and even more so beyond 50 years. Nevertheless, in using a 90-year planning horizon, Forestry Tasmania has implemented measures to ensure that the condition of the forest is improved at the end of it, relative to the start. This is based on a comparison of the distribution of age classes and forest structures and is illustrated in a later section of this report.

The major silvicultural options affecting harvest yields such as thinning, clear-felling, selective harvesting, regeneration, planting and pruning need to be identified. For a particular planning period, only certain stands will be old enough to carry out these harvest operations, so there are a plethora of area constraints for each of the nine 10-year planning periods in the Forestry Tasmania planning model. There are generally upper and lower bounds on the aggregate volumes of wood harvested from particular regions or on special timber species, based on market forecasts relating to the demand for wood of various qualities and properties, together with those maintaining viable minimum supply levels under contracts and agreements. And there are constraints to mitigate negative impacts on environmental services such as landscape aesthetics or wildlife habitat (Burgman *et al*, 1994).

Of course, no solution from such a seemingly black box exercise should be accepted on face value and hence the need for public consultation and for periodic audit and review, to adapt to changes in conditions and knowledge, and incorporate updated data. These steps are required by the Australian Forestry Standard (Sections 4.1.2, 4.1.4, 4.1.5 and 4.8.3).

The questions for this review are then:

(1) How well do the underlying Forestry Tasmania inventory and planning data reflect the current and future state of the forest, markets and dependent industries? Without reasonably accurate inventory data and soundly based planning data, the entire calculation of sustainable yield is clearly at risk.

(2) Does the Forestry Tasmania process of calculating sustainable yield address the principles underlying sustained yield and the calculation of it, as prescribed in the Australian Forestry Standard?

3.5 Forestry Tasmania's Sustainable Yield

Independent audits and reviews of Forestry Tasmania Inventory planning data have been carried out many times, especially since the introduction of the Regional Forest Agreement process in 1997. Forestry Tasmania's capacity to develop a more detailed and accurate inventory and a more detailed and better basis for planning has improved progressively, based on the implementation of recommendations from these reviews, together with the evolution and implementation of better technologies. The most recent reviews date from 2011 and 2012.

The term 'headroom' was first used by Forestry Tasmania in its 2011 Final Report to Signatories to embrace the seemingly unpredictable risks such as future changes to the Forest Practices Code (Forest Practices Board, 2000) and changes in social license to operate. Burgman and Robinson (2012) expanded the concept to include wildfires, climate change and perhaps other global or economic crises.

Discounts are often applied separately to those of headroom adjustments, as in the approach taken by Forestry Tasmania. Unfortunately, in other reviews, headroom adjustments often also include discounts, blurring the distinction. For this reason, I shall make a clear distinction between 'discounts' - the evidence-based corrections- and a 'safety margin' that is intended to cover seemingly unpredictable risks. 'Seemingly unpredictable risks' include cases such as the habitat of a rare animal

where we know that the habitat must exist but we cannot predict where or its extent (i.e. predictable in a limited sense but not quantifiable).

Whiteley (1999) described the detailed framework of the system used in the calculation of sustained yield at that time. That system has carried forward, subject to a number of improvements. Riddell and McLarin (2003) and McLarin (2006) have updated and elaborated that description.

Brack and Vanclay (2011) conducted an independent review of the Forestry Tasmania Sustainable Yield Systems in June, 2011 as part of the verification process required by the Signatories to the Statement of Principles. They stated that:

> Spatial constraints imposed on the solution by the impacts of reserves and the intensification of operations on the remaining area are often confounding. For example a nominated percentage reduction in available area often leads to a greater reduction in economically harvestable volume as extra patches of area become inaccessible. The list of spatially related factors that are reported as being included in the "headroom discount" have the potential to introduce a substantial reduction in the "operational supply". Experiences in Canada suggest that coupe dispersal practices, if comprehensively applied, can reduce operational supply significantly. The effect of other spatial constraints can only be determined by case studies as the quantum of the impacts is unique to the actual spatial patterns of the resource. A more precise estimate of the discount requires detailed simulation studies, but it is our considered opinion that it may be prudent to increase the 10% headroom discount.

While I agree with the need to apply evidence-based area discounts to reflect spatial and other area constraints or volume biases, the description above blurs the distinction between such discounts and the headroom. That blurring recurs in later reviews and is the source of some concern as to the propensity for double counting when substantial increases in headroom are mooted but the identification of components is imprecise. Nevertheless, area and volume discounts are conceptually straight forward, even though they may be time consuming and costly to measure or estimate.

Brack and Vanclay (2011) reported that the inventory and planning data were 'appropriate and conformed to best practice', noting that substantial improvements had been made following the (Dr Phil) West (2007 & 8) review, not least in relation to the plantation estate for which, in 2007, 88% was too young to undertake routine inventory collection and therefore relied on field estimates of Site Index. By 2010, only 30% were too young. Forestry Tasmania had also applied corrections to remove potential biases in the estimates of growth.

Brack and Vanclay (2011) identified possible areas for improvement, notably relating to coupe dispersal and plantations. They concluded:

> The Reference Group can be confident that the scenarios presented by FT offer a reliable indication of resource availability, and that the scenarios are a reasonable basis for comparing options. While the underlying areas, inventory, and simulations conform to best practice, it is not possible to assert a precise long-term non-declining yield for any of the three scenarios without further specification of operational requirements (notably coupe dispersal and swift parrot requirements). Notwithstanding this limitation, the FT summaries offer a good basis for comparing scenarios.

Subsequent improvements reported by Riddell and McLarin (2003) involve minimum area of harvest 'blocks' as small as 10 ha and useful heuristic simulations to grapple with the effects of coupe dispersal and other reductions in areas for environmental purposes. The Forestry Tasmania (2012) response to the PEFC complaint identifies an average reduction for the aggregate area available for wood production (other than Special Timbers) of 22%, after excluding native forest outside the permitted wood production areas.

Burgman and Robinson (2012) reviewed the overall approach to inventory and planning data as part of the independent verification process under the intergovernmental agreement. They found that 'inventory and measurement practices conform to best practice' and that the 'forest growth models and the' (simulation) 'system in which they are embedded are commensurate with the models and systems used by other forestry jurisdictions'.

Burgman and Robinson (2012) also reviewed the sustainable yield system and found them to be 'reasonably accurate' with respect to sawlogs and pulpwood, conditional on two improvements in future calculations of sustainable yield. One was the use of a higher headroom factor than the 10% currently being used. This would not necessarily make the estimates more accurate but it would provide greater protection against risk if the proponent was risk averse, a point to which I shall return later. The second concerned the appropriateness of the volume and area discounts. This qualification just reflected their inability to personally verify these matters because of time limitations.

Much of the Burgman and Robinson (2012) review was devoted to a painstaking detailed analysis of, and corrections of biases in, the volumes of the principal products on individual areas involved in the proposed changes under consideration by the intergovernmental review. Many of these represent important improvements in the calculation of sustained yield. However, some critical aspects of risk in relation to wildfires and in relation to plantations warrant more detailed examination and that takes us back to the distinction between headroom, safety margin and discounts.

3.6 Headroom Factors and Discounts

To quote from the Burgman and Robinson (2012) report:

> The within-coupe class area is discounted by class-specific area factors (ARE) and the projected timber is discounted by IA/FC-specific reconciliation ratios (VRE) as noted above. Hence, projected timber yields are discounted to reflect otherwise unforeseen harvesting constraints such as the presence of class-4 streams and slope, as well as otherwise unforeseen volume reductions such as internal rot, fire, and insect damage.
>
> *Headroom* refers to a percentage of the predicted harvestable resource that is excluded in the scenario as a buffer against unexpected changes in future conditions, spatial constraints, and the like. The 6/6 scenarios used 10% headroom. The scenarios documented in this report use varying amounts. Area reconciliation (ARE) discounts are usually about 20%, based on historical application of the Code. This area is taken into account in modelling before headroom factors are applied. Thus, if a 30% headroom is applied, then the output indicates that approximately half (56%) of the areas potentially available for harvesting can actually be harvested. Below, we evaluate headroom levels and their applicability to different scenarios.

The first paragraph of the quote deals with volume discounts that, like area discounts, are or should be made prior to the application of any headroom. But here, there is a troublesome ambiguous reference to internal rot, fire and insect damage - fire of unspecified character. Are those volume reductions solely catering for internal defects from rot, fire and insect damage? Do they cater for fire damage of all kinds- small fires, large major fires, or both? The word 'unforeseen' is also ambiguous because it may imply a failure or an inability to predict. There is a lack of clarity here that is disturbing and that is also reflected in the background papers by Whiteley (1999) and Riddell and McLarin (2003).

The second paragraph seems to be based on a minor misinterpretation of Forestry Tasmania practice, because the Forestry Tasmania headroom factor is applied as a volume, not an area, discount. The number cited may therefore inflate the aggregate equivalent reduction in area. Based on a very crude approximation using the Von Mantel sustained yield formula for a 'normal' forest (see Davis and Johnston, 1987), a reduction in the aggregate area of a large forest estate results in up to double that reduction in sustainable yield, while a reduction in volume only results in up to an equal proportionate reduction in sustainable yield. Thus a reduction of 20% in area plus a reduction of 30% in volume results in a 42% reduction in sustainable yield. This seemingly arcane academic point has important practical implications.

Some sources of area discounts, such as stream buffers, are quite specific and can be measured relatively precisely. Stamm (2011a, 2011b, 2012) undertook a detailed assessment of area and other discounts of various kinds. He found that there has been little change in the average area discount across all Districts (circa 24 %) since 2007, notwithstanding some increases and some decreases in individual Districts over that period.

However, some of the area discounts under the Code of Forest Practice proposed since 2007 are of an 'umbrella' character that reflects difficulties in precisely

specifying boundaries in the implicit tradeoffs between the commercial management for wood production and the largely non-commercial supply of environmental services.

Table 1 shows some personal estimates of the volumes of various products and their prices at stump and the resulting opportunity costs expressed both in annual value and present value, the latter based on a social rate of discount of 5% applied over a planning horizon of 90 years. Needless to say, applying either of the Auditor-General's recommended discount rates would increase the present value greatly over that shown.

Table 1. Estimated opportunity costs of an additional 1% reduction in sustainable yield

Product	**Approx. volume sold** ('000 m^3/y)	**Approx. stumpage** ($/$m^3$)	**Approx. total revenue** ('000 $/y)
High Quality Sawlogs	238	58	13,800
Other Sawlogs	67	42	2,814
Peeler Logs	216	35	7,560
Native Forest Pulplogs	2,004	19	38,076
Totals	2,525		62,254

Average opportunity cost	$24.66/ m^3
Sustained yield	330,000 m^3/y

Opportunity cost of an additional 1% reduction in sustainable yield

Annual cost	$81,362/y
Present value @ 5% discount rate	$1,627,233

The actual values of volumes sold and stumpage are not available publicly. Hence the values in Table 1 are personal estimates drawing on the 2009-10 Annual Report values for forest sales and are only very rough approximations. Furthermore, they assume that the particular reduction in yield stems from a reduction corresponding to the overall average growth in volume. Nevertheless, they illustrate the order of magnitude of the average opportunity cost over the Forestry Tasmania native forest estate of an additional 1% discount relating to an environmental tradeoff.

Rounding the values off, each 1% per unit of **sustainable yield** reduced constitutes an average opportunity cost of about $80,000 per year or a present value, when discounted at 5% over a 90-year period, of about $1.6 million. Those changes in sustainable yield that derive from area discounts could, using the earlier argument based on Von Mantel's formula, be only half those amounts per additional 1% in **area** reserved, but they are still substantial.

The recent proposals for changes to the Forest Practices Code reflect research and expert advice and merit attention in the future Code. However, alternative solutions might achieve the same outcome at a lower opportunity cost. For example, does the particular provision need to apply over the entire 90-year

period? Time limited (5-year) provisions like adjacency constraints have a very much lower impact on sustainable yield, if correctly applied. Does the provision need to apply to the entire estate or could it target relevant portions separately, reducing the overall impact? Are there alternative incentives or penalties that can achieve the same outcome at a lower opportunity cost? These issues may well have been considered but it would be helpful if they were canvassed in reporting the approach taken.

The second paragraph also indicates that the headroom is a buffer against 'unexpected changes in future conditions, spatial constraints and the like.' While unexpected changes and spatial constraints are elaborated later, the issue of major wildfire is left dangling. Furthermore, while unexpected changes constitute a risk that might validly be taken into account via a headroom, spatial constraints are predictable in their impact, admittedly requiring considerable work, and might better measured by a preliminary estimate of the discount, subject to confirmation through further research.

In any event, an overall headroom factor of (say) 20% in volume to cover seemingly unpredictable risks such as wildfire can be inappropriate. For example, if a major wildfire burns young regrowth of a fire-sensitive species, the impact is profound because those years of wood production are probably lost entirely. If the regrowth of a fire-tolerant species, the impact will be much less although the quality of the final sawlogs may be affected somewhat. If a wildfire burns a 'Mature Eucalypt' forest of predominantly fire-tolerant species, there may be changes in competition favoring the fire-tolerant element but quality, at least among remaining near-mature and mature stems, may be little affected.

The Forestry Tasmania (2012a: Attachment A) histogram showing the distribution of plantation, young regenerating forest, regrowth forest of various ages, and of mature forest by area for 2006 and 2095 is shown in Figure 1.

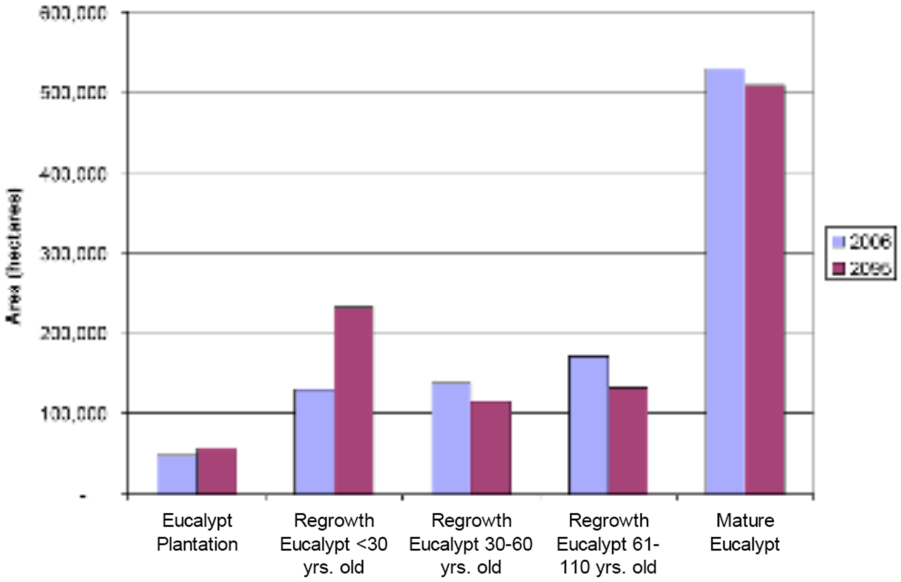

Figure 1. Distribution of areas of forest growth stages within State forest in 2006 and 2095

For the sake of this argument, suppose that much of the regrowth eucalypt 61-110 years old is predominantly of fire-sensitive species and therefore suffers considerable loss in quality, although most fire-killed material could be harvested and used commercially. Again, for the sake of argument suppose half of that area (i.e. 90,000 ha) is not fire-sensitive and can therefore join the fire-tolerant Mature Eucalypts to total about 620,000 ha. The other half joins the fire sensitive younger stages totaling about 400,000 ha.

While the former group may suffer some diminution on volume or quality due to wildfire, I would expect that the change would be slight, calling for a safety margin of perhaps 2% on the fire-tolerant component, based on my perception of the Tasmanian forestry history overall. A 10% reduction across all growth stages would therefore be more appropriately implemented by applying a safety margin of volume of about 20.4% on to the younger growth stages. That uneven distribution has different planning implications than the overall 10% safety margin. Given the very large buffer provided by the Mature Eucalypt forest, the overall change in sustainable yield would probably not be very marked but the timings of the transitions to greater reliance on regrowth and plantations would probably be affected markedly.

It seems that headroom factors have generally been

> (1) somewhat ill-defined, not clearly separating potentially evidence-based discounts from safety margins for the seemingly unpredictable risks,
>
> (2) applied uniformly across native forest and plantations, notwithstanding the differences between and within those categories, and
>
> (3) lacking in a sufficiently detailed rationale and/or analysis to justify the magnitude of the safety margin purporting to cover seemingly unpredictable risks.

All headroom factors advocated for Forestry Tasmania to date are subjective judgments about the collective impact of seemingly unpredictable risks but are confounded to some extent by the inclusion of some discounts. The risks deserve to be tested properly in a stochastic analysis that gives more considered weight to the impacts of major wildfire (see Ferguson, 2009, 2011) or any other major risk in that category.

3.7 Risk

The Australian Forestry Standard documentation contains references to the need to take account of risks of all kinds, including the Australian Forestry Standard 4.4.2 Guide to Verification 'that planning of forest operations takes addresses (*sic*) identified risks to productive capacity.' through Indicators such as ' Forest management plans or equivalent instruments, including strategies (rationale) for annual harvest rates'.

The Forest Practices Authority oversees the mitigation of environmental risks using the Code of Forest Practice (Forest Practices Board, 2000) and associated regulations and systems. To the extent that these provisions restrict the planning of wood harvests, they are reflected by a legion of constraints in the planning process

– these include stream buffers, wildlife corridors, local reserves to protect rare or endangered species or landscape aesthetics, adjacency constraints to avoid prescribed burning near newly regenerated stands and the like. The evidence from the reviews by Brack and Vanclay (2011) and by Burgman and Robinson (2012) is that, with a few minor exceptions, these provisions meet best practice.

All calculations of sustainable yield are subject to errors, some of which reflect the fact that Forestry Tasmania cannot measure every tree in the forest and so use a sample of plots on which the trees are measured to estimate the standing volume and other characteristics. Forestry Tasmania also periodically re-measures some of those plots to estimate growth (Whiteley, 1999; Riddell and McLarin, 2003). The accuracy of any calculations of sustainable yield rest on the impact of these and other sources of error and can be assessed using two criteria - bias and precision

Bias refers to the difference between the estimate and the true value. As Brack and Vanclay (2011) point out, the ultimate goal is to eliminate bias as far as possible. Various corrections were implemented in recent revisions of the planning process to achieve this (Riddell and McLarin, 2003), based on a comparison of actual and predicted yields where suitable data were available. Burgman and Robinson (2012) checked and/or applied similar corrections for the major individual areas involved in the intergovernmental agreement in a thorough and appropriate manner.

Precision reflects the fact that there are inherent sources of random variation in the estimates, even after any bias has apparently been removed. This partly is a result of sampling, instead of complete enumeration, of the trees in the forest. Those errors generally follow a bell-shaped probability distribution and hence precision can be gauged by the variance or the standard error of that distribution. Estimates of the precision attached to the 2007 estimates of total sawlog volume were calculated and found by Brack and Vanclay (2011) to be 'small enough to allow useful estimates' of harvest yields and therefore, ultimately, for calculating sustainable yield.

Once biases have been removed or substantially eliminated, precision can provide a useful measure of the risk attached to setting a particular target for overall harvest yield in a particular period. For example, one could use the information to calculate that there is a one in three chance (or a probability of .33) of being able to supply 'X' amount of wood or, conversely, a two in three chance of failing to be able to supply it. This is the direction in which harvest scheduling is moving – towards stochastic models in forest planning.

Burgman and Robinson (2012) acknowledged the desirability of developing a stochastic analysis of the present issues, so that risk could be better explored. They point out that much of the data developed in the course of their work could be used for that purpose, but would require more time and resources than were available to them.

In the longer term, stochastic planning models that allow risk to be quantified and expressed in probabilities will probably rest on the use of global optimization techniques based on a genetic algorithm (e.g. Chikumbo and Nicholas, 2009 and Chikumbo, 2011), rather than linear programming. This partly reflects the ever-growing capability of faster computers to handle even larger problems involving greater attention to detail.

But these are matters for continuing improvement. What can be said of the current situation as to the recognition of risks that lie outside the domain of the current inventory, planning and scheduling system? Area and volume discounts are certainly relevant and have already been canvassed but what of the safety margin.

Safety margins are essentially risk premiums or insurance and are or should be the certainty equivalent value of the risk involved. Mostly, an *ad hoc* headroom value is used to embrace those (often ill-defined) discounts that were not measured, together with a safety margin of unspecified magnitude. Because the discounts are generally not described precisely, and the safety margin is not explicit, comparisons of the headroom factors advocated by different analysts are difficult.

A safety margin poses a dilemma for a commercial State-owned entity like Forestry Tasmania. The Auditor-General of Tasmania (2011) has indicated that a risk-free rate of discount should be used in valuation of Forestry Tasmania. This follows a well-established economic principle that if the Forestry Tasmania contribution to State investment is small, a public entity should be risk-neutral in discounting. Arguably then, risk-neutrality might also be appropriate to the safety margin, making it effectively zero. However, the Forestry Tasmania Board and senior executives might have a different view, because of they may be averse to the risk involved to their commercial or management reputations, and might therefore apply a safety margin on that account. These are matters for the Auditor-General and Forestry Tasmania to resolve and highlight the need for a much closer analysis of the safety margin and more precise use of discounts.

In reviewing whether and at what level a safety margin should be applied, consideration also needs to be given to the 5-yearly periodic review of the calculation of sustainable yield. This enables Forestry Tasmania to adapt to past changes that were unpredictable. The periodic review also enables discounts to be revised in the light of additional evidence and research. Discounts and safety margins should not be viewed as set in concrete – they also merit informed review. Seemingly unpredictable risks such as wildfires, on the other hand, cannot be neglected in future analyses of sustainable yield simply because they did not occur in previous 5-year period.

In terms of major seemingly unpredictable risks, at least two potential 'elephants in the room' loom large. One relates to wildfires and the other to market acceptability of eucalypt plantation produce. There may be other seemingly unpredictable risks but these will serve to illustrate some of the issues involved.

3.8 Wildfires

The utilization of native forest produce from stands of regrowth and remnant old growth extends over a considerable period in Tasmania, providing considerable experience for the native forest industry as to the costs involved, the market acceptance of the various qualities of the ultimate produce, and the prices needed to support viable operations. With the exception of major wildfire, most of the impacts of pests and diseases, small fires, coupe dispersal, creation of informal reserves and environmental constraints are either reflected in the inventory and planning data or can be simulated and estimated via geographic information systems. As Burgman and Robertson (2011) note, small fires are of little long-term consequence, because the salvage operations can, for sawlogs and peelers, be

substituted for currently scheduled coupes and the longer term harvest pattern rescheduled.

Catastrophic fires are more problematic because of the extent and volumes involved and Burgman and Roberson (2012) note the potential of major wildfires on the calculation of sustainable yield. Some research has been done on the mean interval between major fires in Tasmania but is handicapped by the limitations of the historic data and the cost of the alternative methods of fire dating (Marsden-Smedley et al., 2012). Wildfire, although seemingly unpredictable, can be predicted stochastically by constructing simulation models that embody the probabilities of occurrence of a fire and the probabilities that, once ignited, it will reach a certain size (see Ferguson, 2009, 2011). For the Forestry Tasmania estate, due recognition would have to be given to the marked regional differences involved in climate, fragmentation, and forest types. Modeling could also be extended to plantations although the distributions involved would differ.

3.9 Plantations

The Forestry Tasmania strategy, dating back at least to the 1997 RFA report, has been to effect a transition to reduce progressively the harvesting of old growth forest, replacing it by harvest from regrowth forest and plantations. However, experience in processing of the produce of eucalypt plantations was and, in some cases, still is quite limited. This means that there is a substantial potential risk to the processors of eucalypt plantation timber pertaining to the properties and consequent costs and market acceptability of the produce.

Earlier estimates by Forestry Tasmania (2007) were predicated on the assumption that, given early pruning and moderate thinning, *E. nitens* and possibly *E. globulus* would provide sawlogs of suitable quality to yield timber acceptable in the market place in competition with that from native forest and plantation. The experience of the F.E.A. sawmill, while seemingly successful in overcoming some of the seasoning problems, suggests (Poyry, 2011) that the product had not met market expectations at a viable price. That experience, however, involved the use of younger unpruned logs. Nevertheless, as Brack and Vanclay (2011) pointed out, 'while the models may reliably predict the total volume of timber, "pushing" the system to ensure all the veneer material is produced may impact on the amount of sawlog produced'.

Burgman and Robinson (2012: Appendix 2) canvassed these issues at length and concluded:

> The question of how much risk is acceptable, who should bear the risk, and what are efficient mechanisms for sharing the risk, are critical ones that the participants of the process must resolve if the eucalyptus plantations are to be considered among the sources of product.

The Forest Industries Association of Tasmania (FIAT, 2011) expressed some concerns about the acceptability of plantation-grown *E. nitens* but more recently (FIAT, 2012) has recognized that plantation-grown pruned logs can meet the existing definition of 'High Quality Sawlog'.

Only time and experience will resolve the issues of the choice of regimes and ultimate market acceptability. Harwood (cited in Forestry Tasmania, 2012a) argues as follows:

> Nitens has some processing problems, but these can be minimised with appropriate processing techniques. The species was an important native forest timber in Victoria, before most of this native forest base was reserved from harvesting. A new plantation resource will not be suitable for all sectors of the native forest processing industry, regardless of the species. In establishing a plantation sawlog resource there must be a "leap of faith" just as there was with radiata pine, and it is reasonable to expect processors to have to change and adapt to the new resource to some degree, during the 25+ year growing cycle of the plantations

At this point in time, considerable uncertainty and risk clearly attaches to the outcomes and another ten to perhaps twenty years will be needed before such fundamental issues are resolved. Forestry Tasmania (2011b) does not seem to have applied a headroom factor to plantations. Burgman and Robinson (2012) used 10% in their calculations but signaled concerns relating to the uncertainties attached to *E. nitens* plantations. In my view, 30% may be needed for the next 20 years, but could reduce to 10% beyond that time because there is a reasonable likelihood that many of these issues will be resolved. Alternatively, as indicated in the next section, legislative changes might enable the use of a safety margin of 10% or less for plantations.

As indicated earlier, a stochastic analysis based on the views of processing experts would be useful in translating the somewhat arbitrary estimates of headroom into a more appropriate treatment of impact of the risks involved, most likely aiming at prescribing that there be (say) a 90% probability of being able to supply 'Y' annual volume over a particular period.

3.10 Legislative Provision of a Minimum Harvest

Section 22AA of the *Forestry Act 1920* states:

> *(1) Each year, from multiple use forest land, the corporation must make available for the veneer and sawmilling industries a minimum aggregate quantity of eucalypt veneer logs and eucalypt sawlogs that meet the prescribed specifications.*
>
> *(2) In subsection (1), "minimum aggregate quantity" means -*
> *(a) 300 000 cubic metres; or*
> *(b) if another quantity is prescribed - the prescribed quantity.*

The intention of the Act was to protect the processing industry by ensuring a stable continuing minimum supply of eucalypt sawlogs and veneer-slicing logs to local industry. While not strictly a risk in itself, this has a profound impact on the entire planning system because, with progressively increasing resource withdrawals over time, it has become a major, if not the major, binding constraint. It has tended to confound the sustainable yield principle of setting a maximum level for the wood that might be harvested annually and, more importantly, it has largely eliminated the flexibility that might be appropriate in effecting the transition to regrowth forest and plantation sources. The latter point requires elaboration.

Given that the scheduling is essentially being driven by the need to make available at least 300,000 m^3/y of high quality sawlogs, this imposes a set of constraints on the transition to regrowth forest and plantations. The areas

available and prescribed rotation lengths limit the contribution of regrowth forests, so these resources are almost certainly taken up to the maximum. The plantation resource must then take up the slack if a seamless transition is to be effected.

In some ways, setting a minimum level for Forestry Tasmania to make available runs counter to the notion of sustainable yield because of the constraint it imposes. Under the Australian Forestry Standard, in the absence of such legislation, the scheduling would aim to identify the maximum annual harvest with due regard to the risks that would leave the estate in a better condition at the end of 90 years. As noted earlier, the Standard allows some flexibility to accommodate market fluctuations – there is no requirement that the prescribed harvest yield be met each and every year.

Is this legislative requirement on Forestry Tasmania to make available 300,000 m^3/y realistic? The evidence of past harvest level is shown in Figure 2 (Forestry Tasmania 2012a:Attachment A). With the exception of the boom years in 2002-06, the actual harvest has been lower. That exception would not be in breach of the Australian Forestry Standard, given (1) that the Standard requires that legislative provisions be met 'to make available' 300,000 m^3/y, (2) the Standard's flexibility to accommodate market fluctuations, (3) the predominance of levels lower than 300,000 m^3/y, and (4) the evidence of Figure 1 as to the likely condition of the estate in 2096 being somewhat improved on that in 2006.

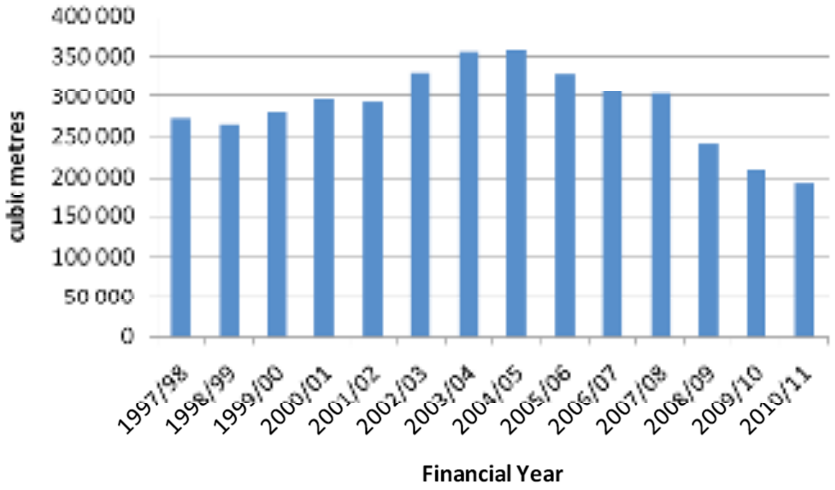

Figure 2. Actual high quality eucalypt sawlog supply from State forest

The legislative requirement was set to provide an assurance to enable industry investment to be maintained in the light of major reductions in the sawlog supply from the 1970s through to the 1991 Forests and Forest Industry Strategy (Walker and Felton 2007). This minimum supply objective was maintained through the 1997 Regional Forest Agreement and 2005 Tasmanian Community Forest Agreement, by providing funding for eucalypt plantations to make up for the sustainable yield foregone by transferring large areas of native forest into reserves.

However, for future yield regulation, it would be far preferable if the legislation were amended to allow the setting of the sustainable yield to relate to the maximum volume to be harvested as described above, for the following reasons.

The seamless transition of the sustainable yield calculations to place greater reliance on regrowth forest and plantation in meeting the 300,000 m^3/y minimum target is presumably predicated on the assumption that such a transition ensures stability of industry activity and dependent employment. While that may be valid for both the existing native forest sawn timber industry and the relatively new veneer-peeling plant, it is unlikely to be achievable for new processors of sawn timber from eucalypt plantations. Given the differences in the species and/or their properties relative to the native forest produce, new sawing and drying technologies will be needed, often requiring staff newly trained in those technologies. New harvesting machinery may be required. New marketing initiatives will be required to gain market acceptance of new and different products. In all likelihood, new entrepreneurs may be involved since a total re-assessment of finances and risks will be required.

Thus, while it is appropriate that governments should be concerned about the transitional employment, that concern would be much better placed in retraining and other assistance for workers leaving the native forest industry, together with accelerated research and training of staff for new processors as the new technologies become operational, than in assuming a seamless transition. Indeed, the calculation of sustainable yield might benefit greatly by dropping the minimum target, exploring the sustainable yield as indicated earlier, and testing a transition period of 10 to 20 years in the startup of all or some of the new processing base on the plantation resource. Such a transition gap does imply a gap in dependent employment but major change seems inevitable even with a seamless transition in volume because of the change in the nature of the employment in the new processing. Furthermore, the additional time would enable longer rotation lengths, potentially larger log sizes and different, hopefully more amenable, properties for both veneer and sawn timber. These observations are, of course, hypotheses and need scrutiny by industry experts.

3.11 Conclusions

1. With some exceptions, the underlying Forestry Tasmania (2007) inventory and planning data reflected the current and future state of the forest, markets and dependent industries appropriately at that time. Most of the exceptions relate to improvements recommended in the course of other reviews and some, relating to a stochastic analysis, have been elaborated further in this review.

2. The Forestry Tasmania (2007) process of calculating sustainable yield meets best practice standards at that time but merits improvement in the course of the 2012 review of the Regional Forest Agreement in order to better address the Australian Forestry Standard principles underlying sustainable yield and the calculation of it.

In particular, the constraints imposed by current legislation to make available a prescribed minimum harvest of 300,000 m3/y of high quality sawlogs need to be amended to enable the Australian Forestry Standard principles underlying the calculation of sustainable yield to be properly implemented. Also, the implied rigidity of a steady annual harvest in the seamless transition of volume involving greater reliance on supply from

regrowth forest and plantations needs to be reconsidered, not least in relation to the uncertainty and risk attached to the transition to greater use of eucalypt plantation sawlogs and peeler logs.

3. Forestry Tasmania regulated the harvest yield in a manner consistent with the requirements of the Australian Forestry Standard and the 2007 calculation of sustainable yield.

4. THE ALLEGATION OF UNSUSTAINABILITY

The Premier of Tasmania (Giddings, 2012) has released the following statement in relation to the report by West (2012) that contains references to alleged unsustainability:

> The Premier, Lara Giddings, said the paper released by Professor Jonathan West today reflected his personal view of the challenges confronting the forest industry.
>
> Ms Giddings said the paper was not part of the terms of reference of the Independent Verification Group and as such, was not be part of negotiations between signatories to the statement of principles.
>
> "The paper represents Professor West's personal views and was used as the basis for the presentation he made to Cabinet this week," Ms Giddings said.
>
> "This report was not suppressed by the government, it was always Professor West's work to release.
>
> "Like the five reports prepared by the IVG and commissioned by the State and Federal Government, the paper prepared by Jonathan West deals with matters that are contestable.
>
> "That is not to say that Professor West's views do not have merit, but it is important that we do not prescribe one man's view above any others.
>
> "It is imperative that the signatories to the statement of principles are given the space to consider the range of differing views in this debate in order to try to reach a negotiated settlement.
>
> "Reaching a settlement will not be easy but given the history of unresolved forest conflict in Tasmania, I firmly believe that an agreed settlement gives us the best possible chance of finding a lasting solution to the forest conflict that has divided our state for too long."

My charter in examining the West assertions is to see whether they accurately reflected the findings of that Group and other relevant recent reports relating to Forestry Tasmania and so to ascertain whether Forestry Tasmania has breached the Australian Forestry Standard requirements concerning the calculation and regulation of sustainable yield.

The West (2012) report states that the 'goal has been to provide a body of independently validated information as a sound foundation for a durable agreement to end the decades-long conflict that has been so damaging to the fabric of Tasmania's society and economy.'- an admirable goal.

Later (West, 2012: p 3) the report states:

> It is vital to understand that the wellbeing of each element of the native-forestry industry depends on the health of the whole. Unless each major component of the forest is able to be marketed profitably—including residue in the form of woodchips or pulp, smaller logs in the form of peeler billets, and larger, higher-quality sawlogs—it becomes uneconomic to harvest our forests at all. Such an outcome threatens to make the native-forest industry in its entirety unviable, and especially the government-owned entity that manages the forests and harvesting operations, even if individual components continued to be profitable.

What is troubling about this statement is not the sentiment, but the fact that it seems to refer solely to native forest, with no mention of plantations.

Further on, in discussing the Independent Verification Group methodology, the report states:

> To avoid such a future, Tasmania needs to ground any resolution to the forest dispute on two vital principles: *first*, the industry must be restored to a sustainable-yield basis, and *second*, all major parties to the conflict must understand and accept any compromise solution. Without sustainability, the industry will ultimately exhaust its resource—and our analysis reveals the potential for this to occur in some segments alarmingly soon.

The inference of the first part of this statement is that the industry is not on a sustainable yield basis. I am unable to see how the West (2012) report reaches this conclusion in terms of the Australian Forestry Standard definition and provisions for calculating sustainable yield.

These statements lead to the key finding by West that:

> 1. **Tasmania's native forests (not including plantations) have been and continue to be harvested substantially above long-term sustainable yield, in respect of the key product segments to which they provide resources.**

I am unable to see how the West (2012) report can logically exclude plantations, given the Forestry Tasmania definition of the Defined Forest Area, not to mention the long history that explicitly incorporates plantations into the transition to the greater use of regrowth forest and plantations in the place of old growth harvesting. This problem recurs in the following excerpt (West, 2012:p4).

> For high-quality sawlogs, Forestry Tasmania is committed by current legislation to provide a minimum of 300,000 cubic metres of resource each year, and until the exit of Gunns last year had signed contracts to supply an estimated 320,000 cubic metres.
>
> Our finding—employing only Forestry Tasmania data with estimation models run by Forestry Tasmania personnel on Forestry Tasmania computers, and peer reviewed by eminent independent forestry experts, is that with appropriate allowances for non-retrievable timber due to mandatory forest-practices regulation (so-called "headroom"), the sustainable annual yield of high-quality sawlogs from native forest is between 117,600 cubic metres (allowing for a non-retrieval rate of 40%) and 156,800 cubic metres (allowing for a 20% non-retrieval rate). Put simply, Forestry Tasmania had been committed to harvesting sawlogs from

> native forest (not including plantations) at about double sustainable yield.
>
> For peeler billets, Forestry Tasmania is committed by contract to provide Ta Ann with 265,000 cubic metres of resource each year until 2022, and it is our understanding that Ta Ann holds a contract option for this supply for a further 5 years beyond 2022. Our finding is that the sustainable yield of peeler billets from native forest is between 76,200 cubic metres (at the 40% headroom level) and 101,600 cubic metres (at the lesser 20% headroom level). This implies that Forestry Tasmania has also been harvesting peeler billets from native forest (again, not including plantations) at about double sustainable yield.

The first paragraph is inaccurate in that the legislation refers to making available a supply of 300,000 m3/y of 'eucalypt veneer logs and eucalypt sawlogs that meet the prescribed specifications'. The contractual commitments are not in breach of that legislation, as seems to be implied.

The second paragraph, leaving aside the ambiguity of the collective 'our finding', asserts the Forestry Tasmania has been committed to harvesting sawlogs at about double the 'sustainable yield from native forest.' This assertion is based on the Burgman and Robinson (2012: Table 18) estimates for the harvest yields from the native forest alone. Clearly, this is NOT the sustainable yield applicable under the Australian Forestry Standard because it strings out the harvest of old-growth native forest over a 100 year planning horizon, whereas the Forestry Tasmania's explicit strategy was to make as rapid a transition from predominantly old-growth harvest of native forest to regrowth and plantation harvest as was possible. West (2012) also ignored the Burgman and Robinson (2012:p72) caveat immediately following Table 18 that 'FT was required to adopt a strategy of sustained (sic) yield that relied on both native forests and plantation'. The values of 'sustainable yield' cited by West (2012) therefore have no relevance to the assertion. The actual average annual harvest of high quality eucalypt sawlogs (288,000 m3/y since 1997) was, in the long run, substantially less than the sustainable yield under the Australian Forestry Standard, remembering that the sustainable yield (300,000 m3/y) was effectively stipulated by legislation requiring Forestry Tasmania to 'make available' that amount under a strategy involving a progressive transition to greater reliance on regrowth and plantation.

The particular example used by West to support the allegation of unsustainability is one based on the application of 'non-declining yield' and excludes plantations. Non-declining yield is a particular construct quite widely applied in forest management and essentially uses special constraints to ensure that the harvest yield of the next 10-year planning period cannot be less than that of the previous period. Notwithstanding its widespread use, I have major reservations about this degree of rigidity, well exemplified by the Forestry Tasmania situation had plantations been included in the optimization. In this case, it would automatically result in a seamless transition in harvest yields, whereas I have earlier argued that the situation would benefit from a gap in the transition and a re-evaluation of the subsequent harvest yield. Provided the two main underlying principles of sustainable yield dealing with long term continuity and a better condition at the end of the planning horizon are met, applying a fixed harvest yield regime through non-declining yield seems counter-productive to intelligent analysis of harvest yields in long term sustainable

forest management.

In interpreting West's (2012) comments, it is important to note the requirements for Tasmanian Forests Agreement Verification stemming from the Tasmanian Forests Intergovernmental Agreement. A Signatories Scenario Workshop in May, 2011 (Forestry Tasmania, 2011b: Appendices 1 and 2) further elaborated these requirements. Burgman and Robinson (2012) addressed the requirements in providing piecemeal corrections and wood supply estimates to facilitate the tradeoffs involved between the Governments and the Environmental Non-Governmental Organisations. Regrettably, from an Australian Forestry Standard viewpoint, they used the term 'sustainable yield' widely to apply to estimates of harvest yields across various resource Scenarios that sometimes excluded plantations, thereby contributing to the subsequent confusion. Scenarios 3, 4, 6 and 8 included plantations and are therefore consistent with the Australian Forestry Standard. However, they relate to prospective changes under negotiation and do not address the calculations for the 2007 Sustainable Yield Review of the Regional Forest Agreement that form the current basis of harvest regulation.

The third paragraph repeats the omission of plantations from the discussion of sustainable yield, notwithstanding very clear statements both historically and presently, that the basis was to ensure a transition to greater reliance on wood from regrowth forest AND plantations. However, the contracts also include provisions for Forestry Tasmania to source peeler billets from private property, so there is yet another source of supply to be considered before making judgments about these contracts. West (2012) ignores both plantation and private forest sources of supply.

The section of the West (2012) report dealing with the first key finding cited above concludes with two observations, the first being that:

> It is important to recognise that sustainable yield is the most fundamental principle of sound forestry management. It is the Hippocratic Oath equivalent: the forests *must not* be harvested at a rate greater than that at which they regrow.

The first part is another point on which I can agree with West, although I would add the caveat that sustainable yield entails the intelligent analysis and planning of present and desired future forest structures, not a pursuit of a steady state that cannot be implemented in practice.

The second observation is that:

> In summary, for Forestry Tasmania to commit to harvest Tasmania's native forests at levels double that of long-term sustainable yield would appear to expose the industry that exists today in Tasmania to excessive risk of resource depletion and market rejection, unless plantations prove in future able to provide large quantities of sawlogs and peeler billets, which at this point appears highly uncertain and to contradict a growing body of evidence and belief in the industry.

The first part of this statement is incorrect because it is interpreting the Forestry Tasmania sustainable yield to exclude plantations. The reference to plantations in the second part is therefore curious, because it indicates that West was not totally unaware of their importance in the calculation of sustainable yield. However, I agree with him that the supply of eucalypt plantation peelers and

sawlogs must be better resolved in revising the calculations of sustainable yields for the Regional Forest Agreement review. West's (2012:p6) awareness of the future role of plantations is spelt out even more forcefully in the second section of his key findings, although the area of eucalypt plantations cited (55,960 ha) is incorrect and should refer to the 36,674 ha of eucalypt plantations that are under Forestry Tasmania's management and form part of its Defined Forest Area.

Conceptually and arithmetically, however, the West/Burgman/Robinson estimates of sustainable yield that exclude plantations are not and cannot be consistent with the definition and calculation of sustainable yield under the Australian Forestry Standard.

The calculated yield under constrained optimization rests on the principles of establishing a harvest that can be sustained over a long period, albeit recognizing market fluctuations, under a legion of constraints AND that leaves the defined forest area in better condition at the end of the planning period. In the Australian Forestry Standard process, the value so calculated is therefore dependent on the contributions that plantations make **and/or** the final condition. **Exclude or change either, and the value for overall sustainable yield will change, as will any other related sub-component (e.g. a native forest Region) thereof**.

The failure to recognize the distinction between the requirements of Tasmanian Forests Agreement Verification for wood supply on 'sustainable forest management basis' and the Australian Forestry Standard definition in their use of the term 'sustainable yield', based on a differing resource base, is at the heart of the confusion arising from West's (2012) allegations of unsustainability.

Values from optimization scenarios that specifically exclude the role of plantations have no relevance to Forestry Tasmania's sustainable yield as defined in the Australian Forestry Standard.

4.1 Conclusions

In terms of the Australian Forestry Standard, I am unable to determine a rational basis in the Independent Verification Group reports, or related documentation, for the West (2012) assertions about the unsustainability of Forestry Tasmania sustainable yield calculations or practices. They do not appear to be founded on the facts pertaining to the Australian Forestry Standard and the evaluations of the Forestry Tasmania process of calculating the sustainable yield and regulating the annual harvest. From an Australian Forestry Standard viewpoint, they reflect an unfortunate confusion in the use of the term 'sustainable yield'.

5. COMPLAINT FROM MR. G. LAW

NCSI also received a complaint from Mr. G. Law regarding the "Unsustainable Logging of State Forest Managed By Forestry Tasmania' dated May 2012 hereafter referred to as Law (2012). Subsequent to writing the first draft of my report, Forestry Tasmania (2012b) supplied a response that identifies various errors in the Law complaint. I do not propose to labor these as the complaint was written in good faith and the essential points can be more briefly and clearly summarized as follows.

In summary, Law (2012) alleges that:

1. Forestry Tasmania has been cutting its forests at well above the rates that can be sustained in the long term and in so doing is diminishing the productive capacity of Forestry Tasmania's native forest in breach of the Australian Forestry Standard Criterion 4, Sections 4.1.1 and 4.4.2 Criterion3, Sections 3.1 and 3.6 (see also PEFC 5.3, 5.3.1 and 5.3.6).
2. In addition, Forestry Tasmania has signed contracts (Ta Ann in particular) that cannot be met sustainably because the eucalypt plantation resource is not capable of supplying sufficient sawlogs and peeler logs.

Each of these allegations is reviewed in turn.

5.1 Unsustainable Cutting

Law (2012) accurately reports a number of the Australian Forestry Standard and other provisions but has failed to grasp the critical points that the calculations and implementation of sustainability refer to the Defined Forest Area, which includes plantations, and that some flexibility is permissible under the Australian Forestry Standard to accommodate market fluctuations.

5.1 For reasons detailed previously, the allegation of unsustainable cutting has no basis in fact under the Australian Forestry Standard or PEFC provisions. Mr. Law bases this allegation on a misconception of the provisions of the Standard.

5.2 Signed Contracts

In an earlier section (3.10) of the report, I have acknowledged that there are serious concerns over the capacity of the *E.nitens* plantation resource to supply sufficient of the earlier predicted volumes of sawlogs and peeler logs of acceptable quality to meet the seamless transition in sustainable yield as the native forest supply reduces markedly around 2031. I have recommended that policy changes to the seamless transition are desirable. These would alleviate the sustainable yield nexus but not necessarily the contractual issues. However, the contracts between Forestry Tasmania and Ta Ann require Forestry Tasmania to source peeler billets beyond State forests, including from plantations and/or from private forests (Forestry Tasmania, 2012b), which expands the scope of the supply review that is needed. Law's concerns may prove exaggerated but only time will tell.

5.2 Should Mr. Law's prognostications relating to peeler contracts prove well founded during the 2012 RFA review (or any later reviews), it will be incumbent on Forestry Tasmania to consider its contractual liabilities and promptly renegotiate the contracts to meet the Australian Forestry Standard provisions for sustainable yield.

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APPENDIX A

PEFC Council PO box 636, Geneva CH-1215 Switzerland

Mr Michael Berry
NCS International
Suite 2 level 1
7 Leeds Street
2138 Rhodes, NSW
Australia

April 3, 2012

Subject: Complaint concerning "unsustainable harvesting" by Forestry Tasmania - certificate No.14647 certified under the Australian Forestry Standard, (PEFC endorsed).

Dear Mr Berry,

The PEFC Council hereby submits an official complaint and request for investigation into the assertions made in the Report of the Chairman of the Independent Verification Group of the Tasmanian Forests Intergovernmental Agreement concerning unsustainable harvesting yields carried out in the forestry holdings of Forestry Tasmania.

The report, available at http://www.forestry.org.au/news/articlefiles/1931-Report%20of%20the_Chair-Tasmanian-Forests-Intergovernmental-Agreement.pdf, claims that Forestry Tasmania is harvesting above sustainable yields levels.

A claim of unsustainable harvesting is a serious matter and requires urgent investigation concerning potential non-compliances with the requirements set out by the PEFC-endorsed Australian Forestry Standard. The PEFC Council is aware that you have already received a complaint on this subject, which reiterates the seriousness of this matter.

I look forward to the results of your investigation, which PEFC intends to make publicly available.

Please do not hesitate to contact me should you require further information.

Yours Sincerely

Dr. Michael Berger
Head of Technical Unit, PEFC Council

Cc:
Ben Gunneberg, Secretary General, PEFC Council
Richard Stanton, National Secretary, Australian Forestry Standard Limited/PEFC Australia
Robert Gordon, Managing Director, Forestry Tasmania