Habitat trees and logging – ecology of the Brush-tailed phascogale in jarrah forest

J A Armstrong and I Abbott

Science and Information Division, Department of Conservation and Land Management, Australia II Drive, Crawley, 6009 Western Australia

1996

Habitat trees and logging - ecology of the Brush-tailed phascogale in jarrah forest[1]

J.A. Armstrong and I. Abbott
Science and Information Division, Department of Conservation and Land Management,
Australia II Drive, Crawley, 6009 Western Australia

SUMMARY

We provide a critique of a recently published paper by Rhind (*W. Aust. Nat.* **21**: 1-22, 1996). The research reported is fundamentally flawed: the data presented are incorrect; the study area is not representative of the cells logged in Kingston Forest Block; the methods used to determine the number and suitability of habitat trees are subjective; and the results reported lack credibility when compared with factual data about the phascogale and the structure of jarrah forests. Contrary to Rhind's assertions, this study found that CALM's logging practices leave a large surplus of potential habitat trees (marked or unmarked) in a size-class suitable for occupation by native fauna.

INTRODUCTION

Rhind (1996) published a paper highly critical of CALM's habitat tree retention practices (her Table 4). This study purported to find that:

- "*logging resulted in an almost total removal of all potential habitat trees from logging coupes*", and
- "*it can be expected that phascogales will become locally extinct in areas extensively impacted by logging*".

These findings are completely at odds with the data being collected by CALM's scientists working in the Kingston Forest Block study. Our audit of Rhind's study sites revealed that her data (Table 4) are wrong and hence her conclusions are unsound.

CRITIQUE

1. Study sites

CALM's logging operations in the Kingston Block had covered, by January 1996, three Compartments (Kingston 1, 3 and 5) and an array of 63 Cells cut to gaps or shelterwood treatments. Rhind (1996) does not identify which of the 63 Cells she had worked in.

---

[1] Since this paper was written, Rhind has retracted parts of her original paper (Rhind 1996). However the errors in her paper are more extensive than acknowledged by her.

After protracted enquiry from us, Rhind (pers. comm.) revealed that her four study sites were located within Compartment 5 of the Kingston Forest Block.

The number of sample sites used by Rhind to examine CALM's habitat tree marking practice is inadequate and not representative of the number of treatment sites available in the Kingston Block logging study.

Rhind's study selected only one logged treatment area out of the three available. Moreover, only four "coupes" were selected by her from the available array of 63 cells logged by CALM in the Kingston Block (i.e. 6% sampled). This inadequately low sample number, coupled with the questionable representativeness of the sites sampled, provides a biased and non-representative assessment of the practices used by CALM in the Kingston Block study.

A statistically sound sampling strategy would have involved two treatment sites and comprised at least two discrete gaps and two shelterwood patches per treatment site.

Nevertheless, CALM's audit of the four sites which Rhind had referred us to revealed data completely at variance with those she published in Table 4 of her paper. Four major discrepancies were discovered:

- CALM found no evidence to suggest that Rhind had actually worked in three of the four sites she referred us to. Despite stating (pers. comm.) that she had "chalked" each of the trees that she assessed within her study sites, CALM found trees marked with yellow crayon only in Rhind's "coupe 4".
- Rhind's study sites appeared not to encompass the complete cells logged by CALM to gap or shelterwood. Her "coupe 4", for example, represents a very selective sub-sample (namely 13%) of the treatment cell logged by CALM to shelterwood. One would expect that a study on CALM's logging practices would investigate the practice as it is applied by the agency - in particular, at the operating scale that the treatment is conducted.
- Rhind grossly misreported the areas of her study sites in her published paper. In her "coupe 4", for example, her study site comprises an area of only 6.8 ha (measured precisely by CALM using GPS technology), yet she reported the area as 15 ha in her publication.
- Rhind's selection of study sites is not representative of the logging treatments practised by CALM in the Kingston Block. Her "coupe 4", for example, has the following significant edge effects:
    * cleared farmland comprises the full length of its eastern boundary,
    * it is completely fenced along its eastern margin,
    * a cleared gravel pit is located on its northern boundary, and
    * it is bounded on the west by a cleared gravel roadway.

  Since no other Kingston shelterwood treatment shares these unusual boundary characteristics, her "coupe 4" is demonstrably unrepresentative of the shelterwood treatments practised by CALM in its Kingston Block operations.

Faced with these worrisome inconsistencies, CALM sought further clarification of the boundaries of Rhind's study sites (particularly for the three "coupes" where there was no evidence of her work) so as to reconcile our figures with her published data. Despite repeated requests, this information has not been provided to CALM.

Because Rhind would not provide CALM with sufficient information to locate precisely three of her four study sites, we have had to restrict our detailed audit of Rhind's study sites to her "coupe 4". For the other three cells in which Rhind indicated that she worked we have instead provided general audit figures for the habitat trees retained by CALM.

2. *Terminology*

Rhind's misuse of the term "coupe" (it is defined clearly in the publication "CALM 1991" referred to in her paper) for "cell" is misleading. CALM's logging practices operate at the coupe level. In compartment 5 of the Kingston Block (the area where Rhind conducted her study) there were 18 cells treated by CALM in its logging operations. Collectively, CALM refers to these 18 treatment cells as a coupe. Rhind selected 4 of the 18 available cells for her study sites but used only a small sub-component of each of these cells in her study. She referred to each sub-component as a "coupe". By selecting partial treatment areas to represent CALM's logging practices, the conclusions Rhind draws are biased and not representative of the operations actually conducted by CALM.

3. *CALM's Detailed Audit of "Coupe 4"*

Of the four study sites that Rhind referred us to, only "coupe 4" had defined boundaries enabling CALM to locate precisely the actual area she studied. Also, since "coupe 4" was the only site with trees marked by Rhind in yellow crayon, its area could be accurately calculated using GPS technology.

The detailed audit of Rhind's "coupe 4" is provided in Table 1. These data contradict completely the information presented in Table 4 of Rhind (1996).

- Rhind lists the area of her "coupe 4" as 15 ha. In fact the area is much smaller, namely 6.8 ha.
- Rhind misrepresents CALM's 1991 habitat tree retention protocol. She states that CALM's 1991 logging prescription requires the Department to "*mark and retain three potential habitat trees per hectare (or at a rate of 15 per 5 hectares)*" (p.14). Based on this apparent misunderstanding, Rhind presents that CALM **was required to mark** 45 trees for retention as habitat trees (i.e. 15 ha X 3 per ha) in "coupe 4", but only marked 25 trees for retention (i.e. a 56% compliance with the prescription).

The 1991 specification actually states that:

"Trees...are to be retained for fauna habitat at a rate of 3 trees per hectare. Where suitable trees are not present a rate of 15 trees per 5 hectares must be achieved. A clump of 3-4 trees is preferred to an even distribution. **If insufficient trees with these characteristics are available retain mature trees as potential habitat**".

In fact, as demonstrated by the audit figures presented in Table 1, CALM **marked for retention** a large surplus of potential habitat trees:

- Rhind misreported 25 marked habitat trees in "coupe 4". In fact, 26 trees had been 'H' marked by CALM in her study site.
- Rhind's statement that "potential habitat trees were not marked for retention at the policy rate of 3/hectare" (p. 2, Abstract) is untrue. The 26 habitat trees marked by CALM represent a retention rate of 3.8/ha (i.e. 26 divided by 6.8 ha, the **actual area** of Rhind's "coupe 4").

Although Rhind does not acknowledge it, there were in fact many more trees marked for retention by CALM in "coupe 4". CALM marked 147 additional trees for retention in "coupe 4" and, since all of these trees are >30 cm dbhob*, they are all potential habitat trees.

* dbhob = diameter at breast height, measured over the bark.

In total therefore, **CALM marked 173 trees for retention** (i.e. 25.4/ha) in Rhind's study site, yet Rhind presents that only 25 "marked trees" were retained by CALM in "coupe 4".

- Rhind's statement that "*few* [of the potential habitat trees marked for retention] *were suitable*" (p.2, Abstract), is untrue.

Rhind used subjective methods to assess suitability of retained trees as potential habitat for fauna. CALM's data demonstrate that her methods for assessing habitat tree suitability are very poorly correlated with the number of trees actually found to contain suitable hollows. Rhind relied partially on ocular estimates to classify standing trees in logged coupes. This is an intuitive method without scientific basis. It involves standing on the ground under jarrah trees and looking up for suitable hollows for phascogales. As jarrah grows to a height of 50m and phascogales occupy hollows with an entrance as small as 2.4 cm in diameter, it is not surprising to find that many trees "identified" with phascogale hollows proved to have no sign of occupation.

Rhind worked alongside CALM scientists involved in a similar study into the impact of logging on native mammals in Kingston Forest Block. We tested Rhind's method of 'identifying' hollows to see if it improved on our data collection, by comparing her ground count with a detailed assessment of the same tree after it had been felled. The result was a very poor correlation (r^2=0.25) between her estimate and the actual number of hollows (Whitford, in prep.). Remarkably, this information (Whitford, in prep.) had been communicated to Rhind prior to her publication.

Rhind (Table 4) presents that only 2 of the habitat trees marked by CALM (8%) were "actual" habitat trees and 7 more (i.e. a total of 9 trees) were "possible habitat trees" (i.e. only 0.6 marked trees/ha were deemed by Rhind to be suitable habitat trees). In fact, even the animals currently utilizing trees in "coupe 4" disagree with Rhind's assessment. CALM's audit revealed that 13 of the 26 marked habitat trees (50%) showed signs of actual use (i.e. obvious possum tracks on their outer bark) and, to this figure can be added the 7 other marked trees in use by fauna (i.e. a total of 20 marked trees actually in use by fauna). This quantum equates to 2.9 marked trees/ha currently in use in Rhind's "coupe 4".

- Rhind makes no reference to the suitability of other trees marked for retention by CALM in "coupe 4".

CALM's audit reveals that 147 trees (> 30 cm dbhob), additional to the 26 'H' marked trees, were also marked for retention by CALM in its logging operations in "coupe 4". CALM's research (Whitford, in prep.) suggests that 29% of these retained trees (i.e. 43 trees) are possible habitat trees for phascogales. If we add to this the number of other marked trees actually in use by animals (i.e. 7 trees) we find that 50 of the retained trees that were marked for other purposes are suitable habitat trees for phascogales - i.e. 50 other marked retained trees (7.4 trees/ha) are suitable habitat trees, and 14% of these (i.e. 7 trees) are currently in use.

- Rhind presents that very few unmarked retained trees (5 in total) are suitable habitat trees for fauna.

Again, even the animals take exception to Rhind's notion of habitat tree suitability. CALM's audit revealed that 13 unmarked trees showed signs of actual use (i.e. obvious possum tracks on their outer bark), a figure much higher than the 5 suggested by Rhind.

In fact, CALM's audit of Rhind's "coupe 4" reveals that 247 unmarked trees (> 30 cm dbhob) were retained by CALM in its logging operations. CALM's research (Whitford, in prep.) suggests that 29% of these retained trees (i.e. 72 trees) are possible habitat trees for phascogales. If we add to this the number of unmarked trees actually in use by animals (i.e. 13 trees) we find that 85 of the

retained unmarked trees are suitable habitat trees for phascogales - i.e. 85 unmarked retained trees (12.5 trees/ha) are suitable habitat trees, and 15% of these (i.e. 13 trees) are currently in use.

- Rhind presents that CALM retained in "coupe 4" only 14 trees (marked or unmarked) that were suitable habitat trees for fauna (i.e. 0.9 trees/ha). Again, this is untrue.

CALM retained a large surplus of potential habitat trees (marked or unmarked) in "coupe 4" (i.e. 420 retained trees > 30 cm dbhob, or 61.8 trees/ha). CALM's research suggests that 29% of these retained trees are possible habitat trees for phascogales. If we add to this the total number of retained trees actually in use by animals (i.e. 33 trees) we find that 155 retained trees are suitable habitat trees for phascogales - i.e. 155 retained trees (22.8 trees/ha) are suitable habitat trees, and 21% of these (i.e. 33 trees) are currently in use.

4. CALM's General Audit

CALM's general audit of Rhind's nominated study sites is provided in Table 2. These data contradict completely the following statements published by Rhind (1996):

- "*examination of each coupe revealed that few to no suitable habitat trees were retained*" (p.14).

There is, in fact, a large surplus of suitable habitat trees retained by CALM in its logged treatment cells. CALM retained 1,372 trees (> 30 cm dbhob) in the four treatment cells referred to, and of these some 499 trees would be suitable habitat trees for phascogales (i.e. 13.7 suitable trees retained/ha).

- "*the contribution of incidentally left trees to habitat tree availability was low*" (p.15).

In fact, the contribution of incidentally left trees to habitat tree availability was high. A total of 766 unmarked trees (> 30 cm dbhob) were retained by CALM in the four treatment cells and 29% of these (i.e. 222 trees) were assessed as suitable habitat trees for phascogales.

- "*an overall (marked and unmarked) total of 0.53 potential habitat trees/hectare remained for phascogales (1 tree/2 hectares)*" (p.15).

In fact, an overall (marked and unmarked) total of 37.6 potential habitat trees/hectare remained for phascogales (75 trees/2 hectares).

- "*In the shelterwood coupes where a greater retention of trees is intended, potential habitat tree levels for phascogales were collectively 0.45 trees/hectare (1 tree/2 hectares)*" (p.15).

In fact, in the shelterwood treatments (i.e. Rhind's "coupes" 3 and 4), potential habitat tree levels for phascogales were collectively 44 trees/hectare (88 trees/2 hectares).

- "*unless incidentally left trees are marked for retention as "crop trees" they are not secure, as these are poisoned, felled or pushed over during post-logging Jarrah Stand Improvement (CALM 1995)*" (p.15).

This statement is untrue. 'CALM 1995' states that incidentally left trees greater than 50 cm dbh are not culled in treatments cut to gap. Such trees are ideal habitat trees for phascogales (refer Rhind's Figure 3, p. 8). Remarkably, this information had been communicated to Rhind prior to her publication (Lloyd, pers. comm.).

- "*the trees that contain suitable hollows are large, and logging removes these trees*" (p.16).

Rhind's own data refute this statement. In Figure 3 of her paper (p.8), she records the diameters of trees in use by radio-collared phascogales. Rhind observed trees of diameter class sizes as low as 5-14 cm dbhob in use by phascogales and concluded (p. 7) that "utilization of nesting trees became most apparent at about 40 cm dbhob (Figure 3)". CALM's logging practice retained 37.6 trees/ha (> 30 cm dbhob), and of these 15.3 trees/ha were > 50 cm dbhob, the diameter class that trees have

become "markedly useable as habitat trees", according to Rhind (refer Abstract). Clearly, CALM's logging practice retains a large surplus of habitat trees suitable for phascogales.

- *Historically these [dead] trees have not been retained as habitat trees because of their financial value as firewood or woodchip*" (p.18).

  In fact, numerous dead trees (viz. 51, or 1.4/ha) were left by CALM in the logged treatment cells.

5. *Other important issues*

   a) Although indicating (p6) that she used a standard BACI (Before/After - Control/Impact) protocol (used commonly in ecological studies), Rhind presents no data in her paper in that format.

      Trapping was abandoned in 1995 and so Rhind (1996) is unable to present the necessary data on population numbers **after** logging; she relied after logging on observing the behaviour of marked animals, a flawed methodology for determining actual habitat trees used by phascogales.

      CALM's research reveals that radio-tracking of arboreal mammals to deduce utilization of habitat trees is unreliable. Of 19 trees to which animals were radio-tracked, when felled CALM found that only 9 of these trees had hollows with unequivocal evidence of phascogale use (scats or nest). Rhind's reliance on such flawed techniques resulted in unsound conclusions.

   b) Rhind states in her paper that she determined the number of "possible habitat trees" by counting those with "...significant fire or termite damage" (p.14 and Table 4).

      Contrary to Rhind's assertion, CALM's research shows that both fire scars and/or termite damage are very poor predictors of trees containing hollows suited to phascogales (Whitford, in prep.). Rhind's reliance on such flawed techniques corroborates our assertion that her data are subjective and the conclusions she draws from them are unsound.

   c) Rhind states (p.11) that 27% of her recorded habitat trees were dead. However, "dead" is defined idiosyncratically as "95% dead above ground - some had a few regrowth shoots" [p.11]). It appears that size, age and decay status of a tree, and not whether it is alive or not, determines the abundance and size of hollows present.

   d) Rhind's finding that "after logging, phascogale nesting was completely confined to trees within retained corridors" (p.15) is used to infer that future logging of corridors would result in local extinctions of phascogale populations.

      This is a non sequitur. A more likely explanation is that, given a choice, phascogales prefer to select habitat trees from the greater variety available in the corridors. The test of this will be to re-examine the trees retained in logged coupes for the presence of phascogales during the next year. Regrettably, Rhind did not examine these retained trees for evidence of phascogale occupation.

      Rhind removed and relocated nesting boxes in the "coupes" to be logged before these "coupes" were logged, apparently because of concern about possible damage to the boxes. Yet, her boxes in the adjacent unlogged areas were not disturbed. Sound science demands that all treatments in an experiment are treated alike.

e) No information is provided on the numbers of **potential** habitat trees present in the forest **before** logging. Nor is the number of all trees left in the coupes **after** logging, especially those logged as shelterwood, disclosed.

Without these data, valid inferences about the impact of timber harvesting on the number of habitat trees remaining are not possible.

f) Rhind's conclusion (p.19) that "data on the longevity of trees retained after logging is very limited" is incorrect. CALM has 600 permanent growth plots in jarrah forest in which the presence of all trees (permanently marked) is routinely monitored. Her suggestion (p.19) that "determining habitat tree survival should be considered a priority" is already the subject of active analysis by CALM officers. It is already well known that jarrah is not prone to windthrow because of its deep root system.

6. *Peer review of Rhind's manuscript*

Rhind did not ask CALM scientists to review her manuscript. Given that CALM set up the study site and managed the implementation of all experimental treatments, it is a breach of scientific etiquette that CALM scientists were not given the opportunity to review the manuscript constructively. CALM scientists are always willing to comment on draft papers so that misleading interpretations can be averted, to the mutual benefit of author and reader.

Our scientists would no doubt have alerted Rhind to several important deficiencies. For example:

a) Rhind's conclusion (p.19), "Changes to current habitat tree retention practices are needed if this species is to be conserved in production forests", is out of date.

CALM's research in the Kingston study confirmed that the 1991 Specification allowed too much latitude for subjective interpretation and CALM moved in 1995 to clarify and refine the protocol. In December 1995 CALM's Corporate Executive approved changes to the habitat tree retention protocols for CALM's jarrah tree harvesting operations (CALM, 1995).

This change in prescription resulted from extensive technology transfer between scientists involved in the Kingston study and CALM staff responsible for tree marking in October 1995. This is a typical example of the rapid incorporation of new, scientifically-sound information into CALM's operational practices.

CALM's new guidelines specify a minimum dbh* and structure categories for primary habitat trees, defines a new category *potential habitat trees* and clarifies how trees are to be retained (e.g. the retention of habitat units).

b) Rhind's failure to make better use of some of the soundly-based data which she did collect.

She found that female phascogales have exclusive territories $\geq$20 ha. Even at the previous prescription of 3 marked habitat trees retained per ha, each territory would have held 60 habitat marked trees - surely an impressive array for a female choosing hollows for occupation.

* dbh = diameter at breast height

c) Rhind's failure to show awareness of data being collected by CALM scientists.

For example, a forest-wide, random sample of 111 trees stratified across diameter classes and senescence classes identified 32 trees (29%) with 63 hollows with suitable dimensions for use by phascogales (Whitford, in prep.). These data indicate that suitable hollows are not in short supply in logged jarrah forest.

7. *Lack of credibility of the conclusions published by Rhind (1996)*

Rhind's scenario (in which phascogales become extinct locally throughout logged forests) is incongruent with many other facts known about the animal and the structure of the forest.

In the light of CALM's audit of logged cells in the Kingston Block and the newly adopted silviculture guidelines, we can consider cautiously, from an informed basis, the consequences of timber harvesting.

1. Female phascogale territories are 20-30 ha and exclusive (pp 3-4, 13 of Rhind's paper).

2. Trees with hollows of suitable dimensions for phascogales range in dbh from 24 to 158 cm (Whitford, in prep.).

3. Trees with actual evidence (scats or nest) of use by phascogales range in dbh from 42 to 143 cm (Whitford, in prep.).

4. Considering the existing jarrah forest, there are 37.9 trees/ha of dbh >40 cm or 4.5 trees/ha of dbh >80 cm (jarrah forest inventory data published on p.172 of CALM 1992).

5. Hence, an averaged sized territory of a female phascogale should contain 758 trees with dbh >40 cm or 90 trees with dbh >80 cm.

This set of information provides no indication that phascogales are headed for local extinction in areas extensively impacted by logging.

CONCLUSION

None of Rhind's criticisms of CALM's logging practices are valid. CALM's audit of her study sites reveal that the standard of science is unsound and that she employed subjective methods to assess the suitability of retained trees as habitat for fauna. Contrary to Rhind's assertions, CALM's logging practices leave a large surplus of potential habitat trees (marked or unmarked) in a size-class suitable for occupation by native fauna.

ACKNOWLEDGEMENTS

We thank A. Seymour and staff (Forest Resources Division, CALM) for providing the audit information, and K. Whitford (Science and Information Division, Dwellingup) for sharing unpublished information.

REFERENCES

CALM (1991). Treemarking and silvicultural treatment in the jarrah forest. Silvicultural Specifications 2/91.

CALM (1992). Management Strategies for the South-west Forests of Western Australia - A Review.

CALM (1995). Silvicultural practices in the jarrah forest. Silvicultural Guidelines 1/95.

Rhind, S.G. (1996a). Habitat tree requirements and the effects of removal during logging on the marsupial Brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) in Western Australia. *Western Australian Naturalist* **21**, 1-22.

Rhind, S.G. (1996b). Addendum-errata. *Western Australian Naturalist* **21**, 141.

Table 1. Kingston 5: CALM'S Detailed Audit of Rhind's "Coupe 4"

REFERENCE AREA		AREA INVOLVED	
Rhind's Area	CALM's Cell	Rhind	CALM's Audit
Coupe 4	MKG059518(A)	15 ha	6.8 ha

MARKED TREES (>30 CM DBHOB[1]) RETAINED															
MARKED 'H' TREES								OTHER MARKED TREES RETAINED							
Number		Actual[2] Habitat Trees		Possible[3] Habitat Trees		Suitable[4] Habitat Trees		Number		Actual Habitat Trees		Possible Habitat Trees		Suitable Habitat Trees	
Rhind	CALM	Rhind	CALM	Rhind	CALM	Rhind	CALM	Rhind	CALM	Rhind	CALM	Rhind	CALM	Rhind	CALM
25	26	2	13	7	8	9	21	NS[5]	147	NS	7	NS	43	NS	50
(1.7/ha)	(3.8/ha)	(0.13/ha)	(1.9/ha)	(0.5/ha)	(1.2/ha)	(0.6/ha)	(3.1/ha)		(21.6/ha)		(1.0/ha)		(6.3/ha)		(7.4/ha)

TOTAL MARKED TREES RETAINED							
Number		Actual Habitat Trees		Possible Habitat Trees		Suitable Habitat Trees	
Rhind	CALM	Rhind	CALM	Rhind	CALM	Rhind	CALM
25	173	2	20	7	50	9	70
(1.7/ha)	(25.4/ha)	(0.1/ha)	(2.9/ha)	(0.5/ha)	(7.4/ha)	(0.6/ha)	(10.3/ha)

(Table 1 continued)

UNMARKED TREES (>30 CM DBHOB) RETAINED							
Number		Actual Habitat Trees		Possible Habitat Trees		Suitable Habitat Trees	
Rhind	CALM	Rhind	CALM	Rhind	CALM	Rhind	CALM
NS	247	0	13	5	72	5	85
	(36.3/ha)		(1.9/ha)	(0.3/ha)	(10.6/ha)	(0.3/ha)	(12.5/ha)

TOTAL TREES (MARKED AND UNMARKED) (>30 CM DBHOB) RETAINED							
		Actual Habitat Trees		Possible Habitat Trees		Suitable Habitat Trees	
Rhind	CALM	Rhind	CALM	Rhind	CALM	Rhind	CALM
NS*	420	2	33	12	122	14	155
	(61.8/ha)	(0.1/ha)	(4.9/ha)	(0.8/ha)	(17.9/ha)	(0.9/ha)	(22.8/ha)

[1] DBHOB = diameter at breast height measured over the bark

[2] CALM's number of actual habitat trees refers to trees showing signs of actual use (ie obvious animal tracks on their outer bark)

[3] CALM's number of possible habitat trees is conservative and is based on research showing that 29% of all retained standing trees (>20 cm dbhob) contain hollows suitable for occupation by phascogales.

[4] The number suitable includes actual habitat trees plus possible habitat trees.

[5] NS = not stated

Table 2. Kingston 5: General Audit of Rhind's Nominated Study Sites

	REFERENCE AREA		TREES (>30 cm dbhob[1]) RETAINED												
			Living Trees Retained						Dead Trees Retained			Total Trees Retained			
	Rhind	CALM's Cell	30-50 cm dbhob			>50 cm dbhob			30-50 cm dbhob	>50 cm dbhob	Total	Number	Actual[2] Habitat Trees	Possible[3] Habitat Trees	Suitable[4] Habitat Trees
			Marked	Unmarked	Total	Marked	Unmarked	Total							
	Coupe 1 (5 ha)	MKG059504 (5.4 ha)	10	101	111	21	33	54	0	5	5	170	18	49	67
	Coupe 2 (6 ha)	MKG059505 (7.1 ha)	1	60	61	14	60	74	2	8	10	145	3	42	45
	Coupe 3 (10 ha)	MKG059523 (17.2 ha)	190	148	338	146	129	275	10	14	24	637	47	185	232
	Coupe 4 (15 ha)	MKG059518(A) (6.8 ha)	100	187	287	73	48	121	6	6	12	420	33	122	155
Totals No./ha	31 ha	36.5 ha	301 8.2/ha	496 13.6/ha	797 21.8/ha	254 7.0/ha	270 7.4/ha	524 14.4/ha	18 0.5/ha	33 0.9/ha	51 1.4/ha	1372 37.6/ha	101 2.8/ha	398 10.9/ha	499 13.7/ha

[1] DBHOB = diameter at breast height measured over the bark
[2] CALM's number of actual habitat trees refers to trees showing signs of actual use (ie obvious animal tracks on their outer bark)
[3] CALM's number of possible habitat trees is conservative and is based on research showing that 29% of all retained standing trees (>20 cm dbhob) contain hollows suitable for occupation by phascogales.
[4] The number suitable includes actual habitat trees plus possible habitat trees.

143

Media RELEASE

INFORMATION
Murdoch University
Murdoch, Western Australia 6150
Tel: (09) 360 2491 Fax: 310 4233

ATTN: CARINA TAN VAN BAREN THE WEST AUSTRALIAN

Logging research findings retracted

INCORRECT claims that CALM breached its own logging policy in South West forests have been withdrawn by a Murdoch University research student following her reassessment of study data. The University and Associate Professor Stuart Bradley, as supervisor, regret the publication of this incorrect data, and endorse Ms Rhind's retraction.

The author of the study, Ms Susan Rhind, a doctoral student at Murdoch University, has unreservedly apologised to CALM for her unjustified criticisms of the Department's actions. Ms Rhind's revised data do not support her criticism of CALM's management policy with respect to habitat tree retention.

CALM disputed Ms Rhind's estimates of the number of trees retained after logging as habitats for native fauna and the conclusions she drew from her study. Stimulated by CALM's criticisms, Ms Rhind reassessed her findings.

After viewing post-logging aerial photographs provided by CALM, Ms Rhind reassessed her data and found significant mistakes.

Pro Vice-Chancellor (Research) Professor Andrew Glenn said the University welcomed the continuation of research collaboration with CALM in areas of common scientific interest.

Media enquiries, contact: **Professor Andrew Glenn;**
Pro Vice-Chancellor (Research)
Murdoch University
Mobile: 015 774 776