DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

NSW Wildlife and Conservation Bushfire Recovery

Supplement A – Assessing the impact of the bushfires on wildlife and conservation

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Cover photo: Post-fire regrowth, Torrington State Conservation Area. John Spencer/DPIE

Acknowledgement of Country

We acknowledge the traditional custodians of Country and pay our respects to Elders past, present and emerging. The land management of earlier generations, including the Elders, who have fought for their rights in the management of our natural environment are valued and respected. We acknowledge the grief of Aboriginal people in response to the recent fires, and recognise that the actions we take today impact on the natural environment, and we commit to collaborating with Aboriginal people who continue to hold the knowledge of our traditional custodians to improve the way we manage our natural environment now and into the future.

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Environment, Energy and Science
Department of Planning, Industry and Environment
4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment, Energy and Science enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
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1. Introduction

The scale of the bushfires that burned throughout New South Wales (NSW) in 2019–20 was unprecedented. They took a terrible human toll, destroyed homes and livelihoods, ravaged communities and had a significant impact on native plants and animals.

Estimates suggest that nearly three billion native mammals, birds and reptiles were killed or displaced across Australia (WWF-Australia 2020). In New South Wales, the fires affected 2.7 million hectares (almost 40%) of the state's national park estate, just over half of the Gondwana Rainforests World Heritage Area and more than 70% of the Greater Blue Mountains World Heritage Area. One-quarter of all koala habitat in eastern New South Wales was damaged or destroyed, and several already threatened and at-risk species have been put under greater pressure.

While fire is a natural and essential part of the Australian landscape, and many species have evolved to co-exist with fires, the scale of the 2019–20 bushfires impacted large areas of habitat for species and ecosystems that were either still recovering from the impacts of previous fires or are not adapted to fire. In places where bushfires were very extensive, unburnt areas that provide refuge for wildlife as burnt areas recover are scarce.

During and following the 2019–20 bushfires, the NSW Government acted quickly to support wildlife and conservation recovery. In January 2020, the Government released *Wildlife and Conservation Bushfire Recovery: Immediate Response January 2020* (the Immediate Response) (DPIE 2020a). That document described the Government's early response to the bushfires, and provided an overview of preliminary findings on the extent and severity of fire damage across the State.

Since the release of the Immediate Response, significant work has been done to improve our understanding of the impacts of the fires on wildlife and biodiversity. This document provides the latest information on the extent and severity of the fires, and details the findings of conservation assessments undertaken on fauna, flora and ecological communities in New South Wales.

2. Mapping the extent and severity of the fires

In January 2020, the Department of Planning, Industry and Environment (DPIE) published an initial Google Earth Engine Burnt Area Map (GEEBAM) that predicted how severely the vegetation canopy had burnt by measuring the change in the colour of vegetation after a fire (DPIE 2020b). This map has been regularly updated to provide the latest information about the ongoing effects of the 2019–20 fires across New South Wales (Figure 1). Burnt area mapping is an important tool to support on-ground decisions about conservation and the development of recovery actions. While burnt area maps can be produced quickly, they do not capture changes in the landscape at a detailed level.

To develop a greater level of detail, DPIE scientists worked with the Rural Fire Service to develop Fire Extent and Severity Maps (FESM). These maps use a combination of field data and satellite imagery to give a more detailed understanding of fire impact. They provide information about the damage caused to tree canopy and understory, and how far each fire has spread. These maps enable researchers to better understand impacts to the landscape and inform on-ground assessments and conservation actions.

The data and maps for the 2019–20 fires are available through the NSW Government Sharing and Enabling Environmental Data (SEED) portal, most recently for GEEBAM on 2 April 2020 and FESM on 18 December 2020 (DPIE 2020c; DPIE 2020d).

3. Mapping impacts on biodiversity

In May 2020 DPIE published the *NSW Fire and the Environment 2019–20 Summary* (DPIE 2020e), which provides an outline of post-fire biodiversity and landscape data and analyses. This summary is designed to help governments, businesses and communities understand the broad environmental effects of the 2019–20 fires, and to support research and recovery.

The report provides information on the impact of the fires and also measures changes in three key biodiversity indicators developed for the first NSW Biodiversity Outlook Report (DPIE 2020f): ecological condition, ecological carrying capacity and ecosystem persistence.

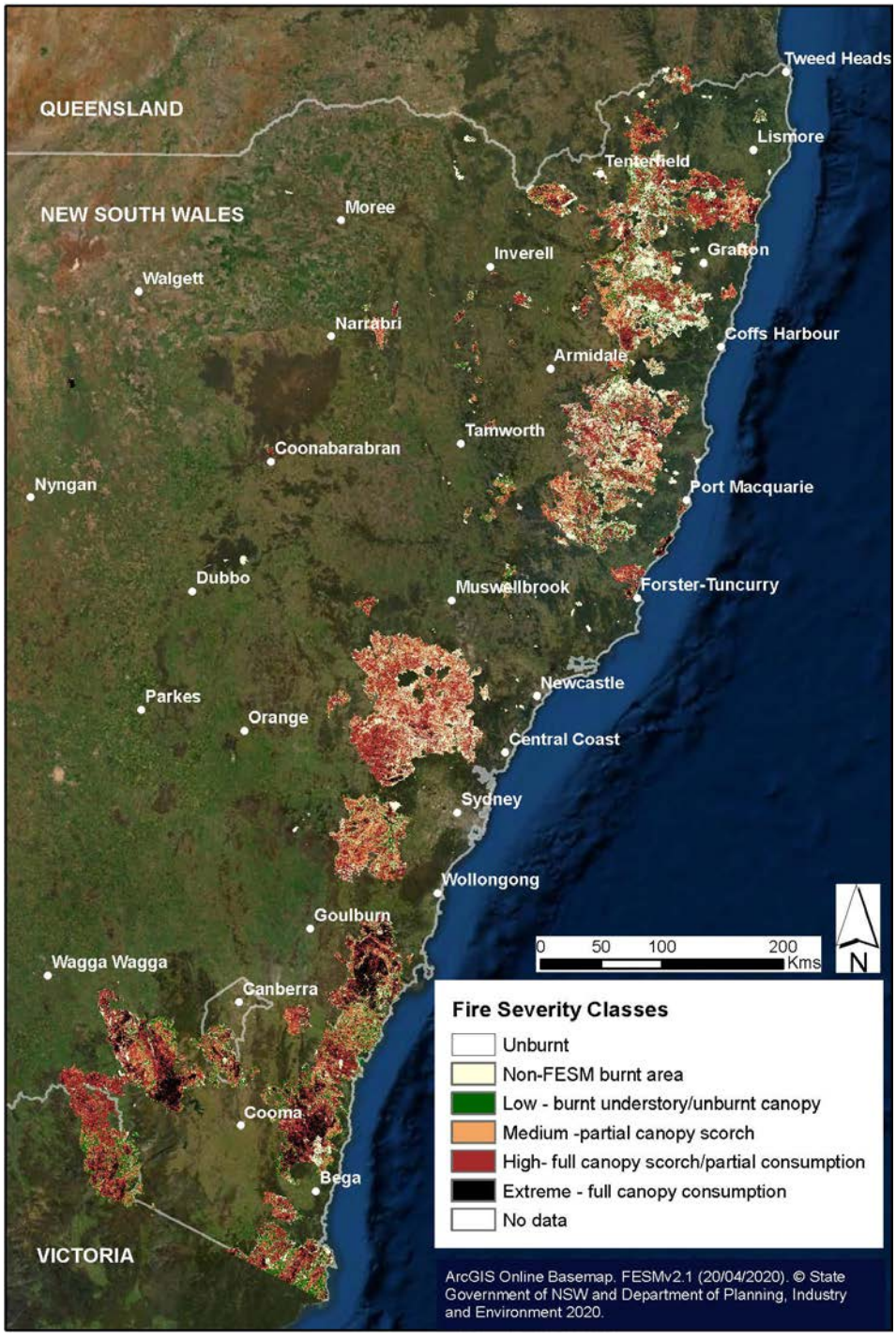


Figure 1 Fire extent and severity map of New South Wales, April 2020

4. Conservation assessments

Since January 2020 the Commonwealth Government has been publishing priority lists of animals, invertebrates, plants, and ecological communities requiring urgent management intervention (DAWE 2020). DPIE staff have provided support for many of these Commonwealth-led assessments, and have either completed or are completing supplementary, NSW-specific assessments and prioritisations that take account of local conditions and knowledge (Auld et al. 2020; Keith et al. 2020; Tozer et al. 2020). These findings inform New South Wales' prioritisation of post-fire conservation recovery action over the medium term. The 'NSW Priority Species and Communities for Bushfire Impact Assessment and Conservation Action' can be found on the Sharing and Enabling Environmental Data (SEED) portal under the Bushfire-related Dataset (2020i). These lists are dynamic and are updated as new information is obtained.

4.1 Fauna

Commonwealth Government assessment

The Commonwealth Government's interim priority list contained 119 animal species, with 113 listed as a high priority for urgent management intervention. Of these species, 90 occur in New South Wales: 63 terrestrial animals and 27 aquatic animals.

NSW species identified as being especially impacted included iconic species such as the koala, brush-tailed rock-wallaby and mountain pygmy-possum. The provisional assessments also identified some species not currently listed as threatened that may require urgent intervention, such as the platypus.

In total, of the 63 terrestrial animals in New South Wales identified on the Commonwealth's priority list, 45 are listed as threatened under the NSW *Biodiversity Conservation Act 2016* (BC Act). Five of the 26 aquatic animals on the Commonwealth's list are fish listed under the NSW *Fisheries Management Act 1994,* which is managed by NSW Department of Primary Industries (Fisheries).

DPIE assessment

New South Wales has built on the Commonwealth framework, developing a state-specific priority fauna list that considers additional information and factors relevant to New South Wales, such as the impact of drought (DPIE 2020i).

In total, 77 terrestrial fauna species are currently considered priorities for assessment on the NSW fauna list, with 33 listed as threatened under the BC Act. The NSW criteria included species with over 30% of habitat burnt and either:

- known to be negatively affected by intense fire, or
- negatively affected by competition and predation from introduced species; severe habitat fragmentation; or a loss of habitat elements by high intensity fire.

Erosion and sediment deposition from flash flooding has led to a relatively high number of frogs being listed, including some not currently listed as endangered. Only one invertebrate is included, as aquatic and non-threatened species were not considered in the NSW analysis. A subsequent analysis will assess invertebrates.

The Commonwealth and NSW priority lists do not fully align, as New South Wales uses additional data at a local and regional scale to inform its prioritisation (see Table 2). Consideration will be given to all priority species from both lists, with prioritisation to be refined by ongoing assessment, which now includes field validations.

Table 1 Comparison between the Commonwealth and NSW fauna priority lists

Priority list	Total species on list	Occur within NSW	Listed under BC Act*
Commonwealth	119	90 (63 terrestrial)	45 (of 63)
NSW	77	77	33

* *Biodiversity Conservation Act 2016* (NSW)

Saving the smoky mouse

The critically endangered smoky mouse was identified as at serious risk of extinction due to the 2019–20 bushfires, which burnt more than 90% of its habitat. There are only two sites in New South Wales where smoky mice are known to occur – the Nullica area on the Far South Coast and in Kosciuszko National Park.

As part of DPIE's analysis of fire impacts, 58 motion-sensing cameras were set up in burnt, semi burnt and unburnt areas of Kosciuszko National Park. The camera traps recorded more than 40,000 images in just five weeks and discovered the smoky mouse was alive and well at seven burnt sites.

SoS will survey more areas of Kosciuszko National Park over the next 12 months to get a better understanding of the size and distribution of the smoky mouse population. To increase the species' chance of survival, SoS will also continue a captive breeding program, which commenced in 2016.

Photo: Smoky mouse. L Broome/DPIE

4.2 Flora

The Commonwealth Government's interim priority list of plant species affected by the 2019–20 bushfires contained 471 plant species listed as the highest priorities for urgent management intervention (Gallagher 2020a). The revised list based on updated analyses (Gallagher 2020b) comprises 357 NSW plant species.

A complementary analysis by DPIE scientists has identified 231 NSW plants of national significance as being at greatest risk of global decline and/or extinction (Auld et al. 2020). As with the fauna list, there is some variation between the Commonwealth and NSW priority lists due to differences in the underlying data (much NSW-specific data is not available nationally) and a focus in the NSW analysis on endemic and threatened species.

The current list of NSW plant species at risk and identified as national priorities based on those identified by Gallagher (2020b) and subsequent revisions to Auld et al. (2020) can be found on the SEED portal (DPIE 2020i), and includes rainforest taxa that are rarely burnt such as the iconic Wollemi pine (*Wollemia nobilis*) and Gondwanan rainforest species such as the Nightcap oak (*Eidothea hardeniana*) and Antarctic beech (*Nothofagus moorei*).

Table 2 Comparison between the updated Commonwealth (Gallagher 2020b) and NSW (Auld et al. 2020) plant priority lists

Priority list	Total species on list	Occur within NSW	Listed under BC Act*
Commonwealth	471	357	107
NSW	231	231	111

* *Biodiversity Conservation Act 2016* (NSW)

4.3 Ecological communities

Impacts to ecological communities varied across the landscape. Of the 37 Commonwealth-listed threatened ecological communities (TECs) identified as having one or more major post-fire threats, 26 occur in New South Wales.

DPIE undertook a complementary assessment of the impacts of the 2019–20 fires on the 114 TECs listed under the BC Act (Tozer et al. 2020). It found that 27 TECs were substantially within the fire footprint and exposed to impacts over at least 10% of their distribution. An estimated 15 TECs have been burnt over more than 50% of their distribution and were identified to be at risk of significant declines in diversity, richness and ecological function due to threats that are likely to impact their survival and regeneration. Key threats include:

- incidence of severe drought in the 18 months prior to the fires
- high fire frequency and/or severity
- impacts associated with invasive herbivores, predators and weeds
- hydrological change and post-fire disturbances, erosion or pollution.

The current list of TECs assessed as at risk can be found on the SEED portal (DPIE 2020i).

4.3.1 Plant community types

DPIE also completed an assessment of all plant community types (PCTs) within the fire zone using the same analysis framework as the TEC assessment (DPIE 2020i). PCTs are the master community-level typology used in New South Wales' planning and assessment tools and vegetation mapping programs. They are a classification developed independently from TECs that covers all plant communities in New South Wales, not just those listed as threatened under the BC Act.

Some 225 PCTs (26%) were identified as being at high risk of declines in diversity, richness and function as a consequence of the fire in conjunction with other factors including:

- exposure to severe and protracted drought (216 PCTs)
- high fire frequency (95 PCTs)
- severe post-fire erosion (102 PCTs).

These risks are likely to be amplified by other threats such as feral herbivores, weed invasion, disease and hydrological change.

Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion

Newnes Plateau Shrub Swamp is an endangered ecological community that was heavily impacted by the 2019–20 fires. The high intensity fires, compounded by severe drought and hydrological change affecting the aquifer, caused almost complete collapse of this swamp community in some locations. This community forms part of the Commonwealth-listed Temperate Highland Peat Swamps on Sandstone that was listed as a 'very high' priority for recovery activity by the Australian Government following the 2019–20 fires.

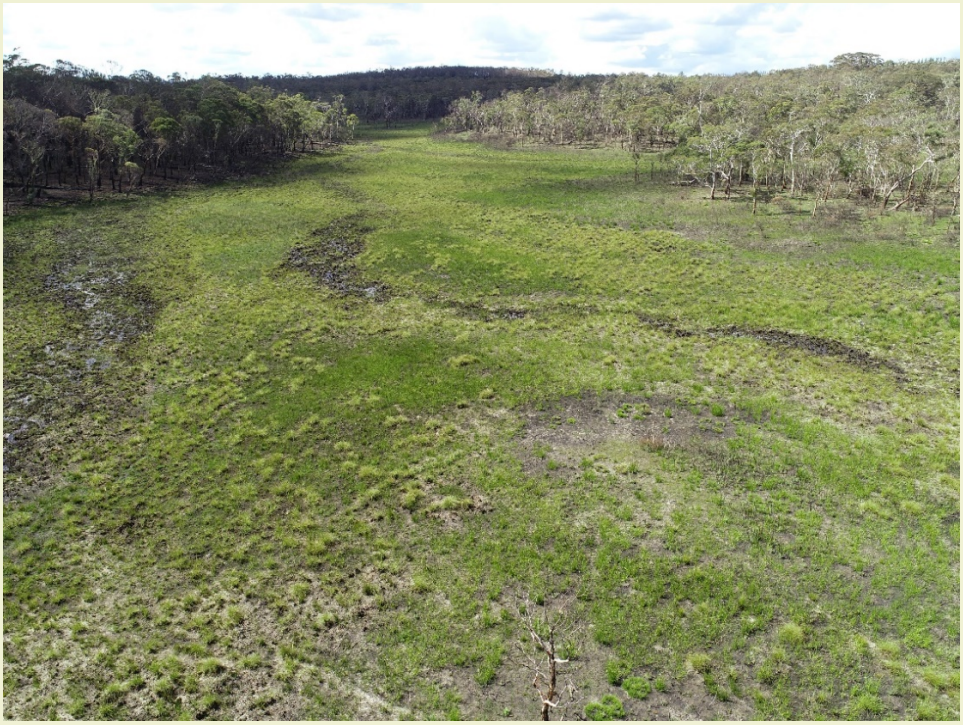
Photo: Carne Swamp. C Simpson

Some sites, like Carne Swamp (pictured below), were still smouldering as late as March 2020 and showing few signs of recovery in April. Peat deposits in these locations were reduced to a deep bed of ash and oxidised sediments.

Photo: Carne Swamp, still smouldering in late March 2020. C Simpson

In comparison, recovery was well underway in April 2020 at Broad Swamp. The severity of impacts at Carne Swamp and several other swamps on the plateau are attributed to the drying of the peat.

Carne Swamp was the subject of a $742,500 investment through the Environmental Trust's Swamped by Threats project before the fires. Post-fire funding has been directed to a threatened species habitat assessment and establishing an additional recovery site for three threatened frog species: giant burrowing frog (*Heleioporus australiacus*), Littlejohn's tree frog (*Litoria littlejohni*) and red-crowned toadlet *Pseudophryne australis*.



Broad Swamp in April 2020. C Simpson

5. Compounding impacts of other threats

The 2019–20 bushfires came at a time when the natural environment was already under stress from a range of key threatening processes (KTPs) (Dickman et al. 2020). KTPs are processes that adversely affect threatened species or ecological communities, or could cause species or ecological communities that are not threatened to become threatened.

High frequency fire, pest animals and weeds, diseases, habitat loss and fragmentation, drought and climate change are all KTPs that increase pressure on native plants and animals (DPIE 2020g; EPA 2019; TSSC 2019). For many species and landscapes already under stress, the 2019–20 bushfires have added an additional compounding layer of damage, hazard and loss.

Preliminary analysis by the TSSC (2020) found that several critical habitat attributes have been extensively lost or reduced by the bushfires, limiting the capacity of animal species to recover and repopulate burnt areas. The habitat attributes identified as critical for many recovering animal species included:

- *tree hollows*: used by birds (parrots, cockatoos, owls, nightjars and treecreepers), mammals (possums, gliders, antechinus, quolls, bats) and reptiles (goannas, geckoes, skinks, pythons) for shelter and breeding
- *understorey and mid-storey vegetation*: essential food resources, shelter and nesting sites for many reptile, bird and mammal species. Even in areas where the canopy remained unburnt, large swathes of understorey have been lost
- *eucalypt canopy*: food resources for many insects and small birds (honeyeaters, gleaners, insectivores), gliders, possums, koalas, flying-foxes and microbats. Burnt canopy cannot produce flowers and nectar to support insect populations
- *forest floor*: food and nesting resources for many mammals, birds, reptiles and amphibians. These animals depend on the insects and fungi living in the topsoil, leaf litter and amongst the coarse woody debris.

The TSSC also identified two KTPs that will significantly impact the survival and reoccupation of burnt forest habitat by fauna:

- loss of hollow bearing trees, and
- the removal of dead wood and dead trees (see also Lindenmayer et al. 2002; TSSC 2004).

The bushfires have also exacerbated many other threats; for example:

- High frequency fire results in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition (NSW Scientific Committee 2000).
- Small mammals and birds are more exposed to fox and cat predation where understorey vegetation and fallen timber have been burnt (Woinarski et al. 2020; Moore et al. 2014).
- Feral herbivores such as goats, deer and horses are concentrating their grazing in unburnt areas, where they are damaging habitats and competing with native herbivores for the small amount of food that remains.
- Post-fire recovery through epicormic shoots and mass germination events are highly susceptible to infection by the exotic pathogen myrtle rust. This can delay ecosystem recovery or alter the trajectory of post-fire recovery.
- Grazing by domestic stock changes the mix of plant species (State of the Environment Committee 2011) and damages the habitat of threatened birds and mammals (Jackson et al. 2017; DPIE 2020h).

- Areas that lost their canopy in the fires are more vulnerable to invasion from weeds, which alter habitat and compete with native plants (Leonard et al. 2010).
- Removing burnt woody debris post-fire may exacerbate the loss of hollow bearing trees and remove trees that would sprout if left in place (Banks et al. 2011; Collins et al. 2012).
- Post-fire rainfall increases the risk of soil erosion and deposition, reducing water quality.

Another compounding threat is the increasing impact of climate change. Climate change is leading to more extreme and frequent weather events – fire, drought, floods – which can all have negative effects on biodiversity. There is ongoing potential for loss of species and populations and cascading ecological change from both drought and fires, especially if the fires become so frequent that plants cannot reach maturity and set seed between fires.

As warming continues, changes in climate and/or fire severity and behaviour may result in ecosystem changes. Rainforest areas, for instance, may change to eucalyptus forest or shrubland. Wetter forest types that are rarely affected by fire may become more prone to fire as fire-tolerant species replace fire-sensitive species.

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