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Aspects of the distribution and ecology of the rare shrub *Prostanthera tallowa* (Lamiaceae), an endemic of the lower Shoalhaven River valley, South Coast, NSW

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Abstract: The results of a field survey of *Prostanthera tallowa* (family Lamiaceae), a rare and only recently described shrub from the lower Shoalhaven River valley, on the NSW South Coast, are described. The extent and size of populations in the vicinity of the type locality at Tallowa Dam are greatly expanded and several new and distant populations are described. Information is provided on all known populations and their habitat. The species is regarded as adequately reserved, as almost all known populations occur in protected areas though the actual area of occupancy is small. The species recruits after fire with most sites having been burnt about 10 years ago; the total known population size is currently over 3,300 plants.

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Introduction

Although recognised as distinct since the 1980s (the type specimen was collected in 1988), the shrub *Prostanthera tallowa* (family Lamiaceae) was only formally described by Conn and Wilson in 2012, despite the general area of occurrence being readily accessible by motor vehicle for a long time. The taxon was previously referred to as *Prostanthera* sp. 'E' in *Plants of New South Wales* (Jacobs & Pickard 1981), *Flora of NSW, Volume 3* (Conn, in Harden 1992) and *Flora of the Sydney Region* (Pellow *et al.* 2009). It was not included in a list of rare, un-named species of *Prostanthera* in Briggs and Leigh (1996).

At the time of its formal description, and indeed until this study, the species was known only from one small area near Tallowa Dam on the Shoalhaven River, west of Nowra, on the southern edge of the Central Coast Botanical Subdivision, where Conn and Wilson (2012) estimated the number of plants (population 1c in this study) to be about 50 plants. This paper describes the results of recent searches for additional sites and updates the investigations in Mills (2014).

The name *Tallowa* appears on the current Burrier and Bundanoon 1:25 000 maps in two places, namely Tallowa Gully, a significant tributary of Bundanoon Creek, and Tallowa Dam. The parish of Tallowal [*sic*] is on the southern side of the Shoalhaven Gorge. The map of New South Wales prepared by surveyor Thomas Mitchell in 1834 shows only the eastern end of what is now known as Tallowa Gully, which is un-named on the map, and places the name Tallowa where Badgerys Spur meets the Shoalhaven River, i.e. at Badgerys Crossing Place. The headwaters of Tallowa Gully are not far north of the Tallowa location of Mitchell. The diary of Charles Throsby contains a reference to Tallawa [*sic*] at Barron Flat at the junction of the Shoalhaven and Kangaroo Rivers, i.e. the site of today's Tallowa Dam. The word is apparently of Aboriginal origin. Thus, the same name is identified at two locations in the Shoalhaven Gorge, perhaps suggesting that the name was given by the Aboriginal people to the Shoalhaven Gorge between the two points mentioned above.

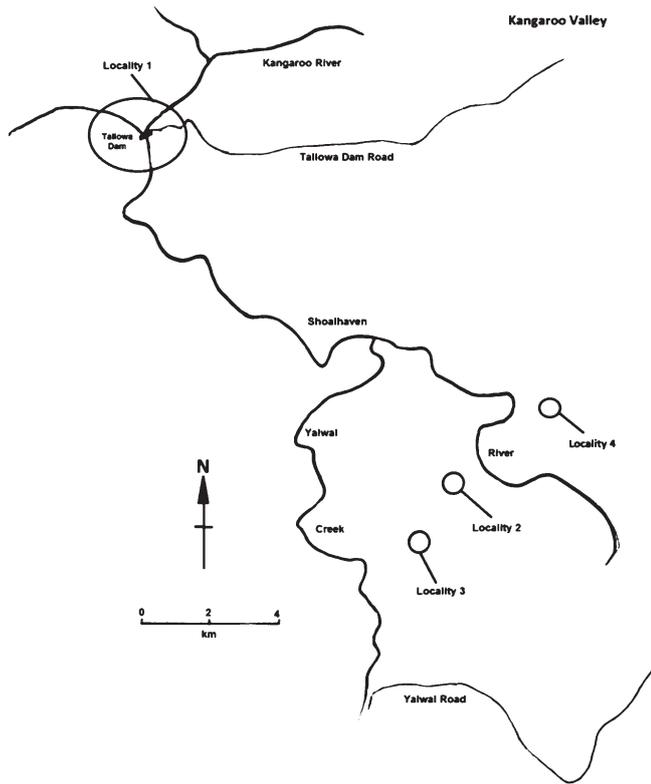


Fig. 1. General location of known populations of *Prostanthera tallowa* in Nowra area.

Methods

Field surveys in 2013 and 2014 investigated the extent, population size and general ecology of *Prostanthera tallowa*. Searches initially focused on the type locality at Tallowa Dam, with subsequent searches extending out in all directions. The fortuitous discovery of a population 14 km to the southeast led to a search of Morton State Conservation Area (Mills 2013). It soon became clear that the species is associated with clifflines, and these areas became the primary focus of searches.

For each discrete population, information was recorded on geology, habitat, associated plant community and associated plant species, the condition of the plants of *Prostanthera tallowa*, and general information on the site. The number of plants in each population was counted as the site was searched. GPS recordings were taken at the limits of each population. The sites were also marked onto a topographic map in the field and various digital photographs were taken. At two populations, all plants counted were allocated to a height class, as an approximate surrogate for plant age.

Results

Distribution

Prostanthera tallowa was found in four distinct, well-separated localities, three of which contain several separate populations in relatively close proximity, with no plants

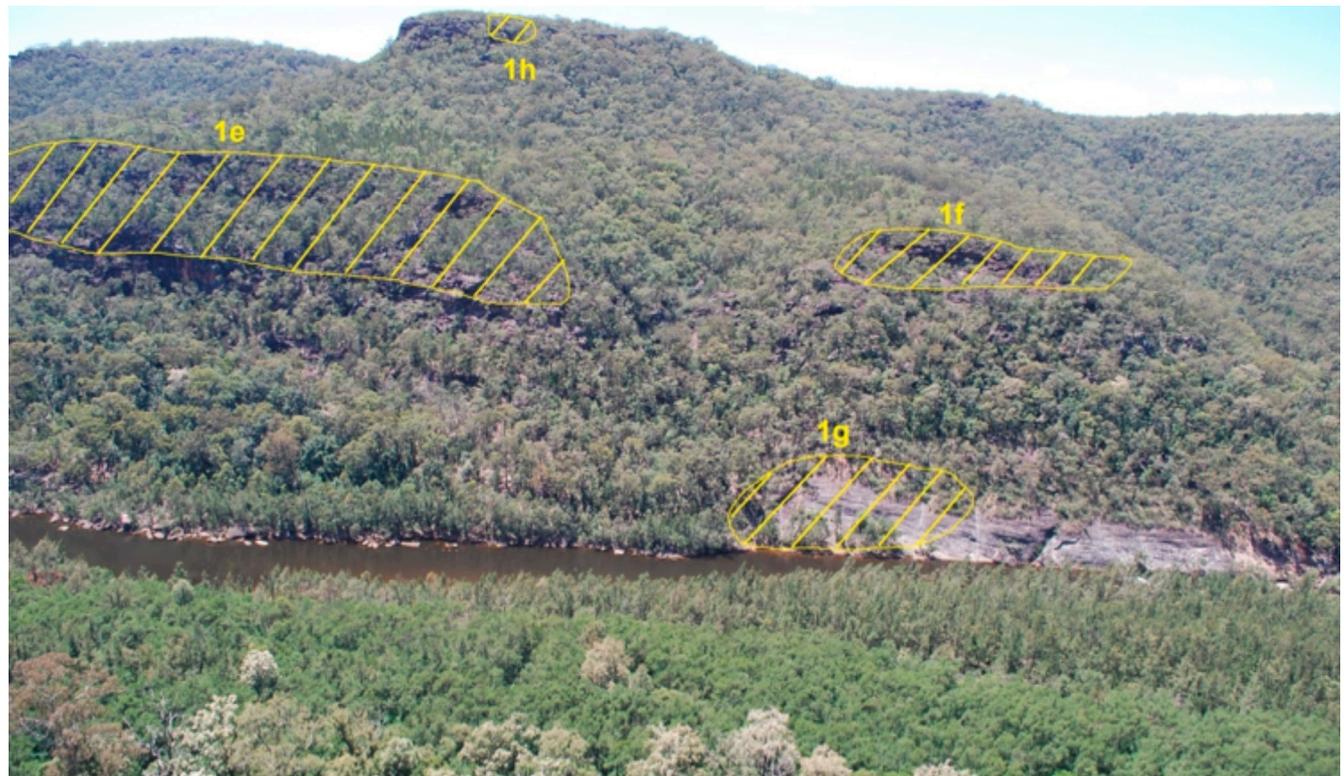


Fig. 2. Habitat of *Prostanthera tallowa* populations near Tallowa Dam. Photograph looking north across the river from the escarpment at population 1j. Geology: 1h - Nowra Sandstone; 1e and 1f - Snapper Point Formation; 1g - Tallong Conglomerate.

Table 1. Summary of known populations of *Prostanthera tallowa*

| Site No. | Locality/ Population/GPS | No.of plants | Habitat/ Vegetation |
|--------------------------|--|--------------|---|
| 1 | Tallowa Dam | | |
| 1a | Tallowa Dam Road (upper east) Morton National Park 0255220 61499349 to 0255151 6149427 | 25 | road cutting (low rock face) scattered plants |
| 1b | Tallowa Dam Road (upper west) Morton National Park 02551134 6149514 to 0255137 6149437 | 184 | escarpment cliffs/ disturbed roadside open woodland |
| 1c | Tallowa Dam Road (lower) Morton National Park 0254921 6149313 to 0254778 6149226 | 139 | escarpment cliffs open woodland/shrubland |
| 1d | Tallowa Dam escarpment (east) Morton National Park 0254646 6148706 to 0254620 6149068 | 357 | escarpment cliffs open woodland/ shrubland |
| 1e | Barron Flat escarpment (north) Morton National Park 0254703 6148703 to 0254543 6148003 | 841 | escarpment cliffs open woodland/mallee/ shrubland |
| 1f | Barron Flat escarpment (south) Morton National Park 0254604 6147756 to 0254573 6147934 | 121 | escarpment cliffs open woodland |
| 1g | River side cliff Morton National Park 0254423 6147937 | 37 | conglomerate cliff scattered shrubs/small trees |
| 1h | Tallowa Dam lookout Morton National Park 0255148 6147649 | 2 | sandstone cliff edge woodland |
| 1i | Tallowa Dam west Morton National Park 0253458 6148708 to 0253503 6148585 | 166 | sandstone cliff edge woodland/shrubland |
| 1j | Tallowa Dam southwest Morton National Park 0253534 6148453 to 0253792 6148148 | 362 | sandstone cliff edge woodland/shrubland |
| 1k | Tallowa Dam south Morton National Park 0253926 6147977 to 0254008 6147833 | 21 | sandstone cliff edge woodland/shrubland |
| 1l | North of Purri Plateau Morton National Park 0253400 6148450 | 240 | sandstone cliff edge woodland/shrubland |
| 1m | East of Purri Plateau Morton National Park 0253880 6147708 | 26 | rocky gully side open forest/ tall shrubland |
| 2 | Grassy Gully ¹ Unnamed creek Morton State Conservation Area 0263487 6139226) | 324+ | small gorge/cliff top dry rainforest |
| 3 | Durkin Spur escarpment | | |
| 3a | Escarpment (north) Morton State Conservation Area 0262669 6137655 to 0262558 6137449 | 391 | exposed escarpment edge open woodland /heathland |
| 3b | Escarpment (west) Morton State Conservation Area 0262288 6137377 | 12 | exposed escarpment edge open forest/shrubland |
| 3c | Escarpment (south) Morton State Conservation Area 0262562 6137299 | 10 | exposed escarpment edge open forest/shrubland |
| 4 | Bugong escarpment Illaroo Lookout 0265900 6141500 | 50+ | exposed escarpment edge open forest/shrubland |
| Total counted population | | 3308+ | |

1. The location is in a small un-named gully east of Grassy Gully itself, which empties directly into the Shoalhaven River to the north.

Table 2. Characteristics of sites of the known localities

| Site | Geology | Altitude | Aspect | Last fire ¹ | Plants |
|-------|-------------------------|-----------|------------------------|------------------------|--------|
| 1a-1f | Snapper Point Formation | 100-210 m | southwest to northwest | Jan. 2003 | 1667 |
| 1g | Tallong Conglomerate | 50 m | south | Jan. 2003 | 37 |
| 1h | Nowra Sandstone | 310 m | south | Jan. 2003 | 2 |
| 1i-1m | Snapper Point Formation | 200-250 m | north to west | Jan. 2003 | 815 |
| 2 | Grassy Gully Rhyolite | 75 m | northeast | Jan. 2003 | 324+ |
| a-3c | Nowra Sandstone | 330-360 m | west to north | Jan. 2003 | 413 |
| 4 | Nowra Sandstone | 248 m | south | unknown | 50+ |

1. It is unlikely that all of the area burnt, as rocks and escarpments result in a mosaic of burning.

Table 3. Distribution of plant heights in two populations

| Population | <20cm | 20-50cm | 50-100cm | 100-200cm | >200cm | All |
|------------|--------|---------|----------|-----------|----------|-----|
| 1c | 4 (3%) | 4 (3%) | 13 (9%) | 37 (27%) | 81 (58%) | 139 |
| 3a | 8 (2%) | 31 (8%) | 87 (22%) | 217 (55%) | 48 (12%) | 391 |

in the intervening areas (Figure 1). The localities occur in Morton National Park (including the Sydney Catchment Authority Special Area around Tallowa Dam), in Morton State Conservation Area, and at one site just outside Bugong National Park; these sites are up to 14 km distant from each other.

The four separate localities and their constituent populations are summarised in Table 1. The Tallowa Dam locality (1) is within Morton National Park and the in-holding that is the Sydney Catchment Authority Special Area around Tallowa Dam. Locality 3 is about 14 km to the southwest of locality 1, while locality 2 is about 1.8 km to the north-north-east of locality 3. The Grassy Gully (2) and Durkin Spur (3) localities are within Morton State Conservation Area, which adjoins Morton National Park to the west. Location 4 is on the escarpment at Illaroo Lookout, just south of the boundary of Bugong National Park and on the northern side of the Shoalhaven River, about 3.7 km northeast of the closest population in Morton SCA.

The total area occupied by the known populations is quite small, in the order of a few hectares of habitat, based on the limits of the populations determined through the field survey. There are hundreds of kilometres of escarpment and rock outcrop in the district that could support this species, so further populations are almost certain to occur in the wider area, particularly along the Shoalhaven River gorge between the two known locations of Bugong and Tallowa Dam.

Field surveys during 2013–2014 greatly extended the known range of the species from the type locality next to Tallowa Dam Road, as well as significantly increasing the number of plants known to exist. Searches along the escarpments to the north, south and west of the dam found the species to be common on the exposed edges of most escarpments. The typical habitat of the populations around Tallowa Dam is shown on Figure 2; the yellow hatching showing the distribution of the populations indicated.

Habitat

The consistent feature of the habitat of all known *Prostanthera tallowa* populations is their occurrence on substantial rock outcrops, primarily on the exposed edges of escarpment cliffs. The altitude range of the populations is from 50 to 360 m. Four geological substrates are involved (Table 2); localities 1, 3 and 4 are on similar, coarse-grained sandstone of Permian age, namely the Snapper Point Formation and the Nowra Sandstone. A small population (1g) occurs on the Tallong Conglomerate, which underlies the Snapper Point Formation and crops out in the gorge near the Shoalhaven River. Populations 1h and 4 occur on the Nowra Sandstone, while locality 2 is growing on the Grassy Gully Rhyolite of Devonian age, which underlies the Permian sediments. Locality 2 is in a valley on the cliff edge of a small rocky gorge.

Prostanthera tallowa does not seem to grow in dense heathland or forest, but occurs in sparsely treed areas with open heathland and rock very visible on the surface. On the escarpment sites the species grows on the cliff face and on the exposed edge of the escarpment, usually extending no more than 10 m behind the edge unless the vegetation is very open. The type of vegetation associated with each population ranges from open heathland to dry rainforest; see Table 1. The dry rainforest at locality 2 is dominated by *Backhousia myrtifolia*, which is typical of the deeply incised gullies in the general area. Much of the area around the Grassy Gully site is exposed rhyolite rock.

The plant species associated with the known populations are characteristic of the Sydney Basin sandstones. Typical species are those that are often associated with rock outcrops and exposed escarpment cliffs, such as the trees *Eucalyptus punctata* and *Eucalyptus agglomerata*, the mallee *Corymbia eximia* and the shrubs *Kunzea ambigua*, *Dodonaea truncatiales* and *Dillwynia ramosissima*. The rare shrub *Accacia subtilinervis* is also often associated with the stands of *Prostanthera tallowa* at the Tallowa Dam sites, as is the regionally rare *Olearia ramosissima*.

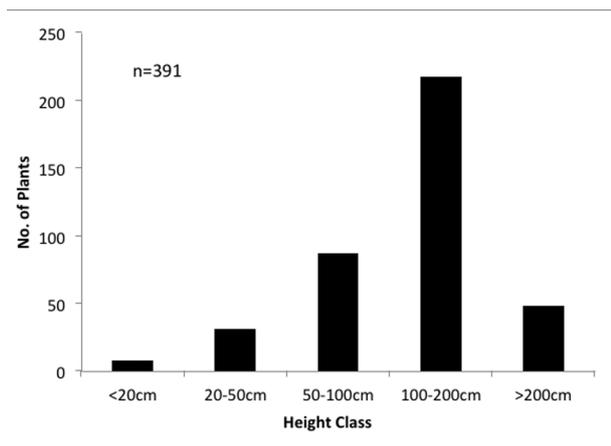


Fig. 3a. Distribution of plant heights in population 3a.



Fig. 5. Habitat of population 3a; escarpment is to the right.

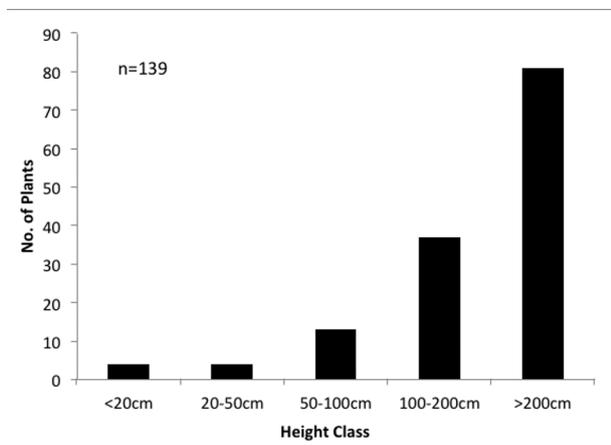


Fig. 3b. Distribution of plant heights in population 1c. The populations at sites 3a and 1c are skewed towards larger, older plants, and there are very few small (young) plants.



Fig. 6. Leaves of *Prostanthera tallowa* (population 2).



Fig. 4. Seedlings of *Prostanthera tallowa* in population 2.

General observations

Height classes for the plants counted in populations 1c and 3a show populations are skewed towards larger, older plants, and there are very few small (young) plants (Table 3, Figure 3a,b). The height (comparative age) distribution pattern exhibited in these populations is similar to that observed in the other populations of this species; that is, a dominance of older plants. The tallest plants of *Prostanthera tallowa* observed were over 4 m in height; these had a spread of up to 4 m, with several main branches. A small and obviously long unburnt gully within population 3a contained 27 plants over 3 m tall, while many plants in population 1d were over 3 m tall. The tallest plants in all populations are generally spindly and somewhat sparse in their foliage; some specimens have a substantial trunk. Dead branches are common on many of the tallest (oldest) plants, no doubt because of the exposed locations where they occur, the dry and windy conditions and possibly the age of the plants. Virtually no dead plants were found, although in very dry periods, some small plants were severely wilted.

Conn and Wilson (2012) report the main flowering period for this species as November to March but in this study at least a few flowers were observed in most months, including May and June. Plants were flowering quite heavily in the

populations to the west of Tallowa Dam when visited on 5 January 2014. Occasional fruit were observed in all populations in 2013.

Browsing, most likely by Swamp Wallabies *Wallabia bicolor*, was observed in some populations. Goats are another potential browser, but no recent evidence of goats was observed along the escarpments searched, although old dung was found in caves near Tallowa Dam. Browsing, whether by native or feral herbivores, is not considered a significant threat to this species.

Discussion

The field surveys found a considerably broader distribution and larger population size than the estimated population of 50 plants at one site (population 1c here) in Conn and Wilson (2012). The known total population has been expanded to over 3,300 plants, distributed over a range of 14 km, although the actual area of occupation is small, a matter of a few hectares in total. There is great deal of intervening and surrounding sandstone country, which has not been searched, but is likely to contain more populations as it has similar habitat.

The dominance of large (presumably old) plants in all populations and the lack of small (young) plants suggest that the species regenerates following fire. Most species of *Prostanthera* are fire sensitive, regenerating by seed after fire. Some species re-sprout after fire, but there was no evidence of suckering by *Prostanthera tallowa*.

All the localities where the plants occur, except locality 4, were burnt in January 2003 (NPWS, Nowra, pers. comm., October 2013). After 10+ years without fire, the great majority of the populations contain old plants although obviously senescent plants are almost unknown. There are almost no seedlings. Fires that are either too frequent or too infrequent can have a detrimental effect on species associated with the sandstone country, where severe fire is a fundamental element of vegetation ecology. The locations where the *Prostanthera* plants grow experience severe fire from time to time, although this can be mitigated by the rocky character of most sites. The large plants in population 3a probably escaped burning in the 2003 fire because of the nature of the surrounding rock.

Almost all populations of *Prostanthera tallowa* occur within protected conservation areas, including the Sydney Water Special Area around Tallowa Dam, which is a protected catchment managed for water harvesting. The small population at locality 4 is just outside Bugong National Park. Threats to the species are minimal, particularly with the discovery of the large and distant populations within Morton State Conservation Area.

Few sites have suffered from human disturbance. At the Tallowa Dam locality, plants occur along the edges of the access road and below the adjacent power line. Clearing below the power line and road maintenance no doubt regularly destroy some plants, although the larger populations are away from this area. The Sydney Catchment Authority maintains



Fig. 7. Specimen of *Prostanthera tallowa* collected from population 3a.



Fig. 8. Bark on an old plant of *Prostanthera tallowa*.

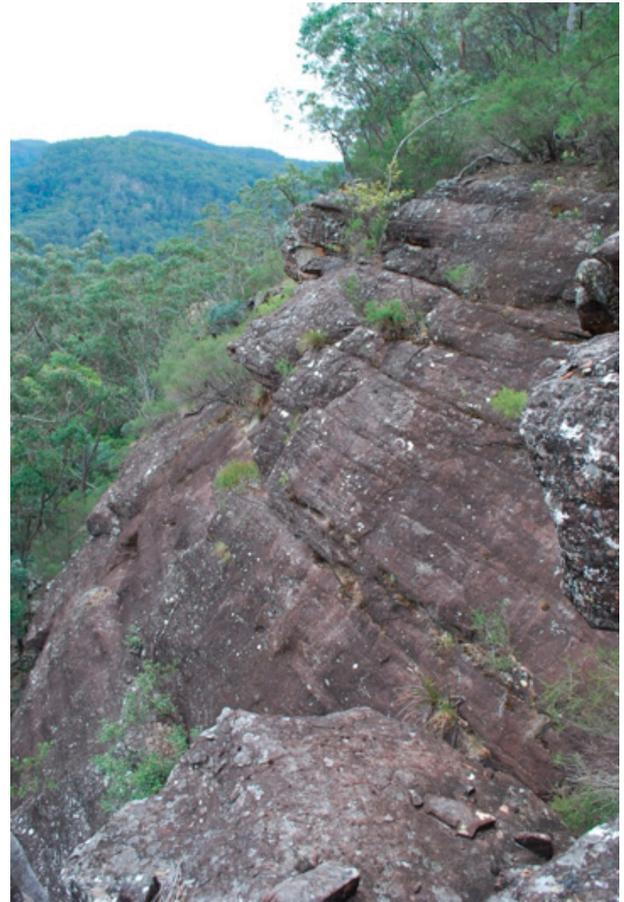


Fig. 9. Cliff habitat of *Prostanthera tallowa* at population 1d.

a survey station on the escarpment within population 1d. The access track is overgrown with little evidence of recent clearing at the survey station. Plants of *Prostanthera tallowa* grow around the survey station and the end of the access track. Minor threats exist along the escarpment at locality 3 where there is evidence of sandstone boulders being stolen; vehicle access is not possible but there is a parking area nearby. However, given its limited distribution and small area of occupation, albeit almost totally within protected areas, *Prostanthera tallowa* is worthy of consideration for listing as vulnerable under the *Threatened Species Conservation Act 1995* (NSW).



Fig. 10. Flower of *Prostanthera tallowa* in population 1h. (Scale bar = 5 mm).

Conclusion

The field surveys for the rare shrub *Prostanthera tallowa* in 2013–2014 extended the range of the population from Tallowa Dam (in the Central Coast Botanical Sub-Division) 14 km to the southeast and into the South Coast Botanical Sub-Division. The study found that the known populations of the species contain over 3,300 plants in four distinct localities containing 18 separate populations. It appears that plants are killed by fire and regenerate by seedling after being burnt though the time required for plants to set viable seed, i.e. plant age, is still unknown; this information is critical to managing fire where the species grows.

There is no immediate threat to the species, given the new populations found in Morton State Conservation Area and the significant expansion of the distribution and population size at Tallowa Dam. The presence of this species needs to be considered in management decisions for Morton National Park and Morton State Conservation Area and Sydney Catchment Authority should take account of the existence of this rare species on land that they control at Tallowa Dam. Clearing below the power line and roadside maintenance near the dam have previously impacted on some plants and clearing activities require modification to avoid destroying plants of this species, which do not grow high enough to impact upon the power line. This is important at this location as the type locality is adjacent to the road.

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