

Assessing impacts and recovery after the 2019/2020 fires of priority plant species that were not previously threatened

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Background

The extensive fires in south-eastern Australia in 2019/2020 burnt a number of plant species (and their habitats) that were not considered threatened prior to the fires. This has the potential to increase the risk of those species becoming threatened in the near future should factors relating to the 2019/2020 fires or other threats lead to decline. A range of factors will determine the ability of these species to successfully recover after the fires. This includes the separate and cumulative effects of fire severity, fire frequency, ongoing drought and a changing climate, along with direct biotic threats such as impacts of post-fire grazing by feral animals and stock, weeds, and pathogens. The IUCN Red List criteria for species identify different mechanisms by which species may be threatened with extinction and can be applied to species impacted by the 2019/2020 fires.

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: 1) Prevent extinction and limit decline of native species and ecosystems affected by the 2019-20 fires, and 2) Reduce impacts from future fires.

Progress to date

There are three main components to the project:

1. Support for development of a nomination for 'Fire regimes that cause biodiversity decline' as a Key Threatening Process (KTP) under the national Environment Protection and Biodiversity Conservation Act (EPBC Act).

Funding has supported (in combination with other funding sources) the assessment and preparation of this KTP document under the EPBC Act. The KTP nomination

was completed in collaboration with experts from the TSSC, was endorsed by that expert Committee, and was released for public comment in December 2021. In April 2022, then Minister for the Environment, Sussan Ley, formally announced the KTP listing under the Act (<https://www.dcceew.gov.au/environment/biodiversity/threatened/key-threatening-processes/fire-regimes-that-cause-declines-in-biodiversity>).

The project funding also helped 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), and contributed to three journal articles: Zylstra (2021); Zylstra *et al.* (2022a) and Zylstra *et al.* (2022b). These articles were 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 (Figure 1).

2. Impacts of 2019/2020 fires on selected priority plant species

Gallagher (2020), Gallagher *et al.* (2021, 2022) and Auld *et al.* (2020) identified species of national significance in Australia that were potentially adversely impacted by the 2019/2020 fires. Gallagher *et al.* (2018) and Le Breton *et al.* (2019) identified those species not currently recognised as threatened, that had geographic range sizes that are below the thresholds in IUCN Red List Criterion B. A combination of these sources allowed us to create a priority list of species for field inspections to identify factors threatening recovery after fire for species with restricted geographic range sizes. Unfortunately, the field surveys have suffered from significant delays in 2020 and 2021 due to COVID-19 lockdowns and travel restrictions, and more recently (first six months of 2022) from road and track closures due to heavy rainfalls and flooding in eastern Australia.



Figure 1. Understorey dynamics in Jarrah forest exemplify the drivers of fire risk measured in Zylstra *et al.* (2022). Recently burned Jarrah (A) has a dense understorey of germinated shrubs and saplings that burned seven times more frequently than the same forest left unburnt for around 50 years, which develops an open understorey (B). Processes of growth and forest succession such as self-thinning and self-pruning act as 'ecological controls' on wildfire spread and severity (Zylstra *et al.* (2022a). Photos: Philip Zylstra



Two groups of taxa were chosen:

- a. Species were chosen to allow comparisons of those with canopy versus soil seed banks and between resprouting versus obligate seeding plants (Table 1). 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 buffer may be present. Resprouting species are considered likely to be less at risk unless drought conditions have led to increased plant mortality before, during and after the 2019/2020 fires.

The focus was on NSW endemics, as NSW was the part of Australia most impacted by the 2019/2020 fires, and in order to collaborate with work proposed, or being undertaken, by the NSW Department of Planning and Environment (DPE) and universities on the recovery of other plant species after those fires. Development of standardised field data sheets has been done in collaboration with researchers at the University of New South Wales (UNSW) and DPE. The ANPC is also working with UNSW to undertake IUCN Red List assessments and Conservation Assessments for some of these species.

A completed IUCN Red List assessment and Conservation Advice has been completed for *Banksia penicillata* based on field work done by Baird and Benson (2021), in collaboration with UNSW.

This recommends that the species be listed as Endangered under the EPBC Act and identifies a number of population declines from the 2019/2020 fires where those fires burnt over areas that had not recovered from a previous fire in 2013 (none of the seedlings from the 2013 fire had matured and produced woody fruits when they were killed by the 2019/2020 fires.) This assessment is now with the Commonwealth TSSC for consideration of listing as Endangered nationally. A Conservation Assessment report for *Banksia paludosa* subsp. *astrolux* (Figure 2) has also been prepared and shows decline in some sites due to very low post-fire recruitment levels.



Figure 2. *Banksia paludosa* subsp. *astrolux* is one of the target species being surveyed by the ANPC following the 2019/2020 bushfires. Photo: Tony Auld

Table 1. Species selected for the San Diego Zoo Wildlife Alliance project to assess impacts and recovery after 2019/2020 fires of priority species with restricted geographic ranges that are currently not threatened. R = resprouter; OS = obligate seeder; ? = uncertain response.

Scientific Name	Family	Seed bank type	Response to fire	Risk Drivers (from Gallagher, 2020 and Auld <i>et al.</i> 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	Completed
<i>Banksia penicillata</i>	Proteaceae	Canopy	OS	Drought / High fire frequency / Fire severity / Fire sensitivity / Cumulative fire risk	Experts/ UNSW & ANPC	Completed
<i>Bursaria calcicola</i>	Pittosporaceae	Soil	R?	Drought / Herbivory / Other threats	NSW DPE/ UNSW & ANPC	Waiting for survey results
<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	Completed
<i>Dillwynia crispifolia</i>	Fabaceae (Faboideae)	Soil	OS?	Drought / High fire frequency / Herbivory / Fire severity / Cumulative fire risk	NSW DPE/ UNSW & ANPC	Completed
<i>Dillwynia stipulifera</i>	Fabaceae (Faboideae)	Soil	R	Drought / High fire frequency / Herbivory / Fire severity	NSW DPE/ ANPC	Waiting for survey results
<i>Grevillea buxifolia</i> subsp. <i>ecorniculata</i>	Proteaceae	Soil	OS	Drought / High fire frequency / Herbivory / Fire severity / Cumulative fire risk	NSW DPE/ UNSW & ANPC	Waiting for survey results
<i>Hakea constablei</i>	Proteaceae	Canopy	OS	Drought / High fire frequency / Fire severity / Fire sensitivity / Cumulative fire risk	DPE/ANPC	Waiting for survey results
<i>Hakea macrorrhyncha</i>	Proteaceae	Canopy	OS	High fire frequency / Herbivory / Fire severity / Fire sensitivity / Cumulative fire risk	DPE/UNSW & ANPC	Waiting for survey results
<i>Leptospermum macrocarpum</i>	Myrtaceae	Canopy	R	Drought / High fire frequency / Disease / Fire severity	DPE/ANPC	Waiting for survey results
<i>Leptospermum rotundifolium</i>	Myrtaceae	Canopy	R, but occasionally OS	Drought / High fire frequency / Disease / Fire severity	DPE/ANPC	Waiting for survey results
<i>Leptospermum spectabile</i>	Myrtaceae	Canopy?	?	Drought / High fire frequency / Disease / Fire severity	DPE/UNSW & ANPC	Waiting for survey results
<i>Melaleuca capitata</i>	Myrtaceae	Canopy	R	Drought / High fire frequency / Disease / Fire severity	DPE/ANPC	Waiting for survey results

b. Epiphytic orchids were a group of taxa that were difficult to effectively assess for the likely impacts of 2019/2020 fires as data were lacking. Epiphytic orchids in Australia pose a challenge for conservation assessment for two main reasons: (1) they are commonly affected by taxonomic uncertainty, with boundaries between closely related species uncertain; and (2) they are difficult to survey because they often occur high in trees. Nevertheless, epiphytic orchids were defined as being of conservation concern after the 2019/2020 fires because of their vulnerability to fire impacts, with most species believed to be sensitive to fire/unable to resprout post fire, and reliant on the habitat provided by their host trees

(which may have also been damaged or killed by fire). Consequently, a group of such orchids (Table 2) was chosen to examine risk of, in particular, fire severity on plant survival, prioritising species with restricted distributions which included the areas of the 2019/2020 fires. Priority species were identified by Mark Clements, Lachlan Copeland, Bob Godfree and Heidi Zimmer, and this list was further narrowed down to those which could be readily surveyed. Field assessment is being undertaken by Jeremy Bruhl and Lachlan Copeland.

Table 2. Candidates for assessment of impacts of 2019/2020 fires on epiphytic orchids

Species	Family	Distribution	2019/2020 fire impacts
<i>Adelopetalum argyropum</i> syn. <i>Bulbophyllum argyropus</i>	Orchidaceae	Currently understood to occur in north-eastern NSW, Lord Howe Island, Norfolk Island and SE Qld, although there is some evidence that island populations may be distinct taxa.	Approx. 50% populations burnt. The main population of this species on mainland Australia was severely burnt.
<i>Tropilis angusta</i>	Orchidaceae	This species exists only in north-eastern NSW and SE Qld (Lamington plateau), but its boundaries with closely related species, including <i>T. radiata</i> and <i>T. aemulum</i> require further definition.	Some populations burnt. If this species is considered as it is described then up to 100% of its habitat may have been burnt.
<i>Plectorrhiza purpurata</i> syn. <i>Schistotylus purpuratus</i>	Orchidaceae	North-eastern NSW	At least three populations severely burnt.
<i>Sarcochilus aequalis</i>	Orchidaceae	North-eastern NSW	At least one population severely burnt.

3. Impacts of Myrtle Rust on plants of Myrtaceae

The ANPC is planning to undertake more post-fire surveys of the impacts of Myrtle Rust on Myrtaceae species, to follow up on our 'Fire and Rust' project from last year (<https://www.anpc.asn.au/fire-and-rust/>) and complement a separate Commonwealth-funded ANPC project, in progress, to capture representative germplasm of the Critically Endangered Native Guava (*Rhodomyrtus psidioides*), including from fire-affected regions, as a first step towards assisted recovery of this severely Myrtle Rust-affected species. This latter project is in close accord with the species recovery strategy mapped out in *Myrtle Rust in Australia – A National Action Plan* which was lead-authored by the ANPC's Bob Makinson (Makinson *et al.* 2020).

The ANPC is also supporting and participating in the development of a video on Myrtle Rust (including in the post-fire environment) being developed in Queensland in conjunction with Indigenous stakeholders in south-east Queensland and on the NSW North Coast. This video is now in post-production.

Future work

Field inspections will quantify recovery and identify threats that need amelioration. Funding will be allocated towards postgraduate students or expert field ecologists to focus some of their work on target species in Tables 1 and 2. For other taxa, data from NSW Government surveys will soon be available to allow IUCN assessments to be done. Where a species is considered to meet any one of the IUCN Red list criteria, preparation of a nomination to list the species as threatened will be undertaken. This will entail an assessment against all IUCN Red List criteria and the preparation of an Australian Government compliant Conservation Assessment report (known as a CAM-compliant report). Any species likely to be critically endangered will be prioritised.

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Acknowledgment

This project has been generously funded by the Plant Conservation Team at the San Diego Zoo Wildlife Alliance.



Vale Dr Beth Gott AM

25 July 1922 – 8 July 2022

Editor's note: Instead of a member profile, in this issue of ANPC we pay homage to legendary ethnobotanist Dr Beth Gott, who passed away earlier this year. This tribute was first published by Monash University at <https://www.monash.edu/vale/home/articles/vale-dr-beth-gott-am>

Renowned ethnobotanist Beth Gott, who has died aged 99, was born to be a scientist. In primary school she recalled explaining to her companions exactly why Father Christmas couldn't exist, due to the lack of empirical evidence.

Instead, the alchemy that excited her took place in the cells and structures of organic matter. From a young age she understood that the survival of humanity hinged on the silent, magical work of plants.

Beth went on to dedicate her working life to botanical research, developing a deep understanding of Victorian Indigenous communities and their thousands of years of plant knowledge. Her research revealed the amazing powers of healing and nourishment that existed in the leaves, stems and roots of plants as well as their capacity for harm (Burke and Wills, for instance, starved to death after eating the Indigenous plant food Nardoo, which they mistakenly believed to be nutritionally adequate.)

Beth was the first person to develop a comprehensive database of Aboriginal plant food knowledge, revealing a huge array of Australian plants that are edible. The plant which particularly captured her imagination was the humble murnong – or yam daisy – a small, dandelion-like plant which at one time was the staple food of the



Image courtesy of the Monash University Archives.