

# Do all fire ephemerals warrant listing under threatened species legislation?

STEPHEN A.J. BELL

School of Environmental and Life Sciences, University of Newcastle, NSW.  
Corresponding author: [stephen.bell@newcastle.edu.au](mailto:stephen.bell@newcastle.edu.au)

Vegetation surveys are commonly undertaken to list or monitor plant species within a nominated area, and outcomes can be particularly dynamic in many environments. For most plants, the presence of above-ground components is ordinarily sufficient to enact an identification, albeit within the caveat of seasonality for those taxa where the presence of fertile material is needed to confirm identity. Terrestrial orchids, for example, can rarely be confirmed without the seasonal emergence of flowering stems from underground tubers, or fruiting bodies may be required to distinguish between closely related species of Cyperaceae or Chenopodiaceae. There is also a whole suite of taxa ('disturbance specialists') which may only appear after some form of significant disturbance event (*e.g.*, forest thinning, flood, fire) but will persist often for many years or decades in the above-ground flora. Representatives from the widespread Fabaceae and Rutaceae families are good examples of this life-strategy.

But what about those taxa that emerge following a fire event and rapidly mature, set seed and die within a short time period? These are commonly referred to as 'fire ephemerals', and although such taxa may be abundant during certain stages of a fire cycle, their persistence in an area may well only be within the seed bank for many decades. Bond and van Wilgen (1996) define fire ephemeral species as those that appear soon after fire, have relatively short life spans, are usually dead before the next fire, and rely on fire for regeneration. This life strategy can complicate assessments of conservation status when there are few records due to poor timing of surveys relative to fire events.

## Fire ephemerals and conservation assessments

Within the IUCN guidelines for the listing of threatened taxa (IUCN 2019), key drivers for qualification are Area of Occupancy (AOO), Extent of Occurrence (EOO), population size and decline. These attributes are invariably drawn from herbarium collections and verified observation records, which provide an overview of how widespread or restricted a taxon may be.

Clearly, such databases are heavily dependent on the amount of effort that has gone into searching for a specific taxon, and this is especially so for those that are rarely seen due to seasonality or ephemerality. Fire ephemeral species will, by definition, only be detectable shortly after a fire event: searches in appropriate habitat at all other times will invariably result in no plants being seen. So, to what extent has this life form strategy been incorporated into conservation assessments of legally threatened and other taxa? What influence have taxa with few records due to fire ephemerality had on current threatened species listings? Are all such taxa really threatened?

Fire ephemeral species are represented within the Apiaceae [Araliaceae], Malvaceae [Sterculiaceae], Poaceae and Solanaceae families, and all of the Gyrostemonaceae (Baker *et al.* 2004). Other families also support fire ephemerals, but these are often less well known (*e.g.* Polygonaceae, Hunter *et al.* 1998; Prober *et al.* 2007; Geraniaceae, Kubiak 2009). New fire ephemeral species continue to be described following discoveries in long unburnt post-fire landscapes (*e.g.*, Perkins 2017; Perkins and Dilly 2017), and some species known from few populations at the time of their naming have subsequently been found to be abundant after fire events (*e.g.*, Mulcahy *et al.* 2021).

## Listed vs unlisted fire ephemerals

To illustrate the difficulty in application of threatened status to fire ephemerals it is useful to consider examples of listed and unlisted taxa that have emerged following recent wildfire seasons. Most of these have been drawn from the Greater Blue Mountains World Heritage Area of NSW, where fire events over the last 10 years have promoted germination and led to increased observations. Several of these taxa also occur in other states, often abundantly so (Table 1).

Table 1. Listed and unlisted fire ephemerals discussed in text. Records are based on herbarium (AVH) and observational (Bionet) databases, cleaned of duplicates.

Family	Taxon	Current status		Ex-NSW	Records
		NSW BC Act <sup>1</sup>	Cwth EPBC Act <sup>2</sup>		
Apiaceae	<i>Actinotus forsythii</i>	-	-	Vic	86
Euphorbiaceae	<i>Monotaxis macrophylla</i>	End.	-	Qld	137
Gyrostemonaceae	<i>Gyrostemon australasicus</i>	-	-	Vic WA SA	6
	<i>Gyrostemon thesioides</i>	End.	-	Vic WA SA Tas	7
Malvaceae	<i>Androcalva procumbens</i>	Vul.	Vul.	-	188
	<i>Androcalva rosea</i>	End.	End.	-	65
	<i>Commersonia rugosa</i>	-	-	-	49

<sup>1</sup> NSW Biodiversity Conservation Act 2016

<sup>2</sup> Environment Protection and Biodiversity Conservation Act 1999

### Malvaceae, Euphorbiaceae and Apiaceae

In northern Wollemi National Park (NP) in central eastern NSW, new populations of the Endangered *Androcalva rosea* (Malvaceae) and *Monotaxis macrophylla* (Euphorbiaceae) (Fig. 1) were initially reported in Bell and Holzinger (2015) following post-fire surveys. Neither of these species had ever been recorded in this part of that NP previously, and for *Androcalva rosea* this represented a 30 km extension of range from the type locality. Both species were present in their thousands and were the dominant ground cover at that time. Further populations of both species, again in their thousands, have also been located following the most recent fire events in other parts of Wollemi and Goulburn River NPs, and near Yengo NP. New populations of *Monotaxis* have also been reported elsewhere in large numbers post-fire (e.g. Miles 2019; Saunders 2020). Both of these species are clearly secure in these lands with no real threats operating, and there seems little reason to retain them on threatened species listings. A third species, *Androcalva procumbens* (Malvaceae), was also located in its hundreds (possibly thousands) on burnt rocky ridgelines in Goulburn River NP as part of recent post-fire inspections

in May 2021 (Fig. 2). Just two of countless burnt ridgelines were inspected during this brief helicopter-based survey, suggesting that many more populations of this vulnerable species were likely across this reserve.

In contrast, recent fire events in the Blue Mountains NP and other areas have promoted large populations of the rarely seen but unlisted wiry herb *Actinotus forsythii* (Loots 2021; Noble 2021) (Fig. 3, 4). Despite these impressive displays, flora databases (Bionet and AVH) have only 86 unique observations or collections of this species between 1902 and 2021, a period of nearly 120 years. Similarly, the unlisted *Commersonia rugosa* (Fig. 5) has been observed at several locations in Goulburn River NP and environs after recent fires, yet this species has only 49 unique records between 1893 and 2011. By comparison, the threatened *Monotaxis macrophylla* has 137 unique records, *Androcalva procumbens* 188 records (both over a similar 120-year period), and *Androcalva rosea* 65 records over 25 years (from 1996). On a comparative reporting basis, the question may be asked: Why are *Monotaxis macrophylla*, *Androcalva procumbens* and *Androcalva rosea* considered threatened species, while the less commonly observed



Figure 1. *Monotaxis macrophylla* (yellow-green) dominating post-fire landscapes in northern Wollemi NP, October 2020. Photos: Stephen Bell

*Actinotus forsythii* and *Commersonia rugosa* are not? All occur in similar well protected landscapes with few threats, and all undergo often dramatic increases in above ground representation after fire events, but quickly die out. Part of the answer may be explained by the realisation that increased reporting of records generally occurs *after* a taxon is listed as threatened. However, irrespective of that all these species follow similar boom or bust life strategies: should all be considered threatened, or none of them?



Figure 2. Post-fire ephemeral *Androcalva procumbens* colonising rocky open ridge lands in Goulburn River NP, May 2021. Photo: Stephen Bell



Figure 3. *Actinotus forsythii*: rarely seen fire ephemeral but not listed as threatened. Photo: Gavin Phillips



Figure 4. *Actinotus forsythii* carpeting the ground at the Budawang. Photo: Gavin Phillips



Figure 5. *Commersonia rugosa*: rarely seen fire ephemeral but not listed as threatened. Photo: Stephen Bell

### Gyrostemonaceae

Another useful comparison can be made within the Gyrostemonaceae family. Two species of *Gyrostemon* are currently known in New South Wales: *G. australasicus* from far south-western parts of the State and *G. thesioides* from the greater Sydney area. Both appear to occupy restricted ranges based on few records (six unique NSW records for *G. australasicus*, the most recent in 2008; and seven for *G. thesioides*, the most recent in 2004), yet only one (*G. thesioides*) is currently listed as threatened. In relation to threats, none are mentioned within notes for any observations or collections of *G. thesioides*, yet for *G. australasicus* trampling by goats is highlighted for one record from 1977. Comments linked to observations for both species confirm their fire ephemerality, and in all other aspects database records of these two species are comparable. The final determination to list *G. thesioides* as Endangered in 1998 specifies lack of recent records (>30 years) as a key factor but implies continuing decline in habitat quality, although this is not supported by evidence.

Historical records (1910 to 1967) of *Gyrostemon thesioides* at the time of its listing all occurred between Ingleburn and Douglas Park in largely urbanised inner western Sydney, including one record on the edge of the Holsworthy Military Area. There are no more recent records of this species from these locations, although it may persist still in the seed banks there. Since listing in 1998, two new records of this species 70 km apart were made in 2001 from Blue Mountains NP and in 2004 from southern Wollemi NP, both following wildfires that passed through these areas. These observations were both incidental and un-targeted finds yet given the wide expanse of conserved lands of similar habitats between the two, considerably more populations of *Gyrostemon thesioides* may occur in conserved lands all around Greater Sydney. By contrast, all records for *Gyrostemon australasicus* (1977 to 2008) fall within unreserved lands north-east of Mildura, where this species is legally

unprotected but considered rare in NSW (Porteners *et al.* 1997). The questions then arise whether *Gyrostemon thesioides* should remain listed as Endangered given secure potential habitat across large parts of the Greater Blue Mountains World Heritage Area, should *Gyrostemon australasicum* be nominated for listing given few records in unsecured habitat, or should neither species be listed?

### A suggested strategy

All of these examples suggest that plant taxa, such as fire ephemerals, that are rarely seen will not always require listing as threatened. It can be difficult to determine whether rarely seen species are threatened without a solid understanding of their ecology, but this needs careful consideration when any assessments of conservation status are made. To avert the possible misdirection of conservation funding away from taxa that really are threatened, a simple four step process might be employed:

1. **Understand life-history:** this may seem obvious but gaining knowledge on what drives recruitment and persistence in a taxon is imperative. Assessments of conservation significance cannot be confidently made when there are knowledge gaps in basic ecology, and this includes such things as what promotes germination, what constrains growth and persistence following germination, and the time period over which individuals are reproductively mature and can contribute to replenishment of the seed bank.
2. **Document habitat requirements:** what are the preferred habitats and environmental conditions necessary to maintain a taxon within the local flora? If fire is needed, how often and how intense should they be without compromising persistence of a taxon in an area?
3. **Assess land tenure:** where are most known records and likely habitat located, and more specifically are they evident within secure conservation lands? If much of the range and potential habitat falls within national park estate, then it might be expected that the target taxon is also secure, irrespective of limited records.
4. **Consider listing (or delisting):** if a taxon is shown to be relatively short-lived, quick to mature, dependent on fire to break seed dormancy, and occurs predominantly in secure conservation tenure with few active and real threats, then it may be unnecessary to list as threatened (despite a lack of recent observations). Taxa seen only occasionally over long periods of time should be considered as 'rarely seen', not threatened. Existing listings of fire ephemeral taxa might also be regularly reassessed in the light of new data. The Endangered *Androcalva rosea* for example is now far more abundant and widespread than previously known at the time of its listing in 2004, with extensive new populations located in recent years after wildfire events, some in areas that have not seen fire for up to 70 years. This species could now be considered one of least concern under IUCN criteria.

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