

**CENTRAL GIPPSLAND
FOREST MANAGEMENT AREA**

ESTIMATE OF SAWLOG RESOURCE

**Department of Natural Resources and Environment
Victoria**

March 2002

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Published by the Department of Natural Resources and Environment
PO Box 500, East Melbourne
Victoria 3002, Australia

<http://www.nre.vic.gov.au>

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The National Library of Australia Cataloguing-in-Publication entry:

Victoria Dept. of Natural Resources and Environment.
Central Gippsland Forest Management Area
Estimate of Sawlog Resource

Bibliography
ISBN 0 7311 5179 8

1. Forest management – Victoria. 2. Sawlog resources – Victoria. 3. Forests and forestry – Victoria. I. Victoria Forests Service. II. Title. III. Title: Estimate of Sawlog Resource.

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FOREWORD

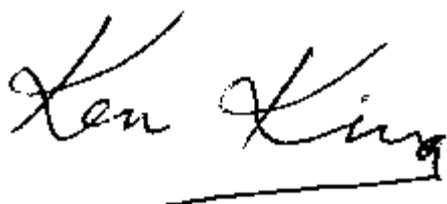
In March 2001 the Minister for Environment and Conservation initiated a process to issue new sawlog licences at appropriate levels. This process culminated in the preparation and release of the *Our Forests Our Future* Statement in February 2002. This Government Statement announced wide ranging reforms 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 Central Gippsland 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

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1 Introduction

This Estimate of Sawlog Resource (ESR) summarises current Central Gippsland 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 Estimate of Sawlog Resource 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 (EDRG) and peak industry and union groups, and is intended to assist in identifying soundly-based options for future licensing arrangements with the timber industry.

2 Background

Central Gippsland Forest Management Area (FMA) is located within the Latrobe and Gippsland regions, Victoria. It encompasses areas south of the Great Dividing Range to the coast and stretches from the Bunyip River in the west to the Dargo River and Lake Wellington in the east. It includes the major rural centres of Warragul, Traralgon, and Sale, and the smaller towns of Noojee, Erica, Heyfield, Maffra, Dargo and Yarram (see Map 1).

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 sawlog yield rates were determined for each one of 15 Forest Management Areas 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 (FMP's), 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* listed the sustainable yield at 183,000m³ nett per year C+.

The forest resources of Central Gippsland FMA were quantified in the Resource Assessment Report published in 1991.

The Statewide Forest Resource Inventory (SFRI) project commenced in the Central Highlands at the time of the 1996 sustainable yield review. However, new data was not available to update existing information. One change that was made was to

convert the C+ sawlog figure to D+. As a result the sustainable yield for Central Gippsland was adjusted to 225,000 m³ nett per year D+.

Two Forest Management Plans and two Regional Forest Agreements (RFA) apply to the Central Gippsland Forest Management Area. The Central Highlands Forest Management Plan and the Central Highlands RFA were completed in 1998. The Gippsland RFA was completed in March 2000 and the Proposed Gippsland Forest Management Plan was released in July 2001.

A Timber Resource Analysis was undertaken as part of the Gippsland RFA. It concluded that 173,000m³ nett per year D+ would be available from 2002 for ten years and that this would increase to 200,500m³ nett per year D+ from 2012 for a further ten years. The Timber Resource Analysis did not use a complete SFRI area data set. This is now available and was used for this Estimate of Sawlog Resource.

The reserve system in the Central Gippsland Forest Management Area including parks, reserves and Special Protection Zone (SPZ) has provided for the protection of comprehensive, adequate and representative values to agreed targets. Harvesting can occur in the General Management Zones (GMZ) and Special Management Zones (SMZ) under specific conditions (Figure 1).

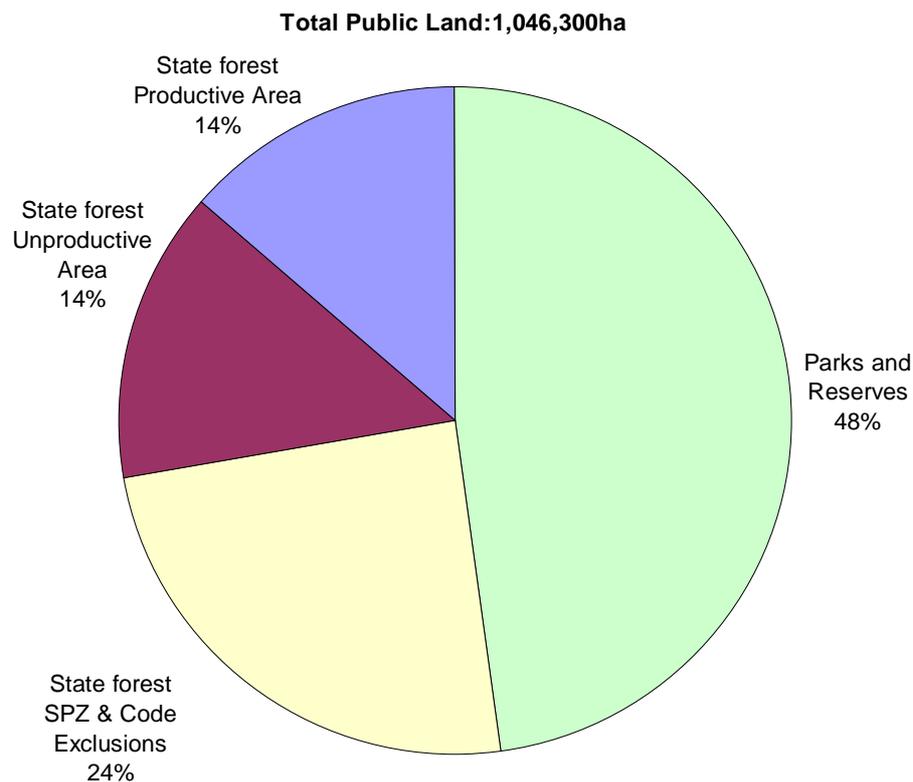


Figure 1. Public Land in the Central Gippsland Forest Management Area

The forests of the Central Gippsland FMA are predominantly regrowth forests and have a long history of timber harvesting.

The major defining event in this area was the 1939 bushfires, which resulted in the majority of ash forest being killed or damaged. At that time the Government initiated a scheme that directed the timber industry to concentrate operations in these stands.

Milling operations were accelerated to minimise timber losses, reaching a peak during 1945-1950. Salvage operations were terminated in 1952 to avoid damaging the regenerating forest. Much of the ash regrowth resource originates from this period.

Harvesting in the period 1950-1980 has concentrated on the mixed species resource that survived the 1939 fires and those ash stands that were not burnt. Much of the harvesting was undertaken on a sawmiller-selection basis. Stands of mixed species remaining are either regrowth, have histories of selective logging, or are comprised of non-desirable species. Harvesting commenced in the 1939 regrowth ash in the early 1980s. Large areas of regrowth have originated from this harvesting.

3 Licence Commitments

Tables 1 and 2 below show the long term sawlog and residual log commitments for Central Gippsland FMA. Licensed volumes steadily expire from 2002 to 2010.

Table 1. Current Central Gippsland FMA Commitments by Licence Type and Expiry

Licence Type	Expiry date	No. of Licences
Sawlog, Standard	30/06/02	11
Sawlog, Standard	30/06/07	3
Sawlog, Standard	30/06/08	1
Sawlog, Standard (non renewable)	30/06/05	2
Sawlog, Evergreen	30/06/07	13
Sawlog, Evergreen	30/06/08	5
Sawlog, Evergreen	30/06/09	1
Sawlog, Evergreen	30/06/10	1
Total		37
Standard, E Grade ³ Residual Logs	2008	1 ¹
Agreement, Residual	2030	1 ²
Total		2

Note: 1. This licence is shared with two other FMA's.
 2 This Agreement is shared with three other FMA's.
 3 E Grade logs are better quality Residual Logs from which sawn timber can be produced

Table 2. Current Central Gippsland FMA Commitments by Species and Grade

Product / Grade	Annual Allocation			
	Species Type			
	Ash Species	Non-specific	Mixed Species	Total
Sawlog (m³ nett)				
B+	51462	9355	0	60817
C	57963	33619	1200	92782
D	6895	20038	300	27233
Sawlog Total	116320	63012	1500	180832
Specialty	0	240	0	240
Residual Log (m³ gross)				
E Grade ¹	10320	0	0	10320
Residual Log ²	292500	0	150716	443216
Residual Log Total	302820	0	150716	453536

Note: 1 E Grade Logs are better quality Residual Logs from which sawn timber can be produced
 2 Based on 2000/2001 planned intake.

4 Harvest History

4.1 Total Sawlog Production

Figure 2 shows sawlog volume produced for each forest type from 1990/91 to 1999/00. Annual production levels have been significantly less than the current licence level. Average nett sawlog production over the last 10 years is 132,286m³ nett.

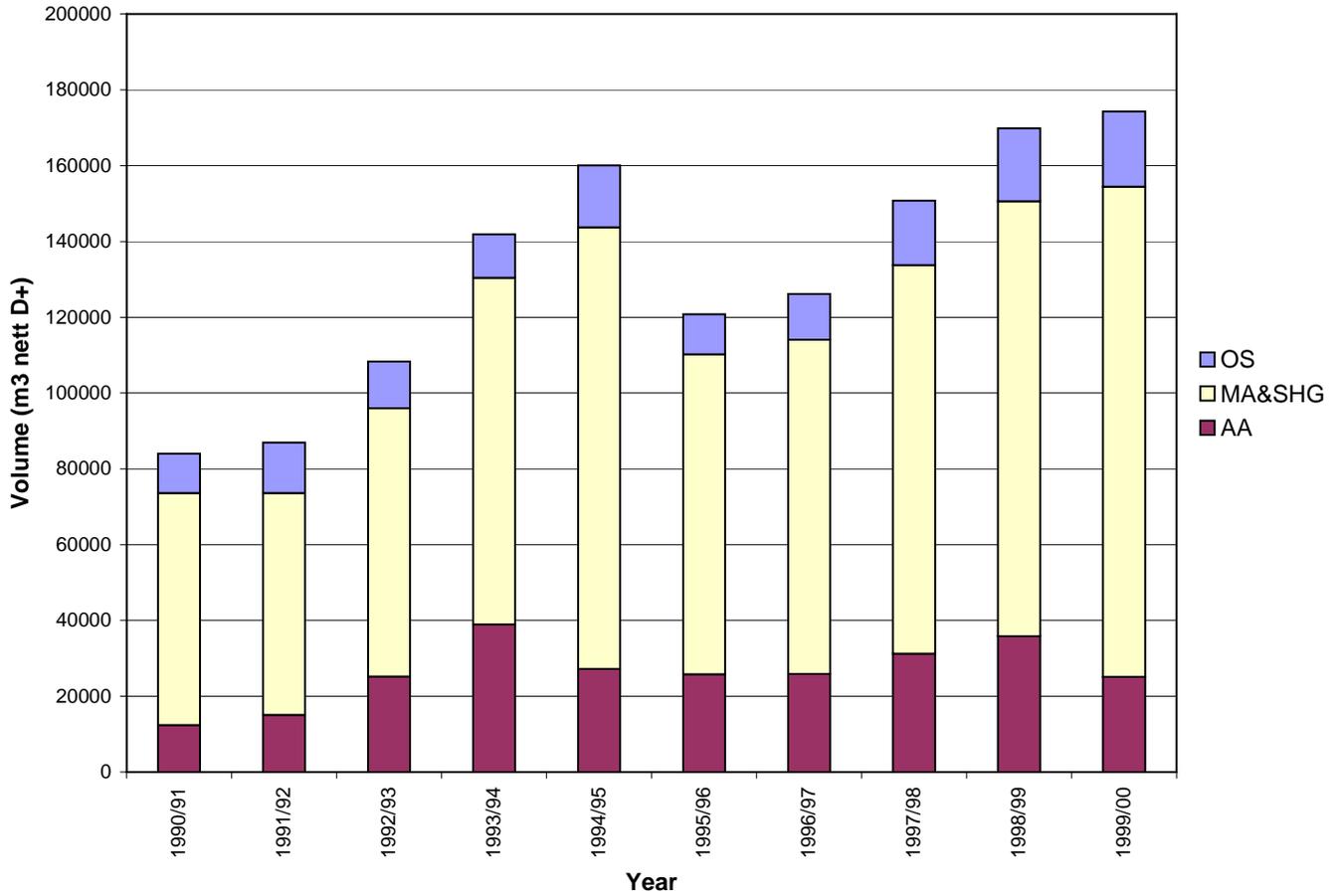


Figure 2. D+ Sawlog produced by Forest Type by Year

Note:

Forest Types: AA – Alpine Ash, MA&SG – Mountain Ash and Shining Gum, OS –Mixed Species

4.2 Sawlog Grades

Figure 3 shows sawlog grade production has changed from 1990/91 to 1999 – 2000 based on nett volumes produced. This reflects the restructuring of licences, and increased harvesting of Alpine Ash.

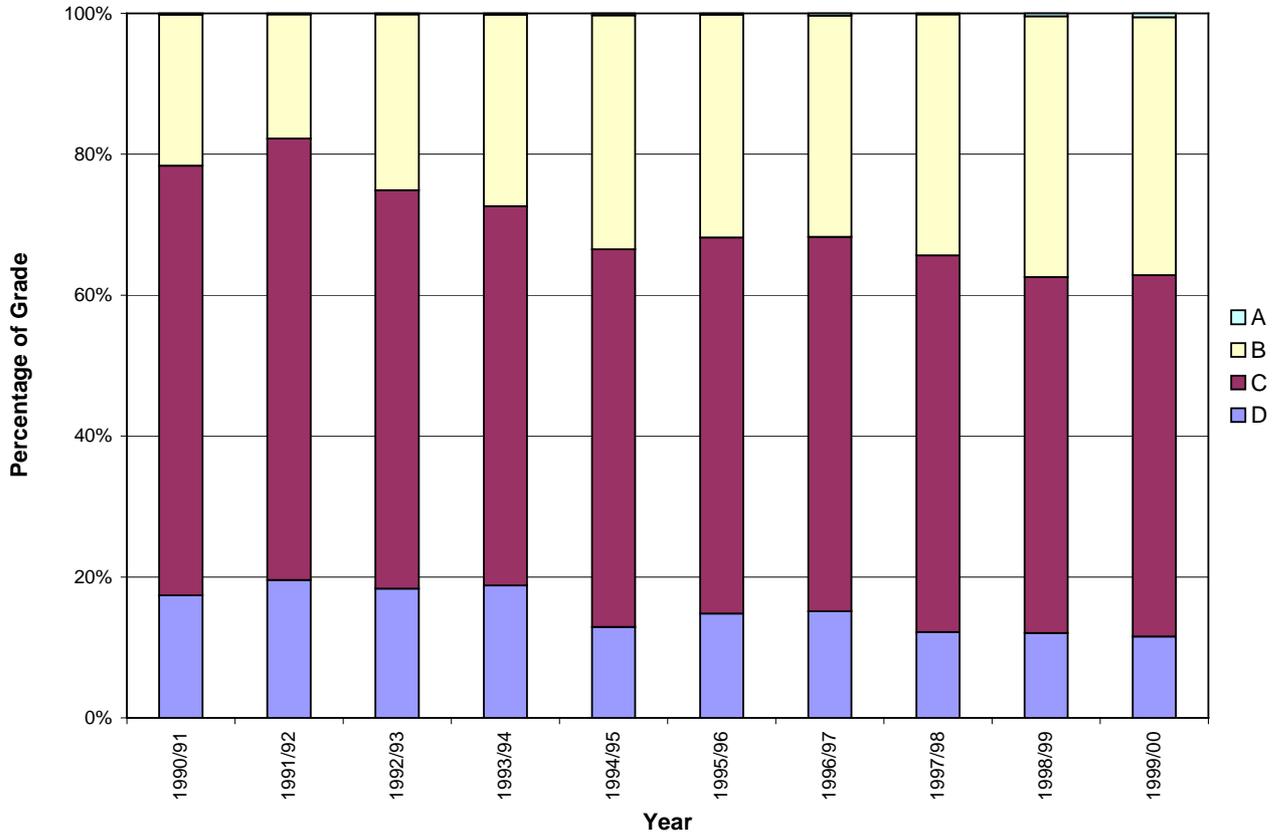


Figure 3. D+ Sawlog Grade Proportions by Year

4.3 Sawlog Size Classes

Figure 4 shows the proportion based on nett volume of sawlogs below 45cm in diameter under bark produced from 1997/98-1998/99 by individual species.

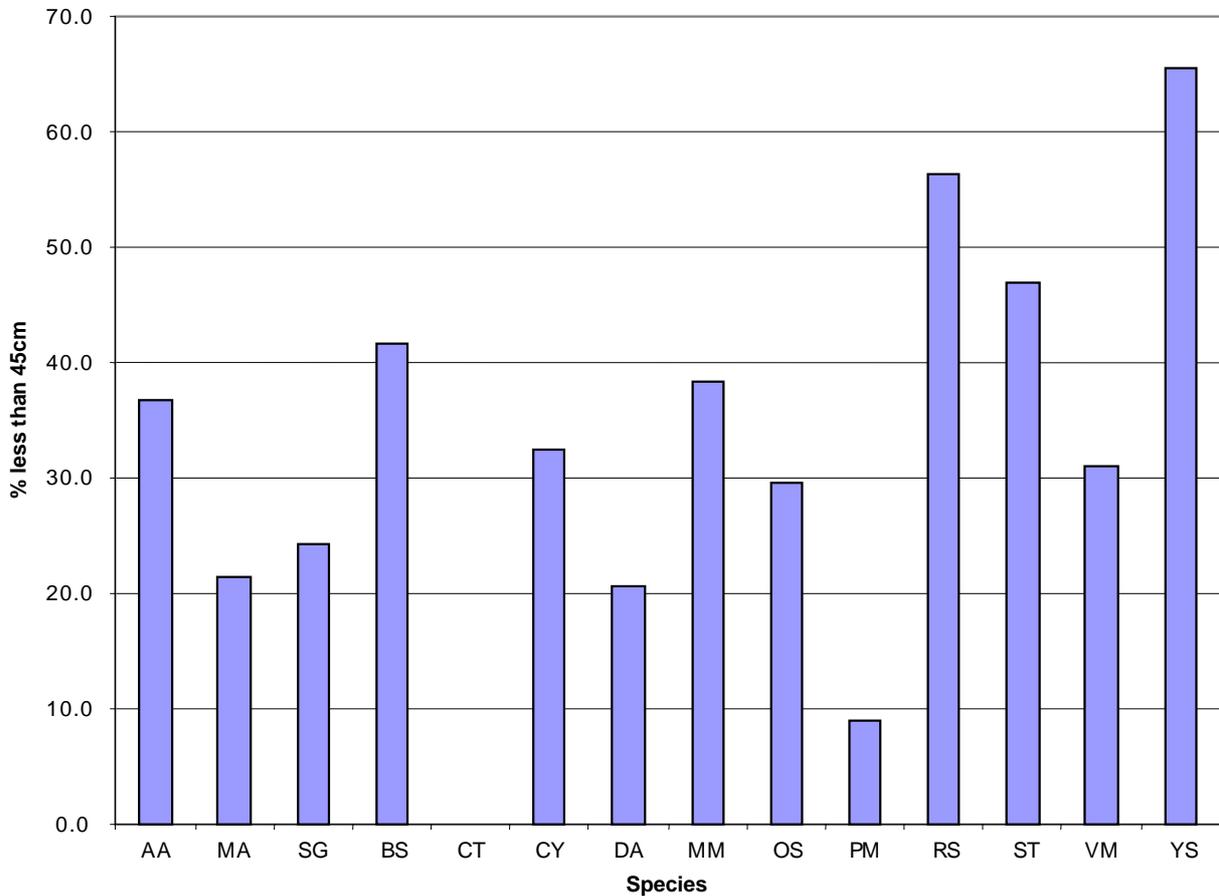


Figure 4. D+ Sawlog Size Class Distribution by Species for the 1997/98 – 1998/99 Period

Notes:

Mixed species amount to approximately 6 % of the harvested area over this period and includes the following species:

Ash Species

AA-Alpine Ash,

MA-Mountain Ash,

SG-Shining Gum

Mixed Species:

BS-Brown

Stringybark,

CT-Cuttail,

CY-Mountain

Grey Gum,

DA-Mountain Gum,

MM-Messmate,

OS-Other Species,

PM-Peppermint,

RS-Red Stringybark,

ST-Silvertop,

VM-Manna Gum,

YS-Yellow Stringybark.

The figure also shows a high proportion of larger log sizes associated with Mountain Ash and Shining Gum. Coupe selection has targeted the faster growing stands as these forests are still relatively young. These log sizes may not be representative of the resource as many smaller diameter stands at higher elevations have not yet been scheduled for harvesting.

4.4 Area Harvested

Figure 5 shows areas harvested by forest type from 1990/91 to 1999/00.

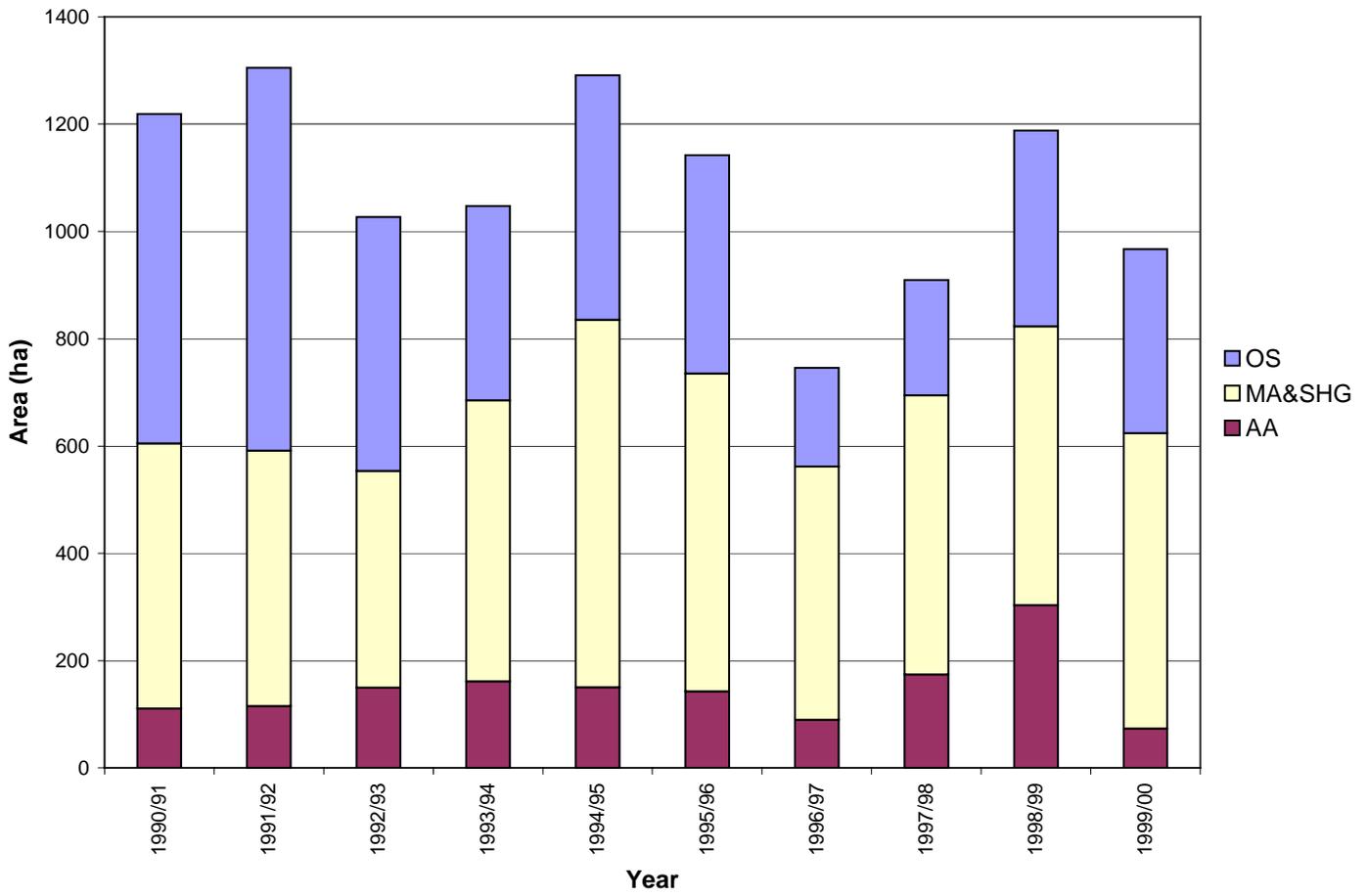


Figure 5. Areas harvested by Forest Type by Year

4.5 Sawlog Yields

Figure 6 shows yields from harvesting by forest type for the period 1990/91 to 1999/00.

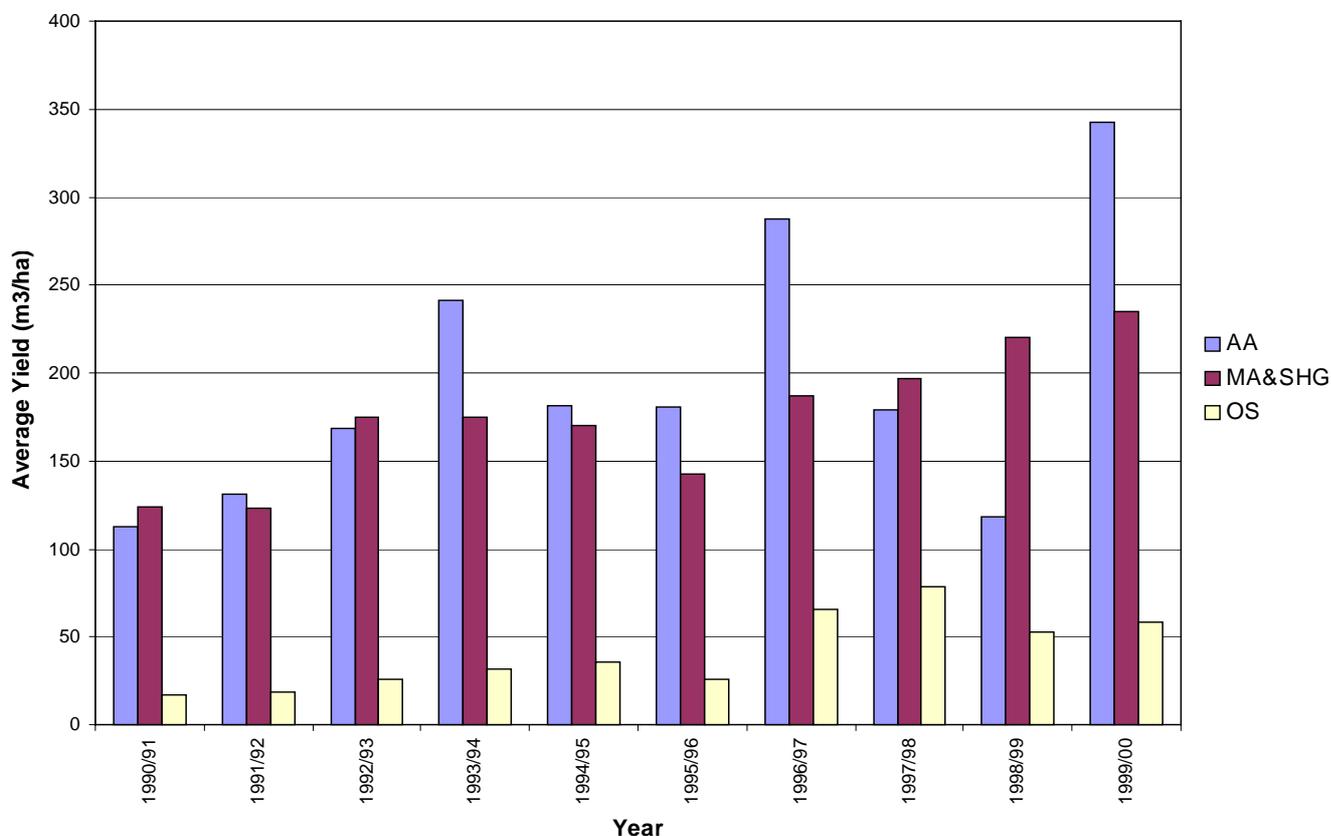


Figure 6. Sawlog Yields by Forest Type by Year

Areas scheduled for harvesting have tended to concentrate on the faster growing and higher yielding regrowth stands in both the ash and mixed species. High yielding stands of Alpine Ash have been almost exclusively harvested in preference to lower yielding stands. These high yielding stands are estimated to comprise only one third of the total Alpine Ash resource.

The regrowth Mountain Ash forests grow faster than other ash species and have produced sawlogs since 1985.

Increases in ash yields would be expected to indicate that the resource is growing. This may not be the case as in years of low sawlog demand such as 1990/91-1991/92 and 1995/96 – 1996/97, higher pulp yielding stands were scheduled to meet residual commitments. The area constraints such as those in the Thomson catchment have also meant that the highest yielding stands have been selected for harvesting. Such yields may not continue.

Increases in mixed species yields reflect a transition from the mature to the regrowth resource. The mature resource is low yielding, having had a history of selective logging or containing many non-desired and often unmerchantable species. As with the ash forest, better stands have been selected for harvesting in recent years and this may not continue into the future.

4.6 Residual Log Sales

Figure 7 shows residual log sales for the period 1989/90 to 1999/00. Generally, all of the residual log produced is sold.

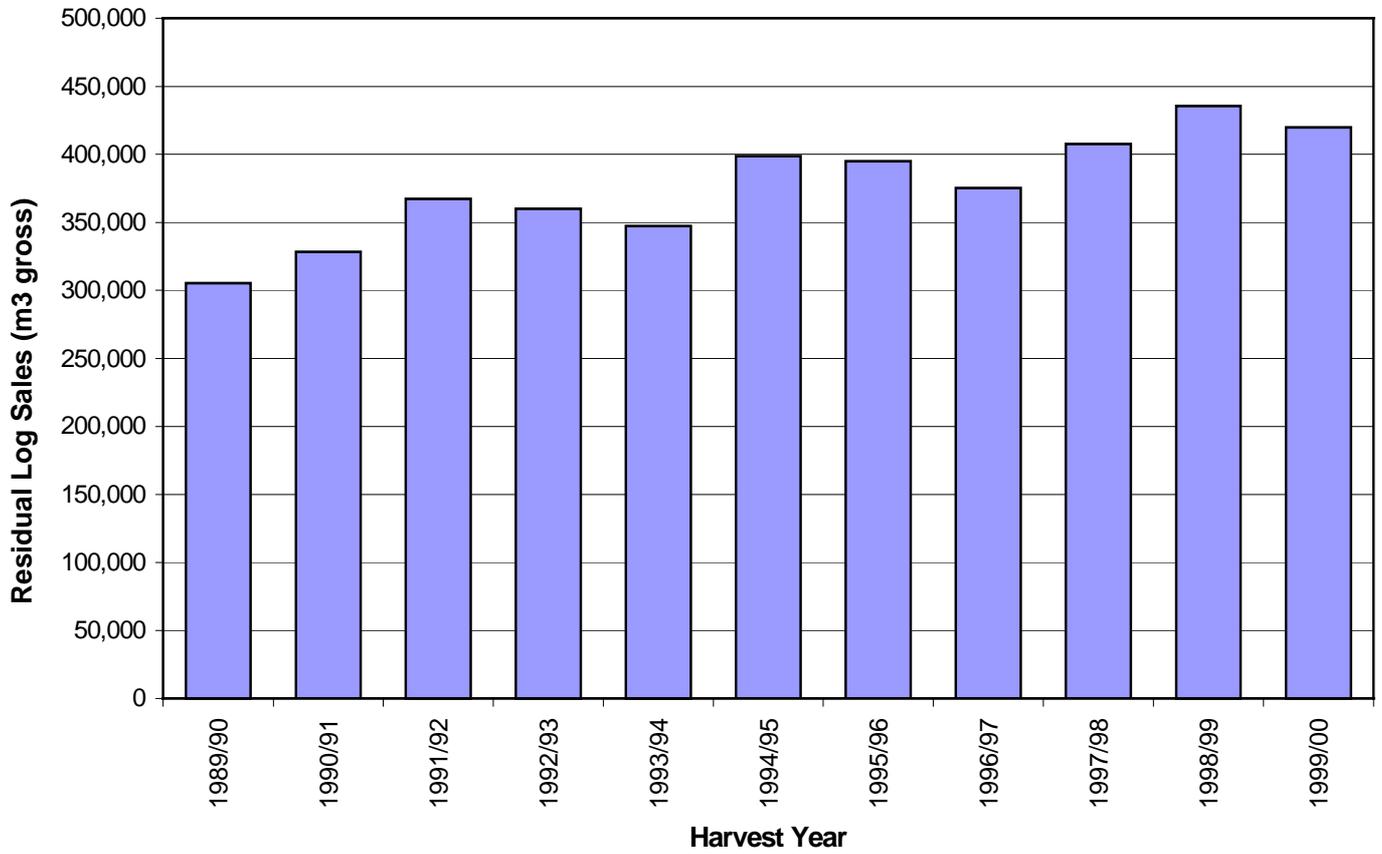


Figure 7. Residual Log Sales by Year

5 Volume and Growth Information

5.1 Standing Volume

State Forest Resource Inventory (SFRI) stand mapping benchmarked to June 2000 has been used to determine the area of species and age classes. SFRI volume and growth data is currently not available specifically for Central Gippsland FMA. The yield data used for the ESR is based on actual yields. The data used in 1992 to calculate the sustainable yield was generic for the Central Highlands and not specific to Central Gippsland FMA.

In the absence of SFRI yield and growth data, harvesting records were examined for a five-year period for the FMA, excluding Caledonia fire salvage. SFRI height classes were correlated to yield for each forest type. It was possible to prepare specific yields for most of the timber catchments using this data.

Reductions in yields caused by the following factors have been accounted for by the use of yields based on actual harvesting:

- Retained habitat and seed trees.
- Harvesting losses.
- Log grading non-compliance.

5.2 Growth

Yield curves were derived using the following process:

- Ash curves were compared to a recently developed North East FMA Alpine Ash curve that is considered an improvement to those used previously.
- Ash curves were then fitted by scaling both axes. This addressed some of the shortcomings of previous curves.
- Mixed Species curves were derived using the 1996 data. Actual yields were used to scale the yield axis. No scaling was done to the time axis. These curves are more accurate than previous curves in the short to medium term.

When harvesting records are used to derive yield curves and tables, there is a likelihood that they are from a biased sample. Records used were from a five-year period, during which, it is considered that better than average coupes were harvested. This may have inflated actual yields above the average. Mixed species curves are more likely to be affected by this than ash curves as there is more variation in the resource. Lower volume classes are more likely to be affected than higher volume classes. A 10% allowance for high volume classes and 20% for low classes have been used to account for this possible Coupe Selection Bias. The forest has been stratified into a high and low volume class that is intended to lessen the effect of Coupe Selection Bias. Classes were used where an observable difference could be found from analysing SFRI species and height data and sawlog volume records within a Timber Catchment.

6 Resources

6.1 Wood Flows

In the Central Gippsland 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 representation of sawlog resource within a standardised statewide format. Volumes are indicative only. This profile is to be read in conjunction with the accompanying comments on each resource element. Differences between previous estimates of volumes and areas and those shown in Table 3 are explained further in the Appendix.

Table 3. Profile of Resource Elements for Central Gippsland FMA

No.	RESOURCE ELEMENT	Note	Area (ha)	Annual Volume (m ³ nett/yr)
	STATE FOREST (INCLUDING SOME HISTORIC AREAS)		521,917	
	Code and Forest Management Plan elements:			
1	SPZ & proportion SMZ		133,108	
2	Code slope & stream buffer exclusions		110,667	
3	FMP prescriptions	1	0	
4	Unmapped streams and soaks not considered in Code buffer exclusions		33,726	
5	Standard SFRI unproductive stands		115,967	
	BIOLOGICAL SUSTAINABLE YIELD		128,449	112,000
	Operational elements:			
6	Further unproductive stands		23,098	0
7	Slopes additional to Code exclusions		1,441	1,000
8	Areas not harvested near stream buffers		2,633	3,000
9	Small and isolated areas		11,930	12,000
10	Rocky areas	2		
11	Harvesting losses			
	Management elements:			
12	Landscape buffers			
13	Fire losses			1,000
14	Disease losses			
15	New flora, fauna and cultural site reservations			
16	Temporal and spatial constraints			5,000
	Remaining element:			
17	Economically Accessible Resource		89,347	90,000
	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	3		

Notes: Elements 6 to 16 and 18 to 22 may alter, increasing or decreasing the economically accessible resource element 17

1. Leadbeaters Possum Habitat requirements (see section 6.3.3)
2. See section 6.3.8.
3. See section 6.3.22 for potential areas and volumes for this element

6.3 Resource Elements

6.3.1 Special Protection Zone and Proportion of Special Management Zone

All Special Protection Zone is excluded from harvesting and some parts of the Special Management Zone is considered available for harvesting.

6.3.2 Code Slope and Stream Buffer Exclusions

The *Code of Forest Practices for Timber Production* (NRE, 1996) requires exclusion of slopes steeper than 30 degrees, streamside and rainforest buffers.

6.3.3 Forest Management Plan Prescriptions

Areas of temporary Leadbeaters Possum habitat have been included in the available area but are scheduled for harvesting over the next twenty years. Habitat for Leadbeaters Possum is defined as live mature ash trees or areas of ash forest with a high density of fire killed habitat trees. Considerable areas of this latter temporary habitat exist in the west of the FMA and remain unavailable in the short term until the dead habitat trees collapse. This is predicted to occur in the next twenty years, however, uncertainty exists as to exactly when these high value areas will be available.

6.3.4 Unmapped Streams and Soaks Not Considered in Code Buffer Exclusions

Refer to section 6.3.8.

6.3.5 Standard Statewide Forest Resource Inventory Unproductive Stands

The forest stands which are excluded in the Central Gippsland FMA on the basis of being non-productive are *E.angophoroides* (Apple-topped Box), *E.bridgesiana* (Apple Box), *E.camphora* (Mountain Swamp Gum), *E.cephalocarpa* (Silver-leaved Stringybark), *E.chapmaiana* (Chapmans Gum), *E.goniocalyx* (Long-leaved Box), *E.ignorabilis* (Grey Scent-Bark), *E.mannifera* (Brittle Gum), *E.pauciflora* (Snow Gum), and *E.stellulata* (Black Sallee), and stands that are not capable of attaining heights greater than approximately 28 metres. Unstocked wattle stands were classed as productive in the SFRI analyses but have been excluded from this analysis.

6.3.6 Further Unproductive Stands

Logging history, field checking and industry feedback has identified that various species combinations, in addition to those defined as unproductive by SFRI, are considered unproductive in the Central Gippsland FMA. Various species/stands were evaluated to determine their suitability for sawlog production.

All late mature and senescent ash species (Mountain Ash, Alpine Ash, and Shining Gum) and ash species originating prior to 1950 that had not reached approximately 28 metres was deemed to be non-productive.

The following species are considered unproductive in addition to those defined by SFRI:

Species	Common Name
<i>E.camaldulensis</i>	River Red Gum
<i>E.croajingalensis</i>	Gippsland Peppermint
<i>E.elata</i>	River Peppermint
<i>E.ovata</i>	Swamp Gum
<i>E.polyanthemos</i>	Red Box
<i>E.rubida</i>	Candlebark
<i>E.smithii</i>	Gully Gum
<i>E.tereticornis</i>	Forest Red Gum
<i>E.tricarpa</i>	Red Ironbark

In addition the following stands/species are considered unproductive:

- Stands containing very low yields (less than approximately 4m³/ha) or those with species considered unproductive.
- All mixed species that had not reached approximately 28 m of origin prior to 1950.
- Stands associated with *E.mannifera* (Brittle Gum).
- Mature, Late Mature, or Senescent Grey Gum stands in Noojee and Erica.
- Stands of regrowth Grey Gum in Noojee and Erica that had not reached 32 metres in height by the age of 50.
- Stands of Grey Gum in Heyfield that had not reached approximately 35 metres in height by the age of 50.
- Stands of Mountain Gum if they were not associated with ash species and/or were less than approximately 37 metres tall when over 50 years old. All senescent and late mature age groups.
- Stands of Broad or Narrow-Leaved Peppermint if they were not associated with ash species or if they were older than 50 years and had not reached a height of approximately 32 metres.
- Stands of Silvertop if they were older than 50 years and had not reached a height of approximately 32 metres.
- Stands of Manna Gum if they were older than 50 years and had not reached a height of approximately 32 metres.
- Stands of Red Stringybark if they were older than 50 years and had not reached a height of approximately 37 metres.
- Stands of White Stringybark if associated with Peppermints or Red Stringybark or if they were older than 50 years and had not reached a height of approximately 32 metres.

6.3.7 Slopes Additional to Code Exclusions

Refer to section 6.3.8.

6.3.8 Areas Not Harvested Near Stream Buffers

Additional constraints were examined by determining the extent of actual stream buffers, unmapped streams, and unmapped steep slopes. The effect of these factors on harvestable area was measured using case studies or modelled with GIS.

Case studies in the Noojee Forest District examined 2,500ha of harvesting. Results indicated that only 82% of ash areas and 85% of mixed species were operationally available.

The GIS analysis used a 30 metre stream buffer to simulate actual stream buffers, given that harvesting studies show that in the steeper dissected country stream buffer widths exceed 20 metres. In the analysis 25-30 degree slopes immediately adjacent to 30 degree plus slopes were also excluded from the harvestable area to replicate actual harvesting trends.

The current mapping of Tanjil and Tyers catchments appears to underestimate the level of streams that exist. In some areas additional stream patterns were identified (and incorporated into current mapping) using work undertaken for mapping Baw Baw Frog habitat.

Correction factors for each of the timber catchments are listed below. These factors consider field studies (where available), slopes of 25 degrees adjacent to slopes of 30+ degrees, unmapped streams and modelled stream buffers:

Timber Catchment	Correction Factor	Source
Dargo	0.72(ash) & 0.57(OS)	GIS model
Erica	0.68(ash) & 0.67(OS)	GIS model
Latrobe Bunyip	0.82(ash) & 0.85(OS)	Field Study
Maffra Heyfield	0.75(ash) & 0.62 (OS)	GIS model
Tanjil	0.76(ash) & 0.85(OS)	Adjust Field Study
Tarago	0.82(ash) & 0.85(OS)	Field Study
Thomson	0.74(ash) & 0.51(OS)	GIS model
Tyers	0.73(ash) & 0.85(OS)	Adjust/transpose Field Study
Yarram	0.94	GIS model

These non-operational areas are comprised of four elements. The first is increased buffers created by the width of the saturated zone. The second is the large number of unmapped streams and soaks, and their associated buffers. The third is areas of unmapped steep slopes. The fourth is areas made unavailable by buffers and slopes and often the interaction of these two factors. It is not possible to accurately determine the effects of each factor, other than they are all of significant magnitude.

6.3.9 Small and Isolated Areas

The area statement for the harvestable area has also removed isolated areas of 7ha or less. These small areas have little effect where the harvestable area is contiguous. Overall 11,930ha nett were excluded as small areas. Excluding polygon areas of 5-7ha amounts to approximately 2,550ha. Of this area 30% is ash, the majority not being scheduled for a further 15 years due to log size constraints.

6.3.10 Rocky Areas

Refer to section 6.3.8.

6.3.11 Harvesting Losses

Logging waste is accounted for by the use of yields based on actual coupe harvesting.

6.3.12 Landscape Buffers

It is considered that buffers placed on visually sensitive ridgelines, roads or private property boundaries in the GMZ can be managed temporally. Ridgeline and road areas have been assumed to be available but their scheduling has had spatial and temporal constraints applied. This may limit immediate availability.

Current harvesting has been concentrated away from the urban/forest interface. In future buffers adjacent to landholders will be applied as a visual screen and to assist in fuel reduction burning operations. This may have a small impact on mixed species availability, but is not considered significant at this stage.

6.3.13 Fire Losses

An allowance of 1000m³ nett per year has been used for fire in all forest types (based on MIRA Consultants Limited (1992) analysis). This is consistent with the approach in the Gippsland RFA Timber Resource Analysis.

6.3.14 Disease Losses

Psyllid (*Cardiaspina bilobata*) infestations have been identified by SFRI. No attempt was made to prescribe lower yields to these stands. It is assumed that the level of diseased stands is proportional to those harvested in the last 5 years. No factors or allowances have been applied to account for this element.

6.3.15 New Flora, Fauna and Cultural Site Reservations

The habitat requirements for the Baw Baw Frog may need further consideration.

Recent research identified significant potential habitat on the southern face of the Baw Baw plateau. The stream pattern in this area was also mapped comprehensively. The mapping showed an increased density of streams and as a result many areas initially considered to be available for timber harvesting would be excluded given proposed Baw Baw Frog habitat prescriptions.

For the purposes of this ESR, scheduling of these areas has been deferred for ten years to allow research into habitat requirements and to develop prescriptions that will allow harvesting to occur in some or all locations. These prescriptions may involve a reduction in area due to increased buffers and both temporal and spatial constraints. It has been assumed 50% of the area will be available to harvest over a 40 year period commencing in 2012.

6.3.16 Temporal and Spatial Constraints

An allowance of 5000m³ nett per year is made for the impacts of temporal and spatial constraints.

Water Catchment and Water Yield

Maintaining water yield is important across all catchments. Area limits are prescribed in the Forest Management Plan for the Thomson catchment where a harvesting limit of 150ha per year of ash type forest is applied.

In the Tarago catchment there are large areas of high quality mixed species and Mountain Ash that are of productive size. Given that maintaining water yield is also an objective for management of these forests, a limit of 782ha per ten years is

proposed. This will enable 50 hectares per year of ash to be harvested and 28 hectares of mixed species while minimising impacts on water yield.

Coupe Spacing

The Regional Prescriptions and the *Code* specify that an aggregation of coupes shall not exceed 120 hectares and that there shall be uncut forest in between these clusters of coupes. Given that much of the regrowth resource grows in extensive stands these prescriptions may constrain the level of timber harvesting in some areas. This has been considered in the modelling.

Landscape SMZ

The Central Highlands Forest Management Plan and the Proposed Gippsland Forest Management Plan have created Special Management Zones for landscape purposes. Prescriptions for these are under development and are likely to require that harvesting be spread through time to protect the landscape. This has been considered in the modelling.

Apiary Management

No allowance has been made for Apiary Management Prescriptions. Interim prescriptions have been proposed for Central Gippsland FMA and these have been considered when scheduling the mature mixed species resource in timber catchments used by apiarists.

Fire Protection Plan Zoning

Fuel Management Zone prescriptions have also been considered in scheduling of mixed species for each timber catchment.

6.3.17 Economically Accessible Resource

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

6.3.18 Changed Residual Log Markets

History supports the assumption that residual log markets will remain at or near current levels and allow most stands to be harvested readily. Lack of residual markets may limit the scheduling of many stands that are included in the ESR. Such residual log markets will be required if some mixed species and some ash stands are to be harvested. Haulage distance is a critical cost factor for residual log purchasers, so that distant low quality sawlog stands may prove difficult to harvest economically when residual markets are weak.

6.3.19 Changed Minimum Log Diameter Specifications

Standard sawlog grading rules have been applied to resource estimates. However, industry has difficulty processing and marketing the products from small logs, particularly mixed species. Approximately 2000m³ nett of sawlogs below 40cm were forfeited in the 2000/2001 logging season.

6.3.20 Changed Silviculture System

Thinning operations have been conducted in parts of the FMA. Mixed species thinning operations have resulted in increased yields and may allow for shorter

rotations. Such operations will not increase short-term availability of wood but may increase sawlog availability in the future. Research is required to determine if the volume lost due to damage on retained stems is outweighed by the increase in volume due to growth response.

6.3.21 Additions to the Forest Estate

Some opportunities exist to add forested private land to the forest estate. The majority of these sites have had the timber harvested and their inclusion would only affect long term availability.

6.3.22 Reforestation of Unstocked Stands

Of the 10,671 hectares of unstocked stands, only a small proportion is suited to reforestation operations. Many sites are not capable of producing high quality sawlogs and would not justify the large capital outlay. Reforestation activities, if funded, will be at a level of 100-200ha per year. No analysis of reforestation has been included in the ESR. If undertaken it would result in approximately 2,000m³ nett per year of timber being available approximately 80 years into the future.

7 Resource Outlook

7.1 Sawlog Levels

A sawlog level of approximately 90,000m³ nett per year is possible from 2004 until 2027. After 2027 the annual volume increases to over 100,000m³ nett per year and slowly increases thereafter to 117,800m³ nett per year by 2092. The volume and proportion for individual forest type for this level is shown in Table 4. The proportions will change over time according to the age classes and stand conditions present for each Forest Type.

Table 4. Volume available by forest strata for Central Gippsland FMA

Forest Type	Volume (m ³ nett per year)	Proportion of Total (%)
Mountain Ash & Shining Gum	42,400	47
Alpine Ash	36,400	41
Mixed Species (High Volume)	3,900	4
Mixed Species (Low Volume)	7,300	8
Total	90,000	100

7.2 Rotation Ages

Rotation ages used for modelling purposes aim to maximise the long-term sustainable yield and consider minimum log size. Log size is directly proportional to rotation age.

The modelling method does not constrain rotation length in the first rotation. There is a transition to longer rotations and larger sizes in the second rotation which is concurrent with current industry preference for larger diameter logs. These provide higher recovery and enable existing sawing techniques to be used. Minimum rotation lengths used in can be shown in Table 5.

Table 5. Summary of rotation ages used in the ESR

Species/Volume Class	Rotation Age – Minimum for First Rotation	Rotation Ages – Minimum for Subsequent Rotations
Mountain Ash (high volume)	60	80
Alpine Ash (high volume)	60	80
Shining Gum (high volume)	60-65	80
Mixed Species (high volume)	60-80	80-100
Mountain ash (low volume)	60-80	80-100
Alpine ash (low volume)	60-80	80-100
Shining Gum (low volume)	60-80	100
Mixed species (low volume)	70-85	70-100

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 parameter 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 Central Gippsland Forest Management Area, area was given three stars, yield - two stars, and woodflows - three 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 Central Gippsland FMA are predominantly regrowth forests and have a long history of timber harvesting.

The major defining event in this area was the 1939 bushfires, which resulted in the majority of ash forest being killed or damaged. The Government initiated a scheme which directed the timber industry to concentrate operations in these stands. Milling operations were accelerated to minimise timber losses, reaching a peak during 1945-1950. Salvage operations were terminated in 1952 to avoid damaging the regenerating forest. Much of the ash regrowth resource originates from this period.

Harvesting in the period 1950-1980 has concentrated on the mixed species resource that survived the 1939 fires and those ash stands that were not burnt. Much of the

harvesting was undertaken on a sawmiller-selection basis. Stands of mixed species remaining are either regrowth, have histories of selective logging, or are comprised of non-desirable species. Harvesting commenced in the 1939 regrowth ash in the early 1980s. Large areas of regrowth have originated from this harvesting.

The area available for harvesting has been reduced from previous estimates due to the inclusion of operational constraints not previously measured. There are insufficient sawlog resources to maintain current licence levels. The sawlog level is approximately 90,000m³ nett until 2027 when the level will gradually increase.

10 References

MIRA Consultants limited. (1992) *Fire Protection Risk Management Study for the Department of Conservation Natural Resources*. Department of Conservation Natural Resources.

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

NRE (1998) *Forest Management Plan for the Central Highlands*. Department of Natural Resources and Environment. Melbourne.

Pearson P.D. and Featherston G.R. (1992). *Forecast of sustainable yield for grade C and better sawlogs in the Central Gippsland Forest Management Area*. Forest Technical Report Number 10, Department of Natural Resources and Environment.

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).

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 forest

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 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.

Stag Dead habitat tree.

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.

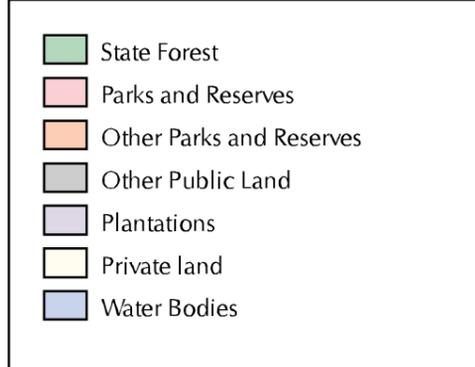
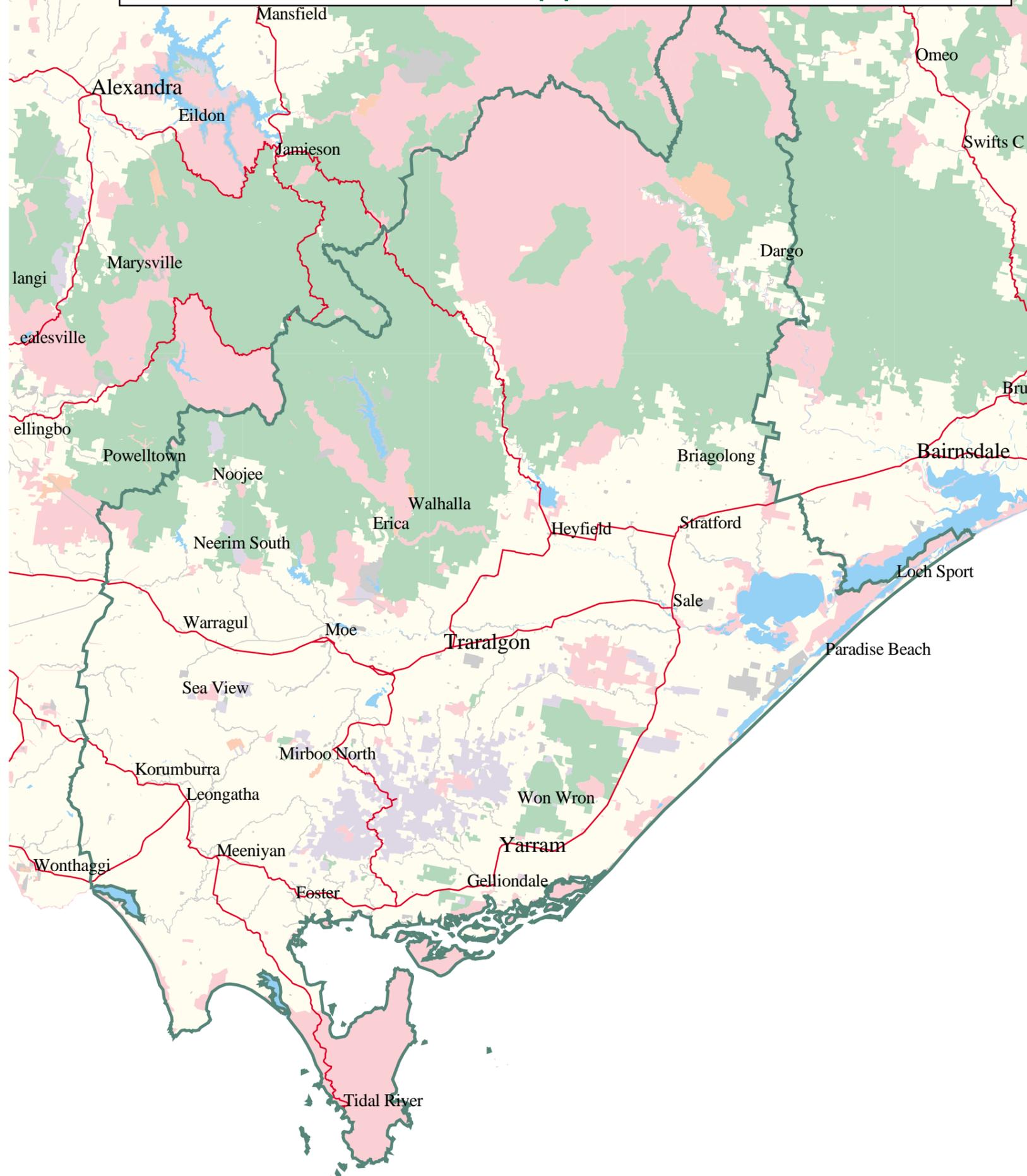
Value Adding An economic term which describes how a raw product is processed into a product which is of more value than the material in its raw state. In the forest and wood industry context, examples of this include the kiln-drying of sawn timber and the manufacturing of wood veneers.

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 – Central Gippsland FMA

Central Gippsland FMA



Appendix - Differences Between RFA Timber Resource Analysis and ESR Resource Elements

Comparison with TRA Area Data

Table 1 contains details of changes in areas that have resulted since the 2000 Gippsland TRA.

Area changes have resulted from:

- New SFRI data,
- Updated logging history,
- The ESR has defined small and isolated “islands” as less than 7ha, whereas the TRA used 10ha in the Gippsland RFA area and 3.0ha in the Central Highlands RFA area,
- New slope models.

Table 1. Changes in available area between Gippsland TRA and data set used for ESR

Species	1880s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	Mat/OM ¹	Grand Total
Alpine Ash	0	-103	1215	-3584	130	441	346	21	-566	89	-156	-2165
Mountain Ash & Shining Gum	0	0	-5818	732	4	216	375	-358	2059	547	-222	-2466
High Quality Mixed Species	0	0	-3680	-81	50	212	521	-299	-749	102	-4314	-8238
Low Quality Mixed Species	7	-12	1444	-638	705	4596	14391	5484	2459	467	-17310	11591
Total	7	-115	-6840	-3572	889	5465	15633	4849	3202	1206	-22002	-1278

¹ Mature/overmature

Further changes in area have resulted from:

- Better definition of operationally available areas using case studies and GIS analysis,
- Definition of non-merchantable stands

These are summarised in Table 2.

Table 2. Changes in area due to of new modelling factors

Espp1	Vol Class	1880s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	Mat/O M	Total
Alpine Ash	Hi	0	-12	-458	-58	-57	-29	-77	-4	7	0	-130	-818
Alpine Ash	Lo	0	-66	-1269	-23	-205	-345	-337	-19	28	1	-507	-2742
Shining Gum	Hi	0	0	-277	-9	-1	0	0	-1	-1	0	-10	-300
Shining Gum	Lo	0	-1	-170	0	0	-9	-5	1	-2	0	-5	-190
Mountain Ash	Hi	0	0	-3773	-373	-49	-43	-95	-32	-93	-3	-508	-4968
Mountain Ash	Lo	0	-1	-744	-173	-15	-55	-116	22	24	0	-124	-1181
OS	Hi	0	0	-569	-18	-57	-52	-195	89	-2	3	-1660	-2461
OS	Lo	-4	-58	-4528	-190	-326	-1719	-2846	-531	-154	-20	-22026	-32401
Total		-4	-139	-11789	-844	-710	-2252	-3669	-475	-192	-19	-24969	-45060

The effect of these changes is to remove operational elements to derive the core resource area.

Temporal availability changes have resulted from consideration of the following issues:

- Baw Baw Frog Habitat
- Water yield in the Thomson and Tarago Catchments
- Zone 1B Leadbeaters Possum Habitat,
- Coupe aggregation and spacing
- Fuel Management Zone prescriptions
- Apiary management prescriptions
- Log size and rotation ages

The TRA was prepared using the Integrated Forest Planning System (IFPS) and the ESR has been prepared using a multi-catchment Sustainable Yield Spreadsheet (SYSS) approach.

Comparison with TRA Yield and Growth Data

Table 3 describes weighted averages for yields at age 60 in each species group used in the Timber Resource Analysis undertaken for the Gippsland RFA and this ESR:

Table 3. Comparison of Yields

	2000 TRA m ³ /ha	2001 ESR m ³ /ha
Mountain Ash and Shining Gum	176.4	172.9
Alpine Ash	170.7	164.0
Mixed Species	33.4	33.2

It can be seen that yields differed slightly between the Timber Resource Analysis and the ESR. It should be noted that a coupe selection bias has not been applied to the ESR figure seen above and that the shape of the ash yield curves also differed. These two factors have reduced the yields by between 10 and 20 per cent.