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Splitting of W.A. Sheoak
(*Allocasuarina fraseriana*)

Logs Stored under
Water Spray or Dry Stockpiled

by G.K. Brennan



Report No. 5
August 1988



Wood Utilisation Research Centre

Department of Conservation and Land Management

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SUMMARY

The major factors causing log degrade during storage in a dry stockpile are end splitting, checking and insect attack. Splitting and checking are caused largely by the release of growth stresses when a log is cross cut or sawn into timber. In this study, small and mature W.A. sheoak (*Allocasuarina fraseriana* (Miq.) L. Johnson) logs were stored in a dry stockpile or under water spray over summer/autumn. Logs in the dry stockpile degraded rapidly, having moderate and major splits and checks after seven days, and after 270 days four logs had split in half. Storage under water spray resulted in minimal splitting and checking. The only insect damage occurred on four mature logs stored in the dry stockpile.

INTRODUCTION

The timber of W.A. sheoak (*Allocasuarina fraseriana* (Miq.) L. Johnson), which grows in the south-west of the State, has the typical broad medullary rays of the genus and when sawn on the quarter shows an 'oak' figure. It is used for furniture, decorative hardware and turnery, roofing shingles, flooring, panelling, and also makes excellent fuelwood. Until the advent of the aluminium cask, it was a favoured species for beer barrels (Bootle 1983).

Prior to converting sheoak logs into sawn timber, it is often necessary to store the logs in a manner that prevents degradation. The extent to which a log degrades during storage is determined by a combination of factors. These include: susceptibility to insect and fungal attack, time of felling, climatic conditions at the storage site, time length of storage, and the amount of growth stresses present in the log (Rawlinson 1968).

In the case of insect attack, most pinhole borers attack timber soon after felling, but some species, notably from south-eastern and Western Australia, can degrade wood in living trees (Neumann and Harris 1974). The sapwood of sheoak is reported to be susceptible to powder post borer (*Lyctus* spp.) attack (Forest Products Association 1985.) and the bardee borer *Phoracantha semipunctata* attacks dry stockpiled unbarked jarrah logs (P. Shedley¹, personal communication). A joint study involving the CSIRO Division of Forestry and Forest Products and the Department of Conservation and Land Management is investigating how susceptible sheoak sapwood is to *Lyctus* spp. attack, particularly *L. brunneus* Steph. which is the most common species found.

Logs affected by borers are unsuitable for conversion into the more profitable 'select' or 'standard' grades because of borer holes, and can be marketed only as scantling.

The end splitting and checking of logs is largely caused by the release of growth stresses when the log is cross cut. The size of these defects in small diameter regrowth logs may be double those in mature logs (Bootle 1983). After felling radial cracks may appear in the log, particularly if it is stored in full sunlight. Cracks in the log due to faulty tree-felling techniques appear as tangential rather than radial cracks (Hillis 1978).

Usually most end splitting of the logs will occur within a week of felling. However, additional splitting can occur during sawing, when longitudinal bending of flitches occurs due to residual stresses in the log. These cracks and splits can be accentuated during drying (Hillis 1978).

Storage of logs under water spray has been frequently recommended as a method to reduce end splitting and checking, and it has been demonstrated satisfactorily with *Eucalyptus grandis* and *E. pilularis* (Hillis 1978).

¹. Mr. P. Shedley, Department of Conservation and Land Management, Como.

This study was carried out to compare the effects of storing small and mature sheoak logs under water spray, with storing in a dry stockpile in direct sunlight. The two methods were assessed by the comparative amounts of log splitting, checking, and insect attack.

MATERIALS AND METHODS

The sheoak logs were extracted from Bristol Block, Collie District by Collie sawmiller Mr G. Saunders. The site where the sheoak was logged is located in the Collie Coal-basin, on a mid-slope area, with grey sand and Havel site type 'J' (Havel 1975). This area was cut over for W.A. sheoak approximately 25 years previously and contained patches of smaller undamaged trees.

The small W.A. sheoak logs were cut from trees with a diameter over bark at breast height (d.b.h.o.b) of 25 cm or less, and having sapwood around the periphery of the tree. Mature logs were derived from trees with a dbhob of greater than 25 cm. The majority of these trees had fire scars, and hence interrupted sapwood.

The small logs were in the diameter range 10 to 19 cm small end diameter under bark (s.e.d.u.b), and lengths ranged from 1.5 to 3.0 m. The mature logs were in the diameter range 20 to 70 cm s.e.d.u.b with similar lengths. The irregular buttress shape of the logs made it difficult to accurately determine log diameter using a diameter tape, therefore the maximum and minimum diameters were measured and the mean diameter calculated.

The logs were felled and delivered to the Wood Utilisation Research Centre (WURC) at Harvey on 24 October 1984. At the mill landing, logs were identified as either small or mature, and their s.e.d.u.b.s and lengths were measured. Any splitting and checking was recorded for both ends, and photographs taken of these defects.

Fissures that occur on the end of a log, but not extending all the way to the log perimeter are defined as checks. End splits differ from checks in that they start from the outside perimeter of the log, then radiate towards the log centre. Both checks and splits were assessed qualitatively as major, moderate or minor.

Five small logs and five mature logs were randomly selected and placed under water spray. At the same time, five small and five mature logs were placed in a dry stockpile in direct sunlight. All logs had their bark intact.

The degree of log end splitting and checking, and any evidence of insect attack, was recorded daily for the first five days then weekly for a further four weeks. A final assessment was done after nine months storage on the 22 July 1985.

A chi-squared test was used to compare the total number of defects in the two treatments for mature logs and for small logs.

RESULTS

Visual assessment of end checking and splitting

The amount of log degradation for both stockpiling treatments is tabulated in Table 1. Combined numbers of splits and checks and their severity for the five small and five mature logs are listed. Field observations were made of the number and severity of checks and splits, but for ease of documentation they are not given in this report.

The majority of the logs placed under water spray had only minor or moderate checking after seven days (Table 1). These checks were evident at the time of storage. After 28 and 270 days, the severity of checking remained the same. Major end and lateral splitting was not a problem using this method of stockpiling, and sawn timber could be successfully recovered from any of these logs.

The small sheoak logs in the dry stockpile had mainly developed minor or moderate splits after five days, whereas major splitting was evident in the mature logs. After 28 days three small logs had split in half and the other two had major splitting (Table 1).

Mature logs stored in the dry stockpile had major or moderate splits after two days, and after 28 days all logs had major splitting and one log had split in half (Table 1). After 270 days storage over the summer/autumn, the severity of end splitting increased and further degradation resulted with lateral splitting.

Splitting is more of a degrading factor than end checking when logs are stored in a dry stockpile in direct sunlight. Sawn timber could not be recovered from any of these logs after 270 days storage.

The chi-squared test comparing the total number of defects in the treatments for mature logs showed highly significant differences in the dry stockpile after two and five days, and very highly significant after seven, 14 and 21 days. There were no significant differences under water spray (Table 2). Similarly for the small logs, highly significant differences occurred in the dry stockpile after five and seven days, and very highly significant after 14 and 21 days. There were no significant differences under water spray (Table 3).

Table 1
Degradation of small and mature sheoak logs stored in a dry stockpile and under waterspray for 270 days.

Storage time (days)	DRY STOCKPILE						UNDER WATERSPRAY					
	Combined number of log defects (checks, splits) at both ends for:						Combined number of log defects (checks, splits) at both ends for:					
	5 small logs			5 mat. logs			5 small logs			5 mat. logs		
	min	mod	maj	min	mod	maj	min	mod	maj	min	mod	maj
Day of stockpiling	20			14	9	2	20	1		24	1	2
1 day	32		1	37	12	3	17	1		24	2	2
2 days	35	2	1	45	23	6	17	1		25	2	2
5 days	39	6	1	51	31	9	13	6		22	2	2
7 days	39	4	1	74	24	11	13	6		21	5	2
14 days	40	21	4	72	27	16	9	6		5	4	2
21 days	42	20	8	89	35	26	9	6		5	4	2
28 days	19	6	16		18	39	9	6		5	4	2
		3 logs split in half			1 log split in half							
270 days	>50		11		18	39	9	6		5	4	2
		3 logs split in half			1 log split in half							

- NOTE:**
1. min - minor
mod - moderate
maj - major
 2. The only observed insect damage occurred in the dry stockpile after 270 days, where three mature logs had evidence of *Phoracantha* attack and one mature log had pinhole borer damage.

Table 2
Comparison between the amount of splitting for mature sheoak logs stored
in the dry stockpile and under waterspray.

Storage time (days)	Total number of log defects (checks, splits) at both ends for:	
	DRY STOCKPILE	UNDER WATERSPRAY
Day of stockpiling	25	27
1 day	52 n.s.	28 n.s.
2 days	74**	29 n.s.
5 days	91**	26 n.s.
7 days	109***	28 n.s.
14 days	115***	16 n.s.
21 days	150***	11 n.s.

- NOTE:
1. Comparisons are made between the day of stockpiling and stockpiling times for both treatments.
 2. Comparisons finished at 21 days as some logs split in half at 28 days and could not be counted for minor, moderate or major splitting.
 3. Chi-squared test applied for testing significant differences.
 4. n.s. = not significantly different at 95 per cent confidence level.
 ** = significant at $p < 0.01$
 *** = significant at $p < 0.001$

Table 3
Comparison between the amount of splitting for small sheoak logs
stored in the dry stockpile and under waterspray.

Storage time (days)	Total number of log defects (checks, splits) at both ends for:	
	DRY STOCKPILING	UNDER WATERSPRAY
Day of stockpiling	20	21
1 day	33 n.s.	18 n.s.
2 days	38 n.s.	18 n.s.
5 days	46*	19 n.s.
7 days	44*	19 n.s.
14 days	65***	15 n.s.
21 days	70***	15 n.s.

- NOTE:**
1. Comparisons are made between the day of stockpiling and stockpiling times for both treatments.
 2. Comparisons finished at 21 days as some logs split in half at 28 days and could not be counted for minor, moderate or major splitting.
 3. Chi-squared test applied for testing significant differences.
 4. n.s. = not significantly different at 95 per cent confidence level.
 * = significance at $p < 0.05$
 *** = significance at $p < 0.001$

Visual assessment of insect damage

In the early stages of log storage, using either method, insect damage was not a problem (Table 1). However, after 270 days some pinhole borer damage was observed in one mature log and *Phoracantha* damage in three mature logs stored in the dry stockpile. The log attacked had a fine white-yellow powder on the log surface, with the pinholes resulting from attack by a Bostrychid borer (I. Abbott², personal communication). Logs under water spray and the small logs in the dry stockpile had not been attacked by insects after 270 days.

²Dr. I. Abbott, Department of Conservation and Land Management, Como.

DISCUSSION

The usual recommendation for successful log protection has always been the rapid extraction and conversion of logs. Failing this, storage under water spray, ponding or as a last resort, chemical protection have been widely used overseas. This study quantifies the effects of storing sheoak logs under severe environmental conditions in Western Australia during the summer and autumn.

Results of this study indicated that log degradation, through excessive end splitting and end checking, resulted if sheoak logs were stored in a dry stockpile for less than one week (significant splitting occurring after two days). A further 28 days in the dry stockpile resulted in more end splitting. Checking is largely caused by the release of growth stresses when logs are cross cut, appearing when logs are stored unprotected in full sunlight (Hillis 1978).

Insect damage, particularly *L. brunneus* attack, was not a problem after 28 days in the dry stockpile. However, as the moisture content of the logs drops below fibre saturation point (f.s.p.), *L. brunneus* attack may become a problem in logs with a large proportion of sapwood. *L. brunneus*, a common species in Australia is known to attack the sapwood of some hardwood timbers with moisture contents ranging from 10 to 20 per cent (Howick 1968). *L. brunneus* attack on the sapwood of furniture grade sheoak boards has been reported to the Department of Conservation and Land Management (P. Shedley³, personal communication).

The sapwood of green hardwood timbers is susceptible to Bostrychid infestation until the moisture content falls to about 20 per cent (Howick 1968). Rapid drying of the sapwood in the majority of sheoak logs in the dry stockpile would have resulted in the moisture contents falling below f.s.p. before the borers could attack. Only one mature log was attacked by a Bostrychid borer. Continuous water spray would have deterred insects from attacking logs in the water spray stockpile. *Phoracantha* attack has been reported in dry stockpiled jarrah logs (P. Shedley⁴, personal communication). In the present study, three mature logs stored dry for 270 days had been attacked by the *Phoracantha* borer.

In summary, sheoak logs stored in a dry stockpile in direct sunlight under summer/autumn condition will have major splitting after seven days. After 28 days some logs will be so severely split that they will be uneconomical to convert into sawn timber. Storage for a longer time reduces the moisture content of the sapwood and increases the chance of insect attack, particularly by *L. brunneus*. Storage under water spray with the bark intact prevents major splitting and eliminates the chance of insect attack.

^{3,4} Mr P. Shedley, Department of Conservation and Land Management, Como.

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