



FACT SHEET 8



BUSHLAND RESILIENCE AND FIRE

Bundanon Trust has a substantial task as custodian of the biological legacy of its properties. Two hundred years of burning, clearing and farming and fifty years of big yellow machines has resulted in the degradation of bushland elements. The land will never fully recover all that has been lost since European settlement; however, the causes of the degradation can be reduced or eliminated and the landscape of the past can be partially recovered. The propensity for recovery is referred to as 'resilience'.

Image: Smoke clouds west of Bundanon, 1982, Photo Gary Hogan, Bundanon Trust Archive

BUSHLAND CONDITION PRIOR TO THE COMMENCEMENT OF THE PROJECT

Prior to colonisation the landscape would have been completely forested, however timber harvesting and agricultural management of the land has, to a greater or lesser degree, permanently changed the floristics of most of the remnant bushland on the properties. The river banks and the timbered, flat, accessible and arable lands are assumed to have had the longest period and greatest extent of disturbance on site. Ecological community mapping categorises the most affected areas as being disturbed agricultural land. The use of this land for agriculture has created large gaps in the riparian, river flat and side slope forest communities and has significantly altered the movement of animals and plant genetic material to and along the river banks.

The bushland has been extensively logged and disused fences indicate that the regrowth areas within the bushland have also been grazed especially North-North West of Haunted Point. The historic grazing is likely to have occurred prior to the introduction of many weed species reaching the property and prior to motorised pasture improvements ie tilling, exotic pasture grasses being sown and the soil being ameliorated with phosphate based fertilisers.

The bushland has signs of tree felling, understorey clearing and burning and grazing. It is also highly likely that fires would have been used out of season in order to control bushland regrowth. The steep and moderately sloped land below rocky ledges would have been grazed. These pressures have led to the organic soil horizon, where seed would be stored, being eroded and a correspondingly diminished understorey and paucity of native plants has resulted.

The resilience and weed density (condition) of the bushland was provided later in the LMP however it is noteworthy that the bushland /farmland / creek line interfaces are problematic management zones for any land holder. Bushland will be affected detrimentally by weeds, herbicides, pesticides and fertilisers.

Resilience

The level of soil disturbance, which might be chemical, physical or hydrological, is a fundamental measure of the resilience of bushland. Resilience has been defined as “the manifested recovery of a plant community, species or ecosystem following disturbance, as well as the potential of the plant community, species or ecosystem to recover after disturbance” (DIPNR 2003). Resilience describes the ability of bushland to regrow without assistance and most directly relates to the presence of viable seeds and other native plant propagules in the soil. The ability of the native soil seed bank to regenerate is also strongly influenced by the presence of animals that eat plants and by the competition between native plants and non-native plants for nutrients, light and water.

Highly resilient bushland is generally found at the top of catchments and is unaffected by agricultural farm fed creeks, roads and other disturbance. Paddocks that have been repeatedly tilled, fertilised and grazed have virtually no resilience. Bushland growing adjacent to paddocks and agricultural farm fed creeks are said to have ‘edge effects’ and might have a moderate or low resilience. Bushland with low resilience is generally the least valuable ecologically and has the highest cost to rehabilitate while conversely highly resilient bushland has the greatest ecological value and the lowest cost to regenerate. Resilience is used as the key guiding factor in determining the priorities for a bush regeneration program for resilience is directly related to the sustainability of the weeding process.

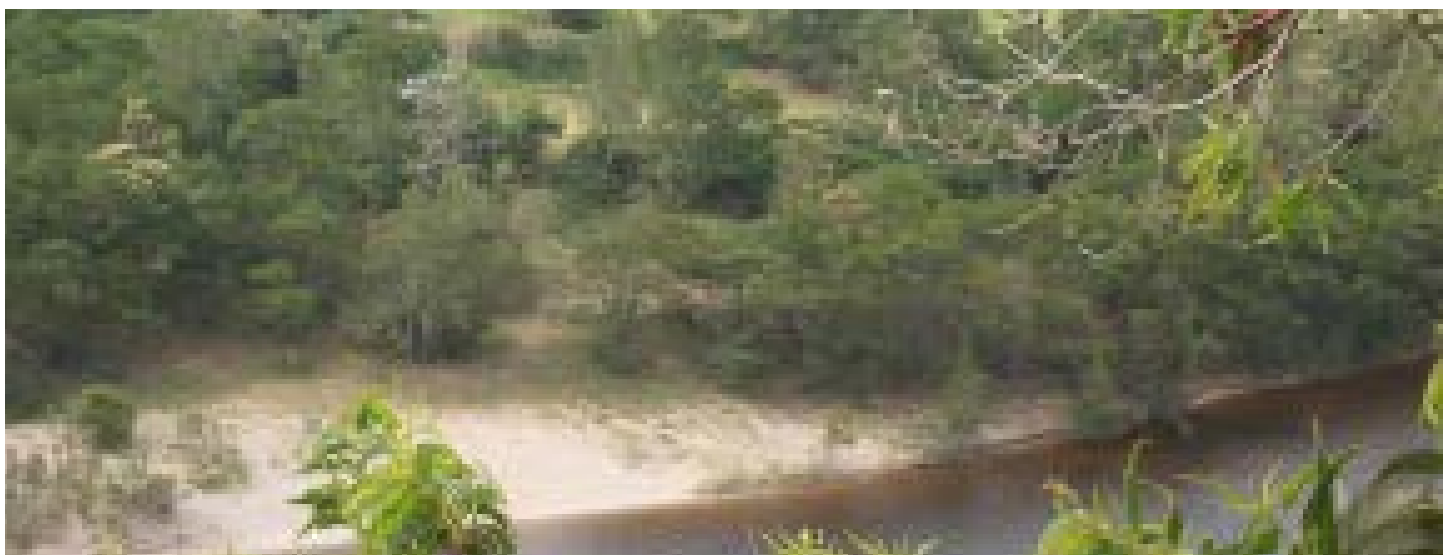


Image: Bundanon beach prior to the commencement of the Living Landscape project. Lantana had infested riparian zones

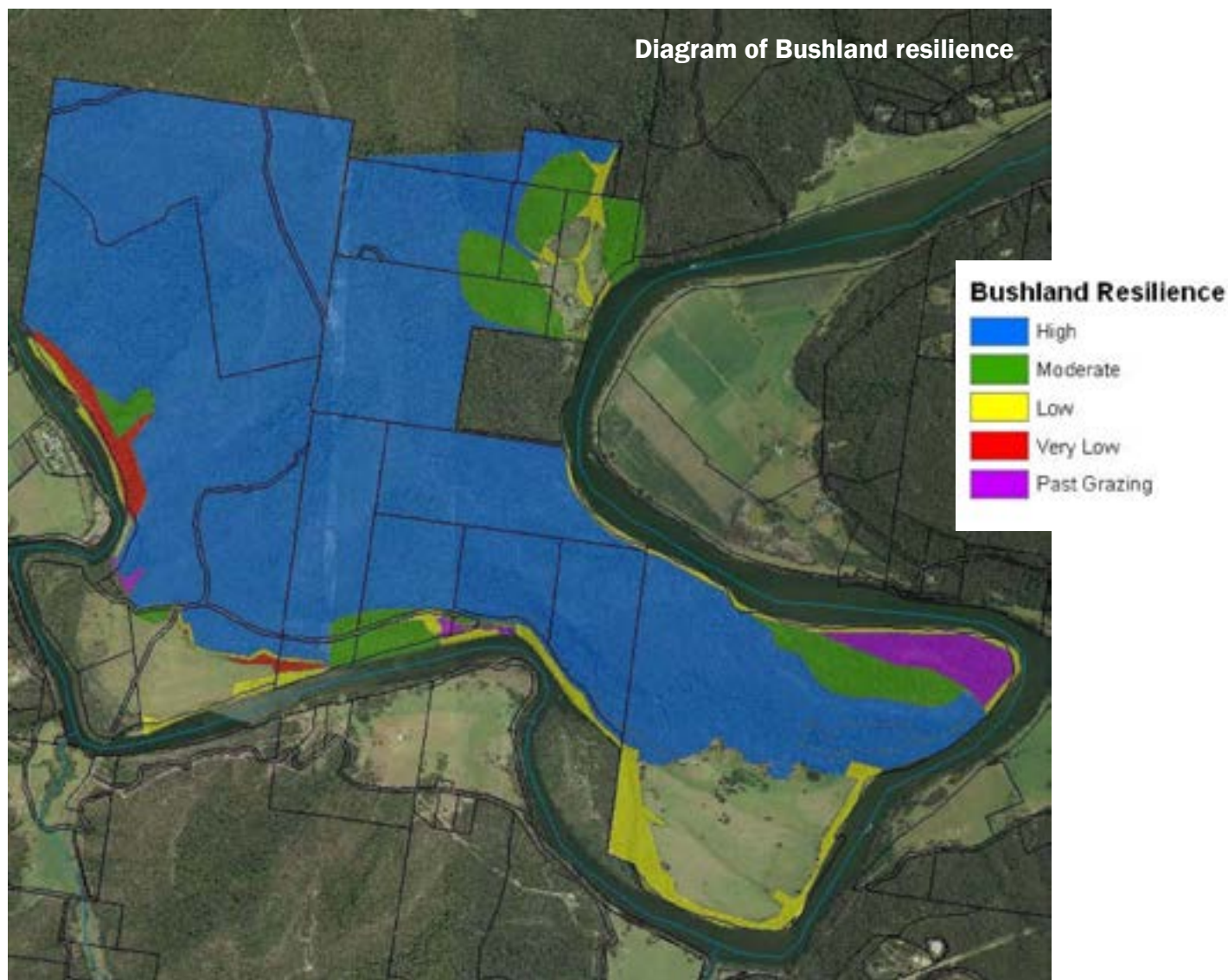
Early records of the Shoalhaven River indicate that the gravel flood plains and gently sloping river banks that have been turned into paddocks would have been vegetated with trees including: Swamp Oak, River Oak, Coachwood, Golden Sassafras, and Red Cedar. The shade cast by these trees and their roots that bounds the soil on the river banks and protects the fish along the banks. These fish feed on the insects that fall from the vegetation along the river bank.

The fauna lost from bushland when it is cleared cannot be easily reintroduced and can take a long time to return; however regenerating the bushland that has been partially disturbed, and revegetating cleared land to recreate bushland, will provide additional habitat into which animals can recruit naturally or be reintroduced. The populations of most animal species living on site and on adjacent properties are likely to benefit from a bushland regeneration and revegetation program.

Variables in predicting resilience

There are a number of site features and variables that can assist in predicting the likely resilience of a site, and consequently, in guiding the appropriate levels of bushland management. Key features include:

- The extent, nature, condition and diversity of structural elements present (indicates whether representatives of all principal elements of structure are likely to regenerate);
- The individual native species present (indicates the minimum range of diversity to be expected)
- The presence of certain disturbance-sensitive ground cover species
- The nature of reproductive habit and dispersal mechanisms of existing plant species
- Observed recruitment and regeneration occurring
- Remnant size and connectivity (proximity to other native vegetation)
- Land use and disturbance history, including fire history
- The nature of current and ongoing level of disturbance (including adjacent land use) and whether this can be controlled or not
- Types of weed infestation and their extent



FIRE AND THE NATURAL ENVIRONMENT

Fire management and flora

The Bundanon Trust properties contain a wide range of plant communities and species, each with a differing ability and preference for fire interval, intensity, and seasonality. Various legislative instruments determine allowable and required use of fire relating to biodiversity, including flora and fauna species, habitat, and vegetation communities. Threatened species and threatened communities particularly are required to be managed within codes set up for their management. The Shoalhaven BFM prepared such a plan in 2010, and classified vegetation types into fire threshold categories.

Fire behaviour and plant communities

Bundanon is a property that has very large tracts of bushland within it and is completely encircled by bushland. The dominant bushland structure on site is forest as distinct from a grassland, woodland or rainforest which are also on site. Forest is considered to have a high bush fire risk potential. There are small areas of woodland, heathland and rainforest on site and large areas of grassland; these have significantly different fire management requirements. The floristic structure of a forest is such that a fire that begins close to the ground can climb from short plants (groundcovers), into the shrub layer, then through the small tree layer and into the canopy. This ladder of contiguous fuels allows fire to crown and then spread through the canopy. Once a fire is in the canopy they generally create their own wind which will preheat the bushland in front of them, creating explosively dry conditions. Embers that are pushed up and ahead of the fire front by the wind will then create spot fires. Understanding this simple process allows us to take a rung out of the fire ladder.

The starting point of most fires is on the ground in the leaf litter where very fine twigs and leaves act as kindling. If the weight of fire fuel on the ground is reduced then the likelihood of a fire starting is also significantly reduced additionally if the shrub layer is absent or scattered then the likelihood of fire reaching the canopy is also reduced. The volume of fuel on the ground is the principal determinate of fire risk in bushland and when combined with the heat content of the fuel and the rate of spread the fire (due to slope, wind and humidity) a measure of fire intensity can be determined. Burning to reduce fuel loads is termed hazard reduction burning.

Many Australian native plants have adapted themselves to the presence of fire. Their leaves and bark may burn but they will re-grow from buds beneath their bark or from thickened roots that reshoot from below the ground. Their seeds may only drop from fruiting capsules that are prised open by the heat of a fire, or their seed coats may only imbibe water that has been infused with smoke or may in some other manner trigger the growth of a seeds embryo. Importantly, gum trees like Eucalypts, Corymbias, and Angophoras drop leaves and bark which are excellent fire fuels. These trees create fire prone conditions around themselves as a means of burning other plants that grow too close and which compete with them. The bare burned ground which has increased light levels due to the canopy being burned off creates a nutrient rich and light filled environment for growing seedlings from very small seeds. The seeds are literally the size of a full stop and cannot grow if they are smothered by deep layers of leaf litter or grasses. These plants are commonly called sclerophyllic.

Fire history of the Bundanon Trust properties

A fire or series of fires occurred in 1982, as indicated in The Fuel Management Plan 1999. The author of this plan does not indicate whether the fire was a bush fire or prescribed burn and there are no details of the fire intensity or its exact location. It is presumed that only a relatively small area of the Bundanon ridgeline was burned as well as the power line easement and over heathland/woodland above the western escarpment of Earie Park.

The lack of fire on the property has resulted in a build-up of fire fuels in the moist south facing slopes and along the ridge tops. The thirty year period since 1982 involving a lack of fire at Bundanon may be detrimental to the Ecological Communities on site. The time elapsed since this fire event is so long that any fuel reduction benefit has been lost. The only known burn that has occurred since 1982 and prior to 2019/20 was a fire in 2002 which threatened but did not burn the property.



Image: Fire nears Bundanon property from the west, 1982 Gary Hogan, Bundanon Caretaker

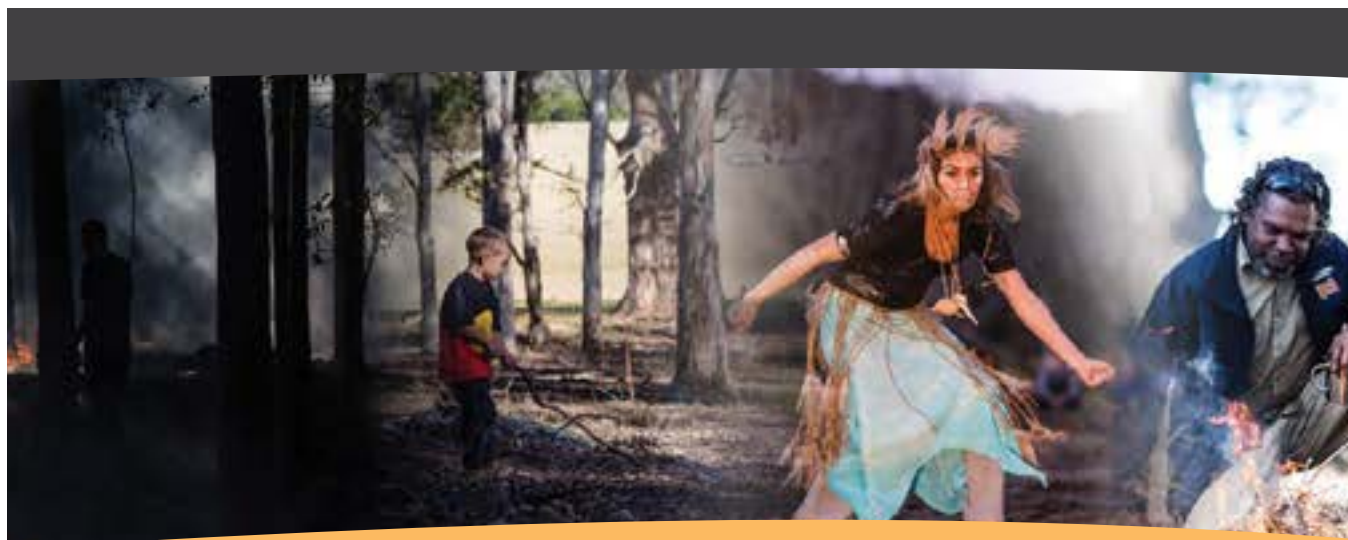
CULTURAL BURNING

In 2017 Bundanon established a partnership with the Nowra based Mudjingaalbaraga Firesticks team. This group was associated with a rapidly developing National Indigenous Firesticks Alliance.

The Firesticks Alliance Indigenous Corporation uses the term 'cultural burning' to describe burning practices developed by Aboriginal people to enhance the health of the land and its people. Cultural burning can include burning or prevention of burning of Country for the health of particular plants and animals such as native grasses, emu, black grevillea, potoroo, bushfoods, threatened species or biodiversity in general. It may involve patch burning to create different fire intervals across the landscape or it could be used for fuel and hazard reduction. Fire may be used to gain better access to Country, to clean up important pathways, maintain cultural responsibilities and as part of culture heritage management. It is ceremony to welcome people to Country or it could also be as simple as a campfire around which people gather to share, learn, and celebrate.

In July 2018, Bundanon hosted the 10th annual National Indigenous Firesticks Workshop. Over 400 people attended the four day event to learn about and practice cultural burning. A burn was established in understorey vegetation at the north western end of Bundanon Ridge. Indigenous fire practitioners walked with that fire over 14 days until it was extinguished by rain. In total, approximately 150 h/a of leaf litter, ground covers and mid canopy vegetation was burnt with very little impact on the upper canopy. A number of research projects are underway to assess the impact of the cultural burn on the property.

After several years of prolonged drought, the summer of 2019/2020 was a mega bushfire season in Eastern Australia. Over 186,000 square kms of bushland was affected and many homes and associated infrastructure was destroyed. In early January the "Currowan" fire approached Bundanon from the west and south. The NSW Rural Fire Service was in attendance and helped to prevent fire accessing the property. There is good evidence that the cultural burn of 2018 also contributed.



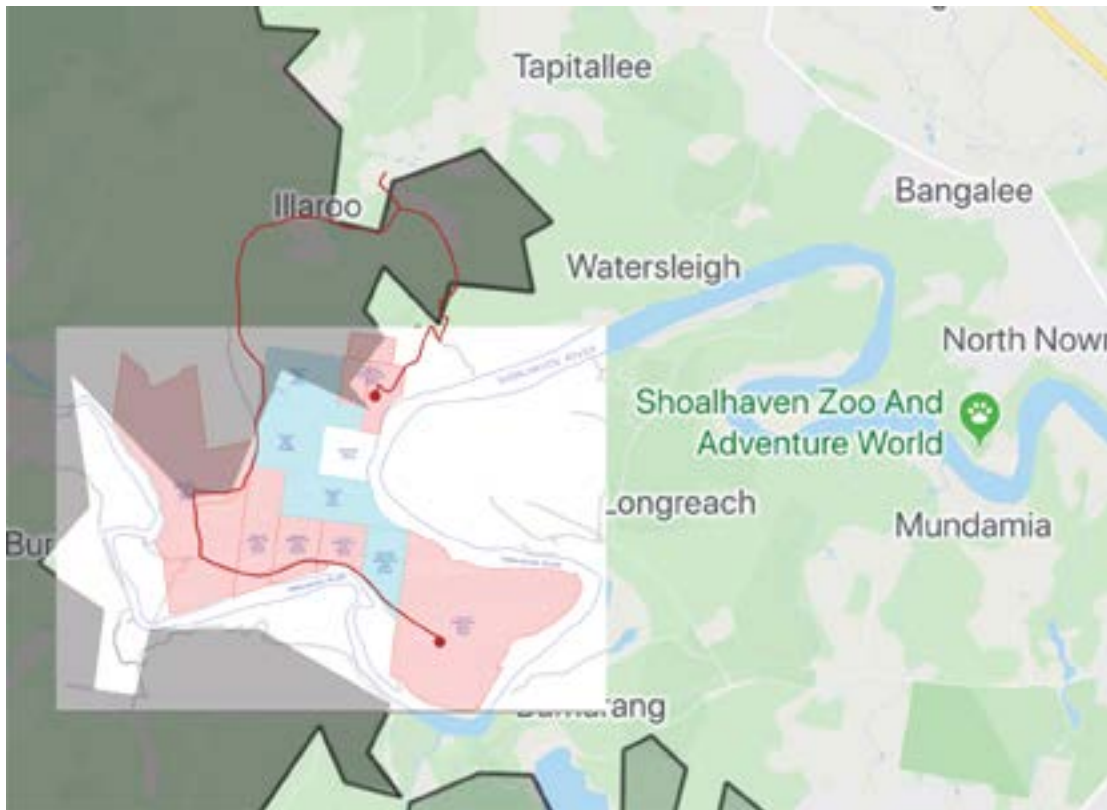
HEALING CULTURE, PEOPLE AND COUNTRY WITH THE KNOWLEDGE OF FIRE

National Indigenous Fire Workshop

Bundanon, 12-15 July 2018



CURROWAN FIRE IMAGES 2019-2020



Map: A combined map from RFS Fires Near Me app showing extent of the fire ground, in relation to the Bundanon Trust properties.



Image: View across the farm paddocks at Bundanon, revealing the proximity of the Currowan fire. February 2020.



Image: Bundanon Road, after tree clearing



Image: Aftermath of January 2020 fire in heath land at top of Bundanon Road



Image: Helicopter fighting fire, refilling with water from the Shoalhaven River during breakout burns above Riversdale, late January-early February 2020.



Image: After the fires: Burrawang shoots new leaves. February 2020.



Image: After the fires: epicormic growth on eucalypt. February 2020.

FIRE

Fire frequency

The more frequently bushland is burned the greater the dominance of plants that have adaptations that create fire conducive conditions. Eucalypts in sclerophyll communities drop fine twigs and curled oil rich leaves that form loose air filled layers that are perfectly set to burn. Burning too often can literally feed the fire. Burning too frequently will also reduce the diversity of species by killing plants that do not have time to reach maturity and that have not been given the opportunity to set new seed and replenish the soil seed bank in readiness for a new germination pulse that is stimulated by fire.

Rainforests generally grow in sheltered south facing slopes where humidity is higher and where fire is less frequent. Bushland that is not burned frequently will slowly be supplanted by species that do not like fire and these species will create microclimatic conditions that they are better adapted to. These plants are often called mesophyllic and their seedlings prefer lower light level on the ground and higher humidity. The leaves and twigs of the mesophyllic communities are made of light wood and their leaves lay flat on the ground which forms a moist layer of composting vegetation which is quickly recycled. In time mesophyllic plant communities will literally rot sclerophyll species and transform the community into rainforest which doesn't burn readily. It is important that the right frequency of burning is implemented so that the floristic communities of plants that are growing at Bundanon remain as diverse and species rich as possible. If we burn bushland too often or too infrequently we will reduce the diversity of species and we will reduce the diversity of habitats that these plants create for the animals that live in the bush.

Fire and species diversity

Species diversity is a direct indicator of bushland's buffering capacity to change or its resilience. Recent scientific research into the effects of climate change demonstrate that plant and animals species will have to adapt to changes in temperature, or shift their distributions to better suit their climatic preferences; failure to do so will result in localised extinctions of species (Walther et al., 2002).

Burning needs to be undertaken in a mosaic pattern for ecological purposes. If we burn a large tract of land we create a broad expanse of one age class of bushland which, like a community in a new subdivision in a big city, attracts a narrow demographic range of people to it. Diversity in habitat for animals is improved by providing some animals with an open ground cover/shrub layer like the Dunnart and a closed shrub layer adjacent to grassland like the Bandicoot. Burning a large area will also kill more animals than a small area burn because a small area burn will maintain refugia into which animals can retreat. Planning an ecological burn also requires consideration of the breeding cycles of animal species. There is no good time for burning from an animal's perspective however if we know that we have a rare micro bat on site that lives beneath the bark of a *Eucalyptus punctata* then we should avoid burning a stand of these trees in winter when the bat is torpid (hibernating). Burn planning within the core habitats must consider the lifecycles of the threatened species in these areas. To complicate the fire planning process further different plant species like to be burned at different temperatures some prefer a cool burn and others prefer hot burns.



Banksia Serrata, Old Man Banksia, a species which is tolerant to fire activity