

Section Three

Managing bitou bush in different habitats



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Habitats invaded by bitou bush

Bitou bush invades a range of native habitats. Habitat type will influence the control options available, as some methods may have negative impacts if used in some environments.

In all native habitats, control and management must:

- Minimise damage to desirable vegetation,
- Minimise soil disturbance,
- Encourage native plant regeneration, and
- Treat bitou bush at a rate that allows for natural regeneration or restoration processes to occur.

This section describes the major habitats invaded by bitou bush, along with corresponding management considerations. This information is best used in conjunction with the control methods outlined in Section 4 and restoration options in Section 5.

Coastal sand dunes

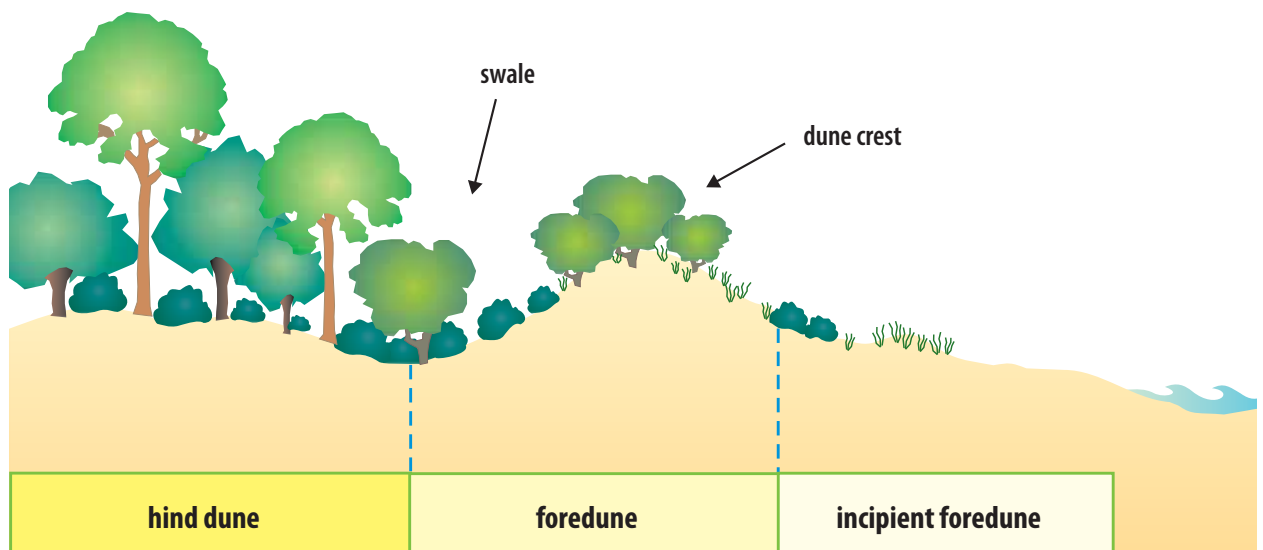
Coastal sand dunes run parallel to the shoreline as a series of crests and swales (parallel depressions) above the high-tide mark, often stabilised by vegetation. There is a succession of vegetation from the incipient foredune into the hind dune woodland areas, which are protected from salt spray and wind

erosion by the preceding vegetation. While native plants are generally specific to one part of the dune system (e.g. spinifex grass is restricted to foredunes, banksias mostly in hind dune woodlands etc.), bitou bush is able to invade across the dune landscape.

Mineral mining in sand dunes drastically altered the original structure of many coastal dunes. *“In many areas, the natural dune structure has been lost; there is no incipient foredune left, no dune crest, no hind dune – there is just sand.”* – Peter Gollan, Hallidays Point Landcare.

Foredunes

The foredune is the first sand dune at the back of the beach beyond the high-tide mark. Transient, windblown sand may accumulate immediately seaward of the established foredune and form a small bench or platform (incipient foredune) which is highly susceptible to erosion by wind and wave action. The vegetation community on the foredune of strandline plants leading into woody shrubs is highly dynamic and is affected by coastal changes.



Typical coastal dune profile from incipient foredune through to hind dune. Figure replicated with permission from *Coastal Dune Management: A manual of coastal dune management and rehabilitation techniques* (NSW DLWC 2001)

The dune crest (the peak or ridgeline between two parallel low lying areas of sand) may not be very high in elevation (i.e. <1 m), although it may reach up to 6 m. Dune crests protect hind dunes and the associated vegetation from wind erosion and salt spray. Thus the height of the crest may influence the height of the vegetation in the swale or hind dune.

Hind dunes

The hind dune consists of a series of ridges and swales inland behind the most seaward dune. Generally, the hind dune area has high native species richness, compared with foredune areas. Hind dune vegetation communities include banksia woodlands, casuarina woodlands, littoral rainforests and coastal heaths.

Hummocks

Bitou bush plants that colonise dunes can lead to the formation of 'hummocks'. Hummocks are isolated mounds of sand held together by bitou bush roots which form when sand is trapped around the base of the bitou bush plant. The ability to produce roots at the nodes on decumbent stems enables bitou bush to grow over the accumulated sand, enhancing the mounded growth form.

As the hummocks start to form, wind is channelled through gaps between the hummocks, causing erosion. This in turn increases the height of the hummocks. Often the original native species have long since died out of the seed bank, or been eroded away and do not recolonise the exposed sand.



Jeff Thomas

Coastal heath

Heath is a low growing vegetation community, averaging a height of 50 cm (with emergents to 2 m), often in exposed areas or on shallow soils. There are several coastal heath communities that are invaded by bitou bush including headland heath (pictured below). Heath species commonly mix with littoral rainforest and *Themeda* grasslands forming 'ecotonal' alliances or mixed flora habitats.



Jackie Miles

Coastal scrub

Coastal scrub is a closed low forest community with a canopy height to 4 m that often grows on sedimentary substrates, particularly on hill slopes, or on coastal sand dunes.



Ruth Armstrong

Littoral rainforest

Littoral rainforest is a unique community of low rainforest, heavily influenced by coastal forces. Littoral rainforest typically occurs within close proximity to the beach, in many instances right behind the foredune where sandy soil is highly visible, or on headlands. Plants that grow on the windward side protect the interior of the forest from salt spray and excessive winds.



Shane Ruming

Woodlands

Coastal woodlands are plant communities dominated by tree species, often *Banksia*, *Eucalyptus* or *Casuarina* species with a shrub understorey, which occur on deep sandy soils in hind dunes or on headlands.



Deb Stevenson

Headlands and steep slopes

Coastal headlands are rocky, exposed areas usually with steep cliffs that drop to the ocean. Tops of headlands are often characterised by open grasslands, heathlands or shrublands. The steeply sloping areas are generally erosion-prone and difficult to access.



Mark Hamilton



Riparian areas

Riparian habitats typically occur as a strip on either side of a watercourse or around a body of water (e.g. lake or wetland). These areas include swale lagoons that run parallel to the beach and empty onto the beach through small creeks. The plant species that occur here have a higher water dependency or tolerance than those that occur outside the riparian zones. Tidal or estuarine areas (influenced by saltwater movement) support plant species that are salt tolerant.



Shane Ruming



Management considerations within specific habitats

Habitat	Considerations for management (to be used with Sections 4 and 5)
<p>Sand dunes (foredune, hind dunes, dune crests and swales)</p>  <p>Glen Saunders</p>  <p>Marion Winkler</p>  <p>Hillary Cherry</p>	<p>Sand is held in place by vegetation (including bitou bush) in these habitats. Treating or removing bitou bush from sand dunes can therefore lead to erosion via wind or wave action. To avoid major erosion events during or following bitou bush control, you can:</p> <ul style="list-style-type: none"> • Plan to remove bitou bush in stages to minimise erosion. Various patterns of staged removal have been found effective, depending on the character of each particular location. For example, treat a strip along the dunes, leaving a parallel, untreated strip adjacent to it to act as a buffer against wind erosion. This works best if run parallel to the shoreline. The rate and stages of bitou bush removal should depend on the rate of native plant regeneration. Alternatively, clear bitou bush in a mosaic or ‘maze’ fashion. • Revegetate (where appropriate) simultaneously with bitou bush removal to maximise dune stability, or even begin revegetation prior to weed control, particularly if dunes have been degraded from sand mining and/or long-term bitou bush invasion. • Erosion control structures or restricted access may be required, during or after bitou bush control, particularly on degraded dunes. <p>On the top of dune crests, bitou bush can protect the swale and hind dune vegetation from wind shear and salt spray, so removing it may have negative impacts on native plants in those areas. If removing bitou bush from the dune crest, either:</p> <ul style="list-style-type: none"> • Work in combination with native regeneration or revegetation activities on both the front and back of the dune simultaneously, with particular focus on the windward side of crest to enhance the vegetation barrier protecting swale/hind dune vegetation, or • Start removing bitou bush from the western (landward) edge of the densest infestations and work in stages eastwards towards the beach, always leaving standing bitou bush ahead as a windbreak, until natives have established. <p>When using herbicides on sand dunes you should:</p> <ul style="list-style-type: none"> • Be aware that sand is extremely porous and there is minimal organic matter within the dune profile. This may allow higher levels of herbicide to leach through the soil profile than in other habitats. Carefully consider the types of herbicide, application methods, and intervals between each application. • As sand dunes are highly mobile and access through dense infestation may be difficult, ensure you use equipment appropriate to the habitat. For example, a vehicle carrying a spray rig can cause less damage if it has wide-tread tyres (see Section 4). <p>Hummocks Control of bitou bush plants that have formed hummocks will require a staged approach to avoid excessive erosion. This is likely to include extensive revegetation and remedial work depending on the size and shape of the hummocks. See Section 5 and case study – <i>Staged removal of bitou bush to protect Aboriginal sites and conserve biodiversity on the Yaccaba Peninsula</i> on page 90.</p>
<p>Coastal heath and scrub</p>  <p>Paul Downey</p>	<p>Bitou bush invasions in heath and coastal scrub tend to form thickets at the same height as surrounding vegetation. When treating bitou bush in heath or coastal scrub:</p> <ul style="list-style-type: none"> • Use control methods that minimise the impact on native species and maximise native plant regeneration. • Ensure control methods will not contribute to erosion, particularly where invasions occur on headlands.

Habitat	Considerations for management (to be used with Sections 4 and 5)
<p>Littoral rainforests</p>  <p>Stephen Booth</p>	<p>In rainforests, bitou bush can climb up into the canopy in dense thickets, supported by surrounding trees. Where bitou bush has invaded the windward component of this community, it may be protecting the rest of the community from salt spray and wind shear. When removing bitou bush from rainforests:</p> <ul style="list-style-type: none"> • Stage the treatment of bitou bush on the windward edge to ensure a robust barrier remains to protect the rest of the community from salt spray and wind shear. • Within the rainforest, remove bitou bush as quickly as possible to capitalise on the rapid regeneration potential of rainforest species. See case study <i>Replacing bitou bush the natural way</i> on page 92.
<p>Woodlands</p>  <p>Paul Downey</p>	<p>Woodlands support both shrub and climber growth forms of bitou bush. When removing bitou bush from the windward sections of coastal woodlands:</p> <ul style="list-style-type: none"> • Stage bitou bush removal to allow for native plants to replace this windward edge. This will provide protection to the woodland community from salt spray and wind shear as well as protect native species at risk.
<p>Headlands and steep slopes (including sea cliffs)</p>  <p>Glen Saunders</p>	<p>Headlands and steep slopes are commonly erosion-prone. Water erosion can occur after the removal of bitou bush particularly on sloping loam and clay soils, such as headlands. When treating bitou bush on headlands and steep slopes:</p> <ul style="list-style-type: none"> • Always consider occupational health and safety guidelines during the planning stage. People with appropriate training and experience using safety equipment such as harnesses and ropes may be required on cliff faces, steep slopes and inaccessible areas. • Do not leave large areas of bare ground. Use control methods that limit soil disturbance, especially on slopes. Manual control (handweeding) should only be used on small infestations when the soil is moist to minimise further soil disturbance. Chemical control methods are the most suitable because roots remain in the ground and soil is not disturbed. • Take into account drainage patterns, and always work from the top of a slope to the bottom to avoid erosion and spreading of seed down slopes. • Aerial spraying may be an option for inaccessible headland locations (see Section 4 on control methods).
<p>Riparian areas (including tidal rivers and estuaries)</p>  <p>Marion Winkler</p>	<p>Bitou bush can grow in riparian areas including river edges, floodplains, edges of inter-dunal 'swale' lakes, outer edges of saltmarshes and mangroves. It does not grow in permanently inundated areas. When controlling bitou bush near water bodies:</p> <ul style="list-style-type: none"> • Use control methods that minimise bank erosion. Treat small areas one at a time to allow native plants to regenerate and stabilise the bank. In addition, try to prevent large amounts of plant material falling into pooled water, as large inputs of organic matter can impact on aquatic organisms by reducing oxygen levels. For these reasons, mechanical control such as slashing should be avoided in riparian areas. • Remove plants from the edge of watercourses to prevent seeds moving downstream. <p>Some herbicides contain surfactants that are toxic to aquatic organisms such as frogs. When working in riparian or wetland areas use only herbicides registered for use in aquatic situations and follow all label directions. See Section 4 for information on herbicides.</p>


Management considerations across all habitats

There are a range of broader management considerations that apply to **all** habitats and which should be taken into account when planning a bitou bush control program.

Management issue	Considerations for management (to be used with Sections 4 and 5)
<p>Infestation density</p> <div data-bbox="236 763 256 864" style="writing-mode: vertical-rl; transform: rotate(180deg);">Marion Winkler</div>  <p><i>Outlier or small infestations</i></p> <div data-bbox="236 1160 256 1261" style="writing-mode: vertical-rl; transform: rotate(180deg);">Stephen Booth</div>  <p><i>Heavy infestations – monoculture</i></p>	<p>Outlier, small or isolated infestations</p> <p>Outlier infestations may be individual plants, or small pockets of a few plants away from a concentration or core infestation of bitou bush. These plants should be given a high priority for control and be eradicated as quickly as possible to limit further spread.</p> <p>Also:</p> <ul style="list-style-type: none"> • All outlier infestations should be mapped and monitored post-control to ensure areas are maintained bitou bush free for at least 10 years and future recruitment is prevented. • It is more cost efficient to manage outlier or small infestations before they expand. Also it is advantageous for native species as it reduces competition. Note: Locating (accessing) and controlling such plants may pose a range of management challenges (e.g. safety). <p>Heavy infestations</p> <p>Bitou bush may form monocultures or discrete (isolated) heavy infestations. These infestations can result in adverse effects such as erosion (see hummocks, page 25), soil slippage or fire in decaying stands of bitou bush.</p> <p>When controlling heavy infestations:</p> <ul style="list-style-type: none"> • Use a staged approach with intensive follow-up over a long period as well as some type of restoration. • Only treat areas where you can commit to follow-up works (i.e. ensure the area for follow-up control is manageable). Avoid the temptation to treat large areas without follow-up as it will rarely achieve long-term success, rather it can increase the problem and put native plants under additional stress by depleting seed banks. • Monocultures of bitou bush may be difficult to treat due to the density of plants. Some groups have found removing bitou bush in a strip or mosaic pattern, either by hand or machinery, to be effective. Always leave some bitou bush standing in the early stages, and preferably on the seaward side for protection against wind and salt spray erosion.
<p>Unstable soils</p> <div data-bbox="236 1832 256 1973" style="writing-mode: vertical-rl; transform: rotate(180deg);">Scotts Head Dunecare</div>  <p><i>Sloping land and exposed soil are particularly susceptible to erosion</i></p>	<p>Unstable soils (on sand dunes, cliff faces, exposed slopes, headlands and riparian areas) are all particularly susceptible to wind and water erosion or land slips when vegetation, including bitou bush, is absent or removed. Erosion management must be considered during planning, implementation and restoration of habitats containing bitou bush on unstable soils.</p> <p>Where erosion is a risk:</p> <ul style="list-style-type: none"> • Use control techniques that minimise soil disturbance, such as those which kill the bitou bush plants but leave the roots in the soil. Bitou bush canes left standing <i>in situ</i> after control protect soil to some extent from wind erosion. • Stage your treatment of bitou bush according to the rate of native revegetation or natural regeneration so that some form of stabilisation remains constant. • Use specific methods to limit erosion (e.g. eco-logs – see Section 5).

Management issue	Considerations for management (to be used with Sections 4 and 5)
<p>Native plant species at threat from bitou bush invasions</p>  <p>Mark Hamilton Tanja Lenz</p> <p>Some of the native species at risk from bitou bush in New South Wales include <i>Cordyline congesta</i> and <i>Thysanotus juncifolius</i></p>	<p>The <i>NSW Bitou Bush Threat Abatement Plan</i> (Bitou TAP) identifies 157 plant species, three threatened plant populations and 24 ecological communities at risk from bitou bush invasions and a process for protecting them through bitou bush control. If you have one of these species, populations or ecological communities present at your site:</p> <ul style="list-style-type: none"> • Check the Bitou TAP website (www.environment.nsw.gov.au/bitoutap) or contact the Bitou TAP coordinator (bitou.tap@environment.nsw.gov.au) for further information on managing your site. If you don't know whether or not you do, the <i>Native Plant Species at Risk from Bitou Bush Invasion</i> field guide will be of assistance (Hamilton <i>et al.</i> 2008). The field guide shows photographs and gives a description of each species at risk (see page 10). <p>In all states in Australia:</p> <ul style="list-style-type: none"> • Certain activities are regulated around listed threatened species and communities under the threatened species legislation in your state. Use of herbicide around threatened species, for example, is prohibited without an appropriate licence. • If you are in New South Wales and have completed an approved Bitou TAP site management plan, you will be issued with a scientific licence to work in areas where threatened species are present. • For more information on licences and threatened species, contact the threatened species authority in your state. See Section 8 for further details.
<p>Native (and alien) animals</p>  <p>Glen Saunders Jeff Thomas</p>	<p>Bitou bush may pose a threat to a number of native animals, although the exact nature of that impact is not fully understood. Bitou bush also provides benefits (e.g. shelter, nesting sites or food) to native and alien animals. It may not be immediately apparent how birds, mammals or reptiles are utilising the habitat provided by bitou bush, but care should be taken to avoid harming the fauna that is living on your site.</p> <p>In all situations:</p> <ul style="list-style-type: none"> • Assess your site for native (and alien) animals before control. A staged approach may be required for habitat or food preservation. Also see Section 2.
<p>Depleted native seed bank</p>  <p>Glen Saunders</p> <p>Long-term disturbance can leave sites species poor</p>	<p>Bitou bush invasions can deplete native seed banks through suppression of germination and loss of seed bank viability over time, which therefore hampers natural regeneration. Degradation of habitats via sand mining, or hummock formation and sand blowouts, can also drastically alter the seed bank. In response to a depleted native seed bank:</p> <ul style="list-style-type: none"> • Assess the potential resilience of the seed bank and allow opportunities for natural germination before you consider planting. Some native species may not regenerate, depending on the ecosystem you are managing, however responsive native seed banks only become evident as plants start to emerge. Allow time for vegetation to naturally recruit after control before other methods of revegetation are applied. • See Section 5 and case study <i>Replacing bitou bush the natural way</i> (see page 92).
<p>Culturally significant sites</p>  <p>Hilary Cherry</p> <p>Cultural heritage includes historic buildings such as lighthouses</p>	<p>Sites of significant indigenous or non-indigenous (i.e. European) heritage may occur where bitou bush grows, as coastal areas hold great significance to both indigenous and non-indigenous Australians. Places of significance may include sacred sites, burial sites, middens, rock art or other sites that bear particular significance to historical events (e.g. heritage listed buildings). It is important to:</p> <ul style="list-style-type: none"> • Identify cultural heritage sites in your planning stage (see Section 2) and develop your control program accordingly. • Ask first before you begin any control work around known, or suspected cultural heritage sites – Aboriginal heritage sites will have different management priorities depending on site specifics and the desires of the local community. • If a cultural heritage site is discovered while undertaking control, contact the relevant authority, for example the local council or Aboriginal community in your area.

Managing other weeds: an holistic approach

 **Other weed species either co-occur with bitou bush or invade following bitou bush control, so it is essential to develop your bitou bush control strategy to encompass these other weeds.**

Many weeds are likely to pose a similar threat to native species and in some instances are more difficult to control (e.g. glory lily) than bitou bush. Thus, knowledge of these other weeds (e.g. their identity, ecology and density at your site), and how to control them is essential when developing your bitou bush program.

A small list of the major weeds (by region) that are known to co-occur with bitou bush is provided to help you plan for their concurrent management (see page 30).

Recognition of such weeds and their likely effect on your management program will provide valuable foresight in gauging future resource commitments and ensuring appropriate measures are put in place to control them. Three of the major weeds that invade after bitou bush control, all of which are more difficult to remove than bitou bush, are profiled below and on page 30. Consult your local weeds officer for advice on controlling these species.

Glory lily (flame lily)

Glory lily (*Gloriosa superba*), Liliaceae, is an herbaceous annual climber with perennial underground tubers and red and yellow flowers. The plant's green fruit resembles a small choko and contains up to 180 bright red, fleshy seeds, highly attractive to birds. Glory lily may form dense understorey carpets in coastal dune systems, competing strongly with native flora. It reproduces by division of the underground tubers or from seed, which may remain dormant for 6–9 months. Glory lily aggressively colonises bare soil after bitou bush control and has been recorded in densities of up to 70 stems per m². Glory lily is extremely difficult to control.



Andrew Storrie, NSW DPI

Lantana

Lantana (*Lantana camara*), Verbenaceae, is a sprawling, thicket-forming perennial shrub to 5 m high or climbing shrub to 15 m high. It produces black fleshy fruits and is spread mainly by bird-dispersed seed. Once established, plants out-compete native seedlings and can smother vegetation. Lantana poses a significant threat to native species and may be more difficult to control than bitou bush.



Pete Turner

SECTION 3: Managing bitou bush in different habitats

Ground (basket) asparagus

Ground asparagus (*Asparagus aethiopicus*), Asparagaceae, is a multi-stemmed, bushy, prostrate, perennial herb that forms a thick mat of fibrous roots spreading from a central corm. It grows particularly well in shaded areas and in low fertility, shallow, sandy soils, and is spread by bird-dispersed seeds. In established colonies, the mass of above ground foliage, together with thick mats of underground corms and roots, can suppress growth of native species. Ground asparagus is very difficult to control.



Paul Downey

Strategic practices to prevent other weeds from replacing bitou bush

Hastings Bush Regeneration Services teams on the New South Wales Mid-North Coast treat 'hard to manage' weeds first, before treating bitou bush. This allows time for the seed bank of 'hard to manage' weeds to germinate and be partially reduced before tackling the infestation a second time. Bitou bush is gradually removed in the second phase after the difficult weeds have been initially controlled.

Major weeds occurring with bitou bush from SE Queensland to NE Victoria

List created through discussion and stakeholder consultation at national bitou bush workshops in Feb/March 2008.

Scientific name	Common name	SE Qld to Mid-North Coast NSW	NSW Central Coast	NSW South Coast to NE Victoria
<i>Acacia saligna</i>	Golden wreath wattle	✓		
<i>Acetosa sagittata</i>	Turkey rhubarb	✓	✓	✓*
<i>Anredera cordifolia</i>	Madeira vine	✓	✓	
<i>Araujia sericifera</i>	Moth vine	✓		
<i>Asparagus aethiopicus</i>	Ground asparagus	✓*	✓*	✓*
<i>Asystasia gangetica</i>	Asystasia		✓	
<i>Bryophyllum delagoense</i>	Mother of millions	✓	✓	
<i>Cestrum parqui</i>	Green cestrum		✓	
<i>Cortaderia jubata</i>	Pampas grass		✓	
<i>Euphorbia cyathophora</i>	Painted spurge	✓		
<i>Euphorbia paralias</i>	Sea spurge			✓
<i>Gazania linearis</i>	Gazania		✓	
<i>Gloriosa superba</i>	Glory lily	✓*	✓*	
<i>Ipomoea cairica</i>	Coastal morning glory	✓		
<i>Ipomoea indica</i>	Morning glory, mile-a-minute	✓		
<i>Lantana camara</i>	Lantana	✓*	✓*	✓*
<i>Lilium formosanum</i>	Formosa lily		✓	
<i>Macroptilium atropurpureum</i>	Siratro	✓		
<i>Ochna serrulata</i>	Ochna, Mickey mouse plant	✓		
<i>Opuntia stricta</i>	Prickly pear	✓		
<i>Passiflora suberosa</i>	Corky passion flower	✓		
<i>Passiflora subpeltata</i>	White passion flower	✓		
<i>Polygala myrtifolia</i> var. <i>myrtifolia</i>	Polygala	✓	✓	✓
<i>Senna pendula</i> var. <i>glabrata</i>	Senna, winter senna, winter cassia	✓		✓
<i>Yucca</i> sp.	Yucca/agave	✓		
	Grasses – various	✓		

* Weed considered as one of the top three major weeds occurring with bitou bush.