



Defining the Product Log Grades Used in Australia

**A report for the RIRDC/Land & Water
Australia/FWPRDC
Joint Venture Agroforestry Program**

by Dr R. N. James

December 2001

RIRDC Publication No 01/161
RIRDC Project No ANU-44A

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ISBN 0 642 58380 3
ISSN 1440-6845

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Published in December 2001
Printed on environmentally friendly paper by Canprint

Foreword

Forestry in Australia has entered a new era with increased emphasis being placed on the expansion of plantation forestry. This follows the promulgation, in 1997, of the "2020 Vision" which had the aim of expanding the plantation estate by 2 million hectares and establishing plantation forestry as a "profitable, long rotation crop with significant private sector investment". This vision was developed by both the Federal Government and industry stakeholders ; including Australian Forest Growers, The National Association of Forest Industries and Plantations Australia. In addition the founding document recognised that the involvement of other stakeholders was necessary. These include investors, landholders, local Governments, researchers, farmer associations, unions, Landcare groups and others with an interest in natural resource management.

The founding document for this Vision recognised that, to be successful, the plantation and processing industries would need to operate in the "global" market place, in a manner that was internationally competitive, commercially oriented and market focussed. In their statement of the Vision, the Implementation Committee recognised that the additional area would only be achieved if new participants were encouraged to become forest owners but that the information which would allow them to assess this opportunity was lacking, outside current forest owners and forest products processors. The first goal to improve information flows was to "Provide growers with log specifications and anticipated prices". Some progress has been made towards disseminating price information through the ANU Forestry Marketing Report, another JVAP funded project. However interpretation of this valuable source of information is hampered by a lack of understanding among potential forest growers as to how "logs" are defined in the market place and of the principles which drive these definitions of quality.

The aim of this report is to clarify these issues and to explain, in lay terms, what constitutes a saleable log and why some logs are more valuable than others. It will aid potential growers to more realistically assess whether forestry will be viable in their situation and inform those already attempting to manage forest crops of the most valuable products types and their specifications.

This project was funded by the Joint Venture Agroforestry Program (JVAP). The JVAP is supported by three R&D Corporations — Rural Industries, Land & Water Australia and Forest and Wood Products. These Corporations are funded principally by the Federal Government.

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Acknowledgements

This report would not have been possible without the help and support of a large number of individuals from publicly and privately owned forest estates and from the wood processing industry in all States and Territories of Australia where forestry is practised on an industrial scale. All were pleased to contribute, revealing widespread goodwill support for the aims of the project throughout the forest growing and processing industries. Thirty-seven individuals are mentioned personally at the end of the report, all gave of their time and contributed information in a most generous manner. Richard James was responsible for the photographic illustrations.

Abbreviations

ACT	Australia Capital Territory
cm	centimetre
m	metre
mm	millimetre
NSW	New South Wales
Sed ub	Small end diameter, under bark

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Executive Summary

As a result of the 2020 Vision, promulgated in 1997 by the Federal Government and other stakeholders, the area of land under forest plantations is planned to expand three fold. Most of this area is to be on land that is now farmland. It is therefore hoped that many farmers will plant trees, or manage for timber crops, any native or exotic trees they now have on their farms.

An impediment to this is the lack of information about prices currently being received by small growers. The ANU Marketing Report - with the support of the RIRDC - publishes a collection of price data each quarter. Often the prices will be specified by log grade but the Market Report does not itself define these grades or the ways in which forest produce is specified. That is the aim of this report.

The main factor determining log specifications is intended use. Logs form a hierarchy of quality classes and values. From best to worst these are: veneer logs (for face veneer or the manufacture of plywood). Sawlogs (of which there are many grades), and pulplogs (usually thinnings or residues from clearfelling). Logs of higher quality can usually be used for lower value uses, but not *vice versa*.

In addition a class of logs called "preservation logs" is comprised of logs used in-the-round (ie unsawn) as wharf piles, girders, power transmission poles, telephone poles, orchard supports, vineyard poles, fence strainers and posts. They are usually preserved using creosote or copper/ chrome/ arsenic compounds.

Method of sale also influences the way logs are specified. When the wood is sold standing, the main purpose of the log specifications is to determine the difference between logs suitable for utilisation - which must be paid for - logs which may be taken at buyers option and residue. Alternatively wood may be sold "at mill door", in which case only logs of suitable quality are delivered to each mill. A third market is the export log market. Here logs are sold by individual grade to a number of destinations in Asia.

As log specifications may be developed for a specific sale, many, slightly different, specifications exist. There are however common features to all grades. Historically grades were used to define logs which could be sawn to scantling for building. Suitable species (native and exotic) are defined in each State. Log lengths are commonly specified in multiples of 2.4 metres, the common stud length, plus an allowance for cross-cutting to length of about 0.1 metre but other lengths are used, especially for logs from native forests. The most commonly preferred length is 6.1 metres but 4.9 metres is another common length and logs as long as 19 m and as short as 2.4 m are harvested. Diameter is also important, particularly the minimum size as this affects conversion rate into sawn timber. Veneer logs are usually larger than 30 centimetres in diameter at the smallest end measured under bark. Sawlogs are usually larger than 15 cm and pulplogs larger than 7 cm in small end diameter under bark.

(In Western Australia, houses have traditionally been built in double brick and log lengths have never been based on the stud length in that State.)

Other countries have their own traditions and many export logs are cut to completely different lengths from those used in Australia. Preservation logs are graded on a system that is extremely detailed and quite different from other products.

As well as by dimensions, logs are graded by defects which occur as a result of natural processes. For native forests the chief defect in logs is internal, central, rot or pipe. Grading rules specify the minimum proportion of the log volume available for sawing. Limb size, sweep (deviation from straightness) and other defects such as cracks, gum veins, open splits and spiral grain are all used to determine if the logs are utilisable.

Exotic species are generally grown for a shorter time and under greater silvicultural control. Their defects are easier to define but are similar to logs from native forests. Straightness is important and is often specified on a sliding scale such that more sweep is tolerated on logs of larger diameter. Branch sizes are also important as

they result in the knots which reduce the strength of the sawn timber. Within the general class of sawlogs there are often locally applicable grades. Usually these demarcate quality classes or reflect the suitability for a particular mill. Some "special" grades define logs of poorer general quality but which are suitable for mills designed to handle them. An example is "Break" logs from stand edges and fire breaks in South Australia. These logs have diameters and branch sizes greater than the normally acceptable limits.

For preservation logs there is a National Australian Standard. The most critical point on a pole is the portion around the ground line. This is defined for all lengths and defects in this zone are strictly limited. Straightness is also very important.

Exports logs represent a market option that has recently expanded. The sizes and quality classes are related to overseas building traditions and often bear only an approximate relationship to Australian sizes and quality classes. Approximately 17 export grades are currently in use, mainly for the Japanese, Korean and Chinese markets. The major categories of veneer logs, sawlogs and pulplogs are all recognised in overseas markets.

Plantation hardwoods have not yet been harvested in sufficient quantities for specific grades to develop. For pulpwood, logs must be debarked, longer than about 3 metres and may be as small as 50 cm in small end diameter.

For growers wishing to develop silvicultural regimes to maximise income the following "target" log specifications are useful.

Native forest sawlogs should be at least 2.4 m long, (plus cutting allowance), and of at least 25 cm in diameter at the small end. The logs must be substantially straight, properly manufactured and all branches and large limbs trimmed. For higher grades less than 25% of log volume should be lost to internal rot.

Plantation grown pine sawlogs should be at least 2.4 m long (plus cutting allowance) and of at least 15 cm in diameter under bark at the small end. Logs should be substantially straight with a minimum deviation (from a line log end to log end) of 25% of the small end diameter under bark measured over a 2.4m length. Logs must be properly processed with ends cut square and free of rot or blue stain. No single knot should be greater than 50% of the log small end diameter, up to a maximum of 75mm; although lower grades will accept larger knots.

Prices for forest produce are usually included in supply contracts and therefore confidential. However two organisations publish mean stumpages (Royalties), Forestry SA and the Department of Conservation and Land Management in W.A. In Western Australia sawlog stumpages for exotic species ranged from \$18.70 per cubic metre for logs up to 250 mm small end diameter to \$63.48 per metre cubed for logs 500-550 mm small end diameter. For the same diameter range the prices were \$30.35 and \$79.10 in South Australia (in both cases prices dated 1/7/2000). The prices paid in WA are less but if a log size of 300-350 mm (sed-ub) is taken as the standard, WA has the steeper gradient. In Victoria, the average prices for native sawlogs (Ash and mixed species) in 2001/2002 are \$65, \$50, \$35 and \$15 per metre cubed (GST exclusive) for log grades A, B, C and D respectively.

Sawmillers do not, in general, hold in high regard the produce from small farm woodlots. Their concerns are mainly of the small size and poor access of the woodlots themselves and the poor quality of the crop which they see arises from poor establishment or inadequate silviculture, such as the absence of thinning.

The main grades applied throughout Australia and their descriptions are listed in the appendix; for each State and for export logs.

1. Introduction

1.1 Forestry - An Expanding Industry

The Federal Government and its industry partners are promoting new developments in the forest industries. This includes a trebling of the current plantation estate with increasing participation from the private sector, especially from farmers and other land holders not currently engaged in forestry. For many of these "new players" the growing and sale of conventional forest produce will form at least part of their plans. In order to participate successfully new growers will need to understand the way in which the products they will offer for sale are specified. Although not secret in any way, this information is not generally known outside the wider forestry industry. Most new entrants into forest growing will be involved with the establishment of forest plantations. Some however will manage privately owned native forests. Log specifications will be given for both natural and plantation forests.

The information in this report was obtained from public and private forest growers and organisations which utilise forest products in all Australian States and the Australian Capital Territory. In almost all cases the organisation was visited in person and detailed explanations were obtained for all the log specifications in current use.

1.2 The Importance of Log Grades and Specifications

The purposes of log specifications are twofold: to define the limits to acceptability of harvested material for each potential end use and to discriminate between different qualities of logs within end use types. Log grades are important because they are a fundamental part of the process of transfer between growing trees to processing them into a marketable commodity. Although grades specifications are not usually controversial in themselves, because they are applied at the point of sale after many years growing, their application and interpretation may be controversial. This is because log specifications define classes of logs which may be assigned different values and differences in interpretation may affect the amount of money paid and received.

2. First Principles

Like any other traded commodity, products from forests vary in their quality. In general "quality" means fitness for a defined end use and log specifications (or quality grades) are used to determine whether the log is "fit for purpose". Logs can be visualised as being divided into a hierarchy of end-use categories. From the most valuable to least valuable these are:

Veneer logs
Sawlogs
And pulplogs.

Logs are generally of better quality if they are straight, have a round cross-section, a larger diameter, have small branches and are free from defects such as rot and insect damage, internal defects and have not been damaged in the processes of felling, extraction and cross cutting.

Veneer logs are the most valuable logs and have the most demanding specifications whereas logs destined to be made into pulp are often the residue left after sawlogs and veneer logs have been segregated. They will be reduced to fibres and have the least demanding specifications. In most cases a log higher in the quality hierarchy can be used for purposes lower in the quality order, but the reverse does not apply. In most cases the price, per cubic metre for logs higher in the order will be greater than in the lower categories. The category "sawlogs" is so broad that often there is a series of quality classes or grades, within that broad category.

An exception to the above classification is the category "preservation logs". This term refers to forest produce used "in the round" and is a broad term that covers wharf piles, girders, transmission or power poles, telephone poles, building poles, orchard supports, vineyard poles, fence strainers and posts. Their common feature is that they are used without sawing, exposed to the weather and are often in contact with the ground. To prevent rot they are preserved; usually by impregnation under pressure with creosote or a mixture of chemicals containing salts of copper, chromium and arsenic. The way in which preservation logs are graded is different from logs which will be peeled, sawn or pulped. For preservation logs, size at critical points along the stem, taper and general appearance are important as well as the universal characteristics such as straightness and knot size. Some categories of preservation logs are more highly valued than any other type of forest produce.

2.1 The Wood Supply

While all log specifications conform to the general principles described above, actual specifications vary by State, species and individual supply contracts.

Native species are harvested in quantity in every State except South Australia. In Western Australia the principal timber species are Jarrah (*Eucalyptus marginata*) and Karri (*E. diversicolor*); in Victoria and Tasmania the Ashes (*E. regnans*, *E. delegatensis* and *E. obliqua*); in Southern Coastal NSW Ash, Silver topped Ash (*E. seiberi*), Spotted Gum (*Corymbia variegata*) and Blackbutt (*E. pilularis*); Northern Coastal NSW Flooded Gum, (*E. grandis*), Blackbutt and many other species; Queensland, Blackbutt, Spotted Gum, Gympie Messmate (*E. cloeziana*) and many other species. In NSW and Queensland the native softwood, Cypress pine (*Callitris spp.*) is harvested. This list of species is greatly abbreviated for all States but especially for NSW and Queensland where many species are harvested, particularly for special uses such as girders and piles.

Some log specifications may apply to a few species only. This may be to take into account special features exhibited by the species or special uses to which they are put. A much more detailed list, by region, of native species which are used commercially is given in "Australia's State of the Forests Report" (BRS, 1998).

There has recently been a trend towards establishing native hardwood species in plantations. Although currently only 29% of the resource is of hardwood species, the latest data for new land planting are 94 812 ha in 1999, of which 89% were in hardwoods (BRS, 2000). There are two clearly different types of native forest plantation. One where the objective is short term pulpwood; usually of

Blue Gum (*E. globulus*) or Shining Gum (*E. nitens*) and the other where the objective is timber for solid (ie non-pulp) uses. The latter occurs mainly in Tasmania, Northern NSW and South-east Queensland and many species are used although the Ashes, Spotted Gum, Blackbutt, Flooded Gum, White Gum (*E. dunnii*) and Gympie Messmate are prominent. However most plantations are currently of softwood, predominately of Radiata Pine (*Pinus radiata*) (BRS, 1998).¹ Regions for plantation forestry were defined during the National Plantation inventory process (BRS, 1997). The regions and principal species are shown in Table 1, below.

Table 1. Major Plantation Species by Region

	Region	Softwood	Hardwood
1	Western Australia	<i>P. pinaster</i>	<i>E. globulus</i>
		<i>P. radiata</i>	
2	Tasmania	<i>P. radiata</i>	<i>E. globulus</i>
			<i>E. nitens</i>
			<i>E. regnans</i>
3	Green Triangle	<i>P. radiata</i>	<i>E. globulus</i>
4	Lofty Block	<i>P. radiata</i>	
5	Central Victoria	<i>P. radiata</i>	<i>E. globulus</i>
6	Murray Valley	<i>P. radiata</i>	
7	Central Gippsland	<i>P. radiata</i>	<i>E. nitens</i>
			<i>E. regnans</i>
8	East Gippsland/ Bombala	<i>P. radiata</i>	<i>E. nitens</i>
9	Southern Tablelands	<i>P. radiata</i>	
10	Central Tablelands	<i>P. radiata</i>	
11	Northern Tablelands	<i>P. radiata</i>	
12	North Coast	<i>Araucaria cunninghamii</i>	<i>Corymbia variegata</i>
		<i>P. elliotii</i>	<i>E. dunnii</i>
			<i>E. grandis</i>
			<i>E. pilularis</i>
			<i>E. saligna</i>
13	South East Queensland	<i>A. cunninghamii</i>	<i>E. cloeziana</i>
		<i>P. caribaea</i>	<i>E. grandis</i>
		<i>P. elliotii</i>	<i>E. pilularis</i>
		<i>P. elliotii</i> X <i>caribaea</i>	
14	North Queensland	<i>A. Cunninghamii</i>	
		<i>P. caribaea</i>	

Each of the species listed will have characteristics which affect utilisation and influence their log specifications. Specifications are always a compromise between what is desirable for utilisation and what can be provided from the forest. Specifications and grade descriptions will therefore vary between species groups and sometimes between species; at least in detail.

¹ While the botanical names of species are standardised, common names often vary by location. For example *Eucalyptus regnans* is called Swamp Gum and *E. obliqua* is called Brown Stringybark in Tasmania. These species are called Victorian Ash and Messmate respectively in Victoria. The correct names can be found in standard botanical reference books.

2.2 Method of Sale

The way in which wood is sold will influence the way in which it is specified. One common method of sale is the sale of the standing timber. The wood processor may or may not be responsible for logging and cartage to mill but in any case the specification will be written with the objective of defining an acceptable log. The grower will have a financial interest in ensuring that all trees containing merchantable logs are counted for the purposes of payment; whether actually extracted or not. Likewise the purchaser will wish to pay only for wood that can be utilised in the mill.

Two methods of achieving this are used. One is to assess the standing timber and determine the volume of utilisable logs as defined by the log specifications. Payment will be made on that basis and it will be up to the utiliser to ensure that all merchantable timber is removed. A variation of this method is to fell trees of merchantable size and assess each tree after felling, cutting the tree into merchantable logs. The first variation is mostly used for exotic plantation timber where variation is less and defects can be determined before the tree is felled. The second method is used more frequently for native forests. There the defects might only be assessable after felling. Examples of such defects are: internal decay (pipe) which can only be seen after the trunk cross section is exposed to view by cutting into log lengths, or damage or defect in the upper stem which may be visible from the ground but which can only be precisely evaluated when the tree has been felled and branches trimmed.

A second method entirely is that often referred to as "mill door sales" (sometimes called "log merchandising"). In this case the miller buys only logs suitable for utilisation at the particular mill. The forest owner fells and segregates the different qualities of logs and delivers them to the appropriate mill. For example if the mill was a sawmill, logs which were better suited to pulping or veneer manufacture, or as preservation logs would be directed to those mills and the sawmiller would only purchase sawlogs best suited for sawing.

No one method is suitable for all circumstances. A miller who purchases a whole stand of trees has the advantage that volume is guaranteed but may have the task of selling logs more suitable for other purposes to other mills. Where the mill is integrated and contains more than one processing plant, the allocation of logs to best use may be achievable on-site and therefore not a problem but an advantage. There is a general trend for the larger forest growers in Australia to prefer mill door sales as this gives them better physical and financial utilisation of their forests.

A comparatively recent development in Australia is the expansion of the export market. This has been useful in enabling some growers to sell logs for which they otherwise would not have a market.

This is relevant to log specifications because they might be influenced by the method of sale. A sale of wood from a defined area of forest may have log specifications which principally aim to discriminate between an acceptable log and a log that cannot be used. On the other hand a sale "at mill door" may use log specifications which were designed to distinguish between log quality and value groups.

3. What features Describe Log Quality?

Because many log specifications are designed for one particular sale, a large number of specifications actually exist. However they all follow a number of common themes. These themes provide a way of understanding the intent and application of the many log grades. Log specifications have a long history of use and were originally developed for native logs which were to be sawn into structural timber for suburban dwellings. Most log grades therefore are defined in ways which describe their suitability for sawing into house framing; even although that may not be the most common use to which that timber is currently put.

3.1 Species

In each region of Australia there will be a list of species acceptable for each use. For some uses, such as naturally durable beams and girders, the list will be quite restricted.

3.2 Size of Log

The common unit in a house is the "stud" - the timber member of the framing system which runs from floor to ceiling and which actually bears the load of the walls and roof. Before metrication the most common stud length was eight feet. After metrication this was rounded down to 2.4 metres. Most logs are still cut to multiples of the 2.4 metre unit plus a cutting or trim allowance. The cutting allowance is to allow some leeway in cutting the log under bush conditions where it may be difficult to measure and cut dimensions with the accuracy possible in a mill. It also provides a safety factor in case of damage during extraction transport. The cutting allowance is usually 10 centimetres (0.1m) but may differ under some circumstances. Actual log specifications tend to specify the amount of cutting allowance in one of two ways; either by specifying a log length 0.1m longer than that required (eg 2.5m) or by specifying a length with a tolerance of plus or minus 0.05 m (eg 2.45m plus or minus 0.05m). The effect is virtually the same.

As a general rule the shortest log that is cut and extracted from a forest is 2.5 metres long, however this is not a common length. The reasons for this are that handling costs in a mill or forest are usually generated on a log basis. It is therefore better in a financial sense to spread the cost over a greater volume and multiples of 2.4 metres are preferred. Another reason for preferring a longer length is that 2.5 metres is mostly too short to handle easily. For most log cartage systems a log that length would fall between the bolsters (or side restraints) which retain the log on the truck. A 2.5m log is also too short to be de-barked using the machinery installed at most mills. For these reasons logs are cross cut into longer lengths, the usually preferred length is 6.1 metres (*ie* two and a half times 2.4m + 0.1m) but a log length of 4.9 metres is also common.

The diameter of a log is also important. There are a number of reasons for this. The sawmilling process is one where straight rectangular pieces of sawn timber are manufactured from tapered, rounded, often crooked logs. The most common component of the house frame is the 90 x 35 mm stud. Logs are measured for diameter at either their small end or at their mid-length point. It is unusual to saw a log of less than 150 mm in diameter. This is because the conversion factor - the ratio between recovered sawn volume and the original log volume - is too low and processing costs too high for smaller logs. For pine species another reason is that such pieces contain too large a proportion of wood from the low density core and when sorted using machine test grading, will fall into the lower, less valuable strength grades. The value, per cubic metre, usually increases with the diameter as handling costs are spread over a larger volume and recovery percent and timber grade values improve. Depending on the configuration of machinery within the sawmill, the improvement due to the increased diameter may reach a plateau - often said to be about 30-35 cm by some millers of radiata pine but about twice those dimensions for eucalypt logs.

As always there are exceptions to the general rules given above. In Western Australia the common house building technique has been to use full or double-brick construction. Log lengths in that State have never been based on stud lengths. For logs from native forests, although multiples of stud

lengths are preferred, the incidence of defects and the requirement to maximise forest utilisation means that many lengths other than the preferred ones are accepted and that logs of minimum length of 2.4m are often produced. When logs are to be sawn into pallets they are cut into combinations or multiples of 2.5 or 3.7metre lengths (includes cross cutting allowance). Although the aim of the plywood manufacturer is to make ply sheets of 1.2 x 2.4 metres, veneer so commonly splits at the ends during the drying process that an additional allowance is made. Sheets are initially made over-size and trimmed to an exact size once they are glued. Veneer logs are therefore usually based on a 2.5 metre unit plus cross cutting allowance. Other countries have their own building sizes and conventions. The length of logs destined for the export market are usually quite different to those used in Australia and the lengths vary by market destination.

Timber destined to be used in the round as preservation logs is assessed on entirely different criteria and log lengths are not related to stud lengths but based on the actual intended use.

Markets for sawn timber are changing and so are processing methods. The previous domination of house scantling is changing in favour of more sophisticated products, for native timber species. These products include flooring, panelling, furniture and high strength components in buildings which are mainly framed in pine. For this market the influence of the stud as a length determinant is becoming less.

Advancing technology is also changing the methods used to saw wood from exotic pine species. Many millers now use laser scanning technology and computer aided decision support systems to assess how best to saw their logs. Such mills tend to buy logs in longer lengths and "merchandise" them within the mill. At one mill in Queensland, logs are transported in the longest legal transportable length - 19 metres- and cut to lengths which will optimise utilisation and throughput at the mill. The use of scanning devices in sawmills is increasing and this can be expected to result in an increase in the desired length of sawlogs in the future.

In summary logs are described by length and diameter. There are lower limits to the acceptable dimensions of these two parameters and the preferred lengths for sawlogs tend to reflect their suitability for the scantling market, especially for pine logs but less so for native forest logs.

3.3 Defects in Logs

A description solely in terms of external dimensions is not sufficient to define the suitability of a natural product such as a forest log. Even logs from plantations of exotic species, which is the simpler case, are subject to the forces of nature and despite the best attempts to improve the genetics of plantation species and silvicultural treatment to correct faults or remove poor quality trees by thinning, some logs will contain defects. Products from natural forests will have been grown over a longer time, been subject to greater environmental influence and generally received much less silvicultural improvement. Sawmillers and other processors accept that logs will contain some imperfections but rely on the actual specifications to define the limits of acceptability or to define grades or quality classes.

The limits of acceptability of a feature which make it into a defect vary by species and log type. They will be presented by log type here.

3.4 Native Forest Sawlogs and Associated Products

Often logs could qualify for more than one use. For logs of native forest species the order, from most to least, valuable is, generally; poles, piles and girders, veneer logs, sawlogs and pulplogs.



Figure 1 : A high quality Tallowood sawlog from the North Coast of NSW. Only a small volume is lost to pipe defect.

A defect can be defined as any feature of a log which would prevent sawn timber of the lowest merchantable grade being recovered.

In NSW and Queensland the main purpose of the log specifications is to define logs fit for use. These are called "Quota" logs if sourced from State Forests of NSW and "Compulsory" logs if from forests managed by the Queensland Department of Primary Industries - Forestry. However in both cases sub-standard logs may be taken at the millers choice (called "Salvage" logs in NSW and "Optional" logs in Queensland) for a much reduced fee. A similar system applies in Tasmania where 3 grades of logs are separated. Logs of the poorest category are sold by agreement with individual customers as "category 8" logs. This also applies in Western Australia and Victoria where the poorest logs may be taken at the buyers' option.

However in Western Australia, Tasmania and Victoria the log specifications used for State forest wood also define quality classes as well as defining the minimum quality for acceptable logs. These quality classes have different market values.

Strictly, the log specifications used by State forest organisations only apply to sales made by those organisations. However as these comprise the majority of sales by volume and have a strong technical base to their development, they are often adopted by private growers. Some sales from private land are made on a "run-of-bush" basis. While this phrase usually means "you must accept the logs as they occur in the forest"; in reality it may mean that there are no rules.

Manufacturing standards:

Logs which are cut too short or which have "pulled wood" (wood drawn out from the log in the process of felling) are considered to be below specification. It is usual to specify that logs be cut square and that slovens (irregular lengths attached to the log ends) be cut off. In some cases the "scarf" (the sloping cut at the base of the butt log which determines the direction of tree fall) must be removed. The way in which branches and large limbs are to be trimmed is defined.

For a log to be acceptable there is usually a requirement that there is at least one 2.4 metre length of utilisable timber available. Minimum acceptable diameter for a sawlog is often 25 centimetres measured under bark at the small end of the log.

Sweep:
 Logs which are not straight are said to be swept. Tolerable sweep in logs is often defined as a fraction of the log diameter. This is because a given deviation from straightness, measured from a straight line from end to end of the log, has a greater effect in reducing conversion factor for a log of small diameter than a larger log. By expressing the limits to sweep as a function of diameter, a sliding scale is created which takes this effect into account. In NSW, Victoria and Tasmania a deviation up to one fifth (Tasmania one seventh) of the log diameter over a 2.4 metre length is accepted.

The method of measurement deviation from straightness differs in Queensland. The log is treated as two straight sections which intersect at the centre of the bend. The centre line of the two sections is extended by line of sight to form a "V". The distance apart of the open ends of the V are measured. There is sliding scale - depending on log diameter - for an acceptable/ not acceptable value.

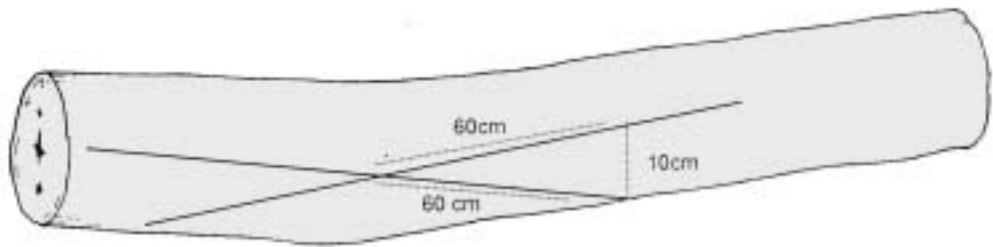


Figure 2:Maximum acceptable bend in logs 50 cm diameter under bark or greater at centre of the bend.
 Source: Queensland DPI-Forestry

Pipe:
 The most common and important defect found in logs from Australian native forests is internal rot or "pipe". The term refers to the absence of sound wood in the centre of the log. This is caused by fungal decay and/or termite attack and may be seen as decayed wood or the complete absence of any wood at all; hence the term pipe.

When logs with pipe are sawn the defect is "boxed out". That is the sawing process will result in the rejection of a squared baulk of timber containing the pipe defect. In Queensland, NSW, Victoria and Tasmania, the limits to the size of the pipe are set on a sliding scale; the larger the log the larger the dimensions of the acceptable pipe. In Western Australia the acceptable limit to the size of the pipe also varies with the size of the log but it is calculated as a percentage of the log volume. The effect is similar to the other States. Part of the (generalised) size limits for acceptable pipe in NSW are given below. Values for other States are similar.

Table 2. Maximum Size of Pipe for "Quota" Sawlogs - NSW

Log Diameter (cms)	40	44	48	52	56
Pipe (cms)	18	22	26	28	32

Source: State Forests of New South Wales (averages of regional values)

In this case the log diameter is measured at the centre point of the log, under bark, and the pipe dimension refers to the average size of the square box which would enclose the pipe - assessed at both ends of the log.

Limbs and Bumps:

Large limbs represent a fork or other major departure from the ideal of a single stem in a tree. Bumps (swellings) tend to indicate the site of damage or former limbs which have now grown over. A trimmed branch is regarded as a "large limb defect" if its diameter is larger than 10 centimetres. This is because the limbs of that size will degrade the sawn timber that will be derived from the log. The limbs will become large knots in the sawn timber. A log can be affected by a number of limbs along an otherwise acceptable log, or by limbs arranged around the circumference of the log. Log specifications commonly take both locations into account. For example, if the limb(s) together with associated swelling occupy 50% or more of the circumference of the log it usually means that the log is acceptable only at the buyers option.

The specifications for NSW and Queensland indicate that limbs have their greatest degrading effect in those States. Limbs are more loosely specified in Victoria, Tasmania and Western Australia.

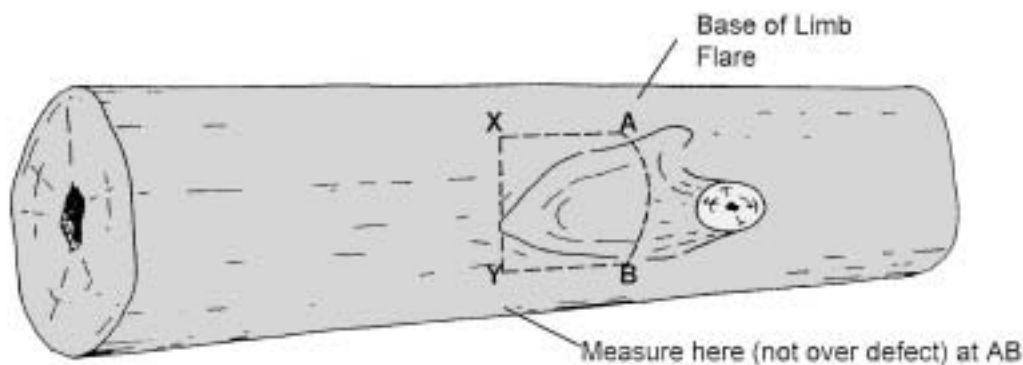


Figure 3: Effect of limbs ,This log will be ruled as acceptable if the dimension X-Y is less than half the circumference
Source: Queensland DPI-Forestry

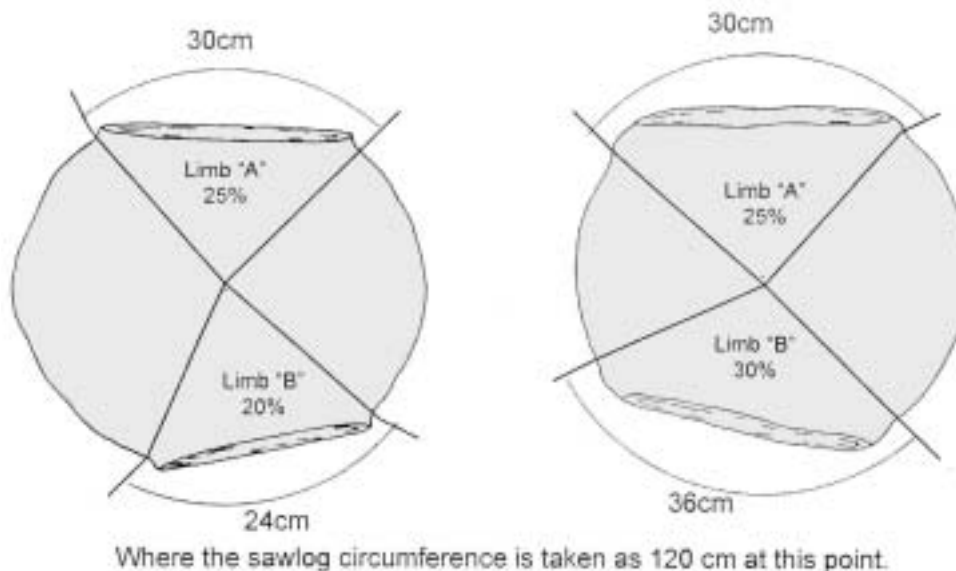


Figure 4:Effect of limbs at the same height is calculated by adding dimensions. The log on the left is acceptable but that on the right is not
Source: Queensland DPI-Forestry.

Other Defects :

Logs from native forests can exhibit a a variety of defects which, depending on species and locality, can become major source of degrade. Spiral grain refers to the spiral distortion of grain along the

length of the log. The way in which this is usually defined is as a ratio of displacement from longitudinal along the stem. A ratio not exceeding 1:10 is a common limit to acceptability but up to 1:6 is sometimes accepted.

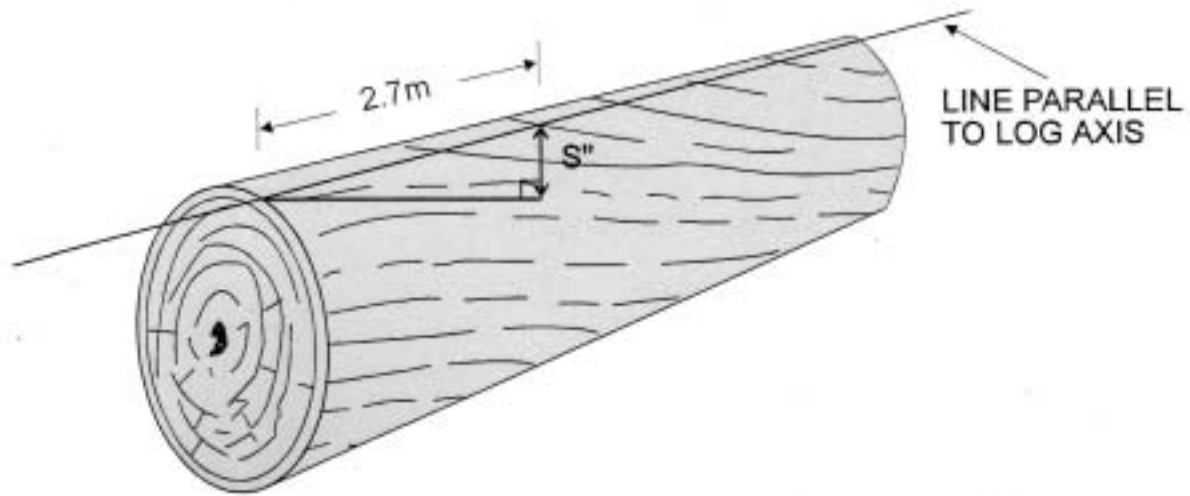


Figure 5: Measurement of Spiral Grain Ratio.
Source: Forestry Victoria

Open ring shakes, loose or open gum veins refers to partial or complete separation of adjoining layers of wood tissue due to causes other than logs drying after harvest. Gum veins are ribbons of kino between growth zones. Both cause a defect that appears as one or more arcs parallel to the growth rings and exposed when the log is cross cut to length. These defects may occur close together so that in effect, they constitute a central defect; and are thus measured and assessed as if they made up a pipe defect. They may be so substantial in themselves that they are treated as a pipe defect even if they are not centrally located.

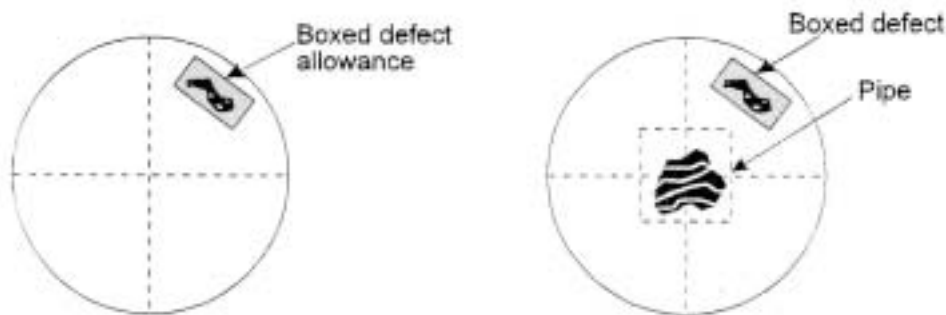


Figure 6 : Gum vein defects shown as a pipe defect (left) and separate from the pipe (right)
Source: Forestry Victoria

Other defects such as shake, a separation of wood along radially rather than circumferential lines; rot pockets and fire scars may also be treated, for measurement purposes, as if they were a "pipe" defect.

Where there are many isolated defects and a substantial pipe defect to be considered, there may be an over-all criterion to determine whether the log is acceptable or not. Fifty percent of the remaining cross-sectional area of the log is the standard used in Queensland and similarly for first grade logs in Western Australia. In NSW the percentage tolerance varies with the diameter of the log, in Victoria the log is considered as if it were divided into notional quarters. In principle all are similar in that they provide a method of evaluating the accumulated effect of many small defects which occur close together.

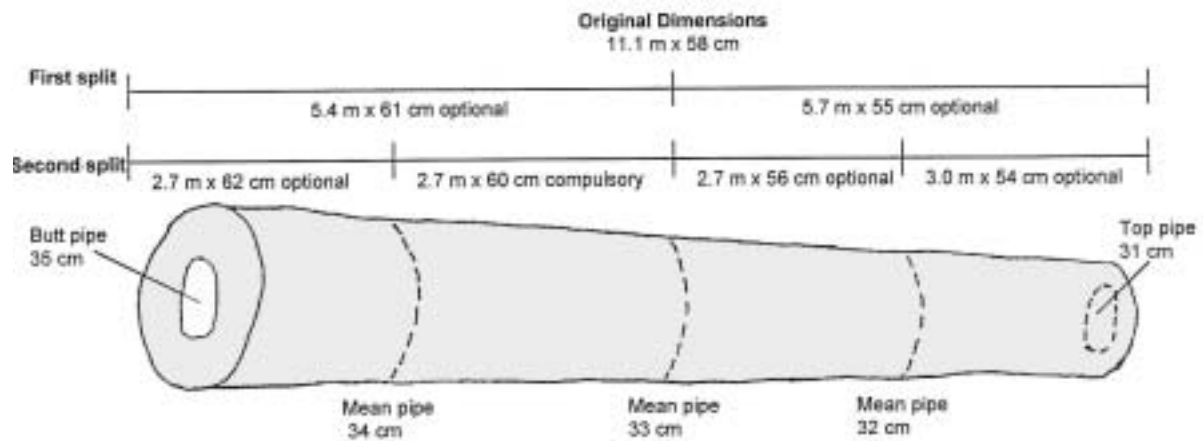


Figure 7: The total of core defect and loose ring defect has made this log unacceptable. Chalk marks show miller's estimate of volume to be "boxed out".

Recutting of logs:

A tree may, when felled, contain some sections which when cross-cut could be acceptable logs and other sections which would not. Many degrading defects will only be exposed when the log is cut to length. In all States but especially in NSW and Queensland, the felled tree may be recut to detach sections which contain unacceptable defect. All States which supply timber from native forests have a category of log which is below the standard specification but which may be taken at the buyers discretion. These are called "Optional" logs in Queensland, "Salvage" logs in NSW, "Grade D" logs in Victoria, "Third grade" sawlogs in Western Australia and "Category8" logs in Tasmania. However although grade D logs may be refused by millers in Victoria, an equivalent volume is forfeit from their allocation.

These logs may, by agreement with the buyer, be left attached to the within-specification log - or conversely they may be sold detached. In general these below specification logs come from two sources; logs from the butt end of the tree with greater than acceptable pipe or the small, under diameter and sometimes large limbed swept logs from the top of the tree stem. In general the nation-wide Regional Forest Agreement process has resulted in a reduction in the volume of wood available for harvest. Many mills have been able to remain in business by accepting logs which are below the normal specification. Some have specially re-equipped to better utilise wood from this source. Logs below specification are traded at prices substantially below conforming logs.



rings. There are limits to ovality (out-of-roundness) that is acceptable in veneer logs which will be peeled; "the minor diameter shall not be less than 85% of the major diameter" is an example. As well there are limits to the amount of fluting that is acceptable in buttlogs. "Drysides" - a term that refers to the dry surface of bark free timber that is formed as a result of damage during the growing phase - is generally not accepted at all. If defects are permitted in veneer logs, they must be distributed around the log. Knots or other defects which are distributed in a longitudinal line along the log will result in defects which will contact the peeling blade in unison. This is liable to damage the blade and cause costly down-time in the mill.

In general (but not always) a veneer log can be described as a better quality sawlog but the tolerance of any core defect is much smaller. This is because the manufacturing process depends on the presence of sound-end-surfaces into which the chucks which drive the log during the peeling stage can grip.



Figure 9: The effect of core defect on veneer logs. These logs were rejected after the turning chuck failed to grip.

3.6 Girders

Girders are load bearing members, used in the round or sawn to large square sizes and are of very high quality and value. Only a few species in each State are acceptable. Minimum length is 3.0 metres. Logs must be straight and no pipe is permitted at the small end and little at the large end. No unsound knots (ie with rot) are permitted and the number of sound knots is restricted.

3.7 Poles

This is another high value product with very strictly defined specifications. These specifications are given in AS 2209 (Standards Australia, 1994) and apply throughout the country, although some States may have additional requirements. This product is intended to support overhead loads which may increase sharply under wind loads during storms. Each pole must carry the load on an individual basis and must therefore be of high quality. Both high strength and good appearance are required. Only a few selected species can be used.

The way in which strength is judged is quite specific and quite different from other timber products. In principle, the rules are designed to ensure adequate strength at the most critical points in the pole - in the region at or just above ground level when the pole is in service. Durability is usually obtained by impregnating the pole with preservative salts under pressure.

A feature of log specifications is the "critical zone". The critical zone is determined as follows: the nominal ground line is defined as 10% of the total pole length plus 60 centimetres. The critical zone extends 60 cm below and one metre above the nominal ground line. This will be the region of the pole where greatest strength is required when the weight of the transmission line is increased by wind loading. The tolerance for defects is less in the critical zone than elsewhere in the pole.

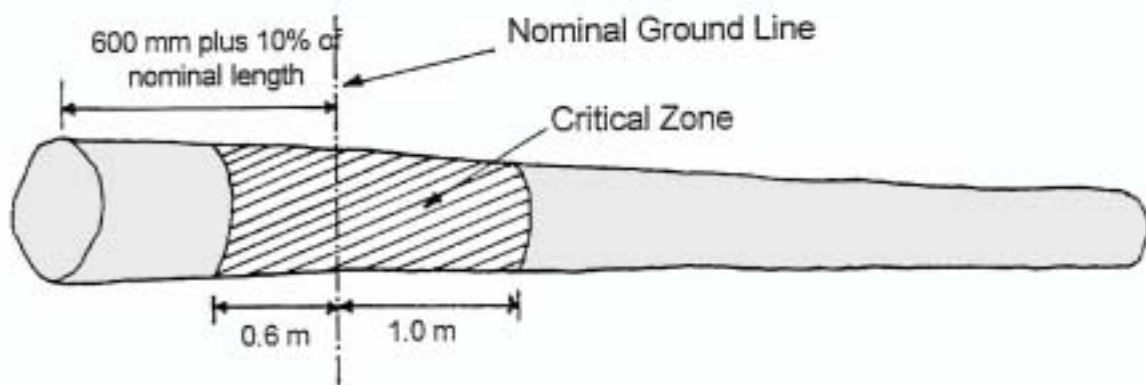


Figure 10: Location of the critical zone in Transmission Poles
Source Queensland DPI-Forestry

Hardwood poles are 8.0 metres or greater in length. The standard lengths are fixed at 1.5 metre intervals above the minimum; ie 8.0, 9.5, 11.0, 12.5 and so on. Poles are graded into strength groups (with values in kiloNewtons) based on their thickness at two points on their length: 2m from the butt end (D line) and at the head (top end). The strength rating determines the load that can be placed on the pole; that is, the strength requirement necessary to withstand wind loading. To apply the dimensions poles must first be assigned to one of the three strength groups based on species. For example Grey Gum (*Eucalyptus punctata*) is in strength group one, Red Ironbark (*Eucalyptus sideroxylon*) in group two and Forest Red Gum (*E. teriticornis*) strength group 3.

The details are given in the Australian Standard for lengths up to 23 metres and for 4 strength groups per length. The table below contains a small sample as an illustration.

Table 2: Dimension for Critical Diameters, Pole length 9.5m, Strength rating 5kN

Species Strength group	Minimum Diameters (mm)	
	"D" line	Head
1	210	135
2	225	150
3	240	160

For the same designed strength, poles of lower strength species must be larger in dimensions. Because the suspension of power lines is so critical, the acceptable defects are restricted in size and occurrence. For example no rot of any sort is accepted in the critical zone and only small lens shaped examples elsewhere and these must be cleaned out when the pole is made. Small occurrences of insect or grub holes are permitted. Only a small sized pipe (less than 20% of diameter) will be tolerated at the butt only. There are to be no gum pockets, dry side, knots or mechanical damage in the critical zone and only small amounts of these defects elsewhere in the pole. The way in which sound knots and limbs are trimmed is closely defined. The other important property of poles is that they are straight or nearly so. Straightness is assessed in two ways: as butt sweep in the bottom 2 metres of the pole and as overall straightness. For butt sweep the displacement is measured by extending the line of the pole sides from the 2 metre point to the butt. The enlarged dimension must not exceed 125% of the butt diameter for poles where the D-line diameter is greater than 400 mm, or 150% for poles of smaller diameter.

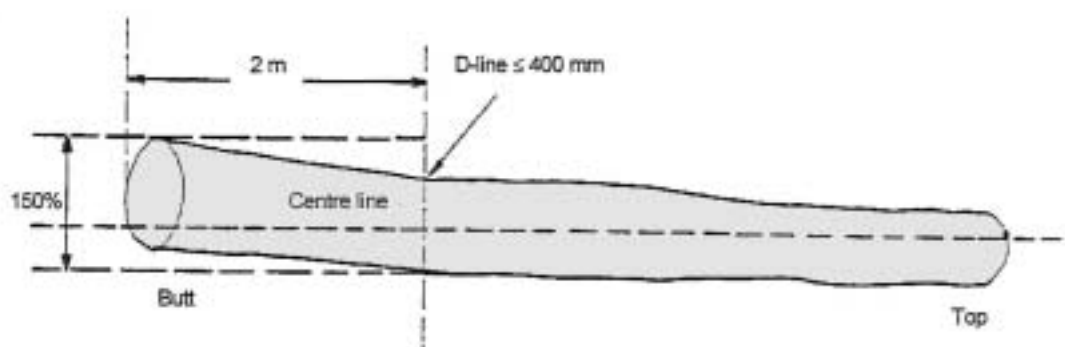


Figure 11: Measurement of pole straightness at the butt
Source Queensland DPI-Forestry

Other assessments of straightness are more complex and rely on defining the type of curvature and applying a set of criteria from the Australian Standard. Sweep is a curvature of large radius, crook is a localised curvature of small radius, kink is an abrupt offset occurring in a section of a pole. Each type of curvature is tolerated to a different degree as specified in the standard. The way in which the different curves are assessed is shown below. While these may seem complicated, to the lay person, the system of grading poles is well understood in the industry.

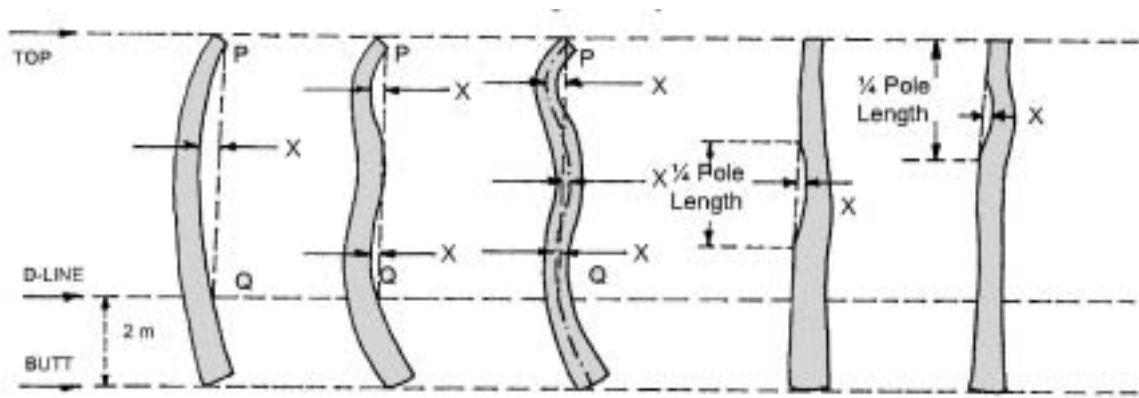


Figure 12: Illustration of Straightness Assessment in Transmission Poles
Source Standards Australia (AS 2209)

The methods of assessment for poles may seem complicated and onerous, they are necessary because of the critical nature of the uses to which poles are put. Poles are the most valuable type of forest produce. A 9.5 metre pole, suitable for preservation is valued at \$17.16 per pole (Royalty) for rating 5kN. The most valuable poles are worth more than \$1000 before treatment. For example the most valuable, a 32 metre pole of strength rating 20kN is worth \$1652 (July 2000).

3.8 Cypress Pine Sawlogs

The native softwood species of cypress pine (*Calltris spp.*) grow in western districts of NSW and Queensland in areas of comparatively low rainfall. The trees are generally smaller than other merchantable species but are highly regarded for the decorative, hard, termite resistant wood they produce. Logs of cypress pine are graded in the same manner as other species but different dimensions apply.

Logs must be : longer than about 2.6m, greater than 16 centimetres under bark at the butt end and 12-14 centimetres diameter under bark at the upper end of the log. Heart defect is unacceptable if the butt diameter is less than 22 cm (under bark); otherwise it must not exceed one fifth of the diameter. The trees must be substantially straight with sweep (deviation from straight over 2.6 m) not exceeding 20% of the log centre diameter. Knots greater than 12 cm must not occur closer than one metre apart. Other features such as insect holes, spiral grain and dry patches (stem damage) are restricted. However logs which do not comply with this description may be taken at buyers discretion.

3.9 Pulpwood

This product usually has the lowest value of all forest products and is often treated as a residue. A typical instruction to cutters is "when a pulpwood market is available, logs which are unsuitable for other products should be segregated as pulpwood". Some species, particularly those which have dark coloured wood may be unsuitable for pulpwood. Pulpwood specifications accept shorter lengths and diameters than for other products. Straightness is only important if the log cannot be debarked or reduced to chips. There is often some limit set on moisture content and or stain. Often the specification will take the form of specifying time of delivery; for example within one month of felling. Logs with rot or extraneous matter such stones, bitumen, plastic or charcoal attached to them will be excluded.

4. Plantation Timber - Exotic and Native Species

Plantation timber is produced under conditions that are much more controlled than for native forests. Many of the defects seen in logs from native forests are rare and unimportant for plantation timber. The specifications are therefore much simpler; but the general principles apply and log specifications for plantation timber have clearly been derived from the more encompassing native forest specifications.

As for logs from native forests, there is a value gradient from preservation logs, veneer logs, sawlogs down to pulpwood. The product produced in the highest volumes is the sawlog. Specifications for this are given in detail and the other products explained as variations.

4.1 Sawlogs - Pine species

General conditions for sawlogs are that they are substantially free from blue stain and rot, are not from a dead tree, are at least 2.4 metres long (plus appropriate cutting allowance), have a minimum small end diameter of 15 cm, are substantially straight and free from mechanical damage or manufacturing defects. Branches must be trimmed close to the log (within 35mm of the bark is a common specification) and there may be general limits on knot size. Abrupt changes in diameter (of the kind which may occur above a large branch whorl) where the reduction is 40% or more are not accepted. Logs usually have to be delivered to the mill within 14 days of felling to ensure that moisture content remains high. External damage scars (dryside) are not accepted.

Straightness is an important feature of sawlogs but the limits to acceptability may be specified in a number of ways. In common with logs from native forests, deviation from straightness is more important the smaller the diameter of the log. Some specifications use a simple formula that results in a sliding scale of acceptability; eg " $\frac{d}{4}$ ". This means that the maximum distance from a straight line from end to end of the log must not exceed one quarter of the small end diameter of the log when measured under bark. Similar definitions are "one fifth of centre diameter over bark", "one fifth of small end diameter under bark, over a 3 metre length".

In South Australia the State agency, Forestry SA applies a set of sweep (ie curve) limits by log diameter classes.

Table 3. Maximum Acceptable Sweep Allowances, South Australia (mm)

Small end Diameter (mm)	Log Length (metres)				
	4.0	4.3	4.9	5.5	6.1
150-199	60	75	75	80	80
200-299	65	80	85	85	90
300-399	70	85	90	95	100
400 +	75	90	100	110	120

Source: Forestry SA

The general trend of accepting more deviation if the logs are larger is similar to the formula approach.

For Slash Pine (*Pinus elliotii*), which is generally of smaller diameter than radiata pine, the minimum small end diameter may be as little as 12 centimetres and excessively flared butts may be trimmed before extraction or reduced in diameter at the mill before sawing to prevent jamming machinery during the sawing process.

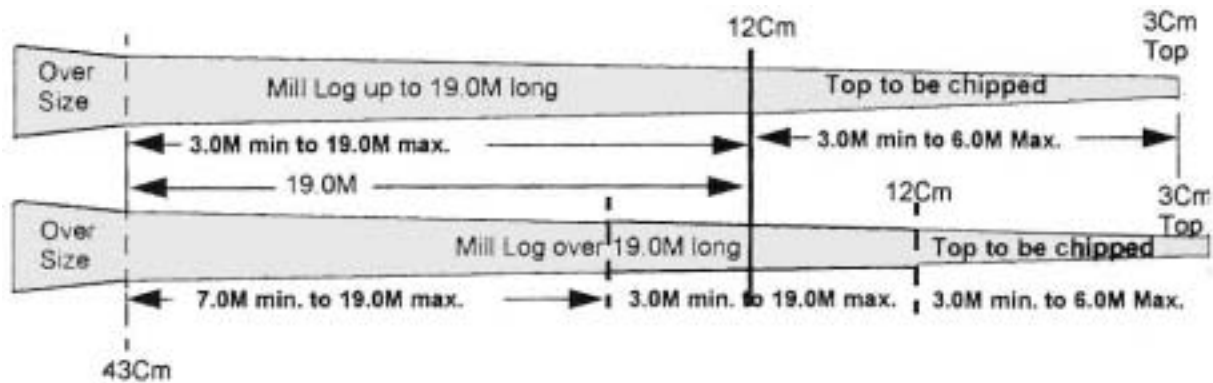


Figure 13: Illustration of log cutting for Slash Pine
Source: Industry

The log length most usually preferred for pine logs is 6.1 metres (including crosscutting allowance). Except for Queensland where some logs are harvested in lengths up to 19 metres, the six metre log is the usual maximum. Other log lengths which are generally applicable are 5.5m, 4.9m, 4.3m and 3.7m; (all including cross cutting allowance).

4.2 Veneer logs for Plywood Manufacture

As for logs from native forests, ply logs are based on a unit of 2.5 metres (to allow for losses during manufacture) plus cutting allowance. The most usual length is 5.1 metres (ie $[2 \times 2.5\text{m}] + 0.1\text{m}$). Sometimes a 2.6m log is accepted. Log manufacturing standards are generally higher than for sawlogs; in particular that the log ends be flat and square. This is for the same reason as for native logs, so that the lathe “dogs” (the spike grips on the chuck which turns the log) have a firm surface to attach to. Branches must be trimmed as for sawlogs and as flush as possible with the log surface.

Some grades of plywood logs include knots but they must be small; 75 millimetres if green or 60 mm if dead are common limits but as little as 50 mm might be specified. Changes in diameter above a whorl must be less than 20% of diameter and logs must be substantially straight. The permitted deviation from straight may be as little as 2.5 cm over a billet length, but a more usual limit may be up to 15 cm over a 5.1 m length. Minimum diameter is usually 300 mm inside bark. Ply logs must be of round cross section with the shorter diametric axis of the log being no less than 20% shorter than the longer diameter axis.

4.3 Pulpwood Specifications

The requirements for pulpwood are less stringent than for sawlogs. The acceptable small end diameter is less - a minimum of 75 mm may be accepted although 100 mm is a more common lower limit. Length is often only specified by a minimum value, 3.6 metres is common and, as the logs are going to be reduced to chips before use, random lengths above the minimum are often accepted up to the limit set by transport or handling requirements. Manufacturing requirements are more tolerant than they are for sawlogs with longer branch stubs being accepted and logs only needing to be cleanly crosscut. The only impediment to accepting crooked logs is generally that they must be able to be handled by machinery in the mill. The only other common specification is that it is usual to specify that the pulplogs contain no foreign matter such as stones, charcoal, wire or other imbedded objects. Any form of decay is unacceptable and the logs must be fresh, ie to ensure that blue stain is minimised and that moisture content remains high.

4.4 Preservation Logs

These are logs to be used “in-the-round” for : fence posts, rails, strainer posts, vineyard poles, house building and power transmission poles. The smallest posts are 75 mm in diameter at the small end and 1.8 m long. Strainer posts may be up to 200 mm at the small end.

Lengths can vary upwards from 1.8 m, in 0.3 m steps to 4.8 m. Because they are seldom re-manufactured, posts must be of good appearance and have only small knots in order to carry their load on an individual basis. Knots of 25 mm or less are usually permitted.

For aesthetic reasons preservation wood is required to be substantially straight. A sweep of 10 mm per metre of post may be tolerated. Preservation wood must also be free of incidental defects such as fractures, dryside, unsound knots, termite and other insect damage, clusters of cone holes and fungal attack except for blue stain. Superficial axe cuts or marks from debarking machinery may be accepted if minor.

4.5 Special Grades

Although there is a hierarchy of general log uses, quality classes and implied values, there are some logs which don't fit these general categories but which may be useful for some purposes. These logs are of poorer quality when judged by the conventional rules. However they may be valuable for some uses. For some sawmills which have designed their sawing configuration to efficiently produce a standard out-turn of structural material, logs can sometimes be too large in diameter for their machinery. Rather than saw these logs at a loss, the managers may prefer to re-sell them to smaller more specialised mills with different sawing equipment. These mills may produce a different product for which large sizes are an advantage and perhaps one which is more tolerant of the defects often associated with large branch diameter, such as large knot size. Examples of such products are: fencing boards, pallet boards and large "landscape" materials such as "garden sleepers". Grades for such logs are largely informal and include such features as over-size diameter, over-size knots or logs mis-manufactured in the forest - for example logs cut too short.

In South Australia a number of such special log grades have been formally defined. "Break" logs are those cut from trees at stand edges or along fire breaks. "D" class break logs must be at least 300 mm or more in small end diameter. Individual knots are tolerated up to 200 mm and up to two knots per log may be up to 300 mm in diameter provided that no knot exceeds half the small end diameter of the log. Other properties are the same as for ordinary sawlogs except that the acceptable amount of sweep is approximately twice that which is normally tolerated. "E" class logs are described as "large, rough break logs" if judged by the usual standards. Knots must be less than 300 mm except that up to three knots per log, up to 350 mm in diameter are permitted as long as no knot exceeds half the log small end diameter. The sweep tolerance is approximately twice that for orthodox sawlog grades. "Recovery" class logs are short logs recovered from trees which are otherwise umerchantable. Lengths are usually short - down to a minimum of 2.5 metres and up to 3.7 m only. Individual knots are only accepted up to 100 mm although one knot per log up to 150 mm in diameter is permitted. Sweep is more tolerated than for general sawlogs.

4.6 Export Log specifications

The export trade in softwood logs has recently increased in Australia. The destination of the logs is mainly the Asian countries of Japan, China and Korea. Australia is a relatively new and minor player in this trade which is dominated by the USA, Canada and Russia. Other countries with substantial export trade in the same softwood species as Australia are New Zealand and Chile. The species most exported is radiata pine but some logs of *Pinus ponderosa* have also been exported. The main ports through which logs are exported are Portland and Geelong in Victoria and Port Kembla in NSW as well as Burnie and Bell Bay in Tasmania.



Figure 14: Export logs being marshalled at the wharf in Geelong

The advent of the export log trade has been particularly helpful to many forest owners as it has allowed them to sell logs for which there is no local market. In some cases these logs have been the poorer quality logs produced in a locality where there is no local market for that grade, (eg where there is no pulpmill). In other cases the logs are of good quality and export provides an alternative market that may not be synchronised with the Australian business cycle. The export market may also be of use to Farm Foresters. Exports tend to be on a boat-by-boat basis and the normal requirements of continuity of supply that are essential for an industry do not have to be met. Sales can be made on a "one-off" basis.

Other countries may use building systems and conventional timber sizes which differ from those current in Australia. Although frame construction methods are becoming more accepted, the traditional Japanese house is based on the "post and beam" system where beams with a 4 metre span rest on 3 metre posts. Log lengths exported to Japan tend to be combinations of 3 and 4 metre lengths. Some Asian countries make plywood based on a sheet size of 3 feet by 6 feet (*ie* 0.9 x 1.8 m). Log lengths tend to be based on multiples of 3.6 metres for those markets. Logs sold to China may be specified in lengths shorter than for other markets to reduce weight because some logs are still "man-handled" at their destination.

In general however logs are longer than for the domestic market as this facilitates handling at the wharf. A disadvantage of the export trade is that logs which are rejected at the wharf or over-supplied often cannot be resold on the domestic market without re-manufacture to local specifications.

Table 4 Common Lengths for Export Logs

Japanese Sizes (m)		Korean Sizes (m)	
Sawlogs	Veneer logs	Sawlogs	Veneer logs
12.13	5.23	11.13	7.83
8.13	2.63	7.43	5.93
4.13		5.53	4.03
		3.73	
(1)	(2)	(3)	(4)

Notes:

- (1) multiples of 4 m beam length + 0.13 m cutting allowance
- (2) multiples of 2.5 m + cutting allowance
- (3) multiples of 6 ft + cutting allowance of 4 or 9 inches
- (4) multiples of 6 ft 2 inches + 9 inch cutting allowance

Pulplogs for export are commonly 3.73 metres in length.

4.7 Plantation Hardwoods

There is comparatively little experience in using plantation grown hardwoods in Australia. Most experience to date has been with pulp crops. In common with pulplogs from pine plantations, these logs are designed to be reduced to chips before processing and the specifications are aimed only at rejecting logs which are badly manufactured, too small or too large to be handled in the mill. Species recognised at pulpmills include: Blue Gum (*Eucalyptus globulus*), Mountain Ash (*E. regnans*) and Shining Gum (*E. nitens*).

Logs are to be delivered without bark and acceptable log dimensions are: greater than 3 metres long and less than 12 metres, greater than 10 centimetres small end diameter and less than 70 centimetres sed. However in some cases Blue Gum logs are used down to 50 millimetres small end diameter. Pulplogs may contain checks, cracks and small gum veins, sound knots and cross grain.

As with all pulp logs freedom from attached "impurities" is important and logs must be free of dirt and not contain charcoal, gravel, or metal objects. Eucalypt pulplogs from dead or fire killed trees may be acceptable if they otherwise conform to the above specifications and do not form more than one third of the volume input.

5. Generalised Sawlog Specifications

Log specifications provide a means of deciding if a given log is merchantable or not and if so where in the quality scale it lies. Forest growers need to design their silviculture so that they maximise production of the preferred log types. However log specifications are designed to be applied log by log and in any case may change slowly over time in response to market and manufacturing developments. The generalised specifications given below are suggested in the hope that they will provide growers with general but stable targets for future production. They do not represent the current targets of any region in Australia but are intended to be a guide to the qualities of logs which are recognised as acceptable in all regions.

These target specifications are only given for sawlogs. These are the logs which most growers will aim to produce. If there is a market, the best sawlogs will be suitable for veneer logs and likewise logs too poor for sawlogs may find a sale as pulplogs.

5.1 Native Forest Sawlogs

To be acceptable in the market sawlogs from natural forests should be:

At least 2.4 metres long (plus cutting allowance),

and of at least 25 centimetres diameter at the small end, under bark.

The logs must be substantially straight and properly manufactured with ends cut square, branches and large limbs trimmed, and the stem cut so that dry side scars and rot pockets are not included in the log presented for sale. Logs should have less than 50% of their volume lost to internal rot or pipe.

In Queensland and NSW logs are graded as acceptable or not. In Victoria, Tasmania and Western Australia logs are graded into quality classes but the above description would define logs which are better than the poorest grade recognised in those States. These are roughly equivalent to the acceptable/ not acceptable grade barrier of Queensland and NSW.

5.2 Plantation Grown Sawlogs of Exotic Pine Species

To be acceptable in the market sawlogs from exotic pines should be:

At least 2.4 metres long (plus cutting allowance),

and of at least 15 centimetres small end diameter under bark.

Logs should be substantially straight with a maximum sweep (deviation from a straight line log end to log end) of 25% of the length over the minimum log length - up to 10 cm maximum. Logs must be properly manufactured with ends cut square and no shattered fibres or projecting splintered wood. The wood must be free of blue stain, rot and must not have been cut from a dead tree.

No single knot should be larger than 50% of the log small end diameter; up to a maximum of 75 mm measured across the shortest axis.

6. Price Variation for Exotic Softwood Logs

Prices obtained for the various logs grades are generally not publicly available. This is because they are usually incorporated into long term contracts between forest grower and wood processor and are therefore commercially sensitive and consequently confidential.

One source of information is the RIRDC sponsored "ANU Marketing Report". This is issued on a regular quarterly basis and contains prices for current sales - usually from private growers - which give an indication of prices being received by "Farm Foresters". The reports can be obtained on application to the Department of Forestry, Australian National University, Canberra 0200; or accessed via the world wide web at the address

www.anu.edu.au/forestry/info/marketreport/index.html.

Two State Government organisations publish average prices paid for timber they sell. These indicate the comparative value for different classes of logs and are useful to growers who are deciding on which product type to concentrate.

Table 5 Stumpages received for Exotic Softwood logs In Western Australia and South Australia

Sawlog Diameter (mm)	Western Australia		South Australia	
	* Rate \$/ m ³	Index	Rate \$/m ³	Index
< 150			17.52	35
150-200			19.42	38
200-250	18.70	56	30.35	60
250-300	26.17	78	40.44	80
300-350	33.62	100	50.57	100
350-400	41.09	122	60.60	120
400-450	48.57	144	69.61	138
450-500	56.02	167	76.89	152
500-550	63.48	189	79.10	156
>550			81.32	161
Veneer Log G1	77.09			
G2	57.15			
Poles	95.81		37.14 / 46.42**	
Posts	29.81			
Pulpwood	11.96			

*Sources :Department of Conservation and Land Management, Western Australia
Department of Primary Industry - Forestry, South Australia
Both price lists issued 1/7/2000*

** "base stumpage", not including roading, inforest and administration costs*

*** length less than 6m / greater than 6m; mean of 5 diameter classes*

The table illustrates prices obtained for sawlogs by two prominent growers of exotic timbers. In general terms prices, per cubic metre, rise rapidly with diameter class until the logs reach 30-35 centimetres in diameter. Logs larger than this are still worth more per cubic metre but the rate of increase is not so great. Many sawmillers agree that logs are worth more as their diameter increases but claim that logs are worth very little more per cubic metre if larger than about 35 cm small end diameter. They argue that the main advantages of larger logs - reduced handling costs, better utilisation, ability to cut more valuable dimensions, have mostly been obtained when logs reach 35 cm. This viewpoint is very much conditioned by the type of machinery within the sawmill. For example sawmillers who operate bandsaws generally prefer larger logs than those with gang saws.

7. The Sawmillers View of Logs from Small Scale Growers

In general owners of small woodlots receive less per cubic metre for their wood than the larger growers. The reasons given for this are controversial and, in part, reflect the bargaining stances taken by both growers and processors. Despite those differences it must be remembered that sawmillers are generally the major customers for the wood produced by farm foresters and that therefore some attention must be paid to the customers viewpoint.

The objective of this report has been to explain the characteristics which make up log quality and by this means help growers to produce a more valuable crop. Sawmillers have, without exception, cooperated with this project because they "have seen some long term benefits for their business" in this form of knowledge sharing.

High log quality is only part of the reason why wood is regarded as valuable. Millers have reported that many farm foresters when selling wood for perhaps the first time expect some concession from the purchaser. On many occasions it was claimed that companies used the same set of log grade rules for both in-house and external purchases. They therefore saw no reason to use a less stringent set of criteria when purchasing from a small grower; all purchases were treated as business transactions. The only exceptions mentioned were school blocks where rural schools had and tended blocks of trees. These were often logged as a "public relations" exercise despite being less than the minimum economic size. It was stated by sawmillers and forest growers in three States that the minimum economic size for a timber block is 20 hectares. The rationale is simple. It is an area which could yield about 1000 tonnes of wood in a thinning. This is said to be the minimum economic yield required to justify transport and set-up of logging machinery. Sawmillers also stated that although some grades, such as veneer logs, were worth a premium, they might occur in volumes that were too low to segregate economically. In such cases they would be purchased at a lower price than their intrinsic value would indicate. Features of a wood lot which would reduce its economic worth were said to be: isolation from the mill or other forests being harvested, poor access on site (ie poor quality roads, steep terrain, poor ground surface) and poor quality logs. If stands have received no thinning it is common to find they contain high levels of malformed trees. If establishment was poor and stocking reduced, the trees will have enlarged branches. No sawmillers were prepared to pay a premium for pruned logs as all claimed that this resulted in no improvement for logs sawn to structural timber; currently the main market. This may be a comment more applicable to current than future markets. For example, premiums have been offered for certified pruned veneer logs.

An alternative market for logs that are perceived as low quality by millers is the export market. This market tends to operate in shipload batches and the log sale agents obtain the contents of each load from many sources. Both sawmillers and large forest growers use the export market as a way of quitting grades that are produced in surplus on the Australian market. However the market tends to fluctuate with international economic trends outside the growers control.

8. Acknowledgements

Full responsibility for the accuracy of the information and the interpretation of the facts presented here remains with the author. However I acknowledge that this report would not have been possible without the generous cooperation of many organisations and individuals.

The following organisations have granted permission to reprint excerpts from their published and internal documents:

The Department of Conservation and Land Management, Western Australia; Forestry Tasmania; the Department of Primary Industry - Forestry SA; the Department of Natural Resources and Environment - Forestry Victoria; State Forests of New South Wales, Department of Primary Industries - Forestry of Queensland and ACT Forests.

The following individuals are particularly thanked for their help to me while carrying out this project:

Stuart Austin	Big River Timbers, Grafton
John Clarke	CALM Western Australia, Perth
Ian Conley	Boral Timber Division, Herons Creek
Peter Crowe	State Forests of NSW, Albury
Max Evans	SOTICO, Perth
Belinda Field	Carter Holt Harvey Wood Products, Myrtleford
Bob Germantse	State Forests of NSW, Albury
Dennis Gould	Weyerhaeuser Australia Pty Ltd, Caboolture
Laurie Hein	Green Triangle Forest Products, Mt. Gambier
Neil Humphreys	Forestry Pacific Pty Ltd, Melbourne
Graeme King	State Forests of NSW, Coffs Harbour
Greg Levinge	Weyerhaeuser Australia Pty Ltd, Caboolture
Brent Lonn	Carter Holt Harvey Wood Products, Mt. Gambier
Ian McArthur	ACT Forests, Canberra
Keith Maplestone	Forestry Victoria, Melbourne
Peter Marshall	Australia Paper Plantations, Morwell
Brian McCormack	Queensland DPI - Forestry, Brisbane
Andrew Moore	Green Triangle Forest Products, Mt. Gambier
Peter Moore	Queensland DPI - Forestry, Brisbane
John Norrie	Boral Timber Division, Grafton
Bruno Notaras	Notaras Sawmills, Grafton
Spiro Notaras	Notaras Sawmills, Grafton
Lew Parsons	Forestry SA, Mt. Gambier
Peter Paunovic	State Forests of NSW, Coffs Harbour
Michael Plummer	Auspine Export, Tarpeena
Ian Sedger	Pentarch Forest Products, Geelong
Richard Schaffner	Wespine Industries Pty Ltd, Bunbury
Leith Shepherdson	Wespine Industries Pty Ltd, Bunbury
Phil Stelling	State Forests of NSW, Queanbeyan
Peter Stiles	Weyerhaeuser Australia Pty Ltd, Tumut
Geoff Stringer	Hyne & Son, Pty Ltd, Tuan
Bob Style	Wespine Industries Pty Ltd, Jandakot
Malcolm Tonkin	Hancock Victoria Plantations Pty Ltd, Melbourne
Rick Tranter	Koppers Timber Preservation Pty Ltd, Grafton
Jeff Walls	Queensland DPI - Forestry, Brisbane
Robert Williams	Brown and Dureau Sawmills, Morwell
Michael Wood	Forestry Tasmania, Hobart

John Clarke, Neil Humphreys, Keith Maplestone, Peter Paunovic, Jeff Walls and Michael Wood are particularly thanked for their helpful comments on an earlier draft version of this report.

9. Appendices

9.1 Appendix 1: Description of Log Grades

Every State forest agency in Australia has developed specifications for the logs sold within its jurisdiction. Sales between private growers and wood processors either use the same grade definitions or others derived from the specifications developed by the State agencies. Although the general principles are the same throughout Australia, the precise definitions of grades vary. This leads to confusion when comparisons of prices and qualities are attempted. The definitions of grades used in the various States are given below. They are either quoted directly from official publications and documents; or inferred from official documents.

A 1.1 Western Australia

Uniquely, the log grade descriptions applicable in WA are published in a document available (for purchase) by the public. This is entitled "Manual of Management Guidelines for Timber Harvesting in WA". It is available from the Department of Conservation and Land Management, Perth.

Native Forest Sawlogs

Premium Grade Sawlogs:-the highest quality sawlogs that may be sold for specific end uses such as seasoned timber for furniture manufacture.

First Grade Sawlogs:- the most common type of sawlog cut. The minimum length and minimum crown diameter under bark is generally 2.1 m and 200 mm for Jarrah, and 2.4 m and 300 mm for Karri, and the minimum amount of millable wood is generally set at 50% as assessed on the worst end.

Second Grade Sawlogs:- sawlogs below the standard of first grade sawlogs. Unless otherwise indicated, the minimum standard of a second grade sawlog is 2.1 m in length and 250 mm in crown diameter under bark, with at least 30% of millable wood assessed on the worst end.

Third Grade Sawlogs:- sawlogs below normal second grade log quality, that may be sold by the Department. Third grade sawlogs have no minimum standard and selection of such logs from reject material on bush landings is the responsibility of the buyer.

Small Sawlogs:- sawlogs with diameters under bark of 150-200 mm.

Short sawlogs:- sawlogs of a specific quality below a specific length, that may be sold for specific end uses.

Feature Sawlogs:- sawlogs with desirable features of grain, colour, shape or size sold for specialty end uses. Two grades are recognised "high" and "low".

Softwood Sawlogs

Premium Grade Sawlogs:- High quality pine sawlogs of at least 300 mm in diameter under bark and 4.8 m in length. First class Sawlogs are obtained from plantations at least 25 years of age.

Second Grade Sawlogs:- Lower grade pine sawlogs of diameter down to 200 mm and length down to 2.1 m.

Third Grade Sawlogs"- sawlogs below second grade sawlogs, selected by the buyer.

Small sawlogs:- sawlogs of small end diameter under bark between 150 and 200 mm.

Sawlogs:- sawlogs where stumpage is based on mid-log diameter rather than a class of log. (eg where an infra-red scanner is operational.)

Veneer Logs:- Veneer or peeler logs are intended for slicing or peeling into sheets for the production of veneer or plywood. Veneer logs must be of a consistently high quality with much less allowable defect than sawlogs. Softwood peeler logs which are prepared in good faith to the set specification but are below standard are sold as second class peeler logs.

Bridge and Jetty Timbers:- These are hardwood logs intended for use in the construction of bridges wharves and jetties. Like veneer logs, bridge and jetty timbers must be of a consistently higher quality than sawlogs. There are four types of bridge and jetty timbers: piles, stringers, corbels and bedlogs. Bridge and Jetty timbers are originally produced from the forest as "unprocessed round timbers".

Poles:- Poles are long straight logs used in an upright position to support loads above ground. Poles are usually of smaller diameter than bridge timbers but must be of the same high quality.

Chip logs:- Chiplogs are Marri and Karri logs destined for conversion into woodchips.

Mining Timbers:- These are generally short straight Jarrah logs used to support underground coal mines.

Charcoal Logs:- Jarrah logs destined to be converted into charcoal.

Particle Board logs:- Particle board logs are traditionally radiata pine and pinaster pine logs produced mostly from thinning operations, for conversion into particle board. Other species have been tested for this purpose.

Industrial Wood:- This is the specific term used to describe pine logs used for medium density fibreboard. It is also a general term to describe all wood used for industrial processes other than sawing.

Other definitions are listed for: Pine rounds for treatment, domestic firewood logs, minor forest produce (eg craftwood, fencing material, chopping logs, garden paving slabs, burls, forest debris)

The Manual contains technical definitions for 22 grades of native forest hardwood specifications and 11 grades of softwood logs from plantations.

A 1.2 South Australia

Radiata pine plantations

South Australia specialises in plantations of radiata pine and a number of log grades are distinguished. Sawlogs must be between 15 and 90 cm at the small end; lengths greater than 4.0 m and knots less than 75 mm. Ply logs (veneer logs) are straighter and have a larger diameter than sawlogs. "D" class break logs are logs cut from stand edges and may be shorter than other log grades and with larger knots. Sweep is also permitted to a larger degree. "E" class rough break logs are similar to D class but larger knots are tolerated. "Recovery" class logs are shorter and smaller than other classes and knot size is more restricted than for Break classes. Pulpwood standards vary according to contract but this class accepts a smaller minimum size than other classes. Preservation Roundwood is wood for posts rails and strainers. Short lengths are accepted and diameter may be as small as 75 mm.

A 1.3 Tasmania

Native Forest Logs

Veneer Logs:- These are sold in two qualities (VQ1 and VQ2). Veneer Quality one logs are logs in which the whole of the log meets the veneer log specification. Veneer quality two logs are those from which at least a 250 x 250 mm flitch, which will meet veneer quality can be recovered from the log. Veneer "logs" can also be sold as flitches (sawn baulk) in which case all the flitch must meet veneer standards but the minimum size is 150 x 150 mm.

Eucalypt Sawlogs:- Three grades are recognised, (Categories 1,2 and 3).

Category One and Category 3 sawlogs are first class sawlogs, generally with minimal defect.

Category one has historically been used to describe logs from mature and pro-mature trees while Category 3 is used to describe logs from re-growth forests. Category two logs are second class sawlogs, generally with some external defects such as limbs and bumps.

Category Eight logs are those which do not meet other specifications but which may be taken at the customers' discretion. Usually at least one quarter of the log face at each end will consist of solid wood suitable for sawing.

Special species grades:- Tasmania produces wood, in relatively low volumes, from a number of species with special qualities. The best known are Blackwood (*Acacia melanoxydon*), Huon Pine (*Lagarostrobos franklinii*) and Myrtle (*Nothofagus spp.*). For these species two grades are recognised, Category Four sawlog and Utility log. The main difference between the grades is the number of longitudinal quarters of the log that are free of defect.

Eucalypt peeler grades are logs sold, for the manufacture of plywood, on the export market using grade definitions that vary with each customer.

Roundwood: the main product is utility poles and these conform to the Australian Standard.

Radiata pine logs

Log grades mainly follow the general specifications described in the main text.

A 1.4 Victoria

Eucalypt Sawlog Grades

Four grades are recognised (A,B,C and D). The chief method of discriminating between the grades is the size of the pipe in relation to the size of the log. The highest quality grade (A) has the greatest amount of defect free wood. Once separated into grades using the internal defect as a category, other criteria such as loose gum veins, tight gum veins, stain and sloping grain are applied to determine the final classification. The poorest grade, D, may be taken at buyers discretion.

Softwood Plantations

There are potentially seven grades of sawlogs sold in Victoria. These are based primarily on log centre diameter under bark and the amount of acceptable sweep. In practice many of these grades are effectively merged and grades acceptable to specific to customers obtained.

The names of grades recognised include: Short and Standard Veneer logs, Thinnings, Six Metre Sawlogs and Standard Sawlogs (ie shorter). Small sawlogs (small end diameter below usual limits), Residual logs (poor quality, below other grades), and pine Preservation logs. Some grades are named for specific supply agreements with specific sawmills. These may include "Oversize" (ie large diameter logs), "S" grade (small knots), "B" grade (large knots) and "Standard" (intermediate knot size) grades.

A 1.5 New South Wales

Native Forest Logs

The grades recognised by State Forests of NSW for hardwood logs include

- poles plies and girders
- Veneer logs
- "Quota" sawlogs
- Small graded logs
- "Salvage" logs

- Pulpwood

"Quota" logs are good quality logs which a purchaser who has contracted to buy logs must accept. "Salvage" logs are logs below Quota standard and may be taken, at a reduced price, at the customer's choice. Small logs are those of less than usually acceptable diameter but which otherwise generally conform to Quota log quality. The specification of a grade of log does not imply that it can or will be sold at that quality. For some categories supply may exceed demand. The rules may be applied differently for the many different species available in NSW. For River Red Gum (*Eucalyptus camaldulensis*) and Alpine Ash (*E. delegatensis*), the rules which distinguish Quota and Salvage logs are similar to those which apply in Victoria.

White Cypress Pine

Acceptable logs for this species (*Callitris glauca*) are defined; with the provision that logs of poorer quality may be taken at buyer's option. The minimum standard for Cypress pine logs is one where merchantable lengths of at least 2.4 m length can be produced.

Exotic Plantation Species

Four main product type are sold by State Forests of NSW. They are: Veneer logs, Sawlogs, Pulpwood and Preservation logs. Sawlogs have a minimum small end diameter of at least 16 cm and are at least 2.4 m long. Knot size and straightness standards are defined. Veneer logs are essentially superior sawlogs in terms of straightness and diameter. Pulplogs are of poorer quality than sawlogs in terms of knot size and sweep and may be as small as 8 cm in sed.

A 1.6 Australia Capital Territory

Exotic Plantation species

Three products only are produced, sawlogs, export logs and preservation roundwood. There is no market for pulpwood as such in the ACT. Sawlogs are defined for each supply customer but follow the usual criteria. Minimum length is 2.4 metres and minimum diameter is 12 centimetres but these are for special purposes only such as "Case Logs" (ie for packing material). More usually log minimum dimensions are 3.7metres and 18 cm. The minimum diameter for preservation logs can be 75 mm.

A 1.7 Queensland

Native Forest Logs

The grades recognised by the Queensland DPI - Forestry are very similar to those recognised in NSW. They include:

- Poles, piles and girders
- Compulsory Logs
- Optional logs

"Compulsory" logs are those defined as being of good quality and which a purchaser must accept as part of their volume allocation. "Optional" logs may be taken at customer's choice.

Cypress Pine

Cypress pine (*Callitris spp.*) logs are classified as compulsory or non-compulsory. The quality characteristics which define a Compulsory log are defined by dimensions and quality. The main

quality considerations are the presence of heart rot (pipe) or a combination of defects which prevent 50% of the volume being utilisable such as grub holes, “yellow doze” and spiral grain.

Exotic Plantation Species

Logs are graded as Sawlogs, standard or select, pulplogs and round timber. Select sawlogs are pruned. The precise definition of an acceptable sawlog varies with specific supply agreements but in general logs must have a small end diameter greater than 12 cm and contain at least 2 x 2.4 m lengths or one 3.0 m length of merchantable stem. Sweep must not exceed 20% of the small end diameter. In addition to being pruned a Select stem must have a tree diameter at Breast Height (1.3m) of 30 cm.

Pulplogs have a minimum small end diameter of 7 cm and contain at least one reasonably straight log of minimum length 4.8 m.

Round timber must have a minimum small end diameter of 7 cm and at least 2 x 2.4 m straight sections.

A 1.9 Export Logs

There are many export grades for logs. Each grade tends to be for a specific country and product. The following are those currently in operation. All radiata pine unless otherwise stated.

"A" grade	a high quality sawlog
"TP" grade	an industrial peeler grade (plywood with knots)
"KP1" grade	a high quality peeler grade for the Korean market
"KP2" grade	a peeler grade for slightly smaller logs, for the Korean market
"AA" grade	an industrial peeler grade (plywood with knots)
"J" grade	a sawlog or peeler grade for the Japanese market
"J2" grade	a lower quality sawlog for the Japanese market
"JM" grade	a smaller peeler or sawlog
"H" grade	a small peeler grade
"K" grade	a high quality sawlog for the Korean market
"P" grade	Ponderosa pine, sawlog size
"P14" grade	a small sized log down to 14 cm small end diameter
"KM" grade	a smaller sawlog for the Korean market
"P10" grade	post sized logs down to 10 cm small end diameter
"KI" grade	a rough case or sawlog grade for Korea
"KA" grade	a high quality sawlog for Korea
"SP" grade	a sawlog/ pulpwood grade

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