

Cunninghamia

A journal of plant ecology for eastern Australia



Date of Publication:
August 2016

ISSN 0727-9620 (print) • ISSN 2200-405X (Online)

Population estimate of the parasitic herb *Thesium australe* (Santalaceae) in Booroolong Nature Reserve, Northern Tablelands, NSW

John T. Hunter¹ and Vanessa H. Hunter²

¹School of Environmental and Rural Science, University of New England, Armidale, NSW 2351, AUSTRALIA;

²Hewlett Hunter Pty Ltd, Armidale, NSW 2350, AUSTRALIA

Abstract: A survey of the population of the parasitic herb *Thesium australe* R.Br. (family Santalaceae) in Booroolong Nature Reserve, northwest of Armidale, found it was restricted to an eastern facing lower slope on metasediments, within regenerating grassy woodland of *Eucalyptus nova-anglica* H.Deane & Maiden (New England Peppermint) and a predominantly *Themeda triandra* Forssk. (Kangaroo Grass) and *Sorghum leiocladum* (Hack.) C.E.Hubb. (Native Sorghum) understorey. The population is in two clusters over a total area approximately 260 m long by 40 m wide and was estimated to be about 800 individuals at the time of survey (May 2014). Current threats include a maintenance trail, erosion of creek bank, stray cattle and sheep, rabbits and *Rubus anglocandicans* A.Newton (Blackberry) invasion. It is recommended that further searches be conducted and that monitoring occur on a regular basis using the permanently marked sites and methodology used in this survey.

Cunninghamia (2016) 16: 45-49

doi: 10.7751/cunninghamia.2016.16.006

Introduction

Thesium australe (family Santalaceae) is a green to yellow parasitic herb which grows to 40 cm tall (Figure 1). The stems are slender arising from a central base with opposite leaves. It is weakly erect to decumbent and is generally inconspicuous as it grows intertwined with grasses which it parasitises and is cryptic and easily missed. Although perennial, its above-ground parts often die back and may not be visible every year. *Thesium australe* is known to occur from south eastern Queensland south to Tasmania, though no extant populations are known from Tasmania. Initial observations indicated a preference for occurring in *Themeda triandra* Forssk. dominated grasslands on basaltic soils (Griffith 1996). These initial habitat preference concepts however lead many targeted surveys to falsely concentrate on areas dominated by *Themeda* on basalt in preference to others locations. Later surveys have found *Thesium* to be associated with various grass dominated understoreys, including exotic grasses, across a range of rock types (e.g. Hunter *et al.* 1999; Hunter 2000; Hunter 2003; Hunter 2011; Hunter *et al.* 2012). Within the New England Bioregion of New South Wales there are over 150 current and historical records of *Thesium australe* (Atlas of Living Australia; accessed 1/06/2016); however population sizes have rarely been recorded.

Thesium australe is a listed Vulnerable Species under the Federal *Environmental Protection and Biodiversity Conservation Act* (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=15202) and the New South Wales *Threatened Species Conservation Act* (<http://www.environment.nsw.gov.au/ThreatenedSpeciesApp/profile.aspx?id=10802>).

In April 2014 *Thesium australe* was discovered opportunistically during a vegetation mapping program conducted for the NSW Office of Environment and Heritage (Hunter 2014) within Booroolong Nature Reserve northwest of Armidale and an intensive investigation of its population size was consequently undertaken. This paper describes the size, habitat and potential threats to this population.



Figure 1. *Thesium australe* (family Santalaceae) is a green to yellow parasitic herb with slender stems arising from a central base with opposite leaves. It is generally inconspicuous as it grows intertwined with grasses which it parasitises.

Study location

Booroolong Nature Reserve is approximately 30 km by road northwest of Armidale, in the Northern Tablelands Botanical District and New England Tablelands Bioregion of New South Wales. The Reserve, dedicated in 1999, covers approximately 967 ha. Within the reserve *Thesium australe* was found associated with mid-reaches of a northerly facing valley on an eastern facing metasediment hill-slope between 1210 and 1220 m elevation, associated with *Eucalyptus nova-anglica* (New England Peppermint) regrowth and derived grasslands resulting from previous clearing of *Eucalyptus nova-anglica* Woodland.

Methods

The method chosen to assess the population incorporated a modified adaptive cluster design (Barker 2001, Christman & Lan 2001; Smith *et al.* 2004) with the following principal steps (see Figure 2):

1. A random 10 x 10 m quadrat is initially placed within the known population of *Thesium australe*.
2. Additional 10 x 10 m quadrats are then placed around all boundaries of the initial plot.
3. If an occurrence of *Thesium* is detected adaptive, 10 x 10 m plots are then added around that plot (8 in total).
4. If no *Thesium* is detected no further plots are placed around the negative plot (adaption is stopped).
5. If *Thesium* is detected in a plot it is permanently marked with surveyors pegs in all four corners and given an individual identification numbered and labelling in the southeastern corner.
6. Each positive plot is subdivided into five 2 x 10 m strips to assist in detection of plants.
7. The number of individual *Thesium* plants within each of the five strips is counted by two botanists independently.
8. After counting individual plots the botanists check their detection ability with each other by comparing numbers found within each 2 x 10 m strip.
9. If counts are significantly different (> 15%; arbitrarily chosen) the strips within the plot are resurveyed by both botanists individually until the difference is minimised.
10. When adaption was complete an adaptive line transect method, in which strips 20 m apart were walked, was used to search widely around the vicinity of the original population to capture any additional nearby clusters.
11. If additional populations were found an adaptive plot was placed and the process of 1-10 was repeated.

The survey was conducted from 2-5th May 2014 when *Thesium* is easier to see due to its yellowing colour at this time of year.



Figure 2. The site location of the Booroolong populations of *Thesium australe* showing the sampling layout.

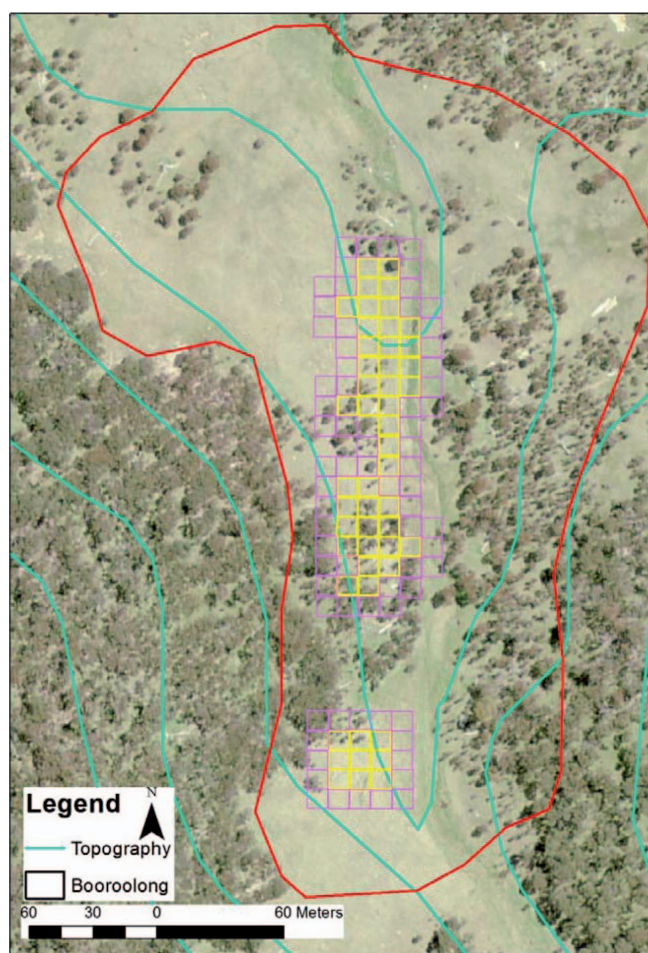


Figure 3. Placement of 10 x 10 m adaptive cluster design plots (squares) for the survey of *Thesium australe* and the area in which adaptive line transects were walked (red boundary) within Booroolong Nature Reserve. Positive subplots are indicated by yellow border and negative subplots by pink border.

Results

There were 52 permanently marked plots in total; 43 positive plots within the initial cluster and nine plots placed around

a second cluster about 60 m further south (found during the adaptive line transect searches) (Figure 3). The results of the double count within each subplot and the five belt transects within them are given in Appendix 1. A total of 800 individuals of *Thesium* were found within the area searched. The highest number of individuals recorded within a 10 x 10 m subplot was 80 (0.8 plants/sqm) and the highest number within a 2 x 10 m strip was 28 (1.4 plants/sqm).

The *Thesium* clusters were confined to a 40 x 260 m area (Figure 3) and restricted to a narrow belt upslope from the valley floor and entirely on an eastern face. The clusters were intersected at their lower boundary by a management trail and an eroding creekline. Stray cattle and sheep are known within the vicinity and cow dung was found within the survey area. Macropods were observed in large numbers.

Though individual plants were found between vehicular wheeltracks the observed numbers decreased significantly on areas affected by vehicle movement. Individuals occurred along the tops of eroded creek faces indicating that some habitat has been lost through creek bank erosion. Rabbit burrows did not occur within the population but were frequent on the opposing western facing valley slope.

Discussion

The current (2014) population of *Thesium australe* within Booroolong Nature Reserve is substantial (ca. 800 individuals), and equivalent to the other known large extant populations (Griffith 1996; Cohn 2004). However, as the above ground parts of *Thesium* are not visible every year, regular surveys may be required to understand the species dynamics and avoid erroneous conclusions based on sudden decreases or increases in observed population size. Thickening of vegetation may impact on *Thesium australe* populations in a negative way by increasing the cover of the overstorey and changing the cover and abundance of understorey species on which *Thesium* may be parasitising. The population currently occurs in open derived native grassland and *Eucalyptus nova-anglica* woodland in various stages of recovery. It is highly likely that further expansion of *Eucalyptus nova-anglica* will occur across the open grassland areas containing the *Thesium* population. These permanently marked plots could easily be used to monitor the effects of the recovery of *Eucalyptus nova-anglica* woodland on the density and population size of *Thesium australe*.

Another threat to the population is the internal maintenance vehicle trail which should be diverted to avoid the current population clusters. In addition stabilisation of the creekbank may be of benefit, along with control of *Rubus anglocandicans* (Blackberry) and pest animals such as rabbits and stray livestock. It is likely that other *Thesium* clusters may be found in the modified woodlands and derived grasslands of Booroolong Nature Reserve and further investigation may be fruitful.

References

- Barker, P. (2001) *A Technical Manual for Vegetation Monitoring*. (Resource Management & Conservation, Department of Primary Industries, Water & Environment: Hobart).
- Christman, M.C. & Lan, F. (2001) Inverse adaptive cluster sampling. *Biometrics* 57: 1096-1105.
- Cohn, J.S. (2004) Effects of slashing and burning on *Thesium australe* R.Br. (Santalaceae) in coastal grasslands of NSW. *Proceedings of the Linnaean Society of New South Wales* 125: 57-65.
- Griffith, S.J. (1996) *Thesium australe*. Species Recovery Plan. (NSW National Parks & Wildlife Service: Hurstville).
- Hunter, J.T. (2014) Vegetation and flora of Booroolong Nature Reserve. Unpublished report for the NSW Office of Environment and Heritage. DOI: 10.13140/RG.2.1.2823.0246.
- Hunter, J.T. (2011) Vegetation and floristics of Little Llangothlin Nature Reserve. Unpublished report for the NSW Office of Environment and Heritage. DOI: 10.13140/RG.2.1.2788.8482.
- Hunter, J.T. (2003) Vegetation of Arakoola Nature Reserve, North Western Slopes, New South Wales. *Cunninghamia* 8: 157-284.
- Hunter, J.T. (2000) Vegetation and floristics of Kings Plains National Park. Unpublished report to the NSW National Parks & Wildlife Service. DOI: 10.13140/RG.2.1.1740.2724.
- Hunter, J.T., Hawes, W. & Sonter, T. (2012) Uralla Shire Council Biodiversity Strategy: Arding, West Invergowrie, Kentucky & Rocky River. Unpublished Report to Uralla Shire Council. DOI: 10.13140/RG.2.1.3266.4169.
- Hunter, J.T., Kingston, J. & Croft, P. (1999). Vegetation and floristics of Kwiambal National Park and surrounds, Ashford, New South Wales. *Cunninghamia* 6: 3890394.
- Smith, Z. James, E.A. & Ladiges, P.Y. (2004) Morphological and genetic variation in the rare daisy *Olearia pannosa* subsp. *cardiophylla* (Asteraceae). *Muelleria* 20: 33-48.

Manuscript accepted 19 July 2016

Appendix 1: Raw counts of *Thesium australe* from both surveyors (A and B) of each of the five belt transects within each of the 52 plots.

Plot	1	2	3	4	5	Score
A	0	0	1	14	6	
B	0	0	1	12	6	
1 Total	0	0	1	14	6	21
A	0	0	0	0	1	
B	0	0	0	0	0	
2 Total	0	0	0	0	1	1
A	0	0	4	1	0	
B	0	0	5	1	0	
3 Total	0	0	5	1	0	6
A	1	0	0	0	0	
B	1	0	0	0	0	
4 Total	1	0	0	0	0	1
A	0	0	0	3	1	
B	0	0	0	2	1	
5 Total	0	0	0	3	1	4
A	2	4	4	3	7	
B	3	4	4	3	7	
6 Total	3	4	4	3	7	21
A	4	1	0	0	3	
B	4	1	0	1	2	
7 Total	4	1	0	1	3	9
A	0	1	0	0	1	
B	0	0	0	0	0	
8 Total	0	1	0	0	1	2
A	25	18	12	3	3	
B	19	19	14	3	6	
9 Total	25	19	14	3	6	67
A	19	17	12	9	12	
B	23	17	11	10	11	
10 Total	23	17	12	10	12	74
A	7	20	11	12	9	
B	8	19	15	12	9	

Plot	1	2	3	4	5	Score
11 Total	8	20	15	12	9	64
A	6	7	4	1	0	
B	8	7	4	1	1	
12 Total	8	7	4	1	1	21
A	5	7	7	11	9	
B	5	8	5	12	10	
13 Total	5	8	7	12	10	42
A	1	0	0	1	2	
B	1	0	0	1	1	
14 Total	1	0	0	1	2	4
A	9	4	7	3	2	
B	11	4	3	3	4	
15 Total	11	4	7	3	4	29
A	7	5	3	0	5	
B	6	7	3	1	5	
16 Total	7	7	3	1	5	23
A	0	0	0	2	1	
B	0	0	0	2	1	
17 Total	0	0	0	2	1	3
A	11	4	2	2	4	
B	10	2	1	1	4	
18 Total	11	4	2	2	4	23
A	0	0	0	0	1	
B	0	0	0	0	1	
19 Total	0	0	0	0	1	1
A	3	1	0	0	2	
B	4	0	0	0	2	
20 Total	4	1	0	0	2	7
A	1	0	0	3	1	
B	0	0	0	3	1	
21 Total	1	0	0	3	1	5
A	0	1	0	1	0	
B	0	1	0	1	1	

Plot	1	2	3	4	5	Score
22 Total	0	1	0	1	1	3
A	0	6	2	6	0	
B	0	2	1	5	0	
23 Total	0	6	2	6	0	14
A	4	0	0	1	0	
B	5	1	1	2	0	
24 Total	5	1	1	2	0	9
A	0	0	2	9	15	
B	0	0	1	5	15	
25 Total	0	0	2	9	15	26
A	0	0	0	0	1	
B	0	0	0	1	1	
26 Total	0	0	0	1	1	2
A	1	4	3	0	2	
B	2	3	5	0	0	
27 Total	2	4	5	0	2	13
A	0	0	0	0	1	
B	2	0	0	0	0	
28 Total	2	0	0	0	1	3
A	0	0	0	0	5	
B	1	0	0	0	7	
29 Total	1	0	0	0	7	8
A	1	0	0	0	0	
B	1	0	0	0	1	
30 Total	1	0	0	0	1	2
A	1	1	6	1	2	
B	1	1	7	1	3	
31 Total	1	1	7	1	3	13
A	2	1	3	0	1	
B	2	1	3	1	2	
32 Total	2	1	3	1	2	9
A	1	2	1	0	0	
B	2	1	1	0	0	
33 Total	2	2	1	0	0	5
A	4	0	2	2	6	
B	2	1	0	5	5	
34 Total	4	1	2	5	6	18
A	0	1	0	1	2	
B	0	0	0	2	2	
35 Total	0	1	0	2	2	5
A	0	1	0	0	0	
B	0	0	0	0	0	
36 Total	0	1	0	0	0	1
A	0	3	0	2	1	
B	0	3	0	3	0	
37 Total	0	3	0	3	1	7
A	4	5	2	0	1	
B	4	5	2	0	1	
38 Total	4	5	2	0	1	12
A	0	0	4	0	0	
B	1	0	4	1	0	
39 Total	1	0	4	1	0	6
A	1	0	0	0	0	
B	0	0	0	0	0	
40 Total	1	0	0	0	0	1
A	0	1	0	1	1	
B	0	1	0	0	1	
41 Total	0	1	0	1	1	3
A	0	1	0	0	0	
B	0	0	0	0	0	
42 Total	0	1	0	0	0	1
A	0	0	0	0	1	
B	0	0	0	0	1	
43 Total	0	0	0	0	1	1
A	13	18	8	10	6	
B	15	21	13	12	8	
44 Total	15	21	13	12	8	69
A	1	1	1	0	0	
B	1	0	1	0	0	
45 Total	1	1	1	0	0	3
A	8	8	3	3	1	
B	8	8	3	3	1	
46 Total	8	8	3	3	1	23
A	0	0	2	0	1	
B	0	0	1	0	1	
47 Total	0	0	2	0	1	3
A	4	5	20	28	23	
B	4	5	20	27	23	
48 Total	4	5	20	28	23	80
A	6	0	0	0	0	
B	5	0	0	0	0	
49 Total	6	0	0	0	0	6
A	0	0	3	6	6	
B	0	0	3	7	5	
50 Total	0	0	3	7	6	16
A	0	0	0	1	5	
B	0	0	0	1	5	
51 Total	0	0	0	1	5	6
A	1	2	0	0	0	
B	1	2	0	0	0	
52 Total	1	2	0	0	0	3

