Totem tree management and conservation recommendations

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1. Background and the significance of Totem trees

This management report, based on my Honour thesis (available on request), outlines and justifies the main recommendations for the management and long term conservation of Totem trees. The term Totem tree, coined by the Territory and Municipal Services (TAMS) directorate of the ACT Government, refers to a standing dead tree that has been made "safe" through the removal of unstable or decayed branches and is regularly inspected for structural integrity [1].

Figure 1: Totem tree in Wongoola Close parkland (Photograph credit: Alexander Pecenko)

The term was first used by TAMS as a descriptor in contractor and urban tree inventories in the 1980s [1]. Canberra is the only city in Australia that has had, since 1988, a Totem tree management programme, and, according to Brice [1], it seems that no other country follows such an approach to the creation and preservation of standing dead tree habitats in urban settings.

Although Totem trees are a type of dead tree, they could be classified as a special subcategory, mainly because they are managed to be safe and provide habitat. Totem trees represent a unique management practice of urban forests in Canberra that has, to date, not been the subject of any published academic research. Consequently, my Honours thesis is the first study to outline the management of Totem trees for their future conservation in the Canberra urban forest. Due to the constraints of the Honours programme, this report is based on data collected on the Totem trees in only seven parklands (Table 1).

This reports' findings, on which the management recommendations are based, are derived from my Honours thesis results. The thesis applied a mixed methods research approach incorporating: silvicultural assessment; fauna appraisal by *ad libitum* sampling, focal sampling, and evidence for fauna presence; and a purposive questionnaire survey for evaluation of the public perceptions about the Totem trees' habitat value, safety and conservation. These methods allow for a holistic assessment and comprehensive understanding of Totem trees' diverse habitat and community values and the consequently tailored management recommendations.

The main findings from my Honours thesis, applicable to and useful for the future management of Totem trees, are outlined below (Table 1). For reference to the background research, factual results and further information, please refer to my Honours thesis, deposited with the Conservation Council.

Table 1: Integrative summary of the Totem tree mensuration, fauna diversity, abundance and behaviours observed per Totem tree, across the seven parklands studied (based on findings from my Honours thesis).

Canberra Parkland	No. Totem trees	Average DBH (cm)	Average Height (m)	Average no. hollows per tree	Average Hollow height (m)	Average Hollow width (m)	Average no. Totem trees with branches	Average no. Totem trees with Bark	No. fauna categories observed per tree	No. fauna individuals observed per tree	No. behavioural categories observed per tree	No. behavioural events observed per tree
Corroboree Park	3	72.5	8.0	2.3	0.4	0.3	0.3	0.3	13.0	325.7	7.7	38.3
Latrobe Park	4	80.7	9.5	3.3	0.2	0.2	0.0	1.0	10.3	315.3	6.3	24.0
Lofty Close	3	74.1	11.8	0.3	0.2	0.2	1.0	1.0	10.3	187.3	7.0	27.7
Maitland Street	1	87.1	7.5	4.0	0.1	0.1	1.0	0.0	37.0	364.0	21.0	141.0
Rochford Street	2	99.1	18.8	4.0	0.2	0.1	0.5	1.0	16.5	224.0	10.0	38.5
Gurrang Avenue	2	78.3	11.8	4.0	0.4	0.2	1.0	1.0	21.5	351.0	10.5	75.5
Wongoola Close	9	72	10.1	4.0	0.6	0.2	0.8	1.0	7.0	138.4	2.6	7.8
7 parkland average	3	80.5	11.1	3.1	0.3	0.2	0.7	1.0	13.7	264.7	7.3	35.0
7 parkland total	24	N/A	N/A	77.0	N/A	N/A	0.6	0.9	2.4	231.7	6.4	30.5

The integrative summary of the silvicultural and habitat value parameters, per Totem tree, demonstrates several important trends (Table 1) with significant management implications. There is a strong negative correlation between the number of Totem trees in each of the parklands and the fauna categorical and behavioural diversities per tree (Table 1). For example, the Wongoola Close parkland has the lowest number of fauna categories and behaviours observed per Totem tree, despite having the largest total number of trees (Table 1). Therefore, clustering of Totem trees seems to significantly reduce the habitat value per tree.

There is also a slight correlation indicated between the number of hollows and fauna diversity: the parklands with a higher average number of hollows per tree (e.g., Maitland Street, Gurrang Avenue) have a higher fauna (37.0 and 21.5 respectively) and behavioural diversity (21.0 and 10.5 respectively) per tree (Table 1).

2. Conservation and management of Totem trees

2.1 Significance of the Totem trees' habitat value for conservation

The study of Totem trees shows that they have a significant habitat value since they provide hollows, nesting sites, shelter, perching sites and food for a variety of fauna. The most significant components contributing to their habitat value are the hollows, with a large range of sizes, and their structural complexity, providing habitation for a wide diversity of arboreal and areal fauna (Figures 2, 3).

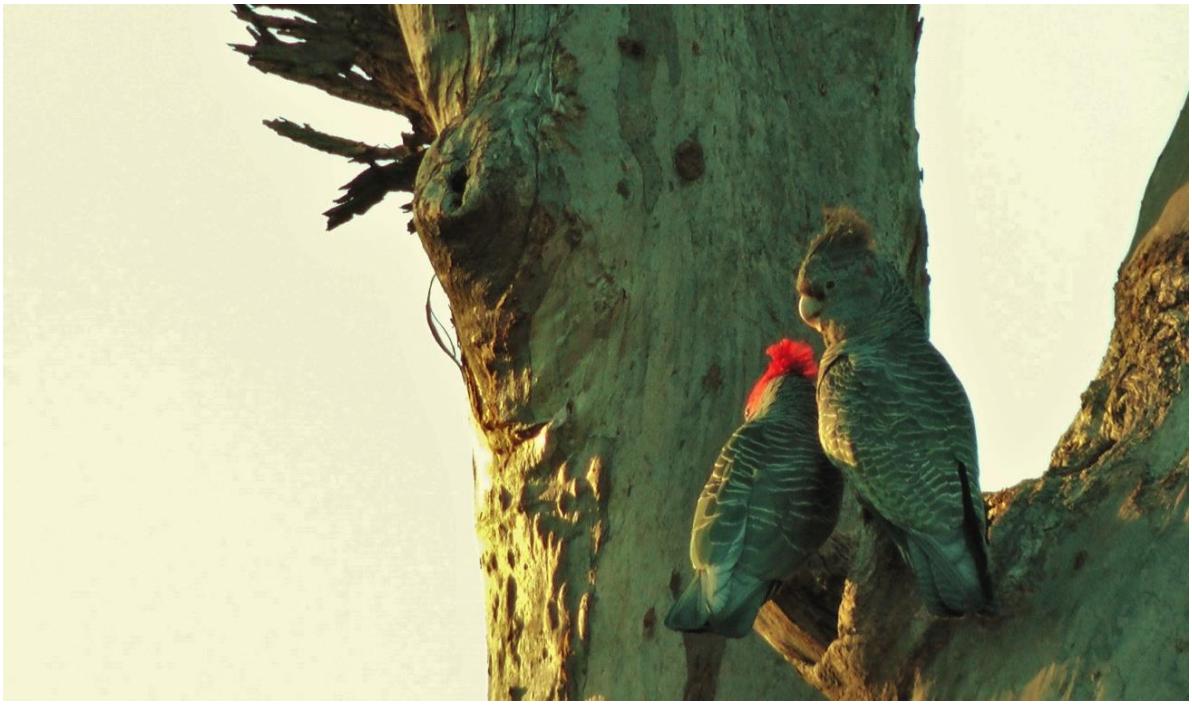

Figure 2: Pair of *Callocephalon fimbriatum* perching on a Totem tree (Photograph credit: Alexander Pecenko)

Furthermore, those Totem trees which have significant structural complexity, especially numerous branches, bark and differently sized hollows, have a great habitat value for arboreal and areal fauna. In addition, free–standing Totem trees harbour a much larger diversity and abundance of fauna categories and behaviours than the clustered ones. Comparable outcomes are found in previous studies on the hollow preferences [2] and habitat value of structurally complex live trees [3-5].

2.2 Public attitudes towards Totem tree conservation

The participants' main arguments against Totem tree conservation were safety concerns; the general gist of the responses was that "unless they are dangerous I don't see the point of interfering with [the] natural landscape". Similar public views were found in previous research on standing dead trees [6, 7] and the urban forest [8-10], which indicate that the perceived or real danger of falling branches is the most prominent argument against conservation.

A secondary argument for Totem tree removal was that the participants considered them untidy or, of "disorganised appearance" and "if they [Totem trees] were replaced by a fresh planting [live trees], it would be acceptable". This attitude is also demonstrated in a study on the visual perception of different live tree forms, showing the public preference for well–structured tidy trees with extensive canopies [11]. Furthermore, the minority of participants who considered the Totem trees as unsightly may have disliked their leafless bare–branched aesthetic. However, overall, the Canberra participants' dislike of Totem trees seems less pronounced than the level of dislike found in previous forest research on dead trees [11-13].

The participants' primary arguments for Totem tree conservation were their habitat value (e.g., nesting sites), aesthetic appeal and social functions (e.g., education) (Figure 3). They mainly favoured the conservation of the Totem trees, stating the provision of habitat for larger fauna, such as *Phalangeriformes* and *Psittaciformes*, however, *Invertebrata* and other fauna would indirectly benefit, as underscored by the flagship species theory [14, 15]. Since trees with more hollows, larger DBH, bark and greater structural complexity have a greater fauna diversity and habitat value (Table 1), they are more valuable candidates for current management and future conservation.

The second most prominent reason for conservation, perceived by the public, was the Totem trees' aesthetic appeal since the participants "enjoy the view [of Totem trees] from the park to look for Gang Gangs on Totem trees". Furthermore, several participants said that the Totem trees should be conserved since parents "can show different species on them to the children", thus adding to their educational value. It seems that the Totem trees' structural complexity and the diversity of fauna

using them, especially *Aves*, contributes to their aesthetic appeal and educational value, as similarly found in the past studies of the public perceptions of the urban forest [16-19].

In conclusion, the need to conserve the Totem trees was supported by the majority of the parkland users and residents. They listed the Totem trees' habitat for fauna — predominantly hollows, shelter, nesting sites — and aesthetic appeal as the main grounds for conservation, stating that Totem trees "represent the only hollow bearing habitat and [their] removal would result in loss of the habitat." Furthermore, given that the Totem trees provide a variety of fauna habitats and social functions, they would be appealing to most residents and parkland users, maybe even more so than directly stated, since the participants used the parklands for multiple purposes (Figure 3). Consequently, this report recommends that Totem trees conservation and management continue into the future.

2.3 Totem tree management outcomes and recommendations

The Totem tree structure is directly linked to, and interdependent with, its habitat value, which in turn influences the public perceptions of the trees. All these interrelated aspects and parameters are involved in, and influence, the Totem tree conservation and management, which are diagrammatically presented below (Figure 3).

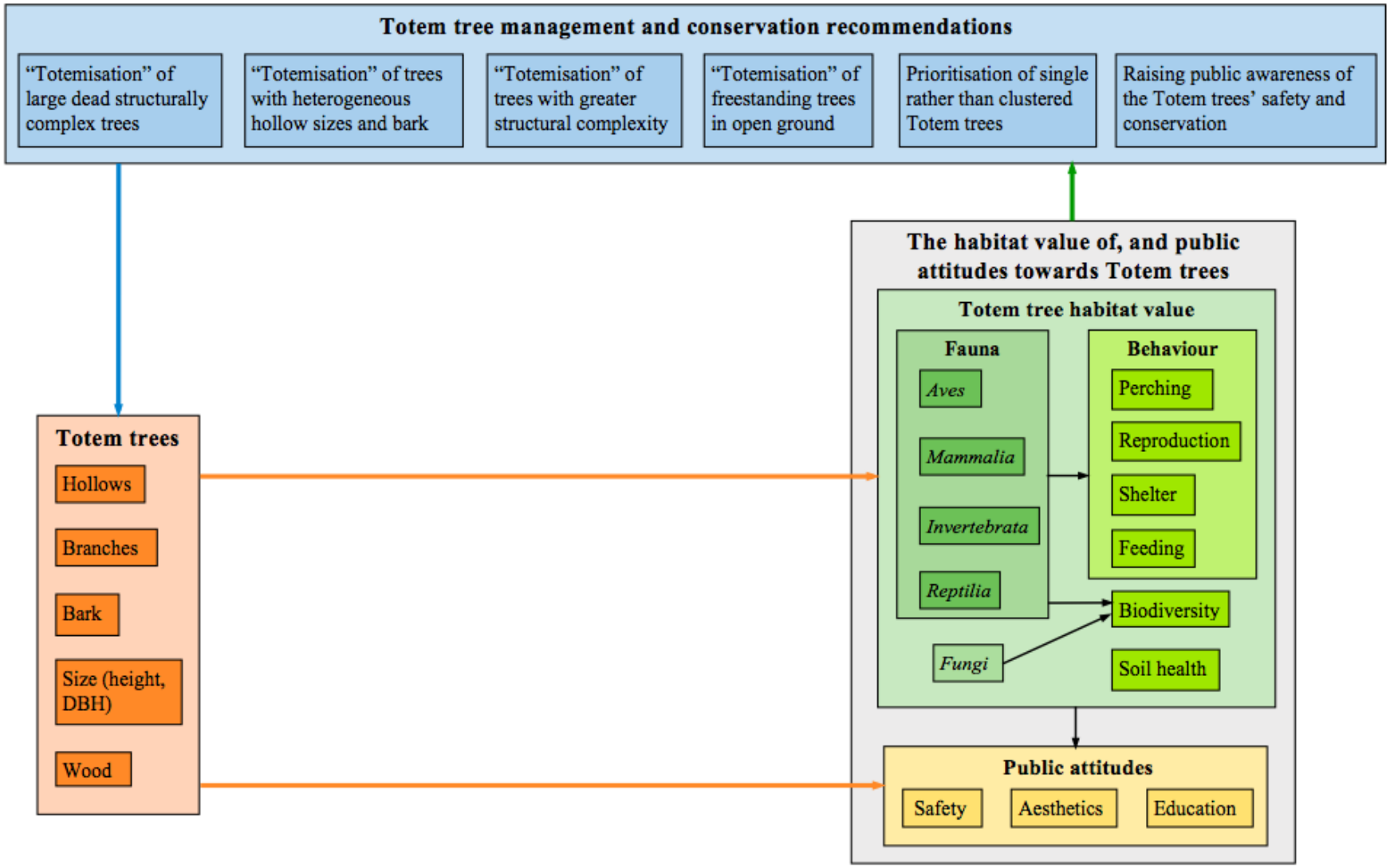

Figure 3: Integrative summary of the conservation and management recommendations in relation to the main structural components and parameters of the Totem trees, their habitat value and the public attitudes (based on findings from my Honours thesis).

The diagrammatic overview of the relationships among the Totem trees, their habitat value, social functions, and management recommendations (Figure 3), demonstrates the complexities and interconnectedness of the parkland ecosystem and the multi-faceted approaches necessary for managing Totem trees. The fauna assessment shows that the Totem trees do have significant and diverse habitat values, especially in providing nesting and habitation sites in hollows; perching, feeding and vocalisation on branches; and shelter and feeding on the wood and bark.

The Totem tree components and characteristics have a direct influence on their habitat values and public attitudes, which in turn have a strong impact on the management approaches recommended here (Figure 3). Furthermore, each of the management recommendations has a different, yet important, positive impact on the Totem trees' conservation, management, public perceptions and habitat value and hence, the greatest benefit would be gained through the combined application of all the management recommendations listed below. In future, in the selection of candidate standing dead trees for "totemisation" and their subsequent management, the following management recommendations may be followed:

1. Large, old and structurally stable standing dead trees may be selected for "totemisation", provided funds are available, to increase the total quantity of habitat in Canberra (Figure 3). There are currently only 112 Totem trees under TAMS management which is a small proportion of the total Canberra tree population.
2. Standing dead trees chosen for "totemisation" should preferably have a variety of hollow sizes to provide a range of habitat niches for differently sized fauna (e.g., ranging from *Microchiroptera* to *Tyto alba*). In addition, they should have extensive bark, large DBH, and be surrounded by logs, to provide more heterogeneous habitats and food for *Invertebrata*, especially *Coleoptera* borers, and arboreal fauna, such as *Apis* and *Cacatuidae* (Figure 3).
3. Ensuring the Totem trees have significant structural complexity is an important criterion for their "totemisation" (Figure 3; Table 1). Their diversity in hollow number, size, height of trees and presence or absence of bark and branches (Figure 3) indicates habitat heterogeneity which in turn attracts a greater abundance of fauna. From the heterogeneity of structural complexities (Table 1) it may be implied that the Totem trees should have a variety of structures (e.g., hollows, branches), and varying habitat values (e.g., heterogeneity in hollow size, number and positioning of branches).
4. Standing dead trees in open ground, especially if tall (such as at the Rochford Street and Gurrang Avenue parklands), are recommended for "totemisation" since they appear to have significant habitation value for *Aves*, such as *Cacatua galerita* and *Cracticus tibicen*.

Furthermore, they may be used as resting places and stepping stones for *Aves* moving about Canberra.

5. Selection of single free–standing Totem trees is preferred to clustering of the trees, since on a per tree basis, those parklands with more Totem trees have a lower abundance and diversity of *Eucaryota* and their respective behaviours (Table 1; Figure 3). Furthermore, previous research on standing dead trees [3, 20] demonstrates the negative impacts of clustering on habitat value.
6. To address concern about the safety of Totem trees, the public needs to be informed about their safety and conservation (Figure 3). The following methods of information dissemination are suggested: (a) signposts at all the parklands, street verges an central reservations with Totem trees, explaining their safety centred management regime, habitat value and conservation; (b) brochures, outlining the TAMS safe management approach, sent to households surrounding sites with Totem trees; (c) public information sessions, in schools and workplaces; (d) media broadcasts, posts, and announcements.

2.4 Future research recommendations

Based on my Honours thesis findings I suggest, apart from the abovementioned management recommendations, the following recommendations for future research.

The findings on the habitat value and public perceptions of Totem trees are not representative of the entire Totem trees population in Canberra. Consequently, assessment of all the 73 urban sites with Totem trees is recommended here, conducted over a longer period of at least one year (encompassing all the four seasons). Such a long-term study would produce more statistically robust findings, by applying all the mixed methods involved, and thus provide better guidelines for which trees, in which suburbs/regions of Canberra, should be prioritised for conservation and "totemisation". Lastly, research into the importance of Totem tree structural complexity and the relative impact on, and from, the surrounding live vegetation in relation to fauna use would contribute to future improvements in parkland design and Totem tree selection.

3. References

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