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A Report on Forest Wood Resources and Wood Based Industries in the Eden CRA Region

A report undertaken for the NSW CRA/RFA Steering Committee

March 1998

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THIS REPORT WAS COMPILED BY THE COMMONWEALTH DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY USING MATERIAL PROVIDED BY THE BUREAU OF RESOURCE SCIENCES AND THE AUSTRALIAN BUREAU OF AGRICULTURAL AND RESOURCE ECONOMICS

A report undertaken for the NSW CRA/RFA Steering Committee

project number NE 05/ES

March 1998

Report Status

This report has been prepared as a working paper for the NSW CRA/RFA Steering Committee under the direction of the Economic and Social Technical Committee. It is recognised that it may contain errors that require correction but it is released to be consistent with the principle that information related to the comprehensive regional assessment process in New South Wales will be made publicly available.

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The project has been overseen and the methodology has been developed through the Economic and Social Technical Committee which includes representatives from the NSW and Commonwealth Governments and stakeholder groups.

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INTRODUCTION

This report is a profile of the native hardwood and softwood timber resource and industries within the Eden Regional Forest Agreement (RFA) region. It provides a description of commercial forest management, a description of forest based industries, an economic profile of the market outlook for the major forest industries and an overview of industry development opportunities. Profiles of minor forest products such as firewood, fencing timbers, sleepers, poles and grazing are also included in this report.

Information from this report was drawn from a number of sources including existing published and unpublished sources. The report also includes information summarised from the following studies:"Identification of Plantation Expansion Opportunities in New South Wales - Eden CRA" and "Industry Development Opportunities for the Southern NSW Forest Industry to 2010 and 2020".

Resource and economic profiles of other forest activities are covered in detail in the following reports:

- Eden Region Mineral Assessment
- Economic Value of Recreation and Tourism in Forests of the Eden RFA
- Report on Apiary in NSW - Eden CRA
- Hydrology of the Eden CRA region

NATIVE HARDWOOD AND SOFTWOOD FOREST MANAGEMENT

There are 198 315 hectares of state forest of which 152 651 hectares is potentially available for wood production from native forests in the Eden CRA region (which includes current fauna moratorium areas) representing 32 % of the total public land and 77 % of State Forest. The actual available land for wood production is determined by the extent of environmental, operational and economic constraints.

There are 35 510 hectares of plantation in the Eden CRA region, of which 1 070 hectares are hardwood and 34 440 hectares softwood species.

Forest Management Planning

Currently, forest management planning within State Forests includes the following elements: a forest management plan; zoning for long-term management intent (Preferred Management Priority (PMP) classification); environmental impact assessment and harvesting plans prepared for each forest area proposed for harvesting.

The current Environment Impact Statement (EIS) (SFNSW 1994) covers a three year period following determination of the EIS. This EIS follows from previous EIS's for the Eden area, the first of which was undertaken by Harris Daishowa Aust. Ltd. in 1986 to meet the requirements of the Commonwealth *Environment Protection (impact of proposals) Act 1979*. The Forestry Commission of New South Wales prepared four EIS's for proposed forestry operations in the Eden Management Area commencing in the years 1988-1989, 1990, 1991, and 1992.

Native Forest Silviculture

The silvicultural practices used in Eden are designed to optimise sawlog production. The current silvicultural system is effectively a system of heavy selection harvesting, although when there is little regrowth it becomes effectively a seed tree system with retained growers (regrowth likely to become future sawlogs) leading to a dual age forest where no regrowth is present, or multi-aged forest where regrowth is retained. Post-harvest burning is standard practice and was introduced to reduce the possibility of large-scale regeneration loss from wildfire and to improve seed bed. Stocking rates following harvesting average around 5,000 seedlings/hectares.

Sawlog Yield

The sawlog yield for the Eden region will be derived as part of the CRA process, with the full range of influences on sawlog yield being brought to account by the Forest Resource and Management System (FRAMES) and Ecologically Sustainable Forest Management (ESFM) projects.

VALUE AND SIGNIFICANCE OF EDEN'S HARDWOOD BASED INDUSTRIES

The native forests of the Eden region occupy 4 % of the total forested area in New South Wales. The major commercial industries associated with native forest use in Eden are wood processing, tourism and recreation. Eden's native forests are also used for other commercial activities such as water catchment, grazing, beekeeping and various other types of small scale production such as firewood and seed capsules.

Hardwood sawlog production in the Eden CRA region accounted for only around 6.2 % of total state (public and private) sawlog production (quota and salvage logs) in 1995-96. However, pulplog production from the Eden CRA region accounted for 63 % of total pulplog production in New South Wales in that year. The region produced around 42 175 cubic metres of sawlog, and 463 500 tonnes of residual log (public and private logs) in 1995-6.

Most of the hardwood sawmills sourcing logs from the Eden CRA region are engaged in a limited range of sawntimber processing activities. The majority of production is green sawntimber products such as structural timber, scantling, fencing, palings and pallets. Only a small proportion of output emerges as appearance grade product, which involves value adding processes such as kiln drying and timber dressing.

By far the largest volume of output from the region is associated with the pulpwood processing activities at the Harris Daishowa woodchip mill in Eden. This mill sources pulplogs predominantly from state forests but also receives inputs from private hardwood forests, plantation establishments and sawmill residues from within New South Wales and Victoria (Gippsland).

The sawmilling and woodchip industries using wood sourced from the Eden region employed 117 full time staff in 1995-96, with an estimated gross value of turnover of $41.9 million. A further 161 people were employed in logging and haulage and 76 people were employed in forest management. It is anticipated that 91 people will be employed in the sawmilling and woodchip industries in 1997-98, with an estimated gross value of turnover of $30.8 million (in 1995-96 dollars). Logging and haulage is expected to employ 105 people in 1997-98.

INDUSTRY DEVELOPMENT OPPORTUNITIES

The Australian Bureau of Agricultural and Resource Economics (ABARE) engaged forestry consultants 'Margules Pöyry' to examine opportunities for the development of a competitive wood based industry for the southern New South Wales region (consisting of the Southern CRA and Eden CRA regions), subject to the availability and quality of the hardwood and softwood resource. The main findings of that study as they apply to the Eden CRA region are outlined in Chapter 6.

Development of the native hardwood sawnwood sector is expected to concentrate on value added products for the rapidly expanding Asian markets. As a result, there may be more investment in kiln drying and development of technology to recover higher value products from the resource as it changes over time. Such technology includes that to enable the handling of short logs, smaller diameter logs, regrowth logs and sawn pieces, kiln drying technology and technology for value adding processes such as dressing and moulding. The number of hardwood sawmills in the Southern region is likely to decrease because production is expected to be concentrated in fewer, larger plants.

Large increases are expected in the availability of softwood sawlogs from the Bombala softwood resource. This implies that scope exists for significant industry development in the future. Under scenarios developed by the consultants it is anticipated that a world scale sawmill (capacity of about 400 000 cubic metres a year) and a laminated veneer lumber/plywood plant (using 120 000 cubic metres a year) will be constructed by 2010 and 2020 respectively. It is expected that capacity will be expanded at the proposed sawmill by 2020 so that all of the available sawlog resource will be used. Given Bombala's favourable location in relation to the proposed wharf at Eden, the likely markets for these products will be export based.

MINOR FOREST PRODUCTS

Firewood

About 800m^3 of firewood is sold annually from Eden CRA region. This is both domestic and commercial. The preferred species are the durable timbers of grey box (*E. bosistoana*), ironbark (*E. sideroxylon ssp tricarpa*), woolybutt (*E. longifolia*), and yellow stringy bark (*E. muelleriana*).

Fencing timbers, sleepers, poles and posts

Within the region there is a limited market and demand for fencing timbers, sleepers, poles and posts, and landscape timber. Around 150 to 200m^3/year of timber is harvested to produce these products. The desirable species are the durable redwoods or yellow stringybark and are generally collected from integrated operations and some from approved harvesting companies. Harvesting plans are required for harvesting any timber to be felled in State Forests.

Grazing

The level of grazing activity in the Eden CRA region is minor with 4 126 hectares covered by 24 crown leases and 1 114 hectares covered by 6 occupational permits and a total carrying capacity of 728 cattle.

1. INTRODUCTION

This report is a profile of the native hardwood and softwood timber resource and industries within the Eden Comprehensive Region Assessment (CRA)/Regional Forest Agreement (RFA) region.

Chapters 2 and 3 of this report provide a description of commercial forest management within the Eden CRA region. The prime emphasis is on the State forest resource and covers the areas of forest types, historic and current management, available timber volumes and species, growth rates of particular forest types and silvicultural practices. In addition to information on State Forests it provides information on available plantation forests and potential yields from these forests. Figure 1 shows the areas of State Forest, parks and reserves, plantation forests, and private land in the Eden CRA region.

In Chapter 4, the economic values associated with natural resources are discussed. An overview of the contribution of forest related and other industries in the Eden region to output and employment is provided in Chapter 5. Chapter 6 of the report provides an economic profile of the Eden region, the market outlook for the major forest industries and an overview of industry development opportunities for native hardwood industries.

Information from this report was drawn from a number of sources including existing published and unpublished sources. The report also includes information summarised from the following studies:"Identification of Plantation Expansion Opportunities in New South Wales - Eden CRA region" and "Industry Development Opportunities for the Southern NSW Forest Industry to 2010 and 2020".

Other forest activities are covered in detail in the following reports:

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2.

2. FOREST RESOURCE

2.1 GENERAL FOREST DESCRIPTION

Forest typing for the Eden comprehensive regional assessment (CRA) has been based on the Keith, Bedward, Smith (1997) classification system. Given this forest typing is heavily reliant on understorey vegetation, and less on the overstorey, it is not particularly suitable for commercial forest typing. A more appropriate system for classification of forests as commercial forest types is the Forest Commission Research Note 17 (FCNSW 1989). There are 68[1] forest types in Eden CRA region using this classification which includes all land tenures. In order to present forest resource information, these forest types have been grouped into associations based on similar forest types. This has been used for determining site productivity in section 2.2.8 and so it is appropriate to describe forest types on their associations. In the State Forest 1994 Environmental Impact Statement (EIS), forest types were amalgamated into forest leagues. The associations provide an intermediate level of classification and description between the forest leagues, and forest types.

[1] There are some suspect codes which are highlighted in table 1. In the 1994 EIS there were 37 codes identified within State Forests.

Map 1. Tenure: Eden CRA

Map 2. Forest Association - Eden CRA.

Table 1. Forest associations by land tenure (source SFNSW, BRS 1997)

Forest Association	State Forest RN 17 types	Description	Crown Land (Leasehold / Reserved / Other)	National Park / Nature Reserve / Coastal Inlet	Private Land	State Forest	State Forest (PMP 1.3)	State Forest Plantation	Total
0		No floristics data available	688	1 387	713	58	2	1	2 849
1	37	blackbutt forest types	547	1 770	1 058	192	0	0	3 567
2	50	sydney blue gum/Bangalay types	101	322	617	132	0	0	1 172
3	73,74,76	spotted gum types	89	1 577	653	714	0	0	3 033
4	54^,101^,112,113,114,162	silvertop ash types	790	36 319	8 037	66 501	1 394	71	113 111
5	66,102,121,123,130,132,133, 169	bloodwood, stringybark, peppermint types	964	2 1561	10 143	20 720	882	315	54 585
6	63,85,86,88,92,206	w oollybutt, grey ironbark, coastal grey box	1 454	10 649	16 382	13 872	44	27	42 427
7	129	smooth and roughbarked apple types	0	30	107	0	0	0	137
9	150,151,152,153,154,155,156	messmate, brown Barrel types	1 124	34 380	8 590	21 716	796	225	66 831
10	157,158,159,165,166	gum types	1 605	37 408	16 878	52 169	1 177	226	109 463
11	110,111,124,125,131	brittle gum, sribbly gum	4 868	4 812	17 063	4 555	23	476	31 796
12	99,103	box types	0	345	29	79	0	0	454
13	136,138,139,140,143	snow gum, black sallee	1 599	870	8 244	1 259	29	108	12 111
16	31,211,214	paperbark, river oak, wattle	0	12	0	25	8	0	45
91	6,14,18,19,23	rainforest	109	5 107	2 342	2 944	184	10	10 697
92	216,218,219,220,223,224,231 ,233,234,235	non-commercial (including cleared agricultural land)	8 731	12 558	243 216	4 167	332	40 181	309 185
93		Floristics described as "unknown"	8	315	201	111	0	77	711
94		Floristics described as "unmapped"	106	42 966	3 517	3 794	51	291	50 726
99		Incomplete floristics code *	62	818	89	313	73	0	1 355
Total	^suspect occurrence		22 846	213 205	337 880	193 320	4 995	42 008	814 254

Notes on forest type mapping

Floristics level 1,2 and 3 coding from NPWS was used to determine RN17 code (unless this was already available).

Where multiple level codes were provided, the first was used. Where this was insufficient to determine RN17 code, the second was used.

Where the level code began with H or N (regrowth - post logging or post fire), the remainder of the code was used to derive RN17 code using the above method.

RN17 coding was used to determine association.

In some cases the level coding was insufficient to determine RN17, but an association was assigned using level 2 codes (less accurate).

*Those areas where neither RN17 nor Association could be determined, are classed as 99 (see note above).

Not all RN17s and Associations which occur in the entire EMA (as defined by the tenure dataset) occur within State Forest (pre/post 96)

The forest resource on public and private land for the Eden CRA is outlined in table 1 with Map 2 showing broad locations. silvertop ash/stringybark forest is the most widespread forest association occurring across the CRA region particularly concentrated in the coastal forests to the south and south-west of Eden. Messmate (*Eucalyptus obliqua*) and gum forests occupy large areas of the southern tablelands and escarpment, extending over the escarpment toward lower gully situations. Brown barrel (*E. fastigata*) occurs on the tablelands, especially in the north of the CRA region. Rainforest is found in deeply dissected gully systems, and there are very limited occurrences of spotted gum (*E. maculata*) forests between Bega and Bermagui.

2.1.1 Association No. 1 -- type 37 -- blackbutt

Blackbutt (*E. pilularis*) is one of the most important and valuable timber producing forest types in New South Wales; although it has a minor occurrence within the State Forests of the Eden CRA region of only 192 hectares (hectares). It occurs as a dry sclerophyll forest from 30-40 metres in height on moderate rainfall areas generally over 900 mm and at relatively low altitude's up to 750m. Within the Eden CRA region the main occurrences are within the Ben Boyd National Park just north of Eden, and within Broadwater State Forest.

2.1.2 Association No. 2 -- type 50 -- sydney glue gum, bangalay

This association also has a very limited distribution within the northern parts of the Eden CRA region of only 131 hectares State Forest. It generally occurs as a wet sclerophyll forest from 35 to 50 m in height with understorey that tends to develop into rainforest in the absence of repeated fires. Both sydney blue gum (*E. saligna*) and bangalay (*E. botryoides*) are commercially valuable timbers especially for the specialty market, however their occurrence is limited within the Eden CRA region.

2.1.3 Association No. 3 -- types 73,74,76 -- spotted gum types

Spotted gum (*E. maculata*) is confined to relatively dry sites below 300 meters elevation close to the coast (FCNSW 1989). It occurs in either pure stands or with a wide range of other associates including various stringybarks, woollybutt (*E. longifolia*), silvertop ash (*E. sieberi*), red bloodwood (*E. gummifera*), mountain grey gum (*E. cypellocarpa*), or red or grey ironbark (*E. sideroxylon* or *E. paniculata*). Spotted gum can occur as a wet sclerophyll or dry sclerophyll forest ranging from 25 to 45 meters in height. A small area of this forest type occurs within Tanja and Bermagui State Forests with the majority in Mimosa Rocks National Park. Its occurrence is not identified in the Keith, Bedward, Smith (1996) classification, but shows up under FCNSW (1989) occurring on about 700 hectares of State Forests (less than 0.4 % of State forest, and 0.6 % of total public land). Spotted gum is a highly desirable timber for heavy construction, and more specialist uses in furniture and tool handles.

2.1.4 Association No. 4 -- types 112,113,114,162,(54,101) -- silvertop ash types

This association accounts for 34% of State Forest (66 500 hectares) in the Eden CRA region and 22% of the public forest area representing the most widespread forest association. Its widespread distribution is associated with adaptation to the geological, topographic and climatic conditions that occur most extensively within the study area and in particular in the coastal forests. This forest association includes either silvertop ash-dominated or stringybark-dominated forests and associations of silvertop ash/stringybarks with yertchuk (*E. consideniana*). These communities are common in the coastal and foothills areas, but also occur further

inland on to the drier and more exposed sites of the tablelands and escarpment.

Silvertop ash is the principal commercial species occurring in this forest association. It ranges from a relatively slow growing species in dry sclerophyll forest usually under 30m in height to a very fast growing commercially highly valuable wet sclerophyll species growing to over 40m in height (FCNSW 1989). Silvertop ash generally dominates the stands ranging from 50 to 100 % of the overstorey.

In both the tablelands landform and the western parts of the escarpment and foothills landform, silvertop ash/peppermint and narrow-leaved peppermint *(E. radiata)* forest types tend to replace silvertop ash/stringybark types on the drier ridges and intermediate slopes (SFNSW 1994).

Other significant commercial species include yellow stringybark (*E. muellerana*), white stringybark (*E. globoidea*), and mountain grey gum. Within these forests types, a number of important specialty timbers occur, which include red ironbark, woollybutt, red bloodwood and rough barked apple (*Angophora floribunda*). Some understorey species are useful for craftwood, including white banksia (*Banksia integrafolia*), forest she oak (*Allocasuarina littoralis*) and wild cherry (*Exocarpos cupressiformis)* (SETMUG[2] pers.comm.).

2.1.5 Association No. 5 -- types 66,102,121,123,130,132,133,169 -- ironbark, bloodwood, stringybark, peppermint types

This association largely consists of a range of slower growing forest types including grey ironbark, yertchuk, various peppermints, stringybarks and bloodwood. It covers 20 720 hectares of State Forests (10% of State Forest and 11% of public land) and 21 561 hectares of national parks and reserves. There are a number of commercially significant timber species in these forest types, especially yellow stringybark, grey ironbark and to a lesser extent white stringybark.

Grey ironbark is common in both coastal and foothills forests and is often co-dominant with various stringybarks but on some sites may approach complete dominance. They generally occur on sites of relatively low rainfall but on moderately fertile, well drained soils.

The yertchuk forest type replaces the silvertop ash/stringybark forest types where the soils are shallow with impeded drainage. This forest type is of low height, rarely over 20 metres and is often associated with roughbarked apple, various stringybarks, peppermints and bloodwood (FCNSW 1989).

Within this forest association, different species of stringybark occur. White stringybark is most common nearer the coast, particularly on Ordovician metasediments. Blue-leaved stringybark *(E. agglomerata)* is more common on granitic parent materials, and yellow stringybark mostly occurs on the more sheltered sites (SFNSW 1994).

Red bloodwood has a scattered occurrence throughout the South Coast and usually occurs on poor shallow soils. It is associated with various stringybarks, ironbark, and roughbarked apple.

2.1.6 Association No. 6 -- Types 63,85,86,88,92,206 -- woollybutt, forest red gum, grey ironbark, coastal grey box

Woollybutt occurs in dry sclerophyll forest within coastal or foothills areas as either as a sole dominant or as a co-dominant with grey or red ironbark, and/or white or blue-leaved stringybark (FCNSW 1989). Other associates include bloodwood, roughbarked apple, smoothbarked apple (*Angophora costata*), and silvertop ash with typical examples occurring within the Murrah State Forest. There are 13,872 hectares of this forest association in state forests

[2] South East Timber Millers and Users Group

representing 7 % of state forest, while in parks and reserves there are 10,648, representing 2% of total public land.

Forest red gum (*E. tereticornis*) occurs with roughbarked apple and/or grey ironbark to form a forest up to 35 metres in height generally with a grassy understorey. On drier coastal areas on rather heavy periodically waterlogged soils, coastal grey box (*E. bosistoana*) and forest red gum may dominate in a woodland up to 30 metres in height with subordinate species of bloodwood, ironbark, stringybarks, and roughbarked and smoothbarked apple's.

Coastal grey box and woollybutt occur as dominant species in a wet or dry sclerophyll forest ranging from 25 to 40 metres in height. In the Nullica State Forest it is found in poorly drained basins with a grassy understorey and associated with red ironbark (FCNSW 1989).

On drier ridges and slopes of the South Coast and adjacent foothills, Coastal grey box occurs as a dominant with mountain grey gum or maidens gum (*E. globulus ssp.maidenii*) and associated stringybarks. This type usually occurs as a dry sclerophyll forest under 25 metres in height with examples in Cathcart and Tantawangalo State Forests (FCNSW 1989).

The range of species in this association make it important source of durable and specialist timbers. woollybutt, grey and red ironbark, forest red gum, and coastal grey box are highly desirable specialist timbers due to their dark reddish colours, attractive grain and feature, and durability (SETMUG pers.comm.).

2.1.7 Association No. 7 -- types 129 -- smooth and rough bark apples

Smoothbarked apple occurs as the clear dominant or as one of a number of dominant species including stringybarks, silvertop ash and bloodwood (FCNSW 1989). roughbarked apple is often associated with banksias, sometimes red stringybark (*E. macrorhyncha*) and red ironbark. Site height is normally below 30 metres and sometimes below 15 metres (FCNSW 1989). This forest association is very limited in the Eden CRA region with only 137 hectares in parks and reserves and private land.

2.1.8 Association No. 9 -- types 150, 151,152,153,154,155,156 -- messmate, brown barrel types

The messmate and brown barrel forest types are the most commercially significant forest types in the region due to their extent (8.9% or 21 715 hectares of State Forest, 34 379 hectares in parks and reserves) and higher productivity than other forest types (see 3.2.8).

The messmate forest types are clearly dominated by messmate with narrow-leaved peppermint (*E. radiata*) the most common associate and other associates being mountain grey gum, brown barrel, silvertop ash, and mountain gum (*E. dalrympleana*). This forest type generally occurs as a dry sclerophyll forest from 25-35 metres in height and is a poorer forest type than the others represented in this association. Messmate also occurs with manna gum (*E. viminalis*) or mountain grey gum as the dominant species with other associated species being stringybarks, silvertop ash, and peppermint as dry or wet sclerophyll forests. Examples of this type occur in Bondi State Forests (FCNSW 1989).

Brown barrel occurs as a clear dominant in wet sclerophyll forest of the Tablelands region within the Bondi State Forest. On the most favourable sites it can grow up to 60 m in height and has a dense understorey often consisting of rainforest species. On less favourable sites it occurs in mixed stands with other species, such as messmate, peppermints and a range of gums (SFNSW 1994). It forms an association with a number of gum species including shining gum (*E. nitens*), maidens gum (*E. maidenii*), manna gum, and mountain grey gum with examples in the Coolangubra, and Bondi State Forests.

Brown barrel-messmate dominated stands occur as a wet sclerophyll forest from 30-50 metres in height and are found particularly in the escarpment zones of the CRA region above 600 meters elevation in the Nalbaugh State Forest (FCNSW 1989).

2.1.9 Association No. 10 -- types 157,158,159,165,166 -- gum dominated types

This association incorporates a wide range of gum dominated forest types with 21 719 hectares on State Forest, and 37 408 hectares on parks and reserves. The gum species that dominate these stands vary with the site condition and as a consequence forests range from dry sclerophyll through to wet sclerophyll. manna gum occurs on fertile areas of gentle topography with good soil moisture and drainage. Mountain grey gum or monkey gum (*E. cypellocarpa*) occupies a range of topographic positions with less favourable nutrient and moisture regimes. Shining gum is found in high altitude sites of moderate topography and high nutrient status. Other gum types such as mountain gum, southern blue gum (*E. psuedoglobulus*) and maiden's gum can occur as dominant species in this association (SFNSW 1994) with examples in Glenbog State Forest.

Two peppermints types are included in this association, gully peppermint (*E. smithii*) and river peppermint (*E. elata*). Gully peppermint occurs with yellow stringybark, and various brown barrel and messmate types along the escarpment zone of the tablelands. It generally forms a wet sclerophyll forest extending along gullies up to the ridges with examples in the Nullica State Forests. River peppermint is a characteristic creek bank community forming a wet sclerophyll forest up to 40 metres in height (FCNSW 1989).

2.1.10 Association No. 11 -- types 110,111,124,125,131 -- brittle gum, scribbly gum, red stringybark

This association forms largely non-commercial dry sclerophyll stands generally on soils of low fertility. This forest type covers 4 554 hectares of State Forest largely along the western and north-western tableland areas of the RFA region. Some species within these stands may have commercial value such as red stringybark, yellow box (*E. melliodora*), and some of the peppermints (FCNSW 1989).

2.1.11 Association No. 12 -- types 99,103 -- apple box, red box, long leaved box, yellow box

This association has a very restricted distribution with only 79 hectares of State Forest in the region. The box species have little commercial value except as craft species or for the small sawmilling industry, and possible apiary interests.

2.1.12 Association No. 13 -- types 136,138,139,140,143 -- snow gum, black sallee

Snow gum (*E. pauciflora*) and black sallee (*E. stellulata*) forest occupy limited areas, generally on or adjacent to the tablelands landform on sites with a harsh climate and, in places, on poorly drained soils at high elevations. Snow gum is replaced by swamp gum *(E. ovata)* as the dominant tree species in generally less exposed but swampy situations (SFNSW 1994). Whilst on better sites they may be associated with mountain gum, manna gum, and various peppermints; they are generally non-commercial forest types.

2.1.13 Association No. 91 -- types 6,14,18,19,23 -- Rainforest

Warm Temperate, Subtropical, Cool Temperate, and Dry and Depauperate Rainforest are represented in the study area (FCNSW 1989). Rainforest occurrence is restricted and fragmented, occupying just 1.5% of State Forest and

1.7% of all public land in the CRA region. Patches of rainforest are generally confined to narrow strips along sheltered creeks and gullies with optimal moisture and nutrient levels. They are commonly found on sites located on cooler and moister south to east aspects in gully environments, particularly towards their heads. Most rainforest sites occur within 50 km of the coast (SFNSW 1994).

2.1.14 Association 92 -- Non-forest Plant Communities and Association No. 16 -- types 31,211,214

This grouping covers artificial communities such as improved pasture and cropland, settlements, roads, gravel pits, cleared land and partly cleared land, and plantations (see 3.3). Is also includes shrub dominated communities such as heath and scrub. Association 16 includes paper bark, river oak, and wattle and are non-commercial forest types.

2.1.15 Association 93, 94, 95 -- Floristics unknown, Floristics un-mapped, Incomplete floristics codes

During determination of the forest types from the initial mapping some areas could not be assigned a Research Note 17 forest type and are termed an unknown association. Figure 2 shows the areas which have no vegetation mapping as dark grey. These areas are a mixture of all land tenures but the largest portion are national parks and reserves. There are some areas mapped which had incomplete floristics codes and hence no RN17 code or association could be determined from the floristics data.

2.2 NATIVE FOREST MANAGEMENT

2.2.1 History of native forest harvesting

The Eden CRA region forests have a history of commercial use from the mid 1800's where pit saws were the common method of sawing timber, through to the steam powered saws of 1900, to the present integrated harvesting operations, producing sawlogs and pulpwood.

Sleeper cutting commenced in 1903 utilising the durable species of woollybutt and coastal grey box and at one stage employed over 300 cutters. In the 1940's silvertop ash sleepers were harvested for export but by 1963 the industry was in decline with only 23 licensed cutters (Bridges 1983). As early as the 1930's, the silvertop ash resource was noted as a good possibility for a pulpwood resource due to the large areas of relatively pure stands on undulating terrain and the high proportion of trees with small girth and long length (Bridges and Dobbyn 1991). The chance to establish a paper mill based on this resource faded with Australian Paper Mill's decision to build a mill in Maryvale, Victoria. This opened up the opportunity for Harris-Daishowa Australia Pty. Ltd. (HDA) to utilise the Eden forests for the export trade of woodchips for processing into paper in Japan.

In 1969, the New South Wales State Government signed a 20 year supply agreement with HDA to export woodchips from the Eden forests. Largescale integrated harvesting was introduced to harvest both sawlogs and pulpwood in the one operation. While sawlog yields were up on previous levels prior to integrated harvesting, pulpwood was not harvested at allocated levels of 530,000 tonnes/year until 1975/76 when by which time infrastructure and operational procedures were well established at levels commensurate with allocations (SFNSW 1994).

The first Eden Native Forest Management plan was operative from 1975 and outlined harvesting requirements, areas of working and operational constraints (FCNSW 1975). Alternate 15 hectares coupes were introduced in 1976 in order to better manage for other forest values particularly aesthetic and wildlife (Streeting and Hamilton 1991).

The second forest management plan (FCNSW 1982) recognised that substantial reductions in sawlog yield were inevitable by the end of first cutting cycle and that present allocations could not be sustained in the short term. The Timbillica wildfire of 1980 had a substantial impact on the 1970's regrowth resource with the large amounts of unburnt fuel following harvesting contributing to the impact. In 1982 post harvest burning and seed tree retention was introduced for fire protection reasons and as a seed source following wildfires (see 2.4.1 for more detail). Additionally 50 hectares alternate coupes became standard in compartments of around 200 hectares.

The 1990 South-East Forest Agreement (SEFA) signed in 1993 identified about 51 000 hectares of new National Parks of which 46 000 hectares was dedicated in November 1994 and March 1995; the area not dedicated at this time were the existing State Forest Flora Reserves.

In June 1995 the NSW Government introduced the Forestry Reform Strategy the main features of which included:

- a regional evaluation of industry and conservation needs;
- development of a Comprehensive Adequate Representative (CAR) reserve system;
- commitment to an ecologically sustainable sawlog-driven hardwood timber industry;
- maintenance of current quota log supply commitments until July 1996;
- rescheduling of the logging program to source supply mainly from regrowth and plantation forest while the IAP is undertaken; and,
- a 40% reduction of sawlog supply in the Eden Management Area.

The 1996 Interim Assessment Process (IAP) undertaken under the direction of Resource and Conservation Assessment Council (RACAC) identified 50 000 hectares of new National Parks (which included 5 000 hectares of Flora Reserves identified in SEFA) which were dedicated in January 1997. In addition to the declaration of new National Parks and Wilderness areas in the region, a further 34 000 hectares of State Forest were deferred for further consideration during the CRA/RFA process. The IAP process preceded the more detailed CRA with the aim of "*identifying on a regional basis those forests that may need to be set aside from logging for inclusion in a CAR reserve system*". The joint Commonwealth-NSW Deferred Forest Agreement (DFA) report of 1995 identified areas available for harvesting until the Regional Forest Agreement (RFA) was finalised.

2.2.2 Forest Management Planning

Currently, forest management planning includes the following elements: a forest management plan; zoning for long-term management intent (PMP classification); environmental impact assessment; harvesting plans prepared for each compartment proposed for harvesting.

The harvest planning process involves detailed on-site assessments and implementation of prescriptions, legislation and codes of forest practice. Forest management plans have been prepared for each management area in New South Wales. The first management plan for Eden (FCNSW, 1975) applied until replaced by the current plan (FCNSW, 1982). A new plan will be developed after the finalisation of the RFA.

The Preferred Management Planning (PMP) classification (SFNSW, 1993) divides the State Forests into three primary classifications:

- indigenous forest use
- exotic forestry use
- non forest use

These primary zones are further subdivided into secondary categories and most are further subdivided into tertiary categories. For indigenous forest use there

are 4 secondary and 9 tertiary categories available for classification.

SFNSW's environmental planning process for forest management activities includes compliance with the Environmental Planning and Assessment Act (1979), Threatened Species Conservation Act (1995), the National Parks and Wildlife Act (1974) and the Pollution Control Act (1970). Specific harvesting plans are developed for each compartment to be harvested. Planning documents are prepared for road construction and fuel management activities.

Environmental Impact Statement and Species Impact Statement

The current EIS (SFNSW 1994) covers a three year period following determination of the EIS. This EIS follows from previous EIS's for the Eden area, the first of which was undertaken by HDA in 1986 to meet the requirements of the Commonwealth *Environment Protection (impact of proposals) Act 1979*. The Forestry Commission of New South Wales prepared four EIS's for proposed forestry operations in the Eden Management Area commencing in the years 1988-1989, 1990, 1991, and 1992 (FCNSW 1988, 1990, 1991, 1992 respectively).

Under NSW law, the environmental planning process for the forest management activities proposed in the 1994 EIS has two main streams (SFNSW 1994):

The first stream is prescribed by the Environmental Planning and Assessment Act 1979. If SFNSW considers that a proposed activity will have a significant environmental impact, then SFNSW must prepare an EIS in accordance with the Environmental Planning and Assessment Regulation 1980, which requires, among other things, that the requirements of the Director, NSW Department of Planning, be included in the scope of the EIS. After the EIS is prepared, it is submitted for public comment. SFNSW will review these comments (representations) and decide whether to proceed and apply for approval of the EIS. If SFNSW decides to proceed, responses to the comments will be prepared and submitted to the Department of Planning along with the EIS. The Department of Planning will assess the EIS and the public comments and then present the EIS to the Minister of Planning with a recommendation for approval or rejection. A recommendation for approval will often include specific additional conditions that must be met by SFNSW. The Minister will then approve or reject the EIS. When the EIS has been approved by the Minister, it will be determined by SFNSW, who may then undertake the proposed activities after a fauna licence has been issued.

The second stream is prescribed by the National Parks and Wildlife Act (1974) and the Environmental Planning and Assessment Act 1979, which require the applicant for a fauna licence to prepare a Fauna Impact Statement (FIS) and provide opportunity for public comment. NPWS review the comments and assess the FIS. NPWS then present the fauna licence application to the Director-General, NPWS, with a recommendation for approval or rejection. A recommendation for approval will often include specific additional conditions that must be met by SFNSW. After the EIS for the activities covered by the FIS has been approved by the Minister of Planning, the Director-General will then approve or reject the fauna licence application (SFNSW 1994).

For the period of the 1994 EIS, the fauna impact statement is appropriate. Following the end of this EIS the Threatened Species Conservation Act (1995) will require Species Impact Statements to replace Fauna Impact Statements.

The 1994 EIS (SFNSW 1994) provided a comprehensive document indicating the potential environmental impacts from the areas to be harvested in the following 3 years from approval in December 1995. After the EIS is prepared, it is exhibited for

public comment, and written submissions are made to SFNSW. SFNSW considers any submissions, prepares a report on those submissions (SFNSW 1995) and forwards the submissions and report to Department of Urban Affairs and Planning (DUAP). DUAP prepares an assessment report for their Minister (DUAP 1995), which forms the basis for approval. This approval details any additional conditions that are to be applied to the EIS proposal. After considering this approval the EIS can then be determined by SFNSW.

2.2.3 Harvest Planning

The final stage of planning is the harvesting plan document prepared by SFNSW staff which covers the on ground assessment of compartments. These assessments include fauna/flora, water and timber values as well as outlining the areas to be harvested. The resultant plan provides prescriptions and the basis for the control for each harvesting operation which require approval by the EPA (including compliance with pollution control license) prior to the commencement of harvesting.

Coupes are harvested using an alternate coupe system which spreads the effects of harvesting in space and time (SFNSW, 1994). Since 1976, compartments being routinely logged for the first time have been planned using the alternate coupe system. Each compartment is subdivided into a number of coupes, which are scheduled for logging in an alternating pattern on 2 separate occasions. When this system was introduced, the nominal maximum period between logging operations would have been about 20 years. However, the subsequent and ongoing reduced availability of new compartments due to deferrals, moratorium areas, constraints, and reductions in the total State Forest area have meant that is nominal period has been reduced (SFNSW pers.comm.). Within these constraints, the planning intent is to maximize the period between the 2 harvesting operations in each compartment.

2.2.4 Forest Practices Code

The forest practices code for timber harvesting in native forests part 2 (SFNSW 1995b), was introduced in 1995, and was an update of the 1993 Code of Logging Practice. The current code covers licensing requirements, planning provisions for harvesting, tree marking and retention, through to wet weather controls, pollution controls, and penalty provisions for breaches.

2.2.5 External controls

A number of legislative controls and processes apply to all harvesting operations within the State Forests of the Eden CRA region. Legislative controls include compliance with the laws, regulations, and ordinances that are relevant to harvesting. The principal Acts include (SFNSW 1995b):

- **Forestry Act 1916**

  parts 4 and 5 of the 1994 regulations

  Outlines the management and administration of State Forests. The 1983 regulations outlines controls in the harvesting of timber.

- **Bush fires Act 1949,**

  Regulates the use of fire.

- **Construction Safety Act 1912**

  Licensing of log loading machinery operators.

- **Dangerous Goods Act 1975**

  Dangerous Goods Regulation 1978, as amended

  Transport and storage of dangerous goods.

- **Environmental Planning and Assessment Act 1979**

  Environmental Planning and Assessment Regulation 1994

  Encourage the proper management, development and conservation of natural and man made resources.

- **Factories, Shops and Industries Act 1962, Timber Industry (Health and Safety) Regulation 1992, amended 1988 (TI Reg)**

  Provide for safe work practices and standards.

- **Environmental Offences and Penalties Act 1989 - Littering on State Forests**

  Regulates littering in State Forests, timber and flora reserves.

- **National Parks and Wildlife Act 1974, as amended by the Endangered Fauna (Interim Protection) Act 1992**

  Provides for the protection of Aboriginal relics and the protection of flora and fauna.

- **Occupational Health and Safety Act 1993 (OH&S act)**

  Occupational Health and Safety (First Aid) Regulation, 1992 (OH&S [First Aid] Regulation)

  Provides for protection of workers, and the visiting public.

- **Pollution Control Act 1970, Clean Waters Act 1970, Environmental Offences and Penalties Act 1989**

  These acts deal with the control of pollution, including the discharge of chemicals and another pollutants. Most timber harvesting operations require pollution control licenses under the Pollution Control Act.

- **Soil Conservation Act 1938**

  Applicable to State Forests through the Soil Erosion Mitigation Guidelines for Logging in NSW (SEMGL) and the Code of Forest Practice.

- **Surveyors Act 1929, Survey Coordination Act 1949**

  Interference with survey marks.

- **Traffic Act 1909, Roads Act 1993, Motor Accidents Act 1988, Local Government Act** 1993.

  Registration of motor vehicles, load limits, third party insurance.

- **Workers Compensation Act 1987**

  Requires people engaged in timber harvesting operations to comply with provisions of this act with particular reference to insurance and rehabilitation of injured workers.

- **Timber Industry (Interim Protection) Act (1992 as amended)**

  Provides interim protection for the employment of workers in the timber industry pending the completion of ElS's.

- **Threatened Species Conservation Act (1995)**

  Administered by NPWS.

2.2.6 Log Classification

Sawlogs

Sawlogs are harvested and processed at sawmills to produce sawn timber for the local, state and interstate markets. Sawmills located in Bombala and Cooma obtain sawlogs from the State Forests of the Eden CRA region. The major products produced from these logs are green scantling for housing construction materials, industrial crating, fencing and palings (SFNSW 1994).

The species preferred by sawmillers and most commonly available as sawlogs are brown barrel, messmate, yellow stringybark, silvertop ash, shining gum, maiden's gum, mountain grey gum or monkey gum. Smaller amounts of ironbark, coastal grey box, spotted gum and blackbutt are found in the Eden CRA region. The various other gums, boxes, bloodwoods and peppermints are not generally suitable as sawlogs, as they produce timber that has a high level of defect or are dimensionally unstable

(SFNSW 1994). The mix of high sawlog yielding tableland forests and lower yielding coastal forests become important in maintaining both an appropriate species mix to sawmills and ensuring supply commitments to the sawmill and pulpwood industry.

Specifications for compulsory (quota) and non-compulsory sawlogs (non quota), as defined in timber sale agreements, are as follows (SFNSW 1994):

Compulsory Sawlog Specifications: *Eucalypt-derived timber as accepted by the industry as suitable for sawmilling and complying with the current compulsory utilisation standard schedule for log quality from the EMA and is within the following sizes:*

- minimum log length: 2.4 m for butt diameters 40 cm (under bark) and over; 4.0 m for butt diameters less than 40 cm (under bark)

- minimum butt (large end of log) diameter: 36 cm (under bark)

- minimum toe (small end of log) diameter: 30 cm (under bark)

- minimum defect % as specified in the agreed segregation standard with the sawmills.

Non-Compulsory Sawlog Specifications: Logs that are outside the quality or size specifications listed for compulsory sawlogs.

A portion of the better quality pulpwood can be used by the sawmill industry as non-quota logs. While these don't have high recovery rates, some sawn timber can be recovered. A high percentage of the timber in these logs generally ends up as pulpwood.

Pulp Logs

The State Forests of the Eden area contain a large resource of eucalypt fibre suitable for the pulp and paper industry. Most eucalypt species are suitable, with the exception of the of woollybutt, roughbarked apple, red ironbark, red bloodwood, coastal grey box, red box and forest red gum due to their red wood and density characteristics. These unacceptable species have a limited occurrence in the area. A small number of acacia species, predominantly silver wattle (*Acacia dealbata*), are also suitable. Pulp logs are cut from trees and parts of trees that are considered unsuitable for sawlogs, owing to high amounts of defect, poor shape or because the species are unsuitable for sawlogs (SFNSW 1994).

All pulp logs harvested from the State Forests in the Eden CRA region are converted to woodchips at the HDA mill located at Twofold Bay. The woodchips are shipped to conversion centres in Japan, where they are converted to pulp and, subsequently, paper products, such as high-grade printing and writing paper, computer paper, photocopying paper and facsimile paper. About 98% of HDA's paper output is consumed by the Japanese domestic market, with the remainder being sold to south-east Asia, where the major markets are in Hong Kong, Malaysia and Singapore (SFNSW 1994).

Specifications for pulpwood, as defined in the timber supply agreement between SFNSW and HDA, are as follows (SFNSW 1994):

Pulpwood Specifications*: Eucalypt timber and timber produced from other non-eucalypt trees, are accepted by the pulpwood industry as suitable for paper making, subject to the timber being sufficiently straight for the manufacturing process, not less than 2.0 m in length or with an average cross-sectional area of less than 80 cm^2, and an average wood thickness of not less than 10 cm.*

Eden Timbers and potential uses

The following describes the timbers of the Eden CRA region and their potential uses including requirements by quota mills, and specialist uses by small scale mills.

Specialty timbers generally refer to timbers that due to their specific qualities, such as colour, durability or figure, supply specialist markets in furniture, joinery, heavy construction or cabinet making. Whilst most of the timbers within the Eden CRA region can be value added beyond the green scantling stage, little extra value adding is currently occurring from the major mills taking State Forests quota sawlogs (see chapter 6). The following is a description of the species within the Eden region concentrating on species that have potential as specialty or further value added timbers (source SETMUG, Brooker et al (1994)).

Small trees currently not utilised by the normal sawmilling industry locally that are sought after for value added uses.

These species are used in low volume because they are generally small in size and restricted availability. However, they are an important resource for the value added industry as they provide an exotic addition to the more normal hardwoods timbers used.

Species	Common Name	Properties
Acacia dealbata	silver wattle	Light brown to pink straight grained timber, useful for joinery, furniture, craft.
Acacia melanoxylon	blackwood	Seldom reaches large sizes regionally. Highly desirable timber deep dark brown, furniture, craft.
Banksia integrifolia	coast banksia	Timber yellow brown. Unusually featured grain structure with “eyes”. Good for wood turning and small sizes in cabinet work and furniture making.
Casuarina littoralis	black she oak	Small tree. Timber white to pale pink. Unusually featured grain structure. Good for wood turning and small sizes in cabinet work and furniture.
Exocarpos cupressiformis	wild cherry	Small tree, timber very high tensile strength. Was historically sought after for bullock dray poles.One of the best for wood turning and carving

Larger trees not currently utilised by industry locally that have potential for value added uses

These species are not normally used by conventional quota sawmills locally, but are used by small operations and have good potential for increased use.

Species	Common Name	Properties
Angophora floribunda	rough-barked apple	Dark brown, interlocking grain resistant to splitting. Not suitable for external use. Used for butchers blocks, flooring, panelling, feature uses. Logs subject to gum veins and often faulty, but good timber can be recovered with mobile and small fixed mills.
Eucalyptus gummifera	bloodwood	Red /orange timber. Stable in drying. Very durable, often used for fencing. Logs subject to gum veins and often faulty, but good timber can be recovered with mobile and small fixed mills. Clear timber very good for internal and furniture use.

Larger tree species that are sought after for value added uses

These are the most sought after species for value adding, and currently utilised by

quota sawmills but not necessarily used for high value added end uses.

Species	Common Name	Properties
Eucalyptus bosistoana	coastal grey box	Very strong, in demand for heavy construction work. Attractive yellow brown wood suitable for appearance grade uses such as panelling.
Eucalyptus botryoides	mahogany	Attractive red timber with nice feature grain. Subject to borer attack, but good for appearance grade uses. Very restricted in Eden CRA
E. sideroxylon	ironbark	Dark red, dense, hard, durable, strong. Excellent for heavy construction, sleepers. Good for bench top, table tops, as slabs or boards, appearance.
E. longifolia	woollybutt	Red heartwood, dense, strong and durable good for construction, appearance, sleepers.
E. maculata	spotted gum	In high demand by joineries as a general purpose appearance grade timber. Traditionally used for boat building and stem bending due to long fibre length.
Eucalyptus tereticornis	forest red gum	High quality red timber, in always attracts a premium price. Used for appearance grade fitting out timber in houses, bench tops, etc. Commonly cut as natural edge slabs for bench and table tops. In high demand by craft users, joineries
Eucalyptus muelleriana	tellow stringybark	Best of the stringybarks. In demand as appearance grade timber for general fitting out. Also used as structural building timber. Special use as piers for wharf construction with bark on, as is resistant to marine borers.
Eucalyptus agglomerata	blue-leaved stringybark	Good quality white timber for general appearance grade uses in house construction. Suitable for flooring and panelling.
Eucalyptus globoidea	white stringybark	Good quality white timber for general appearance grade uses in house construction. Suitable for flooring and panelling.
Eucalyptus globulus ssp maidenii	maidens gum	Subject to drying stress and distortion. Often has “birds eye” feature caused by insect damage which gives it a distinctive appearance. Has good potential as an appearance grade timber because of this.
Eucalyptus sieberi	silvertop ash	Good quality white timber, subject to pinhole borer. Can be subject to movement in drying. Wood from larger trees suitable for appearance grade uses and panelling

Larger tree species that also occur in the region

These species find limited use in value adding enterprises but are mostly suitable for sawn timber uses.

Species	Common Name	Properties
Eucalyptus bauerana	blue box	Small to medium tree with unexplored potential.
Eucalyptus cypellocarpa	monkey gum	Attractive timber but subject to movement during drying. Good for appearance grade uses if dried then reconstituted or re-machined.
Eucalyptus elata	river peppermint	Subject to high levels of drying stress and distortion. Can be used for panelling etc. once dried and re-machined.
Eucalyptus pilularis	blackbutt	Similar to stringybarks .
Eucalyptus polyanthemos ssp. vestita	red box	Good quality red timber for appearance grades, but not common in the district.
Eucalyptus radiata	narrow-leaved peppermint	Subject to high levels of drying stress and distortion. Can be used for panelling etc. once dried and re-machined.
Eucalyptus tricarpa	red ironbark	small sizes, limited range, but good quality red timber for appearance grade.
Eucalyptus obliqua	messmate	Timber has light brown to brown heartwood, is straight grained with moderate hardness and strength. Used for general construction, and some appearance grade applications.
Eucalyptus fastigata	brown barrel	Timber has a light brown heartwood is straight grained, moderately hard, and of moderate strength and durability. Suitable for flooring, building, and some appearance grade applications.
Eucalyptus nitens	shining gum	Timber has straw coloured or pale pink heartwood, is straight grained, tough but relatively easy to work. Suitable for general building, flooring, joinery, furniture, pulp and paper.
Eucalyptus fraxinoides	white ash	Timber as straw coloured to light brown heartwood, moderately coarse texture, straight grained, low durability. Suitable or joinery, flooring, and general construction.
Eucalyptus viminalis	manna gum	Timber subject to drying distortion but can have attractive feature with pale yellow to light pink heartwood. Suitable for general construction, joinery, panelling, flooring.

Small quantities of specialty timbers are available from State Forests and are currently sold to mills with Crown quota allocations. These timbers lend themselves to high value end use in heavy construction or furniture applications due to attractive colours or durable/strength qualities.

There is a consistent demand for these timbers by local small scale sawmillers who currently source this timber through secondary purchasing from the current licensed mills, from private property harvesting, or through non-quota allocations (SETMUG pers.comm.). Private property harvesting has become more difficult to obtain due to the provisions of the State Environmental Planning Policy No. 46 (SEPP 46) which controls private land clearing regulations.

The 1994 EIS permits 5,000m^3 of non-quota sawlogs to be harvested during the period of the EIS agreement. The amount that is sold varies according to demand and each parcel sold is authorised by a timber licence (SFNSW amendment to EIS 1996). The restriction of sawlog availability by parcel to only non-quota logs limits further value adding opportunities due to the poorer quality of the timber available (SETMUG pers.comm.).

The organisation representing specialty timber users in the Southeast Region is the "Southeast Timber Users and Millers Group (SETMUG)" who propose possible options for the long-term supply of specialty timbers. These options include:

- availability of craft wood licenses,
- introduction of a tendering system to supply a steady but small volume of timber to mobile and small fixed sawmills over a 3-5 year period.,
- setting aside particular areas of forest for long-term silvicultural management for specialty and high value added timber supply.

2.2.7 Timber Resource Availability

Public Forests

There are 198 315 hectares of state forest of which 152 651 hectares is potentially available for wood production from native forests in the Eden CRA region (which includes current fauna moratorium areas) representing 32 % of the total public land and 77 % of State Forest (see table 2.). The actual available land is determined by environmental, operational and economic constraints. The main restrictions to State Forest availability for timber harvesting are PMP exclusions, stream reserves, rainforest and buffers, steep terrain, geomorphic hazards, areas of high visual sensitivity, wildlife concerns, significant recreational, cultural or heritage areas. The Code of Forest Practice (SFNSW 1995) and EPA pollution control licence (SFNSW 1996) provides conditions under which forestry operations may be undertaken to reduce environmental impacts. Table 2 shows areas excluded from harvesting according to the FRAMES net harvestable area project. Of note with table 2 is that there is significant overlap with many of the exclusions. This is why the cumulative area is displayed, which shows the cumulative impact of additional exclusions.

Table 2. Net harvestable area for the Eden CRA region.

Exclusions	Area (hectares)	cumulative area (hectares)	cumulative %
PMP(1.1.2, 1.1.7, 1.1.9, 1.2.0, 1.3.0, 3.1.0,3.2.0)	22 914	22 914	11.56
rainforest and buffers	5 061	26 731	13.49
rocky areas and buffers	2 122	27 711	13.99
swamp (wetlands) and buffers	754	28 320	14.29
heath and buffers	2 166	29 590	14.93
slope > 30 degrees	3 456	31 746	16.02
fauna stream buffers	14 350	40 987	20.69
PCL stream buffers	16 804	44 416	22.42
hazard category 4	5 236	45 493	22.96
slope > 20 degrees (for net thinable area)	32 013	66 399	33.51
Total area-post 1996 compartments		198 144	
Net Harvestable Area		**152 651**	
Net Thinable Area		**131 745**	

Changes in sustained yield levels since the introduction of integrated harvesting

Sustained yield is a basic precept of forest management, and requires not harvesting more timber from the forest than it grows; adherence to this principle would permit sustained levels of harvest in perpetuity. Maintenance of this sustained yield is based on a specific set of assumptions. It assumes that certain conditions will be maintained for the period over which the sustained yield is calculated. These conditions include a designated area available for production, and no additional prescriptions are introduced that reduce the amount of timber that can be harvested within the harvestable area. Any changes to the area base, or management prescriptions may effect sustained yield.

Table 3 shows the changes in timber harvesting levels since integrated harvesting began in 1969, and table 4 the changes in allocated timber levels over this period. The 20 year (special) license to HDA from 1/1/1970 was for supply of 450 000 tons net (457 200 tonnes). It was increased to 510 000 tonnes to provide an additional 50 000 tons from the Eden Management Area that was originally to be supplied through Nowra Management Area (SFNSW Southern Region files). In 1973 this net commitment was translated to 530 000 tonnes gross to allow for a 4% non-removable defect. This change was effected in negotiation of a sales agreement to replace the special license. These allocations were derived by assuming the available area of multi-aged forest would be harvested by integrated harvesting over a forty year period (HDA 1986).

The changes in sawlog volumes harvested reflect the reductions in allocations (table 4) associated with changes in the available area, the introduction of additional environmental prescriptions, and the changes in management intent. The major changes have been as follows:

The 1982 Forest Management plan estimated that harvesting of the multi-aged resource would be completed by 2012, completing the first cutting cycle. The second cutting cycle would be based on the regrowth resource established from both wildfire and integrated harvesting.

Table 3 shows the progressive reduction of sawlogs harvested over the period of integrated harvesting. The first reductions in sawlog allocation were a result of the 1979 amendment to the 1975 management plan. Following reductions resulted from reduced allocations, firstly from the 1982 Eden Forest Management Plan yield review and subsequently from the reduction in State Forest area in the South East Forest Agreement, and the NSW Government Forest Reform Strategy (this reduction reflected changes in environmental prescriptions affecting both the productive area and the unit area yields).

The reduction in the sawlog allocation in 1992 from 65 500 m^3/yr to 59 000 m^3/yr was a direct result of the areas of State Forest being transferred to the conservation reserve system (SFNSW 1994). The South East Forest Agreement provided for the creation of additional 51 000 hectares of new national parks and nature reserves of which about 50 000 hectares was previously State Forest.

The reduction in sawlog allocation in January 1996 was part of the Government Forest Reform Strategy announced in June 1995. In Eden Management Area sawlog allocation was reduced by 40 % from 59 000 m^3/yr to 35 400 m^3/yr. This reduction was made in recognition that existing allocations were not sustainable. A major factor related to the prescriptions and moratorium that had been applied as a precautionary approach to flora and fauna management. In addition to flora and fauna concerns, increased prescriptions associated with EPA pollution control license requirements necessitated reductions pending the assessments and decisions that were to be made under the IAP and the CRA.

SFNSW (1994) recognised there would be sawlog supply shortages following completion of the first cutting cycle in 2012. Streeting and Hamilton (1991) estimated the regrowth resource would not be available at 59 000 m^3/year until 2029, but did indicate there were a number of management strategies that could be used to provide sustained sawlog yields. During the 1996 IAP process, SFNSW extended the time over which the multi-aged forest would be harvested from 2012 to 2020. This reduced the non-declining yield from what was 59 000 m^3/year to 41 490 m^3/year based on the 1991 sawlog resource (SFNSW 1996). The yield model in the Wood Resources Study calculated an average non-declining yield of 41 100 m^3/year using the same time period (SFNSW 1996). Extending the period over which the multi-aged forest was harvested

would assist in the phasing in of regrowth thinnings and would not make even-flow sustainability dependent on the regrowth resource until after 2020 (RACAC 1996).

The 1997 reduction from 35 400 m^3/year to 26 000 m^3/year was part of the New South Wales government IAP decision in September 1996, which created a further 46 000 hectares of National Park, all of which was previous State Forest. This decision allocated sawlogs at a level of at least 26 000 m^3/year until the RFA was finalised and a minimum of 20 000 m^3 following completion of the RFA. No commitment was given for pulpwood levels which were calculated on a ratio of 1:13. Current licensed commitments to Eden sawmills are 33 505 m^3 per year (source SFNSW).

The sawlog yield for the Eden region will be derived as part of the CRA process, with the full range of influences on sawlog yield being brought to account by the FRAMES and ESFM projects. Sawlog allocations will then be based on the sustained yields estimated during this CRA process.

Table 3. Quantities of timber harvested from State Forests, timber reserves and other crown land in the Eden Management Area from 1964 to 1997 (SFNSW records)

		Sawlogs		Pulpwood (green log weight)	
Dates	Period years	volume (gross m^3)	Average rate (gross m^3/yr)	Amount (tonnes)	Average rate (tonnes/yr)
1964/65-1968/69	5	443 556	88 807	nil	nil
1969/70-1974/75	6	734 864	122 478	1 317 095	219 515
1975/76-1981/82	7	725 081	103 583	3 563 840	509 120
1982/83-1990/91	9	677 306	75 283	4 845 792	538 421
1991/92	1	58 108	58 107	479 100	479 100
1992/93	1	51 545	51 544	501 330	501 330
1993/94	1	48 860	48 859	498 270	498 270
1994/95	1	48 289	48 288	516 650	516 650
1995/96	1	42 863	42 863	463 142	463 142
1996/97	1	30 697	30 697	347 230	347 230
Totals/averages		8025	86 701	7986	448 547*

* since pulpwood harvesting began (28 years)

Table 4. Sawlog and Pulpwood Commitments from Eden Management Area in the period 1970 to 1997 (source SFNSW)

Year	Annual Sawlog Commitment (m^3 gross)	Annual Pulpwood Commitment (gross tonnes)	Comment Code
1970	96 680	450 000 increased to 510 000 (net)	1
1975	96 680	530 000	2
1979	94 720	530 000	3
1982	94 080	530 000	4
1987	65 500	530 000	5
1992	59 000	504 000	6
1996	35 400	*460 200* *	7
1997	26 000	340 000	8

* based on 1:13 ratio but not a legislative requirement.

Comments

1. Sawlog allocations derived from southern region file records (gross volume = 1.36x net volume)
2. Management Plan for South East Hardwood Pulpwood and Sawlog Management Area (July 1975) [Eden: 24 040m^3net, Bega: 11 256m^3 net, Bombala: 17 256m^3 net]

3. Management Plan for South East Hardwood Pulpwood and Sawlog Management Area (July 1979 amendment) [Eden:24 570m^3net, Bega: 20 360m^3 net, Bombala: 24 720m^3 net]
4. Eden Native Forest Management Plan (1982) [Eden:24,100m^3net, Bega: 20 360m^3 net, Bombala: 24 720m^3 net]
5. Sawlog allocations reduced by 30% (10% per year in 1 January 1985, 1 January 1986, 1 January 1987); reductions were part of strategy recommended in Eden Native Forest Management Plan (1982).
6. Sawlog allocations adjusted from 1 January 1992 to account for losses in State Forest area as a result of the South East Forest Agreement.
7. The NSW Government Forest Reform Strategy announced in June 1995, a 40% reduction in sawlog allocations for Eden Management area effective from 1 July 1996. This reduction was implemented in Eden Management area from 1 January 1996.
8. The NSW government IAP decision in September 1996 determined that sawlog allocations would be at least 26 000m^3 gross until the Regional Forest Agreement for the Eden region was finalised.

Table 5. Volume by forest zone by standing resource (m^3) (*source SFNSW*)

Zone	stringybark		silvertop ash		Monkey gum		Tablelands		messmate		Spotted gum		Specials		Other		Total	
	< 40 cm	40 cm +	< 40 cm	40 cm +	< 40 cm	40 cm +	< 40 cm	40 cm +	< 40 cm	40 cm +	< 40 cm	40 cm +	< 40 cm	40 cm +	< 40 cm	40 cm +	< 40 cm	40 cm +
Jingera	3 900	28 800	1 900	15 500	400	3 000	0	400	200	1 500	0	0	100	700	1200	8000	7 700	57 900
North East	4 600	27 400	1 000	8 300	1 300	15 100	0	200	0	0	3 100	12 100	500	2 300	500	2 300	11 000	67 700
North Tablelands	300	4 400	800	9 400	800	14 200	2 000	43 500	1 000	18 200	0	0	0	100	700	13 100	5 400	102 900
South East	2 000	21 100	1 100	12 400	300	3 400	0	0	100	1 600	0	0	0	0	0	200	3 500	38 700
South Tablelands	500	6 400	1 200	16 300	1 200	20 900	700	17 700	1 300	27 500	0	0	0	200	0	100	4 900	89 100
Yambulla	3 300	60 600	3 800	72 100	600	11 300	100	1 700	400	6 800	0	0	0	200	700	12 400	8 900	165 100
Grand Total	14 600	14 8700	9 600	13 4000	4 600	67 900	2 800	63 500	3 000	55 600	3 100	12 100	600	3 500	3 100	36 100	41 400	521 400

Forest Zone : Forest Sections

Jingera : Lennards, North Jingera, South Jingera, West Jingera, Yurammie

North East : Murrabrine, Mumbulla, Murrah

North Tablelands : Cathcart, Glen Allen, Glenbog, Tantawanglo, West Yurammie

South East : East Boyd, Nadgee, Timbillica

South Tablelands : Bondi, Coolangubra, Nalbaugh, Pericoe, Rockton

Yambulla : Allan Brook, North Falkner, South Falkner, Waalimma

Species Compositions

stringybarks : White stringybark, Yellow stringybark, Blue-leaved stringybark, Blackbutt

Tablelands : Mountain gum, brown barrel, Shining gum, manna gum, White ash

Specials : ironbark, Coastal Grey Box

Others : bloodwood, peppermints, Red gum, woollybutt

Table 6. Forest association by net harvestable area

Forest Association	Description	Private Land	State Forest
0	No floristics data available	611	50
1	Blackbutt forest types	1 019	167
2	Sydney blue gum/Bangalay types	538	68
3	Spotted gum types	574	588
4	silvertop ash types	7 575	60 429
5	bloodwood, stringybark, peppermint types	8 975	17 509
6	woollybutt, Grey ironbark, Coastal Grey Box	14 266	11 503
7	Smooth and roughbarked apple types	106	0
9	messmate, brown barrel types	7 917	17 418
10	gum types	14 264	36 060
11	Brittle gum, Sribbly gum	15 896	2 990
12	Box types	27	77
13	Snow gum, Black Sallee	7 116	884
91	Rainforest	46	8
92 + 16	Non-commercial Paperbark, river oak, wattle	210 489	1 343
93	Floristics described as "unknown"	181	90
94	Floristics described as "unmapped"	3 183	3 287
99	Incomplete floristics code	68	265
TOTAL		292 852	152 737*

* note the slight change from table 2 is associated with minor variations in the base data set.

Private Forests

Estimates by HDA show the continued availability of 20 000 - 25 000 tonnes/year pulpwood from private property in southern NSW the majority of which is in Eden from the Tablelands area (Frank Whitelaw pers.comm.[3]). Part of this was from clearing operations and part from harvested and regenerated forests. The introduction of SEPP 46 legislation in 1996 on private property clearing severely reduced this timber availability as shown in table 7.

As of 1990 an estimate of 1 844 000 tonnes of pulpwood was available from private property (Streeting and Hamilton 1991). Based on amounts harvested from 1990 to 1997 there are 1 620 902 tonnes remaining but under SEPP 46 legislation only a small proportion of this may be available.

[3] Manager Forest Operations HDA, Eden

Table 7. Private property pulpwood resource harvested 1990/97.(HDA)

Year	Tonnes
1990	48 000
1991	49 000
1992	38 000
1993	38 000
1994	51 000
1995	37 000
1996	298
1997	1 800

2.2.8 Native Forest Timber Productivity

Productivity in this study refers to the capacity of the forest to produce timber; primarily aimed at sawlogs with a by product of pulpwood. Productivity is generally measured as mean annual increment (MAI measured as m^3/hectares/year) of the total product or the average yearly growth rate for a stand or forest type. Forest timber productivity is determined by a range of environmental factors and silvicultural manipulation. The most significant environmental factors are: rainfall, temperature, soil type and condition, geology, position in slope, aspect, and drainage. Productivity generally increases with rainfall and therefore the most productive forests are in the higher rainfall areas with the messmate/brown barrel being the most productive association in the Eden CRA region (see table 9).

Management through thinning stands or removal of unmerchantable trees will increase overall sawlog productivity by reducing unwanted competition and potentially decreasing sawlog rotation age. Where high value trees such as sawlogs, are harvested without the additional removal of low value non commercial trees, the report of high value trees in the stand declines, together with stand health and vigour. Bridges (1983) showed logging regeneration of 6 000 stems/hectares to have a higher MAI of 1.29 m^3/hectares/yr standing volume compared with fire regrowth at 37 500 stems/hectares which had a MAI of only 0.44 m^3/hectares/yr for the largest 500 stems/hectares indicating the competitive effects of overstocking. Table 9 provides an indication of the range of forest productivity for forest associations of the Eden CRA region.

Existing literature has cited a range of growth rates in the Eden silvertop ash forests, Bruskin and Horne (1990) showed growth rates between 5.4 to 12.6 m^3/hectares/yr volume under bark in fire regrowth (although they were questions as to the assessment methodology) and 1-3 m^3/hectares/yr in logging regrowth. Bridges (1983) showed growth rates from fire regrowth of 0.8 to 5.4 m^3/hectares/yr.

Growth rates for tableland forests are estimated to be between 3-14m^3/hectares/yr (table 9). As a comparison East Gippsland mountain mixed species forest have growth rates of 2.4 m^3/hectares/yr sawlog (East Gippsland CRA 1996).

The range of site productivity's is critical to determining long term sustainable yield. This is where the site productivity project becomes critical (BRS and SFNSW 1997). This project develops the spatial layer that will fulfill the requirements of the growth models being developed. The method used for the project was primarily based around mapping of factors that contribute to forest growth. These are nutrients, moisture, temperature and light. Reality checking was undertaken using existing volume data compiled within the wood resources database. In addition to this work the 3PG (Physiological Principles in Predicting Growth) model (Landsberg & Waring, 1997) was also used as an independent predictor of standing biomass and biomass accumulation through time.

Map 3 MAI (m3/ha/yr) for Net Harvestable Area - Eden CRA

Table 8. Forest Area by productivity class for Eden CRA region by net harvestable area

MAI (m^3/hectares/year)	Area (hectares)
1	22
2	25 730
3	16 050
4	1 653
5	48 492
6	106
8	25 109
10	9 553
12	11 437
14	10 199
Total Known	148 351
Unknown	4 471
TOTAL STATE FOREST	**152 822**

Table 9. Mean annual increment (m3/hectares/year) for each forest yield association (SFNSW Eden)

association	minimum	average	maximum
1		2	
2		8	
3	2	4	6
4	2	5	12
5	2	5	8
6	2	5	8
9	3	10	14
10	3	8	14
11	2	3	4
12		2	
13		2	

2.2.9 Yields

The major aim of FRAMES for the Eden CRA has been to determine the time when sawlog production from regrowth forest is of sufficient volume to replace the sawlog volume from the multi-aged forest (MAF). This then set a number of tasks, given limitations of time and resources:

- Accurately determine the net harvestable area and volumes per hectare from the multi-aged forest (see table 5,6,7,8).
- Determine the extent of the critical age groups of regrowth forests and inventory these (FRAMES reporting on this).
- Using the information above and appropriate growth functions simulate the growth of the regrowth forest three-time, including issues such as whether the stand was started after harvesting or fire, and what proportion of the canopy has been retained.
- Apply appropriate silvicultural treatment such as thinning to promote sawlog production from the regrowth forests.

The regrowth forest has been subdivided into strata based on:

- location - coast or tablelands
- regrowth type - logging or fire
- age class - grouping into similar age classes
- site quality - units of similar site quality

For each stratum, yield tables (yield by product at designated harvesting age) are simulated using standing basal area or diameter distributions and stocking derived

from STANDSIM. STANDSIM is a Victorian growth simulation package incorporating NSW growth functions. The yields tables produced by STANDSIM showing age and expected product volumes have been incorporated into a yield scheduling database.

This then allows the determination of product volumes by years from the regrowth forests. It also enables specification of the year in which regrowth sawlogs are available in sufficient volume to replace sawlogs from the multi-aged forest. Once the critical year regrowth sawlog volumes is determined appropriate scheduling of the multi-age forest can occur.

The final task relates to growing the forest forward long enough through time to enable verification of non-declining yields. Appropriate sensitivity analysis has also been undertaken to frame the boundaries around calculated volumes (source FRAMES technical committee, M. Bullen).

2.2.10 Native forest silviculture

Silvicultural System

Prior to 1969 single tree and group selective harvesting of the commercially desirable timber primarily for sawlogs was practiced (Bridges 1983). In combination with wildfires this led to a gradual decline of the forest quality from a silvicultural viewpoint as only desirable species, and size/quality classes were harvested leaving a forest dominated by pre-commercial and uncommercial non-sawlog trees. This left much of the accessible forest in a severely degraded state for sawlog production with the result being a low sawlog to pulpwood ratio of 1:7 in moist tableland forests to 1:13 in drier coastal forests (FCNSW 1982).

The introduction of a pulpwood industry and therefore integrated harvesting in 1969 (harvesting pulpwood and sawlogs in the one operation) made it commercially viable to harvest these forests and provided conditions for their effective regeneration following harvest. Mechanical disturbance during the operation created the seed bed, and seed was provided by both retained trees and felled heads. Initially uncommercial stems were retained such as the red wood species and trees of unsuitable size classes which were unsuitable for sawlogs or pulpwood. In the late 1970's pressure mounted to retain more trees for wildlife habitat. The silvicultural system changed from effectively a clearfelling to a seed tree system with regrowth retention in the early 1980's to better cater for wildlife and regeneration requirements (Streeting and Hamilton 1991, SFNSW 1994).

The current system does not easily fit into a classic system of silviculture. Up to 40% of the trees and 30% in of the basal area of the original stand can be retained after integrated logging (SFNSW 1994). This effectively makes the system a heavy selection harvest, although when there is little regrowth it becomes effectively a seed tree system with retained growers (regrowth likely to become future sawlogs) leading to a dual age forest where no regrowth is present, or multi-aged forest where regrowth is retained (SFNSW 1994). Post-harvest burning is standard practice and was introduced following the destructive 1980 wildfires to reduce the possibility of large-scale regeneration loss and to improve seed bed (SFNSW 1994). Stocking rates following harvesting average around 5 000 seedlings/hectares, while wildfire can result in regeneration as dense as 85 000 seedlings/hectares (Bridges 1983).

The higher quality wetter forest types such as brown barrel, messmate, manna gum, and Shining gum tend to occur more in the escarpment/tableland forest on the more fertile, higher rainfall sites, and sheltered aspects. The escarpment/tableland forests have a higher proportion that have not been previously selectively harvested largely due to their proximity to Eden and

previous lack of access. The lower incidence of fire and lack of previous harvesting mean a higher sawlog to pulpwood ratio of around 1:7 (FCNSW 1982). Regeneration is generally readily established in the moist forests, although occasional difficulties are experienced in brown barrel forests requiring limited artificial enrichment plantings (SFNSW 1994).

It can be important to bring forward the harvesting age of certain stands in order to smooth out timber supply over time. This requires intensification of silviculture for particular stands especially even-aged silvertop ash regrowth. This can begin during the harvesting and regeneration process or following regeneration establishment. Practices of intensification in East Gippsland of clearfelling, and artificial sowing controls stocking, and reduces the requirement for pre-commercial thinning (NRE 1997). Pre-commercial thinning when required may bring forward commercial thinning age and therefore final harvesting age but is an expensive operation. Commercial thinning provides the opportunity to remove non-sawlogs and promote growth on the better quality trees while still obtaining a commercial return. Further intensification can involve fertiliser application in order to promote growth and further reduce rotation age (NRE 1997). A further discussion on intensification is attached as appendix 1 (source SFNSW and BRS)[4].

Commercial Thinning

Thinning is an essential part of the long term sustainable yield strategy. It provides a current pulpwood harvest and possibly some small sawlogs by removing suppressed and defective stems, thereby decreasing competition for water, light, and nutrients for the retained better quality stems. This will have the effect of concentrating growth on the better stems thereby decreasing sawlog rotation age.

An area of about 1 500 hectares of 1952 fire regrowth is identified for thinning during the 1994 EIS period as operational trials, with the aim being to develop technology, skills, and operational procedures for future application in regrowth forests following integrated harvesting (SFNSW 1994). Table 2 shows gross thinable area to be 131 745 hectares based on net harvestable area less than 20 degrees. The 20 degree restriction is the limit for the mechanical thinning machinery used in harvesting. Only a small proportion of this resource is currently suitable for thinning due to the current age structure.

Thinning trials have been concentrated in 1952 wildfire regrowth with the broad aims of (SFNSW 1994):

- removal of 700 trees/hectares leaving a stocking density of 200 trees/hectares, and
- removing the suppressed and subdominant trees before co-dominant tree removal.

Thinning is undertaken using a bay and outrow method generally removing an outrow of about 3.5-4m and leaving a 14m bay. The outrow provides access for the mechanical harvesting machinery to thin within the bay and for forwarder access for extraction (Brian Clarke pers.comm.[5])

The fires risk associated with increased fuel loads from the ground debris is reduced to some extent by compacting the bed of head material through harvesting machinery access.

Commercial thinning can be undertaken on slopes generally up to 20° and viability is dependent on resource quantity and site factors. SFNSW (1994) have estimated thinning yields of 70 tonnes/hectares coming from first thinning operations although HDA has a preference for sites

[4] This discussion provides an indication of possible treatments for particular associations and forest types. It has not received endorsement by the economic and social technical committee.

[5] SFNSW Senior Planning Forester, Eden.

of 90-100 tonnes/hectares. SFNSW (1994) indicated thinning beginning at 30 years and continuing at 30 year intervals, although collaborative work between CSIRO and SFNSW is refining this estimate. The highest quality sites can be thinned as early as 20 years and trials are currently being undertaken on 20 year old regrowth (B.Clarke pers.comm.). Both the age and the site quality of regrowth sites is critical to determining long-term sustainable yields, as this influences the timing of regrowth thinning, and time to commercially acceptable sawlog size. Commercial thinning can provide important advantages in levelling out supply requirements by bringing forward the harvesting year.

Pre-commercial thinning

Some pre-commercial thinning trials have commenced in the Eden forests as part of the south-east forest regional adjustment package but this is at a very small scale. Research in the regrowth forests in East Gippsland have shown doubling of Basal Area 3 years after pre-commercial thinning in 9 year old *E. sieberi* regrowth and that intensive silvicultural management of regrowth silvertop ash forest can increase sawlog yield and economic return (Connell and Raison 1996).

Pre-commercial thinning can assist in reducing rotation ages in order to satisfy medium to long-term supply requirements. It also potentially provides benefits in increasing profitability of growing eucalypt forests. This is through decreased rotation length, increased volumes of merchantable wood and potential decrease in later harvesting costs (NRE 1997). The economics are largely dependent on initial costs, subsequent growth rates, and future wood royalties.

Methods of pre-commercial thinning range from clearing saws and chainsaws which based on experience in Victoria tend to be the most expensive technique with operator productivity of 0.03-0.04 hectares/hour, to the more economical stem injection techniques of 0.04 - 0.13 hectares/hour (NRE 1997).

2.3 PLANTATION FOREST MANAGEMENT

2.3.1 History

Pinus radiata plantations were established extensively from 1967 through to present in the Bombala Management Area with around 34 400ha currently planted (NFI 1997).

Hardwood plantations are far less extensive covering a little over 1 000 hectares with the first being established in the 1980's (NFI 1997).

Initial plantings of *Pinus radiata* began in the Nalbaugh State Forest in 1927 and in Bondi State Forest in 1928 (FCNSW 1984). More extensive plantings did not occur until the 1967 to 1975 period as a result of the Commonwealth Softwoods Agreement of 1967 and 1972 (FCNSW 1994). The majority of plantings up until 1980s were on cleared native forest on Crown Land, however more recent plantings have been on cleared private property purchased specifically for plantation establishment.

2.3.2 Plantation Management Planning

The management of plantations by State Forests is documented by the Bombala Exotic Forests Management Plan (FCNSW 1984). The plan outlines the objectives of the plantation project and provides a framework for operations and marketing to achieve the plans objectives. SFNSW are currently reviewing management options before development of any further management plans for the Bombala Softwood Region (M.Welch pers.comm[6].).

[6] Plantations Information System Project Manager, Albury

2.3.3 Coupe planning

Before any harvesting can occur a harvesting plan must be produced and approved by the EPA. The harvest plan is a comprehensive document providing details on sediment control, riparian filter strip management as well as road maintenance and use. The aim of the harvest planning is to protect the intrinsic values of forest systems including soil and water while harvesting a timber product.

Wood Flow Plans: A wood flow plan is produced covering product availability over time. Normally the time span is for two rotations with the last plan produced in 1996 (M.Welch pers.comm.).

2.3.4 Forest Practices Code

State Forest plantations are covered by the Forest Practices Code part 1 Timber harvesting in State Forest Plantations (SFNSW 1995a), and part 3 Plantation Establishment and Maintenance (SFNSW 1997). Where State Forests own resources or expertise are used for plantation establishment or maintenance operations as a consultant or contractor to private landholders then the Code of Forest Practice is followed. The Code is also promoted as minimum standards for all private plantation management (SFNSW 1997).

2.3.5 External controls

External legal controls are covered in section 2.2.5 Additional legislation in relation to plantations are as follows (SFNSW 1997):

- **Fertilisers Act 1995**

Provides for registration of brand names of chemicals.

- **Fisheries Management Act 1994**

Covers obstruction to fish passage.

- **Heritage Act 1977**

Provides for making of emergency, interim and permanent conservation orders to protect buildings, relics, works or place of scientific natural and aesthetic significant for state.

- **Noise Control Act 1975**

Prescribes acceptable levels for some sources of noise.

- **Noxious Weed Act 1993**

Requires State Forests another public authorities to control noxious weeds on their land.

- **Pesticides Act 1978**

Controls the possession and use of pesticides.

- **Rural Land Protection Act 1989**

Provides for the establishment and management of travelling stock reserves.

- **Timber Plantations (Harvest Guarantee) Act 1995**

Provides for the accreditation of timber plantations established in compliance with the EP&A Act and SEPP 46.

2.3.6 Log Classification

Sawlogs

Sawlogs can be classified into several classes based on size.

- Large : over 44cm sedub (small end diameter under bark)
- Medium: between 30cm and 44cm sedub
- Small: between 24cm and 30 cm sedub
- Super Small: between 18cm and 24cm sedub
- These sawlogs are all structural grade sawlogs.

Pulp Logs

Pulpwood is generally less than 18 cm sedub or with branches greater than 15 cm (SFNSW supply agreement 1997).

Plantation Timber Resource Availability

There are 35 510 hectares of plantation in the Eden CRA region, of which 1 070 hectares are hardwood and 34 440 hectares softwood species. New South Wales State Forests have 300 hectares of hardwood plantation trials in the region, however, these are not included as potentially merchantable resource.

As indicated in table 10, softwood plantations dominate the plantation resource. The dominant species is *Pinus radiata* which constitutes 97.7 % of the total area. *Eucalyptus nitens* is the major hardwood species.

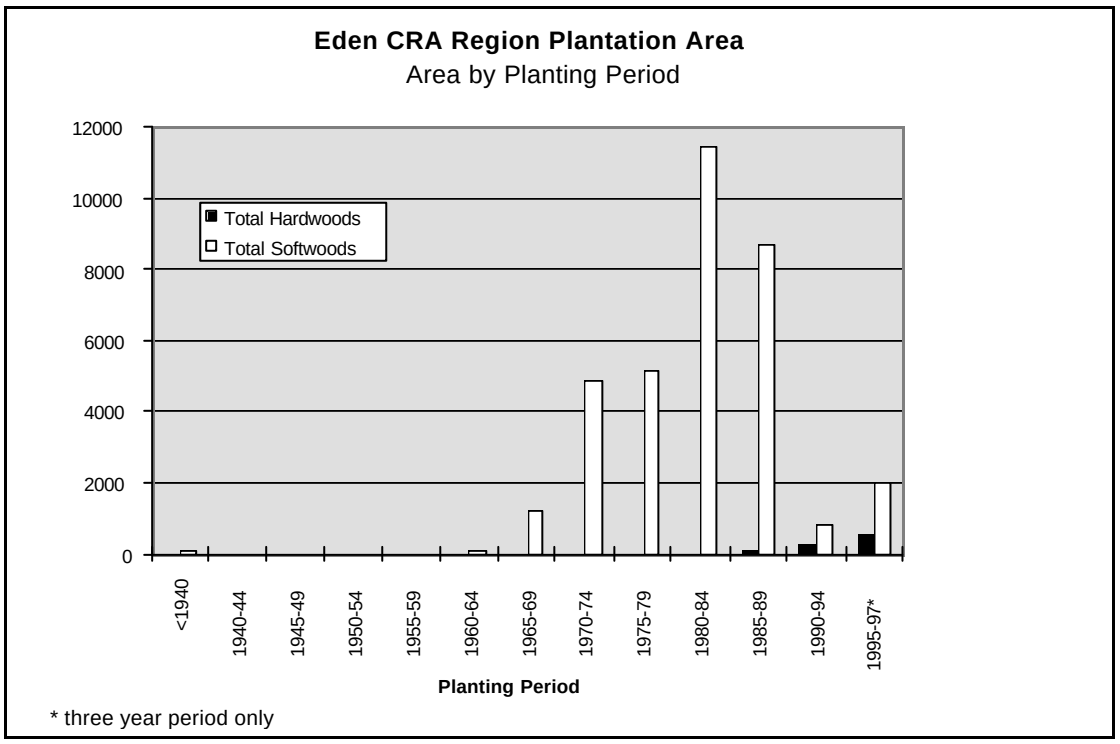
Table 10. Plantation Species and Area (hectares) in the Eden CRA region (NFI 1997)

Euc. nitens	Euc. globulus	Woodlots	other hardwoods	Total Hardwood	Pinus radiata	other softwoods	Total Softwood	Regional Total
700	40	300	30	1 070	34 390	50	34 440	**35 510**

There is a progressive increase in the areas of softwood plantations established since the late 1960s, peaking in the 1980-84 planting period which is abnormally high due to the replanting of resource lost in the 1983 wildfires. The areas planted in the subsequent decade are much lower, however, the period 1995-97 indicates an increase in the areas planted to softwoods.

Both Willmott Forests Pty. Ltd. and NSW State Forests report continued softwood planting programs over the next few years with total plantings in 1998 expected to be 2 100 hectares. There is a small but increasing area of hardwood plantations, planted since the second half of the 1980s primarily for pulpwood.

Figure 1. Areas of hardwood and softwood by planting period. (NFI 1997)



2.3.7 Forest Productivity

The current estate is producing sawlogs at an average M.A.I. of 12 m^3/hectares/year, while pulpwood is currently growing at a M.A.I. of 6 m^3/hectares/year (M.Welch pers.comm.).

Table 11: Softwood Resource Volumes from Plantations in the Eden CRA Plantation Area (SFNSW)

	sawlogs (m3) per annum	pulpwood (tonnes) per annum	sawlog residues (tonnes) per annum
current harvest	50 000	35 000	
potential 2002 a,b,c	290 000	200 000	87 000
potential 2010 a,b,c	380 000	270 000	114 000
potential 2020 a,b,c	550 000	270 000	165 000

a. potential 2002 level of yield based on current plantation resource; potential 2010 level of yield assumes an expansion of the plantation estate by about 10 000 hectares over the period; potential 2020 level of yield assumes a further expansion of the plantation estate by about 10 000 hectares over the period.

b. Sawlog availability predicated on the sale of all pulpwood.

Potential yields represent sustained annual levels when uniform age class distribution is achieved (even areas of all age classes).

2.3.8 Yields

Table 11 explains the potential yields from the current and expanded plantation estate. The expansion on the plantation estate is based on an approximate expansion of 1 000 hectares per year. The potential 2002 is based on the current plantation resource. Additional plantings from 1998 to 2002 will have no influence on timber availability at 2002 given their lack of merchantable product.

The case for the label "potential 2002", used in table 11, compared with the term "current potential" used in the Margules Poyry (1997) Industry Development options consultants report, (publicly available as part of the "Development Opportunities for the Southern NSW Forest Industry to 2010 and 2020" CRA project report) is based on the fact that the earliest recognised industry development option is for a mill processing 300 000 cubic metres in 2002. For this reason the label "current potential", used in the Margules report could be considered misleading.

Yield regulations: the system used by State Forests Bombala is based around yield tables[7]. The yield table contains potential wood production over to time, given a prescribed silvicultural regime. Yield type can be derived number of ways. The FRI (forest resource inventory) New Zealand software product known the as STANPAK is used to model silvicultural regimes and produce a yield table.

The yield table is then assigned to compartments. The resulting file is then imported into a linear program interpreter and solved. The solution reports on long term sustainable wood flows and takes into account estate constraints. These constraints include long-term would supply agreements and clearfall ages for yield tables (M.Welch pers.comm.).

Inventory: the inventory system used by State Forests is called MARVL, FRI New Zealand (Method of Assessment of Recoverable Volume by Log Grades). This system relies on temporary plots where all trees are measured for dbhob (diameter breast height over bark) and log quality factors are recorded. The inventory results can indicate growth rates and potential

[7] for further information on yield tables see plantation potential project (BRS, SFNSW 1997)

volume recoveries. The inventory results are then used to monitor yields.

2.3.9 Plantation forest silviculture

Establishment

General site preparation on first rotation sites is as follows:

- Deep ripping to 600mm
- Aggressive grass control through knockdown and residual herbicide application.
- Genetics matched to site conditions (e.g.) cuttings
- General site preparation on second rotation is as follows (M.Welsch pers.comm.):
- Spot cultivation with excavator to 600mm
- Aerial spraying with herbicide to reduce competition

Management

Thinning operations are normally confined to a delayed first thin (because of the lack of a pulpwood market in Bombala) followed by a second thinning at age 30 then clearfall from about age 34 and older.

Fertiliser is limited to post thinning booster applications.

Pruning is carried out on the higher productivity sites generally ex pasture sites, which may have excessive side branching if left unpruned. The aim being to control branching on the first 6 meters and provide a better economic return on the high productivity sites. This will ultimately produce high value clearwood (wood without branch knots).

2.4 THREATENING PROCESS MANAGEMENT

2.4.1 Wildfire

Fire has been a regular part of the forest ecosystem with the vegetation communities adapted to regular wildfire. The large expanse of unroaded country, lack of access and personnel has meant major wildfire's were inevitable. In 1939 and 1952 major wildfire's burnt unchecked causing severe damage to the forest resource (Bridges 1983). The resultant forest varied from little or no damage to the overstorey to complete death and establishment of thick dense regeneration in the ideal conditions following the burn.

Since 1967, 169 324 hectares of native State Forest have been burnt in wildfire's with the most significant being 1969, 1972, 1980 and 1982/83 (SFNSW 1994). Prior to 1980, 2 500 hectares of regrowth had been burnt by wildfire (Bridges 1983), in 1980, 12 886 hectares of integrated harvesting regrowth was burnt. In 1983, 1 400 hectares of regrowth forest was burnt (Bridges pers.comm.), and 6 405 hectares of pine forest were killed in the Bondi plantation from wildfire (FCNSW 1984).

The dry sclerophyll forests are prone to frequent and sometimes intense fires for which the forests are well adapted (SFNSW 1994). It generally takes between 5-8 years for sufficient fuel to accumulate to support another wildfire following a fuel reduction burn or wildfire (Cheney 1976). The natural fire frequency as studied by Banks (1990) in the dry sclerophyll Glenbog State Forest was shown to be 8 years which is in contrast to the natural fire frequency of 14 years in moist forest sites.

SFNSW aims to limit the extent of wildfires, to control them, and to extinguish them. There are three levels of priority within State Forest covering:

Priority one: community protection, forest adjacent to radiata pine, protection of

eucalypt plantations, and protection of research areas.

Priority two: protection of regrowth, native forest preservation program areas, protection of areas classed as PMP Special Emphasis and areas identified for schedule 12 fauna management.

Priority three: Other parts of State Forest in the management area.

Increased efforts in fire protection, the expanded road and access network, and the substantial fuel reduction program assist in protection of forest assets.

2.4.2 Pests and Diseases

Within *Pinus radiata* plantations the main pests and diseases are Sirex wood wasp, Dothistroma, and to a certain extent possums and wallabies. Sirex wood wasp and Dothistroma are largely under control within the Bombala exotic forest management area. Wallabies and possums are occasional pests soon after planting.

In native forest there are few current major pests. The root rot fungus (*Phytophthora cinnamomi*) is present but causes little tree mortality (SFNSW 1994). The main insect pests are the wood eating insects, especially termites which are widespread throughout the study area and to elicit extent ambrosia beetles especially *Austroplatypus incompertus* (SFNSW 1994).

3. MINOR FOREST PRODUCTS

Levels of minor forest produce harvest are relatively low in the Eden CRA region. This is largely due to the small local population centres and the large distance to major markets.

The largest volume of minor produce is firewood, but smaller volumes of fencing materials, poles and posts, landscape timber and amounts of eucalypt seed are harvested on both a commercial and non-commercial basis. All commercial operators require operator licenses issued through SFNSW which contain binding conditions to ensure a high standard of practice.

Total royalties from minor produce excluding rock and gravel extraction in 1996/97 were $9 794.

Table 12. Minor forest produce volumes and royalties for 1994/95-1996/97

	1994/95		1995/96		1996/97	
Product	**Volume**	**Value**	**Volume**	**Value**	**Volume**	**Value**
Firewood	912 tonnes	$5 320	776 tonnes	$5 044	695 tonnes	$5 206
Fencing	125m^3	$3 026	68m^3	$1 940	146m^3	$4 289
Seed	0	0	1.7 kg	$46	7kg	$162
Chopping blocks	0	0	0	0	0	0
Craftwood	0	0	0	0	0	0
Poles	0	0	8m^3	$190	0	0
Girders	0	0	30m^3	$3 713	0	0
Landscape timber	74m^3	$1 412	71m^3	$2 495	6m^3	$137

3.1 FIREWOOD

There is about 800m^3 of firewood sold annually from Eden CRA region. This is both domestic and commercial. The preferred species are the durable timbers of grey box (*E. bosistoana*), ironbark (*E. sideroxylon ssp tricarpa*), Woolybutt (*E. longifolia*), and yellow stringy bark (*E. muelleriana*). Other species are also harvested and preference is often associated with availability from logging coupes.

The majority of timber is collected from logging coupes and head material retained following harvesting. Only commercial operators are permitted to fell trees and then only if they are properly licensed and the trees are unlikely to contain hollows.

There are currently six commercial operators working in the Eden CRA region, but with recent job losses in the industry SFNSW Eden have experienced

renewed interest in persons establishing commercial firewood harvesting businesses.

The major markets for firewood are domestic and some interstate to Canberra, Sydney and Melbourne. The capacity to increase has been limited by uncertainty in the industry. Royalties are based on volume at $10/tonne for 1 tonne, $18/tonne for 2 tonnes, $8/tonne > 3 tonnes.

3.2 POLES, POSTS, FENCING TIMBER, LANDSCAPE TIMBER

There is a limited market and demand for fencing timbers, sleepers, poles and posts, and landscape timber. Around 150 to 200m^3/year of these timber is harvested for local consumption. The desirable species are the durable redwoods or yellow stringybark which are generally collected from integrated operations and from approved harvesting companies. Harvesting plans are required for harvesting any timber to be felled in State Forest.

Royalties

$36/ m^3 split durables

$33/ m^3 round durables

$30/ m^3 other split

$28/ m^3 other round

3.3 SEED

Three commercial collectors harvest seed from the Eden CRA region, predominantly from felled heads in harvesting operations. The seed in demand are Shining gum (*E. nitens*) and Maidens gum (*E. maidenii*). The collectors require a forest products license and pay by the kilogram of seed harvested.

E. nitens	$104/kg
Other species	$ 26/kg

3.4 CHOPPING BLOCKS

There is infrequent demand for chopping blocks in the Eden CRA region for use in local shows and wood chop competitions.

3.5 GRAZING

Grazing in the Eden CRA region is conducted under either grazing or occupation permits issued by the District Forester. Grazing permits are for those wanting to agist animals on a short term basis and the fee is paid on a per head basis. Occupation permits are annual permits based on annual carrying capacity. Grazing is also undertaken on Crown land leased for this purpose. Crown leases have been dedicated as State forest, but the condition of the pre-existing leases regarding grazing continue to apply (SFNSW 1994).

In 1997, the level of grazing activity in the region was minor and has undergone a slight reduction since the 1994 EIS. The 1994 EIS notes that the demand for grazing areas is low, with 17 occupation permits and 25 long standing leases for use of Crown land valid in 1994, covering 6 950 hectares of land with a capacity of 815-1 090 cattle. Table 13 gives a summary of grazing activity in the Eden CRA region in 1997.

Table 13. Grazing activities in Eden CRA region in 1996-97 (SFNSW records)

Grazing permit type	Number	Area (hectares)	Cattle carrying capacity (head)	Revenue($)
Crown leases	24	4 126	565	$2 897
Occupation permits	6	1 140	163	$1 902
Total	30	5 266	728	$4 799

4. ECONOMIC VALUES OF NATURAL RESOURCES

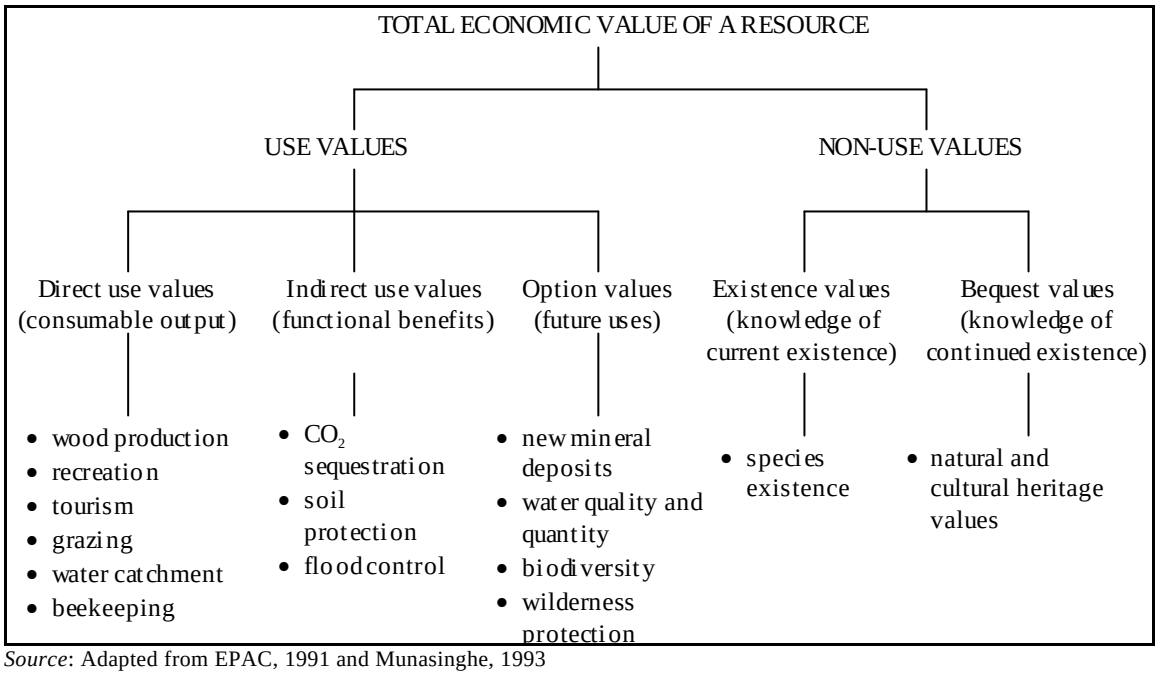
The native forests of the Eden region occupy 4 % of the total forested area in New South Wales and represent 5 % of the total available hardwood sawlogs for timber production in the state. The significance of the wood based industry in Eden is reflected in the level of economic activity it supports in the region. The major commercial industries associated with native forest use in Eden are the wood processing industries and the tourism and recreation industry. Eden's native forests are also used for other commercial activities such as water catchment, grazing, beekeeping and various other types of small scale production such as firewood and seed capsules.

Natural resources, such as forests, represent existing or potential sources of net benefit to various groups within society. In addition to those values accruing from the direct use of forest resources (mentioned elsewhere in this report), a number of other values exist which may also be important despite often being less easily quantified.

When the economic efficiency of various resource management options is being assessed, all such values must be recognised, and the relationships between each must be understood. The principal means of evaluating resource use conflicts is benefit–cost analysis, where potentially all values are included and the relationship between each value (that is, whether they are complementary or irreconcilable) is understood. Preferred options are those which.

maximise the net benefits derived from the resource.

Figure 2. Economic values associated with natural resources



Source: Adapted from EPAC, 1991 and Munasinghe, 1993

4.1 USE VALUES

Use values involve the direct consumption of various attributes of a resource, although this may not preclude the generation of further benefits in the future. Resources which have the propensity to regenerate (such as forests), for example, can continue producing such benefits indefinitely if their use is managed sustainably. The major direct use values accruing from the forests of the Eden CRA region can be expected to be timber production, tourism and mineral production (primarily the production of construction materials).

Two other commonly cited resource use values are the indirect use value and the option value.

The *indirect use value* attributes a benefit to society for the natural functioning of the resource and its interaction with the surrounding environment. Forests may have indirect use values in terms of transforming carbon dioxide to oxygen and of preventing soil erosion and salinity, for example. Some indirect use values may be exclusive in that the consumption or use of the resource for other purposes may diminish the benefits derived from its indirect value — for example, a value associated with maintaining or returning a forest to a pristine or natural state. This implies a tradeoff between the indirect use value and other uses of the forest resource, but management options which are designed with an understanding of the process and purpose of these functions may minimise the extent of these tradeoffs. An example of such an approach is the management of regrowth forest. Regrowth forest management allows the benefits associated with direct forest use (such as timber production) to be attained without totally diminishing the benefits available through indirect forest uses (such as carbon sequestration, soil protection and flood control).

The *option value* of a resource is the welfare obtained by retaining the resource for possible use at some future date. Society may benefit if a medical use for a particular plant species is discovered in the future, for example. To the extent that other management options deny this potential by prematurely consuming the resource, an opportunity cost in the form of a potential loss is imposed upon society. Deriving a benefit from preserving a

resource for potential future use may seem in conflict with the forest's direct use values. However, resource management options which guarantee the maintenance of, for example, biodiversity may reduce this potential tradeoff.

4.2 NON-USE VALUES

There are also values which may be independent from the consumption or functioning of a resource and which, in some cases, may require the actual exclusion of that resource from many forms of consumption. These non-use values are often categorised as either existence values or bequest values.

Existence values arise when individuals place a value on the continued existence of a resource, usually in its natural or pre-use state. The benefit derived from the knowledge of the resource's existence is independent of, and may preclude, any ability to experience the resource. Consequently, there is often a significant tradeoff between the existence values of forests and their direct use values.

A *bequest value* occurs when benefit is derived from the knowledge that a resource will be available for the experience or satisfaction of future generations. This is unrelated to any option value which is attributed to the resource, because the bequest value derives from the knowledge of the resources continued existence, whereas the option value may imply its future use. Again, the tradeoff between this value and direct use values of the resource can be significant. However, this may be mitigated in the case of renewable resources such as forests if the management regime ensures the sustainability of resource use.

4.3 MEASUREMENT OF RESOURCE VALUES

An analysis of the economic efficiency of resource management options should consider all values. Some values associated with resource use can be observed within a market framework, enabling them to be quantified in monetary terms. However, the estimation of some use values and non-use values can often be problematic because they are not traded in formal markets. Consequently, a number of methods have been developed to undertake valuations under these conditions, and these have been practiced in resource management conflicts both in Australia and overseas.

It may be possible to estimate some benefits and costs by using a proxy market. The option value associated with a resource, for example, may be approximated by estimating the potential future benefits flowing from the resource and weighting those benefits by the possibility of their realisation. Other values, such as many of those associated with tourism, do not occur within a formal market. However, consumers' willingness to pay for the use of the resource can sometimes be estimated from aspects of their behaviour. This procedure is termed the 'revealed preference' approach, which often manifests itself in the travel cost approach to valuing a resource.

Other values are less easily definable, particularly the non-use values of resources. Non-use values can be estimated through the contingent valuation approach, whereby participants are asked their willingness to pay for restricting the use of a resource or, alternatively, for their willingness to accept payment for the use of the resource by a third party. This procedure is termed the 'stated preference' approach. The process has been used widely in discussing resource use conflicts in Australia (for example, Carter 1992; Hundloe et al. 1990; Imber, Stevenson and Wilks 1991) but generally has not been used in policy formulation.

The contingent valuation approach has attracted a number of criticisms despite its popularity. One factor which should qualify any interpretation of the results derived from such an analysis, for example, is the knowledge of the study participants that there is no actual payment involved, thus providing them with the motivation to

volunteer exaggerated values according to their views on the conflict. Potentially more important than strategic bias in the application of the contingent valuation approach in Australia is the potential bias introduced to the survey through the specification of the payment vehicle for a hypothetical market. Whether bias is introduced depends on whether the payment vehicle is applicable to survey respondents, whether respondents believe the method of payment would ever be implemented and whether there is any disagreement on the equity, ethics or suitability of the vehicle among respondents (Treadwell and Short 1997). A participant's responses also depend on their understanding of the issue, and any results derived from this process will reflect the perceived issue, not necessarily the actual issue. Generalisations and exaggerations can each distort these perceptions and contribute to spurious results. Finally, an important factor which is often absent from these studies is the concept of diminishing marginal returns. As successive areas of forest are dedicated to conservation, for example, the marginal social benefits derived from them are likely to decline and could lead to levels of conservation which exceed the social optimum.

Given the problems entailed with this form of valuation, and the unreliability of any resulting estimates, the benefits and costs of management options are increasingly being reconciled through a process known as threshold value analysis.

This process determines the total net costs of a management option deriving from all those values which are readily quantifiable, then compares this against the remaining values which cannot be quantified easily. A proposal to increase the area of forest excluded from logging, for example, will have quantifiable opportunity costs such as reduced revenues and falls in employment. The total value of these costs will give the 'threshold' or 'switching' value, above which the unquantified net benefits from the proposal must rise if the overall net benefits to society are to be positive. These unquantified values may include both the benefits and costs of the management option.

This approach has been used in Australia (see Streeting and Hamilton 1991), and seemingly overcomes the problems of placing a value on essentially unquantifiable effects, but the procedure retains a significant degree of subjectivity and has led to a number of criticisms. Whether the unquantified values exceed those already measured remains a subjective decision, and may depend on the adequacy of available information, and the environment in which the decision is made. In addition, the performance of successive threshold value analyses will ignore the diminishing returns to conservation, resulting in a combined conservation area which exceeds the social optimum. Finally, the inclusion of both benefits and costs into a threshold value can complicate the process and diminish the meaningfulness of the threshold value. If an enlargement of a conservation zone is expected to cost $10 million from reduced production, for example, this would constitute the switching value. The benefits from conservation and existence must be compared against this, although these are offset to some degree by the unknown social costs of unemployment. Nevertheless, a threshold value analysis does explicitly state the tradeoff involved, as opposed to a contingent valuation whose assumptions can obscure this tradeoff.

5. FOREST RELATED INDUSTRIES IN EDEN

Within the Eden CRA region, the hardwood timber, wood processing, recreation and tourism, and minor forest product industries (for example, beekeeping) are based on the region's native forest resource, and mining is based on access to land occupied by that resource.

5.1 ECONOMIC CONTRIBUTION OF FOREST RELATED INDUSTRIES

New South Wales' gross state product, by industry, is shown in table 14. Access to native forest resources provides at least part of the base for agriculture, forestry and fishing; mining; accommodation, cafes and restaurants; and cultural and recreational services. These industries accounted for 9 % of gross state product in 1995-96. However, only a small proportion of the gross state product associated with these broad industry groupings can be attributed to forest based industries and it must also be noted that some output of other sectors relies on native forest resources. The manufacturing category, for example, includes output from the wood processing industries.

It was estimated in a study by Margules Groome Pöyry (1995a) that New South Wales' timber industry (defined as the hardwood and softwood industries and the further processing and fabrication industries) directly employed around 21 000 people and directly contributed around $2.1 billion to gross state product in 1993-94.

Table 14. Industry contribution to New South Wales' gross state product, 1995-96 ***In 1995-96 dollars***

	Contribution	Share
	$m	%
Agriculture, forestry and fishing	3 800	2.6
Mining	3 214	2.2
Manufacturing	22 265	15.1
Electricity, gas and water	4 279	2.9
Construction	9 677	6.6
Wholesale trade	9 788	6.6
Retail trade	11 102	7.5
Accommodation, cafes and restaurants	3 651	2.5

continued

Table 14. Industry contribution to New South Wales' gross state product, 1995-96 ***In 1995-96 dollars (continued)***

Transport and storage	7 584	5.2
Communication	4 442	3.0
Finance and insurance	7 320	5.0
Property and business services	15 619	10.6
Government administration and defence	4 651	3.2
Education	6 553	4.5
Health and community services	8 378	5.7
Cultural and recreational services	2 700	1.8
Personal and other services	3 213	2.2
Ownership of dwellings	16 384	11.1
General government	2 476	1.7
Total	147 096	100.0

Source: Australian Bureau of Statistics (1996a).

Eden is estimated to have accounted for 0.4 % of employment in New South Wales in 1991, the latest year for which data are available (table 15). The forestry and logging industry directly accounted for 3.2 % of employment in the Eden region in 1991 and the wood and paper products industry accounted for 3 % of regional employment. It is important to note that employment attributable to the wood resources of the native forests of Eden extends beyond the Eden RFA boundary and is not included in these statistics. Timber processors located outside the region which source wood from the Eden CRA region are an example.

It is apparent from table 15 that employment in the forestry and logging sector and wood and paper products sector fell significantly between 1986 and 1991 — by 8 % and 18 % respectively — in contrast to the trend in total employment in the Eden region, which increased by around 13 %. The reduction in forest industry based employment over this period can be largely attributed to the phased reduction of sawlog yields under the second management plan of the Forestry Commission, which was thought to be necessary to reflect naturally occurring sawlog–pulplog ratios (State Forests New South Wales 1994). Recent trends in employment in the Eden timber industry are discussed in chapter 6.

Adding to those people directly employed in harvesting, transporting and processing timber in the Eden region, the timber industry indirectly supports employment in other sectors of the economy. The input–output analysis conducted by Margules Groome Pöyry (1995a) indicates that one person is employed indirectly for every person directly employed in the New South Wales timber industry.

Table 15. Employment in Eden and New South Wales, by industry

	Eden [a]			New South Wales	
	1986	1991	Share [b]	1991	Eden share [c]
	no.	no.	%	no.	%
Agriculture, forestry and fishing	1 468	1 314	13.0	94 300	1.4
Forestry and logging [d]	353	325	3.2	2 957	11.0
Mining	12	14	0.1	23 726	0.0
Manufacturing	792	960	9.5	315 575	0.3
Wood and paper products [d]	375	308	3.0	26 899	1.1
Electricity, gas and water	130	134	1.3	34 165	0.4
Construction	794	732	7.2	148 541	0.5
Wholesale and retail trade	1 626	1 885	18.7	455 574	0.4
Transport and storage	377	368	3.6	119 449	0.3
Communication	121	116	1.1	41 623	0.3
Finance, property and business services	714	777	7.7	306 134	0.3
Government administration and defence	479	409	4.0	121 006	0.3
Community services	1 156	1 392	13.8	408 174	0.3
Recreational, personal, other services	955	1 232	12.2	174 634	0.7
Nonclassifiable economic units	305	770	7.6	164 075	0.5
Total	8 929	10 103	100.0	2 406 976	0.4

a Estimates from 1986 and 1991 census data based on statistical local areas (SLAs). The Bega Valley and Bombala SLAs have been used in constructing these estimates. Parts of both these SLAs are outside the Eden CRA region; in addition, the Cooma–Monaro SLA has not been included although a small portion of this SLA is within the RFA region. **b** Share of Eden employment in 1991. **c** Regional share of New South Wales employment, by industry category, in 1991. **d** Subcategory, also included in above major category.

Source: Australian Bureau of Statistics (1996b).

6. EDEN TIMBER INDUSTRY

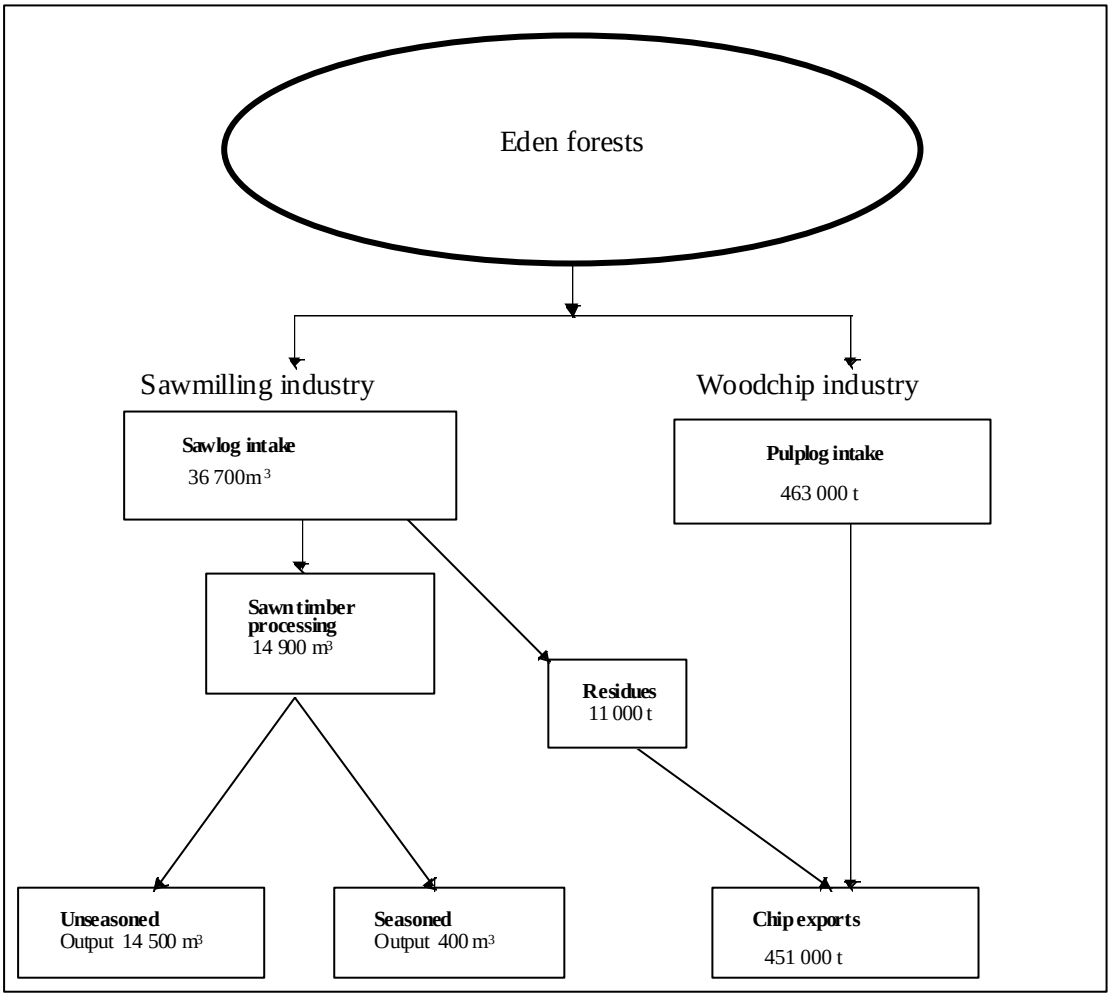
Only a small proportion of the native eucalypt forests of the Eden CRA region produce high quality sawlogs (SFNSW 1994). Past wildfires and selective harvesting are two factors limiting the potential of forests in Eden to yield a substantial volume of high value sawlogs. The limited share of quota quality sawlogs means that only a small proportion of wood resources from the region are highly suitable for milling into sawntimber products. The majority of wood resources harvested in the Eden CRA region are pulplogs, which are regarded as a cost effective input into the manufacture of export woodchips.

6.1 STRUCTURE OF EDEN'S HARDWOOD BASED INDUSTRIES

The locations of state forests in the Eden CRA region and of sawmills receiving logs from the Eden region are shown in Map 4. There were seven hardwood sawmills and one pulpwood processor receiving state logs from the Eden CRA region in 1995-96. Two of the hardwood sawmills also received logs from private forests in 1995-96 and a further six mills sourced logs from private forests in the Eden CRA region. Log allocation from State Forests New South Wales will have fallen by almost 30 % by 1997-98 since 1995-96. As a result, only two sawmills will be receiving state logs from the Eden CRA region in 1997-98. It must be noted that log allocations from 1 January 1998 will depend on the outcome of the Eden RFA process. The hardwood sawmills previously sourcing state logs from the Eden CRA region are expected to source state logs through occasional parcel sales of logs from the Eden CRA region and log allocations in other regions, or to take only private logs from the Eden CRA region. One mill left the industry in 1996-97. The structure of the Eden hardwood based industry in 1995-96 is shown in figure 3.

Map 4. Forest resource and sawmill locations - Eden CRA

Figure 3. Structure of the hardwood industry sourcing logs from the Eden CRA region in 1995-96[a]



a Estimates from sawmill survey. Output of mills sourcing a proportion of their total log intake from outside the Eden CRA region has been adjusted by multiplying total output by the proportion of total intake sourced from the Eden CRA region. Only intakes of logs/residues attributable to the Eden CRA region are shown.

Hardwood sawlog production in the Eden CRA region accounted for only around 6.2 % of total state (public and private) sawlog production (quota and salvage logs) in 1995-96 (table 16). However, pulplog production from the Eden CRA region accounted for 63 % of total pulplog production in New South Wales in that year. The region produced around 42 175 cubic metres of sawlog, and 463 500 tonnes of residual log (public and private logs) in 1995-96. In 1997-98, the region is expected to produce around 26 000 cubic metres of sawlogs and approximately 338 000 tonnes of residual log based on a sawlog–pulplog woodflow ratio of 1:13 from state forests (G. Meade, State Forests New South Wales, personal communication, September 1997).

Thinning residues of 46 000 tonnes are also expected to be available to the pulpwood industry in 1997-98.

Table 16. Gross volume of hardwood logs harvested, Eden CRA region, 1996 *a*

		Quota	Salvage	Pulp
		m^3	m^3	t
Public		42 175	695	463 142
Private		na	1 000	298
Eden total		42 175	1 695	463 440
New South Wales total		678 884	478 383	732 925
Eden share	%	6.2	0.4	63.2

a Includes logs from public and private sources. Sawlog production in the Eden CRA region is composed of various grades of logs. These range in descending quality from quota quality logs to salvage logs to pulplogs. **na** Not available.

Source: Ian Barnes, District Forester, State Forests New South Wales, personal communication, August 1997.

The Eden CRA region accounted for $10.6 million of log royalties in 1995-96, or around 27 % of total state forest log royalties (table 17). Pulplog royalties accounted for 87 % of all log royalties from the Eden region. Total sawlog royalties received from the region were around $1.4 million in 1995-96, while total residual log royalties were approximately $9.2 million.

Table 17. Hardwood royalties received by Eden CRA region, 1996 *a* ***In 1995-96 dollars***

	Unit	Quota	Salvage	Pulp	Total
Public	$'000	1 341	10	9 241	10 592
Private	$'000	25	0	0	25
Eden total	$'000	1 366	10	9 241	10 617
New South Wales total	$'000	24 847	3 119	11 390	39 356
Eden share	%	5.5	0.3	81.1	27.0

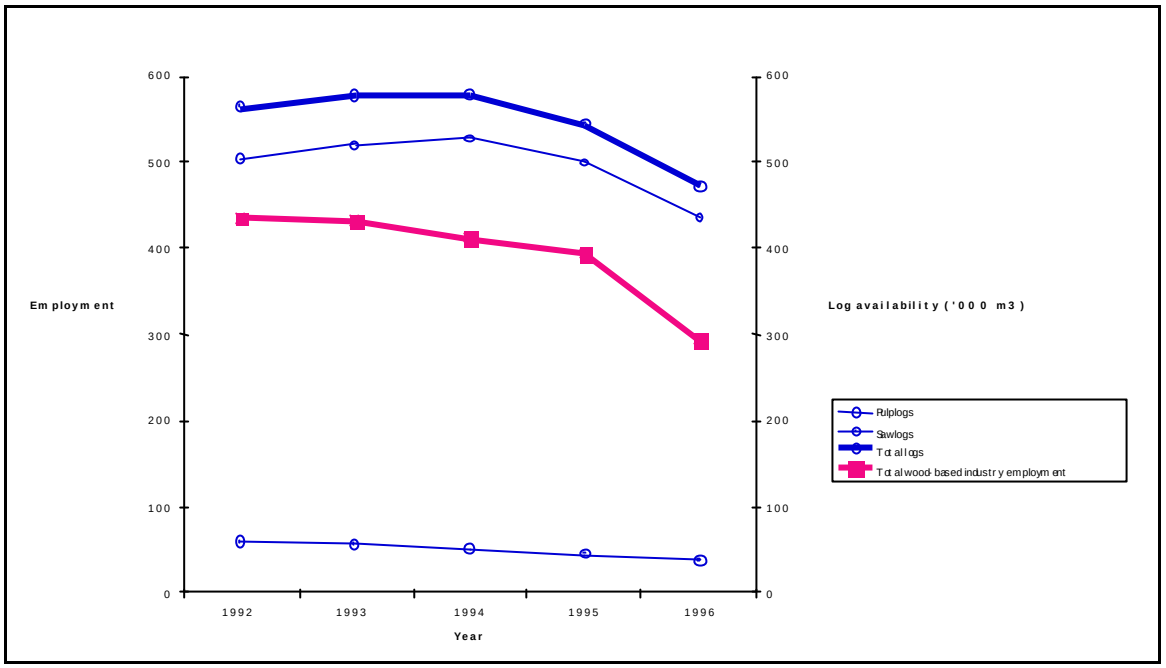
a Sawlog production in the Eden CRA region is composed of various grades of logs. These range from quota quality logs to salvage logs to pulplogs.

Source: I. Barnes, District Forester, State Forests New South Wales, personal communication, August 1997.

In addition to royalty payments, sawmill licence fees for mills operating in the Eden CRA region were around $2 300 in 1995-96 (I. Barnes, District Forester, State Forests New South Wales, personal communication, August 1997).

The hardwood sawmilling industry in Eden has recently experienced significant structural change as a result of a declining supply of hardwood resources from state forests (figure 4). The availability of state forest hardwood resources for harvesting has recently fallen, leading to a decline in the volume of quota sawlogs available for harvesting (down by 37 % from the 1992 level to 36 700 cubic metres in 1996). Furthermore, quota sawlog availability is expected to fall by a further 29 % to 26 000 cubic metres in 1997-98.

Figure 4. Resource availability and wood-based industry employment in Eden 1992 - 1996



Pulplog availability fell by around 14 % from the 1992 level to 434 500 cubic metres in 1996. It is expected to decline further, in line with the expected reductions in sawlog supplies, to approximately 338 000 cubic metres in 1997-98.

Changes to land tenure and additional environmental regulations have been the main factors behind reduced access to wood resources in the Eden CRA region. An additional 90 000 hectares of forest in the Eden CRA region has been dedicated as national parks since 1990. Thus, the area available for wood harvesting in the Eden CRA region has declined. Additionally, some forest areas which were not affected by changes to land tenure arrangements have become the subject of more stringent environmental regulations since the early 1990s. These regulations have not had a major impact on the total area available for timber harvesting, but they have reduced the availability of suitable wood resources for sawntimber production in the Eden CRA region because they affect areas in which a greater proportion of sawlogs are found (such as gullies) (R. Bridges, State Forests New South Wales, personal communication, October 1997).

Associated with this reduction in log availability has been a decline in employment in the hardwood based industries in Eden. Employment in the sawlog based industry (sawmilling and product distribution) decreased from 81 people in 1992 to 41 people in 1996. Employment in the pulpwood based industry (pulpwood processing and product distribution) fell from 119 people to 67 people. Employment in the logging sector (harvesting and transport to mills) fell from an estimated 157 people to 110 people.

Additionally, the distribution of quota sawlog allocations between Eden's hardwood sawmills has become more concentrated: the larger wood processing operators have continued to receive allocations from state forests but other mills have left the industry as log allocation volumes have fallen over time (I. Barnes, District Forester, State Forests New South Wales, personal communication, August 1997). Since early 1996, three hardwood sawmills sourcing logs from the Eden CRA region have closed. These closures have largely been a result of reductions in resource availability. Reductions in sawlog allocations have been implemented in response to conservation and sustainable management issues surrounding the wood

based forest industry in Eden (State Forests New South Wales 1994).

Following the South East Forest Agreement (1990) and the Interim Forest Assessment (1996) some forest areas have been dedicated as national parks (50 000 hectares in 1993 and 40 000 hectares in 1997) or 'deferred' until the Commonwealth and state governments agree on forest management through the RFA process. This has necessitated the renegotiation of some wood supply agreements made with mills before the RFA process began. Availability of quota allocation logs is expected to remain at current levels until the RFA is signed in February 1998.

Most of the hardwood sawmills sourcing logs from the Eden CRA region are engaged in a limited range of sawntimber processing activities. The majority of production is green sawntimber products such as structural timber, scantling, fencing, palings and pallets. Only a small proportion of output emerges as appearance grade product, which involves value adding processes such as kiln drying and timber dressing.

By far the largest volume of output from the region is associated with the pulpwood processing activities at the Harris Daishowa woodchip mill in Eden. This mill sources pulplogs predominantly from state forests but also receives inputs from private hardwood forests, plantation establishments and sawmill residues from within New South Wales and Victoria (Gippsland).

The sawmilling and woodchip industries using wood sourced from the Eden region employed 117 full time staff in 1995-96, with an estimated gross value of turnover of around $41.9 million (table 18). A further 161 people were employed in logging and hauling logs from the Eden CRA region and 76 people were employed in forest management. It is anticipated that 91 people will be employed in the sawmilling and woodchip industries in 1997-98, with an estimated gross value of turnover of approximately $30.8 million (in 1995-96 dollars). Logging and haulage in the Eden CRA region is expected to employ 105 people in 1997-98.

Table 18. Key economic features of Eden's hardwood based industries, 1995-96 *a*

Total gross value of wood based industries (product value)	$m
Pulpwood based industries	36.1
Sawmilling industry	5.8
Total	41.9
Total forestry and wood based industry employment	no.
Forest management	76
Pulpwood based industry	60
Sawmilling industry	57
Logging and haulage	161
Total	354
Total log volumes produced	m^3
Total sawlogs produced	38 700
	t
Total pulplogs produced	463 142
Total state forest royalties received	$m
Total sawlog royalties received	1.4
Total residual log royalties received	9.2
Total	10.6

a Calculated by multiplying the percentage of total intake sourced from Eden by the relevant total employment, production or gross value of production figures. Gross value figures based on sawmill and pulpmill receipts and outlays only. Figures relate to all sawmills and pulpmills using wood resources from the Eden CRA region in 1995-96.

Note: The timber volumes quoted in this table are derived from an August 1997 ABARE survey of timber processing mills in the Eden CRA region and may differ slightly from figures quoted by SFNSW sources which have been used in other parts of this report.

Sources: Ian Barnes, District Forester, State Forests New South Wales, personal communication, August 1997; ABARE 1997 sawmill survey.

Added to employment in direct harvesting, transport, sawmilling and pulpwood processing, the native hardwood resources of the region also contribute to employment in a range of other wood based manufacturing activities, such as the production of structural timber, furniture and joinery outputs.

6.1.1 Sawmill industry survey

To provide an accurate assessment of the economic circumstances underpinning competitiveness and value of the hardwood sawmilling industry, an economic survey of sawmills using resources from the Eden CRA region was conducted.

The survey contained a series of questions designed to assess the economic conditions influencing the long term competitiveness and value of the industry. It was conducted over two weeks in April 1997 and involved face to face interviews with sawmill owners or managers. All sawmill owners/managers were contacted as part of the survey. Questionnaires were completed for eleven of the thirteen hardwood sawmills receiving state and private forest logs from the Eden CRA region. The survey responses, in log intake

terms, accounted for over 99 % of total state forest logs sourced from the Eden CRA region in 1995-96.

Box: Deriving total estimates for the Eden sawmilling industry

Eleven of the thirteen hardwood sawmills receiving logs from the Eden CRA region were surveyed. Total estimates for the Eden sawmilling industry were derived by weighting the survey respondents. The population of sawmills receiving logs from the Eden CRA region was stratified into two groups based on the size of their total log intake for 1995-96 (including any intake from outside the Eden CRA region). The size classes were:

Log intake	Population	Survey responses
less than 5000 m3	8	6
more than 5000 m3	5	5

Weights, calculated on both the sawmill population and estimated log intake of the sawmills on a stratum basis, were applied to the survey results to estimate key variables for the total industry.

Some sawmillers supplied only partial responses to the questionnaires. Estimates calculated from average costs, prices and returns were used for omitted data.

Total estimates for Eden are supplied with a relative standard error. These errors are the standard errors of the estimates expressed as a percentage of the survey estimates (to obtain the standard error of the estimate from the relative standard error, multiply the relative standard error by the survey estimate and divide by 100). There is roughly a two in three chance that the survey estimate is within one standard error of the value that would have been obtained from the total population and a nineteen in twenty chance of it being within two standard errors.

Information derived from the survey has been used in conjunction with other market based information to estimate the total gross and net economic value of the hardwood sawmilling industry receiving logs from the Eden CRA region. The method used to derive estimates is outlined in the boxed section.

6.2 HARDWOOD SAWNTIMBER INDUSTRY

Seven hardwood sawmills received logs from state forests in 1995-96, with two of these mills also sourcing logs from private forests located in the Eden CRA region. Six other hardwood sawmills also sourced logs from private forests in the Eden CRA region in 1995-96. The following financial and physical information presented on the hardwood sawmilling industry relate to the 1995-96 financial year (the latest year for which complete records are available).

Total sawntimber production in New South Wales was around 926 000 cubic metres in 1995-96 (BIS Shrapnel 1996). Hardwood sawntimber production dependent on wood resources from the Eden region was an estimated 15 000 cubic metres in 1995-96 or almost 2 % of total sawntimber production in New South Wales (hardwood and softwood production) and around 3 % of total hardwood sawntimber production in New South Wales.

Sawmills receiving logs from the Eden CRA region obtained their logs from a number of sources. It is estimated that of those mills sourcing logs from the Eden CRA region in 1995-96, around 35 % of

their combined total log intake was sourced from state forests within the Eden CRA region and less than 2 % of their combined total log intake was sourced from private forests within the Eden CRA region (table 19). Almost two-thirds of the intake of these mills was sourced from outside the Eden CRA region because a number of the larger mills sourced less than 10 % of their log intakes from the Eden CRA region. The vast majority of the wood sourced from outside Eden was from the Narooma and Nowra supply zones. Sawmills receiving logs from Eden did not receive any raw wood materials from other sawmills in the region in 1995-96.

Table 19. Total log intake from all sources for hardwood sawmills processing logs from the Eden CRA region, 1995-96 *a*

Total sawmill intake from all sources				
Source of logs	**Mill size < 5000 m^3**	**Mill size > 5000 m^3**	**Total**	**Share of total**
	m^3	m^3	m^3	%
Eden state forest	836 (38)	35 829	36 665 (1)	34.5
Eden private forest	1 604 (18)	0	1 604	1.5
Other than Eden RFA	523 (61)	67 331	67 854 (1)	64.0
Total intake by sawmills	2 963 (19)	103 160	106 123 (1)	100.0

a Preliminary estimates for industry based on sawmill survey.

Note: Figures in parentheses are relative standard errors of the estimates, expressed as percentages.

In contrast, only two mills are expected to be receiving state logs from the Eden region in 1997-98 and six mills are expected to receive private logs. A few of the larger mills which sourced logs in the Eden CRA region in 1995-96 are expected to source logs from state forests from alternative regions in New South Wales in 1997-98. Consequently, about 95 % of combined total log intake of mills sourcing logs from the Eden CRA region is expected to be sourced from state forests in 1997-98. The remaining 5 % is expected to be sourced from private forests from within the Eden CRA region.

The reduction in sawlog availability from the Eden CRA region means that sawntimber production is expected to fall by 22 % from the 1995-96 level to 11 648 cubic metres in 1997-98.

Some key financial features of the hardwood sawmilling industry using logs sourced from the Eden CRA region are presented in table 20. It must be noted that the data in table 20 are adjusted to account for the proportion of each mill's total wood intake sourced from the Eden CRA region.

Table 20. Key financial features of the hardwood sawmilling industry sourcing logs from the Eden CRA region, 1995-96 *a*

	Sawmill intake			
	< 5000 m^3	> 5000 m^3	Total	Share > 5000 m^3
				b
	$m	$m	$m	%
Gross receipts from sawntimber and products	0.45 (21)	4.71	5.16 (1)	91
Gross receipts from sawmill residues (woodchips, etc.)	0.02 (40)	0.59	0.61 (1)	97
Gross value of production	0.48 (21)	5.30	5.78 (1)	92
Labour costs (wages and salaries paid)	0.19 (32)	1.28	1.47 (4)	87
Total operating costs c	0.47 (23)	4.27	4.74 (2)	90
Capital investment by sawmills in 1995-96	0.01 (25)	0.07	0.08 (2)	88
Net value of production (gross value of production minus total operating costs)	0.01 (634)	1.03	1.04 (5)	99
Replacement value of fixed capital	0.43 (21)	2.80	3.23 (2)	87

a Preliminary estimates for industry based on sawmill survey. For mills sourcing a proportion of their log intake from outside the Eden CRA region, estimates of the contribution of wood resources from Eden have been calculated by multiplying the percentage of total intake sourced from Eden by the relevant total value, cost or investment figure. Gross and net value figures based on sawmill and pulpmill receipts and outlays only. **b** Share of mills with intake greater than 5000 cubic metres of total. **c** Operating costs include labour costs, wood purchasing and delivery costs, repairs and maintenance, depreciation and interest payments.

Note: Figures in parentheses are relative standard errors of the estimates, expressed as percentages.

In 1995-96, the total value of turnover (gross receipts) for hardwood sawmills receiving logs from the Eden CRA region was estimated to be $5.77 million, with total operating costs estimated at $4.74 million and the total net value of production (net profit earned) estimated to be around $1.04 million. It is estimated that labour costs accounted for approximately 31 % of total operating costs.

The larger sawmills, on average, were more profitable than the smaller sawmills. Sawmills with log intakes greater than 5000 cubic metres had a combined net value of production of $1.03 million in 1995-96, compared with an estimated $10 000 for sawmills with log intakes less than 5000 cubic metres. Combined total operating costs accounted for 81 % of the gross value of production of the larger mills and for 98 % of the combined gross value of production of the smaller mills.

Changes in the availability of resources in the Eden CRA region in 1997-98 will result in changes to the structural and financial characteristics of the industry. These changes are reflected in the data in table 21. The total value of turnover for hardwood sawmills which continue to

source logs from the Eden CRA region is expected to be $4.8 million.

Table 21. Key financial features of the hardwood sawmilling industry sourcing logs from the Eden CRA region, 1997-98 *a*

	Total
	$m
Gross receipts from sawntimber and products	4.2
Gross receipts from sawmill residues (woodchips etc.)	0.6
Gross value of production	4.8
Labour costs (wages and salaries paid)	1.2
Total operating costs	3.9
Net value of production (gross value of production minus total operating costs)	0.9

a Estimates based on the 1995-96 sawmill survey and log allocation information from State Forests New South Wales. Gross and net value figures based on sawmill and pulpmill receipts and outlays only.

Source: ABARE 1997 sawmill surveys; Glenn Meade, State Forests New South Wales, personal communication, September 1997.

It is estimated that there were 57 people employed in hardwood sawmills processing wood from the Eden CRA region in 1995-96. Mills with total log intakes greater than 5000 cubic metres are estimated to have accounted for around 84 % of this total. In 1997-98, it is anticipated that 44 people will be employed in sawmills processing wood from the Eden CRA region. However, it is important to point out that this does not necessarily imply a reduction of this amount in hardwood sawmill employment. Some mills previously receiving logs from the Eden CRA region may have been able to increase their log intakes from other regions, mitigating the impact of a reduced allocation of logs from Eden.

6.2.1 Log pricing and allocation arrangements

Logs are classified in New South Wales using a system of log grades which indicate sawlog quality, ranging from quota quality sawlogs to salvage sawlogs through to pulplogs. Currently, quota quality sawlogs account for the bulk of the hardwood sawlogs produced in the Eden CRA region. Pulpwood is also available in Eden as an input for woodchip production and makes up the largest proportion of hardwood resources sourced from the Eden CRA region.

Licences are required for timber harvesting and the production of sawntimber in sawmills in the Eden region. These are generally valid for up to a year and give the licensee the right to harvest and buy timber from the Eden CRA region and to operate sawmills.

A few producers in the region, including Harris–Daishowa, have wood supply agreements with State Forests New South Wales which were negotiated before the Interim Forest Assessment. These are being renegotiated to take account of the assessment which dedicated 90 000 hectares of forest areas within the Eden CRA region as national parks. These areas are unavailable for log harvesting pending the outcome of the Eden RFA.

Log allocation arrangements for the smallest mills operating in the Eden CRA region are currently run on an opportunistic basis. Operators who use salvage wood may purchase supplies (‘parcel’ or spot sales) of logs from state forests when they are available.

Licence allocations are measured in gross volume terms and include the share of defect material unsuitable for milling. Sawlogs sourced from Eden’s state forests are sold at the stump, where royalties are due on a monthly basis to State Forests

New South Wales. Recently, State Forests New South Wales began determining royalties on logs from public forests using the 'log value pricing system'. This system uses a 'standard' log as the basis for comparison with logs to be harvested. The royalty determined for the 'standard' log, which is based on the residual value of wood recovered from that log, is used to estimate the royalties to be levied on other types of logs harvested in state forests in New South Wales. The new royalty structure is designed to reflect the value of the log based on the species and the types and shares of outputs it yields. Before this system was used, a flat rate system of determining royalties was applied (which did not allow for differentiation between logs of different market values).

6.2.2 Log harvesting and transport arrangements

At present, sawmillers hire contractors to harvest and transport logs from the forest to the mill. Nineteen logging contractors and 35 haulage contractors employed 161 persons within the Eden CRA region in 1995-96 (table 22). The number of people employed by contractors operating in Eden fell to 75 in 1996 from 110 in 1992, with the number of trucks in service falling from 56 to 31 (V. Phillips, Harris–Daishowa (Australia), personal communication, August 1997). This reduction is a consequence of recent reductions to sawlog and pulplog allocations in the Eden CRA region.

Table 22. Log harvesting and transport contractors operating in the Eden CRA region, 1995-96 ***a***

Employment	
Logging	115 persons
Transport	46 persons
Total employment	161 persons
Log volumes	
Total volumes handled	564 000 m^3/yr
Proportion of total volumes handled from public native forests in the RFA region	95 %

a Includes hardwood and softwood contractors and employees.

Source: I. Barnes, District Forester, State Forests New South Wales, personal communication, August 1997; Harris–Daishowa (personal communication, 1997).

6.2.3 Major sawntimber products and markets

Approximately 97 % of the 14 924 cubic metres of hardwood sawntimber production based on resources from the Eden CRA region in 1995-96 was unseasoned timber such as scantling, palings and pallets (table 23). The remaining 3 % was sold as seasoned structural or further processed timber. Only a small volume of air dried and kiln dried timbers are processed into appearance grade products such as decking and furniture for the domestic market.

Table 23. Hardwood production in the Eden sawmilling industry, 1995-96 *a*

	< 5000 m^3	> 5000 m^3	Total	Share
	m^3	m^3	m^3	%
Seasoned sawntimber				
Appearance – select	0	0	0	na
Appearance – standard	0	0	0	na
Structural	0	325	325	2
Further processed	0	73	73	1
Total seasoned timber	0	398	398	3
Unseasoned timber				
Structural (F22)	0	846	846	6
Scantling	725 (34)	6661	7 386 (3)	50
Palings and pallets	304 (25)	5 057	5 361 (1)	36
Other sawn	56 (61)	877	933 (3)	6
Total unseasoned timber	1 085	13 441	14 526	97
Total sawntimber	1 085 (21)	13 839	14 924 (1)	100
Total sawmill residues	1 125 (46)	11 210	12 335 (4)	100

a Preliminary estimates for industry based on sawmill survey. **na** Not available.

Note: Figures in parentheses are relative standard errors of the estimates, expressed as percentages.

Few facilities currently exist for processing hardwood sawlogs from the Eden CRA region. Only one of the thirteen hardwood sawmills sourcing logs from the Eden CRA region in 1995-96 had installed kiln drying facilities.

Wollongong was the major market for seasoned and unseasoned timber products from those mills sourcing logs from the Eden CRA region in 1995-96. Sydney, Canberra and Melbourne were also important markets for seasoned timber products, while local markets accounted for a significant proportion of unseasoned timber sales.

Production of sawntimber from hardwood sawlogs from the Eden CRA region is expected to fall by 22 % to 11 648 cubic metres in 1997-98. The composition of this production can be seen in table 24.

Unseasoned sawntimber is expected to account for almost all sawntimber production from the Eden CRA region. Given that kiln drying activity in the region is likely to cease in the short term, less than 1 % of total sawntimber production using wood from the Eden CRA region is expected to be seasoned (air dried) in 1997-98.

Table 24. Hardwood production in the Eden sawmilling industry, 1997-98 *a*

	Total	Share of total
	m^3	%
Seasoned sawntimber		
Appearance – select	0	na
Appearance – standard	0	na
Structural	0	na
Further processed	73	0.6
Total seasoned timber	73	0.6
Unseasoned timber		
Structural (F22)	680	6
Scantling	6 523	56
Palings and pallets	4 372	38
Other sawn	0	na
Total unseasoned timber	11 575	99.4
Total sawntimber	11 648	100
Total sawmill residues	11 649	100

a Preliminary estimates for industry based on sawmill survey. **na** Not applicable

Note: Figures in parentheses are relative standard errors of the estimates, expressed as percentages.

Following changes to the structure of the timber industry based on wood resources from the Eden CRA region, the pattern of trade in sawntimber produced in the region is expected to change in 1997-98. Canberra, Melbourne and local markets are expected to be the major markets for sawntimber production based on the wood resources of the Eden CRA region in 1997-98. Wollongong will cease to be the main outlet for sawntimber produced in the Eden CRA region, because the mills which sold to this market in 1995-96 will source logs from other RFA regions in 1997-98.

6.3 PULPWOOD PROCESSING INDUSTRY

The processing of pulpwood sourced from the Eden CRA region is dominated by hardwood woodchip production at the Harris–Daishowa mill at Eden. The Eden mill produced around 550 000 tonnes of hardwood woodchips in 1995-96 and employed 77 full time staff. All woodchip output is exported to Japan for the production of pulp and paper products. Exports from the Harris–Daishowa mill represented about 10 % of the volume of Australian exports of woodchip in 1995-96.

Around 80 % of the total public pulpwood intake (including thinnings) of the Eden mill of around 580 000 tonnes in 1995-96 was sourced from the Eden CRA region. Harris–Daishowa's private hardwood plantations provided approximately 30 000 tonnes of pulpwood for use at Eden in 1995-96. Around 78 % of the total input to the Eden woodchip mill in 1995-96 was sourced from the Eden CRA region. The facility at Eden is also an important market for sawmill residues from New South Wales and Victoria, accounting for around 230 000 cubic metres of residue sourced from these sawmills in 1995-96.

Based on the approximate percentage of total intake sourced from the Eden CRA

region, it is estimated that 60 jobs at the Eden woodchip mill and approximately $36.1 million of the gross value of production from the mill were based on pulpwood and sawmill residue sourced from the Eden CRA region in 1995-96. However, using these estimates to assess the implications of a reduction in wood supply from the Eden region is potentially misleading because the viability of the entire operation can be affected by wood supply changes.

Given the integrated nature of the logging process in the Eden CRA region, pulplog volumes from state forests are expected to decline in line with sawlog volumes in 1997-98 (based on the sawlog to pulplog ratio of 1:13 stated previously). Given this, a reduction in sawlog production to 26 000 cubic metres in 1997-98, could be associated with the production of approximately 338 000 tonnes of pulplogs over the same period. It is estimated that 47 jobs at the Eden woodchip mill and approximately $26 million (in 1995-96 dollars) will be based on resources sourced from the Eden CRA region in 1997-98.

6.4 EDEN'S SOFTWOOD INDUSTRIES

Softwood resources within the Eden RFA boundary account for a relatively small share of total wood resources in the region. These resources are located in the Bombala Management Zone and, for the purposes of this report, are taken to be completely within the Eden CRA region.

Only two softwood sawmills were using softwood logs from the Eden CRA region in 1995-96. The availability of these resources in 1995-96 can be seen in table 25 and the associated log royalties are summarised in table 26.

Sawmill employment attributable to Eden's softwood resources is estimated to have been around 35 persons in 1995-96. It is estimated that another fourteen people were employed in logging and transport operations associated with this wood. Relatively low employment in the industry, compared with that in similar sized operations in the hardwood industry, can be attributed to the large and capital intensive nature of softwood sawmill operations (relative to the hardwood operations) using logs from the Eden CRA region.

Table 25. Gross volume of softwood logs produced in the Eden CRA region, 1995-1996 *a*

	Unit	Sawlogs	Preservation roundwood	Pulp	Total
Eden	m^3	46 500	34 200	0	80 700
New South Wales	m^3	1 028 108	49 752	598 939	1 676 799
Eden share	%	4.5	69.0	0.0	4.8

a Includes logs from public and private sources.

Source: Ian Barnes, District Forester, State Forests New South Wales, personal communication, August 1997.

Table 26. Softwood royalties received by Eden CRA region, 1996 *In 1995-96 dollars*

	Unit	Sawlogs	Preservation roundwood	Pulp	Total
Eden	$000	744	513	0	1 257
New South Wales	$000	42 741	699	5 830	49 270
Eden share	%	1.7	73.4	0.0	2.6

Source: Ian Barnes, District Forester, State Forests New South Wales, personal communication, August 1997.

6.5 OUTLOOK FOR LOGGING AND WOOD PROCESSING INDUSTRIES

The discussion below is a broad overview of the factors influencing the market outlook for Australian hardwood forest product industries. Based on available data, trends in international markets are analysed and related to the outlook for Australian native forest products industries in terms of the major forest product groups — sawntimber, wood based panels and pulp and paper products.

6.5.1 ABARE macroeconomic assumptions

Key ABARE assumptions in the world economic outlook are given in table 27. increases in OECD countries.

World economic growth is assumed to ease gradually from an average annual rate of 3.8 % between 1996 and 2000 to around 3.7 % between 2001 and 2010 and to 3.5 % between 2011 and 2020. Despite the recent upheaval in South East Asia, Asia is expected to remain the strongest growth region in the world economy, with levels of income per person converging to OECD country levels over the projection period. Economic growth in the Asian region is assumed to moderate from an average annual rate of 6.8 % between 1996 and 2000 to 6.0 % between 2001 and 2010 and to 5.0 % between 2011 and 2020. Population growth in the Asian region is forecast to be close to the world average, but well above the forecast.

Table 27. ABARE macroeconomic assumptions to 2020
Annual average growth rates in each period

	1991–95	1996–2000	2001–05	2006–10	2011–15	2016–20
	%	%	%	%	%	%
Output (measured by real gross domestic product)						
OECD	1.6	2.5	2.3	2.2	2.0	2.0
Australia	2.7	3.6	3.5	3.5	3.0	3.0
Japan	1.4	2.3	2.5	2.3	2.0	2.0
United States	1.9	2.6	2.0	2.0	2.0	2.0
Western Europe	2.3	2.3	2.5	2.3	2.0	2.0
Asia	7.6	6.8	6.0	6.0	5.0	5.0
China	11.4	8.4	7.0	6.0	5.0	5.0
India	4.6	6.4	6.0	6.0	6.0	6.0

Continued

Table 27. ABARE macroeconomic assumptions to 2020 (continued)

	1991–95	1996–2000	2001–05	2006–10	2011–15	2016–20
	%	%	%	%	%	%
Per person output						
Malaysia	8.7	6.2	6.0	5.5	5.0	5.0
Philippines	2.2	4.3	4.5	4.5	4.0	4.0
Singapore	8.6	6.4	5.5	4.2	4.0	3.5
South Korea	7.5	5.8	5.5	5.2	4.5	3.5
Taiwan	6.6	5.6	5.0	4.7	4.0	3.5
Thailand	8.4	3.3	5.0	5.0	5.0	5.0
World	2.7	3.8	3.7	3.6	3.5	3.5
Population						
OECD	0.7	0.5	0.5	0.5	0.4	0.3
Australia	1.1	1.0	1.0	1.0	1.0	0.9
Japan	0.3	0.3	0.3	0.1	–0.1	–0.2
United States	1.1	0.9	0.8	0.7	0.6	0.6
Western Europe	0.5	0.3	0.3	0.2	0.1	0.04
Asia	1.7	1.7	1.4	1.3	1.1	1.0
China	1.2	1.1	0.8	0.7	0.7	0.5
India	2.3	1.8	1.8	1.5	1.2	1.0
Indonesia	1.6	1.6	1.5	1.1	1.0	1.0
Malaysia	2.3	2.0	1.9	1.5	1.2	1.2
Philippines	2.1	1.9	1.8	1.5	1.3	1.0
Singapore	1.5	0.8	0.8	0.5	0.4	0.3
South Korea	0.9	0.7	0.7	0.4	0.2	0.1
Taiwan	0.9	0.8	0.8	0.8	0.7	0.6
Thailand	1.4	1.0	0.9	0.8	0.7	0.5
World	1.7	1.6	1.5	1.3	1.3	1.1
Per person output						
OECD	0.9	1.8	1.8	1.7	1.6	1.7
Australia	1.6	2.6	2.5	2.5	2.0	2.1
Japan	1.1	2.6	2.2	2.2	2.1	2.2
United States	0.8	1.2	1.2	1.3	1.4	1.4
Western Europe	1.8	2.0	2.2	2.1	1.9	2.0
Asia	5.9	5.9	4.6	4.7	3.9	4.0
China	10.2	7.2	6.2	5.3	4.3	4.5
India	2.3	4.5	5.2	5.6	4.8	5.0
Indonesia	5.5	4.8	4.5	4.9	4.5	4.0

Continued

Table 27. ABARE macroeconomic assumptions to 2020 (continued)

	1991–95	1996–2000	2001–05	2006–10	2011–15	2016–20
	%	%	%	%	%	%
Per person output						
Malaysia	6.3	5.4	4.6	4.5	4.3	3.8
Philippines	0.1	3.2	2.7	3.0	2.7	3.0
Singapore	7.0	5.6	4.3	3.7	3.6	3.2
South Korea	6.6	5.6	5.1	4.8	4.3	3.4
Taiwan	5.7	4.6	4.2	3.9	3.3	2.9
Thailand	7.0	5.3	5.1	5.2	4.8	4.5
World	1.0	2.2	2.2	2.3	2.3	2.4

6.5.2 Outlook for forest products markets

North America dominates the production of all forest product categories, accounting for at least 30 % of global output. Western Europe and the Asia Pacific region are the principal importing regions, while the Nordic countries and North America are the principal exporting regions.

In recent decades, the rapid industrialisation of countries such as Japan, South Korea and Taiwan has resulted in an increase in consumption of wood products per person, particularly paper products. Its proximity and its potential for significant increases in consumption mean that the Asia Pacific region is likely to be the main market focus for any expansion of Australia's forest product industries. Economic developments over the past decade have resulted in significant changes to trade in wood products in the Asia Pacific region. Most notably, trade in unprocessed logs has declined as a result of the imposition of log export bans in Indonesia and Malaysia, moves to promote value added domestic processing, and increased domestic demand for wood products in traditional tropical wood supplying countries.

Additionally, the domestic market for timber products is strongly influenced by the international market because Australia is a large net importer of most forest products (except woodchips). Australian trade in most forest products is small in comparison with world trade, and domestic prices are largely determined by the landed price of imports.

6.5.3 Sawntimber

Global production of sawn hardwood increased from 110 million cubic metres in 1980 to 130 million cubic metres in 1991, but has since declined slightly. The production of sawn hardwood in Asia is expected to continue to decline, given the decreasing availability of tropical hardwood logs. However, the Asia Pacific forest products sector has the potential to meet projected consumer demand and, as a result, significant price increases are not expected. Demand could be met through a combination of more efficient use of existing Pacific Rim timber resources and the establishment of new manufacturing capacity to produce non-traditional products such as medium density fibreboard, oriented strandboard and other reconstituted panels (Johnson 1997).

Australian production of sawn hardwood has declined from a peak of 2.6 million

cubic metres in 1964-65 to 1.4 million cubic metres in 1995-96, largely as a result of reduced resource availability in native forests and the increased substitution of softwood for traditional hardwood sawntimber. Australian production, consumption and trade of sawnwood over the five years to 1995-96 is outlined in table 28. Annual sawn hardwood production is expected to fall from current levels until around 2000, before rising gradually over the next two decades as hardwood regrowth and possibly some hardwood plantation logs become available for harvesting. Softwood sawntimber production is also expected to rise as existing softwood plantations mature. Australia is likely to have a small export surplus of softwood sawntimber available by 2002-03 (ABARE 1997a).

Table 28. Australian production, consumption and trade in sawnwood

	1991-92	1992-93	1993-94	1994-95	1995-96
	'000 m^3	'000 m^3	'000 m^3	'000 m^3	'000 m^3
Production					
Hardwood	1 371.0	1 440.5	1 532.9	1 570.4	1 393.4
Coniferous	1 569.7	1 659.8	1 898.2	2 120.5	2 043.7
Total	2 940.6	3 100.2	3 431.1	3 690.9	3 437.1
Apparent consumption					
Hardwood	1 518	1 592	1 647	1 690	1 460
Coniferous	2 589	2 711	2 823	3 008	2 666
Total	4 107	4 303	4 471	4 698	4 125
Exports					
Hardwood roughsawn	16.5	11.6	18.7	24.4	27.5
Hardwood dressed	0.3	0.1	0.2	0.2	0.4
Coniferous roughsawn	6.8	1.6	1.8	1.5	5.0
Coniferous dressed	3.1	9.3	19.9	24.9	21.0
Total	26.7	22.7	40.6	51.0	53.8
Imports					
Hardwood roughsawn	105.1	98.2	77.0	84.5	52.6
Hardwood dressed	58.4	64.9	56.4	60.1	41.5
Coniferous roughsawn	760.3	767.2	640.1	617.6	451.0
Coniferous dressed	269.3	295.2	306.7	296.1	196.7
Total	1 193.1	1 225.5	1 080.2	1 058.4	741.9

Source: ABARE (1996b).

Hardwood sawntimber production in Australia has traditionally been focused on producing timber for building applications and other structural end uses. Historically, the competition between softwoods and hardwoods in internal building applications was influenced by the greater availability and lower price of hardwood sawntimber.

Competition from softwoods for external applications and other structural end uses has been constrained by the natural advantages of hardwoods, such as strength, durability and resistance to biological degradation.

However, softwood production costs have fallen dramatically in recent decades — mainly a result of large automated softwood mills and an increasing softwood resource base. The average cost of sawntimber produced by a new softwood mill is estimated to be around 10 % lower than that for a new hardwood mill producing predominantly unseasoned sawntimber (Jaakko Pöyry 1993). This has enabled softwood sawntimber to increase its market share of internal building applications.

More recently, competition from softwood sawntimber has also contributed to a decline in the market share of hardwood in external building applications. This has been possible as a result of the increasing size of the softwood resource and the decline in softwood production costs, combined with improved processing technologies and treatments for the preservation (for external applications) and lamination (for structural uses) of softwoods. This has allowed softwoods to be increasingly substituted for hardwoods in numerous external building applications, albeit from a small base.

A range of other minor sawntimber products are produced from forests — for example, posts, stakes, trellising, decking and packing cases. The natural advantages of hardwoods in these applications have also been offset by the improved treatments available for the preservation and lamination of softwoods. Softwoods are increasingly likely to be used as a substitute for hardwoods in many of these applications.

The substitution away from hardwood to softwood sawntimber is indicated by the declining market share of hardwood sawntimber in total domestic sawntimber consumption. Apparent consumption of hardwood sawntimber was approximately 2 040 000 cubic metres in 1985 (or 47 % of total apparent consumption) but only 1 580 000 cubic metres (or 35.5 % of total apparent consumption) in 1995. Domestic annual production of softwood and hardwood sawntimber is estimated to have been 2 666 000 cubic metres and 1 449 000 cubic metres respectively in 1995-96.

Further substitution with softwood sawntimber in building applications and other structural end uses over the medium and longer term is expected to continue — especially in Western Australia and Tasmania where hardwood sawntimber consumption still exceeds that of softwood sawntimber (reflecting the previously narrow softwood resource base). However, in line with future projected increases in the softwood resource base and the consequent rise in the availability of softwood sawlogs, softwood consumption in these states can be expected to increase.

The impact of substitution away from hardwoods to lower cost softwoods in housing construction has been partly offset by hardwood sawmillers diversifying into, and expanding, markets for kiln dried timber — for example, furniture, flooring, mouldings and other value added products (Neck, Curtotti and Sar 1996). Many of these applications involve further processing and the replacement of imported products.

The continuing ability of the hardwood sawmilling industry to maintain profitability and compete against domestic softwood and imported timbers will depend on the underlying cost competitiveness of the industry. Increasingly the focus is likely to be on the production of appearance grades of timber used in furniture and joinery, to capture the potential higher returns from the marketing of specific timber species which have distinct natural attributes. Many of these specific features may be exploited in product markets for furniture, linings, flooring, architraves, skirtings and

seasoned beams. Despite the limited potential for price increases, an expected tightening in the supply of hardwood sawntimber in the Pacific Rim could provide continued opportunities for the use of high grade hardwoods for appearance purposes and certain structural applications.

6.5.4 Wood based panels

Wood based panels comprise three main product categories — particleboard, medium density fibreboard and plywood — and are used in a wide range of building, construction and furniture uses. Total world consumption of wood based panels increased by around 400 % from the level in 1960 to reach around 125 million cubic metres in 1995. The growth in world production and consumption of composite wood panels and other engineered wood products reflects the growing market acceptance and competitiveness of these products in a diverse range of end use markets. Plywood is the most important panel produced in the Asia Pacific region in volume terms, accounting for over 70 % of total panel production of about 30 million cubic metres in 1995. However, in line with decreasing availability of veneer logs, production in the Asia Pacific region is expected to decline and investment in the processing capacity of other panel products is increasing.

Medium density fibreboard, of the wood based panel products currently available, has recorded the strongest market growth over the past decade. Rapid growth in the consumption of this product since the early 1990s in domestic and international markets is attributed to the widespread application and growing consumer acceptance of medium density fibreboard products in building and furniture making. Additional capacity is planned to be developed in the region over the next two years.

Australia's total annual consumption of wood based panels reached levels above 1.2 million cubic metres over the past few years, up from almost 1 million cubic metres in 1985. Australia was a net importer of wood based panel products before 1995-96, but is now a small net exporter (table 29).

Table 29. Australian production, consumption and trade in wood based panels

	1991-92	1992-93	1993-94	1994-95	1995-96
	'000 m^3	'000 m^3	'000 m^3	'000 m^3	'000 m^3
Production					
Plywood	106.6	122.0	138.3	145.0	130.9
Particleboard	660.0	726.3	828.4	863.7	825.7
Medium density fibreboard	na	317.9	421.3	436.3	376.5
Apparent consumption					
Plywood	169.8	190.0	198.4	210.1	194.2
Particleboard	651.0	706.5	778.8	827.0	733.8
Medium density fibreboard	na	315.5	375.9	410.2	365.2
Exports					
Veneers	0.70	2.23	2.13	0.78	1.28
Plywood	2.97	1.31	1.38	2.38	2.11
Particleboard	26.08	36.87	71.45	71.18	112.28
Hardboard	18.84	0.29	1.39	0.09	0.26

Table 29. Australian production, consumption and trade in wood based panels (continued)

Medium density fibreboard	105.24	105.58	133.13	128.20	89.65
Softboard and other fibreboards	0.01	0.17	1.34	2.13	0.36
Total	153.84	146.54	210.82	204.76	205.58
Imports					
Veneers	12.71	13.20	18.65	20.70	12.46
Plywood	66.18	69.26	61.43	67.48	65.48
Particleboard	17.06	17.04	21.86	34.55	20.36
Hardboard	4.59	4.98	12.32	14.59	10.74
Medium density fibreboard	93.63	103.11	87.73	102.16	78.28
Softboard and other fibreboards	8.00	13.11	14.30	14.21	11.58
Total	202.17	220.70	216.29	253.69	198.90

na Not applicable.

Source: ABARE 1996b.

In Australia, competition from softwood residues has affected demand for hardwood on two fronts: as an alternative input into wood based panels and as a substitute for hardwood sawntimbers and other residual hardwood products. Use of residual hardwood roundwood in composite wood based panels has decreased over recent years with the increasing availability of softwood residue. This has occurred as a result of the increasing size of the softwood resource, rising mill throughputs and the consequent increase in the availability of low cost residual softwood roundwood. Users have also been substituting composite wood panels for hardwood sawntimbers in internal building applications such as floors, ceilings and walls.

Future opportunities for Australian producers of hardwoods used in composite wood based panel products will be assisted by the forecast reduction in the supply of tropical timbers. An expected tightening in supply of hardwood timber in the Pacific Rim could also provide continued opportunities for the use of high grade hardwoods in select appearance applications. Australian veneer production for example, which targets the high value decorative veneer market is likely to continue to be competitive. The main factors influencing the ability of these producers to expand their market base is the future availability and quality of the resource and the price competitiveness of substitute products such as medium density fibreboard. Limited marketing opportunities exist for new panel producers in supplying the Australian market. Any new producer would need to rely on expanding export markets in the Asia Pacific region.

6.5.5 Pulp and paper

Growth in world paper consumption closely follows changes in economic activity. Consequently, growth in consumption of paper products is expected to be particularly strong in the Asian region. World paper and paperboard consumption is projected to increase from the current level of about 280 million tonnes a year to around 420 million tonnes a year by 2010 (Margules Groome Pöyry 1997). The projected annual rate of growth in world paper consumption to 2010 (around 3 % a year) is well above projected world population growth rates (around 1.5 % a

year). This reflects growing urbanisation and the expected increase in demand for paper as world literacy rates continue to rise. However, growth in paper consumption from 2010 to 2020 is expected to slow slightly, reflecting the slowdown in economic growth rates in developing countries.

An analysis of world market supplies of pulpwood indicates a gradual tightening of pulpwood supplies after 2010 (Cameron 1997). However, upward pressure on paper and paperboard prices and, hence, pulp prices will be moderated by increased use of recovered/waste paper, particularly in the production of lower quality paper products. Nevertheless, real world pulp prices may increase over the medium term. This expected real price increase, together with access to a large domestic forest resource, particularly from plantations, may encourage the expansion of Australia's pulp and paper industry. Australia has been a significant importer of paper products and pulp, allowing for the possibility that an expanding domestic industry could replace imports to some degree.

Hardwood and softwood pulplogs and woodchips are used in pulp and paper production and a degree of substitution between hardwood and softwood inputs is possible. Thus, in examining the outlook for hardwood pulpwood and woodchips, it is important to consider the characteristics of the different pulpwoods used, the types of pulps being produced and how these pulps are used in manufacturing paper.

Worldwide, hardwoods are primarily used to produce high quality printing and writing papers. Softwoods are generally used in the production of newsprint and lower value products such as industrial packaging and liner board. Wood fibres from coniferous timber are generally longer, wider and coarser than wood fibres from hardwoods. Consequently, softwood fibres provide resistance to tearing, an important attribute for wrapping and packaging papers. The smaller hardwood fibres provide smoother and less transparent surfaces, making them more suitable for products such as printing and writing papers (Ausnewz 1996b).

Table 30. Australian production, consumption and trade in paper products

	1991-92	1992-93	1993-94	1994-95	1995-96
	kt	kt	kt	kt	kt
Production					
Newsprint	403.7	433.5	426.1	444.1	466.2
Printing and writing paper	396.0	401.0	388.0	365.0	351.0
Household and sanitary products	143.2	164.6	169.8	173.0	180.0
Packaging and industrial products	1 128.0	1 186.0	1 255.0	1 312.0	1 407.0
Total	2 070.9	2 185.1	2 238.9	2 294.1	2 404.2
Apparent consumption					
Newsprint	616.0	638.1	632.1	701.2	746.0
Printing and writing paper	856.0	914.0	920.0	1 124.0	900.0
Household and sanitary products	150.9	174.9	180.8	188.6	193.5
Packaging and industrial products	1 164.0	1 140.0	1 273.8	1 383.5	1 432.4
Total	2 786.9	2 867.0	3 006.7	3 397.3	3 271.9
Exports					
Newsprint	0.0	0.0	0.0	0.0	1.9
Printing and writing paper	37.3	41.8	45.8	26.5	25.9
Household and sanitary products	4.5	5.4	9.4	11.2	12.0
Packaging and industrial products	205.2	236.9	216.4	208.4	201.4
Total	247.0	284.1	271.6	246.1	241.2
Pulp	2.8	0.30	0.0	0.7	0.5
Woodchips	2 770.4	2 842.7	3 033.0	3 727.9	3 351.1
Imports					
Newsprint	212.2	204.7	206.0	257.1	281.6
Printing and writing paper	495.5	541.0	581.2	782.5	576.8
Household and sanitary products	12.2	15.7	20.3	26.8	25.4
Packaging and industrial products	186.2	196.0	235.2	279.9	226.8
Total	906.1	957.4	1 042.7	1 346.3	1 110.6
Pulp	225.9	235.8	224.0	196.1	183.6
Wastepaper	18.5	24.6	20.2	24.2	25.8

Sources: ABARE (1996b); Ausnewz (1996a).

Woodpulp can be produced using three basic methods: mechanical, chemical and semichemical pulping. The mechanical pulp production process (grinding the wood to separate the fibres) produces a fine pulp and is suitable for newsprint and coarse

printing and writing papers. However, the presence of lignin in mechanical pulps limits their use in the production of smooth writing papers. If a smooth finish is a requirement, chemical pulps (for which chemicals are used to dissolve the lignin which binds the woodfibres) and semi-chemical pulps (for which chemicals are first used to weaken the bonds between fibres which are then separated mechanically) are more appropriate. The mechanical pulping process uses both hardwood and softwood timbers, although it reduces the inherent fibre strength qualities inherent with long fibre woods. Paper products derived from mechanical pulps often contain a proportion of chemical pulp to add strength. Chemically produced pulps, therefore, are used more in the production of wrapping and packaging products where strength is more important.

Table 31. Australian production, consumption and trade in pulp

	1991-92	1992-93	1993-94	1994-95	1995-96
	kt	kt	kt	kt	kt
Production	982	990	1 007	982	954
Exports	1	–	1	–	–
Imports	221	237	223	196	182
Virgin pulp supply [a]	1 202	1 227	1 229	1 178	1 136
Wastepaper	841	861	952	1 056	1 181
Total fibre furnish	2 043	2 088	2 181	2 234	2 317

a Virgin pulp supply = production + imports – exports.

Source: Ausnewz (1996a).

6.5.6 Uses of eucalypt pulps

Approximately 85 % of the world's eucalypt pulpwood is used to produce bleached and semibleached chemical pulp. The kraft (sulfide based) process is the most commonly used chemical pulping process and bleached eucalypt kraft pulp is used worldwide. Approximately 80 % of this pulp is used to produce printing and writing papers, and eucalypt pulp can make up to 100 % of the total furnish (fibre requirement). Eucalypt is especially suited to this product because the shorter fibres of eucalypts help to produce a good formation of the paper and a smooth surface for printing.

The stiffness of eucalypt pulps also makes them particularly suitable for some packaging grades, particularly in corrugating mediums used in supermarket boxes. However, there is strong competition from recycled fibre in these products. Chemical eucalypt pulps also provide the softness and absorbency properties which make them useful in the household and sanitary tissue markets.

Australian hardwood pulplog and woodchips are either used in domestic pulp production or exported to Japan. In Australia, given the historical shortage of softwood and the abundance of eucalypt, the domestic pulp and paper industry has used eucalypt pulp instead of softwood pulps in higher proportions than used elsewhere in the world. It is likely that an increasing softwood resource will mean that the use of eucalypt pulp in these applications will decrease over time.

Australian hardwood pulpwood is also exported (as woodchips) and is primarily used in the production of bleached hardwood kraft pulp and, consequently, for high quality printing and writing papers. Japan is the only significant market for Australia's woodchip exports, accounting for over 99 % of Australia's hardwood and softwood chip exports in 1995-96. There

has been little growth in Australia's woodchip exports in recent years, with shipments averaging 3.15 million tonnes over the five years to 1995-96. Given an expected increase in paper consumption and production in Asia, woodchip demand is projected to increase to 2020.

The absence of a suitable softwood substitute in the bleached hardwood kraft pulping process is likely to result in rising demand for Australian hardwood pulp, with the expected increase in Asian demand for printing and writing papers. The major factor influencing the future supply of Australian hardwood chips appears to be access to suitable forest resources.

6.6 INDUSTRY DEVELOPMENT OPPORTUNITIES

ABARE engaged Margules Pöyry to examine opportunities for the development of a competitive wood based industry for the southern New South Wales region (consisting of the Southern CRA and Eden CRA regions), subject to the availability and quality of the hardwood and softwood resource. A version of the Margules Pöyry report has been published in the "Development opportunities for the Southern NSW forest industry to 2010 and 2020" Eden CRA report to the NSW CRA/RFA Steering Committee. The main findings of the Margules study as they apply to the Eden CRA region are outlined in this section. It must be noted that the development opportunities discussed here assume:

- competitive energy markets in the region;
- internationally competitive ports;
- construction of a general purpose wharf at Eden;
- internationally comparable wood royalties, road tolls, fuel and other taxes;
- no import duties, import quotas or other direct or indirect barriers to Australia's imports of forest products; and
- long term security of wood supply.

6.6.1 Hardwood availability

The availability of hardwood resources in the region will affect development opportunities. Two hardwood resource availability scenarios were examined (tables 32 and 33). The hardwood resources of the Eden CRA region were not identified separately, but the 'coastal' supply zone includes the Eden CRA region and the general trends in the 'coastal' resource indicate the potential log availability assumptions for the Eden region. Many of the hardwood industry development options based on the 'coastal' resource apply to the Eden region and development opportunities for the Eden region have been identified in many cases.

Table 32. Coastal hardwood resource availability – maximum woodflow scenario

	Current harvest	Current potential	Potential 2010	Potential 2020
	'000 m^3/yr	'000 m^3/yr	'000 m^3/yr	'000 m^3/yr
Sawlog	91.3	103.8	100.5	96.4
Pulpwood	463.9	605.2	763.0	830.0
Roundwood	0.8	3.5	7.0	7.0
Total	556.0	712.5	870.5	933.4

Table 33. Coastal hardwood resource availability – minimum woodflow scenario

	Current harvest	Current potential	Potential 2010	Potential 2020
	'000 m^3/yr	'000 m^3/yr	'000 m^3/yr	'000 m^3/yr
Sawlog	91.3	79.3	76.0	72.9
Pulpwood	463.9	457.6	572.9	615.0
Roundwood	0.8	3.5	4.2	4.2
Total	556.0	540.4	653.1	692.1

Under the maximum woodflow scenario, sawlog availability is projected to increase from the current harvest volume of 91 300 cubic metres to 100 500 cubic metres by 2010, before falling to 96 400 cubic metres by 2020. Pulpwood resources are projected to increase from the current harvest of 463 900 cubic metres to 763 000 cubic metres by 2010 and to 830 000 cubic metres by 2020 as more regrowth and thinning material becomes available.

Under the minimum woodflow scenario, sawlog availability is projected to fall significantly from the current harvest of 91 300 cubic metres to 76 000 cubic metres in 2010 and to 72 900 cubic metres in 2020. However, the availability of pulpwood is projected to increase, although only to 615 000 cubic metres by 2020 (which is significantly lower than under the maximum wood flow scenario).

It is important to note that the quality of the hardwood resource is expected to change over time. Quota logs are projected to fall from 78 % of the current harvest of sawlogs in the coastal zone in 2010 to 32 % in 2020. Over the same period, the proportion of 'small' quota logs is projected to increase from 19 % to 59 % of the total coastal sawlog harvest. The quality of the native resource is expected to decline, but the increasing availability of uniform hardwood timber from plantations is expected to assist future industry development. This is because the resource has uniform sawing and drying characteristics and consistent fibre characteristics for pulp, paper and panelboard manufacture and export woodchips.

6.6.2 Softwood availability

The softwood resources of the Bombala region comprise all of the softwood resources of the Eden CRA region. It is projected that softwood available from the Bombala region will increase from the current harvest of 50,000m3/year to 380 000 cubic metres in 2010 and to 550 000 cubic metres by 2020 (table 11). This projection is based on the current resource base in the region and assumes that an additional 20 000 hectares will be converted to plantations by 2020. (This expansion is expected to be equally distributed between state forest and private property.) Production from these additional plantations is not expected to have a significant impact on industry development options to 2020, but the future available volume of sawlog and pulpwood will be significant.

6.6.3 Hardwood sawnwood development opportunities

Development of the hardwood sawnwood sector is expected to concentrate on value added products for the rapidly expanding Asian markets. As a result, there may be more investment in kiln drying and development of technology to recover higher value products from the resource as it changes over time. Such technology includes that to enable the handling of short logs, smaller diameter logs, regrowth logs and sawn pieces, kiln drying technology and technology for value adding processes

such as dressing and moulding. The number of hardwood sawmills in the region can be expected to decrease because production is expected to be concentrated in fewer, larger plants.

The mobile sawmilling industry (which includes fixed mills, mobile mills and craftwood collectors) is expected to continue to operate in niche markets. Potential exists for small scale expansion of this industry given security of access to suitable resource and acceptable licensing and codes of practice.

6.6.4 Plywood and veneer

Opportunities exist for the establishment of a plywood plant given an expected downturn in availability of mixed tropical hardwood peeler logs from traditional suppliers such as Indonesia and Malaysia. Current multi-aged forests may be expected to carry reasonably high levels of defect, rendering a large section of the resource unsuitable for veneer production. Given a change to a predominantly regrowth resource over time, assuming no fire, it is anticipated that veneer quality material will be available from this resource. However, the establishment of such a plant will require further work in assessing the suitability of native species for the production of hardwood plywood or laminated veneer lumber and softwood/hardwood combi-ply.

Markets are expected to be species specific — for example, using high quality spotted gum resources. Resources are insufficient for an industry based solely on this type of product, although potential exists for combi-ply or, for example, for small quantities of hardwood veneer at the proposed (see below) Bombala supply zone plywood plant by 2020.

6.6.5 Softwood sawnwood development opportunities

It was found that the potential exists for the Australian sawn softwood sector to expand, and production of sawn softwood in Australia is expected to continue to increase as resources become available. Changes in building codes which encourage the use of treated softwood, hardwood substitution and import replacement (Australia is currently a net importer of softwood) are expected to allow domestic markets to account for the expected increase in Australian softwood supply over the next decade. However, export markets will need to be developed beyond 2010 if expansion is to continue. The expanding Asian markets are likely to provide the best opportunities for increased exports.

As substitution of softwoods for hardwood timbers continues, market acceptance of softwood plywood is likely to improve. There are opportunities to expand the plywood industry as wood costs in major competing countries increase.

The large increases expected in the availability of sawlogs from the Bombala softwood resource imply that scope exists for significant industry development. It is anticipated that a world scale sawmill (capacity of about 400 000 cubic metres a year) and a laminated veneer lumber/plywood plant (using 120 000 cubic metres a year) will be constructed by 2010 and 2020 respectively. It is expected that capacity will be expanded at the proposed sawmill by 2020 so that all of the available sawlog resource will be used. Given Bombala's favourable location in relation to the proposed wharf at Eden, the likely markets for these products will be export based.

6.6.6 Wood based panel products

It was found that a medium density fibreboard plant could be competitive in supplying the Japanese market, although lower transport costs mean that total delivered costs for Indonesian and Malaysian producers may be slightly lower. The expanding market for medium density fibreboard in Asia and the cost competitive position of the industry in

Australia indicates that this product would be a viable option for development.

It is anticipated that a medium density fibreboard plant with an intake of 250 000 to 300 000 cubic metres a year, predominantly softwood, will be constructed in the Bombala supply zone by 2010. This plant is expected to expand to around 500 000 cubic metres capacity intake by 2020. It would use sawmill residue from the proposed Bombala sawmill and laminated veneer lumber/ plywood plant, roundwood from thinnings and hardwood resources close to the mill as part of the mix in the board (around 15 % under the maximum woodflow scenario and around 10 % under the minimum woodflow scenario).

6.6.7 Pulp and paper industry development

The optimal size for a new bleached hardwood kraft pulp mill is about 700 000 air dried tonnes a year but resource availability (including resources from east Gippsland) would limit capacity of a plant based in the Eden region to about 400 000 air dried tonnes a year, which is small by world standards. The operating costs of such a plant are estimated to be high compared with major competing regions, particularly in supplying the Japanese market. Thus, a large scale pulp and paper mill is not considered a likely development option.

It is expected that the majority of the hardwood pulpwood resource from the Eden CRA region will continue to be processed at the Harris–Daishowa woodchip mill at Eden and exported.

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8. APPENDIX 1.

8.1 RESEARCH NOTE 17 FOREST TYPE SILVICULTURAL GUIDELINES FOR EDEN (SOURCE STATE FORESTS AND BRS)

This appendix provides a guide on silvicultural regimes for research note 17 forest types in Eden. Information on intensification and silvicultural regime, commercial regeneration rates, and commercial value of forest types is presented.

Intensification relates to the potential to silviculturally manage a stand to promote timber production. The predominate method for this is through pre-commercial and commercial thinning, but may also include fertiliser application to promote growth. Forest types were scored for their ability to be intensified in the Eden CRA region. The scoring regime ranges from 0= not applicable (examples being rainforest, uncommercial forest types, or non forest types), to a score of 3= high (examples include Spotted gum types, brown barrel types and silvertop ash types).

Silvicultural regimes relate to the type of silviculture that can be applied to a particular forest type. Silvicultural regimes range from heavy disturbance (for example clearfelling types) to light disturbance (light selection logging). The scoring relates to the particular forest type's capacity to carry a silviculture regime.

Regeneration capacity of a forest type refers to the ability to regenerate commercial species under moderate to heavy disturbance regimes.

Commercial value refers to the potential commercial value a particular forest type has in Eden (for example dry Blackbutt type 37 would be scored higher in the other CRA region's of New South Wales).

Scores for associations were applied to forest vegetation that had not been forest typed but had been grouped into an association category. Association class follows that used in the IAP and FRAMES site productivity project. The information in this appendix has been spatially presented using New South Wales national parks information.

A guide on silvicultural regimes for research note 17 forest types in Eden

FCNSW RN 17. code	Forest type	intensification	silvicultural regime	commercial regeneration rate	commercial value
12	Coachwood/Sassafras	0	0	0	0
14	Lillypilly	0	0	0	0
19	Rainforest	0	0	0	0
23	Myrtle	0	0	0	0
25	rainforest	0	0	0	0
26	rainforest	0	0	0	0
31	Paperbark	0	0	0	0
37	Dry Blackbutt	1	3	2	2
50	Bangalay	2	3	2	2
57	unknown	0	0	0	0
58	unknown	0	0	0	0
63	woollybutt	1	2	2	3
66	Grey ironbark-Stringy	1	3	3	3
73	Spotted gum	3	2	3	4
74	Spotted gum/Grey gum	3	2	3	4
86	Grey Box/Woolybutt	1	2	2	3
88	gum-Box-Stringy	1	3	2	2
99	Red Box	1	3	1	1
102	Yertchuck	1	3	2	1
103	apple box	1	3	2	1
110	Brittlegum/peppermint	1	3	2	1
111	peppermint	1	3	2	2
112	silvertop	3	3	4	3
113	silvertop/peppermint	1	3	3	3
114	silvertop/Stringy	3	3	3	4
116	Sydney Pepper/Blackwood	1	3	2	1
121	Blue-leaved Stringy	2	3	3	3
123	Coastal Stringy	2	3	3	3
125	Red stringy/Brittlegum	1	3	2	1
130	Red bloodwood	1	3	2	1
131	peppermint/gum	1	2	3	2
132	stringybark-gum	2	1	3	2
133	Stringy-appletop Box	1	3	3	2
136	Snow gum/Sallee	1	2	2	1
138	Snow gum	1	3	2	1
139	Alpine Snow gum	1	3	2	1
140	Snow gum/Mtn-manna	1	3	2	1
143	Swamp gum/Sally	1	2	2	1
150	messmate	1	2	3	2
151	brown barrel/messmate	3	1	3	3
152	messmate/gum	1	2	3	3
153	messmate/Silver Stringy	2	2	3	2
154	brown barrel	3	1	3	3
155	brown barrel/gum	3	1	3	3
156	BB/messmate-ash	2	2	3	3
157	Yellow Stringy-gum	2	1	3	3
158	Southern Blue gum	3	1	3	3
159	Mountain/manna	1	2	3	3
162	White ash	1	3	3	3
165	Gully peppermint	1	1	3	2
166	River peppermint	1	2	3	2

A guide on silvicultural regimes for research note 17 forest types in Eden (continued)

167	silvertop Stringy	1	2	3	2
168	Silver Stringy/gum	1	1	3	2
169	Yellow stringybark	2	2	3	3
206	Red ironbark	1	3	3	2
214	Wattle	1	3	1	1
216	Pasture	0	0	0	0
218	plantation	0	0	0	0
219	settlement	0	0	0	0
220	cleared	0	0	0	0
223	heath	0	0	0	0
224	Scrub	0	0	0	0
231	swamp	0	0	0	0
234	rock	0	0	0	0
as3	association 3	3	2	3	4
as4	association 4	1	3	3	2
as6	association 6	1	2	2	3
as9	association 9	1	2	3	2
as10	association 10	1	2	3	2
as11	association 11	1	3	2	2

silvicultural codes

0=Not Applicable, 1= unsuitable for intensification, 2=moderate, 3=high

0=Not Applicable, 1= heavy disturbance (heavy only), 2= medium (medium & heavy), 3=light (any disturbance)

0=Not Applicable, 1=low regeneration capacity, 2=moderate, 3=high, 4=very high

0=Not Applicable, 1=low commercial value, 2=moderate, 3=high, 4=very high