ASSESSMENT OF PARROT DAMAGE TO THE WUNNENBERG BLUEGUM PLANTATION

by

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September 1993

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Cover photo: Typical parrot damage to a young Bluegum tree. The lead shoot has been ringbarked causing it to wilt and break off. With the removal of the apical dominance provided by the lead shoot, lateral shoots will develop resulting in a deformed (bent or multi-stem) tree.

SUMMARY

Following reports of widespread damage by parrots to Bluegum plantations in an area from Collie to Frankland, an assessment of the Wunnenberg Plantation in the Wellington Catchment was made. This confirmed that parrot damage in the 4 year old plantation is very severe. Possibly only 1/3 of the of the 75 hectares of Bluegums planted is worth growing on to harvest, though yields in that area will be substantially reduced.

Parrots damage the trees by ringbarking the lead shoot, thus releasing lateral shoots below the ringbark. Often two or more of the lateral shoots grow on as co-dominants forming a forked (double- or multi-stem) tree. Alternatively, if just one of the stems becomes dominant, the tree will retain its single-stem form, but with a bend.

The methods developed for assessing sample trees were based on recording the height of 'unacceptable deformities', i.e. forks or severe bends which would have to be cut from the tree at harvest. Any lengths of stem left too short for harvest would be wasted.

Using the methods developed in the Wunnenberg Plantation, assessments of other Bluegum plantations are being undertaken. This is necessary to gauge the extent of the problem and we recommend the surveys continue. Also as a matter of urgency, some applied research is required. This should focus on:

(i). developing publicly acceptable means of reducing parrot numbers, and
(ii). finding ways of limiting the destructive impact of the parrots.

INTRODUCTION

Extensive valley plantings of eucalypts in the Wellington Catchment Reforestation Programme include four properties established in 1988 and 1989 with just under 300 hectares of Bluegum (*Eucalyptus globulus*) in commercial Sharefarming Contracts, involving the Water Authority of WA as land holder and the Department of Conservation and Land Management as the managing agency.

The 75 hectare Wunnenberg Plantation, located in the midst of farmland 10 km south west of Darkan, is one of those where the hydrologic utility of fast growing trees in the valley is complemented by a commercial chipwood recovery objective. However, extensive damage to the trees, resulting from browsing of shoots by parrots, is likely to impair the wood production potential.

An assessment was undertaken in July 1993 to ascertain the extent, impact and distribution of damage across the plantation.

BACKGROUND

Parrots

Birds from the parrot and cockatoo families have long been recognised as agents of low to moderate damage in orchards and various types of trees, as well as in agricultural crops (Halse, 1986). Three species of the genus *Platycercus* are known to forage amongst native and planted trees. Neither *P. spurius*, the Red-capped Parrot, nor *P. icterotis*, the Western Rosella, are believed to be active in eucalypt plantings. By contrast *P. zonarius*, the Ring-necked Parrot and its subspecies *P. zonarius semitorquatus*, the Twenty-eight Parrot are seemingly more ubiquitous, and are frequently observed in eucalypt plantations. On occasions they can be seen gnawing and stripping at bark on shoots where the diameter is around 10 to 25 millimetres. The Twenty-eight Parrot is barely distinguishable from the Port Lincoln Ring-neck at a distance, though its range is confined to the south western part of WA (Storr and Johnstone, 1990).

Susceptability of Bluegums to parrot damage

The normally upright, single stemmed growth habit of *E. globulus*, coupled with its fast growth and pulping quality gives it special value as a commercial tree crop. In contrast to the majority of eucalypt species which tend to form multi-stem or bushy crowns, *E. globulus* normally exhibits strong apical dominance, i.e. the primary growing tip produces a main central stem whilst lateral buds develop into comparatively small lateral branches.

Physical damage to growing shoots is commonly observed in eucalypt plantings. Insects, frost, wind, livestock, rabbit or kangaroo browsing at an early age, and birds, are agents of such damage. In some cases nutrient deficiency in young trees or lack of crown competition from adjacent trees in very wide spaced plantings are factors which can lead to multi-stem growth.

E. globulus and other tall fast-growing trees being grown on WA farmland in multi-purpose plantations are vulnerable to damage by parrots. Ringbarking of the lead (apical) shoot allows lateral shoots just below the ringbarking to develop. If only one of these shoots becomes dominant the tree will retain its single-stem form. However, there will be a bend (deformity) in the stem which, if it can be included in a pulp log, may reduce its suitability for de-barking and other processing operations. Often two or more lateral shoots grow on from below the ringbarking to form double- or multi-stem trees. Severe bends and the forks of double- and multi-stem trees are unacceptable in pulp logs. If such "unacceptable deformities" occur at a height less than the minimum acceptable log length then all of the stem below the deformity will be lost. Also, if the distance between two unacceptable deformities in a stem is less than the minimum log length, then that section of the stem will be wasted. Refer Fig. 1 for an example.

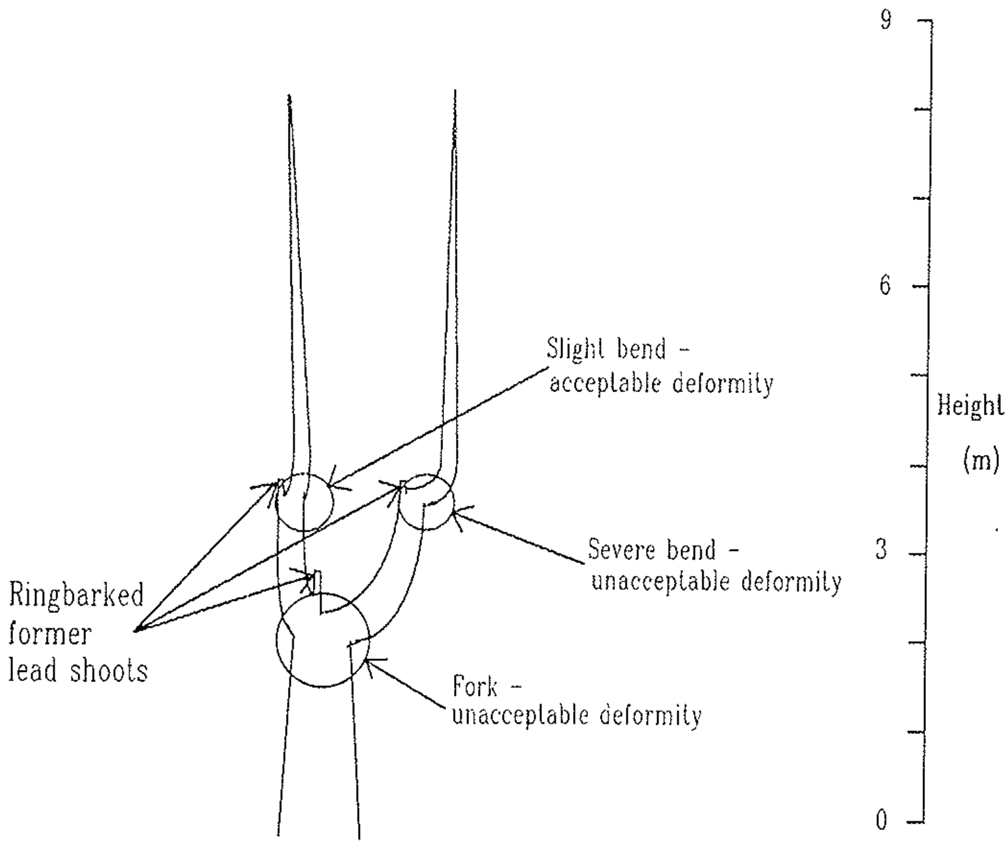


Fig. 1. Representation of the trunk and two stems of a 4 year old Bluegum tree damaged by parrots. Only the left stem and the upper section of the right stem can be used for pulp logs. The trunk and lower section of the right stem do not make pulp logs (assuming minimum log length is 3 m).

An alternative to cutting out a fork in a tree at harvest time would be to cut off one of the stems close too and along the line of the remaining stem. In Fig. 1, above, this would entail cutting off the right stem only at the fork, leaving the trunk and left stem to be cut into logs. This would increase log recovery fom the tree. However, the near vertical cut required to remove the right stem would need to be done with a hand held chainsaw, rather than with a mechanical harvester, which would probably make such an operation impractical.

The first reports of significant damage to commercial Bluegum plantings arose in 1989 at Quindalup where 3 year old trees were losing tops after being ringbarked by Twenty-eight Parrots (J. Wise, Department of Agric., pers. comm.).

Farmers and other tree planters observed and talked about, but did not highlight the browsing effect of various parrots on young seedlings and trees for the ensuing couple of years. Coincidently, in parts of the wandoo/jarrah forest and woodland belt between Darkan and Frankland, blackboy (*Xanthorrhoea* spp) specimens in road reserves and open remnant bush patches on farms were seen to be subject to green frond defoliation by parrots leading in some instances to death of the plant. There have been numerous verbal reports of this phenomenon and it is mentioned by Hussey and Wallace, 1993. The problem is now at serious levels in some parts.

Severe damage in a major Bunnings Treefarms plantation near Bridgetown lead in 1992 to a joint investigation with staff from the Agricultural Protection Board. It was found after a mail and phone survey amongst tree farmers (those linked with the Bunnings programme) around the South-west, that damage to tree plantations thought to be caused by birds was in fact spread over a wide area, albeit patchy in distribution (Massam, 1992).

A survey of two CALM isolated Bluegum timberbelts planted on farmland in 1991 south of Bokal revealed that, by the end of the first summer, between 80 and 95 per cent of young trees had been damaged by parrots.

The Wunnenberg Plantation

The Wunnenberg Plantation occupies lower slopes, either side of and at the head of a saline creek system. Width across it varies from 400 to 700 metres. A number of research trials of species other than *E. globulus*, as well as salt tolerant species plantings adjacent to saline parts occur in the plantation. Outside it, as well as within, are scattered remnant jarrah and wandoo trees. A bush remnant of 5 hectares is nested in the southern end of the plantation.

At Wunnenberg's, within a year of its establishment in 1989, interference to young trees by parrots was observed. However, it was not until 1992 that parrot damage was recognized as a serious problem.

The Dept. of CALM undertook to conduct a survey of the Wunnenberg Plantation after discussions between the Afforestation Manager, Mr Penfold, and the Supervising Engineer in WAWA, Mr Kikiros. Peter Beatty was responsible for co-ordination of the project with assistance from Forestry Consultant Peter Ritson in developing survey and analysis techniques. On one of the 4-5 days of field survey work carried out, assistance was also given by Peter Grime (CALM) and Neil Pettit (WAWA).

METHODS

Field assessment

Sample trees for assessment of parrot damage were located on a systematic (rectangular grid) basis. A compass and surveyor's hip chain (with cotton thread) were used to establish the grid. On arrival at a grid point the hip chain was placed on the ground and the tree nearest to that point assessed. Sampling intensity throughout the plantation was set initially at 50 × 10 m, but increased to 100 × 20 m and, later, to 200 × 20 m.

Table 1 indicates the details recorded on each sample tree. A form for field records and a completed form are also included as Appendices 1 & 2.

It was assumed any fork or a severe bend in the trunk or a stem of a tree was an "unacceptable deformity", i.e. a section which could not be included in a pulp log. As a guide to which bends would be "unacceptable" in pulp logs five small logs with varying degrees of bend were cut from trees in the plantation. These were rated by CALM and Bunnings Tree Farms staff and used as standards for judging other bends.

Data analysis

Data were stored in a Microsoft Excel database to facilitate retrieval and summarising of information.

Each sample tree was placed in one of the log degrade classes shown in Table 2. Note that these classes could easily be re-defined, if appropriate, and summaries showing the 'new' log degrade classes also retrieved from the database.

Table 1. Assessment and recording of parrot damage on each sample tree

Species codes

g = *E. globulus*;	b = *E. botryoides*
s = *E. saligna*;	c = *E. camaldulensis*
v = *E. viminalis*;	**etc.**
r = *E. rubida*;	**none** = no tree within 4 m

Tree form

0 = no damage by parrots;
1 = bark stripped on the main stem by parrots, but no change to form;
2 = single stem tree, but parrot damage causing deformity which could be included in a pulp log;
3 = single stem tree with parrot damage causing deformity which could not be included in a pulp log;
4 = double stem tree (the fork resulting from parrot damage), neither stem dominant;
5 = multi-stem tree - same as 4, but >2 stems.

Height to damage

If tree form is ≥ 3, record height(s) to damage, i.e. height(s) to bend, fork or other deformity which could not be included in a pulp log, estimated to nearest 0.5 m. Show separately damage occurring in the trunk and the stems. Height always recorded from ground level.

Lead shoot ringbarked?

y = yes
n = no

Record this information for the lead shoot of single stem trees or each lead shoot of double- and multi-stem trees. A shoot is 'ringbarked' only if the bark has been removed all the way around a shoot at some point along its length. So far, ringbarking by parrots has only been observed within 1.5 m of the tip. Ringbarked shoots do not necessarily have wilted leaves or show other signs of stress.

Height to ringbark

Record the height above ground level of the ringbark on the lead shoot. At this stage it will not be possible to determine the severity of any deformity that will result from the ringbarking.

Note:

1. If a sample tree is naturally of double- or multi-stem form, i.e. fork not due to parrot damage, take the bigger/biggest stem and assess it as a 'single tree'.
2. Assess damage on the trunk of double- and multi-stem trees up to and including the fork, then assess each stem individually. Should a stem itself have a fork, record the height of the fork in the stem (as damage) and continue assessment only on the larger branch of the stem above the fork.

Comments

Record comments where relevant, e.g:

- observations of parrots;
- note any unusual characteristics of trees, such as small size;
- at several representative points throughout a plantation, record top height of the plantation;
- for the first tree in a transect, note the transect number;
- for the first and last trees in a transect, record soil type and any remnant native vegetation on the adjoining land.

Table 2. Log degrade classes	
None:	No damage, i.e. Tree Form = 0.
Minor:	No loss of volume, possibly, some loss of quality. Any degrade could be included in a pulp log, i.e. Tree Form = 1 or 2.
Major:	Loss of volume. Single, double or multi-stem tree (Tree Form = 3, 4 or 5) with **one only** "unacceptable deformity" at either < 1 m height or > 3 m height. (i.e. can recover a pulp log from the lower trunk of the tree). The lead shoot(s) may be ringbarked.
Extreme:	Single-, double- or multi-stem tree with an "unacceptable deformity" between 1 and 3 m height and/or with >1 "unacceptable deformity" in the tree.

RESULTS

Altogether, 344 sample trees were assessed, 73% *E. globulus*, 10% *E. saligna*, 8% *E. botryoides* and 9% other eucalypts (mostly *E. viminales* and *E. camaldulensis*).

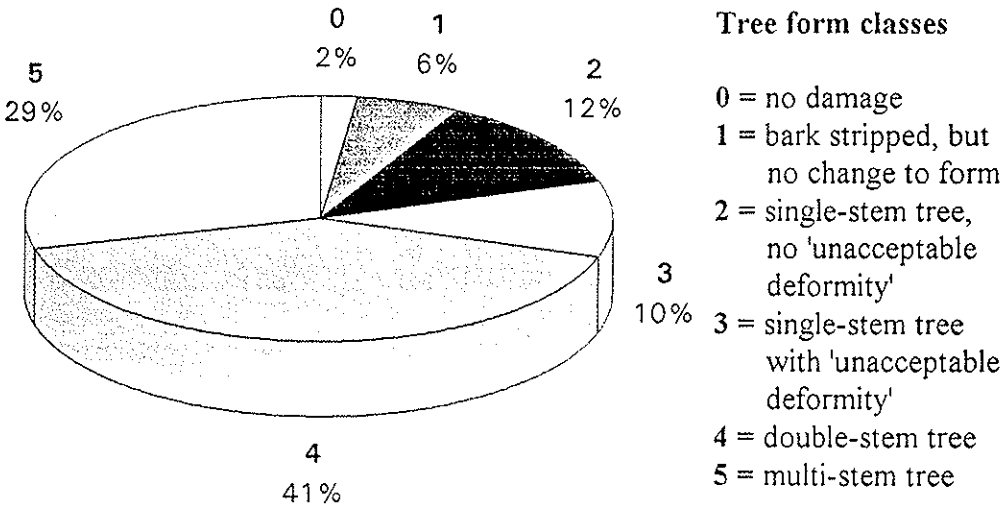
Tree Form

Table 3 shows that parrots caused 70% of the *E. globulus* trees and 62% of the *E. saligna* trees to develop a double- or multi-stem form. A lesser proportion (43%) of the *E. botryoides* developed a double- or multi-stem form but only 16 *E. botryoides* trees were sampled, of which 5 (31%) were single-stem trees with an 'unacceptable deformity'. The results for *E. globulus* are also shown in Fig. 2.

Table 3. Effect of parrot damage on tree form

Tree form	*E. globulus*	*E. saligna*	*E. botryoides*
0	2%	0%	13%
1	6%	19%	13%
2	12%	3%	0%
3	10%	16%	31%
4	41%	35%	6%
5	29%	27%	37%
Total	100%	100%	100%

Fig. 2. Effect of parrots on tree form of *E. globulus* at the Wunnenberg site.



Note: For a full description of tree form classes 0-5 refer Table 1.

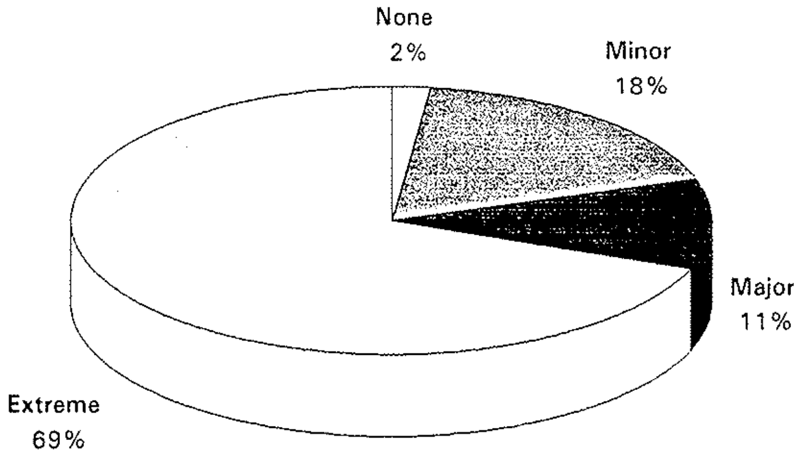
Log degrade

Table 4 shows that 'Extreme' log degrade had occurred in a majority of the *E. globulus, E. saligna* and *E. botryoides* trees assessed, while very few trees had no ('None') degrade. The results for *E. globulus* are also shown in Fig. 3.

Table 4. Log degrade caused by parrots

Degrade class	*E. globulus*	*E. saligna*	*E. botryoides*
None	2%	0%	12.5%
Minor	18%	22%	12.5%
Major	11%	13%	12.5%
Extreme	69%	65%	62.5%
Total	100%	100%	100%

Fig. 3. Log degrade caused by parrots at the Wunnenberg site



Note: For a description of log degrade classes refer Table 2.

Log degrade throughout the plantation is shown schematically in the plan attached as Appendix 4. From this there is no obvious discrete area of 'minor' or 'no damage', though there are relatively less trees in the 'extreme' class in the north east sector of the plantation. Table 5 verifies this.

Table 5. Log damage to *E. globulus* - comparison between sectors

Degrade class	North east sector*	Rest of site
None	3%	2%
Minor	26%	11%
Major	14%	7%
Extreme	57%	80%
Total	100%	100%

Ringbarking

Table 6 shows that ringbarking was observed on the lead shoots of around 30% of all stems (from single-, double- and multi-stem trees). A comparison between sectors (Table 7) shows that ringbarking of lead shoots on *E. globulus* was slightly less prevalent in the north-east sector. Results are based on observations of 613 stems (515 *E. globulus*, 70 *E. saligna* and 28 *E. botryoides*) on a total of 313 sample trees.

Table 6. Ringbarking of lead shoots

Lead shoot ringbarked?	*E. globulus*	*E. saligna*	*E. botryoides*
Yes	30%	34%	25%
No	70%	66%	75%
Total	100%	100%	100%
Ave. height of ringbark (m)	4.8	3.7	4.0

Table 7. Ringbarking of lead shoots on *E. globulus* - comparison between sectors

Lead shoot ringbarked?	North east sector	Remainder of site
Yes	26%	33%
No	74%	67%
Total	100%	100%

Other observations

(i) Parrots

During the course of field work, parrots (believed to be the 'twenty eight parrot' (*Platycercus zonarius semitorquatus*)) were frequently seen or heard. Most often they would be in a group of 3-5 birds flying overhead or flitting amongst the tree tops. A larger flock of around 20 birds was observed several times on the plantation boundary and adjoining pasture.

(ii) Nature of damage

Bark removed by parrots in the last 4-5 months was mostly on the lead shoot or other (lateral) shoots in the upper crown. Occassionally shoots in the middle or lower crown would be damaged, but such damage would have little or no detrimental effect on tree form. Typically bark would be removed from shoots 12-20 mm diameter, in sections 30-150 mm long. The shoots would either be ringbarked or have bark removed from only part of the circumference.

Bark had been removed on shoots carrying mature foliage as well as those with juvenile foliage, i.e. the change to mature foliage did not diminish the parrots propensity to ringbark lead shoots.

(iii) Tree responses

Shoots with only partial bark removal tended to heal over the wound. As little as 5% of the bark circumference remaining seemed sufficient for shoots to heal the wound and survive. Some cases of apparently healthy shoots which had been ringbarked for some time (possibly several weeks) were observed. It was not possible to judge if these shoots can survive in the long term. Typically, ringbarked shoots break off at the ringbarked section. Once a shoot wilts its apical dominance is removed, releasing side shoots from just below the ringbarked section.

(iv) Pathology

Three *E. globulus* stem sections showing damage were examined in a laboratory for wood discolouration, rot and associated fungi. Not suprisingly, discoloured wood, kino formation and some fungal types were found in tissue around the original wounds. Consequently future development of wood rot is considered likely, though impact on wood quality is unclear. A copy of the Dept. of CALM laboratory report is attached as an Appendix 3.

(v) Stand performance and flowering

Top height of Bluegums (undamaged trees) was recorded at between 7.5 and 10.0 metres at selected sites within the stand. In comparison, most damaged trees were 4.5-7.0 metres tall.

Isolated trees in the stand were flowering or had produced fruit. There was no evidence of parrots feeding on this material.

(vi) Small trees

Commonly trees that were free of any parrot damage were suppressed or sub-dominant trees 2.5-4.0 metres tall. It seems possible that parrots were shy of perching on these at a relatively low level in the canopy, or there may have been some nutritional factor involved.

(vi) Remnant native trees

Small numbers of mature wandoo, jarrah, marri and flooded gum were present either as individuals or as clumps within the plantation on adjoining farmland. Parrots were seen to fly in and out of these from time to time.

DISCUSSION AND CONCLUSIONS

The methods used in this study were successful in characterising parrot damage to the Wunnenberg Plantation. The results do not show why and when parrots attack the trees. Nor do they indicate the best control method(s). However, characterising the nature and extent of the damage is a useful first step in answering these questions.

As the damage occurred at all heights in the trees it seems the parrots have damaged the trees each year since planting four years ago. However, it is not known whether the parrots damage the trees in throughout the year or just at particular times of the year, depending on alternative food supplies. The recent ringbarking of lead shoots suggests they are still active (July/August) in the 4 year old stand but the impact of this recent ringbarking on upper stem development is not known at this stage.

Damage to the plantation has been widespread and severe. Though only four years old (just short of half the nominal rotation length) the stand shows a substantial reduction in potential log yield. The most severe concentration of damage was in the narrow segments of the plantation at its western and southern sections. These sections are closer to native forest remnants and the broad salt affected valley floor than the remainder of the plantation. In terms of potential harvest there is probably only an area of 25-30 hectares (the north-east sector) where pulpwood harvesting is still worth while. However, even there the viability of such an operation will be impaired by the prevalence of deformed stems.

Other commercial eucalypt plantings in the Wellington and Upper Blackwood catchments are also being subjected to varying levels of parrot damage. Hence assessments of other plantings (based on the methods developed at the Wunnenberg Plantation) are being undertaken to gauge the extent of the problem.

The development of management strategies to reduce parrot damage (to blackboys as well as commercial eucalypts) is required urgently. Either parrot numbers must be reduced or means of limiting their destructive impact devised.

A variety of approaches could be investigated for reducing parrot numbers though not all may be publicly acceptable. Some possibilities are:

- shooting (to kill birds and scare away others);
- poisoning (risk of poisoning non-target species);
- trapping.

Two possible means of limiting the destructive impact of parrots are:

- Use of repellents. Would only need to apply to the lead shoot of trees. Repellents have been used successfully on seedlings to protect them from browsing mammals e.g. Crozier (1991).
- Pruning of attacked trees to maintain single-stem form, i.e. if two, or more, lateral shoots develop behind a ringbarked apical shoot remove all but one so still have a single-stem tree.

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Appendix 1. Field records form

Site: ______________________ Date: __________ Page: _____ of _______

Sampling grid: _______ m x _____ m Observer(s): ____________

Tree #	Species	Tree form	Height to damage (m)						Lead shoot ringbarked?	Height to ringbark (m)	Comment
			Trunk			Stem					

Appendix 2.
~~Table 2:~~ Example records

Site: Wunnenbere P89 Date: 10/7/93 Page: 5 of 15
Sampling grid: 100 m x 20 m Observer(s): PB, PR

Tree #	Species	Tree form	Height to damage (m) Trunk			Height to damage (m) Stem			Lead shoot ringbarked?	Height to ringbark (m)	Comment
1	g	4	0.5			1.0	1.5	2.0	y	2.5	Begin Transect 11.
						1.0			y	3.0	Gravel soils with grey
											sandy loam matrix.
2	g	2							n		
3	g	5	2.5						n		
									y	3.5	
									n		
4	g	4	1.0	1.5		3.0			y	6.0	Top ht = 8.5 m
						3.0	5.5		y	6.0	
5	g	5	1.5			5.0			n		
						2.0	5.0	5.5	n		
						2.5	3.0		y	4.5	
6	g	2							y	4.5	End Transect 11.
											Gravel soils with
											brown sandy loam
											matrix
1	g	4	2.5						y	3.5	Begin Transect 12,
									n		+ 20 m
											gravel soils with
											brown sandy
											loam matrix
2	g	2							y	4.0	
3	none										gap in plantation
4	g	4	0.5			4.5			n		
						2.5			n		
5	g	3	0.5	2.0					n		Small Tree.
6	g	4	2.0			4.0			n		
						2.5	3.0	4.0	n		
7	g	3	0.5						y	6.0	Top height = 9.5 m.
8	g	4	2.0			3.0	6.0		n		
						3.0			n		
9	g	0							n		
10	g	4	2.0			4.0			y	4.5	
									n		

Notes:

Tree 1 in Transect 11 is a *E. globulus;* tree form = 4, i.e. double-stem tree; height to the fork is 0.5 m; 1st stem has 'unacceptable degrade' at 1.0, 1.5 and 2.0 m and ringbarking at 2.5 m; 2nd stem has'unacceptable degrade' at 1.0 m and is ringbarked at 3.0 m. nb: all distances measured from ground level.

Tree 2 in Transect 11is a *E. globulus;* tree form = 2, i.e. a single-stem tree with some deformity but none so severe it could not be included in a pulp log; and no ringbarking.

Tree 3 in Transect 11 is a *E. globulus;* tree form = 5, i.e. a multi-stem tree; height to the fork is 2.5 m; none of the stems have an 'unacceptable deformity' but one of the three stems is ringbarked 3.5 m above ground level.

Appendix 3.

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

To : Peter Beatty
From: Brian Morgan
Date: 14.7.93
Subject: Eucalyptus globulus, parrot damage (DJ 786)

Stem sections showing parrot damage from three *E. globulus* trees from Wunnenburg's plantation (Darkan) were examined for wood discolouration and rot, and also for associated fungal invasion. The stems were sectioned, wound form recorded, discoloured tissue measured and sampled for fungi. Results are presented below.

Wounds

Parrot wounds of all three trees seemed to have occurred between one and three years ago. The initial wounds caused cambial death, but new wood had largely overgrown the damage. Additional cambial death, in two of the three stems, possibly a result of repeated parrot attack, had also been overgrown by new wood. Kino was associated with dead cambial areas in the wood. Discoloured sapwood extended from the initial wound in those same two stems. Borer holes were associated with the wound in one tree.

Tree 1

Stem section 42 cm long. Two separate parrot attacks occurred about two years ago. About 90% of the cambium of the main wound was killed in the initial bark stripping and about 60 % of wood which regrew over this damaged area was subsequently killed. This damaged area had also been overgrown by new wood. Borer holes existed in the area of the main wound, over a length of 14 cm of stem.

Discoloured wood extended axially beyond the wound, the full 42 cm length of the stem section. *Cytospora eucalypticola* , a weak opportunistic canker fungi, was recovered from the discoloured wood adjacent to a wound. *Acremonium* was also recovered.

Tree 2

Stem section of 28 cm length with a single wound. About 80% to 90% of the cambium had been killed about two or three years ago. This damage had been overgrown by new wood, which had in turn been damaged shortly afterwards, resulting in death of about 50% of the regenerated cambium. This second attack had then been overgrown by new wood.

Discoloured sapwood extended about 4 cm axially beyond the initial wound, so that the column of discolouration was about 19 cm. Fungal saprophytes were recovered from the discoloured wood.

Tree 3

Stem section 19 cm long. About 70% to 80% of the cambium had been killed about one year ago. New sapwood had overgrown this damaged area.

Discoloured wood only occurred adjacent to the dead cambium. A basidiomycete was isolated from this discoloured wood together with *Acremonium* and saprophytes. some basidiomycete fungi can cause wood rots, but these may take several years to develop fully.

General Comments

Stem damage and resulting deformation has occurred over several years. New wood had overgrown old areas of cambial death, and in some cases this too had been damaged with subsequent regeneration of new wood.

Wood extant at the time of wounding was often discoloured, and a column of discoloured wood extended beyond the original damaged area. Kino was associated with the damage. Fungal saprophytes, the weak canker pathogen *Cytospora eucalypticola*, and at least one basidiomycete were recovered from this zone of discolouration. It is therefore probable that wood rots associated with this damage will develop in affected trees in several years' time.

It would be useful to examine further parrot damaged trees especially those damaged five or six years ago, to determine the extent of discolouration and rot.

Brian Morgan

Technical Officer

Elaine Davison

Principal Research Scientist