

**TAMBO
FOREST MANAGEMENT AREA
(Plus 11 Wodonga FMA Blocks)**

ESTIMATE OF SAWLOG RESOURCE

**Department of Natural Resources and Environment
Victoria**

March 2002

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FOREWORD

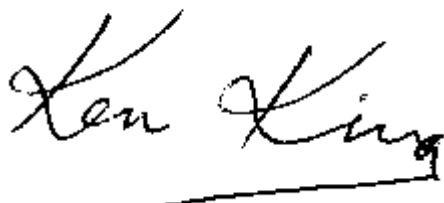
In March 2001 the Minister for Environment and Conservation initiated a process to issue new sawlog licences at appropriate levels. This process culminated in the preparation and release of the *Our Forests Our Future* Statement in February 2002. This Government Statement announced wide ranging reforms to the management of Victoria's native forests and will result in a sustainable timber industry. In the short term a reduction of about 30% to the sawlog levels across the State is required.

This report describes the data and method used to calculate the appropriate sawlog level for the Tambo Forest Management Area. This level has been adopted in the *Our Forest Our Future* Statement.

The estimate of the sawlog levels in this report is based on the information that is known about our forests and a series of estimates about the future, the preferences of industry and the best way to analyse the data. These estimates may be improved in the future as new information becomes available and more measurements of actual performance are recorded. Consequently the sawlog resource available in the future may also change. The *Our Forests Our Future* Statement outlines how these changes will be managed.

An independent Expert Data Reference Group was commissioned to review the data and methodology used to determine this estimate. This group reported in October 2001. It made extensive recommendations on how the processes and data could be improved. This document has considered the advice of the group.

This report provides the opportunity for the timber industry and interested people to gain access to information on how sawlog resources are estimated for Victoria's native forests.

A handwritten signature in black ink that reads "Ken King". The signature is written in a cursive style and is positioned above a solid horizontal line.

Ken King
Executive Director, Forests Service

CONTENTS

FOREWORD	2
1 INTRODUCTION	4
2 BACKGROUND	4
3 LICENCE COMMITMENTS	6
4 HARVEST HISTORY	7
4.1 TOTAL SAWLOG PRODUCTION	7
4.2 SAWLOG GRADES	8
4.3 SAWLOG SIZE CLASSES.....	9
4.4 AREA HARVESTED	10
4.5 SAWLOG YIELDS.....	11
4.6 RESIDUAL LOG SALES	12
5 VOLUME AND GROWTH INFORMATION	12
5.1 STANDING VOLUME.....	12
5.2 GROWTH DATA.....	13
6 RESOURCES	14
6.1 WOODFLOWS	14
6.2 RESOURCE PROFILE	15
6.3 RESOURCE ELEMENTS	16
6.3.1 Special Protection Zone and Proportion of Special Management Zone	16
6.3.2 Code Slope and Stream Buffer Exclusions	16
6.3.3 Forest Management Plan Prescriptions	16
6.3.4 Unmapped Streams and Soaks Not Considered in Code Buffer Exclusions.....	16
6.3.5 Standard Statewide Forest Resource Inventory unproductive stands.....	16
6.3.6 Further unproductive stands	16
6.3.7 Slopes Additional to Code Exclusions	17
6.3.8 Areas Not Harvested Near Stream Buffers	17
6.3.9 Small and Isolated Areas.....	17
6.3.10 Rocky Areas	17
6.3.11 Harvesting Losses	17
6.3.12 Landscape Buffers.....	18
6.3.13 Fire Losses	18
6.3.14 Disease Losses	18
6.3.15 New Flora, Fauna and Cultural Site Reservations.....	18
6.3.16 Temporal and Special Constraints.....	18
6.3.17 Economically Accessible Resource	19
6.3.18 Changed Residual Log Markets	19
6.3.19 Changed Minimum Log Diameter Specification	19
6.3.20 Changed Silviculture System	19
6.3.21 Additions to The Forest Estate	20
6.3.22 Reforestation of Unstocked Stands	20
7 RESOURCE OUTLOOK	20
8 DATA STANDARD	21
9 CONCLUSION	21
10 REFERENCES	21
11 GLOSSARY	22
12 MAP 1 – TAMBO FMA	28

1 Introduction

This Estimate of Sawlog Resource (ESR) summarises current Tambo Forest Management Area timber resource volume, growth and area information, licence commitments and ten-year timber production history in public native forests. The level of forest timber resources available into the future is determined by modelling future harvesting and growth. This ESR has been prepared as part of a licence renewal process established by the Minister for Environment and Conservation in March 2001 to develop a strategy for the issue of sawlog licences following the expiry of current licences, which will occur from 2002. The information contained in this document has been reviewed by an independent Expert Data Reference Group and peak industry and union groups, and is intended to assist in identifying soundly-based estimates for future licensing arrangements for the timber industry.

2 Background

Tambo Forest Management Area (FMA) is located in the eastern part of the Gippsland Regional Forest Agreement area. It covers a total land area of 900,375 hectares, extending from Mt Hotham in the north west, to the NSW border in the north east, the coastline in the south, the Dargo River in the west, and the Timbarra River and Nunniong Plateau in the east (see Map 1).

Formal forest resource inventory has been carried out since the 1930s, supplemented by local less formal inventory programs. These were aggregated into Hardwood Area and Resources Inventory System (HARIS) in the early 1980s and updated for harvesting thereafter.

The Timber Industry Strategy (TIS) released in 1986 established the basis for regional sustainable harvesting of sawlogs from State forest in Victoria. Based on resource data available at the time, sustainable yield rates were determined for each of the 15 FMAs identified by the TIS in order to facilitate the proper planning, management, and administration of publicly owned native forest. The TIS also provided resource security to the timber industry through the introduction of fifteen-year log licences, and flexibility to cope with market variations by allowing annual intake variation between 70% and 130% of annual licence volume. The concept of value adding was introduced with the establishment of four grades of sawlog and the allocation of the better grades of sawlog to those licensees with better value-adding performance. It also provided a planning hierarchy of Forest Management Plans (FMPs), Wood Utilisation Plans and Coupe Plans.

As a result of the TIS, Schedule 3 of the *Forests Act 1958*, as amended by the *Forests (Timber Harvesting) Act 1990*, scheduled the sustainable yield for Tambo at 54,000m³ nett C grade and better sawlogs (C+) per year. In 1996 the yield calculation was adjusted from C+ grade sawlogs to D grade and better sawlogs (D+), and a new long-term sustainable yield of 66,000m³ nett D+ per year was derived.

This ESR covers the Tambo FMA and includes the 11 forest blocks in the Wodonga FMA administered by Tambo FMA staff.

The Statewide Forest Resource Inventory (SFRI) program commenced in 1994 and has largely been completed in Tambo FMA and replaced the HARIS data with more accurate and detailed area and volume estimates that are fully spatially referenced.

Tambo FMA and 11 Wodonga FMA management blocks are covered by the Gippsland Regional Forest Agreement (RFA), which was established between the Commonwealth and Victorian Governments in March 2000. The RFA formally accredits the Gippsland Forest Management Plan (2001) as part of Victoria's ecologically sustainable forest management system. The Gippsland Forest Management Plan provides for the protection of all conservation values to agreed targets in the Special Protection Zone (SPZ) and allows harvesting in General Management Zone (GMZ) and Special Management Zone (SMZ) under special conditions (Figure 1).

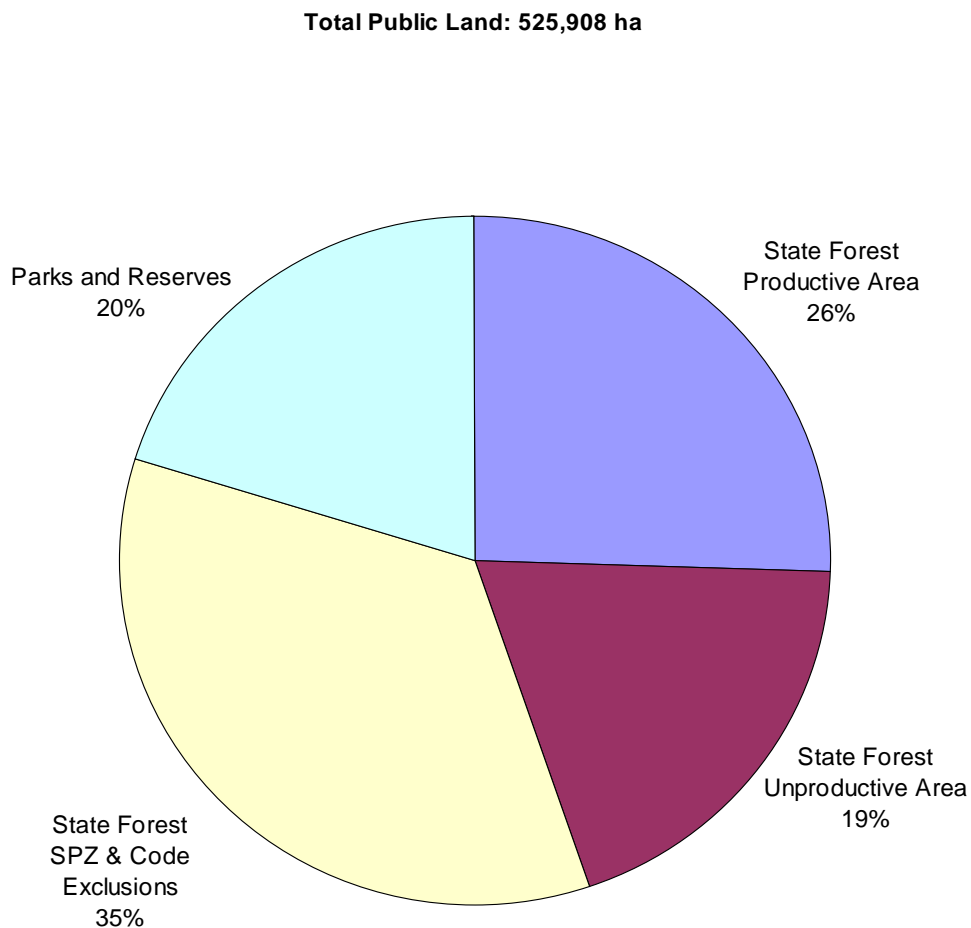


Figure 1. Public Land in the Tambo Forest Management Area

The Timber Resource Availability Analysis undertaken as part of the Gippsland Regional Forest Agreement reduced the licence commitment of sawlogs in the Tambo

FMA and the 11 Wodonga FMA blocks from 82,985m³ nett D+ per year to 72,100m³ nett D+ per year (licence commitments for sawlog from the eleven Wodonga FMA blocks were considered to be 15,269m³ nett D+ per year).

The current age class structure of the forests in the Tambo FMA is predominantly mature (52%) with clearly defined regrowth (29%) and undefined stands (19%). Of regrowth stands, 26% were generated in 1990s, 18% in 1980s, 16% in 1970s, 9% in 1960s, 5% in 1950s or unknown years and 26% in 1930s. Of mature stands, 4% are early mature, 74% mature, 17% late mature and 5% senescent.

3 Licence Commitments

Current licence numbers and commitments are shown in Tables 1 and 2.

Table 1. Current Tambo FMA Commitments by Licence Type and Expiry Date

Licence Type	Products	Expiry Date	No. of Licences
Evergreen	Sawlog (D+)	06/30/07	1
Evergreen	Sawlog (D+)	06/30/10	2 ¹
Standard	Sawlog (D+)	06/30/02	1
Standard	Sawlog (D+)	06/30/05	1
Standard	Sawlog (D+)	06/30/03	2 ²
Standard	Sawlog (D+)	06/30/08	1
Specialty timber, Standard	Sawlog (D+)/RL	06/30/02	1
Total			9
Standard	Residual	06/30/02	6 ³
Agreement	Residual	06/30/02	1
Total			7

Note: 1. Shared with another FMA.
2. One of the licences is shared with another FMA.
3. Four of the licences are shared with another FMA.

Table 2. Current Tambo FMA & NE Gippsland (11 Blocks) Commitments by Species and Grade

Product/Grade	Annual Allocations		
	Species Type		
	Ash Species	Mixed Species	Total
Sawlog (m³ nett)			
B+	11,100	3,425	14,525
C	15,540	15,862	31,402
C+	2,363	10,296	12,659
D	3,860	8,027	11,887
D+		1,396	1,396
Sawlog Total	32,863	39,006	71,869²
Residual Log (m³ gross)			
E Grade ³	3,000		3,000
Residual Log	46,500 ¹	105,000	151,500
Residual Log Total	49,500	105,000	154,500

Note: 1. Includes 17,500 tonne ash thinnings.
2. Includes 250m³ Specialty timber species.
3. E grade logs are better quality residual logs from which sawn timber can be produced.

4 Harvest History

4.1 Total Sawlog Production

Figure 2 shows the volume harvested by forest type for the period 1992/93 to 2000/01 (Tambo FMA only). The average nett sawlog production is 65,700m³ nett D+ per year, which is 300m³ nett below the level of the 1992 forecast of sustainable sawlog yield. Production levels have remained relatively stable over the period with the lowest production year being 9% below the licensed level (1993/94), and the highest production year 19% above the licensed level (1997/98).

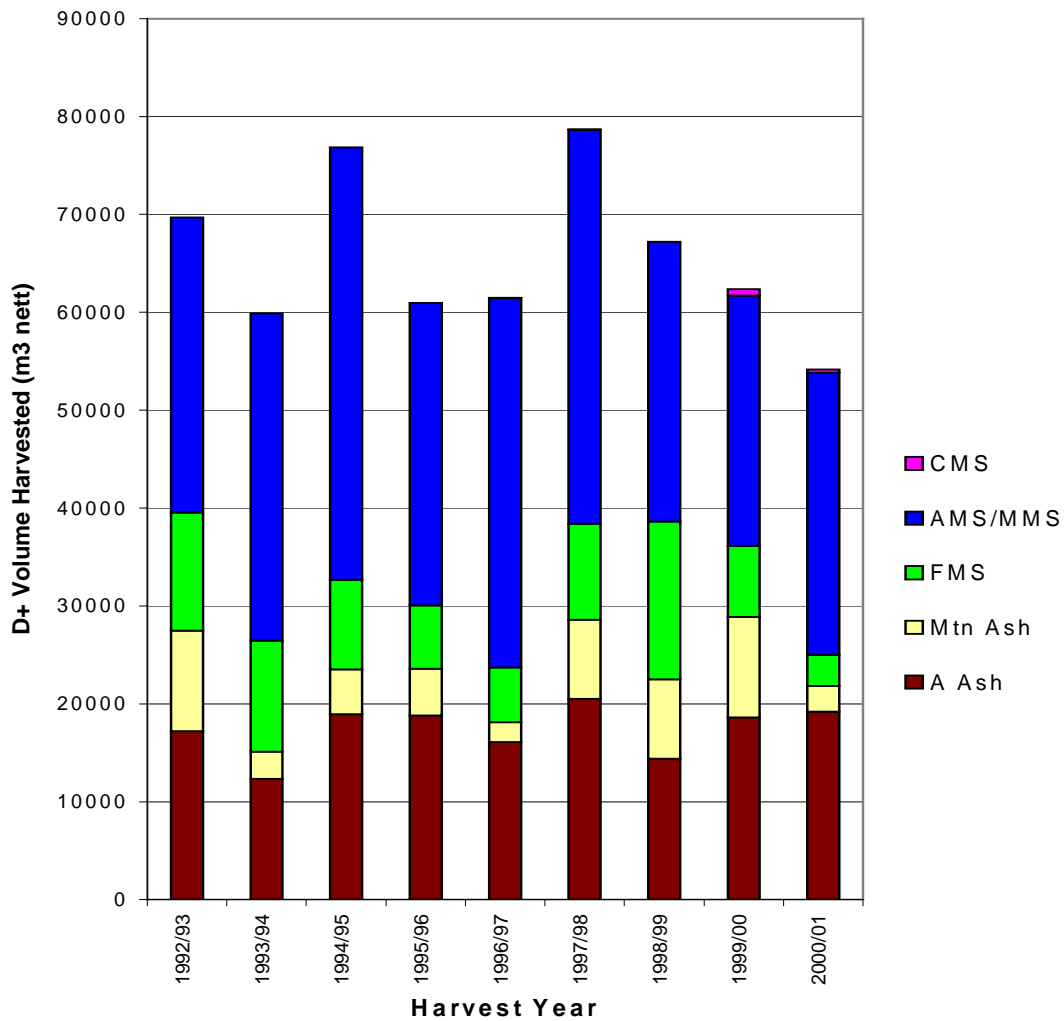


Figure 2. D+ Sawlog Produced by Forest Type by Year

Note: CMS – Coastal Mixed Species; AMS – Alpine Mixed Species; MMS – Mountain Mixed Species; FMS - Foothill Mixed Species; Mtn Ash – Mountain Ash; A Ash – Alpine Ash.

4.2 Sawlog Grades

Figure 3 shows the proportion of sawlog production by grades have remained consistent over the period 1992/93 to 2000/01 (Tambo FMA only). The average production of each grade was 1.6% A grade, 12.6% B grade, 65.0% C grade and 20.8% D grade.

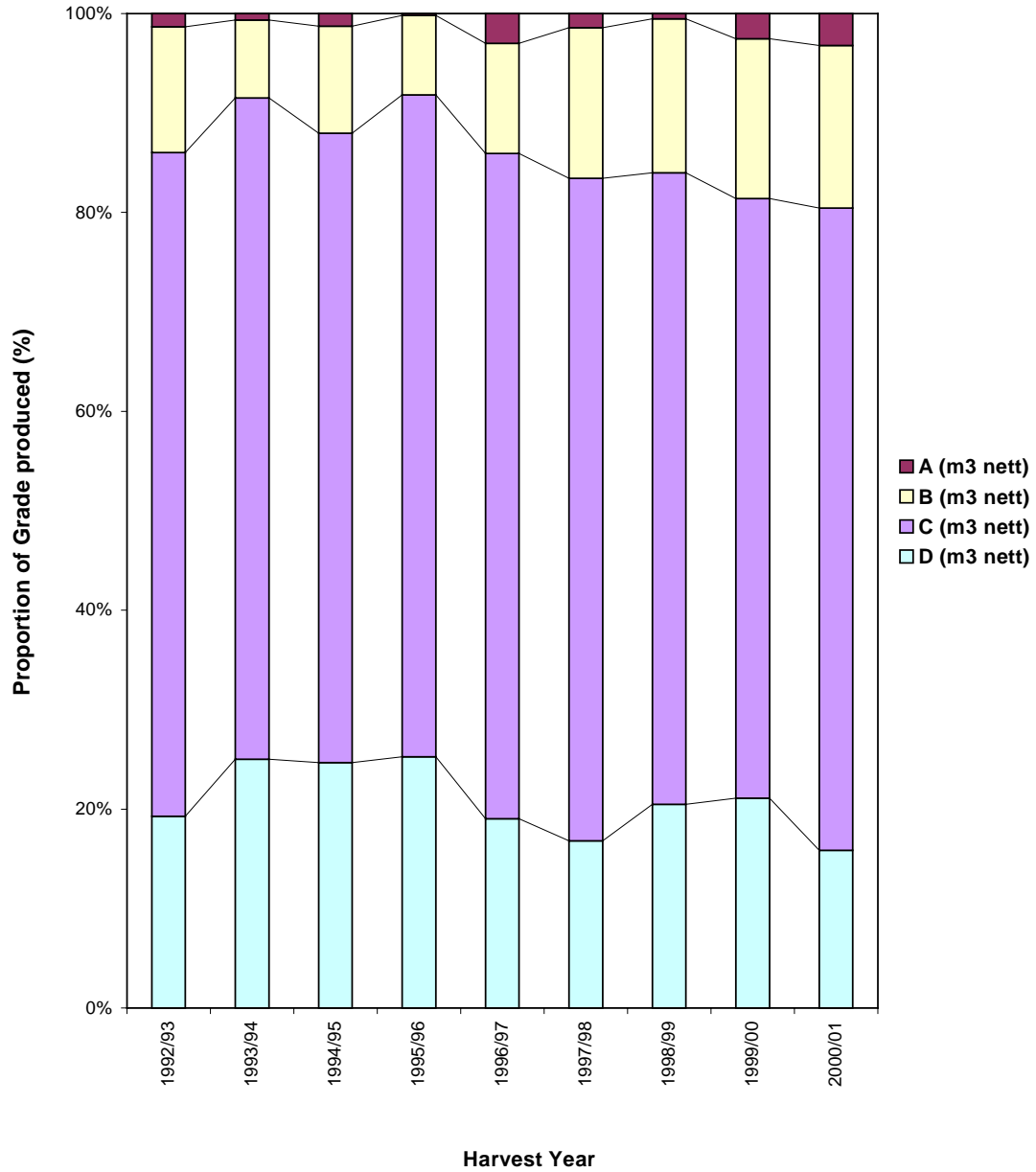


Figure 3. D+ Sawlog Grade Proportions by Year

4.3 Sawlog Size Classes

Figure 4 shows the proportion of size class 1 sawlogs (less than 45 cm centre diameter under bark) and size class 2 sawlogs (45cm and greater-centre diameter under bark) sawlogs produced for the period 1992/93 to 2000/01 (Tambo FMA only).

Size class distribution has remained relatively constant over the period. Size class one averaged 11% and size class 2 averaged 89%.

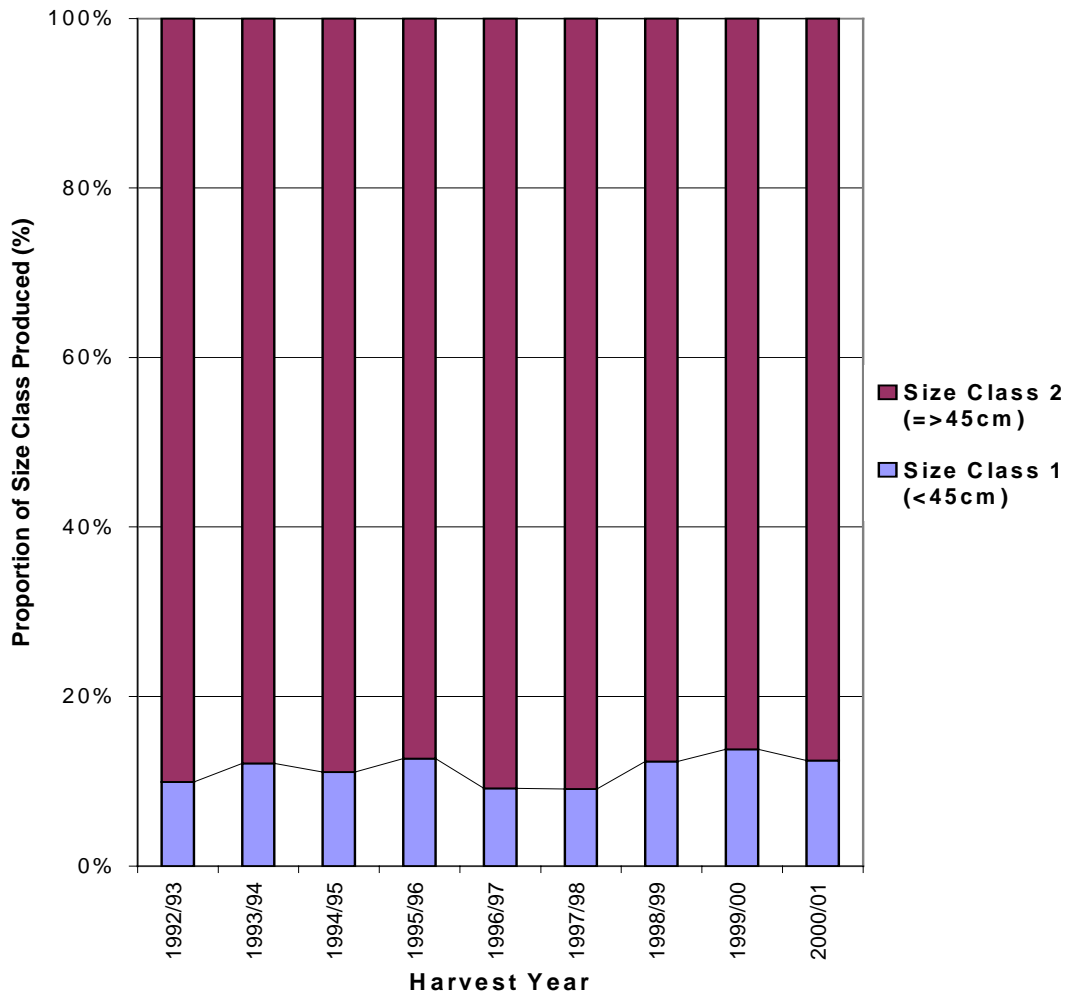


Figure 4. D+ Sawlog Size Class Distribution by Year

4.4 Area Harvested

Figure 5 shows the area harvested by forest type for the period 1992/93 to 2000/01 (Tambo FMA only). Areas harvested from lower sawlog yielding forest types are less than pro-rata due to lack of market for residual log (RL).

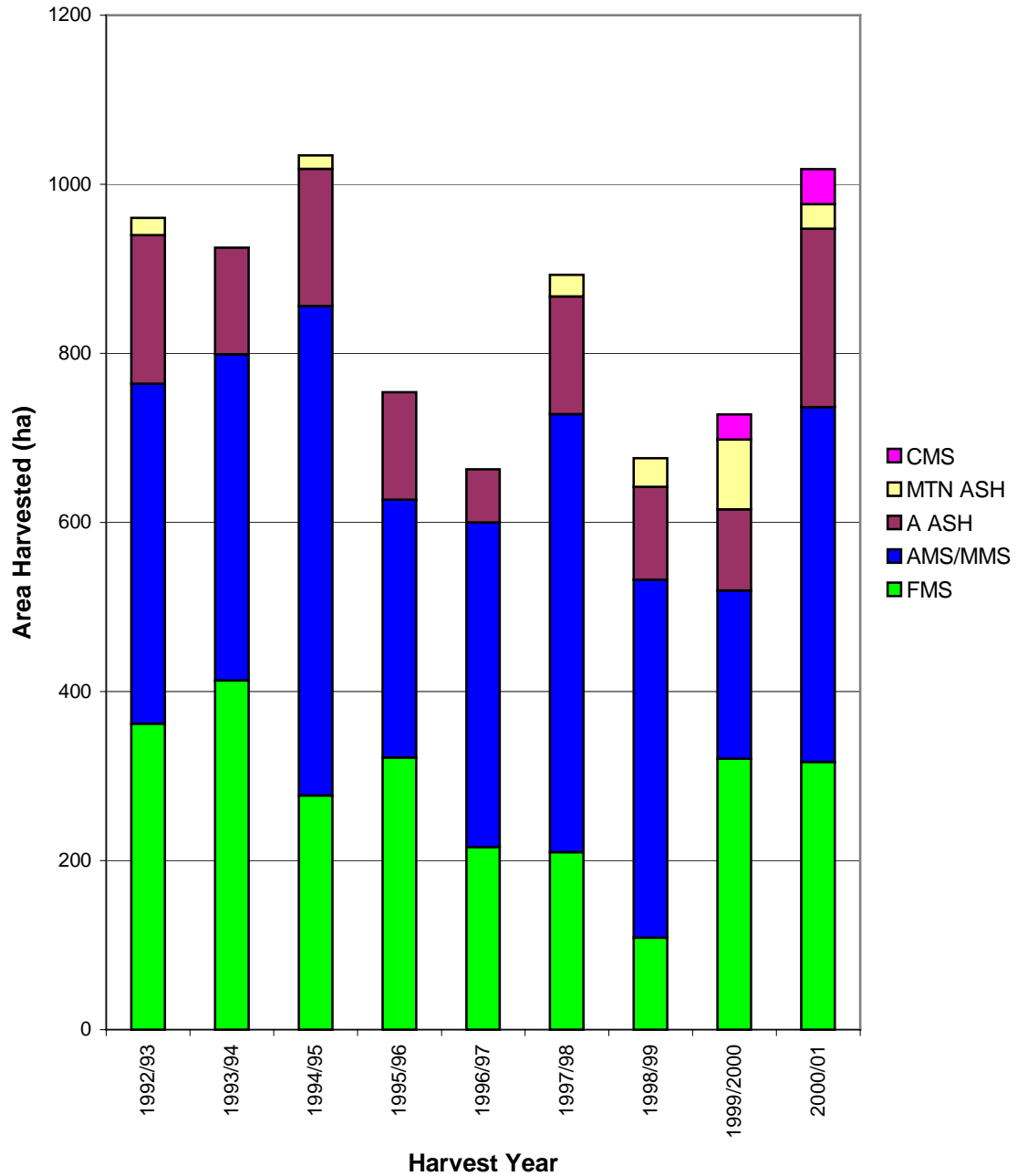


Figure 5. Area Harvested by Forest Type by Year

Note: CMS – Coastal Mixed Species; AMS – Alpine Mixed Species; MMS – Mountain Mixed Species; FMS - Foothill Mixed Species; Mtn ASH – Mountain ASH; A ASH – Alpine Ash.

4.5 Sawlog Yields

Figure 6 shows the annual average sawlog yields by forest type over the period 1992/93 to 2000/01 (Tambo FMA only). As a general trend, sawlog yields have been dominated by alpine ash. Over the period 1992/93 to 1995/96, alpine ash sawlog yield increased steadily, and then peaked the following year at 256m³ nett/ha/yr. Since then the figure dropped significantly in the following two years to a level of 131m³ nett/ha/yr. In 1999/00, it rose sharply to 194m³ nett/ha/yr and then dropped to the lowest level 69m³ nett/ha/yr in 2000/01. AMS/MMS/MA is the second contributor to sawlog yield, varying between 70m³ nett/ha and 128m³ nett/ha. The figures of sawlog yields for FMS/CMS fluctuated between 10m³ nett/ha and 47m³ nett/ha.

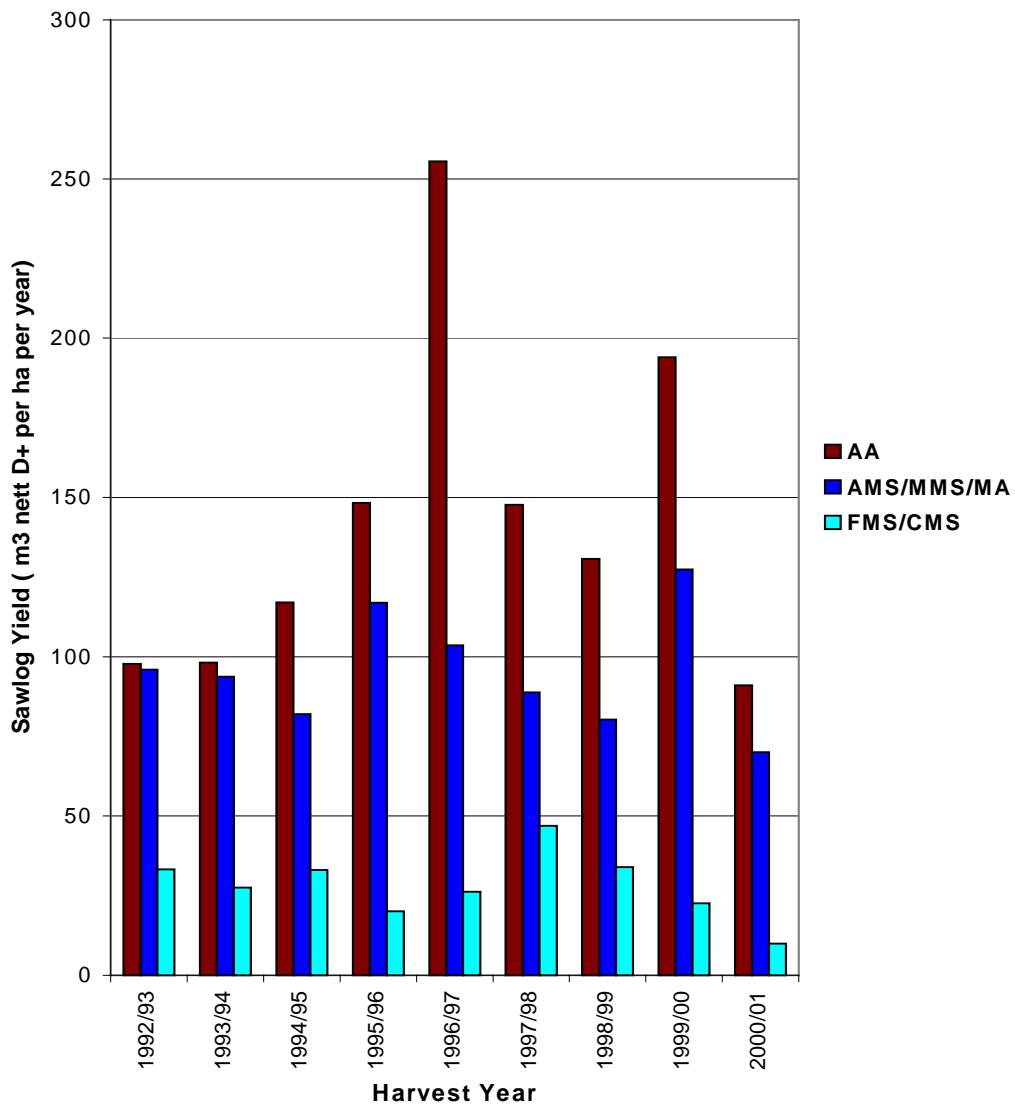


Figure 6. D+ Sawlog Yields by Forest Type by Year

Note: AA – Alpine ash; AMS – Alpine Mixed Species; MMS – Mountain Mixed Species; MA – Mountain Ash; FMS – Foothill Mixed Species; CMS – Coastal Mixed Species.

4.6 Residual Log Sales

Figure 7 shows the quantity of residual logs produced and sold for the period 1992/93 to 2000/01 (Tambo FMA only). Residual log sales have increased from an average of 20,816m³ gross between 1992/93 and 1998/99, to 117,238m³ gross in 2000/01. Significant quantities of residual logs have been produced but not sold before 2000 in this FMA. Over the period, 26% of residual logs sold were ash species, and 74% were mixed species.

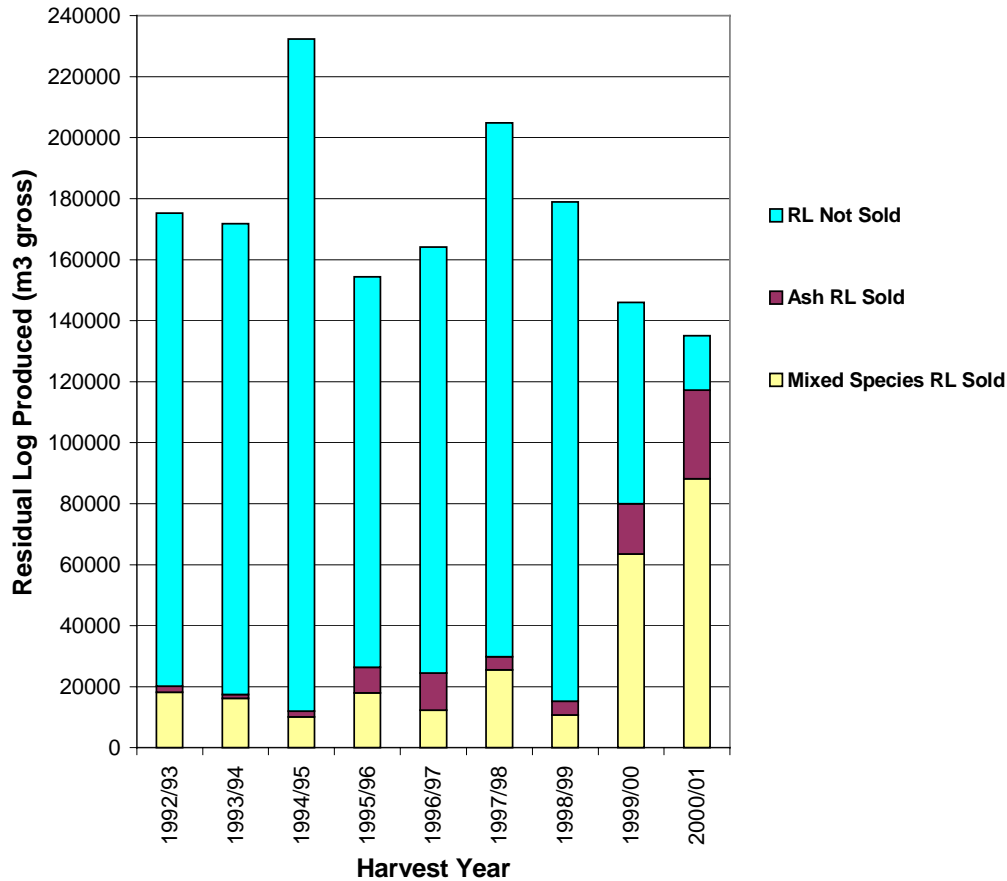


Figure 7. Residual Log produced and sold by Year

5 Volume and Growth Information

The volume and growth information used in this estimate has been entirely derived from the Statewide Forest Resource Inventory (SFRI) information.

5.1 Standing Volume

The SFRI stand class volume prediction model uses sample plot tree volumes plus data collected at other phases of the SFRI program. Volume estimates for all plots within a forest stand are combined, and the data used to develop models for mixed species and ash forest types. The models have been used to estimate current standing volumes for all productive mature stands (including 1939 regrowth). These volumes

have been summarised as average volumes by forest type and broad age categories. Calibrated SFRI volume figures were also checked against operational yields on 125 coupes totalling an area of about 2,300ha and were found to predict, on average, about 90% of the harvested volume. The 10% under prediction may be attributed to coupes being located in better than average stands.

Much of the mixed species forest, and some of the mature ash stands, have had a history of low intensity selection harvesting, which has resulted in a reduction of the sawlog volume, with the remaining trees tending to have higher defect levels. As the SFRI volume estimates are based on stand parameters assessed from aerial photographs, many of these areas are assumed to be carrying full sawlog volume.

Stands that had a harvesting record post 1985 without a significant proportion of regrowth were assigned a nominal yield of 1% of the Mature/Over Mature yield. Stands that had a harvesting record prior to 1985 without a significant proportion of regrowth were identified in Foothill Mixed Species, where these stands comprise 74% of the available area and 62% of the volume. A reduction of 70% was applied to the standing volume in these areas, reducing the average volume from 43m³ nett/ha to 13m³ nett/ha.

5.2 Growth Data

Yield curves were developed for each major age/development class in each of the forest types. A total of 16 yield curves were developed.

For ash, the yields were based on the STANDSIM yield curve from the North East SFRI estimates of stand age, basal area, site quality, diameter distribution and stem quality. The North East yield curve was scaled equally on both the yield and age axes to match the average modelled stand volumes for both 1939 and mature age class Alpine Ash and Mountain Ash forest types. The resultant yield curves are more realistic non-linear curves rather than yield curves where the volume increases equally with age as used previously. The ash yield curves were also scaled to match the TIS Mean Annual Increment of 2.0 at age 60 for the regrowth forest types rather than at the nominal rotation age of 80 years.

For mixed species there is not an equivalent growth model to the one incorporated into STANDSIM for ash type forests. The mature and overmature mixed species were assumed to have no increase in yields over time. For regrowth mixed species, the generalised yield curve developed for the North East SFRI was used. These were scaled on both the yield and age axes to match the TIS regrowth Mean Annual Increment at rotation age for each forest type.

6 Resources

6.1 Woodflows

In the Tambo FMA the predominant silvicultural systems used are clearfelling and seed-tree. They result in even aged regrowth of a known age. Trees are retained in clearfelling and seed-tree operations for habitat, seed fall and in buffers along streams. The estimate of the availability of sawlogs into the future is based on the assumption that clearfelling and seed-tree will continue as the predominant silvicultural systems.

To estimate the availability of sawlogs into the future a method of scheduling wood flows is required. This estimate uses a spreadsheet developed by NRE for this task. It uses the area of each forest type of known age and the yields for a range of ages. Areas of forest can then be scheduled at or near the nominal rotation age during periods into the future. The availability of sawlog has been called the Economically Accessible Resource and is based on the level that can be maintained or increased over the entire planning period, usually to 2100.

6.2 Resource Profile

Table 3 provides a simple representation of sawlog resource within a uniform statewide format. Volumes are indicative only. This profile is to be read in conjunction with the accompanying comments on each resource element.

Table 3. Profile of Resource Elements for Tambo FMA

No.	RESOURCE ELEMENT	Area (ha)	Annual Volume (m ³ nett/yr)
	STATE FOREST (INCLUDING SOME HISTORIC AREAS)	418,908	
	Code and Forest Management Plan (FMP) elements:		
1	SPZ & proportion SMZ	136,375	
2	Code slope & stream buffer exclusions	47,590	
3	FMP prescriptions		
4	Unmapped streams and soaks not considered in Code buffer exclusions		
5	Standard SFRI unproductive stands	100,364	
	BIOLOGICAL SUSTAINABLE YIELD	134,579	92,600
	Operational elements:		
6	Further unproductive stands	27,258	0
7	Slopes additional to Code exclusions	10,100	4,800
8	Areas not harvested near stream buffers	6,735	3,000
9	Small and isolated areas	8,260	4,200
10	Rocky areas		1,400
11	Harvesting losses		3,600
	Management elements:		
12	Landscape buffers		
13	Fire losses		1,500
14	Disease losses		
15	New flora, fauna and cultural site reservations		
16	Temporal and special constraints		2,200
	Remaining element:		
17	Economically Accessible Resource	82,224	71,900
	Potential issue elements:		
18	Changed residual log markets		
19	Changed minimum log diameter specification		
20	Changed silviculture system		
21	Additions to the forest estate		
22	Reforestation of unstocked stands		

Note: Elements 6 to 16 and 18 to 22 may alter, increasing or decreasing the economical accessible resource element 17.

6.3 Resource Elements

6.3.1 Special Protection Zone and Proportion of Special Management Zone

All of the Special Protection Zone is excluded from harvesting. The total area of Special Management Zone in Tambo and eleven Wodonga blocks is 4,808ha, of which 1,184ha are available for timber harvesting, and 3,624ha are unavailable for timber production.

6.3.2 Code Slope and Stream Buffer Exclusions

Areas steeper than 30 degrees and 20m buffers on mapped permanent streams are excluded under provisions of The Code of Forest Practices for Timber Production (NRE, 1996).

6.3.3 Forest Management Plan Prescriptions

This element is not relevant or significant in this estimate for this FMA.

6.3.4 Unmapped Streams and Soaks Not Considered in Code Buffer Exclusions

An allowance of 5% has been made for the area unavailable for timber production due to unmapped streams and soaks.

6.3.5 Standard Statewide Forest Resource Inventory unproductive stands

The area of productive State forest is defined by SFRI and is determined by excluding forest of inherently low productivity (stands that are not capable of attaining heights greater than 28 metres or are non-eucalypt). These stands are dominated by currently unmerchantable species such as *E. angophoroides* (Apple-topped Box), *E. bridgesiana* (Apple Box), *E. camphora* (Mountain Swamp Gum), *E. polyanthemos* (Red Box), *E. goniocalyx* (Long-leaved Box), *E. mannifera* (Brittle Gum), *E. pauciflora* (Snow Gum).

6.3.6 Further unproductive stands

Various species combinations, in addition to those defined as unproductive by SFRI, are generally considered unproductive. Various mixed species stand combinations were evaluated to determine their suitability for sawlog production, in particular, *E. radiata*, Narrow-leaved Peppermint stand combinations. As a result, the following species/stands are considered unproductive in addition to those species and forest types identified by SFRI:

Pure or dominant stands less than 35m tall or senescent of:

- *E. dalrympleana* (Mountain Gum)
- *E. rubida* (Candlebark)
- *E. consideriana* (Yertchuk)
- *E. radiata* (Narrow-leaved Peppermint), *E. dives* (Broad-leaved Peppermint), *E. robertsonii* (Monaro Peppermint), *E. croajingolensis* (Gippsland Peppermint).

Pure or dominant stands less than 35m tall (excluding regrowth), senescent or late mature of:

- *E. cypellocarpa* (Mountain Grey Gum)

Pure or dominant stands of:

- *E. elata* (River Peppermint), *E. smithii* (Gully Gum), *E. melliodora* (Yellow Box and) *E. tricarpa* Red Ironbark

Stands where *E.mannifera* (Brittle Gum) as second (subdominant) species

6.3.7 Slopes Additional to Code Exclusions

Harvesting history shows that not all slopes less than 30 degrees are harvested. Historical practice was considered reflected in a model with the following conditions:

- Less than 25 degrees included in the timber resource as available
- 25 - 30 degrees included in the timber resource as available, dependent on adjacent slopes (GIS analysis used)
 - available if adjacent to areas with slopes less than 25 degrees
 - unavailable if adjacent slopes greater than 30 degrees and greater than 50m from road
 - unavailable if adjacent to permanent streams and greater than 50m from road.
- Greater than 30 degrees excluded from the timber resource

6.3.8 Areas Not Harvested Near Stream Buffers

Operationally stream buffers on slopes are often greater than the minimum 20m which is prescribed by the *Code*, since slopes often dictate that trees cannot be felled without entering the buffer. To account for the historic operational loss of area, modelled buffers were increased from 20m to 30m for all permanent streams.

6.3.9 Small and Isolated Areas

Small areas are isolated patches of available productive forest, below a minimum size that are considered uneconomic to harvest. These were defined as stands of less than seven hectares, which were surrounded by unproductive, economically, unviable or unavailable forests. These small areas have been identified and excluded from the productive area.

6.3.10 Rocky Areas

An allowance of 1,400m³ nett has been made for areas that may be unavailable for harvesting due to rocky outcrops.

6.3.11 Harvesting Losses

A 3,600m³ nett volume reduction has been applied to allow for the losses in converting standing estimated volume to harvested and removed volume.

6.3.12 Landscape Buffers

It is considered that buffers placed on visually sensitive ridgelines or roads or private property boundaries in the General Management Zone can be managed temporally, or are not significant.

6.3.13 Fire Losses

The annual probability of wildfire is based on the average area of State Forest burned within a 25-year period. Potential loss of growth due to wildfire has been estimated as 0.89% for ash and high elevation mixed species and 2.67% for foothill and coastal mixed species with 2.1% derived as the weighted average. Therefore, an allowance of 1,500m³ nett is made for the potential volume loss due to fires.

The assumptions made in this estimate are:

- No volume can be salvaged in stands less than 20 years of age.
- Volume available to be salvaged increases linearly from 0% at age 20 to 100% at age 80.
- Fires after the rotation age of 80 years do not result in any loss of production because sawlogs can be salvaged.

These reduction factors have been applied in generating future availability scenarios.

6.3.14 Disease Losses

Future losses due to *Phytophthora cinnamomi* root rot fungus are considered unlikely in the productive area.

6.3.15 New Flora, Fauna and Cultural Site Reservations

Further Special Management Zones and Special Protection Zones may be created around future identified sites of cultural, historic, flora or fauna significance occurring in General Management Zone areas within the Tambo FMA. Under the Gippsland Regional Forest Agreement if additional Special Protection Zones are required over areas that were previously General Management Zone or Special Management Zone, land of equal value can be swapped from the current reserve system, so there is no nett loss of productive area.

6.3.16 Temporal and Special Constraints

An allowance of 2,200m³ nett is made for the expected difficulty in resolving temporal and likely additional Forest Management Plan and Wood Utilisation Plan constraints. This allowance has been made for the aggregation of several coupes to a maximum area of 120 hectares over 5 years as specified in The Code. This element includes allowances for the provision of seed trees, habitat trees and for fire management plan zone restrictions.

Fuel Management Zones may also impact on the area available for harvesting as the current Fire Management Plan (NRE, 1999) states in regard to Zone 1 and Zone 2:

Zone 1 (17,403ha) - timber harvesting by clearfelling techniques will generally not occur in this zone.

Zone 2 (115,751ha) - the area scheduled for harvesting in any one year should not exceed 1% of the total area of the zone, averaged over a five-year period.

These prescriptions have not been analysed for volume and therefore the impact on sustainable yield has yet to be determined, although it is not thought to be significant, it is included in this element.

6.3.17 Economically Accessible Resource

The area of the economically accessible resource is estimated based on current harvesting practices and management. The annual volume of this element is the proposed level for licensing.

6.3.18 Changed Residual Log Markets

A minimum yield of 60m³ nett per hectare was assumed for sawlog only operations. Discussions with industry indicate that under current payment rates, the minimum yield for economically viable harvesting operations could be as high as 80m³ gross per hectare.

In order to appreciate the impact of restricted residual log (RL) markets, various scenarios were modelled (Table 4). The economically accessible resource assumes mixed species RL sales of 60,000m³ gross per year. Ash is unaffected due to the stands having yields in excess of 60m³ nett per hectare and there is no volume available from Coastal Mixed Species due to very low sawlog yields.

This ESR has assumed full RL availability across the FMA. Table 4 shows the amount of mixed species sawlog available at different levels of mixed species RL.

Table 4. Modelled RL Markets

Modelled Mixed Species RL Availability (m³ gross/yr)	Modelled Mixed Species Sawlog (m³ nett D+/yr)
60,000	21,400
30,000	13,800
0	6,300

If 80m³ gross per hectare is assumed as the minimum yield then the availability of Mixed Species with no RL is around 2000m³ nett per year.

6.3.19 Changed Minimum Log Diameter Specification

This element is not relevant or significant in this estimate for this FMA.

6.3.20 Changed Silviculture System

This element is not relevant or significant in this estimate for this FMA.

6.3.21 Additions to The Forest Estate

This element is not relevant or significant in this estimate for this FMA.

6.3.22 Reforestation of Unstocked Stands

There are approximately 6,500 hectares of unstocked stands. Reforestation is suitable on 410 hectares of unstocked stands per year, for approximately 15 years. If undertaken, it would result in the volume of approximately 8,000m³ per year being available approximately 80 years into the future.

7 Resource Outlook

Based on a non-declining yield for the entire planning horizon, it can be expected that there will be a supply of 71,900m³ nett per year until 2005 rising to 72,600m³ nett per year until 2020. The available volume then steadily increases until 2030 when 79,900m³ nett per year is available.

The Ash to mixed species ratio during this period will remain relatively constant at approximately 70% ash (currently 46%) and 30% mixed species (currently 54%). There will have to be a change within the mixed species with Mountain Mixed Species supplying approximately 23% (currently 65%), Foothill Mixed Species supplying 59% (currently 28%), Alpine Mixed Species supplying 16% (currently 5%) and Coastal Mixed Species supplying around 1% (currently 2%).

The TIS sets a nominal rotation age of 80 years for ash species and 120 years for mixed species stands. The TIS permits harvesting above or below the nominal rotation age in order to regulate age classes and to provide for smooth timber flows. For the purposes of the above scenarios, a minimum of 60 years for the commencement of cutting was applied to existing fire regrowth and logging regrowth Ash and Mountain Mixed Species stands. A minimum rotation age of 80 years was applied to existing fire regrowth and logging regrowth in Alpine Mixed Species and Foothill Mixed Species stands. A minimum rotation age of 100 years was applied to existing fire regrowth and logging regrowth in Coastal Mixed Species stands. For subsequent rotations, nominal rotation ages of; 80 years for Ash species, 90 years for Mountain Mixed Species, 100 years for Alpine Mixed Species and Foothill Mixed Species, and 120 years for Coastal Mixed Species, were used.

8 Data Standard

The Expert Data Reference Group (EDRG) has provided an independent assessment of data and methods used in the development of Estimates of Sawlog Resource. The EDRG has used a one to five star rating to classify data quality and methodological rigour in terms of three fundamental parameters and their relationship to forecasting long term allocation levels:

- area,
- woodflows, and
- yield.

One star indicates data inadequacy and five stars indicate data excellence for the basis of issuing long-term licences at the proposed allocation level. An overall score is also given, based on the weakest of the three fundamental parameters.

In the Tambo FMA (including the 11 Wodonga FMA blocks), area was given three stars, woodflows, three stars and yield, two stars. This has resulted in an overall two star rating.

This rating will be considered in determining future licensing arrangements within a risk management framework.

9 Conclusion

The forests of the Tambo FMA are dominated by mature and overmature forests. The area available for harvesting has been reduced from previous estimates due to the inclusion of operational constraints not previously measured. With a two star rating, the yield data is considered weak by the Expert Data Reference Group. There are sufficient sawlog resources to maintain current licence levels.

10 References

NRE (1996). *Code of Forest Practices for Timber Production, Revision No. 2*. Department of Natural Resources and Environment, Melbourne.

NRE (1999). *Gippsland Fire Protection Plan*, Department of Natural Resources and Environment, Melbourne.

Commonwealth of Australia and State of Victoria (2000), *Gippsland Regional Forest Agreement*, Commonwealth of Australia and State of Victoria, Melbourne.

11 Glossary

“A” Grade Sawlog A sawlog with a minimum small end diameter underbark of 50cm which has no defective quarters and maximum defects on exposed end of: one-quarter diameter lengths of all gum vein or gum pockets, light stain, and maximum angle of sloping grain of 1:10 along the length of the sawlog.

Advance Growth (Advance Regeneration) Any established seedlings, saplings or poles which are present in a forest when some form of forest treatment is planned to obtain regeneration.

Age Classes Stands of timber originating at a defined time ie. wildfire or harvesting disturbance.

Agreement An arrangement for harvesting and removal of forest produce authorised by specific legislation.

Annexures Additions to licences that specify target volumes for sawlog grade or species.

Annual Allocation The annual quantity of timber specified in schedule 1 of a Long Term Licence, and which the Secretary is to make available from time to time under Condition 11 of the Licence Conditions.

“B” Grade Sawlog A sawlog with a minimum small end diameter under bark of 35cm which has maximum allowable defects on exposed ends of: one-quarter diameter length of loose gum veins/pockets and shakes, one diameter length of tight gum vein more than 3mm in width, two diameters length of tight gum vein less than 3mm in width, light stain, 1:10 angle of sloping grain along the sawlog axis, and a maximum of 105cm squared of pipe in an exposed end.

Block A major division of a forest, delineated for management purposes and bounded by natural features such as ridges and streams. Usually comprises a number of compartments.

Buffer A protective margin of vegetation abutting a stream, spring, wetland, body of standing water, swampy ground, private property, road, landscape feature, valued area or an area of rainforest, which protects it from potentially detrimental disturbances in the surrounding forest. Buffer width is defined as horizontal distance from which various operations are excluded.

“C” Grade Sawlog A “C” grade sawlog is considered to be any sawlog with a minimum small end diameter under bark of 30 cm which has maximum allowable defects on exposed ends of: one diameter length of loose gum veins/pockets and shakes, seven diameters length of tight gum vein more than 3 mm width, unlimited lengths of tight gum veins less than 3 mm width, dark stain, maximum sloping grain angle of 1:8 along the length of the sawlog, maximum of two defective quarters, and maximum of 112 cm square pipe on exposed end.

Code of Forest Practices for Timber Production A set of operational principles and, in some cases, minimum performance standards for the conduct of timber harvesting and associated works in forests in Victoria, referred to as the Code.

Comprehensive, Adequate and Representative Reserve System A reserve system to conserve all native forest types as well as the plants and animals that depend on them. Comprehensive: the full range of forest communities recognised by an agreed national scientific classification at appropriate hierarchical levels; Adequate: the maintenance of the ecological viability and integrity of populations, species communities; Representative: those sample areas of the forest that are selected for inclusion reserves which should reasonably reflect the biological diversity of the communities.

Continuous Forest Inventory Plots (CFI Plots) Plots established throughout the forest on which tree growth information is measured. The plots are measured periodically (at five- or ten-year intervals, for example), and growth on the plot can be determined from the difference between measurements.

Coupe An area of forest of variable size, shape and orientation from which logs for sawmilling or other industrial processing are harvested.

“D” Grade Sawlog A “D” grade sawlog is considered to be any sawlog with a minimum small end diameter under bark of 25cm which has maximum allowable defects on exposed ends of: two diameters length of loose gum veins/pockets or shakes, 10 diameters length of tight gum vein more than 3mm width, unlimited length of tight gum vein less than 3mm width, dark stain, maximum sloping grain

angle of 1:8 along the length of the sawlog, maximum of three defective quarters, and maximum of 120cm square of pipe defect on exposed ends.

D+ Sawlog Sawlogs of grade D and better ie. Including C, B, and A grades.

DBHOB Diameter breast height over bark (breast height = 1.3m).

Ecologically Sustainable Forest Management The management of forests on all land tenures to maintain the overall capacity of forests to provide goods, protect biodiversity, and protect the full suite of forest values at the regional level.

Even-aged forest/stand Forest predominantly of the one age. Usually originating as a result of an intense burn or harvesting activity.

Evergreen Licence A sawlog licence with a provision for renewal before the fifth year of the licence, if the licensee has proposals for significant capital expenditure.

Expert Data Reference Group (EDRG) A group appointed by the Minister to review the data used to estimate the available volumes. Consist of Professor J. VanClay (Southern Cross University) and Professor B. Turner (ANU).

Fauna A general term for animals (including reptiles, birds, marsupials and fish).

Fuel Management Zone Modification of fuels by prescribed burning or other means. (There are 5 Fuel Management Zones).

Flora A general term for plants of a particular area or time.

Foothill Mixed Species Forest Forest with a mature stand height of less than 40m and generally occurring on mid range elevations.

Forest 25 A GIS spatial data set at 1: 25000 scale derived from detailed aerial photography interpretation assessments of ash and mixed species forests, and broad structural vegetation mapping for other mixed species forests.

Forest Coupe Plan A Forest Coupe Plan is a plan that must be prepared for each harvesting operation in public native forest and will contain a map identifying the area and a schedule incorporating the specifications and conditions under which the operation is to be administered and controlled. The Forest Coupe Plan will be prepared prior to the commencement of utilisation and will specify the matters set out in Section 2.3.1 of the Code of Practice.

Forest Management Area (FMA) The basic units for forest planning and management in Victoria. Currently Victoria is divided into 15 Forest Management Areas as defined in the *Forests (Timber Harvesting) Act* 1990, however, the Wangaratta and Wodonga FMAs are managed as the North East FMA.

Forest Management Plan Forest management plans are developed by the Department of Natural Resources and Environment to address the full range of values and uses in Forest Management Areas which have been designated as the units for planning forest management activities. Forest Management Plans will be prepared according to the guidelines set out in Section 2.1 of the Code of Forest Practices for Timber Production.

Forest Management Zone An area of similar physical capability or forest value to which particular Departmental strategy and specific prescriptions may apply. There are three types of zones: the Special Protection Zone, Special Management Zone and General Management Zone.

Forest Product Licence Authority to harvest and remove Forest Produce issued under section 52 of the *Forests Act* 1958. Document giving official permission to remove Forest Produce from designated areas of Public Land in the State of Victoria. Licences are issued in various forms depending on the type and quantity of produce, period of licence and method of payment (eg. The Forest Produce Licence and Receipt form is used for small quantities of produce with payment made in advance of removal).

Forest Type A classification of forests according to their life form and height of the tallest stratum, and the projected foliage cover of the tallest stratum.

FORPLAN A computer program that can be used to apply forest values (including financial) to forest stands. It is currently used in conjunction with GIS and models for timber, water and wildlife to estimate the response of these values over time for the whole forest for various management strategies.

General Management Zone (GMZ) Delineates the area to be managed for the broad range of forest values available in the area. The GMZ is divided into two sub-zones: 'Timber Production' where timber harvesting under standard conditions is one of the main uses and 'Other Uses' where the forest is unsuitable for sawlog production but where other activities are permitted.

Geographic Information System (GIS) A system which holds spatially referenced data which can be classified, overlaid, analysed and presented in map, tabular or graphic form.

Grade A measure of the quality of a hardwood log. The grade of a sawlog can be A, B, C, D, E or ungraded. The grade is determined using the Hardwood Sawlog Grading Card. Logsales also uses grade to identify product groups such as residual logs, pulpwood and firewood.

Gross Area The total estimated area of a coupe, forest or block.

Gross Volume The volume of a log inclusive of all defect i.e based only on the external dimensions.

Group Selection System All trees in a small patch are felled, with the gaps created scattered over the forest compartment. Gap size is no more than about two tree-heights in diameter, so that natural (or induced) seedfall from surrounding trees can be used. An uneven-aged system, as the fellings are done every 10-15 years.

Habitat Tree A tree that has been identified as providing important habitat for wildlife and which is given additional protection during forest operations.

HARIS (Hardwood Resource Information System) This system has been in operation since the late 1970's and forms the Statewide timber resource database for native forest on public land in Victoria.

Height Class Height class refers to a specified range of tree heights. The height classes used by the Statewide Forest Resource Inventory are:

Height Class 1a: 60m<	Height Class 1b: 51.1-60m
Height Class 2a: 46-51m	Height Class 2b: 40-45.9m
Height Class 3a: 34-39.9m	Height Class 3b: 28-33.9m
Height Class 4a: 22-27.9m	Height Class 4b: 15-21.9m
Height Class 5a: 10-14.9m	Height Class 5b: 5-9.9m
Height Class 6: <5m	

High Elevation Mixed Species (HEMS) Mixed species forests above 750m elevation but also some forests in frost hollows and on wetter aspects greater than 600m act as HEMS. Successful regeneration generally occurs from spring germination.

Integrated Forest Planning System (IFPS) Victoria has developed a system of linked computer-based tools collectively called the Integrated Forest Planning System (IFPS). The IFPS provides a means of modelling the growth, development and harvesting of forest stands as well as a range of other forest values.

Log Grading Assessment of the quality of a sawlog.

Log Length The length of a log is the shortest distance from end to end along the log. This is measured to the backward 0.1m but is normally considered in multiples of the backward 0.3m when discussing log lengths for grading purposes.

Long Term Licence A licence issued under the *Forests Act* 1958 for a period of more than 3 years and up to 15 years.

Long Term Sustainable Yield (LTSY) The theoretical rate of harvest that can be maintained in perpetuity.

Low Elevation Mixed Species (LEMS) These forests are usually below 750m elevation except for some forests in frost hollows and on wetter aspects between 600-750m which act as High Elevation Mixed Species. Most successful regeneration occurs from autumn germination.

Management Prescriptions Management Prescriptions detail specific conditions or standards that are to apply to forest operations in the vicinity of certain threatened flora or fauna. More detailed prescriptions are established at the local level and are reflected in Wood Utilisation Plans.

Mature Forest Forest at or beyond nominal rotation age but before it reaches the overmature stage. (Generally 60-150 years).

Mean Annual Increment (MAI) The total increment up to a given age divided by that age; average annual increment to that age (m³/ha).

Merchantable Trees, which are suitable for processing into, forest products and for which a market exists.

MESSIM (Messmate Simulator) A computer model developed to forecast the growth of messmate forests at Portland.

Minor Forest Produce Produce harvested from State forest other than sawlogs or residual logs. Minor Forest Produce is often collected by small operators or individuals and includes products such as sleepers, posts and poles, craftwood, firewood, honey, extractives, and eucalyptus oil.

Mixed Species Forest Forest, which has two or more eucalypt species commonly found within the canopy. Generally consisting of peppermint, messmate, gum or stringybark species. Does not include ash, red gum or box ironbark forests.

Nett Area The total estimated area of the coupe (to the nearest hectare). This area is to be determined from the calculated gross area less exclusion areas.

Nett Volume The volume of a log which can be converted to sawn timber. It is equal to the gross volume less the defect volume. Accounts are no longer issued in terms of nett volume however some licences are monitored in nett volume and sustainable yields are usually calculated in nett volume.

Non-declining Volumes, which do not decline over time, but may increase.

Old-growth Forest Forest which contains significant amounts of its oldest growth stage - usually senescent trees- in the upper stratum and has been subjected to any disturbance, the effect of which is now negligible.

Overmature A growth stage of a forest stand or individual tree that is characterised by declining crown leaf area and irregular crown shape due to loss of branches and epicormic growth.

Overwood Standing mature trees remaining after harvesting. Can refer to seed trees, habitat trees, culls or retained merchantable trees.

Periodic Annual Increment (PAI) The average annual increment for any defined short period, such as five years.

Productivity Class An area of forest that is considered for the purposes of yield estimation to be relatively uniform.

Public Land Unalienated land of the Crown managed and controlled by the Minister for Conservation and Land Management, the Minister for Agriculture and Natural Resources, or the Secretary of Natural Resources and Environment, whether or not occupied under a licence or other right (but not including land occupied under a lease, or land vested or leased by the Victorian Plantations Corporation or its successor in law).

Pulpwood Timber sold for the purpose of conversion to paper, pulp or other product which requires it to be chipped.

Reforestation The re-establishment of a stand of trees by planting or sowing with species native to the locality (unless an adverse microclimate requires the use of alternative native species for survival and growth) on previously cleared or poorly forested land.

Regional Forest Agreement (RFA) An agreement about the long-term management and use of forests in a particular region between the Commonwealth and a State Government.

Regrowth Forest Forest stands regenerated either naturally or by seeding following death or removal of the forest overstorey. A growth stage of a forest stand or individual tree in which the crowns have a narrow conical form and where trees are actively growing. A forest originating from fire, disturbance or harvesting actively below the nominal rotation age (Generally 1-60 years).

Residual Log (RL) Logs, not of sawlog quality, produced as a consequence of a sawlog harvesting operation. Unlike pulpwood the end-use of a residual log is not specified.

Retained Trees Trees retained on a coupe during a harvesting operation because they are unmerchantable, are to serve as seed trees or wildlife habitat trees, or have been selected to grow on after thinning.

Roundwood A log before it has been cut to produce sawn timber, veneer or woodchips.

Salvage Logging Logging to recover a resource that would otherwise be lost through damage by fire, pests or disease.

Sawlog Any length of merchantable log suitable for conversion to sawn timber which: is at least 2.7m in length, has a small end diameter under bark of 25cm or greater, does not have a sweep or crook which exceeds 1/5 of the diameter from a 2.4m straight edge, is of Grade D standard or better. Log suitable for conversion to sawn timber.

Seed Tree System All live trees are felled apart from a number of uniformly distributed trees retained to provide seed, and those required for environmental purposes. The seed trees would comprise 10-15% of the basal area of the original stand. An even-aged system.

Seed Tree A tree left standing following harvesting to regenerate the site by release of seed contained in the crown.

Selection System Silvicultural systems used to harvest and regenerate particular forest types. Trees are harvested either singly or in small groups at relatively short intervals indefinitely. Regeneration is established continually in the gaps produced and an uneven-aged stand is maintained.

Senescent See Overmature.

Statewide Forest Resource Inventory (SFRI) A strategic level inventory of forest resources on State Forest Victoria.

Shake A shake is a partial or complete longitudinal separation between adjoining layers of wood due to causes other than drying.

Shelterwood System A silvicultural system used for harvesting and regenerating particular forest types. It consists of the removal of a proportion of the mature trees to allow the establishment of essentially even-aged regeneration under sheltered conditions, followed by later felling of the remainder of the mature (seed) trees.

Silviculture The theory and practice of managing forest establishment, composition, and growth, to achieve specified objectives.

Single Tree Selection The felling of scattered mature individual trees, at intervals (generally 10-15 years) over the rotation. Regeneration is largely from lignotubers and coppice.

Site Index The relationship between the heights and ages of the dominant and co-dominant trees in a stand at a particular age, used as a measure of the amount of timber that could be produced from the stand.

Site Quality The potential of the site to grow timber. A function of soil quality, rainfall and aspect.

Size Class A range of log diameters. One product can have many size classes (or none). Size classes are used mainly for the application of royalty rates.

Small End Diameter Under Bark (SEDUB) The diameter is measured by averaging two diameter measurements taken at right angles to each other across the small end of the log, or by using a diameter tape placed around the circumference of the small end of the log. Bark thickness must be allowed for if using a diameter tape on an unbarked log. Diameter is expressed as the backward whole centimetre.

Smash That proportion of sawlogs that is lost due to damage that occurs when trees are harvested.

Soaks Springs and wet areas where the ground water table intersects with ground surface.

Special Management Zone (SMZ) The Special Management Zone will be managed to conserve specific features, while catering for timber production under certain conditions. These include areas where timber must be harvested in a different manner than is normal to protect particular values; for example in areas where accelerated tree senescence is being induced.

Special Protection Zone (SPZ) The Special Protection Zone will be managed for conservation, and timber harvesting will be excluded. It will include areas of special significance of flora and/or fauna, areas for protection of water quality and other values (such as rainforest, riparian vegetation), and other areas of special significance (like special landscape and historic value). Such areas will be linked to the parks and reserves system where appropriate.

Stand A group of trees in a forest that can be distinguished from other groups on the basis of age, species composition, condition etc.

Stand Condition The health, age and size class distribution, and stocking of a forest stand.

Standard Licence A sawlog licence that is renewable within five years of its expiry date.

STANDSIM A computer model developed to forecast the growth of even-aged stands of Ash, Silvertop and Messmate.

Stumpage The value of timber as it stands in the forest.

Sub-dominant A sub-dominant crown is one where the area occupied by the tree crowns of the upper stratum occupies 11%-30% of the total crown cover of the stand.

Sustainable Yield The sustainable yield of a forest is the maximum level of commercial timber which can be maintained in perpetuity under a given management regime. In Victoria sustainable yield is specified in legislation as the rate of harvest that can be maintained for a defined period (usually 10 years).

SYSS (Sustainable Yield Spreadsheet) A computer model developed to schedule woodflows and determine yields of sawlogs into the future.

Thinning The removal of part of a forest stand or crop, with the aim of increasing the growth rate and/or health of retained trees.

Thinning From Above (THA) Removing the larger and well developed stems from a stand allowing the smaller stems to increase their growth.

Thinning From Below (THB) Removing the smaller and poorly formed stems from a stand and allowing the larger better formed stems to increase their growth.

Timber Resource Analysis An analysis of the timber availability prepared for the RFA process.

Uneven-aged Stand Forest stand which contains a continuum of age classes as a result of more or less continuous regeneration within the stand over a number of years.

Unmerchantable Trees which are not suitable for processing into forest products and for which market exists.

Value Adding An economic term which describes how a raw product is processed into a product which is of more value than the material in its raw state. In the forest and wood industry context, examples of this include the kiln-drying of sawn timber and the manufacturing of wood veneers.

Waste See Smash.

Yield Curves A yield curve defines the volumes of logs available (in a particular forest type and productivity class) at different ages for a particular silvicultural regime.

12 Map 1 – Tambo FMA

Tambo FMA

