THEME 3B.2- BIODIVERSITY AND ENVIRONMENTAL IMPACTS

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Subproject: Impact on priority NSW flora

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OVERVIEW

1. Theme

Biodiversity and Environmental Impacts

2. Project question or problem statement

Which and how many species are at increased risk of population declines following the 2019/20 fires?

3. Key Findings

Approximately **640 plant species endemic to NSW but not currently listed as threatened** are predicted to have been burnt by the 2019/20 fires. More than half of these **(52%) were found to be at High or Medium risk of decline** as a result of the 2019/20 fires.

Over **450 threatened plant species** in NSW (NSW BC Act, EPBC and IUCN listed) were burnt. **Over 60% of these species are considered at High or Medium risk of decline** as a result of impacts of the 2019/20 fires.

Of all High and Medium risk species, **130 were considered at greatest risk of decline, requiring immediate management attention** to aid recovery. This priority group were either i) already listed as Critically Endangered (CR), ii) of highly restricted range where any decline as a result of 2019/20 fires would lead to CR listing, whether currently listed or not, iii) had >50% range burnt and were highly sensitive to some aspects of the fire regime or subject to multiple threats.

High fire frequency accounted for 65% of High and Medium assessments, with drought also a key driver. This potentially highlights and quantifies climate induced fire interval squeeze (Enright *et al*. 2015), where higher fire frequencies combined with drought are a predicted outcome of changing climate.

4. Significance of findings in context of previous studies

The impact of increased risk of decline of non-listed plant species is alarming. While those species already listed as at risk of decline would be considered likely to have exacerbated threats from such broad scale events, the increased risk for taxa previously considered not at threat highlights the need for assessment and management after the 2019/20 fire season.

High fire frequency is a listed key threatening process in NSW and the 2019/20 fires have increased the likelihood of large numbers of species at risk to this threat. High fire frequency acts on critical life cycle processes of both plant and animal taxa, not allowing populations to recover, and in some cases causing local extinction (Keith, 1996; Enright *et al.*, 2014). Those species with life-history traits vulnerable to short fire intervals, such as obligate seeders which have above ground plants killed by fire and are completely reliant on recovery from seeds, are one of the key groups at risk. Fire sensitive species burnt over a significant amount of the distribution are also at high risk, with some having unknown capacity to recover.

Recovery of populations can also be limited by drought both pre- and post-fire, the extreme severity of fires depleting seed banks and available refugia, and disease. It should be noted that the potential for erosion as an additional risk was excluded from this analysis due to a lack of vital information in some regions.

5. Approach and Methods

A framework for assessing impacts of the 2019/2020 fires on plants was developed by researchers with expertise in the fire ecology of plants and extinction risk (Auld *et al*. 2020a). The purpose of the framework was to identify plant species at the greatest potential risk of population declines or local extinctions following the 2019/2020 bushfires and to prioritise such species for post-fire field assessments and recovery actions. A preliminary assessment of priority species

was then conducted using this framework (Auld *et al*., 2020b). For a full explanation of the approach used, please refer to this paper.

A precautionary approach was taken across all assessments, with highest available estimates used where multiple estimates had been made. This is similar to the approach taken for IUCN and BC Act assessment of threat status. A precautionary approach was adopted for: i) % range burnt in the 2019-2020 bushfires; ii) % range burnt in the 2019-2020 bushfires and impacted by pre-fire drought, post-fire soil erosion, or previous fires in the past 5, 15 or 50 years; iii) % range burnt at high severity in the 2019-2020 bushfires; and iv) % range where plants are yet to mature due to fire(s) in the last 5, 15 or 50 years including the 2019-2020 bushfires. Fire severity was calculated using both the FESM algorithm (Gibson *et al*., 2020) and GEEBAM, and ranged from unburnt to extreme.

6. Limitations and remaining knowledge gaps

Note that this is a preliminary analysis. As stated in Auld *et al*., (2020b), "it is important to stress that this assessment is based on a desktop analysis and limited expert opinion of currently available data and for most species, does not yet incorporate post-fire field observations and data on recovery. As a consequence, there will be changes to the estimates of what plant species are considered to be at HIGH or MEDIUM risk over time, especially as field observations are incorporated. This staged approach to assessment is also being applied at the national scale, with an interim national list of affected plant species being finalised in coming months. In addition, while there is considerable uncertainty in some estimates, we have opted for a precautionary approach in assigning risk". Additionally, remotely-sensed detection of fire effects can be limited where canopies remain intact and dense (i.e primarily for fires at the lower end of severity). We have used both FESM and GEEBAM and used a precautionary approach to minimse problems related to this.

7. Implications for management

Immediate implications highlighted to aid prioritisation of medium to long term actions are as follows (from Auld *et al*., 2020b):

- For species flagged as at greatest risk of decline or global extinction (Table 2), field inspections of impacts threats to recovery are needed as soon as is practicable.

- For species sensitive to fire (Criterion H in Auld *et al*. (2020a) framework)), particularly rainforest taxa that are long-lived trees prone to collapse from basal charring, there is an urgent requirement to conduct field inspections in order to assess the scale of tree loss or damage and what rehabilitation actions may be required. Germplasm collection for species considered a high priority for ex-situ cultivation and ex situ conservation could be conducted at the same time.
- Species that have sites/populations impacted by high fire frequency (HIGH or MEDIUM risk under Criterion B from Auld et al. (2020a) framework) are likely to have undergone a decline as a result of the 2019/2020 fires burning over areas where juvenile plants had not yet matured and hence not yet replenished their seed banks (obligate seeders) or had not yet become fire-resistant (resprouters). Field inspections at burnt sites are a high priority for these species to assess the magnitude of post-fire recovery and to identify any threats to recovery that require a management response.
- For all other species, it is a medium priority to visit burnt sites to assess post-fire recovery and threats to recovery. Initial post-fire recovery can be greatly retarded by a range of threats and it is important to identify any additional on ground threats to recovery of these species.

8. Table 1 Total numbers of listed species found at risk after 2019/20 fires

NSW Plant species of national significance	Number burnt in 2019/20 fire	>10% range burnt	>80% range burnt	Number assessed as at High risk	Number assessed as at Medium risk
EPBC Act listed	377	236	51	113	63
IUCN listed (but not Fed or State listed)	52	29	6	13	8
NSW BC Act listed (not on EPBC Act)	107	67	21	47	27

9. Table 2 Species considered to be at greatest risk of global decline

Where listed	Number High or Medium risk	Species managed under SoS	Species not managed
EPBC Act, BC Act or IUCN CR listed	**27**	*Callistemon megalongensis, Eidothea hardeniana, Euphrasia arguta, Genoplesium littorale, Gentiana bredboensis, Prasophyllum bagoense, Prasophyllum keltonii, Wollemia* nobilis	*Prasophyllum innubum, Pterostylis oreophila*
Highly restricted range (excluding CR spp) and >50% range burnt	**92**	*Acacia constablei, Acacia courtii, Acacia phasmoides, Acronychia littoralis, Asterolasia beckersii, Asterolasia buxifolia, Astrotricha crassifolia, Baeckea kandos, Baloskion longipes, Bertya* sp. (Chambigne NR, M. Fatemi 24), *Bossiaea bombayensis, Chiloglottis anaticeps, Darwinia glaucophylla, Dracophyllum macranthum, Epacris hamiltonii Epacris sparsa, Eucalyptus aquatica, Eucalyptus dissita, Eucalyptus fracta, Eucalyptus pachycalyx* subsp. *banyabba, Eucalyptus sturgissiana, Euphrasia bowdeniae, Gaultheria viridicarpa, Genoplesium superbum, Gentiana wissmannii, Grevillea acanthifolia* subsp. *paludosa, Grevillea masonii, Grevillea mollis, Grevillea molyneuxii, Isopogon fletcheri, Leionema lachnaeoides, Melichrus* sp. Gibberagee, *Persoonia bargoensis, Persoonia hindii, Philotheca obovatifolia, Pomaderris gilmourii, Prasophyllum fuscum, Pterostylis metcalfei, Pultenaea baeuerlenii, Solanum sulphureum, Trachymene scapigera, Triplarina imbricata, Typhonium* sp. aff. *brownii, Zieria covenyi, Zieria floydii*	*Acacia beadleana, Acacia blayana, Almaleea cambagei, Boronia anemonifolia* subsp. *wadbilligensis, Boronia imlayensis, Brachyscome brownii, Bursaria calcicola, Cassinia macrocephala* subsp. *tenuis, Cassinia theodorii, Corokia whiteana, Coronidium kaputaricum, Crowea exalata* subsp. *obcordata, Cyphanthera scabrella, Darwinia taxifolia, Dillwynia stipulifera, Eucalyptus corticosa, Eucalyptus scopulorum, Eucalyptus* sp. Howes Swamp Creek, *Galium roddii, Gentiana baeuerlenii, Gentianella sylvicola, Grevillea aspleniifolia, Grevillea irrasa subsp. irrasa, Grevillea rhyolitica, Hibbertia cistiflora* subsp. *quadristaminea, Hibbertia coloensis, Hibbertia decumbens, Hibbertia notabilis, Hibbertia praemorsa, Hibbertia pustulata, Hibbertia rhynchocalyx, Homoranthus binghiensis, Juncus laeviusculus, Leionema ceratogynum, Lepidosperma evansianum, Leptospermum benwellii, Leptospermum crassifolium, Leptospermum petraeum, Macrozamia humilis, Nematolepis rhytidophylla, Pimelea axiflora* subsp. *pubescens, Pimelea venosa, Pultenaea* sp. Olinda, *Thismia clavarioides, Xanthosia scopulicola, Zieria hindii, Zieria ingramii*
Other species >50% range burnt & multiple threats	**15**	*Acrophyllum australe, Boronia deanei, Callitris oblonga, Pomaderris brunnea, Pomaderris cotoneaster, Prostanthera palustris, Velleia perfoliata*	*Banksia paludosa subsp. astrolux, Eucalyptus paliformis, Eucalyptus stenostoma, Hakea constablei, Hakea dohertyi, Persoonia terminalis, Pterostylis elegans*

10. Key reference list

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