Sustainable high quality eucalypt sawlog supply from Tasmania's Permanent Timber Production Zone Land

Review No. 5
July 2017

Sustainable Timber Tasmania

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Note: Minor updates to report made in March 2019

FIGURES

Summary

Sustainable Timber Tasmania monitors eucalypt timber production from native forests and plantations on Permanent Timber Production Zone land. It also models the sustainable yield to monitor that the rate of harvesting is consistent with its statutory obligations and sustainable forest management objectives.

Clause 98 of the Tasmanian Regional Forest Agreement requires a five yearly review of the sustainable yield of high quality eucalypt sawlogs from State forests (now Permanent Timber Production Zone land). Previous reviews in 1998, 2002, 2007 and 2014 incorporated the effects of successive changes in the resource base over that period. This 2017 review incorporates the relevant legislation: the *Forest Management Act (Tas) 2013* and the *Forestry (Rebuilding the Forest Industry) Act (Tas) 2014*.

This review confirms Sustainable Timber Tasmania's ability to make available at least 137,000 cubic metres per year of high quality eucalypt sawlogs from Permanent Timber Production Zone land for the next 90 years. However, these yield predictions are generated from biologically based forest estate modelling of productive capacity, and do not imply supply based on economic criteria.

The yield described in this review is consistent with Sustainable Timber Tasmania's Forest Management Plan and draft High Conservation Value Assessment and Management Plan, but will need to be confirmed once the High Conservation Value Management Plan has been finalised.

Taken together, the predicted yields for arisings from eucalypt native forests and plantations, and the predicted yields for peeler logs from eucalypt plantations, represent an ongoing opportunity for a transition in supply from traditional markets for logs other than high quality eucalypt sawlogs (such as pulpwood) to new engineered wood product markets.

Introduction

This is the fifth review of the sustainable yield of high quality eucalypt sawlogs from public land in Tasmania. Conduct of this review is a requirement under Clause 98 of the 1997 Tasmanian Regional Forest Agreement (Commonwealth of Australia and State of Tasmania, 1997). The results of previous equivalent reviews were published by Forestry Tasmania in 1998, 2002, 2007 and 2014.

> **Clause 98 of the 1997 Tasmanian Regional Forest Agreement**
>
> **Review of Sustainable High Quality Sawlog Supply Levels**
>
> 98. The State agrees to undertake a review of sustainable high quality sawlog supply levels from public land to reflect the changes in the forest inventory and new intensive forest management initiatives concluded in this Agreement. The review will be completed and published during the first year of this Agreement, and thereafter will coincide with the 5 yearly reviews of this Agreement.

This review reports on the predicted yields of peeler logs, pulpwood and other products arising from the sustainable yield of high quality eucalypt sawlogs, as in previous reviews.

This review is based on the detailed and complex analysis of large quantities of data. As in previous years, this report is an overview of the work that was done to conduct this review, and of its results. Sustainable Timber Tasmania welcomes feedback from the readers of this report, about the way in which it communicates the results of its reviews of sustainable yield. A feedback form is included at Appendix 2.

The glossary, included in this review, gives definitions for the various log products and other technical terms to which it refers.

The yield described in this review is consistent with Sustainable Timber Tasmania's Forest Management Plan and draft High Conservation Value Assessment and Management Plan, but will need to be confirmed once the High Conservation Value Management Plan has been finalised.

Background

Sustainable forest management has been defined as the integration of the commercial and non commercial values of forests to improve the material and non material welfare of society, whilst ensuring that the values of the forest as a resource for commercial use and for conservation are not lost or degraded for current or future generations (Commonwealth of Australia, 1992). Sustainable forest management is the underlying foundation of Sustainable Timber Tasmania's business.

Sustainable Timber Tasmania measures its performance of sustainable forest management against internationally agreed criteria under the Australian Forestry Standard. One of the criteria against which sustainable forest management is measured is the extent to which the productive capacity of the forest is maintained over time. The productive capacity of Tasmania's Permanent Timber Production

Zone land is measured against several indicators, one of which is the predicted long term yield of high quality eucalypt sawlogs. This indicator has been used in Tasmania as a primary indicator for at least 30 years.

This review reflects the requirements of Section 16 of the *Forest Management Act (Tas) 2013* which states that a minimum of 137,000 cubic metres high quality eucalypt sawlogs must be made available for the industry annually. No other prescriptions exist under this legislation.

Section 16 of the *Forest Management Act (Tas) 2013*

16. Wood production supply

(1) Each year the Forest Manager must make available –

(a) for the veneer and sawmilling industries, a minimum aggregate quantity of eucalypt veneer logs and eucalypt sawlogs, from permanent timber production zone land, that meets the prescribed specifications that are in force immediately before the commencement of this Act; and

(b) for a prescribed industry, the prescribed quantity, prescribed type and prescribed specification of other prescribed timber (including special species timber, as defined in section 19(1) of the *Tasmanian Forests Agreement Act 2013*).

(2) In subsection (1)(a) –

minimum aggregate quantity means –

(a) 137 000 cubic metres of any combination of eucalypt veneer quality 1, eucalypt veneer quality 2, category 1 sawlogs, and category 3 sawlogs, as specified in Schedule 1 to the *Forestry Regulations 2009* ; or

(b) if another quantity is prescribed, the prescribed quantity.

(3) The regulations may prescribe the time for which the quantity, type and specification of other timber is to be made available and the source of the other timber.

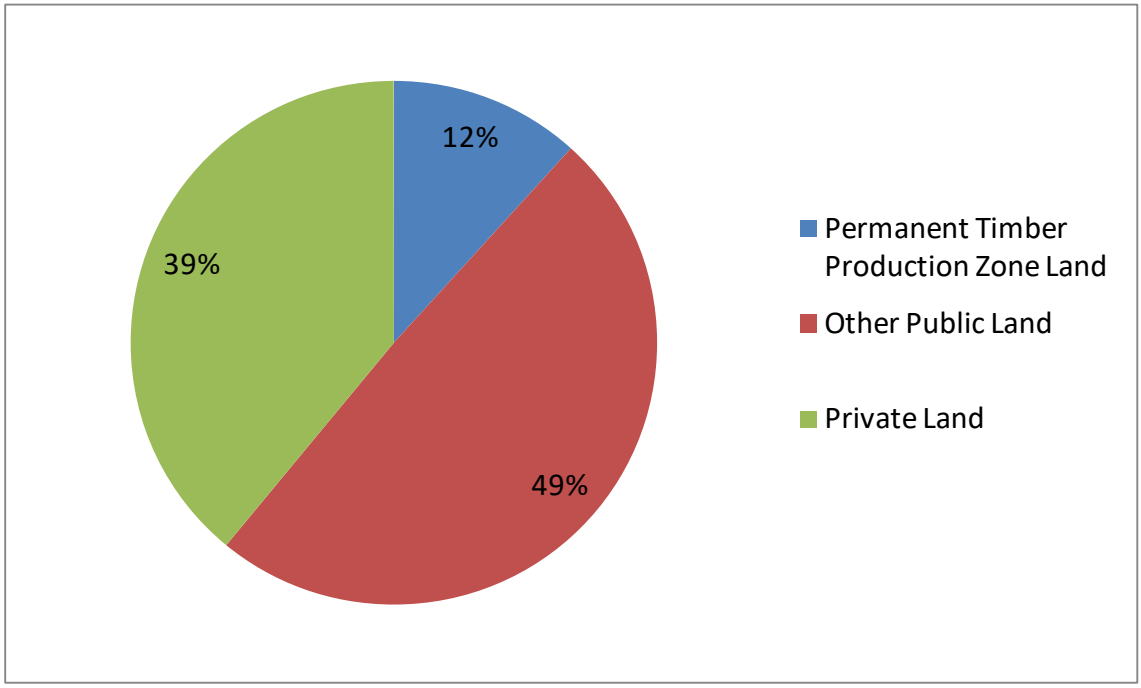
This review focuses on both eucalypt native forests and eucalypt plantation forests on Permanent Timber Production Zone land. Hence Sustainable Timber Tasmania's softwood plantation management is outside the scope of this review. Sustainable Timber Tasmania's management of special timbers is also largely outside the scope of the review because the resource is mainly from blackwood forests and rainforests. However some of the resource also occurs as mature eucalypt forest with an understorey rich in special timbers. Modelled yields from these forests continue to contribute to estimates of sustainable high quality eucalypt sawlog yield but the harvesting of these forests will be optimised to ensure maximum recovery and the continued representation of special timbers within the regenerated stands.

Resource base

Land and forest area

As at 30 June 2016 Forestry Tasmania managed a land base of 821,000 hectares (Forestry Tasmania, 2016a, p. 12), of which 812,000 hectares is designated as Permanent Timber Production Zone land. This figure represents about twelve per cent of Tasmania's total land area (Figure 1).

Figure 1 Status of land in Tasmania



Permanent Timber Production Zone land is categorised using a map based zoning system, known as Management Decision Classification ("MDC"), to delineate areas of forest that are to be managed for wood production and those that are to be managed for uses other than wood production (Forestry Tasmania, 2016b).

The basic operational unit for timber harvesting is the coupe. All forest that is within the Permanent Timber Production Zone land and that has been classified as available for wood production under the MDC zoning system has been mapped into provisional coupes (Forestry Tasmania, 2014a, p. 8-9).

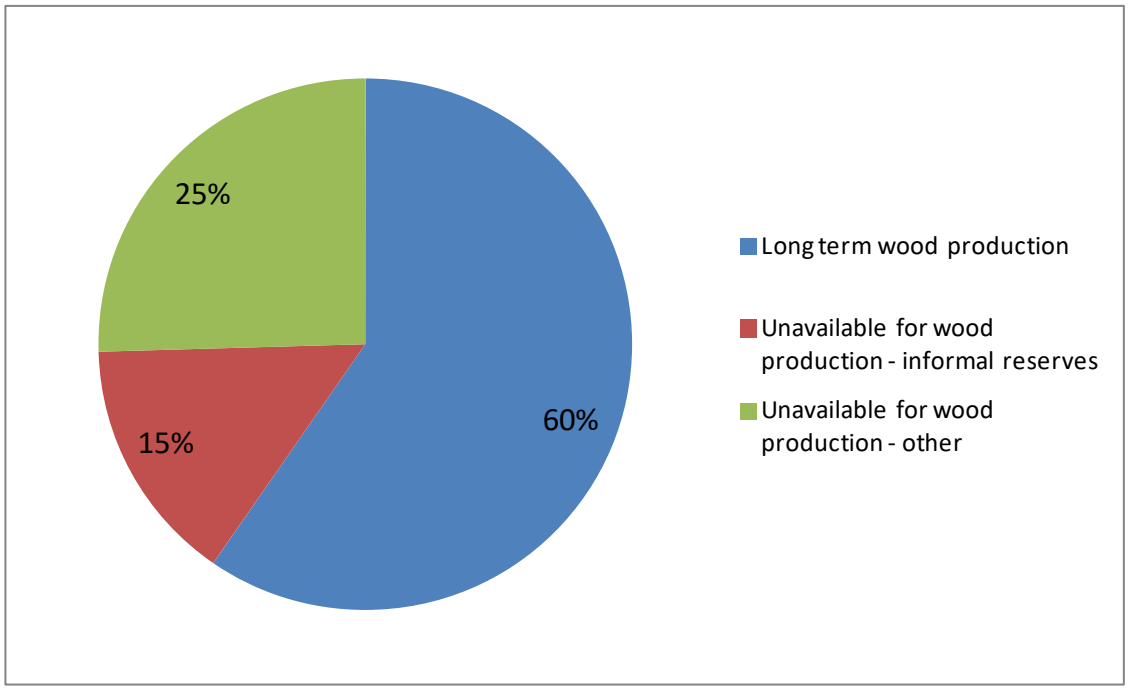
Figure 2 shows the results of the classification of Permanent Timber Production Zone land under the MDC zoning system and the subsequent mapping of wood production areas into provisional coupes. Of the 812,000 hectares of Permanent Timber Production Zone land :

(a) 60% is in provisional coupes, designated for long term wood production (including 10% managed by other forest management companies);

(b) 15% is in reserves that form part of Tasmania's Comprehensive, Adequate and Representative Reserve System; and

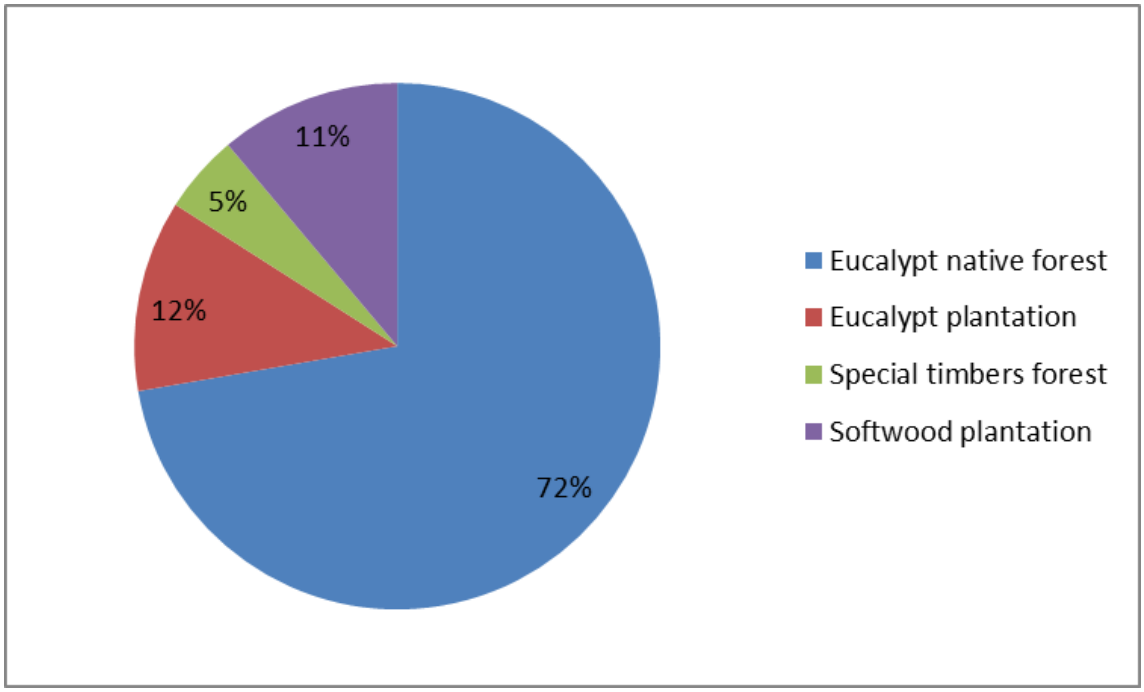
(c) 25% is unavailable for wood production because of other management priorities (e.g., conservation).

Figure 2 Land use classification of Permanent Timber Production Zone land



The area designated for long term wood production (i.e., the area within provisional coupes) can be further classified into broad forest management types (Figure 3). This review assumes that there will be little change to the area within each classification over the modelled period. In particular, this reflects Forestry Tasmania's policy since 2007 that no areas of native forest be converted to plantation.

Figure 3 Forest management classification of areas available for wood production



This review is based on the areas of eucalypt native forests and about half of the eucalypt plantations shown in Figure 3. These account for 78 per cent of the area available for wood production. This equates to about 45 per cent of the area of Permanent Timber Production Zone land, or about five per cent of Tasmania's total land area.

Special timbers forests and softwood plantations are not included in this review, nor are 29,000 hectares of eucalypt plantations on Permanent Timber Production Zone land managed by other parties.

Eucalypt forest management

Eucalypt forests are managed primarily on rotations that are of sufficient length so that a reasonable proportion of the trees that are harvested are large enough to meet the specifications for high quality eucalypt sawlogs. For eucalypt native forests, the nominal rotation length is 90 years (typically varying from about 60 years on highly productive sites to about 120 years on sites of low productivity)[1]. For eucalypt plantations that are managed for sawlog production, the nominal rotation length is 25 years. Actual rotation lengths for individual coupes vary according to local site conditions and to the

[1] Rotations of 200 years are assigned to the 4500 hectares of mature eucalypt forest designated for special timbers.

requirement to avoid large variations in supply from one period to the next. Rotation lengths for eucalypt native forests and eucalypt plantations can also be reduced by thinning operations that remove trees of lower quality or size and thereby accelerates the growth of the remaining trees. Thinning can also result in an interim harvest of logs (e.g., peeler logs, pulpwood or poles and posts) that would otherwise be lost to natural mortality.

Eucalypt native forests are generally managed under either a partial felling regime or a clearfelling regime (with or without thinning). Sustainable Timber Tasmania applies partial felling wherever possible, particularly in highland eucalypt forests and lowland dry eucalypt forests. Adequate eucalypt regeneration in these forests can generally be achieved with low to moderate disturbance, i.e., there is no requirement for high intensity burning and sowing. Partial felling generally accounts for about half of the area of eucalypt native forest that is harvested each year. Clearfelling is applied in situations where the site conditions (e.g., topography and understorey) mean that adequate eucalypt regeneration cannot otherwise be achieved safely and reliably and at a reasonable cost. These conditions are typical of lowland wet eucalypt forests.

Sustainable Timber Tasmania applies variable retention, wherever feasible, in some eucalypt native forests that might otherwise be managed by clearfelling, burning and sowing. Variable retention moderates the visual and ecological impacts of clearfelling, burning and sowing, by retaining strategically located areas of native forest within harvested coupes.

Eucalypt plantation forests (comprising either *Eucalyptus globulus* or, in areas susceptible to frost, *E. nitens*) are generally managed under a clearfelling regime, with pruning and thinning. Sustainable Timber Tasmania's strategic objective for eucalypt plantation management is to maximise the production of high quality (pruned) logs. Pruning is usually undertaken on about the first six metres of the tree in three stages. The timing and intensity of thinning depends on site productivity and wind risk. Thinning usually reduces the final stocking to about 300 stems per hectare at around age 10. However, on high quality sites, value is maximized by conducting two thinning operations, at about age 8 and age 12, to a final stocking of about 200 stems per hectare. Trials of more radical thinning treatments, down to as low as 100 stems per hectare, have been established and continue to be evaluated. Where the production of high quality (pruned) logs is not considered feasible, the production of alternative products (unpruned logs, peeler and pulp logs) is maximised.

Productive capacity

The productive capacity of a forest over time can be measured by comparing the total standing quantity of merchantable wood at the beginning and end of the planning horizon.

The total standing quantity of merchantable wood within eucalypt forest areas available for wood production at the date of this review is about 41 million cubic metres.

Review method

This review follows a similar method to past reviews (Forestry Tasmania, 2014a; Whiteley, 1999). The method used for eucalypt plantations is analogous to that which is used for native forests.

The main components of Sustainable Timber Tasmania's yield forecasting system are:

(a) the area of each type of forest that is available for wood production, based on detailed mapping of forest types (Stone, 1998) and provisional coupes within Permanent Timber Production Zone land;

(b) allowances for each of the many factors that might reduce the area actually harvested, relative to the area available, based on field reconnaissance, detailed mapping and historical data;

(c) predicted yields of each relevant forest product per hectare, for each of 95 identified forest classes in 21 inventory areas, based on plot measurements, growth models and historical data; and

(d) various constraints, based on sustainable yield principles, operational factors and supply targets over time for each relevant forest product.

The relevant data for (a) to (d) are used as inputs to a specialised forest estate modelling software system (the "Woodstock" module of the Remsoft Spatial Planning System - see http://www.remsoft.com/ for more detail). The forest estate model is run as a linear programming optimisation – see https://en.wikipedia.org/wiki/Linear_programming for more detail. The outputs of each run are analysed, and the constraints are modified over successive iterations until an outcome that meets all relevant objectives is found.

The review process has been independently audited by Dr Cris Brack from The Fenner School of Environment and Society, Australian National University. The Executive Summary of the audit is included at Appendix 1.

Management strategy

Sustainable Timber Tasmania's current management strategy has evolved through the Tasmanian Forests and Forest Industry Strategy (Forests and Forest Industry Council, 1991), the Tasmanian Regional Forest Agreement (Commonwealth of Australia and State of Tasmania, 1997), the Tasmanian Community Forest Agreement (Commonwealth of Australia, 2005), the Tasmanian Forest Agreement 2012, *Tasmanian Forests Agreement Act (Tas) 2013* and *Forest Management Act (Tas) 2013*, and most recently by the *Forestry (Rebuilding the Forest Industry) Act (Tas) 2014*.

The impacts of these strategies, agreements and legislation up until 2013 have been documented in previous reviews of the sustainable yield of high quality eucalypt sawlogs from Tasmania's public forest (e.g., see Forestry Tasmania, 2014b) and their relevant outcomes incorporated in those reviews (Forestry Tasmania, 1998, 2002, 2007 and 2014b).

A key element of the management strategy over the period since 1991 has been to reduce progressively the harvesting of oldgrowth and mature native forest, replacing this with a harvest from regrowth native forest and plantations. However, experience in processing the produce of eucalypt plantations, especially those

grown on longer sawlog rotations, is still quite limited. This means there is a substantial risk to the processors of eucalypt plantations pertaining to the cost, properties and market acceptability of the produce (Ferguson, 2013).

In 2012 the Forest Industries Association of Tasmania indicated that, based largely on overseas experience, it may be able to successfully process sufficiently-sized material from *E. globulus* plantations with existing technology (FIAT, 2012). Processing trials on *E. nitens*, which represents the majority of the estate, have demonstrated that processing of this species with existing technology is problematic due to internal and surface checking and lower than optimal stiffness. At that time the industry did not believe that *E. nitens* was acceptable for traditional sawn timber products, nor for rotary peeled veneer products, but that more time and subsequent maturity of the resource may provide cause to review its position. Industry did however acknowledge and accept that plantation grown pruned logs can meet the existing definition of high quality eucalypt sawlog and should continue to be counted within the sustainable yield from Sustainable Timber Tasmania's estate, as prescribed under the Tasmanian Regional Forest Agreement.

The management strategy that has been applied in this review incorporates two key items confirmed as a result of the *Forest Management Act (Tas) 2013* and the *Forestry (Rebuilding the Forest Industry) Act (Tas) 2014*. These can be summarised as follows:

(a) a continuation of the area managed by Sustainable Timber Tasmania, of 821,000 hectares, including 812,000 hectares of Permanent Timber Production Zone land; and

(b) a continuation in the legislated annual minimum high quality eucalypt sawlog to be made available, of 137,000 cubic metres.

In addition, other items incorporated in the last review continue. These can be summarised as follows:

(c) a continuation in the quantity of eucalypt peeler logs contracted for annual supply to Sustainable Timber Tasmania's relevant domestic customer of 195,000 tonnes, until at least 30 June 2027; and

(d) the application of a "headroom factor", being a percentage discount to the modelled predicted yields of each relevant forest product, as a safety margin to account for the potential impact on harvest areas and yields of any future changes to the requirements for conservation under the Forest Practices Code (Forest Practices Authority, 2015).

Past actual production

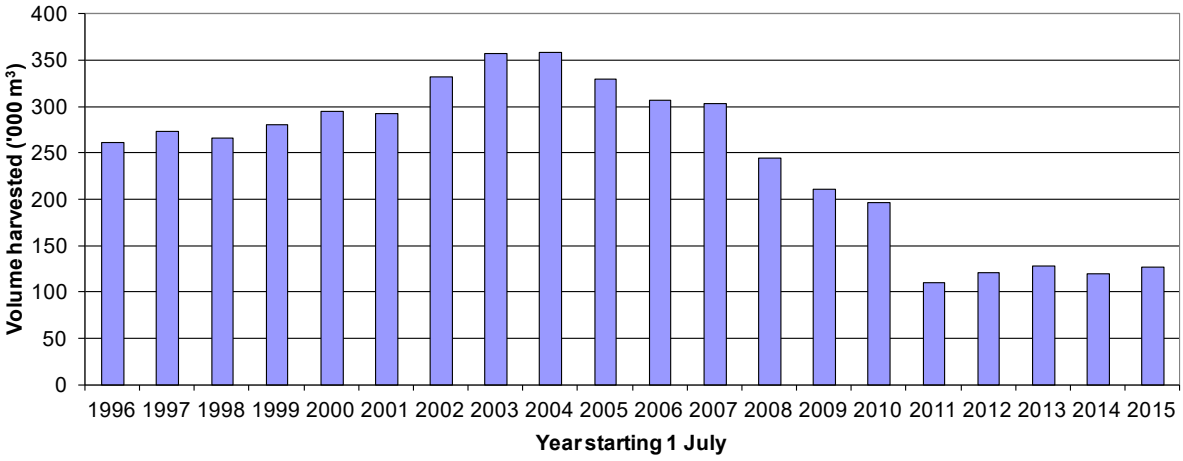
The actual annual production for each relevant forest product over the preceding period (Figures 4 to 6) provides some context for the predicted yields that are reported in the following section. The data shown are sourced from Forestry Tasmania's annual reports over the period 1996/97 to 2015/16.

Annual variations that are evident from the data generally represent changes in customer demand for the relevant forest products, rather than changes in Forestry Tasmania's capacity to harvest and supply those products.

Figure 4 shows the annual supply of eucalypt high quality sawlogs over the period 1996/97 to 2015/16. As with each previous review, the average actual supply for the

past period, i.e., for the three years 2013/14 to 2015/16 (125,000 cubic metres per year), has been less than the quantity that was identified as being available over that period (137,000 cubic metres per year, identified in the 2014 review).

Figure 4 1996/97 to 2015/16 actual annual supply of high quality eucalypt sawlogs from public forest



Forestry Tasmania experienced a significant decline in the demand for high quality eucalypt sawlogs, from 2008/09 onwards. This decline resulted from the implementation, by its largest customer at the time, of a strategic decision to reduce the production of eucalypt sawn timber. Other customers for high quality eucalypt sawlogs continued to report strong demand for eucalypt sawn timber. However, in 2011/12, these customers also reduced their demand for high quality eucalypt sawlogs. This was because the market for their sawmill residues (the by-products of the milling process to produce sawn timber) practically ended when Forestry Tasmania's largest customer withdrew from most of its woodchip export operations. The sawlog demand has recovered somewhat since 2012, but the supply has been hampered by a number of factors, including a transition out of roaded areas designated as future reserves under the (now defunct) Tasmanian Forest Agreement into alternative areas that required upgraded infrastructure, a weak demand for pulpwood, limited access to ports and disruptions in harvesting contractor capacity. Each of these issues continues to be actively addressed.

Figure 5 shows the annual supply of domestic eucalypt peeler logs over the period 1996/97 to 2015/16. Supply to Forestry Tasmania's customer commenced in mid 2007, with the commissioning of the first rotary peeled veneer mill in May of that year. Supply to the second rotary peeled veneer mill commenced in late 2008. Almost all supply has been from native forests. This reflects the requirements of the customer's end markets for engineered wood products, in which strength, stiffness and hardness are key characteristics that cannot readily be met from peeler logs grown in young plantations.

Figure 5 1996/97 to 2015/16 actual annual supply of domestic eucalypt peeler logs from public forest

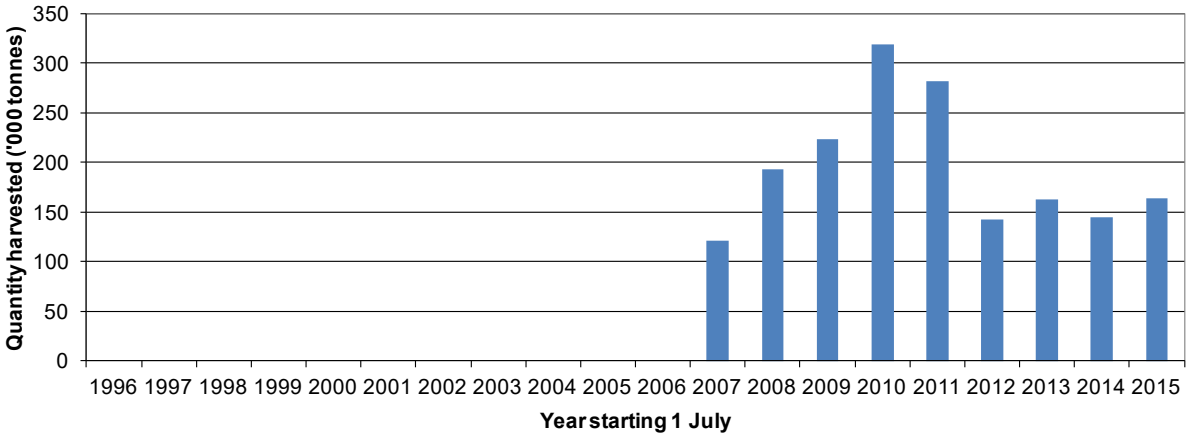
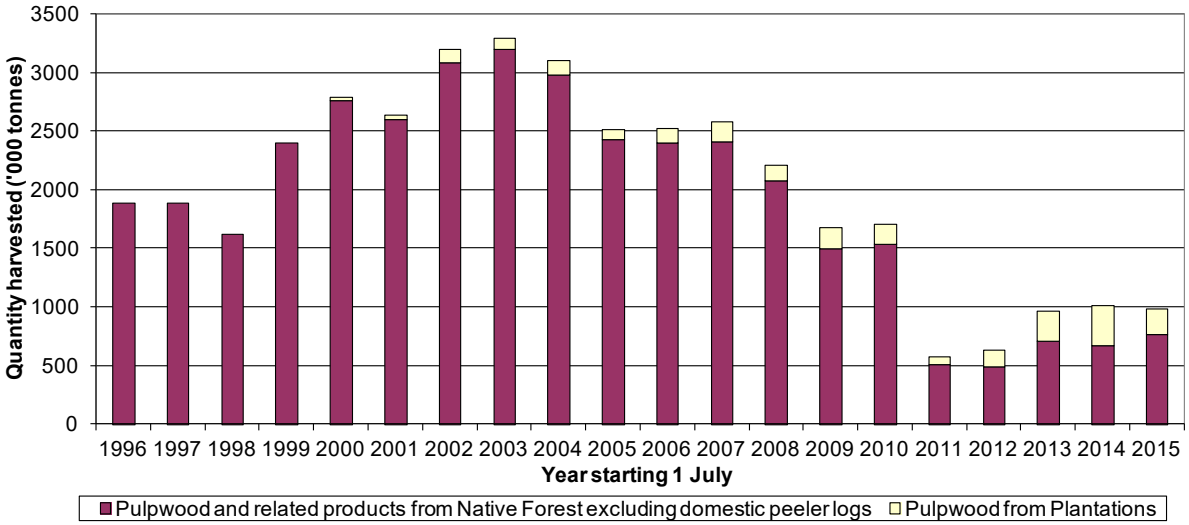


Figure 6 shows the annual supply of arisings over the period 1996/97 to 2015/16. The average supply over the period 1996/97 to 2010/11 was 2.4 million tonnes per year, ranging from 1.6 million tonnes in 1998/99 to 3.3 million tonnes in 2003/04. The average supply from 2013/14 is lower than the relevant quantities that were identified in the 2014 review, i.e., it is lower than the 1.3 million tonnes per year that was identified as available for the period 2013/14 to 2015/16 (Forestry Tasmania, 2014b, p. 21).

Figure 6 1996/97 to 2015/16 actual annual supply of arisings (excluding domestic eucalypt peeler logs) from public forest



The demand for arisings tends to be dominated by overseas markets for pulpwood from eucalypt native forests. Year to year fluctuations in this demand over most of the reporting period relate to the fluctuating strength of overseas demand for printing and writing paper, e.g., in Japan, China, Taiwan and South Korea, as well as to variations in the relative strength of the Australian dollar and in the cost of ocean freight. From 2011/12 Forestry Tasmania experienced a significant decline in

the demand for pulpwood from eucalypt native forests. This decline resulted from the implementation, by its largest customer at the time, of a strategic decision to withdraw from its native forest woodchip export operations.

Yield predictions

The revised yield predictions presented in Figures 7 to 9 are for a 90 year planning horizon, from 1 July 2016 to 30 June 2105. This period notionally represents a single rotation for eucalypt native forests.

The yield predictions are generated from biologically based forest estate modelling of productive capacity, and do not imply supply based on economic criteria. For example, the yield predictions for eucalypt plantations can only be realised if there is continuing investment in future rotations that are pruned and thinned.

Provision is made for various "headroom factors" (see page 12) where possible in these revised yield predictions. In the first period until 2021/22 there is no headroom in the northwest and northeast of the State, and a 2% headroom in the south. From 2022/23 onwards there is a 10% headroom applied statewide. Effectively the 10% headroom introduced for the first time in the last review in 2014, has already been utilised in the northern half of the state in the first period until 2021/22. Likewise, only 2% of the previous 10% headroom is still available in the south in the first period until 2021/22. From 2022/23 onwards the same 10% headroom is applied as in the last review in 2014.

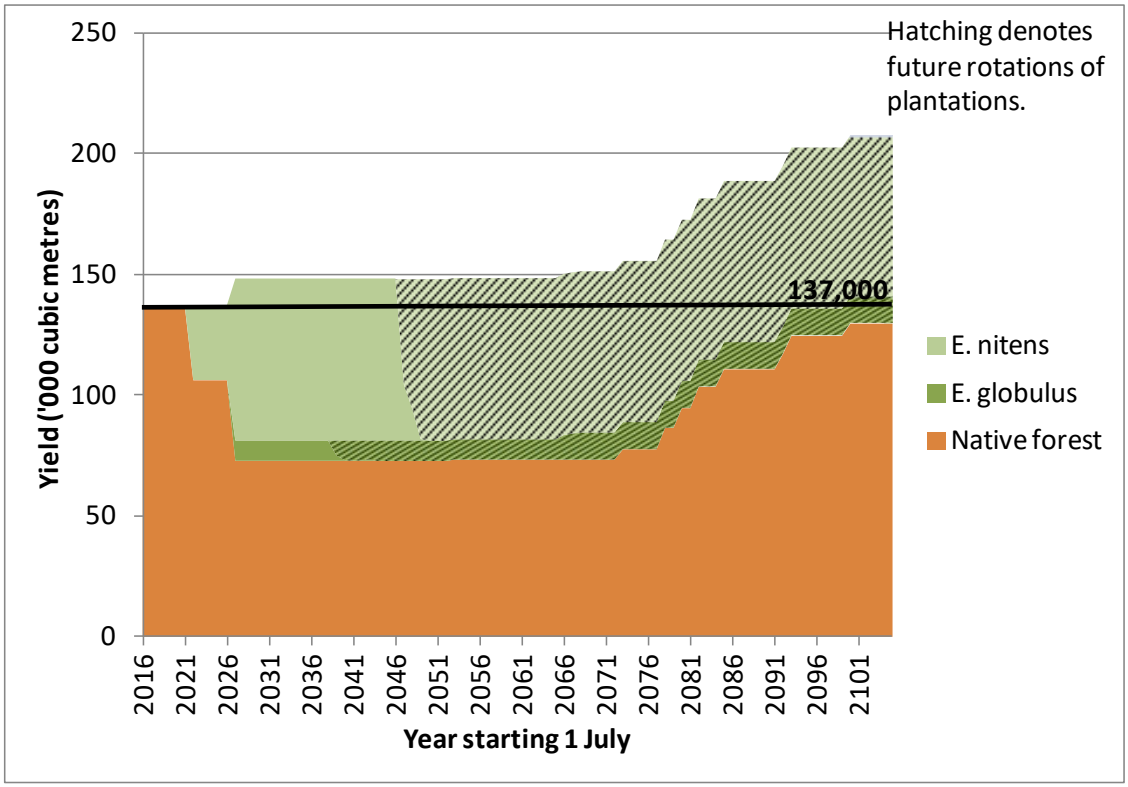
The yield predictions distinguish between production from eucalypt native forests and from eucalypt plantations and, in the case of eucalypt plantations, between *Eucalyptus globulus* and *E. nitens*. These distinctions reflect advice from Sustainable Timber Tasmania's customers about variations in the suitability of native forest and plantation logs for various end products (e.g., sawn timber and engineered wood products).

The sustainable yield of high quality eucalypt sawlogs has been calculated (Figure 7). As a result, peeler logs and arisings yield from the sustainable yield of high quality eucalypt sawlogs are "spiky" (Figures 8 and 9).

High quality eucalypt sawlogs

The yield predictions for high quality eucalypt sawlogs, illustrated in Figure 7, indicate an ongoing sustainable yield of 137,000 cubic metres or more per year. In particular, over the period 2016/17 to 2021/22, the statutory minimum annual quantity to be made available of 137,000 cubic metres can be met from eucalypt native forests. Beyond that period, the predicted yield from eucalypt native forests reduces to about 106,000 cubic metres per year until 2026/27, and then to about 73,000 cubic metres per year, augmented by significant additional quantities of high quality eucalypt sawlogs from eucalypt plantations.

Figure 7 Predicted yield of high quality eucalypt sawlogs from Permanent Timber Production Zone land



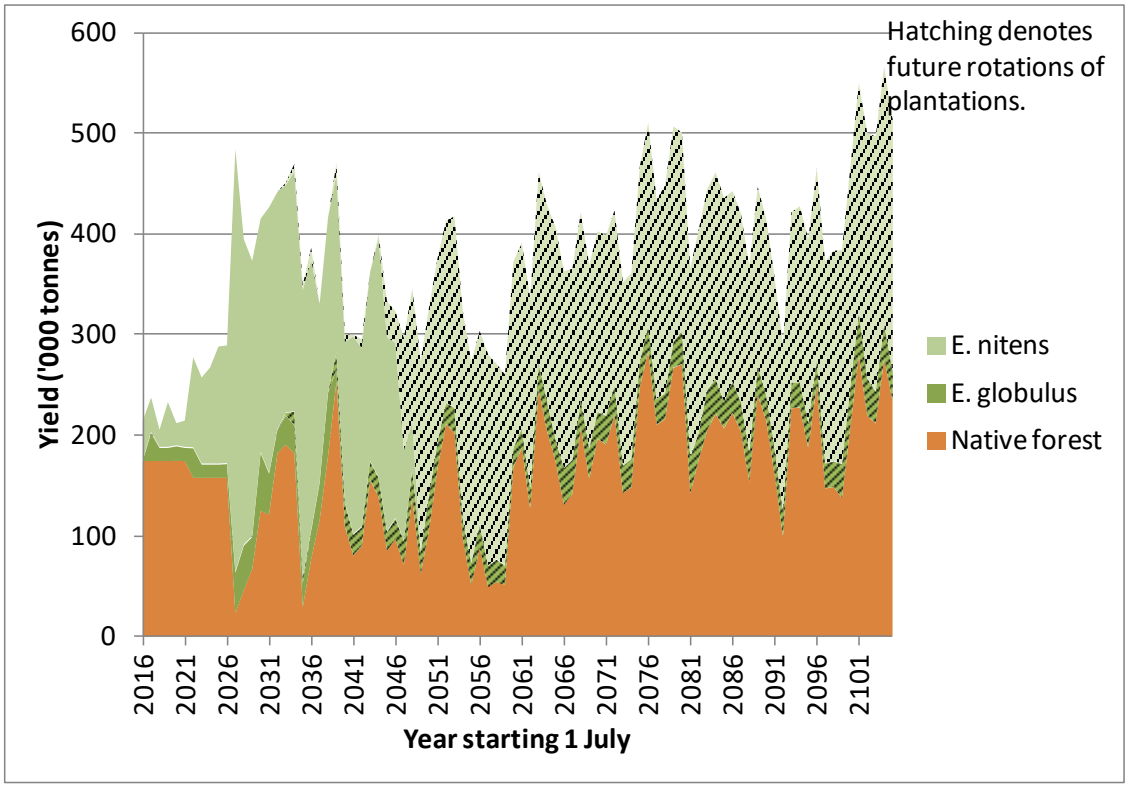
The predicted yield from plantations is separated according to the current rotation, i.e., trees currently growing, and future rotations. This assumes that plantation land will be replanted, favouring *E. globulus* where possible. This is because *E. globulus* exhibits superior density, strength and pulp yield. However, *E. nitens* will continue to be the preferred species on higher altitude frost prone sites that are not suited to *E. globulus*. Predicted yields of high quality eucalypt sawlogs from *E. nitens* plantations reach their predicted full capacity of about 67,000 cubic metres per year from about 2027/28. Predicted yields of high quality eucalypt sawlogs from *E. globulus* plantations commence at about 8,000 cubic metres per year from about 2027/28, and reach their predicted full capacity of about 11,000 cubic metres per year from about 2067/68.

Eucalypt peeler logs

The yield predictions for eucalypt peeler logs, illustrated in Figure 8, indicate a yield of about 175,000 tonnes per year until 2021/22, followed by about 158,000 tonnes per year until 2026/27, from eucalypt native forests. Beyond that period, the predicted yield from eucalypt native forests fluctuates around an average of about 110,000 tonnes per year until about 2059/60, after which the average predicted yield increases to about 200,000 tonnes per year for the remainder of the planning horizon.

For both *E. globulus* and *E. nitens* the predicted yield of eucalypt peeler logs over the period to 2026/27 represents significant potential to augment the predicted yield from eucalypt native forests. However, this potential is subject to the suitability of plantation grown logs, particularly of *E. nitens*, for the customers' end use requirements.

Figure 8 Predicted yield of eucalypt peeler logsfrom Permanent Timber Production Zone land



Predicted yields of eucalypt peeler logs from *E. nitens* plantations reach their long term predicted capacity of about 200,000 tonnes per year from about 2027/28. Predicted yields of eucalypt peeler logs from *E. globulus* plantations reach their long term predicted capacity of about 25,000 tonnes per year from about 2027/28.

Arisings

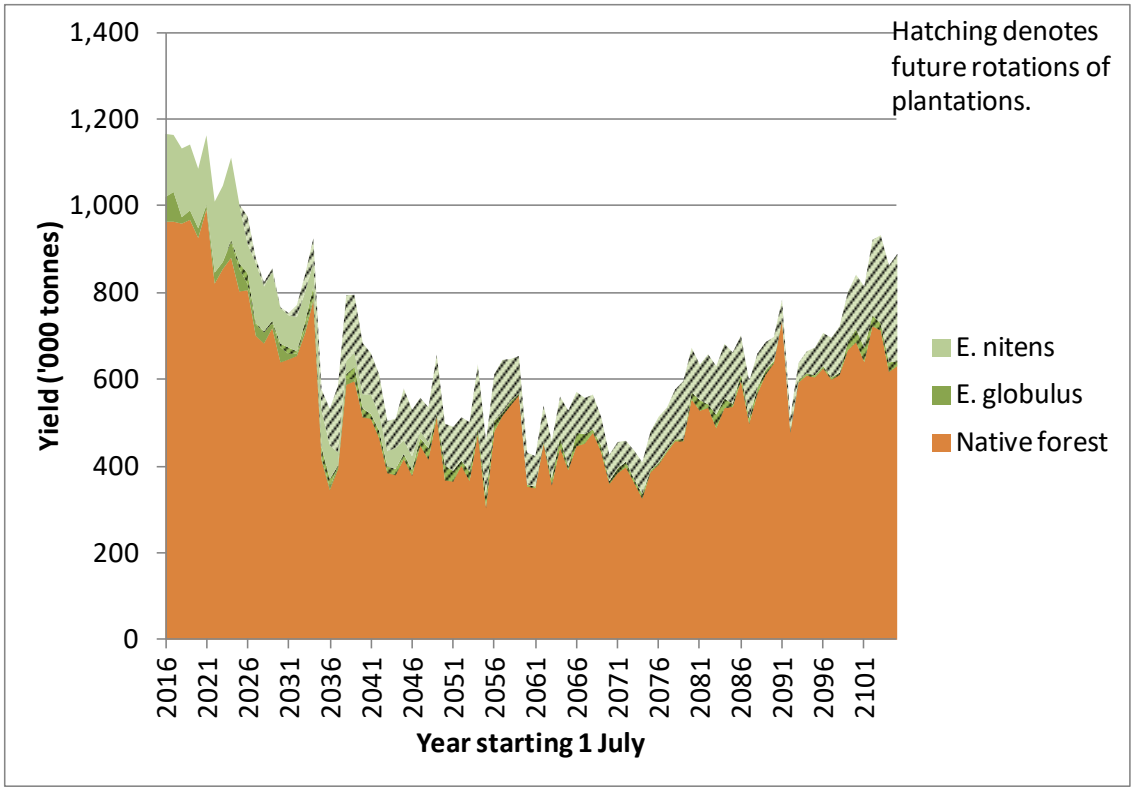
The yield predictions for arisings, illustrated in Figure 9, indicate a steadily declining yield over the period to 2036/37, from about 1.2 million tonnes per year to about 500,000 tonnes per year. Of the initial 1.2 million tonnes per year, about one million tonnes is from eucalypt native forest. The eucalypt native forest supply decreases to about 300,000 tonnes per year over the period to 2036/37.

The main factor contributing to this decrease is the continuation of the transition, begun in the late 1980s, from harvesting of mature age eucalypt native forest to harvesting of older regrowth eucalypt native forest. The former are generally beyond their optimum age for sawlog production, and contain a relatively higher proportion of trees with defects that make them unsuitable for producing high quality sawlogs or eucalypt peeler logs.

Beyond 2036/37, the predicted yield from eucalypt native forests fluctuates annually at around about 400,000 tonnes per year before increasing again, to an average of about 600,000 tonnes per year. This reflects a further transition to harvesting of younger regrowth eucalypt native forest, in which the optimum age for the harvesting of trees to produce high quality eucalypt sawlogs of up

to 90 years is also characterised by the harvest of a relatively high number of other, smaller trees suited to production of arisings.

Figure 9 Predicted yield of arisings from Permanent Timber Production Zone land



The long term yield of arisings from eucalypt plantations is about 120,000 tonnes per year. The predicted yields during the initial period range from about 160,000 tonnes per year to about 230,000 tonnes per year, i.e., higher than the long term yield. This is a consequence of the difference in the composition of yields between many of the existing first rotation eucalypt plantations and future rotations. The existing eucalypt plantation estate includes a proportion of areas that have not been thinned or pruned under the more recently introduced silvicultural regimes that promote the growth of high quality eucalypt sawlogs and eucalypt peeler billets. The harvest of these plantations, forecast to occur over the next twenty years, is predicted to yield a relatively low proportion of high quality eucalypt sawlogs and eucalypt peeler logs, and a relatively high proportion of arisings. Future rotations, to be established following the harvest of the existing plantations, are expected to yield a higher proportion of high quality eucalypt sawlogs and eucalypt peeler logs.

Maintaining productive capacity

The predicted total standing quantity of merchantable wood, within eucalypt forest areas available for wood production at the end of the planning horizon in 2105, is about 58 million cubic metres. This compares with the current value of about 41 million cubic metres. The difference is a result of the transition from harvesting of mature age eucalypt native forest to harvesting of older regrowth, then younger regrowth eucalpyt native forest as mentioned earlier. Initially the standing volume decreases, then it increases, before decreasing again near the end of the planning horizon.

This outcome meets a fundamental principle of sustainable yield, discussed by Ferguson (2013). This principle is that the forecast productive capacity of a forest at the end of a planning period is at least equivalent to, and preferably better than, the actual productive capacity at the start of the planning period.

Conclusion

This review confirms Sustainable Timber Tasmania's ability to make available at least 137,000 cubic metres per year of high quality eucalypt sawlogs from Permanent Timber Production Zone land for the next 90 years. It is also evident from the prediction of growing stock at the end of the planning horizon that this supply level can be sustained thereafter. However, these yield predictions are generated from biologically based forest estate modelling of productive capacity, and do not imply supply based on economic criteria.

Taken together, the predicted yields for arisings from eucalypt native forests and plantations, and the predicted yields for peeler logs from eucalypt plantations, represent an ongoing opportunity for a transition in supply from traditional markets for logs other than high quality eucalypt sawlogs (such as pulpwood) to new engineered wood product markets.

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Glossary

The following definitions reflect the meanings that are given to the various terms in this review, and may not match exactly the equivalent meanings of those terms in other contexts.

Arisings

Forest products in log form, other than high quality eucalypt sawlogs and eucalypt peeler logs, arising from the harvesting of eucalypt native forests and eucalypt plantations. Arisings may include pulpwood, export peeler logs, Category 8 sawlogs, Category 2 sawlogs and poles and posts. In the case of eucalypt native forests, arisings may include species other than eucalypt species (e.g., blackwood and silver wattle).

Category 2 sawlogs

Eucalypt logs that meet the relevant specifications that are in common use by Sustainable Timber Tasmania, representing logs that are suitable for sawmilling but that do not meet the definition of high quality eucalypt sawlogs. In general terms, Category 2 sawlogs comprise eucalypt logs with a minimum small end diameter under bark of 30cm, a minimum length of 2.4m and external defect (according to various categories including internal decay, spiral grain, sweep, scars, limbs and bumps) that affects no more than one quarter of the log.

Category 8 sawlogs

Eucalypt logs that meet the relevant specifications that are in common use by Sustainable Timber Tasmania, representing logs that are suitable for sawmilling but that do not meet the definitions of high quality eucalypt sawlogs or of Category 2 sawlogs. In general terms, Category 8 sawlogs comprise eucalypt logs with a minimum small end diameter under bark of 30cm, a minimum length of 2.4m and external defect (according to various categories including internal decay, spiral grain, sweep, scars, limbs and bumps) that affects no more than one half of the log.

Clearfelling

A silvicultural management practice, applied in some eucalypt native forests and in plantations, in which all of the merchantable trees within a coupe are removed in a single harvest, generally followed by a high intensity burn and aerial sowing (in eucalypt native forests) or planting (in plantations).

Engineered wood products

Panels and beams manufactured in larger dimensions than would be available from logs themselves, through various processes that involve peeling, slicing, sawing, chipping, crushing or grinding logs into smaller dimensions and then reconstituting them in larger dimensions with the aid of resins, presses and kilns. Examples include plywood, laminated veneer lumber, cross laminated panels, oriented strand board, medium density fibreboard, chipboard and hardboard.

Eucalypt native forests

Native forests in which eucalypt species are dominant.

Eucalypt peeler logs

Eucalypt logs that meet the relevant specifications under Sustainable Timber Tasmania's contract with its relevant domestic customer. These specifications exclude logs that meet the definition of high quality eucalypt sawlogs. In general terms, eucalypt peeler logs have a diameter under bark of between 18cm and 70cm, a minimum length of 900mm, no internal decay and minimal other defect (according to various categories including spiral grain, sweep, scars, limbs and bumps).

Export peeler logs

Eucalypt logs that do not meet the definition of high quality eucalypt sawlogs or eucalypt peeler logs, or of another higher value product, but that are suitable for peeling to produce eucalypt structural veneer.

Forest Management Plan

This document is an overview of Sustainable Timber Tasmania's Forest Management System. It provides stakeholders with a high level description of how Sustainable Timber Tasmania conducts its business. In particular, it details Sustainable Timber Tasmania's approach to managing social, economic and environmental values while meeting log supply requirements from Permanent Timber Production Zone land.

High Conservation Value Forest

Forests that possess one or more of the following attributes: concentrations of biodiversity values; regionally significant large landscape level forests; rare, threatened or endangered ecosystems; provide basic services of nature in critical situations; fundamental to meeting basic needs of local communities; and/or critical to local communities' traditional cultural identity.

High quality eucalypt sawlogs

Eucalypt logs that meet the relevant specifications for eucalypt "VQ1" or "VQ2" sliced veneer logs, Category 1 eucalypt sawlogs or Category 3 eucalypt sawlogs, each as defined in the *Forestry Regulations (Tas) 2009*. In general terms, high quality eucalypt sawlogs comprise eucalypt logs with a minimum small end diameter under bark of 30cm, a minimum length of 3.6m and minimal external defect (according to various categories including internal decay, spiral grain, sweep, scars, limbs and bumps).

Intensive forest management

Either eucalypt plantation management in general, or the thinning of eucalypt native forests.

Native forests

Forests comprising tree species that are native to Tasmania, other than plantations.

Partial felling

A silvicultural management practice, applied in native forests, in which the merchantable trees within a coupe are removed in two or more successive harvests, generally separated by a period of at least five (and up to twenty or more) years. Partial felling may be followed by a low intensity burn and hand sowing.

Permanent Timber Production Zone land

This is a new land classification, established under the *Forest Management Act (Tas) 2013*. It applies to the area of public land that is managed by Sustainable Timber Tasmania for wood production (about 800,000 hectares), and is the forest estate on which the yield predictions in this review are based.

Plantations

Forests established by planting seedlings in discrete rows, rather than by sowing seed. In Tasmania, plantations may be of hardwood species (mainly *Eucalyptus nitens* or *E. globulus*) or of softwood species (generally *Pinus radiata*).

Pruning

A silvicultural management practice, applied in plantations, in which the branches on the lower section of selected trees are removed in one or more treatments. Pruning facilitates the growth of clearwood (i.e., knot free wood) that is required for high quality eucalypt sawlogs and for eucalypt peeler billets.

Pulpwood

Eucalypt logs that meet the relevant specifications that are in common use by Sustainable Timber Tasmania, representing logs that are suitable for the production of pulp and paper and that do not meet the relevant specifications for a forest product of higher value.

Rotary peeled veneer

Veneer that is produced by holding a log, rotated about its centre axis, against a large blade that peels the log in a continuous sheet. The veneer sheet is then clipped into panels that are dried and reassembled into plywood and other engineered wood products.

Rotation or rotation length

The period from the initial establishment of a forest to the final harvest of trees from that initial establishment, notionally about 90 years for eucalypt native forests that are not thinned, about 70 years for eucalypt native forests that are thinned and about 25 years for eucalypt plantations that are thinned and pruned.

Silviculture

The management of forests (in the same sense that “horticulture” means the management of plants). A silvicultural regime is a specific “recipe” for the management of an area or type of forest, comprising a schedule of treatments (e.g., establishment, pruning, thinning and harvest).

Special timbers forests

Native forests in which eucalypt species are not dominant. These include rainforests, mixed species forests in which species other than eucalypts are dominant, blackwood forests and silver wattle forests.

Sustainable yield

The level of commercial timber (or product mix) that can be maintained under a given management regime, without reducing the long-term productive capacity of the forest.

Thinning

A silvicultural management practice, applied in eucalypt native forests and in plantations, in which the smaller and lower quality trees within a coupe are removed in one or more treatments. Thinning may result in an interim harvest of merchantable trees. Thinning assists to accelerate the growth of the most valuable (largest and best quality) trees.

Tonnes

Refers to green metric tonnes, i.e., to the weight in metric tonnes of logs immediately following harvest. Logs and timber tend to dry out (and to lose as much as 50% of their weight), when they are processed into final products. For eucalypt logs that are measured and reported in cubic metres, one cubic metre generally weighs between 1.05 and 1.10 green metric tonnes.

Variable retention

A silvicultural management practice, applied in native forests, in which structural elements or biological legacies (for example old trees, stags, logs, tree ferns) from the harvested coupe are retained for the new coupe to achieve ecological objectives. The practice typically requires the majority of the felled area to be within one tree height of forest that is retained for at least a full rotation.

APPENDIX 1 Auditor's statement

Forestry Tasmania Sustainable Yield Audit Review April 2017
Dr Cris Brack, The Fenner School of Environment and Society, Australian National University

Executive Summary

As part of the process of conducting a five-yearly review of the Tasmanian Regional Forest Agreement, I have been engaged to conduct an audit to inform the Board of Forestry Tasmania of the reliability of data sets, models and systems that support the production of sustainable yield estimates. I, in conjunction with colleagues on earlier occasions, have been involved in similar audits in 1996, 2002, 2007 and 2011. This current audit is based on these earlier works and focuses on changes to the various models and systems.

There has been relatively little development in the system since 2012 although the increasing maturity of the annual monitoring systems to allow for routine calibration has increased confidence in the Area and Growth Estimation system estimates over the short to medium periods. This maturity saw the tighter linkage of provisional coupe design and the Forest Operations Database, and regular/annual publication and use of Wood Planning Resource Indicators. The increased coverage of LiDAR has also increased confidence in the estimates of total, accessible and harvested areas. The introduction of the Coupe Confidence Classification system also allows users to assess where/when operational or data uncertainties can cause substantive issues and so plan around them.

Forest Information systems no longer rely on aerial photograph interpreters and there are no technically trained interpreters on staff. Any changes to the PI-Types are the result of on-ground inspection. A lack of aerial photography has been attributed to delays in harvest monitoring and consequent availability of calibration data.

Dedicated in-house human resources devoted to inventory data collection and checking; statistical / analytical development and continuous improvements or R&D have declined significantly. Only four technically trained tree measurers are available to conduct strategic inventories. Systems still appear to be adequate in the resultant "maintenance" mode with annual calibration exercises being relied on to correct for biases or other systematic errors which otherwise would have been addressed.

The native forest growth modelling systems have not changed since substantial re-parameterisation was carried out as part of an external contract (West, 2007, 2008a,b,c), although recent re-parameterisation of the plantation growth models has corrected earlier biases in height / basal area growth estimates (Musk, 2017).

Plantation yield estimates are no longer reliant on SI assumptions made at establishment as some inventory is available (original assumptions biased) and LiDAR-based estimates are available elsewhere. R&D continues to suggest that it is not unreasonable to anticipate sawlogs from plantations and the pruned/thinned plantations will play a significant role in the sustainable yield.

The Simulation/Optimisation system continues to be very reliable. Developments in this system have resulted in increased speed and further enhanced the ability to run multiple case studies for sensitivity analyses. Different constraints can push into areas or periods when underpinning models may not be so well tested.

I conclude that the datasets, models, approximations, systems and methodologies used in the calculation of sustainable yield for 2017 are reasonable and adequate for purpose.

APPENDIX 2 Feedback form

In line with our commitment to continuous improvement Sustainable Timber Tasmania invites you to comment on how this report met your expectation and requirements. In addition to the completion and return of this section, any other comments or suggestions on how we might be able to enhance our report to more clearly communicate sustainable yield issues can be directed to the contact details given below.

1. How much of our report did you read?

☐ All ☐ The majority ☐ Some

2. Overall, how do you rate the report?

Not at all informative **Extremely informative / useful**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

3. Please rate the following criteria by checking the appropriate category:

	Poor	Unsatisfactory	Good	Very good
Substance / Content	☐	☐	☐	☐
Credibility	☐	☐	☐	☐
Readability / Understanding	☐	☐	☐	☐
Completeness	☐	☐	☐	☐
Appearance / Format	☐	☐	☐	☐

4. As a result of reading the report, do you have a clear and sufficient understanding about Sustainable Timber Tasmania's approach to sustainable yield?

5. What additional information would you like to see in the future?

6. All other comments and suggestions are welcome

7. Are you?

☐ a Sustainable Timber Tasmania employee ☐ a Customer ☐ a Supplier

A member of:

☐ the community ☐ the government ☐ an NGO ☐ academia

☐ Other (please specify)

Additional written comments can be directed to:

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