

Preventing rare plant extinction and reducing impacts of future fires

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Background

The extensive fires in south-eastern Australia in 2019/2020 burnt many plant species (and their habitats) that were not considered threatened at the time, but had the potential to increase the risk of these species declining to the point of becoming threatened in the near future.

Many factors determined the ability of plant species to successfully recover after the fires, including fire severity, fire frequency and ongoing drought, along with impacts of post-fire grazing by feral animals and stock, weed invasions and pathogens. The International Union on the Conservation of Nature (IUCN) Red List criteria for species identify different mechanisms by which species may be threatened with extinction. For plants, most are listed as threatened via IUCN Criterion B (i.e. restricted geographic ranges, continuing decline) (Le Breton *et al.* 2019) in part because data on species distributions is readily available to estimate the likely threshold of risk. To be considered threatened under Criterion B, a species needs also to have demonstrated continuing decline, and one of three co-conditions: severe fragmentation, a limited number of locations (*sensu* IUCN 2022) or extreme fluctuations.

In 2020, the San Diego Zoo Wildlife Alliance (SDZWA) Plant Conservation Team provided funding to the ANPC to support plant conservation actions (aligned with the recommendations of the Federal Threatened Species Scientific Committee (TSSC) for Post-fire Recovery), to meet the aims of:

1. Supporting the nomination and listing of fire as a Key Threatening Process under Australia's *Environment Protection and Biodiversity Conservation Act* (EPBC Act) as well as researching how to reduce the impacts from future fires.
2. Preventing extinction and limiting decline of native species and ecosystems affected by the 2019-2020 fires, through investigating the:
 - a. impacts of the fires on selected priority plant species with restricted geographic range sizes and the factors threatening their recovery.

- b. the complexity of recovery in relation to other known threats, e.g. Myrtle Rust.

This report is an update of our previous article published in APC 31(2). More information can be found here <https://www.anpc.asn.au/prevent-rare-plant-extinction-and-reduce-impacts-of-future-fires/>.

Progress to date

1) The SDZWA funding (in combination with other funding sources) has enabled the nomination of '*Fire regimes that cause biodiversity decline*' as a Key Threatening Process (KTP) under the EPBC Act through supporting the assessment and preparation process, in collaboration with experts from the national Threatened Species Scientific Committee (TSSC). In April 2022, the nomination was accepted and the KTP was listed <https://www.dcceew.gov.au/environment/biodiversity/threatened/key-threatening-processes/fire-regimes-that-cause-declines-in-biodiversity>.

This component of the SDZWA funding has also helped to develop guidance on recovery actions to build the resilience of biota to future fires, through lead authorship of a major technical report (Department of Agriculture, Water and the Environment, 2022), two chapters in *Australia's megafires: Biodiversity impacts and lessons learned from 2019-2020* (Gallagher *et al.* 2023 and Lindenmayer *et al.* 2023), and the publishing of five journal papers: Zylstra (2021); Zylstra *et al.* (2022), Zylstra (2022), Zylstra (2023) and Zylstra (2024). These papers are aimed at building the human contribution to the resilience of biota to future fires by quantifying the mechanisms of risk and investigating new approaches to reduce the incidence of future fires.

2a) Gallagher (2020), Gallagher *et al.* (2021, 2022, 2023) and Auld *et al.* (2020) identified plant species of national significance in Australia that were potentially adversely impacted by the 2019/2020 fires, using the methodology developed in Auld *et al.* (2022). Gallagher *et al.* (2018) and Le Breton *et al.* (2019) identified those not currently recognised as threatened, that had geographic range



Figure 1. Burnt peat in rainforest in northern NSW.
Photo: Philip Zylstra

sizes that were below the thresholds in IUCN Red List Criterion B. Combining these sources allowed the creation of a priority list of species for field inspections, surveys and extinction risk assessments.

Two groups of taxa were chosen:

- **Species which allowed comparisons of those with canopy versus soil seed banks and also between resprouting versus obligate seeding plants.** Obligate seeding species (i.e. those killed by fire) with canopy seed banks are thought to be most at risk from high frequency fire or loss of recruitment following the 2019/2020 fires, as the seed bank is exhausted in a single recruitment event after a fire. Obligate seeding species with soil seed banks are somewhat at risk as the seed bank declines, but some seed bank buffer may remain. Resprouting species are considered likely to be less at risk unless drought conditions led to increased plant mortality before, during and after the 2019/2020 fires. Our focus has been on 13 New South Wales (NSW) endemics with a narrow geographic range (Table 1) for extinction risk assessments, as NSW was the part of Australia most impacted by the fires, and to facilitate collaboration with the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW), the University of NSW (UNSW) and Western Sydney University (WSU) who were working on the recovery of other plant species following these fires.
- **Epiphytic orchids**, which were difficult to effectively assess because data on species distributions and populations were limited, as was understanding of their ecology and in particular response to fire. In addition, some epiphytic orchids are affected by taxonomic uncertainty, particularly issues in species delimitation. These factors together are likely to have contributed to the scarcity of extinction risk assessments for these species. Consequently, a group of 10 of these orchids (Table 2) were chosen to examine the impact of the 2019/2020 fires on plant survival. These orchids occur on rocks and/or trees and, depending on local fire severity, may escape being

burnt, or be scorched and survive, or may be killed. The 2019/20 fires were thought to have hit many of these species particularly hard because they are killed by intense fire, due to a lack of both a (protected) underground dormant phase (which is found in many Australian terrestrial orchids) and/or a persistent seed bank from which to recover.

After significant delays in 2020, 2021 and early 2022 due to COVID-19 lockdowns and travel restrictions, and then road and track closures due to heavy rainfalls and flooding in eastern Australia, considerable work has now been undertaken for this component of the project.

In collaboration with UNSW and WSU, we have been undertaking surveys and working on IUCN Red List assessments and Conservation Assessments for a number of the target NSW species with a narrow geographic range. Key summaries of the work are presented in Le Breton *et al.* (2023). Finalised assessments have been completed for:

- *Banksia penicillata*, a fire sensitive shrub species with seeds held in woody fruits in the canopy. Recommended for listing as Endangered.
- *Banksia paludosa* subsp. *astrolux*, a fire sensitive shrub species with seeds held in woody fruits in the canopy. Recommended for listing as Critically Endangered.
- *Bursaria calcicola*, a resprouting shrub species. Recommended for listing as Critically Endangered.
- *Darwinia fascicularis* subsp. *oligantha*, a fire-sensitive shrub species with a soil seed bank. Not considered to be threatened.
- *Dillwynia crispifolia*, a fire-sensitive shrub species with a soil seed bank. Not considered to be threatened.
- *Grevillea buxifolia* subsp. *ecorniculata*, a fire-sensitive shrub species with a soil seed bank. Recommended for listing as Endangered.



Figure 2. *Darwinia fascicularis* ssp. *oligantha* unburnt low shrub in foreground, with *Banksia paludosa* ssp. *astrolux* in background.
Photo: Tony Auld

- *Hakea macrorrhyncha*, a fire sensitive shrub species with seeds held in woody fruits in the canopy. Recommended for listing as Endangered and declared on 15 November 2023.
- *Leptospermum spectabile*, a shrub whose fire response is unknown. Data deficient. More survey work is required to assess if the species is threatened or not.

Future work: IUCN Red List assessments will be undertaken on the five remaining shrub species: *Dillwynia stipulifera*, *Hakea constablei*, *Leptospermum macrocarpum*, *Leptospermum rotundifolium* and *Melaleuca capitata*.

Table 1. NSW endemics with a narrow-range surveyed and being assessed by the project

| Scientific Name | Family | Seed bank type | Response to fire | Risk Drivers (from Gallagher, 2020 and Auld et al. 2020) | Who is doing survey/ assessment | Status |
|---|----------------------|----------------|------------------------|---|---------------------------------|---|
| <i>Banksia paludosa</i> subsp. <i>astrolux</i> | Proteaceae | Canopy | OS | Drought / High fire frequency / Herbivory / Fire severity / Fire sensitivity / Cumulative fire risk | ANPC/ANPC & UNSW | Finalised. Under consideration for listing under EPBC Act. |
| <i>Banksia penicillata</i> | Proteaceae | Canopy | OS | Drought / High fire frequency / Fire severity / Fire sensitivity / Cumulative fire risk | Experts/ UNSW & ANPC | Finalised. Under consideration for listing under EPBC Act. |
| <i>Bursaria calcicola</i> | Pittosporaceae | Soil | R? | Drought / Herbivory / Other threats | DPE/UNSW & ANPC | Finalised. Under consideration for listing under EPBC Act |
| <i>Darwinia fascicularis</i> subsp. <i>oligantha</i> | Myrtaceae | Soil | OS or possibly R | Drought / High fire frequency / Disease / Fire severity / Cumulative fire risk | ANPC/ANPC & UNSW | Finalised. Not considered to be threatened. |
| <i>Dillwynia crispii</i> | Fabaceae (Faboideae) | Soil | OS? | Drought / High fire frequency / Herbivory / Fire severity / Cumulative fire risk | DPE/UNSW & ANPC | Finalised. Not considered to be threatened. |
| <i>Dillwynia stipulifera</i> | Fabaceae (Faboideae) | Soil | R | Drought / High fire frequency / Herbivory / Fire severity | NSW DPE/ ANPC | Drafting started |
| <i>Grevillea buxifolia</i> subsp. <i>ecorniculata</i> | Proteaceae | Soil | OS | Drought / High fire frequency / Herbivory / Fire severity / Cumulative fire risk | WSU/ DPE/ UNSW & ANPC | Finalised. Under consideration for listing under EPBC Act. |
| <i>Hakea constablei</i> | Proteaceae | Canopy | OS | Drought / High fire frequency / Fire severity / Fire sensitivity / Cumulative fire risk | DPE/ANPC | Drafting started |
| <i>Hakea macrorrhyncha</i> | Proteaceae | Canopy | OS | High fire frequency / Herbivory / Fire severity / Fire sensitivity / Cumulative fire risk | DPE/UNSW & ANPC | Finalised. Listed under EPBC Act. |
| <i>Leptospermum macrocarpum</i> | Myrtaceae | Canopy | R | Drought / High fire frequency / Disease / Fire severity | DPE/ANPC | Drafting started |
| <i>Leptospermum rotundifolium</i> | Myrtaceae | Canopy | R, but occasionally OS | Drought / High fire frequency / Disease / Fire severity | DPE/ANPC | Drafting started |
| <i>Leptospermum spectabile</i> | Myrtaceae | Canopy? | ? | Drought / High fire frequency / Disease / Fire severity | DPE/UNSW & ANPC | Finalised. Requires further survey work to resolve threat status. |
| <i>Melaleuca capitata</i> | Myrtaceae | Canopy | R | Drought / High fire frequency / Disease / Fire severity | DPE/ANPC | Drafting started |

Legend:

R - resprouter; OS - obligate seeder, ? - uncertain response
 EPBC Act (*Environment Protection and Biodiversity Conservation Act 1999*)
 ANPC (Australian Network for Plant Conservation)
 UNSW (University of New South Wales)

DCCEEW (New South Wales Department of Climate Change, Energy, the Environment and Water)
 WSU (Western Sydney University)

Surveys of four of the epiphytic orchid species in north-eastern NSW were completed in 2023, for *Plectorrhiza purpurata*, *Sarcochilus aequalis*, *Tropilis angusta* (syn. *Dendrobium aemulum sens. lat.*) (Figure 3) and *Adelopetalum argyropum* (syn. *Bulbophyllum argyropus*). The surveys focused on populations which were within areas affected by the 2019/2020 fires and the number of individuals remaining, if any, were counted. The surveys aimed to document the impact of the fires, establish the geographic distribution and population size of the remaining populations, and inform conservation assessment and threatened species listing.

Many populations were found to be heavily impacted, with most host plants dead and all epiphytes killed. All four species were found to likely meet the thresholds for listing as Endangered according to the IUCN Red List criteria. Conservation assessments are currently underway. Dr Jeremy Bruhl (University of New England & JJ Botanics, who coordinated the surveys) and Dr Heidi Zimmer (Centre for Australian National Biodiversity Research) gave a presentation entitled “*Post-Fire Epiphytic Orchid Surveys, Four Australian Cinderella Orchids*” on the survey outcomes at the ANPC’s Flora After Fire symposium in August 2023, which can be viewed here <https://www.anpc.asn.au/prevent-rare-plant-extinction-and-reduce-impacts-of-future-fires/>. A future APC article is planned to report on the outcomes of these conservation assessments.

Future work: Surveys and IUCN Red List assessments will be undertaken on the six remaining orchid species: *Australorchis schneiderae* (syn. *Dendrobium schneiderae*), *Dockrillia mortii* (syn. *Dendrobium mortii*), *Dockrillia fairfaxii* (syn. *Dendrobium teretifolium* var. *fairfaxii*), *Sarcochilus parviflorus*, *Sarcochilus dilatatus* and *Sarcochilus weinthalii*.

2b) The SDZWA project has contributed towards the production of the high-quality video “*Myrtle Rust, the Silent Killer*” coordinated and produced by one of our collaborators and leading Myrtle Rust impact researcher in Queensland, Dr Geoff Pegg. This is a science-based plain-English video, targeted towards awareness-raising, particularly for land managers, policy influencers, bushcare workers and Indigenous communities, as well as wider audiences. Awareness-raising in these sectors remains a critical task, given the complexity of the issues and recovery strategies.

‘*Myrtle Rust, the Silent Killer*’ can be viewed here <https://www.anpc.asn.au/myrtle-rust-videos/>

The video addresses a sample of species and ecological communities at risk from the pathogen, both burnt and unburnt in the 2019–20 fires. However, the dual burn/pathogen interaction is a substantial focus. As quoted in the video “the combination of fire and Myrtle Rust has affected the regeneration of a range of plant species, killing seedlings and reshooting trees”.

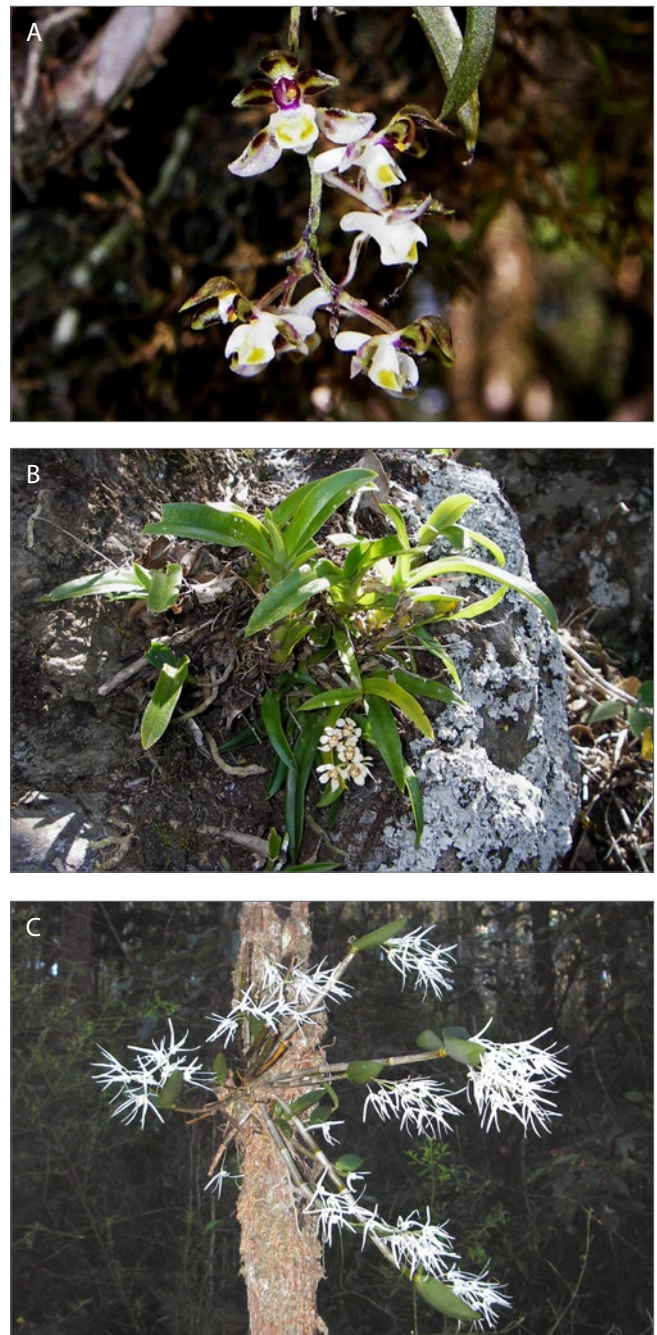


Figure 3. A: *Plectorrhiza purpurata* growing in Cottan-Bimbang National Park. B: *Sarcochilus aequalis* growing in Oxley Wild Rivers National Park. C: *Tropilis angusta* growing in Whian Whian State Conservation Area. Photos: Lachlan Copeland



Table 2. Epiphytic orchids selected for surveys and assessment of impacts of 2019/2020 fires

| Species | Family | Distribution | 2019/2020 fire impacts | Surveyed | Status |
|--|-------------|--|--|-----------|---|
| <i>Adelopetalum argyropum</i> (syn. <i>Bulbophyllum argyropus</i>) | Orchidaceae | North-eastern NSW and Lord Howe Island Enfield SF and Dorrigo NP | Approx. 50% populations burnt | 2022/2023 | Conservation assessment in preparation. Endangered listing recommended. |
| <i>Australorchis schneiderae</i> (syn. <i>Dendrobium schneiderae</i>) | Orchidaceae | Mostly North-eastern NSW and Southern Queensland Richmond Range NP and Yabba NP | 67% of subsp. <i>schneiderae</i> burnt | | |
| <i>Dockrillia mortii</i> (syn. <i>Dendrobium mortii</i>) | Orchidaceae | Mostly North-eastern NSW and Southern Queensland | unknown | | |
| <i>Dockrillia fairfaxii</i> (syn. <i>Dendrobium teretifolium</i> var. <i>fairfaxii</i>) | Orchidaceae | Mostly North-eastern NSW and Southern Queensland | unknown | | |
| <i>Sarcochilus parviflorus</i> | Orchidaceae | Border Ranges to Bega | unknown | | |
| <i>Plectorrhiza purpurata</i> | Orchidaceae | North-eastern NSW | unknown | 2022/2023 | Conservation assessment in preparation. Endangered listing recommended. |
| <i>Sarcochilus aequalis</i> | Orchidaceae | North-eastern NSW. Oxley Wild Rivers NP, New England NP, Boorgana NR. | unknown | 2022/2023 | Conservation assessment in preparation. Endangered listing recommended. |
| <i>Sarcochilus dilatatus</i> | Orchidaceae | Mostly North-eastern NSW and Southern Queensland | Some populations burnt. Listed but may be considered for uplisting | | |
| <i>Sarcochilus weinthalii</i> | Orchidaceae | North-eastern NSW and Southern Queensland | Some populations burnt. Listed but may be considered for uplisting | | |
| <i>Tropilis angusta</i> (syn. <i>Dendrobium aemulum</i> sens.lat.) | Orchidaceae | NSW and Queensland | Some populations burnt | 2022/2023 | Conservation assessment in preparation. Endangered listing recommended. |

Severely fire affected Myrtaceae species that are highly susceptible to Myrtle Rust, and covered by the video, include *Rhodamnia rubescens*, *Gossia hillii*, *Archirodomyrtus beckleri* and *Syzygium corynanthum*, (wet/rainforest taxa seldom if ever previously burnt); *Melaleuca quinquenervia* (an irreplaceable keystone species of freshwater wetlands and floodplains), and *Syncarpia hillii* on K'gari ['gah-ri'] formerly known as Fraser Island, a declared World Heritage Area, more than half of which burnt in 2020. The video has a major focus on a flagship program of post-fire Myrtle Rust monitoring on K'gari by the local Indigenous Ranger group, collaboratively developed by Dr Pegg, the Butchulla Aboriginal community and Queensland agencies. It is hoped that this example will enable a widening of Indigenous involvement in the Myrtle Rust response elsewhere in Australia.

The SDZWA project has been of great assistance in the Myrtle Rust response both directly in the case of the above video, and indirectly, e.g. by catalysing the

production of the first exploratory paper (Zimmer *et al.*, 2023) on the potential interactive effects on epiphytic orchids of Myrtle Rust infection of their host species, in the context of fire and Myrtaceae decline. It has also complemented the ANPC's other Myrtle Rust projects following the 2019/2020 fires, such as the 'Safe Custody for Native Guava' project <https://www.anpc.asn.au/safe-custody-for-native-guava/>.

Future work: Sampling and post-fire surveys of the impacts of Myrtle Rust will be undertaken on selected Myrtaceae species.

Conclusion

This project has so far assisted the nomination of 'Fire regimes that cause biodiversity decline' as a Key Threatening Process (KTP) under the EPBC Act, helped to develop guidance on recovery actions to build the resilience of biota to future fires, undertaken eight extinction risk assessments following the 2019/2020 fires for NSW endemics with a narrow geographic range, four

extinction risk assessments for epiphytic orchid species and contributed towards the production of the “*Myrtle Rust, the Silent Killer*” video. Stay tuned for the results of the next stage of the project.

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