



Best practice guidelines **Eastern Suburbs Banksia Scrub**

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Department of Environment and Climate Change NSW

59–61 Goulburn Street, Sydney

PO Box A290, Sydney South 1232

Phone: (02) 9995 5000 (switchboard)

Phone: 131 555 (environment information and publications requests)

TTY: (02) 9211 4723

Fax: (02) 9995 5999

Email: info@environment.nsw.gov.au

Website: www.environment.nsw.gov.au

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For more information about Centennial Parklands' Eastern Suburb Banksia Scrub remnants, contact the Centennial Park and Moore Park Trust on (02) 9339 6699.

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1 Introduction

As Sydney has developed, much of its original vegetation has been cleared or disturbed. Consequently many native plants and animals have either become locally extinct or there are so few of them living in isolated communities that they are threatened with extinction. These fragmented areas and the threatened species that live within them must be managed carefully to ensure their survival.

Eastern Suburbs Banksia Scrub is listed as an endangered ecological community in NSW under the *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. This type of scrub exists only in Sydney and has been reduced to less than 3% of its pre-1788 distribution. Only 149 hectares remain in scattered remnants that vary in size from a few square metres to over 69 hectares.

The Department of Environment and Climate Change (DECC) and Sydney Metropolitan Catchment Management Authority have identified the need to provide best practice guidance to community volunteers and land managers seeking to conserve these remnants. These guidelines explain the strategies and techniques for best practice management that DECC, Centennial Park and Moore Park Trust, together with volunteers and bush regenerators, are using to protect them.

The intention is for all restoration projects to be managed to current best-practice standards, as inappropriate restoration can significantly threaten the long-term survival of this endangered ecological community.

1.1 Characteristics of Eastern Suburbs Banksia Scrub

Eastern Suburbs Banksia Scrub is a diverse plant community occurring on 100,000-year-old aeolian (wind-blown) dune sand on sandstone in Sydney's eastern and northern suburbs. It is characterised by sclerophyllous (hard-leaved) heath or scrub plants, although some remnants contain small patches of woodland, low forest or wetter areas, depending on the depth and fertility of the soil. Some common plants found in this community can include:

- heath-leaved banksia (*Banksia ericifolia*)
- old man banksia (*Banksia serrata*)
- pink wax flower (*Eriostemon australasius*)
- variable sword sedge (*Lepidosperma laterale*)
- coastal tea-tree (*Leptospermum laevigatum*)
- tree broom-heath (*Monotoca elliptica*)
- bracken (*Pteridium esculentum*)
- grass tree (*Xanthorrhoea resinosa*).

During spring, bushwalkers can experience the abundant display of flowers on which birds such as New Holland honeyeaters feed.

1.2 Aboriginal heritage

From records and anecdotes it appears that Aboriginal populations in this region concentrated on the coast around Birra Birra (Sydney Harbour) after the last ice age (about 6,000 years ago). The local plants were used to produce medicines, food, tools, weapons, canoes, string bags and other useful objects.



Photo: Nick Colman

Figure 1: An Eastern Suburbs Banksia Scrub remnant in Randwick

Eastern Suburbs Banksia Scrub contains many plant species that were of practical daily use to local Aboriginal communities. Plentiful seafood supplies were supplemented with fruit, nectar, roots and tubers from plants. The shrubland provided plants with small succulent edible fruits, including species of *Astroloma*, *Leucopogon*, and *Styphelia*, shrubby geebung, currant bush, native cherry and devil's twine. Sweet drinks were made by soaking the nectar-rich flowers from banksias, grass trees (*Xanthorrhoea resinosa*), and *Lambertia*. Spear shafts were made from grass trees, glued together using resin extracted from the base of these plants. Coolamons (basin-like vessels of wood or bark) were used for carrying water, nectar and seed. These were hollowed out from swollen corky lignotubers of old man banksia (*Banksia serrata*). When a coolamon developed a leak, it could be easily repaired by applying resin obtained from grass trees (Benson and Howell 1995).

Aboriginal social structure and culture disintegrated dramatically within the first ten years of European settlement. This resulted in a dramatic change in the use and scale of fire and subsequent changes in fire regimes and biodiversity from this period to the present.

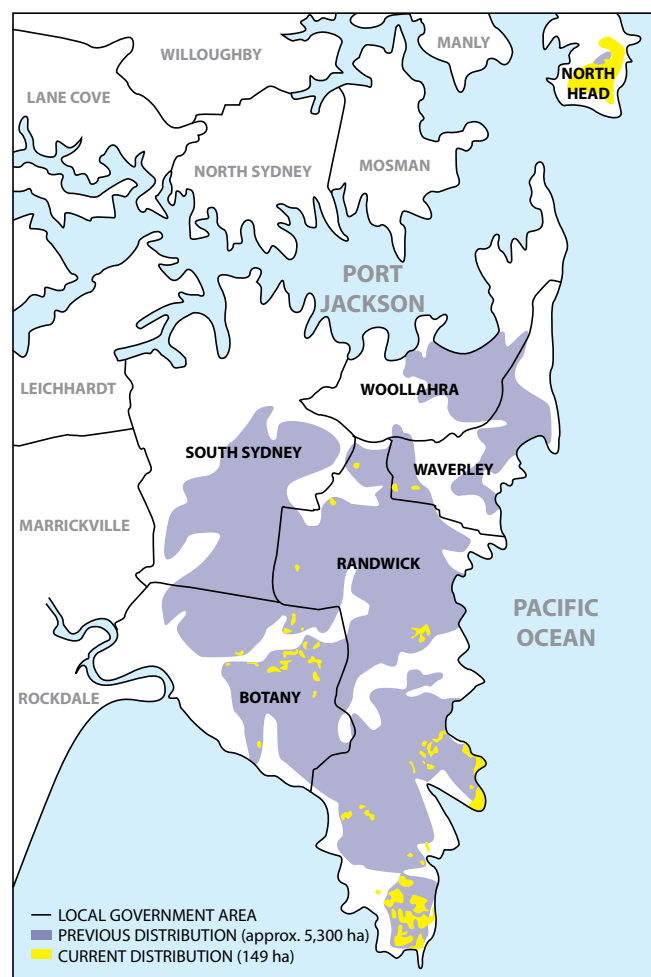
1.3 Historical distribution

The area that is now Randwick was first explored by James Cook when his ship was anchored at Botany Bay in 1770. He wrote that he 'made an excursion of 3 or 4 miles into the Country or rather along the Sea Coast ... great part of the country for some distance in land from the sea Coast is mostly a barren heath diversified with marshes and Morasses.'

Before first contact with Europeans, Eastern Suburbs Banksia Scrub covered an area of around 5,300 hectares on nutrient-poor wind-blown coastal soils. This area lay between North Head and Botany Bay across the Botany, Manly, Randwick, South Sydney, Waverley and Woollahra local government areas. Early clearing began around 1820 when wood was gathered from sheltered gullies for heating and fencing. Little productive timber was found on the steeper sand sheets and ridges supporting heath and shrublands.

During the late nineteenth century, the rate of disturbance increased when the first estates were created for building grand eastern suburbs houses. With the intensive suburban development that took place in the early twentieth century, the natural vegetation became further fragmented and reduced in area as roads and tramlines were constructed to service residential estates.

Since the late 1800s, Eastern Suburbs Banksia Scrub has been reduced to small fragments on public and private land totalling less than 149 hectares; 3% of its original extent (Benson and Howell 1995). Of this area, 33 hectares occur in the protected areas of Botany Bay National Park at La Perouse and in Sydney Harbour National Park on North Head (Figure 2). The other remnants are spread across public and private lands including Randwick Environment Park, several golf courses, Maroubra Reservoir, Malabar Headland, Queens Park in Waverley and Centennial Parklands. These fragments are valued for their natural and cultural heritage, as well as for scientific research and education.



Source: ESB's recovery plan / Illustration: S Faithfull

Figure 2: Past and present distribution of Eastern Suburbs Banksia Scrub



1.4 Threats

Native vegetation clearing

Past and present clearing has been and still is the major threat to this endangered ecological community. Clearing other vegetation around and near remnants has also increased the susceptibility of Eastern Suburbs Banksia Scrub to weed infestation.

Weed infestation

Several remnants are suffering from high levels of weed infestation. Introduced plants such as bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*), boneseed (*C. monilifera* subsp. *monilifera*), lantana (*Lantana camara*) and African love grass (*Eragrostis curvula*) have contributed to a severe reduction in biodiversity in many of these remnants by out-competing the native plants. These weeds are not a problem in Centennial Parklands remnants.

Inappropriate fire regimes


A change in fire frequency can potentially disrupt native vegetation lifecycles in Eastern Suburbs Banksia Scrub. Fires approximately 10–15 years apart (RFS 2004) are believed to benefit this ecological community (for more information see section 3.1).

If the frequency is too low, dominant native flora such as coastal tea tree (*Leptospermum laevigatum*) reduce biodiversity levels (Figure 3).



Photo: Centennial Parklands

Figure 3: Coastal tea tree (*Leptospermum laevigatum*)



Conversely, a high fire frequency also reduces biodiversity by killing individual plants before they can produce any seeds and seedlings, and by reducing the number and diversity of seeds in the soil seed bank. Also, plants that respond well to fire grow faster than those that do not, which ultimately allows faster growing species to dominate and gives weeds a chance to invade.

When developing management strategies for sites containing Eastern Suburbs Banksia Scrub, reinstating appropriate fire regimes, wherever possible, is a priority.

Build-up of leaf litter

The accumulation of a dense leaf litter layer over time can lead to reduced germination of plants from the soil seed bank. In many remnants this has occurred due to the elimination of fire over many decades. A build-up of leaf litter, from either a senescent canopy or introduced overshadowing tree species such as pines or eucalypts, can also hinder the colonisation of other species and natural regeneration.

Pests and diseases

A major threat is the European rabbit (*Oryctolagus cuniculus*), which digs large burrows and grazes on the native vegetation. Foxes and local domestic pets also prey on wildlife. *Phytophthora cinnamomi*, a disease causing root rot, is another threat.

Stormwater pollution

Stormwater, if permitted to infiltrate these remnants, can contribute to weed infestation. The stormwater carries weed seeds and deposits them on the ground. Stormwater flows can also lead to soil erosion and nutrient enrichment of the soil, further allowing weeds to thrive.

Human actions

Actions by people can also reduce the biodiversity in these remnants. Such actions include seed and wildflower collection, inappropriate use of herbicides and inappropriate plantings in or near remnants. Rubbish dumping, including the illegal disposal of construction and green waste, can poison soils and contribute to weed invasion. Mowing and slashing activities destroy native plants and prevent their seedlings from establishing.



2 Centennial Parklands demonstration sites

The lands now known as Centennial Parklands (Centennial Park, Moore Park and Queens Park) were first set aside as Sydney Common in 1811. Prior to this there would have been a predominance of Eastern Suburbs Banksia Scrub in the local area (Benson and Howell 1990). Since then, major changes in the land patterns have occurred across the common once native vegetation was cleared. Aerial photographs reveal that most native vegetation had been cleared by 1930, effectively isolating the remaining areas of this scrub into small remnants (Predavek 2004).

The Centennial Park and Moore Park Trust (CP Trust) manages these five remnants in Centennial Parklands totalling 2.87 hectares. The two demonstration sites are the Bird Sanctuary and the York Road remnants (Figures 7 and 8).



Photo: L Holme

Figure 4: Bush regeneration project sign



Photo: N Oliff/DECC

Figure 5: Eastern rosellas are found in the Bird Sanctuary

microcorys), grey ironbark (*E. paniculata*), Western Australian flowering gum (*E. ficifolia*), lemon scented gum (*E. citriodora*) and red bloodwood (*Corymbia gummifera*) to attract birds such as eastern rosellas and New Holland honeyeaters to the area (Figure 5).

Past maintenance involved pruning, removing dead wood and planting more local native plants to ensure the Bird Sanctuary represented Centennial Park's natural vegetation before development and disturbance (Predavek 2004). More recently, trust staff, bush regenerators and volunteers commenced bush regeneration activities to recover the original Eastern Suburbs Banksia Scrub community in the remnant. There are around 30 species presently on site that belong to the Eastern Suburbs Banksia Scrub plant community.

2.2 York Road site

The York Road remnant covers 1.07 hectares and is adjacent to Moriah College in York Road. It contains vegetation that regrew after most of it was cleared in the 1930s. This comprises an area known as Lot 23. It was returned to Centennial Parklands in 1998 when Moriah College wished to expand into adjacent lands previously used by the Department of Community Services.

2.1 Bird Sanctuary

The Bird Sanctuary is a small patch of Eastern Suburbs Banksia Scrub (0.9 hectares). It was set aside for conservation in 1953 when the Brolga Gate, which was funded by the Gould League of Bird Lovers, was moved from Lachlan Swamp to its present location (Predavek 2004).

The Bird Sanctuary is only accessible to the general public on a few open days throughout the year. It contains a fairly degraded patch of this scrub that has been planted with non-Eastern Suburbs Banksia Scrub species including hoop pines (*Araucaria cunninghamiana*), tallowwood (*Eucalyptus*



Photo: L Holme

Figure 6: Brolga Gate at the Bird Sanctuary

Approval for the lease and new college's development was given on condition that the vegetation was rehabilitated and conservation measures were carried out on Lot 23 and paid for by Moriah College. A vegetation management plan was commissioned in 2003, outlining the conditions for redevelopment. It included specific work to be carried out on the remnant vegetation on Lot 23. This land had previously been subjected to planting, rubbish dumping, clearing and erosion. The requirements included fencing and stormwater mitigation as well as complementary rehabilitation.

A history of disturbance, including suppression of the natural fire regime, erosion and the dominance of understorey weeds, has resulted in low species diversity within these remnants. Prior to the establishment of a rehabilitation and monitoring program in 2003, there was some evidence of natural regeneration, but with relatively low diversity and abundance of Eastern Suburbs Banksia Scrub species. A few scattered shrubs, including *Leptospermum laevigatum*, *Monotoca elliptica*, *Acacia sophorae* and *Brachyloma daphnoides*, formed the shrub layer. In all, there were over 30 species but some were represented by only a few individual plants. Minimal colonisation of other species has occurred due to the elimination of fire from the site over many decades as well as overshadowing from introduced non-indigenous tree species including pines and eucalypts along with the buildup of a dense leaf litter layer.



Photo: LPI

Figure 7: The Bird Sanctuary demonstration site in Centennial Parklands



Photos: LPI

Figure 8: The York Road demonstration site in Centennial Parklands



3 Guidelines for bushland managers and bush regenerators

Successful management practices treat the cause of the problem rather than focusing on the outcome. For example, to manage weed infestations the first step would be to examine why the weeds were present in the first place. In the case of Eastern Suburbs Banksia Scrub, treating the causes and managing weed infestations means:

- controlling runoff from stormwater flows and sewage overflows
- preventing harmful human activities such as rubbish dumping
- installing appropriate fire regimes (see section 3.1).

Successful best practice methods implemented at Centennial Parklands include:

- **access and fauna management** – cyclone fencing has been constructed to prevent rubbish dumping, rabbits from entering to graze and the network of unregulated vehicle tracks from expanding.
- **weed management** – weeds are being removed by hand where possible because this method does not disturb the soil seedbank; it helps native groundcovers and shrubs regenerate.
- **removal of dense litter layer** – raking all leaf litter to expose the pale sand has assisted the germination of seed from the soil seed bank.
- **maintenance and monitoring** – maintenance prevents weeds from re-establishing, allowing native plants to grow. Ongoing monitoring ensures that techniques undertaken in previously worked areas are effective. Monitoring can include documenting the regeneration of native and weed species after using a particular bushland regeneration technique.
- **fire management** – see section 3.1
- **community awareness** – engaging local residents, neighbours and parkland visitors in conservation issues is an important focus of bushland managers and practitioners.

A section 132 licence should be obtained under the *National Parks and Wildlife Act 1974* before undertaking any works in endangered ecological communities such as Eastern Suburbs Banksia Scrub. For information on the nature of the licence and how to apply for it, visit www.environment.nsw.gov.au/wildlifelicences/ScientificResearchLicences.htm

3.1 Guiding principles for fire management

In the past, fires were considered damaging and destructive; however, fire can be necessary for regeneration and ecosystem health (Buchanan 1989; Thomas 1994; McDonald et al 2002). Some native plant species, including those found in Eastern Suburbs Banksia Scrub, require fire to regenerate and maintain their diversity and vigour, but as many of Sydney's more established suburbs expanded and surrounded scrub, the incidence of natural bushfires has been reduced or eliminated. To maintain the ecological health of the scrub remnants, a series of ecological burns has been used in the remnants as 'triggers' to stimulate native regeneration and control weeds.

Ecological prescribed burning consists of 'pile burning'. Initial weeding is followed by burning small dried piles of weeded woody vegetation (Figure 14). This is then followed up with weeding after regrowth has occurred. Burning is conducted in optimal weather conditions, with adequate ground staff and resources available.

Photo: Centennial Parklands



Figure 9: Results of pile burning at the York Road site in October 2008

Photo: T Auld



Figure 10: An old man banksia seedling

Photo: DECC



Figure 11: Implementing a mosaic burn in Eastern Suburbs Banksia Scrub

This procedure is intended to minimise any chance of the fire escaping. It also creates conditions favourable for seed germination and allows regeneration success to be monitored. As these fires can also encourage weeds to grow, follow-up weeding is done after burning as required.

Without fire, native plants such as white kunzea (*Kunzea ambigua*) or coastal tea tree (*Leptospermum laevigatum*) will eventually dominate. This prevents light from reaching the understorey, eventually decreasing biodiversity (Ibbetson 2007). Alternatively, either a lack of fire or extreme fire can cause weeds to dominate, such as bitou bush, lantana and exotic grasses.

Without fire, the seed banks of some native species that require fire, intense heat or smoke to germinate will diminish over time (Figure 10). In the case of Eastern Suburbs Banksia Scrub, a lack of fire will reduce its diversity along with its capacity to respond to any future disturbances.

The season in which the burn takes place will determine which plants will benefit from the fire. For example, heath-leaved banksia (*Banksia ericifolia*) and old man banksia (*Banksia serrata*) should be burnt in mild conditions during late summer and autumn, which is generally more favourable to the survival of their seedlings than burning in winter and spring (Bradstock and Bedward 1992).

Many species set seed in spring and provide food sources for native animals in the area, such as rosellas and finches. If the seed is damaged from burning, a potential food source is no longer available. This causes stress for the native animal populations that feed on them.

The benefits of mosaic burns, when applied within the appropriate fire intervals, are:

- an increase in the amount of sunlight reaching the soil
- an increase in the diversity of species in communities that require fire for regeneration
- the encouragement of new growth of microbial flora and fungi that aid seedling germination
- the release of nutrients such as nitrogen and phosphorus into the soil, which in turn aid in plant growth and vigour (Buchanan 1989)
- that they allow some areas to remain unburnt which then provide refuge for native fauna



- that they restrict the burnt area, enabling bushland regenerators to effectively apply any maintenance work needed, such as weed control.

Threats from inappropriate fire regimes

Burning the remnant too frequently can result in the loss of many native species, as the plants are not given enough time to mature and set seed (such as *Banksia* species). The appropriate fire regime for Eastern Suburbs Banksia Scrub consists of a fire interval of 10–15 years, in a mosaic pattern of varied intensities, with an emphasis on moderate intensity burns (Figure 11).

Fire exclusion for more than 30 years is likely to be detrimental, as the diversity in plant species is reduced through senescence and mortality and the dominance of single species such as tea tree (DEC 2005).

Burning an area that is too large to be maintained by essential follow-up bush regeneration, such as weed management, will be ineffective as it is likely to create more weed management problems. It will also lead to a lack of unburnt refuge habitat for native fauna, and could deprive animals of food and shelter. Failing to burn the ground litter or weed piles to an ash bed may encourage weeds to regrow and spread.

Wherever possible within Eastern Suburbs Banksia Scrub remnants, fire-suppression activities should be carried out with minimal disturbance to the vegetation. They include:

- avoiding the construction of additional fire trails or tracks or widening of existing tracks
- avoiding the use of wetting agents or herbicides, as these may affect soil condition.



Photo: Centennial Parklands

Figure 12: During a prescribed burn, the fire is kept to a manageable height away from the canopy

Site preparation

All relevant licences must be obtained and neighbours notified before planning any burning activity. Consult with the local fire management authorities beforehand to ensure burning is legal.

The aim of prescribed burning in Eastern Suburbs Banksia Scrub is to create a ground fire that reduces the burnt area to an ash bed (Figures 12 and 13). Low intensity burns are not as effective, as weed species are likely to survive in partially burnt or unburnt sections and may easily out-compete native plants.

Before burning, woody weeds are 'cut and painted' (stems are cut near the base and the exposed area is covered with herbicide) and the removed weeds are then placed into piles. Weed piles are spaced throughout the prescribed burn area and left to dry. If there is an extended period of time after clearing the weeds before the burn can be carried out, weed monitoring and maintenance must be carried out as required. It is important to keep the weeds under control until the burn can be conducted.

Weed piles produce a moderately hot fire (Figure 14). It is important to construct piles of different sizes, and if possible allow the fire to burn in between the piles, which burns at a lower heat. This heat variability encourages a more varied range of native plant seeds to germinate.



Photo: Centennial Parklands

Figure 13: Reducing the surface to an ash-bed gives the regenerating canopy and mid-storey native plants the greatest chance of success



Figure 14: This site has been prepared for a prescribed burn; note the weed piles

It is also important to make weed piles under a metre high, as taller piles may result in a fire that burns too intensely. This would sterilise the soil seed bank under the centre of the pile. The pile should be long rather than high to disperse the heat (DEC 2005). Ensure the weed piles are not placed under powerlines, close to fences, at the bases of trees or under a low canopy.

One potential danger with small patch burns is that the areas could be re-burnt by unplanned fires such as through arson or wildfires. This leads to a decline or loss of plant species and stresses the fauna. While mosaic burning is intended to minimise species loss, the site manager should ascertain if there is a potential for wildfires or unplanned fires.

Post-fire maintenance and monitoring

Fire can also stimulate the germination of weed seeds from the soil seed bank. For example, bitou bush seedlings can carpet the site, out-competing the regenerating native plants, rendering the prescribed burn futile (Brougham et al 2006). To reduce the risk of weeds dominating the site:

- allow the native plants to become established before weed removal, as weed removal can disturb the soil and the regenerating native seedlings; weeds must be removed before they set seed
- remove weed seedlings where possible without harming fragile regenerating native plants
- if post-fire maintenance is not possible, 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
- monitor the ecological impacts of all planned and unplanned fires within the remnant.

3.2 Bushland regeneration

The main aim of bush regeneration is to restore and maintain an ecosystem in which 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.

Bush regeneration involves manually removing weeds rather than spraying them or removing them with machinery, to cause minimal disturbance to the soil and the soil seedbank. Bush regeneration works at a pace that allows native vegetation time to establish. Bush regenerators firstly target areas that are relatively free of weeds, and allow native plants to establish in these areas, before moving into areas of high weed infestation (Buchanan 1989).

Planning and site assessment

Restoring and managing Eastern Suburbs Banksia Scrub on a site will ideally be guided by a plan of management (PoM) or vegetation management plan (VMP) that sets out clear management objectives. The VMP (Predavek 2004) for Centennial Parklands is a good example of best practice principles that should be considered when developing a PoM and includes:

- a thorough site assessment, including an assessment of the condition of existing vegetation and threats
- strategies for ecological restoration
- strategies for community awareness
- incorporating legislative requirements
- monitoring the site and evaluating the restoration methods.

For more detail on PoMs, refer to best practice guidelines for bush regeneration on the Cumberland Plain (DEC 2005).

Importance of Eastern Suburbs Banksia Scrub seed bank

The NSW Scientific Committee (2002) noted that all Eastern Suburbs Banksia Scrub species may not be present at any one time and 'may only be present as seeds in the soil seed bank with no above ground individuals present'.

The long-term survival of this scrub depends on an intact and viable seed bank. Even if the scrub appears weedy and degraded, the soil seed bank is the key to regeneration (Clements et al 2001, Lesak 2000). Lesak observed that species, which were not originally present, have germinated from soil removed from a site, which indicates that a soil seedbank does exist. Management tools such as fire and weed removal can stimulate the available seed bank and help the scrub to recover. At some sites, using smoke water, raking back leaf litter, gently turning the soil (Figure 15) and brush matting have helped stimulate germination from the soil seed bank.

Allowing an area to recover by natural regeneration (without planting) is the preferred method. When the seed bank is depleted and the natural vegetative community cannot regenerate, planting helps recover some of what has been lost. Seedlings grown from seeds collected from nearby sites can help maintain genetic integrity (DEC 2005). Also, if land is available, corridors can be created to re-link isolated forest remnants to allow for the movement of fauna and fungi.

Never mulch within an Eastern Suburbs Banksia Scrub community or bush regeneration site. Doing so will prevent the native seed bank from germinating. It can also potentially introduce fungus species and soil pathogens that were not already present. Raking to remove leaf litter and expose the sand at both the York Road and Bird Sanctuary sites was found to stimulate germination from the soil seed bank and reduce the number of weeds germinating.

Weed control

When initially weeding a site (primary weeding), do not remove any weed trees and tall shrub species before considering how much impact the increased sunlight levels and warmth will have on currently unexposed vegetation layers. For example, clearing bitou bush can expose the area to invasion by African love grass, a weed prevalent in Eastern Suburbs Banksia Scrub (Figure 16). A best practice method is to remove invasive groundcovers and low shrubs first. This encourages native regeneration, ensuring a healthy groundcover is established before weed trees and tall shrubs are finally removed.

Weed removal causes soil disturbance, which promotes both native and weed seed germination.



Photo: B Walters

Figure 15: Raking back the leaf litter to encourage regeneration



Photo: Randwick Council

Figure 16: Removing a previous infestation of bitou bush exposed this area to more sunlight, encouraging this invasion of African love grass

Follow-up weeding is necessary to prevent weeds out-competing the native seedlings (Buchanan 1989). After initial weeding there can be a risk from erosion, especially when the plants are on sloping terrain. The area should not be worked heavily again for some months as weed removal may result in some level of soil disturbance. As well as germinating native species, this would also promote germination of weeds.

To become established, native seedlings need a period of minimal disturbance. In some instances resprouting weeds can temporarily shield the native seedlings from harsh environmental conditions. However, it is important to remove weeds before the native seeds set, so monitor and maintain the site at this stage.

As the regenerating native plants become established, the need for maintenance lessens. However, as much Eastern Suburbs Banksia Scrub is surrounded by development and modified landscapes, weed invasion from neighbouring areas is ongoing. Birds, especially, spread weeds by dropping faecal material after feeding on local weeds such as bitou bush and lantana. Consequently, maintenance will always be required for these remnants.

Minimise herbicide use

The use of herbicides is recognised as a necessary tool in the control of weeds within bushland remnants. Spot spraying is to be considered only after the target area is carefully prepared. It should be restricted to the remnant's edges. Herbicide use is to be restricted to two methods. The 'cut and paint' method is where a plant's stem or trunk is cut off near the ground and the exposed area is covered with herbicide. The 'scrape and paint' method is where a plant's stem or trunk is scraped vertically with a knife to remove the outer covering and the exposed length is covered with herbicide. Either of these methods should be used for weeds situated on slopes, where hand-pulling would disturb the sandy soils, as they are highly susceptible to erosion. In general, however, hand weeding, where appropriate, is recommended.

Anyone using pesticides or herbicides – in their business, as part of their occupation or as a volunteer – must be trained in their correct and safe use. Courses include Farmcare, SmartTrain and Chemcert. For further information, contact your local TAFE office or the Department of Primary Industries.

Selective removal of non-Eastern Suburbs Banksia Scrub native vegetation

Microlaena (*Microlaena stipoides*), cheese tree (*Glochidion ferdinandi*) and sweet pittosporum (*Pittosporum undulatum*) are examples of native flora that can out-compete regenerating Eastern Suburbs Banksia Scrub species, and should be selectively removed. In some areas of Centennial Parklands sites, *Acacias* are pruned back to allow light to assist in seed germination. Check with your local council before removing any native trees as doing so usually requires an inspection and a compliance certificate. Consult the appendix for a list of species that should never be removed.

Buffers and adjoining vegetation

Keeping an area of natural bushland around a remnant is crucial to ensuring the remnant's long-term health and survival. This bushland acts as a buffer, minimising the detrimental edge effects of increased desiccation, runoff, rubbish dumping and weed encroachment. Buffers also improve ecological function as they are used as corridors by pollinating species, such as birds and insects.

This makes buffers crucial for the continuing ecological health and evolution of these remnants. The buffer size should be as large as possible but where the buffer is degraded, reconstruction through revegetation (planting) may be appropriate where there is little or no native seed bank present. Plants grown from locally sourced seed are advantageous as the plants have adapted to local climatic and soil conditions (DEC 2005).



***Phytophthora cinnamomi* protocols**

Phytophthora cinnamomi is a microscopic soil-borne plant pathogen that can survive in very small quantities of soil for long periods of time. *Phytophthora* causes dieback in a wide variety of native and non-native plant species by rotting their root systems. Eastern Suburbs Banksia Scrub species are believed to be susceptible to dieback caused by *Phytophthora*. Use the following control methods.

- **Sanitise tools and machinery** – tools must be regularly drenched in a solution of detergent or disinfectant after all traces of soil have been washed off. Use according to the manufacturer's instructions. An alternative is to use alcohol (70% methylated spirits). Place a large drum of a solution of detergent or disinfectant in a convenient place in the depot. When returning to the site, bring tools back already washed to remove soil, then drench them. When planting more than one plant, disinfect tools in a portable container of disinfectant before and after planting each plant. A simple method is to use a spray bottle containing alcohol. This has less damaging effects on tools and equipment than bleach and is an efficient disinfectant.
- **Boots and tyres** – soil clinging to boots and tyres is a common vector in transporting *Phytophthora*. To limit the spread of this pathogen, ensure they are scrubbed clean of all soil in a solution of detergent or disinfectant then sprayed with alcohol.
- **Infected vegetation** – *Phytophthora* can persist in dead organic tissue for many years. Dead roots and any above-ground pruned material must be disposed of carefully. This is especially important if the sites' management practice is to remove weeds off site. Never woodchip vegetation suspected of being infected by *Phytophthora*. NSW has developed a statement of intent for the infection of native plants by *Phytophthora cinnamomi* (DECC 2008).

These sanitation procedures may seem time consuming but prevention and limitation of the spread of *Phytophthora* is the most effective means of control (DEH 2006). The *Phytophthora* root rot fact sheet (Royal Botanic Gardens Trust 2007) describes in detail the management of communities infected with *Phytophthora*.

3.3 Access and fauna management

Animals are essential to healthy ecosystem function. Some birds eat insects that would otherwise feed on the trees, causing dieback (Collett 2001). Weeds can often provide suitable food and shelter for birds and other native fauna. Take care when removing weeds to make sure enough functioning habitat for native fauna is retained.

Work to an appropriate time frame

Allow time for the native trees and shrubs to replace any weeds removed. Always search exotic plants for bird or ringtail possum nests before tree removal. If any nests are found, call the local wildlife rescue organisation to relocate any stranded animals before the trees are removed (Figure 17).

Maintain habitat

Work only small manageable areas at one time, leaving stands of 'caretaker' weeds behind to maintain the habitat. Make sure the right 'caretaker' weeds are left by observing which weeds the birds favour *before* beginning any regeneration work. As many animals feed on the smaller organisms living among logs and leaf litter, do not remove or disturb any fallen branches.



Photo: DECC

Figure 17: Ringtail possums build loose circular nests called dreys, made of twigs, bark and leaves, in the forks of low branches

Consider the habitat potential of rubbish

Old pipes, tiles, car bodies and pieces of tin can be left temporarily as they provide habitat. This is especially the case when the rubbish has been in place a long time and away from public view (Ondinea 1998). It may be advantageous to leave the rubbish there, gradually working towards eradicating it or allowing natural processes to eventually remove it. This gives the local fauna time to adapt to the new sites before the rubbish is eventually removed.

Introduced animals

Rabbits, cats and foxes are a potential problem in Eastern Suburbs Banksia Scrub. Domestic animals from nearby properties and the occasional fox prey on the small mammal and bird species. Scrub fragments are also subjected to serious grazing by rabbits. Education and liaison are the main strategies used to mitigate these threats. By liaising with the neighbourhood, the staff at Centennial Parklands has raised community awareness and concerns for impacts from domestic pets. Rabbits and foxes are controlled by fencing and habitat destruction.

Photo: Randwick Council



Figure 18: Bitou bush and lantana have been left as weed barriers in a remnant at Wassel Street, Randwick; they are a useful temporary tool to prevent human access and rubbish dumping

regeneration areas by impeding unnecessary human access and that helps prevent rubbish dumping. Temporary weed barriers must be de-seeded to avoid these weeds resprouting until they are removed (Figure 18).

Rabbit-proof fencing

Installing a rabbit-proof fence minimises the impacts of introduced animals such as rabbits. This type of fencing also deters unnecessary human traffic (Figure 19).

Photo: Centennial Parklands



Figure 19: Rabbit-proof fence at the York Road site

Using barriers for conservation

It is vital for local vegetation communities to connect with the surrounding bushland. However, the small size of these remnants increases their susceptibility to degrading forces. These include trespass, grazing by feral animals, unauthorised track development (such as bike tracks), horse riding, rubbish dumping and weed encroachment. Barrier techniques can be used to minimise their impact.

Leaving weeds as barriers

Where practical, weeds such as bitou bush and lantana can be temporarily left in dense stands along the remnant's edge. These weed barriers can prevent further weed encroachment. They also protect sensitive





Figure 20: A sediment fence at a remnant in Wassel Street, Randwick, actively prevents encroachment of certain weed species

seed. This is advantageous as the plants have adapted to local climatic and soil conditions (DEC 2005).

If the soil in the earth mound is not of aeolian-derived sand and is potentially nutrient rich, it enables weeds to proliferate. Therefore a greater degree of follow-up maintenance is required in these sections.

Track construction

Informal walking tracks lead to serious degradation and fragmentation of the remnant. They also increase the risk of introducing and spreading *Phytophthora*, which can be brought in on people's shoes. Building a formal walkway through the remnant, such as a boardwalk, is an effective way to channel visitation inside the reserve. This helps reduce the problems caused by expanding networks of informal tracks (Figure 21).

3.4 Monitoring and maintenance

Ecological processes within a community are complex. Therefore when bushland restoration practices are implemented, it is not always known exactly what the outcome will be. This makes it important to monitor a site to measure how it is responding after restoration work has begun (Underwood 2001; Natural Heritage Trust 2004).

Monitoring involves observing the changes taking place on site during and after bush regeneration has commenced. It requires keeping records to measure the success of the activities.

Monitoring is important for three main reasons:

1. It provides feedback on the effectiveness of management actions, and hence whether these actions need to be modified.
2. It allows land managers to see whether natural resources are stable, improving or declining.
3. It allows the response of different bushland regeneration practices to be compared to each other.

Records should be consistent, comparable and easily interpreted by any interested person. The types of documentation can include:

- before and after photographs taken from fixed points

Sediment fences

Sediment fences or silt fences are an excellent way of preventing weeds, such as invasive perennial grasses (for example, African love grass), from entering the remnant. They can also be used to retain weed infestations within the remnant. Silt fences significantly reduce maintenance hours dedicated to managing the interface between bushland areas and the urban fringe (Figure 20).

Earth mound construction

To reduce illegal rubbish dumping into the York Road remnant along the roadside edge, a 1.5 m x 20 m mound of earth was constructed. The mound was planted with plants grown from locally sourced



Figure 21: This boardwalk was constructed by NPWS in a remnant in Jennifer Street Reserve, which is now part of Botany Bay National Park

- aerial photos to record broad-scale changes
- vegetation maps
- maintaining flora and fauna species lists
- quantitative data through permanent quadrats and/or transects
- records of any new techniques being trialled
- reports that detail the original condition and threats to native vegetation, management actions applied and outcomes from management.

Photos should be repeatable over time to show variation and change at the site. Any photos taken should be dated and annotated, noting the direction of views and detailing points of interest with points located on a cross-referenced topographic map. A grid referenced with GPS coordinates showing exactly where the photo was taken is useful.

Monitoring methodologies at both ESBS demonstration sites consisted of:

- Establishing permanent monitoring quadrats on each site to enable consistent data collection. Due to the small remnant size, the whole site was divided into quadrats for monitoring (Figure 22), instead of randomly placing quadrats or placing quadrats along a transect.
- Collecting data at each monitoring visit on floristic changes observed in each quadrat.



Photo: Centennial Parklands

Figure 22: Monitoring quadrats at the York Road demonstration site

This data should be collated and stored by using appropriate data and GIS software packages, and a basic analysis of the data should then be done. A summary of conclusions, identifying species diversity, abundance, life stages and changes in diversity should be provided. This should include the distribution of native species after each monitoring period.

Long-term maintenance

Bushland regeneration works (weeding, prescribed burns, use of triggers) indiscriminately promotes both native and weed species regeneration. Maintenance aims to promote the growth of native seedlings by selectively removing the weed species. When the native plants gain maturity, set seed and replenish the soil seed bank, the role of maintenance will diminish. This process, however, will take several years and, given the reduced size of the remnants, will always be required.

Failure to incorporate a long-term maintenance strategy into Eastern Suburbs Banksia Scrub management will lead to the soil seed bank 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 when the area can be maintained.

3.5 Community awareness

Engaging the community in conservation issues is an important focus of bushland managers and practitioners. This means communicating with local residents, neighbours and parklands visitors about ecological communities and remnant regeneration. Providing information and educational material to the public helps bush regeneration and land management efforts. It helps people understand their relationship with the landscape when it comes to protecting bushland remnants.



Public education can also help encourage potential new volunteers to get involved where on-ground assistance is required. Volunteers make a significant and valuable contribution to restoring Sydney's bushland. Many councils and land managers of reserves – including the Centennial Park and Moore Park Trust and Department of Environment and Climate Change – rely on volunteers to help with bush regeneration and public education. Since 2004, volunteers at Centennial Parklands have contributed over 2,000 hours of their time, helping carry out the regeneration work.

For restoration works in endangered ecological communities, the work of volunteers must not be taken for granted. Nor can it be solely relied on. Such important areas are worth funding to employ professional bush regeneration contractors to carry out restoration works and to guide, educate and assist and supervise volunteers and community groups.

The Centennial Parklands vegetation management plan developed a schedule of public information strategies for the York Road site, which included:

- developing a comprehensive education and interpretive program to raise awareness and appreciation of the Eastern Suburbs Banksia Scrub remnants
- erecting educational signs at these remnants (where deemed appropriate by Centennial Park and Moore Park Trust) indicating their importance, extent and conservation significance
- erecting information signs at sites prior to and during restoration works, detailing the nature and purpose of the works (where deemed appropriate by the trust)
- publishing information and management actions on the Centennial Parklands website
- continuing to use small groups of volunteers coordinated by the trust for monitoring and regeneration.

These practices continue to ensure the survival of these historic remnants for the benefit of the plants and animals that define and live in the Eastern Suburbs Banksia Scrub, as well as for the local community.

Summary – best practice bushland regeneration in Eastern Suburbs Banksia Scrub

- Monitoring is used to ascertain the effectiveness of bush regeneration techniques over time.
- Monitoring records how individual plant species respond to different management practices.
- Volunteer groups should be encouraged to undertake monitoring programs after sufficient training to acquire the necessary skills.
- Never clear an area that cannot be given long-term maintenance.
- Bush regeneration practices need to be tailored to the specific conditions of Eastern Suburbs Banksia Scrub.
- When carrying out bush regeneration, consideration must be given to coordinating weed control and ecological fire management activities within the remnants.
- Appropriate buffers must be restored and maintained around remnants.
- Plans of Management are necessary for the long-term strategic management of remnants.
- *Phytophthora* protocols must be followed when bush regeneration is being carried out.

4 Licences for activities within Eastern Suburbs Banksia Scrub

Bush regeneration, weed control, clearing for fire breaks – indeed almost any activity within an Eastern Suburbs Banksia Scrub remnant – requires approval. This will either be an s.91 certificate of approval – if associated with a development application (*Threatened Species Conservation Act 1995*) – or an s.132c licence (*National Parks and Wildlife Act 1974*). These are obtained from the Department of Environment and Climate Change (NSW). Generally an s.91 licence is required for actions that are destructive, while an s.132c licence is required for scientific and/or conservation purposes. The s.91 certificate application is submitted to the Metropolitan Operations Branch of DECC at Parramatta and the s.132c application is submitted via the Wildlife Licensing Section of DECC at Hurstville.

Approval is needed where prescription burning – including pile burning – is being considered. For burning on private and public lands within the metropolitan area, an Open Burning Approval Certificate must be obtained. These certificates can be obtained from the Metropolitan Operations Branch of Biodiversity Conservation Section at DECC Parramatta. Lodge the application with the relevant certifying authority via the Rural Fire Service BRIMS tool (RFS Act 1994). Notifications should be made to the local fire district authorities: for inner metropolitan areas, notifications are submitted via the NSW Fire Brigades; in outer metropolitan areas, they are submitted via the local RFS Fire District Office.

Visit www.nationalparks.nsw.gov.au/pdfs/scientific_licence_application.pdf for more information regarding licensing issues and for contact details.

To carry out burning on NPWS-managed lands, the normal environmental assessment and certification procedures apply according to the Reserve Fire Management Strategy and Plan of Management guidelines. Lodge the application with the relevant certifying authority via the Rural Fire Service BRIMS tool (RFS Act 1994). Notifications should be made to the applicable local fire district authorities (that is, for inner metropolitan areas, notifications are submitted via NSW Fire Brigades; in outer metropolitan areas, they are submitted via the local RFS Fire District Office).



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Appendix 1: Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion – endangered ecological community listing

The following list of species is from the NSW Scientific Committee's final determination.

The Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion is characterised by the following assemblage of species:

<i>Acacia longifolia</i>	<i>Eucalyptus gummifera</i>
<i>Acacia suaveolens</i>	<i>Gonocarpus teucrioides</i>
<i>Acacia terminalis</i>	<i>Haemodorum planifolium</i>
<i>Acacia ulicifolia</i>	<i>Hakea teretifolia</i>
<i>Actinotus helianthii</i>	<i>Hardenbergia violacea</i>
<i>Actinotus minor</i>	<i>Hibbertia fasciculata</i>
<i>Allocasuarina distyla</i>	<i>Hypolaena fastigiata</i>
<i>Astroloma pinifolium</i>	<i>Kunzea ambigua</i>
<i>Baeckaea imbricata</i>	<i>Lambertia formosa</i>
<i>Banksia aemula</i>	<i>Lepidosperma laterale</i>
<i>Banksia ericifolia</i>	<i>Leptocarpus tenax</i>
<i>Banksia integrifolia</i>	<i>Leptospermum laevigatum</i>
<i>Banksia serrata</i>	<i>Leptospermum trinervium</i>
<i>Bauera rubioides</i>	<i>Lepyrodia scariosa</i>
<i>Billardiera scandens</i>	<i>Leucopogon ericoides</i>
<i>Boronia parvifolia</i>	<i>Lomandra longifolia</i>
<i>Bossiaea heterophylla</i>	<i>Melaleuca nodosa</i>
<i>Bossiaea scolopendria</i>	<i>Melaleuca squamea</i>
<i>Brachyloma daphnoides</i>	<i>Monotoca elliptica</i>
<i>Caustis pentandra</i>	<i>Monotoca scoparia</i>
<i>Conospermum taxifolium</i>	<i>Persoonia lanceolata</i>
<i>Cyathochaeta diandra</i>	<i>Philotheca salsolifolia</i>
<i>Darwinia fascicularis</i>	<i>Pimelea linifolia</i>
<i>Darwinia leptantha</i>	<i>Pomax umbellata</i>
<i>Dianella revoluta</i>	<i>Pteridium esculentum</i>
<i>Dichelachne crinita</i>	<i>Restio fastigiata</i>
<i>Dillwynia retorta</i>	<i>Ricinocarpos pinifolius</i>
<i>Epacris longiflora</i>	<i>Styphelia viridis</i>
<i>Epacris microphylla</i>	<i>Woolisia pungens</i>
<i>Epacris obtusifolia</i>	<i>Xanthorrhoea resinifera</i>
<i>Eragrostis brownii</i>	<i>Xanthosia pilosa</i>
<i>Eriostemon australasius</i>	

The total flora species list for the community may be larger than that given here, with many species present only in one or two sites or in very small quantity. In any particular site, not all of the assemblage listed above may be present. At any one time some species may only be present as seeds in the soil seed bank with no above ground individuals present. Invertebrate species are poorly known but some species may be restricted to soils or canopy trees and shrubs. The species composition of a site will be influenced by the size of the site and by its recent disturbance history. For a number of years after a major disturbance dominance by a few species (such as *Kunzea ambigua* or *Leptospermum laevigatum*) may occur, with gradual restoration of a more complex floristic composition and vegetation structure over time. The balance between species will change with time since fire, and may also change in response to changes in fire regimes (e.g. fire frequency).

The Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion is distinguished from the coastal heath which occurs along the eastern seaboard on soils derived either directly from sandstone or, if aeolian, of younger age than those of the Eastern Suburbs Banksia Scrub. Coastal heath is characteristically much lower than Eastern Suburbs Banksia Scrub and, although sharing many species with the Eastern Suburbs Banksia Scrub, characteristically contains a more maritime element including *Baeckea imbricata*, *Correa alba* and *Westringia fruticosa*.

Heathland with *Banksia aemula* has been recorded from the Central Coast by Benson & Howell (1994). These stands have a less dense shrub layer, a greater density of graminoids in the ground layer and differences in total floristics when compared with Eastern Suburbs Banksia Scrub in the Sydney Basin Bioerion as defined in this determination and are not regarded as part of this community.

The community has been reported from areas of sand deposits in the local government areas of Botany, Manly, Randwick, Waverley and Woollahra which are all within the Sydney Basin Bioregion. On North Head, within Manly local government area the ecological community occurs on a sand sheet of similar age and composition to that on which the ecological community occurs further south.

The Scientific Committee noted that general information on the Eastern Suburbs Banksia Scrub is provided in Benson D & Howell J 1990, *Taken for granted – the bushland of Sydney and its suburbs*, Kangaroo Press, Kenthurst.

Less than 3% of the original area of the community currently exists in the form of a number of remnants.

Threats to the survival of the community include fragmentation, development, increased nutrient status, inappropriate fire regimes, invasion by exotic plants, grazing by horses and rabbits, erosion from use of bicycles, motorcycles and from excessive pedestrian use.

Although a small part of the surviving Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion is included within the Botany Bay National Park, this in itself does not ensure the survival of the community unless the threats to the integrity of the community are ameliorated.

In view of the above, the Scientific Committee is of the opinion that the Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival cease to operate.

Proposed Gazettal date: 23/08/02

Exhibition period: 23/08/02–27/09/02

Reference

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Source

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

