

REHABILITATING SHOALHAVEN LANDSCAPES



Garry Daly ©

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Published by: Shoalhaven Landcare Association Inc
45 Ironbark Rd,
Tapitallee NSW 2540

National Library of Australia
Cataloguing-in-Publication entry:

Daly, G. (2012). *Rehabilitating Shoalhaven Landscapes*. Shoalhaven Landcare Association Inc.

ISBN: 978-0-9874519-1-0

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EXECUTIVE SUMMARY

Bengalee Creek Landcare group has requested a guide to rehabilitating degraded landscapes in the Shoalhaven Local Government Area for Landcare Groups. This guide is a work in progress as various projects are evaluated over time. The goal is to mimic/reconstruct the pre-European vegetation association of a particular area in terms of species diversity but with an emphasis on species, which provide food for fauna. When rehabilitating degraded landscapes restoration will, in many cases, take hundreds of years before a mature forest is re-established that supports select forest dependant species of flora and fauna. Hence, rehabilitation and revegetation are seen in the context of succession of that particular vegetation community over time. The majority of vegetation communities experience fire and this is an important force that shapes communities and the complexity in the shrub and ground layers. Given all these inputs some main actions for rehabilitation are:

- Assess the remnant vegetation of the site to be rehabilitated;
- Plan a strategic approach if weed control is necessary;
- Collect seeds from the adjacent area for the propagation of plants for revegetation;
- Evaluating the risk factors for revegetating an area – herbivores, seasons for replating, soil moisture etc;
- If planting is required or desired then initially plant rapid growing colonising species to maximise canopy cover. Other shade loving species may be planted at a latter date;
- Keep accurate records such as photo-point images, lists of the date and number of each species of plant used in revegetation and dates of spraying. These records will be the basis for future reference by the Landcare group. Documenting the methods and success or failure of actions is important information that should be shared with other Landcare groups;
- Ongoing maintenance of the site in regard to fallen timber, erosion, fire, fencing, domestic and native animals, access and weed control;
- An environmental education component to ensure the future owners/managers are informed on the history of land management and
- A timetable for the completion of rehabilitation and ongoing maintenance, fencing, management actions and monitoring.

Summary of Actions, responsibility and timing

Task	Stage	Details	Time
Initial meeting of landowners	0	Landowners within a given area see the need to rehabilitate a patch of bush or create a habitat/riparian corridor. Field-day for people to discuss and see the problem and come to a consensus.	Prior to any work there has to be a consensus on actions. Landowners can work on their own land at their own pace.
Liaisons with council and incorporation	0	Landowners incorporate and register a Landcare group or link up with an existing Landcare group. Group liaises with the local catchment management authority.	It is important to get as much background information as possible prior to work initiating.
Application for grants	1	Landowners apply for grants to fund on-ground work	Prior to actions and ongoing.
Strategic Plan	2	Decide what area needs work, what can be tackled and maintained by the group and the timing of actions.	Prior to and other on-ground action.
Species Inventory	2	Identify species of plant endemic to rehabilitation area.	Prior to and other on-ground actions.
Establish monitoring points	2	Select photo points and mark with steel pickets.	Prior to and other on-ground actions.
Commence weed control	3	If necessary use weed profiles (http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles) to prioritise and commence control activities. The Splatter gun is an effective tool for tackling lantana on steep slopes. Hand or mechanical weeding cut/scrape/frill and paint or spot spraying for other situations.	Herbicides work best when weeds are in active growth so for warm areas spraying can commence in August and continue to May
Evaluating initial weed control	3	Weeds may take over a month to respond to herbicides and take several months to die. Once dead they can be left or crushed when replanting.	On going.
Follow-up work	4	All sites need follow up work until the canopy is established and the ground cover consists of native species.	Several years.

DEFINITION OF TERMS

Within this report the following terms are defined.

- **Exotic** means species introduced from outside the area, that is from overseas.
- **Vegetation** means indigenous vegetation as per the *Native Vegetation Act 2003*. This includes indigenous trees, shrubs, groundcover plants and aquatic plants.
- **Weeds** means any plant not originally from this area. Some weeds are declared under the *Noxious Weeds Act 1993* within the local government areas of Shoalhaven City Council.
- **Regeneration** means reproduction from self-sown seeds or by vegetative recovery (sprouting from stumps, lignotubers, rhizomes or roots), which occurs naturally after disturbance.

1 INTRODUCTION

1.1 Background and objectives

Bangalee Creek Landcare group has requested a broad rehabilitation plan (RP) for Landcare groups in the Shoalhaven. The following guide was prepared for G. Daly with the following objectives - requests:

- Landcare groups assess the floristic diversity of their sites;
- Landcare groups decide how much time/effort they can devote to the project;
- Landcare groups decide what they want to achieve over a one, two and five year period;
- If weed control is required then the group should have a strategy related to the target species and the area that can be maintained;
- Provide advice on species that may be used for revegetation with the intent of a) using species endemic to the area b) stabilise soil and c) maintain and or enhance biodiversity and
- Provide advice on how to manage native animals, especially Wombats and Swamp Wallabies when revegetating a site.

1.2 Description of the Shoalhaven landscape

Location

The Shoalhaven local government area extends from Berry Road in the north to Murramarang National Park in the south and Morton National Park to the west.

Geology and Soils

The geology of an area is one factor that influences what plants grow in that area. Hence it is important to have a broad view of the geology of your area to understand the association between the vegetation and the soil type. The geology of the Shoalhaven is described by B. and A. Young in the book *Understanding the Scenery of Morton National Park and the coast from Nowra to Batemans Bay* (2007). The following is a very brief description of the main geologic units in the area based on Young and Young (2007). Soils are a result of either eroded parent bedrock or depositional landscapes beside rivers. In the Shoalhaven the highest landscapes in the north of the local government area (LGA) such as Barren Grounds, Devils Glen Nature Reserve and Red Rock are capped with Hawkesbury Sandstone. Blocks of this geology exist in the eroded gullies of the Kangaroo River – Berry area as a result of talus falling from the escarpment above.

The Hawkesbury series merges with the Nowra Sandstone series in Morton National Park (NP), north-west of Tallowa Dam. Even though these geologic units are both sandstone they were formed at different times and subsequently have different characteristics. The Nowra series of sandstone exists over the higher parts of Morton NP and forms the main visual backdrop to the Shoalhaven River from the town of Nowra upstream to the Hampton bridge in Kangaroo Valley. Nowra Sandstone also forms the walls of the upper Endrick and Clyde Rivers. Nowra sandstone forms the peaks of Pigeon House Mountain and the Castle. There is also another form of sandstone in the north of the area called the Budgong sandstones. These

occur below the Hawkesbury sandstone of Red Rock and Devils Glenn and form the escarpment from Budgong to Berry.

On the highest elevation on the escarpment from Budgong to Berry there is Hawkesbury sandstone, below this is residual Budgong sandstones then below this siltstone from the Berry formation. Nowra sandstone occurs along the Shoalhaven River escarpment. In the Cambewarra area there are latites resulting from previous volcanic activity and volcanic soils occur in a portion of Emery's plateau.

Further south the lower coastal plain is Wandrawandian siltstones. Coastal areas such as the Shoalhaven River floodplain consists of geologically recent sediment brought down by the river. The very coastal strip consists of sand derived from marine sediments. However there is another sandstone on the coastal fringe, which forms a very prominent part of the region. This is the Snapper Point formation of the two peninsulas of Jervis Bay, namely Beecroft and Bherwerre. The Shoalhaven has four types of sandstone Hawkesbury, Budgong, Nowra and Snapper Point each of a different geologic age.

To the south of the Nowra sandstone, such as the Budawangs and much of the area in the southern portion of the LGA the rocks are metamorphosed by the action of folding. These are the very broad geologic units that occur in the region except for the areas which have enriched soils as a result of volcanic activity. The areas with volcanic soils are around Milton, Bawley Point and Emery's Plateau (known as monzonites), Cambewarra latites near Cambewarra Mountain, Granite Falls near Wandandian (granites).

Most of the Landcare activities are likely to occur or are occurring on soils with higher nutrients (siltstone, alluvial and volcanic) or the coastal strip. Many of the soils derived from sandstones have lower nutrient levels and hence have been impacted less by Europeans and subsequently have a lower incidence of weeds.

Indigenous Vegetation

The native vegetation in the area has been classified by several people over the years. For the purposes of this report I refer to the Office of Environment and Heritage's Definition of Vegetation Types for the Catchment Management Authority (CMA) areas as can be found on OEH's website. This is a state wide classification system and a summary in Excel of all the vegetation types for each CMA, based on, inter alia, SCIVI is available. See <http://www.environment.nsw.gov.au/projects/BiometricTool.htm#vegtype>.

Native Fauna

The Shoalhaven has a species rich complement of fauna. Within New South Wales it is considered a 'hot spot' for biodiversity. In terms of species the Shoalhaven is more diverse than the surrounding LGA's of Kiama, Wingecarribee and Eurobodalla. This high biodiversity is a result of the size of the LGA, the coastal location and the wide range of geologies and subsequent vegetation communities. Not only is the region biodiverse but it also supports the largest remaining populations of Green and Golden Bell Frog *Litoria aurea*, Broad-headed Snake *Hoplocephalus bungaroides* and Eastern Bristlebird *Dasyornis brachypterus*. One of the last remaining populations of Brush-tailed Rock Wallaby *Petrogale penicillata* persists in the Shoalhaven. Revegetation and rehabilitating degraded landscapes provides habitat and promotes the conservation of native fauna. Species of indigenous plant that may be used for revegetation in the Shoalhaven and their use by fauna is given in **Tables 1-5** and **Appendix 1**.

However, in many areas there are problems in regard to native animals eating regenerating plants.

Managing the impacts of Wombats and Wallabies

The Shoalhaven has large populations of Wombat *Vombatus ursinus* and Swamp Wallaby *Wallabia bicolor* and there is evidence that over the last 25 years these species have attained higher densities and in the case of the Wombats extended distribution to the coastal plain around Jervis Bay. Wombats graze herbs and forbs but also chomp on seedlings of shrubs and trees. They can also cause erosion by digging burrows beside creeks and especially in the headwaters of creeks causing head slump during periods of high or prolonged rainfall. Swamp Wallabies are browsers and take the growing tip bits from shrubs and small trees. They can also break small trees and branches to reach the growing tips. In combination these two species can destroy regeneration and revegetation in an area if plants are not protected.

From my own experience in 1986 I planted hundreds of Bangalow Palms over broad areas of our land and Swamp Wallabies ate the majority of plants. Those that survived were protected by wire cages and/or fallen timber that formed a barrier to the animals. In another instance in 2003 I mechanically cleared an area of lantana and sowed seed of Native Peach, White Cedar, Matt rush, Native Hop and then planted a large number of indigenous species. The trees that I planted were given protection by way of wire cages. I estimated Native Peach seedlings at a density of about ten plants per square metre within a month. After about one month after clearing I spot-lit up to six Swamp Wallabies feeding on this site. The Native Peach that survived after six months were only those that had germinated within the confines of the tree guards.

The plant that did survive the impacts of the wallabies and Wombats was White Cedar as the leaves are generally toxic to animals. It was also interesting that Brown Kurrajong *Commersonia fraseri* regenerated in dense stands after root disturbance as did Hairy Clerodendrum *C. tomentosum*.

Tree Guards

My initial tree guards were constructed from chicken wire. These were inadequate. Swamp Wallabies are dexterous and can slip their hands through the wire and can pull the growing tip towards the animal's head for them to eat. Chicken wire has a relatively small gauge in relation to the open weave area and can be bent by Wombats searching for the growing tips of seedlings.

The mesh that I now use for tree guards is 25 x 25 mm diameter 1.3 mm gauge x 1200 mm high wire. Tree guards are best staked with 25 x 50 x 1200 mm hardwood or steel pickets. Guards should be removed when plants have attained a height of 2.5 metres such that animals cannot eat the apical (growing) tips. I make the tree guards by placing a tape on the ground and marking with a spray can intervals of one metre. I then roll out the wire weighing it down at the start and finish with a heavy object. If a large number of guards are required then up to three rolls of wire can be rolled out one on top of the other. I use a small angle grinder to cut the wire, cutting near the edge of the squares so that one end has a large unsupported length that can be used to wrap around the corresponding edge of uncut square. I do not cut the last strand of wire as this holds the roll intact. I then cut the last strand on each guard as I stand on both cut ends to hold down the rest of the roll.

Tree guards are generally successful to protect plants from Swamp Wallabies and Wombats but have not been particularly successful in protecting plants from Chital, Red and Rusa Deer. In some areas deer can exist at relatively high densities and are a major factor in the loss of plants in revegetation works. They browse plants when they grow above the tree guards and can push them over. In one instance (at Mount Keira) the loss of plants was so great that tree guards were abandoned and the entire revegetation area was fenced with electric wire. Deer also damage and kill larger plants by ringbarking small trees when they rub their antlers. This is occurring in the Tapitallee area from Chital Deer. Given the Shoalhaven now has four species of deer, namely Rusa, Red, Chital and Fallow (Samba and Hog Deer are spreading north from Victoria) then the native vegetation will be irrevocably changed by the presence of these exotic animals.

2 RECOMMENDATIONS FOR REVEGETATION PER REGION

2.1 Berry-Cambewarra escarpment and Milton volcanic area

The escarpment areas are generally those above 50m in altitude (Australian Height Datum – AHD) and include subtropical rainforest, Warm-temperate rainforest, Turpentine–Blue Gum forest in the lower altitudes and Coastal White-topped Box and Brown Barrel at higher altitudes. Riparian corridors in Kangaroo Valley have a River Oak-Cabbage Gum- Angophora-River Peppermint fringing forest often with an understorey of rainforest species.

Revegetation strategy

For rainforest regeneration fast growing species such as Pencil Cedar *Polyscias murrayi*, Celerywood *Polyscias elegans*, Red Cedar *Toona ciliata*, Red Ash *Alphitonia excelsa*, Port Jackson Fig *Ficus rubiginosa*, Small-leaved Fig *F. obliqua* and Native Peach *Trema tomentosa* var. *viridis* can be planted initially, especially on north facing slopes. Native Peach is termed a nurse tree as within a few years they shade out weeds and foster the growth of other rainforest species. The focus in areas that have been subject to previous disturbance is to provide a canopy as quickly as possible to manage weeds such as lantana (**Appendix 2**) and cobblers pegs.

On the margins of the creeks the following species are recommended for planting: River Oak *Casuarina cunninghamiana*, Morton Bay Fig *Ficus macrophylla*, Superb Fig *Ficus superba*, Sandpaper Fig *Ficus coronata*, Brush Cherry *Syzygium australe*, Brown Beech *Pennantia cunninghamii*, Water Gum *Tristaniopsis laurina* as their roots will help stabilise the creek and eventually when they fruit provide a food resource for rainforest birds. On the better-drained slopes of the creek bank species such as Lilly Pilly *Syzygium smithii*, Small-leaved Fig *Ficus obliqua* and Port Jackson Fig *Ficus rubiginosa*, Common Acronychia *Acronychia oblongifolia*, Jackwood *Cryptocarya glaucescens* and Koda *Ehretia accuminata* may be planted. Shrubs such as Bleeding Heart and Grey Myrtle can be planted close to be boundaries of the vegetation corridor so that they receive additional sunlight, which will promote flowering and fruit set.

Some of these species will not do well on most riparian sites in areas subject to frost, such as Kangaroo Valley. In particular of the figs only the Sandpaper Fig *F. coronata* should be included in frost affected areas.

In general I do not recommend planting species of acacia such as Two-veined Hickory, Maidens wattle or Blackwood as these species grow into large trees and when they senesce and fall the result is often damage to the smaller rainforest species. However, in nature the general rule is for disturbed landscapes to be colonised by wattles, which are fast growing and fix nitrogen to the soil via nodules on their roots. Wattles also have the advantage of providing animals such as the Sugar Glider with a source of sap and seed for pigeons such as the Wonga.

Table 1
Some rainforest species for escarpment revegetation and their use by fauna

Common Name	Scientific Name	Fauna	Use
Maidens Acacia	<i>Acacia maidenii</i>	Sugar Glider and birds	Sap/insects
Blackwood	<i>Acacia melanoxylon</i>	Sugar Glider and birds	Sap/insects
Red Ash	<i>Alphitonia excelsa</i>	Lewins Honeyeater	Seed
Grey Myrtle	<i>Backhousia myrtifolia</i>	Various birds	Nesting
Jackwood	<i>Cryptocarya glaucescens</i>	Various pigeons, Bowerbird, Green Catbird	Satin Fruit
Murrogun	<i>Cryptocarya microneura</i>	As above	Fruit
Duboisia	<i>Duboisia myoporoides</i>	Unknown	Fruit
Koda	<i>Ehretia acuminata</i>	Pigeons	Fruit
Pigeonberry Ash	<i>Elaeocarpus kirtonii</i>	Various birds	Fruit
Morton Bay Fig	<i>Ficus macrophylla</i>	Top-knot Pigeon	Fruit
Small-leaved Fig	<i>Ficus obliqua</i>	Top-knot Pigeon	Fruit
Port Jackson Fig	<i>Ficus rubiginosa</i>	Various birds	Fruit
Superb Fig	<i>Ficus superba</i>	Top-knot Pigeon	Fruit
Cheese Tree	<i>Glochidion ferdinandi</i>	Lewin's Honeyeater	Seed
Bleeding Heart	<i>Homalanthus populifolius</i>	Brown Cuckoo Dove	Fruit
Cabbage Tree Palm	<i>Livistona australis</i>	Top-knot Pigeon	Fruit
Brown Beech	<i>Pennantia cunninghamii</i>	Top-knot Pigeon	Fruit
Brush Cherry	<i>Syzygium australe</i>	Various pigeons	Fruit
Lillypilly	<i>Syzygium smithii</i>	Various pigeons, Bowerbird, Green Catbird	Satin Fruit
Native Peach	<i>Trema tomentosa var. aspera</i>	Lewin's Honeyeater and Cuckoo Dove	Brown Fruit

The most appropriate time for planting is during late summer and autumn, after periods of rain. Loss of plants through the browsing activity of the Swamp Wallaby can be reduced by the placement of tree guards around plants as described earlier. **In areas with high densities of Swamp wallaby and Wombat revegetating without tree guards has been shown to be virtually useless as plants are eaten. In these areas the use of tree guards is strongly recommended.**

There are many additional species of rainforest plant that may be used for revegetation but they are often slow growing or are more specific in their requirements. Recent work (2010-2012) using a spatter gun to control Lantana on steep slopes in the Cambewarra area has shown that common regrowth species include Stinging Tree, Native Peach, Bleeding Heart and Pencil Cedar.

Eucalypts may also be used for revegetation as they are fast growing and long lived. In terms of value for wildlife, eucalypts are very important when they become mature and form hollows that may be used by wildlife for denning and nesting (Goldingay 2009). The unfortunate fact is that it may take 120-180years for a eucalypt to form hollows. Besides providing nectar and

hollows, Eucalypts are also extremely significant for invertebrate-eating birds such as Pardalotes, Shrike tit, Tree Creepers, Thornbills, Sitellas, Robins, Shrike Thrush, etc which probably wouldn't exist without them. Hence the planting of eucalypts is an activity that will be a legacy. It is noteworthy that for many years I did spotlight surveys in areas that supported Illawarra Blue Gum forest and had poor results. It was not until I surveyed old growth forest that had hollows that Greater Gliders were detected. Much of the Illawarra escarpment was cleared for coal mining (pit props) or the dairy industry in the early part of last century. Hence much of the existing Blue Gum forest is regrowth from about the 1940's. It will take a long time for these forests to mature for forest dependent species such as the Greater Glider to recolonise the parts of its historic range. In the northern Illawarra (north of Wollongong) recent surveys indicate that Greater Gliders have declined and may be absent from forests below the escarpment (Mahoney 2007). If a landowner was particularly interested in providing nesting and denning spaces for bats and arboreal mammals they can install nest boxes.

Eucalypts also provide nectar, sap and leaves that are used by native animals as part of their diet. For example Koala have a preference for the leaves of eucalypts that grow on high nutrient soils and favour species such as Forest Red Gum, Swamp Mahogany and Grey Gum. For nectar feeding animal such as honeyeaters and sugar gliders the planting of species that flower at various times of the year will provide a resource for these animals. For example Forest Red Gum, River Peppermint and Swamp Mahogany flower in winter, during a period when food resources are relatively scarce. Forest Red Gum typically occurs on higher nutrient soils and some of the largest remaining sands are on the Milton monzonites, beside subtropical rainforest. In other areas they occur as scattered individual trees. Although Forest Red Gum is present in Kangaroo Valley most of the smooth barked eucalyptus in that area are a similar looking species the cabbage Gum *E. amplifolia*.

Although Grey Gum is highly recommended for revegetation programs this species does not occur over the entire local government area. It is highly associated with sandy soils derived from Nowra Sandstone and naturally occurs in the Tapitallee, Budgong, Jervis Bay, and Yalwal areas. Spotted Gum also have a restricted but wide distribution being highly associated with the Wandandarian siltstones in the Nowra area north to about Meroo and west to Budgong and south through much of the coastal plain to Batemans Bay.

Table 2
Priority Eucalypt species for escarpment revegetation and their use by fauna

Common Name	Scientific Name	Fauna	Use
Spotted Gum	<i>Corymbia maculata</i>	Sugar Glider and birds	Nectar
River Peppermint	<i>Eucalyptus elata</i>	Birds	Nectar Invertebrates
Brown Barrel	<i>Eucalyptus fastigata</i>	Greater Glider	Leaves.
Forest Red Gum	<i>Eucalyptus tereticornis</i>	Koala, Sugar Glider and birds	Leaves & Nectar. Invertebrates
Grey Gum	<i>Eucalyptus punctata</i>	Koala, Sugar Glider, Yellow-bellied Glider, Yellow-tufted	Leaves, Sap and Nectar.
		Honeyeater	Invertebrates
Blue Gum	<i>Eucalyptus saligna X botryoides</i>	Many birds	Invertebrates

2.2 Shoalhaven Coastal Plain

The coastal plain supports a wide range of vegetation communities but the common species include Blackbutt, Scribbly Gum, Red Bloodwood, Grey Gum and Spotted Gum. There are small occurrences of Grey Ironbark, Woollybutt, and Swamp Mahogany. The midcanopy often contains Black Oak, Saw-toothed Banksia and the shrublayer often is species rich with many species that provide nectar such as banksias and Grass Trees. In the Shoalhaven there are some large stands of Spotted Gum and Red Bloodwood on the coastal plain. These species often have mass flowering and during those time the majority of the Grey-headed Flying Fox population within New South Wales may take up residence to forage on the blossom. These bats are threatened with extinction and are one of the major pollinators of the eucalypt forests. There are also some trees that are hybrids between Spotted Gum and Red Bloodwood. These appear to be preferential to the Yellow-bellied Glider for sap feeding.

In some areas of the coastal plain, where better drained sandy soils are present there may be stands of Coastal Banksia. This species is highly recommended as it flowers in winter, a period when food resources are not as abundant. In other areas stands of Black She-oak may be present. This species regenerates after disturbances such as fire, hence stands can form. This species is highly favoured by the threatened Glossy Black Cockatoo, especially in the North Nowra and St Georges Basin areas.

Table 3
Species recommended for Coastal Plain revegetation and their use by fauna

Common Name	Scientific Name	Fauna	Use
Black She-oak	<i>Allocasuarina littoralis</i>	Glossy Black Cockatoo	Seed
Heath Banksia	<i>Banksia ericifolia</i>	Honeyeaters, Antechinus, Eastern Pygmy Possum	Nectar and nesting sites
Coastal Banksia	<i>Banksia integrifolia</i>	Lorikeets, Honeyeaters, Wattlebirds, Sugar Glider	Nectar
Saw-toothed Banksia	<i>Banksia serrata</i>	Lorikeets, Honeyeaters, Wattlebirds, Sugar Glider	Nectar
Red Bloodwood	<i>Corymbia gummifera</i>	Honeyeater, Parrots, Yellow-bellied Glider and Sugar Glider	Nectar and sap
Spotted Gum	<i>Corymbia maculata</i>	Sugar Glider and birds	Nectar
Blackbutt	<i>Eucalyptus pilularis</i>	Sugar Glider, Greater Glider	Leaves. Invertebrates
Swamp Mahogany	<i>Eucalyptus robusta</i>	Honeyeater, Parrots, Yellow-bellied Glider and Sugar Glider	Nectar and sap
Scribbly Gum	<i>Eucalyptus sclerophylla</i>	Honeyeaters and Parrots	Used by Little Lorikeet and Rainbow Lorikeet
Grey Gum	<i>Eucalyptus punctata</i>	Koala, Sugar Glider, Yellow-bellied Glider, Yellow-tufted Honeyeater	Leaves, Sap and Nectar. Invertebrates

2.3 Coastal Dunes

Vegetation communities on dune systems can be highly variable, varying in composition height and density. Geologically speaking, sand dunes in the Shoalhaven are typically young sand deposits. Recently formed dunes are relatively more fertile than old dunes, so able to support species such as Bangalay, Blackbutt, Scribbly Gum and Coastal Banksia and Saw-toothed Banksia.

Coastal vegetation communities that grow on sandy soil may include a range of communities that range from heath to rainforest. The largest stand of rainforest that grows on coastal sands (littoral) south of Sydney occurs in the Shoalhaven on Comerong Island. Other stands of littoral rainforest occur on Beecroft Peninsula and Bannister Head. Over the last decade the northern portion of Seven Mile Beach National Park had been progressively become more mesic with rainforest species such as Celerywood *Polyscias elegans*, Cabbage Tree Palm *Livistona australis*, Plum Pine *Podocarpus elatus* and Flame Tree *Brachychiton acerifolius* become common in the understorey.

Due to exposure to often extreme weather events dunes are usually semi-stable. Sand abrasion and salt laden winds can determine the species able to colonise this environment. When aiming to stabilise foredunes, plants that bind or capture shifting sands and are relatively fast growing have greatest impact.

Table 4
Species recommended for Coastal dunes revegetation and their use by fauna

Common Name	Scientific Name	Fauna	Use
Coastal wattle	<i>Acacia longifolia</i> var. <i>sophorae</i>	Parrots	Seed
Heath Banksia	<i>Banksia ericifolia</i>	Honeyeaters, Antechinus, Eastern Pygmy Possum	Nectar and nesting sites
Coastal Banksia	<i>Banksia integrifolia</i>	Lorikeets, Honeyeaters, Wattlebirds, Sugar Glider	Nectar
Saw-toothed Banksia	<i>Banksia serrata</i>	Lorikeets, Honeyeaters, Wattlebirds, Sugar Glider	Nectar
Dianella	<i>Dianella congesta</i>	Butterflies – skippers and Darts	Leaves
Blackbutt	<i>Eucalyptus pilularis</i>	Sugar Glider, Greater Glider and various birds	Leaves, invertebrates
Scribbly Gum	<i>Eucalyptus sclerophylla</i>	Honeyeaters and Parrots	Used by Little Lorikeet and Rainbow Lorikeet
Teatree	<i>Leptospermum laevigatum</i>	Common Ringtail Possums	Drays
Matt Rush	<i>Lomandra longifolia</i>	Butterflies	Leaves
Seaberry saltbush	<i>Rhagodia candolleana</i>	Chequered Blue butterfly?	Leaves
Fan Flower	<i>Scaevola calendulacea</i>	Meadow Argus butterfly?	Leaves

Table 5
Species recommended for Coastal sites with moist sandy soils and their use by fauna

Common Name	Scientific Name	Fauna	Use
Red Ash	<i>Alphitonia excelsa</i>	Lewins Honeyeater	Seed
Red-fruited Olive Plum	<i>Cassine australis</i>	Satin Bowerbird	Fruit
Blueberry Ash	<i>Elaeocarpus reticulatus</i>	Satin Bowerbird	Fruit
Corkwood	<i>Endiandra sieberi</i>	Top-knot Pigeon	Fruit
Swamp Mahogany	<i>Eucalyptus robusta</i>	Honeyeater, Parrots, Yellow-bellied Glider and Sugar Glider	Nectar and sap
Small-leaved Fig	<i>Ficus obliqua</i>	Top-knot Pigeon, Satin Bowerbird	Fruit
Cabbage Tree Palm	<i>Livistona australis</i>	Top-knot Pigeon	Fruit
Bastard Rosewood	<i>Synoum glandulosum</i>	Satin Bowerbird	Fruit
Brush Cherry	<i>Syzygium paniculatum</i>	Satin Bowerbird	Fruit
Lillypilly	<i>Syzygium smithii</i>	Satin Bowerbird, Ringtail Possum	Fruit & den site

Acknowledgements

I thank Kerrie Thompson for comments on coastal dune revegetation and Les Mitchell particularly for contributions regarding sites in Kangaroo Valley and for general comments on vegetation. I also thank John and Jenny Kubale and Les Mitchell for reviewing the report. Rebecca Rudd kindly allowed her comments and images to be used in Appendix 2.

REFERENCES

- Blood, K. (2001).** Environmental weeds – a field guide for SE Australia. CRC Weed Management Systems. CH Jerram & Associates, Melbourne.
- Goldingay, R.L. 2009.** Characteristics of tree hollows used by Australian birds and bats. *Wildlife Research* 36(5) 394–409. <http://www.publish.csiro.au/paper/WR08172.htm>
- Hazelton 1993.** *Soil Landscapes of the Kiama 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.
- Common, I. F. B. and Waterhouse, D. F. 1981.** *Butterflies of Australia*. Angus and Robertson.
- Mackowski, C.M. 1986.** Characteristics of eucalypts incised for sap by the yellow-bellied glider *Petaurus australis* Shaw (Marsupialia: Petauridae), in northeastern New South Wales. *Australian Mammalogy* 11: 5-13.
- NSW Department of Primary Industries 2009.** www.agric.nsw.gov.au/noxweed/
- Shoalhaven City Council 2007.** www.shoalhaven.nsw.gov.au Grow me instead. *A guide for gardeners on the New South Wales South Coast*. Excell, Pambula.
- Thomas V., Gellie N., and Harrison T. 2000.** Forest ecosystem classification and mapping for the southern Comprehensive Regional Assessment. NSW National Parks and Wildlife Service, Queanbeyan.
- Van Dyke, S, and Strahan, R. 2008.** *The Mammals of Australia*. Third edition. Reed New Holland, Sydney.
- Young, B., Young A. and Young, R. W. 2007.** Understanding the Scenery: Morton National Park and the Coast from Nowra to Bateman's Bay. <http://lepidoptera.butterflyhouse.com.au/butter.html>

Appendix 1 Species of indigenous plant that may be used for revegetation in the Shoalhaven and their use by fauna

Species	Common Name	Use
<i>Acacia binervata</i>	Two-veined Hickory	Sap-sugar glider, seeds Wonga Pigeon
<i>Acacia decurrens</i>	Black Wattle	Leaves – Fiery Jewel Butterfly
<i>Acacia elata</i>	Cedar Wattle	Sap-sugar glider.
<i>Acacia longifolia</i> var. <i>sophorae</i>	Coastal Wattle	Seed-parrots
<i>Acacia maidenii</i>	Maidens Wattle	Sap-sugar glider, seeds Wonga Pigeon. Leaves – Tailed Emperor
<i>Acacia mearnsii</i>	Late Black Wattle	Sap-sugar glider. Leaves – Common Imperial Blue Butterfly, Fiery Jewel Butterfly
<i>Acronychia oblongifolia</i>	Common Acronychia	Fruit – Satin Bowerbird and Pied Currawong.
<i>Alectron subcinereus</i>	Native Quince	Fruit- various birds, Leaves – Eastern Flat butterfly.
<i>Allocasuarina littoralis</i>	Black She-oak	Seed - Glossy Black Cockatoo
<i>Alphitonia excelsa</i>	Red Ash	Fruit - Lewin's Honeyeater, Leaves - Fiery Jewel Butterfly
<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	Leaves - Orange Palm Dart butterfly
<i>Backhousia myrtifolia</i>	Grey Myrtle	Nesting site for birds
<i>Banksia ericifolia</i>	Heath Banksia	Nectar-birds, Antechinus nesting site-birds
<i>Banksia integrifolia</i>	Coastal Banksia	Nectar-birds and gliders
<i>Banksia serrata</i>	Serrated Banksia	Nectar-birds, seed-Yellow-tailed Black Cockatoo
<i>Banksia spinulosa</i>	Hair-pin Banksia	Nectar-birds, leaves – Double-headed Hawk Moth
<i>Brachychiton acerifolius</i>	Flame Tree	Seed eaten by Pied Currawong, leaves eaten by Tailed Emperor, White-banded Plane & Common Pencilled-blue butterflies
<i>Brachychiton populneus</i>	Kurrajong	Seed eaten by Pied Currawong, Leaves – Tailed Emperor Butterfly, Eastern Flat butterfly
<i>Breynia oblongifolia</i>	Coffee Bush	Fruit-Lewin's Honeyeater and Brown Cuckoo Dove. Leaves eaten by Large Grass Yellow butterfly
<i>Bursaria spinosa</i> var <i>spinosa</i>	Black Thorn	Nest site-Brown Gerygone
<i>Callicoma serratifolia</i>	Black Wattle	Leaves – Eastern Flat Butterfly
<i>Casuarina cunninghamiana</i>	River Oak	Seed eaten by birds
<i>Ceratopelatum gummiferum</i>	Christmas Bush	Flowers- Consimilis Blue Butterfly
<i>Cinnamomum oliveri</i>	Oliver's Sassafras	Leaves – Blue Triangle Butterfly
<i>Citronella moorei</i>	Churnwood	Fruit- various birds
<i>Claoxylon australe</i>	Brittlewood	Fruit – Brown Cuckoo Dove
<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	Fruit- various birds
<i>Coprosma quadrifida</i>	Prickly Coprosma	Leaves – Coprosma Hawk Moth
<i>Corymbia gummifera</i>	Red Bloodwood	Sap-Sugar Glider, Nectar-birds and gliders
<i>Corymbia maculata</i>	Spotted Gum	Nectar-Sugar Glider, Little Lorikeet
<i>Cryptocarya glaucescens</i>		Fruit- various birds, Leaves - Orchard Butterfly
<i>Cryptocarya microneura</i>	Murrogun	Fruit- various birds
<i>Dendrocnide excelsa</i>	Giant Stinging Tree	Fruit-Lewins Honeyeater, Catbird. Leaves eaten by Jezebel Nymph butterfly
<i>Dianella caerulea</i> + <i>spp.</i>	Blue Flax Lily	Leaves - various butterfly larvae
<i>Diospyros australis</i>	Black Plum	Fruit-Lewins Honeyeater
<i>Diospyros pentamera</i>	Myrtle Ebony	Fruit- various birds
<i>Diploglottis australis</i>	Native Tamarind	Fruit- various birds
<i>Dodonaea triquetra</i>	Common Hop Bush	Leaves - Fiery Jewel Butterfly
<i>Doryphora sassafras</i>	Sassafras	Leaves – Macleay's Swallowtail

Rehabilitating Shoalhaven Landscapes

Species	Common Name	Use
<i>Ehretia acuminata</i>	Koda	Fruit-Lewins Honeyeater, Leaves – Hairy Lineblue Butterfly
<i>Elaeocarpus kirtonii</i>	Pigeonberry Ash	Fruit- various birds
<i>Elaeocarpus reticulatus</i>	Blue-berry Ash	Fruit- various birds
<i>Elaeodendron australe</i>	Red-fruited Olive Plum	Fruit- various birds
<i>Endiandra sieberi</i>	Corkwood	Fruit- Top-knot Pigeon, Leaves – Eastern Flat butterfly
<i>Eucalyptus "botrysaligna" ms</i>	Illawarra Blue Gum	Den sites - Greater Glider
<i>Eucalyptus elata</i>	River Peppermint	Nectar-Sugar Glider and birds
<i>Eucalyptus fastigata</i>	Brown Barrel	Leaves/den-Greater Glider
<i>Eucalyptus pilularis</i>	Black Butt	Leaves-Greater Glider, nectar-birds including Little Lorikeet.
<i>Eucalyptus punctata</i>	Grey Gum	Leaves-Koala, sap- Yellow-bellied Glider, Sugar Glider, Feathertail Glider and birds
<i>Eucalyptus robusta</i>	Swamp Mahogany	Leaves-Koala, Nectar-honeyeaters parrots and gliders
<i>Eucalyptus sclerophylla</i>	Scribbly Gum	Nectar-honeyeaters and parrots
<i>Eucalyptus tereticornis</i>	Forest Red Gum	Leaves – Koala, nectar-Sugar Glider and Feathertail Glider
<i>Eucalyptus paniculata</i>	Grey Ironbark	Flowers-nectar for birds, Sugar Glider
<i>Eucalyptus quadrangulata</i>	Coastal White-topped Box	Flowers-nectar for birds, Sugar Glider
<i>Eupomatia laurina</i>	Bolwarra	King Parrots
<i>Exocarpos cupressiformis</i>	Cherry Ballart	Leaves – Wood White Butterfly, Fiery Jewel Butterfly
<i>Ficus coronata</i>	Sandpaper Fig	Fruit – various birds
<i>Ficus macrophylla</i>	Morton Bay Fig	Fruit-Grey-headed Flying Fox, Top-knot Pigeon and other birds
<i>Ficus obliqua</i>	Small-leaved Fig	Fruit- birds, Leaves - Australian Crow Butterfly
<i>Ficus superba</i>	Deciduous Fig	Fruit-Grey-headed Flying Fox, birds.
<i>Gahnia clarkei</i>	Sawsedge	
<i>Gahnia sieberana</i>	Sawsedge	Leaves – Sword-grass Brown Butterfly, Flame Skipper
<i>Glochidion ferdinandi var ferdinandi</i>	Cheese Tree	Fruit-Lewins Honeyeater
<i>Hibbertia scandens</i>	Golden Guinea Flower	Leaves – Impatiens Hawk Moth
<i>Imperata cylindrica var major</i>	Blady Grass	Leaves - various butterfly larvae – Greenish Darter
<i>Leptospermum laevigatum</i>	Coastal Teatree	Branches-Ringtail Possum drays
<i>Leptospermum polygalifolium</i>	Lemon-scented Tea-tree	Branches-Ringtail Possum drays
<i>Leucopogon lanceolatus var. lanceolatus</i>	Lace Beard-heath	Nectar-Eastern Spinebill
<i>Litsea reticulata</i>	Bolly Gum	Leaves - Blue Triangle Butterfly
<i>Livistona australis</i>	Cabbage Tree Palm	Fruit - Top-knot Pigeon, Pied Currawong. Wombats eat young plants starchy pith.
<i>Lomandra longifolia</i>	Mat Rush	Leaves - various butterfly larvae
<i>Macrozamia communis</i>	Burrawang	Seed - Bush Rat
<i>Melia azedarach</i>	White Cedar	Fruit-King Parrots
<i>Melicope micrococca</i>	White Euodia	Leaves - Orchard Butterfly
<i>Notelaea longifolia</i>	Large Mock-olive	Leaves – Eastern Flat butterfly
<i>Notelaea venosa</i>	Veined Mock Olive	Fruit – various birds
<i>Omalanthus nutans</i>	Bleeding Heart	Seed-Brown Cuckoo Dove
<i>Pennantia cunninghamii</i>	Brown Beech	Fruit-Top-knot Pigeon
<i>Pittosporum revolutum</i>	Rough-fruited Pittosporum	Fruit - Lewins Honeyeater

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Species	Common Name	Use
<i>Pittosporum undulatum</i>	Sweet Pittosporum	Fruit - Lewins Honeyeater
<i>Planchonella australis</i>	Black Apple	Fruit - Grey-headed Flying Fox
<i>Poa sp.</i>	Native Grass	Leaves – various butterflies including Dispar Skipper, Klug's Xenica and Eastern-ringed Xenica, White Grasschat, Banks Brown
<i>Podocarpus elatus</i>	Celery Wood	Leaves – Eastern Flat butterfly
<i>Polyscias murrayi</i>	Pencil Cedar	Fruit - Lewins Honeyeater, Satin Bowerbird
<i>Polyscias elegans</i>	Celery Wood	Fruit - Lewins Honeyeater, Satin Bowerbird, Flowers – Consimilis Blue Butterfly
<i>Rhagodia candolleana</i>	Seaberry saltbush	Leaves – Chequered Blue butterfly?
<i>Scaevola calendulacea</i>	Fan Flower	Leaves – Meadow Argus butterfly?
<i>Solanum aviculare</i>	Kangaroo Apple	Fruit - Lewins Honeyeater, Satin Bowerbird
<i>Syncarpia glomulifera</i>	Turpentine	Grey Goshawk nest in mistletoes
<i>Syzygium australe</i>	Brush Cherry	Fruit – various birds
<i>Syzygium smithii</i>	Lilly Pilly	Fruit – various birds, nest site for Pigeons
<i>Tasmannia insipida</i>	Native Pepper	Leaves – possibly Macleay's Swallowtail
<i>Themeda australis</i>	Kangaroo Grass	Leaves – Wombat and Swamp Wallaby, Eastern Ringed Xenica, Klug's Xenica Butterfly
<i>Toona ciliata</i>	Red Cedar	Growing tips – Red Cedar Tip Moth
<i>Trema tomentosa var viridis</i>	Native Peach	Fruit - Lewins Honeyeater, Brown Cuckoo Dove.
<i>Zieria smithii</i>	Sandfly Zieria	Leaves - Orchard Butterfly

Appendix 2 Priority weed species and control mechanisms

Cape Ivy (*Delairea odorata*)



Legal status: Not declared in the Shoalhaven.

Distribution: Occurs in previously disturbed areas on high nutrient soils.

Priority: High - key threatening process.

Feasibility of control: High with repeated effort.

Control strategy: Hand removal and chemical control. Use splatter gun for large infestations.

Problem

Able to smother understorey shrubs and groundcover with its dense growth.

Likely to be toxic to both people and animals (Blood 2001).

Invades wet sclerophyll forest-rainforest, riparian vegetation and around forest margins.

Specifications for control

Hand-pull or dig young plants, or cut through stems and leave upper parts to die off in place.

Spray regrowth, adding a surfactant to improve penetration of the waxy leaves. Use 360g/L Glyphosate Bioactive at the rate of 200ml per 15 litres of water.

When removing any species of vines, be careful about pulling them down, as this can damage the supporting plant. Generally they are better left to die off and break up in place, unless this would involve leaving the seed in the canopy.

Timing

Prior to the formation of seed (mainly spring).

Lantana (*Lantana camara*)

	<p>Legal status: W4 and W5 declared noxious in the Shoalhaven</p> <p>Distribution: Occurs along the edge of the rainforest and in as a shrub layer in Eucalyptus forests.</p> <p>Priority: Relatively easy to control using a splatter gun, cut and paint or hand pulling but requires repeated control activities. Control is unlikely in the short term.</p> <p>Control strategy: Use splatter gun for large infestations. Target monocultures on forest edge then continue from dead edge and finally remove by spot spraying or by hand. Gradually work towards core infestations.</p>
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Problem

Lantana is a Weed of National Significance.

Lantana casts a dense shade, which suppresses other plants. It can colonise disturbed wetter eucalypt forest and rainforest, and climb to a height of 10 metres or so in the remaining native trees. Lantana is poisonous to stock and humans. When killed by the application of Glyphosate then other weeds such a Cobblers Peg can colonise the site and hence follow up action is required. Cobblers Peg will die out once a canopy is established.

Specifications for control

Seedlings and smaller plants, particularly the straggly specimens, which grow in deep shade within forest, can be hand-pulled or dug out. Pulled plants are to be stockpiled. In summer plants can regrow from a small section of stem that lies on the ground. Large infestations, especially on steeper slopes can be sprayed using a splatter gun. Follow-up action of either direct planting of further spot spraying may be required.

Infestations within creeks are to be controlled using the cut and paint technique (Glyphosate Bioactive) to avoid possible contact of chemicals with frogs. Away from the creek line, spray dense infestations using a splatter gun. For all control works, suckers are likely to arise from the roots and may need follow-up treatment. Seek advice from the Shoalhaven Noxious Weed Officer.

Timing

Timing is dependent on herbicide used (see above) Hand removal all year. The use of herbicide is more effective in the warmer months.

Moth Plant (*Araujia sericifera*)



Legal status: Not declared in the Shoalhaven.

Distribution: Plants in disturbed areas with high nutrient soils, especially tall open forest and disturbed rainforest.

Priority: Medium - key threatening process.

Feasibility of control: Eradication is achievable.

Control strategy: Hand-remove small plants, cut and paint larger vines, remove fruit. Use splatter gun for large infestations.

Problem

Moth Vine is poisonous to dogs, poultry and possibly cattle and the sap can cause skin and eye irritations (Blood 2001). Moth Vine invades damp sclerophyll forest, coastal and riparian vegetation and forest margins. It can tolerate full sun, deep shade, drought and salt.

Moth Vine climbs over shrubs and small trees, smothering and breaking them down. It also spreads over the ground, smothering native groundcover plants. Moth Vine can spread great distances from the parent plants as the seeds are carried by the wind.

Specifications for control

Young plants are easily hand-pulled if growing in loose soil, or can be dug out. Large plants can be treated by the scrape-and-paint method with Glyphosate 360g/L. Wear gloves when handling this plant and avoid getting the sap in mouth and eyes.

When removing the species, be careful about pulling them down, as this can damage the supporting plant. Generally they are better left to die off and break up in place, unless this would involve leaving a lot of seed or fruit in the canopy. Try to control vines before seed has formed to avoid this problem, but if fruits are present (even if they are still green), they should be collected and destroyed by burning or deep burial.

Timing

Spraying operations should occur prior to fruit set. Hand removal all year but easy to locate in autumn when plants are in fruit.

Large-leaved Privet (*Ligustrum lucidum*)



Legal status: W4 in the Shoalhaven
Distribution: Heavy infestation in the hinterland of Berry and Kangaroo Valley.
Priority: high
Feasibility of control: Contain infestation to current area. Control will require repeated effort over several years.
Control strategy: isolated plants are to be treated. Follow up control will be required.

Problem

Large-leaved Privet is declared noxious in the Shoalhaven Local Government area, in category W4. Annual seed production is large and birds (Lewins Honeyeater and Satin Bowerbird), foxes and bats disperse the seed.

Large-leaved Privet is an aggressive invader of disturbed land, particularly disturbed remnant bushland. Areas receiving more water or nutrients than before European settlement, particularly if some or all of the original vegetation has been removed, are particularly vulnerable to invasion by privet. Once established, Large-leaved Privet can replace native shrub and tree species and even in areas of native canopy it can form dense regrowth in the shrub layer. This is one of the hardest weeds to control as the seed is spread by birds.

Specifications for control

Removal of large specimens of Large-leaved Privet has to be done with care as the more disturbance that occurs during the removal of privet, the more likely that seedlings will grow in the area that receives more sunlight.

Small seedlings (i.e. less than 3 cm stem diameter) can be pulled out by hand. However, the root system can be tenacious and must be carefully followed through the soil and removed. Root segments of privet buried to a depth of more than five times their own diameter can re-establish above-ground shoots and regrow. Uprooted plants should therefore be placed upside down with their roots in the air to dry out. Larger plants need to have every stem cut and painted with Glyphosate Bioactive 360 g/L. With all treatments there will be a need to return to site at three-monthly intervals to remove new seedlings.

Timing

Anytime but preferably prior to fruit formation (winter or early spring).

Small-leaved Privet (*Ligustrum sinense*)



Legal status: W4 in the Shoalhaven Distribution: Heavy infestation in the in the hinterland of Berry and Kangaroo Valley.

Priority: high

Feasibility of control: Control will require repeated effort over several years.

Control strategy: Isolated plants are to be treated. Follow up control will be required.

Problem

Small-leaved Privet is declared noxious in the Shoalhaven Local Government area, in category W4. Annual seed production is enormous and birds, foxes and bats can carry the seed well into the bush. Small-leaved Privet is an aggressive invader of disturbed land, particularly disturbed remnant bushland. Areas receiving more water or nutrients than before European settlement, particularly if some or all of the original vegetation has been removed, are particularly vulnerable to invasion by privet. Once established, it can replace native shrub and tree species and form monocultures.

Specifications for control

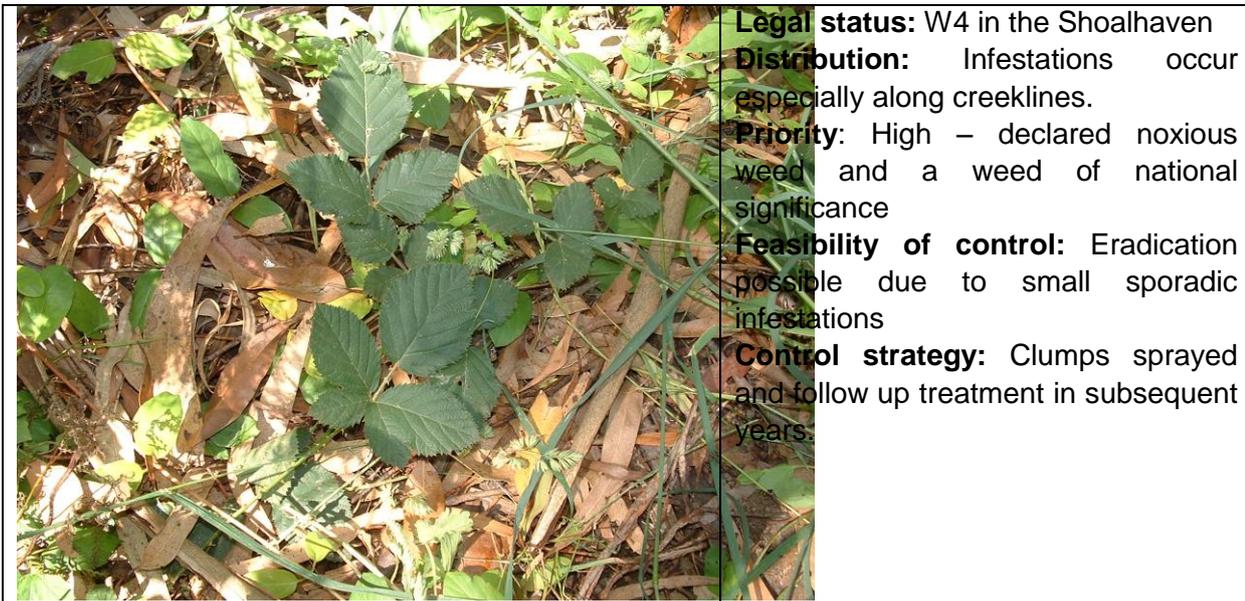
Removal of large specimens of Small-leaved Privet has to be done with care as the more disturbance that occurs during the removal of privet, the more likely that seedlings will grow in the area that receives more sunlight.

Small seedlings (i.e. less than 3 cm stem diameter) can be pulled out by hand. However, the root system can be tenacious and must be carefully followed through the soil and removed. Root segments of privet buried to a depth of more than five times their own diameter can re-establish above-ground shoots and regrow. Uprooted plants should therefore be placed upside down with their roots in the air to dry out. Larger plants need to have every stem cut and painted with Glyphosate Bioactive 360 g/L. With all treatments there will be a need to return to site at three-monthly intervals to remove new seedlings.

Timing

Anytime but preferably prior to fruit formation (winter or early spring).

Blackberry (*Rubus fruticosus* aggregate)



Problem

Blackberry is one of the most significant weeds in temperate Australia because of its invasiveness in both natural and agricultural ecosystems. Blackberry thickets also provide harbour for pest animals such as rabbits and foxes, which further impact on the native flora and fauna. Dead plants and large infestations may become a fire hazard, which may impact the area through fire regime changes.

Specifications for control

Use of foliar herbicides (splatter gun) is recommended as results are usually superior than mechanical removal. However, if use of herbicides is not favoured, small plants may be hand-pulled; grubbed out with a mattock (or similar); or canes can be cut and painted with Glyphosate 360g/L Apply when bushes are actively growing. It is essential to monitor and treat regrowth.

Timing

Apply herbicide when bushes are actively growing, preferably at the commencement of flowering (October to January). Spray operations should be completed prior to the formation of fruit. For further information on control techniques contact Shoalhaven City Council's Noxious Weed Officer.

Mistflower (*Ageratina riparia*) and Crofton Weed (*Ageratina adenophora*)

	<p>Legal status: W4 in the Shoalhaven.</p> <p>Distribution: Colonises riparian areas and moist soils.</p> <p>Priority: Medium</p> <p>Feasibility of control: Prevent further spread and over time reduce level of infestation.</p> <p>Control strategy: Hand-removal and herbicide (splatter gun) use where no waterway will be contaminated.</p>
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Problem

Mistflower and Crofton weed are declared noxious in category W4 (must be continuously suppressed and destroyed) in the Shoalhaven. Plants can form dense stands in moist sites, choking out native vegetation along creek lines. Mistflower and Crofton weed have been shown to be toxic to some stock in laboratory trials—Crofton weed has been responsible for the deaths of horses in the Shoalhaven (Galbraith pers.comm.).

The tiny black or brown seeds have a parachute of fine hairs and are spread great distances by water and wind. Therefore, control of the plant requires a cooperative approach from all land managers upstream of infestations. This is hard to achieve as mistflower is not seen as a priority by some land owners.

Specifications for control

Prior to 2011 the general control method was to hand pull or dig out plants or spot-spray using a non-selective or selective woody weed herbicide such as Glyphosate Biactive, 360g/L at 1:100 (no surfactant to be used). Or 480g/l for Spatter Gun. Spray actively-growing bushes with full foliage. However, in 2011 CSIRO released the Mistflower fungus *Entyloma argentineae* (http://www.landcareresearch.co.nz/__data/assets/pdf_file/0013/20551/Mist_Flower_Fungus.pdf) in upper Kangaroo Valley as a biological control. The results have been spectacular and large areas have been killed and native plants have recolonised the areas (L. Mitchell pers. comm.). The fungus has spread to the Cambewarra area with similar results. It is hoped that another species specific fungus can be used to control Crofton weed.

Timing

Introduce Mistflower fungus during summer. Spraying operations should occur prior to late winter and spring.