Best practice guidelines

Sydney Turpentine–Ironbark Forest

CMA Sydney Metropolitan Catchment Management Authority

Australian Government

Department of Environment & Climate Change NSW

Cover photos:

Main photo: Wallumatta Nature Reserve – photo: M Cufer/DECC
Inset photo: *Acacia decurrens*, a wattle occurring in Sydney Turpentine–Ironbark Forest – photo: T Auld/DECC

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1 Introduction

As Sydney has developed, much of the original vegetation has been cleared or significantly disturbed. Consequently many native plants and animals have become locally extinct. Others are represented by such small isolated populations that they are threatened with extinction.

After 200 years of development, only isolated pockets of turpentine ironbark forest remain in Sydney, reduced to less than 4.5 per cent of its pre-1788 distribution. These unique communities are valued for their fauna habitat values, education, scientific research and their natural or cultural heritage values.

Along with Blue Gum High Forest in the north, Cumberland Plain Woodland in the west and Eastern Suburbs Banksia Scrub in the east, Sydney Turpentine–Ironbark Forest provides a living link to Sydney's natural and historic past, forming part of the natural landscape of Sydney. These remnant natural areas, along with the threatened species contained within them, require careful management.

The Sydney Metropolitan Catchment Management Authority (SMCMA) and the Department of Environment and Climate Change (DECC) identified the need to provide theoretical and practical 'best practice' guidance to bushcare volunteers and bushland regenerators working to restore bushland remnants across the Cumberland Plain. Wallumatta Nature Reserve, which is managed by the NSW National Parks and Wildlife Service, has been identified as one of the sites showcasing some of these 'best practice' methods being used in the management of the Sydney Turpentine–Ironbark Forest remnant at this reserve.

This guide describes the management practices employed at Wallumatta Nature Reserve, helping ensure the long-term viability of this endangered forest community with the view to assist resource managers in better managing remnants of this vegetation community found in other places around Sydney.

1.1 About the Sydney Turpentine–Ironbark Forest community

Sydney Turpentine–Ironbark Forest is an open-forest association occurring on moderately wet sites, with an annual rainfall of 800–1,100 mm per year, growing on clay soils derived from Wianamatta shale. The vegetation of Wallumatta Reserve is basically an open forest with shrub understorey and areas of grass where disturbance has occurred.

Sydney Turpentine–Ironbark Forest is recognised as an endangered ecological community under the NSW *Threatened Species Conservation Act 1995* (NPWS 2002a, NPWS 2002b). It is also listed as critically endangered ecological community under the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

These forests survive as small remnants in the Auburn, Bankstown, Baulkham Hills, Concord, Hawkesbury, Hornsby, Kogarah, Parramatta and Ryde local government areas. The largest surviving example is in the demonstration site, Wallumatta Nature Reserve in North Ryde. The only other large remnant in the Sydney Basin is in Newington Forest at Homebush Bay. This is managed by the Sydney Olympic Park Authority.

Photo: L Holme/DECC

Figure 1: Sydney Turpentine–Ironbark Forest

1.2 Past and present distribution

Sydney Turpentine–Ironbark Forest is a transitional community that once linked Cumberland Plain Woodland in drier areas with Blue Gum High Forest

on adjacent higher-rainfall areas of the Sydney region. This forest community originally extended over 26,000 ha westwards to Guildford, and north of the Parramatta River from Ryde to Castle Hill. It also occurred on the shale ridge caps in the Hornsby Plateau.

Over 200 years of intensive land use in the Sydney Basin Bioregion has severely affected the Turpentine Ironbark Forest. Most of the forest has been cleared, and less than 5 per cent of the pre-1788 forest retains its structural integrity.

Photo: L. Holme/DECC

Figure 2: Turpentine bushland landscape

1.3 Threats to the forest community

In the early years of European settlement, Sydney Turpentine–Ironbark Forest was extensively cleared for farming and timber. This was followed by urban development infilling as Sydney expanded. Currently the main threat to the ecological community across its range is destruction for urban development. Other threats include:

- fringe area mowing and clearing
- urban run-off, leading to increased nutrients and sedimentation
- garden refuse dumping, leading to weed invasion
- building structures, including sheds and cubby-houses
- fires caused by arson.

1.4 Wallumatta Nature Reserve: the demonstration site

Site history

In 1804, Governor Philip King (1758–1808) set aside 2,523 ha in the region known as the Field of Mars Common. It included what is now Wallumatta Nature Reserve. Comprising an area of 6.2 ha, this reserve is located in suburban East Ryde, 10 km northwest of Sydney's centre on the corner of Twin and Cressy roads. It protects one of the last remaining areas of Sydney Turpentine–Ironbark Forest (see Figure 3).

Before this reserve was established, its formation was the focus of community action in the late 1980s. The local community built a strong level of support for the reserve. In 1990, the land was transferred from the Health Commission to the National Parks and Wildlife Service. The reserve is an important area for environmental education and scientific research.

The bushland is contiguous with Ryde council's nearby managed reserves that lie to the north-east. It provides a natural wildlife corridor, linking with Lane Cove National Park some 400 m further east. The reserve is completely surrounded by urban residential development and sealed roads, and weeds have invaded from the fringes.

In addition to its status as a nature reserve, it is listed by the Australian Heritage Commission on the Register of the National Estate.

Aboriginal heritage

Wallumatta Nature Reserve lies within the area occupied by the Ku-ring-gai Aboriginal nation, whose territory stretched from the northern shores of Sydney Harbour to Broken Bay. The immediate area around the nature reserve was occupied by a clan or group of the Ku-ring-gai called the Wallumedegal.

The word 'Wallumatta' is believed to have been used by Governor Arthur Phillip (1738–1814) to describe the area occupied by the Wallumedegal group. Although Phillip tried to promote friendly relations with the Aboriginal people around Sydney, European settlement was devastating to the Ku-ring-gai people. Land was cleared for farms and bushland was cut down to provide fuel and building materials. In the first decade of European settlement, there were at least two outbreaks of disease that decimated the Aboriginal population. There were also numerous instances of conflict between the original Australians and the newly arrived settlers.

Site description

Figure 3 shows the location of the Wallumatta Nature Reserve. The Wianamatta shales at the southern end of the reserve (Twin Road) support an open forest dominated by turpentine (*Syncarpia glomulifera*) and grey ironbark (*Eucalyptus paniculata*) with grey gum (*E. punctata*), red mahogany (*E. resinifera*) and smooth-barked apple (*Angophora costata*) present. Common understorey shrubs include sweet pittosporum (*Pittosporum undulatum*), hop bush (*Dodonaea triquetra*) and elderberry panax (*Polyscias sambucifolia*). There are also numerous wattles, including sickle wattle (*Acacia falcata*) and flax wattle (*A. linifolia*). In open grassy areas, kangaroo grass (*Themeda australis*) and blady grass (*Imperata cylindrica*) are common.

The Hawkesbury sandstone at the Kittys Creek (northern) end of the reserve supports open forest associations dominated by scribbly gum (*E. haemastoma*) and Sydney peppermint gum (*E. piperita*), with patches of red bloodwood (*Corymbia gummifera*). A shrubby understorey with hairpin banksia (*Banksia spinulosa*) and old-man banksia (*B. serrata*) is present, as well as some shale species including *Acacia parramattensis* and *Polyscias sambucifolia*. There is a small transition area between the two dominant associations, but this is without grey gums and grey ironbarks. The understorey here consists mainly of species typical of a Sydney Turpentine–Ironbark Forest community.

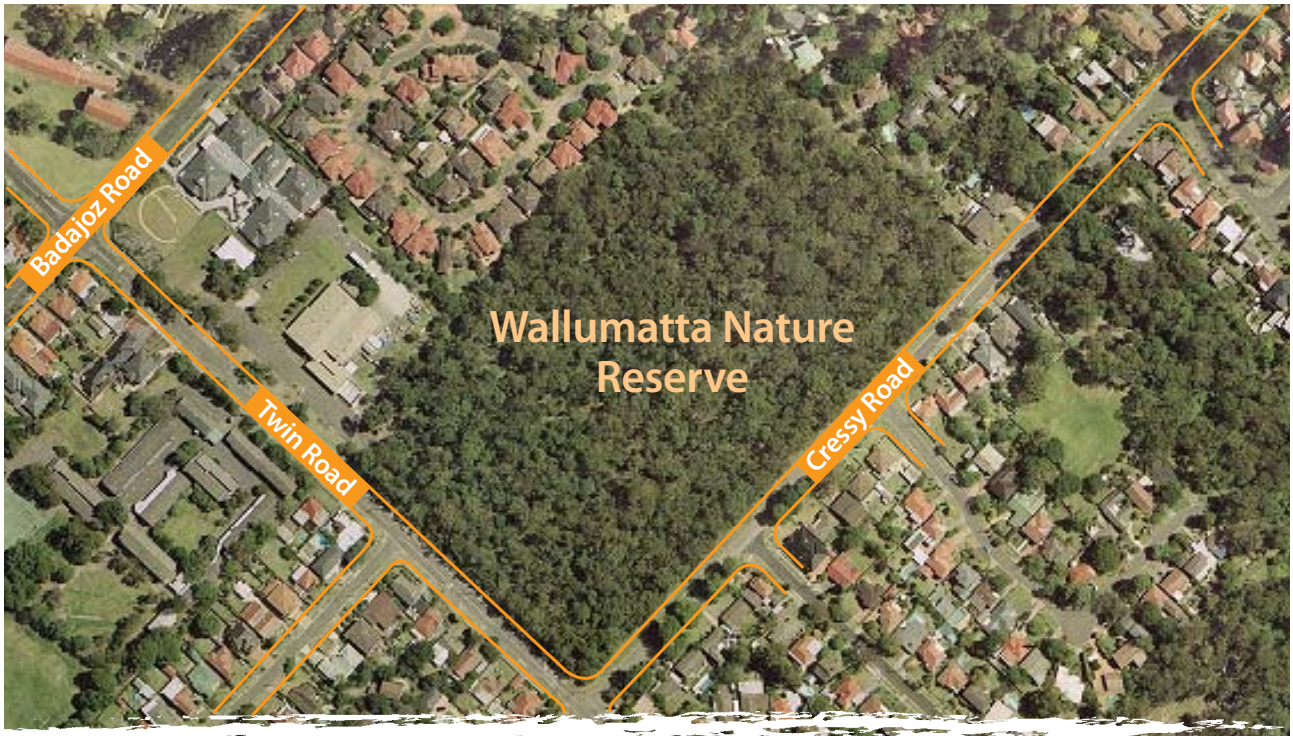

Photo: LPI: Air photography 2007

Figure 3: Wallumatta Nature Reserve location

2 Bushland regeneration

The main aim of bush regeneration is to restore and maintain an ecosystem so natural regeneration can occur (Buchanan, 1989). Bush regeneration draws together issues of weed control, access management, stormwater control, soil erosion and stabilisation, dumping, planting, fauna habitat management and fire management.

2.1 Issues specific to bush regeneration

Small size of remnants

The small remnant size increases the effects of a large edge-to-core ratio (edge-effects). Weed encroachments, tracking, dumping, nutrient-laden stormwater and inappropriate fire regimes take on a greater significance in these small areas.

Wianamatta shale soil

This soil type has far more nutrients compared to Sydney sandstone-derived soils. This emphasises the need for long-term weed control as weeds can more easily establish themselves on high-nutrient soils; for example, by birds and wind spreading the weed seed. Contrast this with low-nutrient Sydney sandstone soils, where weeds usually require disturbance to become established (for example, from erosion by stormwater).

2.2 Guiding bush regeneration principles

Minimise herbicide use

The use of herbicide is recognised as a necessary tool in the control of weeds within bushland remnants. Extra caution should be used in Sydney Turpentine–Ironbark Forests. Herbicide use within remnants is to be restricted to the 'cut and paint' or 'scrape and paint' methods. Spot-spraying should be considered only after careful preparation of the spray target area, preferably restricting it to the edge of remnants. Careful application in an endangered ecological community (EEC) is an important issue, given the regional conservation significance of the individual species in this vegetation association.

Manage sunlight intensities

A common oversight when undertaking primary weeding is to remove the canopy weed species first, without considering the effect of increased sunlight levels and warmth on the vegetation layers below. For example, removing narrow-leaved privet (*Ligustrum lucidum*) in Sydney Turpentine–Ironbark Forest remnants can open up the area to other invasive annuals and ground-cover weeds such as *Ehrharta erecta* and wandering jew (*Tradescantia fluminensis*). It is considered as a best standard practice method to remove weed species in the lower vegetation strata first in order to encourage native regeneration. This ensures the desired response when the canopy weeds are finally removed.

Let the worked zone rest

After initially weeding an area (primary weeding, or following prescription burns) the area will be sensitive and should not be worked heavily again for some months. This is because weed removal creates soil disturbance that promotes the germination of weed and native species alike. Native seedlings must be given a period of time, with low disturbance, to become established. Always keep in mind that the germinating weeds may be shielding the native seedlings from harsh environmental conditions.

The necessity of a buffer zone

Restoring and maintaining a suitable native vegetation buffer around the Sydney Turpentine–Ironbark Forest remnant is necessary for the long-term viability and conservation of the remnant. This non-Sydney Turpentine–Ironbark Forest bushland acts as a buffer, minimising the detrimental edge effects of increased runoff, rubbish dumping and weed encroachment. Buffers such as densely planted vegetation can also deter access to an old track or encroachment as well as soil compaction caused from impacts of edge disturbance to a site.

In addition, buffer areas improve ecological function by being used as corridors by pollinating species, such as birds and insects. Thus, buffers are crucial for the continued ecological health and function of these remnants. Any clearance needed for fire hazard-reduction purposes should be in addition to this buffer. The size of the buffer should be as large as possible, as the larger the buffer, the less the impact of negative edge effects will be on the Sydney Turpentine–Ironbark Forest.

Photo: R Bonner/DECC

Figure 4: An unobtrusive fence at Wallumatta Nature Reserve restricts access from the street and discourages rubbish from being dumped into the reserve's remnant Sydney Turpentine–Ironbark Forest

Planting in the buffer zone

Due to the low seedbank resilience in degraded buffer sections, reconstruction through revegetation (planting) may be appropriate. Planting local provenance (that is, from native plant seed collected locally) is advantageous as the plants have adapted to local climatic and soil conditions (Department of Environment and Conservation, 2005). Some eucalyptus plantings occurred previously in Wallumatta Nature Reserve that were not indigenous to that reserve. Even though the plantings are close to maturity, they will be removed over time and the area allowed to naturally regenerate.

> ***Never*** mulch within Sydney Turpentine–Ironbark Forest as this prevents the native seed bank from germinating and can potentially introduce foreign fungus species that were not previously present on the site.

Fencing as a conservation practice

While it is important for the local residential community to be connected to the surrounding bushland, because of the size of the remaining Sydney Turpentine–Ironbark Forest remnants, even small walking tracks can lead to degradation and fragmentation. For this reason it is preferable to minimise access to these remnants. Fencing materials should be resistant to fire and should not restrict the movement of fauna (see Figure 4).

Sediment fences

Sediment fences or silt fences are an excellent way to prevent ground-cover of exotic weeds, such as invasive perennial grasses (for example, *Ehrharta erecta*) from entering the remnant. They can also be used to retain weed infestations within the remnant.

Licences for activities within the forest community

Bush regeneration, weed control, clearing for fire breaks and other activities within any EEC are likely to require either an s. 91 (*Threatened Species Conservation Act 1995*) or s. 132c (*National Parks and Wildlife Act 1974*) licence from the Department of Environment and Climate Change. Generally speaking, an s. 91 licence is required for actions that are destructive, while an s. 132c licence is for scientific and/or conservation purposes. See www.nationalparks.nsw.gov.au/pdfs/scientific_licence_application.pdf to find out more information regarding an s. 91 licence.

Environmental assessment and certification procedures and notifications to the local Rural Fire Service (RFS) Bushfire District Management Committee as required under the *Rural Fire Service Act 1994* apply for any planned prescription-burning practices. Where a Sydney Turpentine–Ironbark Forest is on local government or private lands, the local government area is the primary agency responsible for certifying prescription-burning proposals.

Phytophthora cinnamomi protocols

Phytophthora cinnamomi is a microscopic soil-borne pseudo-fungus that can survive in very small quantities of soil for a long time. *Phytophthora* kills a wide variety of native and non-native plant species by rotting the roots of its host tree. To inhibit the spread of *Phytophthora*, contractors working within remnants of Sydney Turpentine–Ironbark Forests must adhere to the following procedures:

- **Sanitation of tools and machinery** – tools must have all traces of soil washed off then be regularly drenched in a solution of disinfectant. (A solution of one per cent bleach is sufficient for disinfecting machinery.) When planting several plants, disinfect tools in a portable container of disinfectant before and after planting each one.
- **Boots and tyres** – soil clinging to boots and tyres is a common vector in transporting *Phytophthora*. To limit the spread of this fungus, ensure all soil is scrubbed clean and the surface is disinfected (using a one per cent solution of bleach, or a 70 per cent solution of methylated spirit. Using disinfectant according to the manufacturer's directions is also suitable.)
- **Infected vegetation** – *Phytophthora* can persist for many years in the dead organic tissue of any trees it has infected. Infected vegetation must be disposed of carefully. Never woodchip any vegetation suspected of being infected by *Phytophthora*.

Prevention and limitation of the spread of *Phytophthora* is the most effective means of control (Royal Botanic Gardens Trust 2007).

Germination using 'triggers'

Physical disturbance of the soil may be used to 'trigger' germination from the soil seedbank. Germination trigger practices include using smoke, water, soil disturbance, root disturbance, raking back the leaf litter and irrigation. Soil disturbance is also highly effective in highly urbanised small remnants where fire may not be appropriate. Beware: sufficient soil disturbance may promote both native and weed seed germination.

2.3 Fauna management

Animals are essential for healthy ecosystem functioning. For example, certain species of birds eat insects that would otherwise feed excessively on the trees, causing dieback (Collett 2001). Careful consideration must be given during weed removal as weeds can provide habitat and foraging resources for birds and other native fauna.

When managing fauna:

- **Work to a time frame** that allows enough time for native trees and shrubs to replace the weeds that have been removed. This ensures viable habitat remains for any animals using the weeds. Always search exotic plants for bird and ringtail possum nests before removing weeds.
- **Maintain habitat** by only working small manageable areas at one time, leaving stands of 'caretaker' weeds behind.
- **Consider the habitat potential of rubbish** such as old pipes, tiles, car bodies, pieces of tin, which can be left temporarily as habitat, especially when it is away from public view (Ondinea 1998). Work towards its replacement by natural components, allowing time for fauna to adapt to the new sites before rubbish removal.

Introduced animals

Feral cats (*Felis catus*) and the European fox (*Vulpes vulpes*) have been sighted in Wallumatta Nature Reserve and are a potential problem. Domestic animals are also a major problem in the reserve. Dogs are sometimes exercised there, and domestic dogs and cats also enter from nearby properties. These animals disturb wildlife, affecting their feeding and breeding, as well as posing a direct threat by preying on small native animals.

For these reasons, companion animals are prohibited within the reserve. People bringing animals into the reserve (or allowing them to be introduced) may be issued a penalty notice or prosecuted. Neighbourhood liaison and education are used to reduce this threat.

2.4 Planning and site assessment

A plan of management can be a useful document for clarifying timeframes of follow up tasks and roles and responsibilities.

Each Sydney Turpentine–Ironbark Forest remnant requires a management plan clearly setting out objectives for managing and restoring the remnant. Generally, the plan will contain:

- a thorough site assessment including an assessment of resilience
- strategies for ecological restoration
- legislative requirements
- site-monitoring and evaluation-of-restoration methods.

See www.environment.nsw.gov.au/resources/parks/pomfinalwallumatta.pdf for the Wallumatta Nature Reserve plan of management.

2.5 Volunteers

The work of volunteers in restoring bushland in Sydney and its surrounds has been a significant and valuable contribution for a long time. Many councils and the DECC rely on volunteers to undertake bush regeneration and public education in and around their reserves. Ecological process and restoration techniques are complex. So it is in the best interests of conserving biodiversity, it is important to have professionally trained bush regenerators with the necessary skills and qualifications to supervise the volunteers working on a site.

Summary – Best practice bushland regeneration for Sydney Turpentine–Ironbark Forests

- All native plants in an EEC are protected under legislation; care must be taken not to harm them.
- Bush regeneration practices need to be tailored to the specific conditions of the Sydney Turpentine–Ironbark Forest.
- When carrying out bush regeneration, consider how weed control and ecological fire management activities will be coordinated within the Sydney Turpentine–Ironbark Forest remnants.
- Appropriate buffers should be restored and maintained around Sydney Turpentine–Ironbark Forest remnants.
- A management plan is necessary for the long-term strategic management of Sydney Turpentine–Ironbark Forest remnants.
- *Phytophthora* protocols should be followed when bush regeneration is being carried out in a Sydney Turpentine–Ironbark Forest.
- Minimise herbicide use to cut-and-paint methods.
- Only work in areas that can be easily maintained.

3 Fire management

3.1 Guiding principles for fire management

The re-introduction of appropriate fire regimes to Sydney Turpentine–Ironbark Forest remnants is a priority, since fire is an important factor in the evolution of many native plant communities (Gill 1977; Purdie 1977; Keith et al 2002). Due to the context of bushland remnants in urban areas, urban remnants can suffer from very long inter-fire periods and, as a result, species diversity and community structure can break down (Gill & Bradstock 1995; McDonald 2002).

There are four aspects of fires that need to be examined for best practice management:

- frequency
- intensity
- duration
- seasonality.

These aspects are important for germinating seeds, maximising biodiversity values and vegetative recruitment (Auld 1986). The most recent approach to ensuring adequate biodiversity conservation with respect to fire involves a strategy based on vegetative fire responses (Bradstock 2006); also see Appendix 2.

It is suggested that applying a variable fire regime of fire intensity, season and frequency across space and time will enhance the richness (Bradstock et al 1995; Buchanan 1989; Keith et al 2002). It is vital that the remnants have had primary bushland regeneration treatment before an ecological burn takes place, as it is much more difficult to successfully conduct weed control among regenerating seedlings.

Of course, any fire management must prevent risk to life and property as a top priority, such as ensuring fuel does not build up to dangerous levels near residential areas. In bushland bordering on residential areas, a hazard-reduction program will need to be planned in consultation with the Rural Fire Service, the NSW Fire Brigade or local council in strategic buffer zones adjacent to development.

Fire frequency

Fire management in Sydney Turpentine–Ironbark Forest remnants requires careful consideration, as both high fire frequency and fire exclusion are likely to reduce species diversity. Species within these forests that will be impacted by high fire frequency are:

- fire-sensitive plants that are slow to mature after fire
- animals that rely on the structural complexity of the ecological community.

The interval of time between fires affecting a site is critical. Flora must be given the opportunity to mature and replenish a viable seedbank and hence maintain the species after future fires. For example, a high fire frequency will lead to the local decline of turpentine as it takes many years for a tree to start producing viable seeds. Alternatively, if a remnant Sydney Turpentine–Ironbark Forest remains unburnt for long periods of time, plants that require fire for seed germination will senesce and the soil seedbank can decay. Also, low-frequency fires will compromise the structure (for example, increase weed growth) and flammability of the stands.

The fire frequency guidelines for Sydney Turpentine–Ironbark Forest have been compiled from best available information and research on the fire ecology of the communities (Bradstock et al 1995; Keith et al 2002). The fire interval thresholds are based on a consideration of the broad vegetation type and the species composition of communities.

They are as follows:

- The minimum interval is based on the primary juvenile periods of species sensitive to extinction under frequent fire regimes and does not include the time to replenish seed bank reserves.

- The maximum interval indicates the time since a fire at which species may be lost from the community due to senescence. The figures for maximum intervals are largely based on assumptions and generalisations rather than on quantitative life history studies.

For Sydney Turpentine–Ironbark Forests, the minimum fire frequency is seven years and the maximum fire frequency is 30 years, with only a small area of the remnant burnt at a time. Ideally, prescribed burns should be conducted between 15 and 30 years (NPWS 2006).

Pittosporum undulatum and fire frequency

Pittosporum undulatum numbers can increase because of an absence of fire. The propensity for *Pittosporum* to be spread by birds may give rise to a monoculture of the plant. Regrowth of *Pittosporum* within the remnants should be monitored and, where required, particularly where the regrowth becomes an understorey dominant, mechanical thinning can be carried out.

Fire intensity and duration

Germination for a number of plant species is directly influenced by the intensity and duration of the fire. Sufficient soil heating is needed to promote germination and this generally equates with the need for higher intensity fires to promote abundant germination of particular species (Auld 1986). For species with germination cues related to the interaction of smoke and fire, intensity may influence the magnitude of post-fire germination. For other species with germination cues related to smoke only, fire intensity may not be significant, although this is not yet fully explored. For both plant and animal species maintenance, a fire regime that contains fires of varying intensity is likely to be most favourable (Bradstock et al 1995).

Achieving variable fire intensities

Before burning, woody weeds are 'cut and painted' (stems are cut near the base and the exposed area is covered with herbicide). The removed weeds are then placed into piles. Weed piles are spaced throughout the prescribed burn area and left to dry. During the burn, weed piles enable the fire to burn hotter and promote the germination of canopy, mid-storey and groundcover species. Weed piles are constructed in different sizes and, in between the piles, the fire burns at a lower heat. This heat variability encourages a diverse range of responses from the soil seedbank.

When considering the use of pile burning there are several important guidelines:

- do not make weed piles more than a metre high, as this may result in a fire that burns too intensely and may sterilise the soil seedbank under the centre of the pile
- make the pile long rather than high as this will disperse the heat (Department of Environment and Conservation 2005)
- ensure weed piles are not placed under powerlines, close to fences, at the base of trees or under a low canopy.

Fire season

Little work has been done on the effect of seasonal variation of fires on the species composition of Sydney Turpentine–Ironbark Forest vegetation.

The preferred season for prescribed burns is late summer to early autumn (February to April) or spring (August to October) before the onset of the fire-danger period. During these periods, specific synoptic and weather conditions enable burns to be conducted safely within identified containment lines (National Parks and Wildlife Service 2006).

It is assumed late summer fires are preferable, since the seedlings at these times should encounter favourable moisture conditions for growth (Auld 1986).

Wallumatta as an example of mosaic burning

To maintain the biodiversity that characterises Sydney Turpentine–Ironbark Forests, fires of variable intensity, frequency and seasons must take place. A mosaic approach of different-aged burns and sizes has been implemented at the Wallumatta remnant.

The benefits of mosaic burns are:

- designated sections of importance, such as previously burnt areas and vegetation along creek lines, are protected in unburnt areas
- some areas always remain vegetated, to provide fauna habitat and an adequate food supply
- the burnt area is kept to a suitable size for bushland regenerators to maintain
- a minimum period of five to seven years should be considered for a proposed burn area which is adjacent to any area previously burnt, to allow for structural diversity in the regenerating flora.

Pile burns

Individual pile-burns are an excellent way to perform a small-scale ecological burn in a bushland area that is too small for a broad-acre burn. Pile-burns act to trigger Sydney Turpentine–Ironbark Forest seedbank germination and dispose of previously removed woody weeds. A variety of pile sizes will encourage the fire to burn at different temperatures. This will encourage a diverse response from the soil seed bank.

A potential problem with small patch-burns is that the areas burnt can be potentially re-burnt in unplanned fires, as the surrounding unburnt vegetation allows the wildfire to burn the recently burnt area. This leads to an increase in local-site fire frequency and a decline or loss of associated plant species. The site manager must ascertain if there is a potential of wildfires or unplanned fires. The NSW rural fire service website has useful information for fire management, including total fire bans and current fire danger maps, planned hazard reduction burns, fire permits and restrictions. See www.rfs.nsw.gov.au or call 1800 679 737 (24 hours a day) for updates on major fires or fire bans.

Fire history records

For effective management, detailed fire history records (including fine-scale maps) should be kept for all areas where this type of forest occurs. This will be important for broad-scale management as well as at the site level. Ultimately all stands of Sydney Turpentine–Ironbark Forest will experience some form of fire. If future research reveals certain fire regimes will be more beneficial to the community's survival, then the background fire history information will be particularly important as a platform to make any changes to the actions outlined in this plan.

Available records (NPWS Sydney North Region fire database) suggest that in recent years all fires in Wallumatta Nature Reserve were caused by human interference. These fires have been small but frequent (around two each year from 1987 until 1992). Their frequency has significantly decreased since the reserve was fenced and more active management undertaken. It is believed that there have been no major fires in Wallumatta Nature Reserve for around 20 years (Gosling 1995).

Control of fires in Sydney Turpentine–Ironbark Forest

Protection of life and property is always the primary consideration for controlling fire in an urban setting.

Wherever possible within Sydney Turpentine–Ironbark Forest remnants, fire suppression activities should be carried out with minimal disturbance to the vegetation. These include:

- no construction of additional fire trails, tracks or widening of existing tracks
- no use of wetting agents or chemical retardants, as these may impact on soil condition.

3.2 Post-fire maintenance and monitoring is vital

- Give the area time to rest. Soil disturbance caused by weed removal has the potential to disturb the regenerating native seedlings. It is advisable to allow the natives to become established before weed removal.

- Post-fire maintenance requires skilled staff knowledgeable in plant identification, working at a slow pace and targeting weed seedlings without harming the fragile regenerating native plants.
- If post-fire maintenance is not possible, then the prescribed burn should not go ahead. Native seedlings must be able to grow to maturity and set seed, otherwise the seed bank will become depleted.

Monitoring the ecological impacts of all fires (planned or unplanned) within the remnant allows land managers to evaluate and potentially modify fire-management practices (Bradstock, Keith et al 2002).

Wallumatta Nature Reserve fire-management policies

- The existing management track and easement along the Kittys Creek boundary of the reserve and the loop walking track will be maintained and provide access for fire management and suppression purposes. No additional tracks or trails will be constructed.
- No fuel reduction zones will be provided within the reserve.
- Fire may be used within the nature reserve for:
  - maintaining species and habitat diversity
  - weed reduction
  - protecting any rare species or communities of special significance.
- All planned fuel-reduction activities will include post-fire control of introduced plants and surveys and monitoring for native plants and animals.
- Liaison will be maintained by Ryde Council, the NSW Fire Brigade and neighbours to develop effective joint fire-management strategies.
- DECC will seek to ensure fire-protection measures are incorporated into all new developments adjacent to the reserve in accordance with the Rural Fire Service guidelines in *Planning for bushfire protection* (Rural Fire Service of NSW 2006).

Pre-fire checklist

- ☐ Obtain relevant authorisations, RFS bushfire assessment certificates and permits from the local council and, if necessary, DECC.
- ☐ Perform a pre-fire fauna search before burning. The fire plan may need to be modified to accommodate species requirements. For example, an area may not be burnt if it contains a possum's dray or a patch of valuable native plants.
- ☐ Notify neighbours of the intention to burn and that smoke hazard may be a problem throughout the burn operation.
- ☐ Check firebans have not been declared for the proposed burning day/s.
- ☐ Ensure the weather on the burn day is within acceptable fire prescription which has been assessed and documented in the burn plan. As far as possible, try to plan burn periods for when prevailing wind patterns limit smoke emissions from impacting residential areas, local schools, hospitals and other nearby facilities where their neighbours may be affected.
- ☐ Have fire-control measures on hand, including adequate fire crews and other resources such as suitable appliances with standpipes and sufficient hose length. A traffic-control plan should be in place.
- ☐ Have a post-fire monitoring and maintenance plan.

Summary – Fire management for Sydney Turpentine–Ironbark Forests

- If fires are to be implemented specifically for management of the site, the area to be burnt should be of a size that can be adequately maintained for post-fire regeneration.
- If planned fires are required for bush adjacent to a Sydney Turpentine–Ironbark Forest, but not including the Sydney Turpentine–Ironbark Forest, the site will require an adequate buffer zone of surrounding unburnt vegetation in the order of several hundred metres (if the site is large enough). This also applies to wildfire scenarios where such control options are possible.
- While the effects of fire intensity are still being explored, it is recommended that a mosaic of fire intensities from low to medium be applied to enhance biodiversity values.
- Late summer–autumn burns are more favourable for regeneration than winter–spring burns. There is a trade-off between acceptable fire behaviour and the reduction of food sources and shelter for local birds and mammals.
- Stands of Sydney Turpentine–Ironbark Forest should be monitored when a fire has occurred in the vicinity, to establish whether burning has occurred due to spotting behaviour or where the boundary has been encroached from overburning.
- Accurate fire-history records and maps need to be maintained for Sydney Turpentine–Ironbark Forest habitat areas, both within and outside reserves. This occurs as a standard operating procedure within NPWS reserve areas and comprises part of the regional annual reporting requirement to both DECC and the RFS.
- Check fire bans.
- No construction of new fire trails or widening of existing tracks is to occur in areas containing Sydney Turpentine–Ironbark Forest. Containment should be confined to existing tracks and buffers. Streamlines should only be used if no other control option is available for effective containment or the removal of risk to life and property.
- Other factors to consider regarding fire-management issues are:
  - do not burn any areas where fires have occurred within the last seven years
  - allow for some variation in fire frequency at intervals beyond a seven-year period
  - prevent any site from being burnt by consecutive prescription burning or wildfire at less than seven-year intervals
  - prescription burning should be considered at a site if the period since the last fire is greater than 15 to 30 years
  - wetting agents and chemical retardants should be avoided in areas containing a Sydney Turpentine–Ironbark Forest.

4 Monitoring and maintenance

4.1 Monitoring

Ecological processes occurring within a community are complex. So when bushland restoration practices are implemented, outcomes are not always predictable. This makes it important to monitor a site to measure how it is responding after restoration work has begun.

Monitoring involves observing the changes taking place on a site during and after bush-regeneration practices have begun, as well as keeping records to measure the success of the activities. Monitoring is important for two main reasons:

- it provides feedback on the effectiveness of management actions, and hence whether these actions need to be modified
- it allows land managers to see whether natural resources are stable, improving or declining.

Records should be consistent, comparable and easily interpreted. The type of documentation can include:

- before and after photographs
- aerial photos to record broad-scale changes
- vegetation maps
- flora and fauna species lists
- quantitative data through the establishment of permanent quadrats and/or transects
- records of any new techniques being trialled
- reports detailing the original condition and threats to native vegetation, management actions applied and the outcomes of management (Department of Infrastructure, Planning and Natural Resources 2003).

4.2 Maintenance

Bushland regeneration works (weeding, prescribed burns, use of triggers) may promote regeneration of both native and weed species. Maintenance aims to promote native seedling growth by selectively removing the over-competitive weed species. The need for maintenance will diminish over time as the native plants mature, set seed and replenish the soil seedbank.

However, this process will take many years. Failure to incorporate a long-term maintenance strategy will lead to the soil seedbank becoming depleted, rendering all previous bush-regeneration activities futile. When preparing a site for bush-regeneration works, take into account the requirement for ongoing maintenance and only remove weeds in an area of a size that can be maintained.

As Wianamatta shale soil is of a high nutrient level, weeds are able to establish in relatively intact remnants of Sydney Turpentine–Ironbark Forest. Consequently they are not necessarily reliant on soil disturbance for their establishment, so all remnants require continual monitoring and maintenance.

4.3 Protecting Sydney Turpentine–Ironbark Forest

Local environment plans ideally should identify Sydney Turpentine–Ironbark Forest remnants as environmental protection zones. Private landholders managing Sydney Turpentine–Ironbark Forests are encouraged to consider a voluntary conservation agreement or other covenant that will protect the unique values of the forest in perpetuity.

4.4 Dealing with threats from outside bushland remnants

It is important to enlist the support of community members by engaging them in activities that help protect bushland remnants. People who live near endangered ecological communities can assist by doing such things as:

- Being careful when mowing lawns – mowing underneath a Sydney Turpentine–Ironbark species in a residential area prevents remnant species seedlings from becoming established. If residents do not mow lawns and hand weed rather than poison weeds, this helps promote the growth of forest vegetation that may still be in the soil seedbank.
- Weeding their gardens – removing weeds from local gardens will prevent them spreading into the forest. Birds can transport weed seeds large distances, so it is important to keep a weed-free garden even for those residents who live a long way from a remnant.
- Keeping stormwater out of the bush – installing a rainwater tank can help minimise the impacts of stormwater; those reusing grey water for watering gardens should use low-phosphorous detergents.
- By not dumping rubbish or garden refuse and clippings into bushland as doing so helps weeds spread into the bush.

Summary – Monitoring and maintenance

- Monitoring the effects of bushland-regeneration methods allows the site manager to gauge the success of the practices over time.
- Maintenance is essential after each restoration practice to ensure the native flora survive.
- The role of maintenance will diminish over time. However, as Sydney Turpentine–Ironbark Forests occur on relatively nutrient-rich shale soils, some level of ongoing maintenance will be necessary.
- Keep control of outside threats such as mowing, stormwater and rubbish.

5 Threats and their management: summary

Threat	Management
Weed invasion	• Bush regeneration • Fauna management • Sediment fence installation to prevent further weed encroachment • Track construction • Closure of excess tracks • Pre- and post-bush regeneration monitoring • Planting from locally grown seedlings in buffer zones • Neighbourhood education • Maintenance
Inappropriate fire regimes	• Fire frequency that allows native vegetation to reach maturity before re-burning • Preparation of burn area and weed piles • Mosaic burn approach • Pre- and post-fire monitoring • Post-fire maintenance • High-intensity surface fire to encourage maximum germination of seedlings
Urban stormwater run-off	• Installation of gross pollutant trap • Creek bed stabilisation • Public education for residents to limit the damaging substances going into stormwater
Clearing for urban development	• Plans of management for sites (POMs) • Voluntary conservation agreements (VCAs) • Raise community awareness of the importance of the Sydney Turpentine–Ironbark Forest community.
Mowing	• Public education on the effects of mowing in preventing Sydney Turpentine–Ironbark Forest vegetation from germinating • Public education on the legal penalties on harming Sydney Turpentine–Ironbark Forest vegetation • Educate ground staff on Sydney Turpentine–Ironbark Forest vegetation

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Appendix 1: Sydney Turpentine–Ironbark Forest, an endangered ecological community

NSW Scientific Committee – Final Determination

The Scientific Committee, established by the *Threatened Species Conservation Act*, has made a Final Determination to list the Sydney Turpentine–Ironbark Forest as an Endangered Ecological Community on Part 3 of Schedule 1 of the Act. The listing of endangered ecological communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. The Sydney Turpentine-Ironbark Forest (STIF) is the name given to the plant community that is characterised by the following assemblage of species:

- *Acacia decurrens*
- *Acacia falcata*
- *Acacia implexa*
- *Acacia longifolia*
- *Acacia myrtifolia*
- *Acacia parramattensis*
- *Allocasuarina torulosa*
- *Angophora costata*
- *Angophora floribunda*
- *Aristida vagans*
- *Billardiera scandens*
- *Breynia oblongifolia*
- *Bursaria spinosa*
- *Centella asiatica*
- *Cheilanthes sieberi*
- *Clematis aristata*
- *Clematis glycinoides*
- *Clerodendrum tomentosum*
- *Commelina cyanea*
- *Corymbia gummifera*
- *Daviesia ulicifolia*
- *Dianella caerulea*
- *Dichelachne rara*
- *Dichondra repens*
- *Dodonaea triquetra*
- *Echinopogon caespitosus*
- *Elaeocarpus reticulatus*
- *Entolasia marginata*
- *Entolasia stricta*
- *Eucalyptus acmenoides*
- *Eucalyptus globoidea*
- *Eucalyptus paniculata*
- *Eucalyptus resinifera*
- *Exocarpos cupressiformis*
- *Glycine clandestina*
- *Goodenea hederacea*
- *Goodenia heterophylla*
- *Hardenbergia violacea*
- *Imperata cylindrica*
- *Indigofera australis*
- *Kennedia rubicunda*
- *Kunzea ambigua*
- *Lepidosperma laterale*
- *Leucopogon juniperinus*
- *Lomandra longifolia*
- *Melaleuca decora*
- *Microlaena stipoides*
- *Notelaea longifolia*
- *Oplismenus aemulus*
- *Melaleuca decora*
- *Microlaena stipoides*
- *Notelaea longifolia*
- *Oplismenus aemulus*
- *Oxalis exilis*
- *Ozothamnus diosmifolius*
- *Pandorea pandorana*
- *Panicum simile*
- *Pittosporum revolutum*
- *Pittosporum undulatum*
- *Poa affinis*
- *Polyscias sambucifolius*
- *Pomax umbellata*
- *Poranthera microphylla*
- *Pratia purpurascens*
- *Pseuderanthemum variabile*
- *Rapanea variabilis*
- *Rubus parvifolius*
- *Smilax glyciphylla*
- *Stipa pubescens*
- *Syncarpia glomulifera*
- *Themeda australis*
- *Tylophora barbata*
- *Veronica plebeia*
- *Zieria smithii*

2. The total species list of the community is considerably larger than that given in 1 , with many species present in only one or two sites or in very small quantity. In any particular site not all of the assemblage listed in 1 may be present. At any one time, seeds of some species may only be present in the soil seed bank with no above-ground individuals present. The species composition of the site will be influenced by the size of the site and by its recent disturbance history. The number of species and the above-ground composition of species will change with time since fire, and may also change in response to changes in fire frequency.
3. The structure of the community was originally forest but may now exist as woodland or as remnant trees.
4. Characteristic tree species in the STIF are *Syncarpia glomulifera, Eucalyptus globoidea, Eucalyptus resinifera, Eucalyptus paniculata, Angophora costata* and *Angophora floribunda*.
5. Species composition varies between sites depending on geographical location and local conditions (for example, topography, rainfall, exposure).
6. STIF occurs within the local government areas: Ashfield, Auburn, Canterbury, Concord, Drummoyne, Leichhardt, Marrickville, Bankstown, Ryde, Hunters Hill, Baulkham Hills, Ku-ring-gai, Hornsby, Parramatta, Bankstown, Rockdale, Kogarah, Hurstville and Sutherland. The area is within the County of Cumberland and entirely within the Sydney Basin Bioregion.
7. In many of these LGAs – particularly in the inner western suburbs – only remnant trees may remain. These may have particular ecological and genetic significance and may be important sources of propagation material for use in rehabilitation projects.
8. STIF typically occurs on areas with clay soils derived from Wianamatta Shale, or shale layers within Hawkesbury Sandstone.
9. Occurrences of STIF may occur on plateaus and hillsides and on the margins of shale cappings over sandstone.
10. STIF is referred to in Benson & Howell (1990) and in UBBS (1997). It includes vegetation described as map unit 9o of Benson (1992) and Benson & Howell (1994).
11. STIF provides habitat for a number of plant species recognised as being of regional conservation significance in UBBS (1997). These include:

- *Acacia stricta*
- *Arthropodum milleflorum*
- *Brachychiton populneus*
- *Chloris truncata*
- *Danthonia linkii*
- *Danthonia racemosa*
- *Daviesia genistifolia*
- *Einadia nutans*
- *Einadia polygonoides*
- *Einadia trigonos*
- *Elymus scaber*
- *Glycine microphylla*
- *Lasiopetalum parviflorum*
- *Lepidosperma gunnii*
- *Leucopogon juniperinus*
- *Marsdenia viridiflora*
- *Omalanthus stillingifolius*
- *Opercularia hispida*
- *Paspalidium criniforme*
- *Platylobium formosum*
- *Pomaderris lanigera*
- *Senecio hispidulus*
- *Sporobolus creber*
- *Stipa rudis* subsp. *nervosa*

12. STIF has an understorey that may be either grassy and herbaceous or of a shrubby nature. STIF can have a dense understorey in areas that have not been burnt for an extended period of time.
13. Adjacent communities on sandstone soils are generally part of the Sydney Sandstone Complex (see Benson & Howell, 1990).
14. It is estimated that only 0.5 per cent of the original area of STIF exists in the form of a number of remnants.
15. Only small areas of STIF are presently included in conservation reserves.
16. Large areas of STIF have been cleared for agriculture and urban development. Remnants are small and scattered. Identified threats include: clearing, physical damage from recreational activities, rubbish dumping, grazing, mowing and weed invasion.
17. Given the small size of existing remnants, the threat of further clearing and other known threats, the Scientific Committee believes that Sydney Turpentine–Ironbark Forest in the Sydney Basin Bioregion is likely to become extinct in nature unless the circumstances and factors threatening its survival or evolutionary development cease to operate and that listing as an endangered community is warranted.

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Source

www.environment.nsw.gov.au/determinations/SydneyTurpentineIronbarkForestEndComListing.htm

Appendix 2: Fire interval guidelines for broad vegetation types

The Bushfire Research Group of DECC compiled a fire-response database (see NSW Flora Fire Response Database) for plants within NSW. Data within this has been analysed to calculate fire-interval guidelines for biodiversity conservation. These are indicative guidelines based on broad, state-wide vegetation formations (using the classification of Keith, 2002). For local management purposes, the process used to produce these guidelines can be followed based on local species lists using the fire response databases. Local expert knowledge should be used to guide interpretation of appropriate management procedures.

These guidelines are not intended to be prescriptive. They define a domain of 'acceptable' fire intervals consistent with maintaining existing plant species. Inter-fire intervals describe the condition of a vegetation community at a point in the landscape. At the landscape level there will be a variety of fire-interval combinations, and it is the proportion of this landscape that is currently within the acceptable fire-interval domain that is the main concern for biodiversity conservation.

The following table shows the fire intervals applying to STIF which constitute roughly the broad vegetation structural types indicated.

Vegetation type	Minimum interval	Maximum interval	Notes
Semi-mesic grassy forest	10	50	Crown fires should be avoided in the lower end of the interval range
Sclerophyll grassy woodland	5	40	Minimum interval of 10 years should apply in the Southern Tablelands region
Grassy dry sclerophyll forest	5	50	
Grassy dry sclerophyll forest	7	30	

This analysis has formed the basis of more recent and detailed examination of vegetation associations that relate to EEC's. The relevant points relating to STIF at Wallumatta NR are summarised in the following table. The transition from Blue Gum High Forest through Shale Sandstone Transition to Sydney Turpentine–Ironbark associations comprises a fire-interval range within the general parameters indicated by the guideline document.

Name as per the *Threatened Species Conservation Act 1995* NSW	Legal status	Type listed on *Commonwealth EPBC Act*	Conditions relating to the use of fire	Conditions relating to mechanical forms of hazard reduction
Blue Gum High Forest	EEC		No fire more than once every 15 years, and of low intensity	No slashing, trittering or tree removal
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	EEC		No fire more than once every 10 years	No slashing, trittering or tree removal
Sydney Turpentine–Ironbark Forest	EEC		No fire more than once every 10 years	No slashing, trittering or tree removal
Moist shale woodland in the Sydney Basin Bioregion	EEC		No fire more than once every 10 years	No slashing, trittering or tree removal
Shale-Sandstone transition forest in the Sydney Basin Bioregion	EEC	EEC	No fire more than once every 7 years	No slashing, trittering or tree removal

Ecological consequences of high-frequency fires – key threatening process

High-frequency fire resulting in the disruption of life-cycle processes in plants and animals and loss of vegetation structure and composition was listed as a Key Threatening Process on Schedule 3 of the *Threatened Species Conservation Act 1995* [24 March 2000].

Plants and animals have a range of mechanisms to survive individual fires. The long-term survival of plants and animals over repeated fires is dependent upon two key features:

- the ability of species to maintain life cycle processes
- the maintenance of vegetation structure over time as habitat for animal species.

Where fires occur very close together in time (high-frequency fire), both these key features can be disrupted. If high-frequency fire is sustained it will consequently lead to a loss of plant species, a reduction in vegetation structure and a corresponding loss of animal species. A high-frequency of burning can eliminate some species if they are burnt before they seed.

High-frequency fire and inappropriate fire regimes have been identified as threats to a number of species and communities, including the Endangered Ecological Communities Cumberland Plain Woodland, Sydney Turpentine–Ironbark Forest, Blue Gum High Forest and Shale–Sandstone Transition Forest, which are all likely to suffer a loss of species composition if subject to repeated high-frequency fires.

Threat abatement – priority actions

A number of priority actions have been identified for this key threatening process. Priority actions are the specific, practical things that must be done to tackle a key threatening process. They have been grouped into seven overarching threat abatement strategies:

Strategy 1: Community and land-holder liaison/awareness and/or education Medium priority

Priority Action: Develop and implement education and awareness programs about bushfires (including how high-frequency fire can impact on biodiversity).

Strategy 2: Develop and implement protocols and guidelines High priority

Develop protocols for minimising risk to fire-sensitive species and ecosystems when undertaking fuel-reduction burning.

Strategy 3: Habitat management: fire High priority

Design burning prescriptions for purposes of maintaining ecological processes.

Strategy 4: Monitoring High Priority

Establish monitoring sites to provide basis for long-term monitoring of impacts of fire regimes and fire events.

Strategy 5: Prepare Statement of Intent High priority

Prepare statement of intent by 2009.

Strategy 6: Research High priority

Identify fire-sensitive species and ecological communities.

Strategy 7: Review and amend or adopt existing legislation and policies High priority

Support implementation of the bush fire environmental assessment code and provide information relevant to maintaining threatened species hazard reduction list.

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Source

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