

# Post-fire Recovery: Assessment of the Warrumbungles Fire by the Burned Area Assessment Team

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## **Abstract**

*The new ACT/NSW Burned Area Assessment Team were deployed to the Warrumbungles in January 2013 to assess the damage and risks and provide restoration options for post-fire recovery.*

## **INTRODUCTION**

Recovery is an integral factor in fire management. Bushfires can result in immediate loss and damage, as well as presenting new potential risks such as flooding that damages built assets, landslips onto roads due to erosion caused by the removal of ground cover, impacts on soil regeneration due to burn severity and loss of endangered species or habitat. The rapid assessment of these risks and identification of emergency actions can significantly reduce risks to public safety, infrastructure and the environment.

## **BURNED AREA ASSESSMENT TEAM**

The ACT / NSW Burned Area Assessment Team (BAAT) are a 6-10 person multi-disciplinary team who undertake rapid risk assessment of impacted areas following a bushfire. The team assess risks to life and property, infrastructure and the environment, develop mitigation options, and prepare a costed report for the land manager/s for consideration and action.

The major responsibilities of the BAAT are:

- identify the potential environmental risks that may emerge as a result of bushfire;
- provide recommendations to land managers about strategies and recommendations to mitigate these risks;
- perform a rapid risk assessment and recommend costed mitigation strategies which could be used to support post-fire recovery funding applications;
- produce a written report for stakeholders; and
- assist fire and land managers with the transition from suppression to recovery.

The team is modelled on the US Burned Area Emergency Response teams and the Victorian Bushfire Rapid Risk Assessment teams, and their prior work is fully acknowledged.

The pilot BAAT program was funded by the National Disaster Resilience Grants Scheme.

## **WARRUMBUNGLE DEPLOYMENT**

In January 2013, the first ever BAAT team deployment was undertaken to work on

the Wambelong fire that had occurred in the Warrumbungle National Park.

This Wildfire started on the 12<sup>th</sup> of January 2013 and under extreme fire weather extended over 39 000 hectares in one day. The fire destroyed 53 houses, and impacted a wide range of other assets including burning 22 104 hectares of the national park. This included 43% of the landscape burnt at extreme fire severity.

The BAAT team undertook a very rapid risk assessment, working with the local national parks office over five days and identified extreme and high risks in the burn area. Mitigation options were provided including habitat restoration for the brush-tail rock wallaby, feral animal control options, track and trail restoration and many others.

## **METHODOLOGY**

The team consists of a leader and deputy, plus specialists in flooding and erosion, asset management, cultural heritage, flora, fauna and GIS spatial analysis (Table 1). The primary data sources for the team are:

- satellite remotely sensed imagery before and after the fire that provide fire severity;
- local databases to source a full list of asset information (e.g. NPWS Wildlife Atlas provides flora and fauna data; and
- the Asset Management System provides a full list of built assets) and local expert knowledge.

After an initial briefing with the land manager (NPWS), the team collated information about the assets, identified potential threats and the potential triggers, examples of these threats include: rainfall, visitation and grazing

animals. Using the asset, threat and trigger information a risk assessment based on likelihood and consequence was derived and the priority risks identified.

A risk assessment tool was used to assess possible mitigation options and determine how much these could reduce the residual risk. Risks across all BAAT disciplines were amalgamated where appropriate in a risk moderation process (e.g. flooding & erosion risks to infrastructure). Mitigation treatments for risks identified as extreme and high were then fully costed. Information was compiled into a report and a presentation made on the final day of the deployment.

The fire severity map was generated via the comparison of pre (29/12/2012) and post-fire (24/01/2013) satellite imagery using normalised difference vegetation index (NDVI) ratios. The reflectance values of selected electromagnetic wavelengths are used to determine the change in greenness of vegetation and the level of change corresponds to fire severity which is mapped as four distinct classes (Table 2, and Fig. 1). Validation of the severity mapping was carried out via the sampling of 28 points in accessible parts of the burn area. Only two points varied from the satellite analysis which represents 92.9% accuracy.

## **ENVIRONMENTAL RISK IDENTIFIED**

Key environmental risks and treatment recommendations are summarised below. Additional risks to infrastructure, assets, public safety and cultural heritage were documented in the BAAT report.

<b>Role</b>	<b>Name</b>	<b>Organisation</b>
Team leader	Margaret Kitchin	ACT Environment and Sustainable Development Directorate
Deputy Leader	Simon Hemer	NSW National Parks and Wildlife Service
Spatial analysis	Brent Marchant Saskia Hayes	NSW National Parks and Wildlife Service
Flooding & Erosion specialists	Sally McInnes-Clarke Greg Chapman	Science Division, NSW Office of Environment and Heritage
Flora specialist	Wade Young	ACT Parks and Conservation Service
Fauna specialist	Doug Beckers	NSW National Parks and Wildlife Service
Asset management	Michael Vader	NSW National Parks and Wildlife Service
Cultural heritage specialist	Merv Sutherland	NSW National Parks and Wildlife Service
Logistics support	Richard Yeomans	NSW National Parks and Wildlife Service

Table 1: Warrumbungles BAAT specialists.

Table 2: Fire Severity Summary of the Wambelong Fire.

<b>Fire Severity Class</b>	<b>Total area (hectares)</b>	<b>% of total area</b>
Unburnt within fire footprint	12 378	22
Low shrubs scorched and tree canopy unburnt, patchy or low intensity shrub fire	7 538	13
High shrubs mostly consumed and tree canopy completely scorched	11 944	21
Extreme shrub and tree canopy completely consumed, extreme intensity crown fire	24 509	43

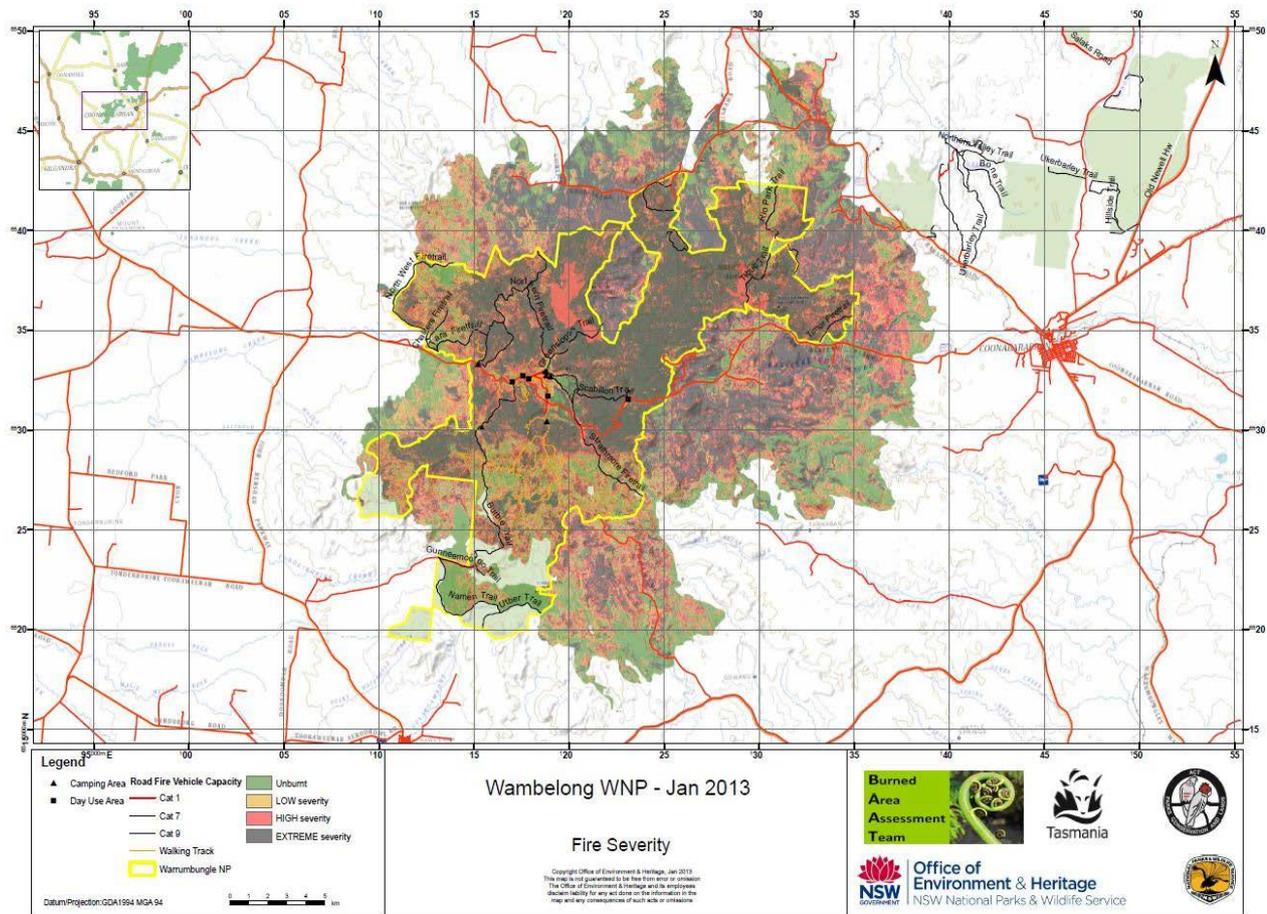


Figure 1: Fire Severity Map of the Wambelong Fire.

## FLOODING AND EROSION

The Warrumbungle National Park features magnificent geological features derived from the Warrumbungles shield volcano that formerly covered much of the area. Topographic relief in the park is high with volcanic domes and vents forming many of the higher peaks. There are two main geologic types - volcanics (including basalt, andesite, trachyandesite, hawaiite and pyroclastics) overlying Pilliga and Purlewaugh sandstones. Soils on volcanic parent materials are generally well-structured and relatively stable, being well-armoured by extensive surface rock. Soils derived from sandstone parent materials are sandy and erodible. The Warrumbungles form the catchment

boundary between the Namoi River catchment to the north, and the Castlereagh River catchment to the east and south. Wambelong Creek drains to the west and joins the Castlereagh River.

Runoff will be of increased frequency, volume and velocity until vegetation recovers. Risk of erosion will decrease as the protective groundcover recovers.

Loss of riparian vegetations leaves unprotected stream banks at risk of erosion, resulting in decreased water quality and impacts on aquatic flora and fauna. Stream bank erosion leads to collapsing banks and stream widening.

Treatment recommendations:

- protect riparian vegetation wherever possible;

- appropriate culvert, causeway and bridge design;
- supplementary riparian planting; and
- detailed inspection of stream condition in high risk areas, and consider bank protection measures.

Unprotected soil is at risk of gully erosion as water flow concentrates in drainage lines. Gully erosion will lead to a moderate loss of the soil resource and ecosystem services. Risk of gully erosion is higher on Pilliga and Purlewah sandstone where soils are deeper and receive more runoff from volcanic slopes above. Outcomes will vary with rainfall regime.

Treatment recommendations include:

- erosion and sedimentation control measures to reduce runoff and disperse water flows in high risk areas identified on the Soil Erosion Risk Map; and
- depending on individual site constraints, treatments may include level sills, matting or hay bale benches.

## **FAUNA**

The Warrumbungle National Park is known as a centre of richness for plant and animals and contains over 300 native fauna species. Mammals commonly found in the park include the koala, echidna, bush-tailed possum, ring-tailed possum, sugar glider, squirrel glider, yellow footed antechinus, common dunnart, eastern water rat, little forest bat, and five macropod species including the endangered brush-tailed rock wallaby.

There are also a range of bird species, reptiles and amphibians. Many of the mammals and birds are dependent on tree hollows for their survival. In contrast to the native species are exotic pests –

including foxes, pigs, goats and rabbits that require monitoring or management.

Field work found that areas of the park affected by high and extreme fire severity had few bird species and no arboreal mammal species. Mortality of macropods on the flats was high; however, small mobs of eastern grey kangaroos and smaller numbers of wallaroos, red-necked wallabies and swamp wallabies have survived the fire. The creek systems provided a refuge for frogs where six species were seen and evidence of breeding found. In areas of high and extreme fire severity many tree hollows have been destroyed and most ground habitat consumed by the fire. Native grasses on the cleared flats have made a rapid recovery and supplementary feeding of lowland macropods is not required.

Treatment recommendations:

- supplementary feeding for threatened species (e.g. brush-tailed rock wallaby, koala);
- aerial and ground shooting of feral goats, and rabbit control measures;
- hollow assessment in hazardous tree management program aimed at conservation of habitat trees and habitat supplementation program (e.g. installation of artificial habitat boxes); and
- population supplementation with captive bred brush-tailed rock wallabies, with monitoring and complementary predator control.

## **FLORA**

The floristic diversity of the Warrumbungle National Park represents the combination of species from east and west NSW. There are seven vegetation communities recognised in the NPWS

Reserve Fire Management Strategy and 779 vascular plants were mapped in 2008. Dominant in the landscape is the *Callitris* woodlands. This species is killed by fire and recovery is from seed, hence takes longer to re-establish a mature population than resprouters. There are a number of listed rare and threatened species in the park, only three of which have been identified to be killed by fire and regenerate from seed although the response for seven species is unknown. The other species regenerate from basal sprouts or epicormic regrowth. Weeds have been introduced into the park in the past through grazing, and are concentrated in the valley floor.

Treatment recommendations:

- monitoring and treatment of exotic weeds. Riparian areas are a high priority;
- aerial shooting, trapping and baiting of feral herbivore species to reduce grazing pressure;
- assess water quality and need for revegetation works at wetland sites; and
- monitor bush tucker sites for regeneration of cultural plants, and intervene with enhanced weed control or regeneration as required.

## OUTCOMES

The team presented the report to local staff and stakeholders on the 2<sup>nd</sup> of February 2013. The BAAT assessment identified 31 key risks across the park, including 10 rated extreme and 14 rated high. Major risks centred on:

- public safety arising from hazardous trees and damaged infrastructure.

- infrastructure damage arising from increased post-fire erosion;
- post-fire grazing pressures for threatened species and communities to optimise post-fire recovery;
- soil movement and stream sedimentation arising from large debris flows; and
- retaining iconic indigenous assets in the post-fire environment.

Proposed risk mitigation treatments in 29 of the 32 risks reduced the residual risk to moderate or low.

Seventy two percent of Warrumbungle National Park was burnt at an extreme or high fire severity, and much of this area has already been impacted by extreme rainfall intensities resulting in rearrangements of the landscape. Nevertheless, two weeks after the fire the BAAT team has assessed risks and observed *Macrozamia* and eucalypts resprouting in the park, demonstrating the resilience and potential for recovery in Australian landscapes.

## BIOGRAPHY

Ms Sally McInnes-Clarke is a Senior Soil Scientist with the NSW Office of Environment and Heritage. She has over 19 years experience in soils and landscape assessment in NSW. She is project manager of SoilWatch - a soil health program which monitors public investment and changes in soil health and land management. She is a member of the ACT/NSW Burned Area Assessment Team where she is the soil and hydrology specialist.