

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
Conservation Advice for
Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) Woodland

1. The Threatened Species Scientific Committee (the Committee) was established under the EPBC Act and has obligations to present advice to the Minister for the Environment, Heritage and Water (the Minister) in relation to the listing and conservation of threatened ecological communities, including under sections 189, 194N and 266B of the EPBC Act.
2. The Committee provided its conservation advice on the Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) Woodland ecological community to the Minister. In 2014, the Minister accepted the Committee's advice, adopting it as the approved conservation advice.
3. The Minister amended the list of threatened ecological communities under section 184 of the EPBC Act to include the Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) Woodland ecological community in the critically endangered category. It is noted that South Australia does not formally list ecological communities as threatened under State legislation.
4. The nomination and a draft description for this ecological community were made available for expert and public comment for a minimum of 30 business days. The Committee and Minister had regard to all public and expert comment that was relevant to the consideration of the ecological community.
5. This approved conservation advice has been developed based on the best available information at the time it was approved; this includes scientific literature, advice from consultations, and existing plans, records or management prescriptions for this ecological community.



Roadside remnant along Hog Bay road, near Penneshaw. Photo credit: Matt White

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1. Description of the ecological community

The ecological community presented in this conservation advice is a terrestrial vegetation-based community associated with drier, temperate landscapes on Kangaroo Island. It typically is a mallee woodland but can occur in a number of vegetation states, ranging from mallee forest to woodland to shrubland, depending on the nature of and timeframe since disturbance.

1a. Name of the ecological community

This advice follows the assessment of a public nomination to list the ‘Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) Eastern Plains Complex’ as a threatened ecological community under the EPBC Act. It is recommended that the ecological community be named **Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) Woodland** as it is an assemblage of organisms occurring with a type of mallee vegetation endemic to Kangaroo Island (KI), but not limited to the Eastern Plains region of the island. The term ‘woodland’ acknowledges the typical structural form in which the ecological community occurs though the definition allows for inherent variation in the structure and composition of the vegetation, notably in response to disturbances such as fire.

The national ecological community includes two communities provisionally recognised as endangered in South Australia but not formally listed as threatened:

E. cneorifolia, *E. phenax* ‘Kangaroo Island’ Mallee on gilgai soils on plains; and
E. cneorifolia, *E. rugosa* Mallee over *Rhagodia candolleana* on glacial sediments on plains.

Throughout this document the full name of the ecological community is abbreviated to ‘KI Narrow-leaved Mallee Woodland’ or ‘the ecological community’.

1b. Location and physical environment

The KI Narrow-leaved Mallee Woodland ecological community is endemic to the Kanmantoo IBRA¹ bioregion that comprises Kangaroo Island and the Fleurieu Peninsula, South Australia. The known distribution of the ecological community is limited to the eastern half of Kangaroo Island and, therefore, lies within the Kangaroo Island NRM region. The ecological community mostly occurs within two of the six regional ecological areas (REAs) on Kangaroo Island: Eastern Plains REA and Dudley-Haines Plateau REA (Willoughby et al., 2001). These two REAs represent the most heavily modified regions on Kangaroo Island, in which only about 15% of the native vegetation currently remains. Minor occurrences of the ecological community extend into adjacent regional ecological areas such as the eastern Seddon Plateau REA, the easternmost part of the North Coast REA and northern parts of the South Coast REA.

The landscape within which the ecological community occurs comprises flat plains to low, undulating hills. The soils on which the ecological community occurs are generally a clay and sand based duplex with a variable presence of ironstone gravels, sometimes extending onto pockets of limestone or basalt (Mooney and Grinter, 2000; Mooney et al., 2008). The Eastern Plains and Dudley-Haines Plateau have large areas of sandy loam to loam over sodic clays that vary in pH from acidic to highly alkaline. Alkalinity generally increases to the south and west from the Dudley Peninsula into the Eastern Plains. There also are extensive areas of

¹ Interim Biogeographical Regionalisation of Australia version 7.

brown cracking clays that often produce a gilgai² landscape

The climate of Kangaroo Island is cool temperate with a winter rainfall maximum. Rainfall lies within the range 500-900 mm/year and shows a distinct east-west gradient with lower rainfall, generally, in the eastern half of the island, where the ecological community occurs (Robinson and Armstrong, 1999; Mooney et al., 2008).

1c. Vegetative components

The KI Narrow-leaved Mallee Woodland can occur in a number of vegetation states that differ in appearance, with transitions between vegetation states facilitated by disturbance events and/or capacity to recover (Pisanu, 2007). These are described in more detail in [Appendix A](#).

Most intact patches of the ecological community are in a long-unburnt, largely uncleared state, sometimes referred to as 'mature' or 'senescent' (Pisanu, 2007; Mooney et al., 2008; Rawson et al., 2012). Long unburnt refers to patches that have not experienced a hot fire in 30 years or more; however, many patches of the ecological community have not had fire for at least 60 years (Dowie, 2006a). The vegetation structure of these patches is generally simple, comprising a closed mallee canopy with an understorey of few, if any, shrubs. The ground layer mostly comprises twig and leaf litter, sometimes bare soil or rock, though pockets of graminoids, other herbs and low shrubs may occur.

The structure and composition of the KI Narrow-leaved Mallee Woodland ecological community can change markedly in response to fire, or other disturbance. A hot fire stimulates mass emergence from the seedbank that results in the development of a diverse and dense shrub and ground layer (Pisanu 2007). Fire may also temporarily remove or reduce the mallee canopy, but stimulates their regeneration from lignotuber resprouts. The density and diversity of the shrubland declines over time, as species with short to medium generation lengths progressively die out. Eventually the low diversity mature form re-establishes.

Other disturbances, such as salinity and grazing, may also lead to shifts in vegetation structure and composition. However, these potentially lead to permanent shifts in plant species composition away from the ecological community; for instance, through the conversion of mallee patches into exotic pasture or salt scalds (Pisanu 2007).

Canopy layer

A tree canopy is present with *Eucalyptus cneorifolia* (KI narrow-leaved mallee) as the dominant or co-dominant³ species. KI narrow-leaved mallee often occurs as a single dominant in many patches. Other eucalypts may be present, depending on the site or substrate, but are never dominant on their own. Typical species that co-occur with KI narrow-leaved mallee include: *Eucalyptus albopurpurea* (purple-flowered mallee box), *E. diversifolia* subsp. *diversifolia* (coastal white mallee) or *E. phenax* subsp. *compressa* (white mallee). The following species also may occur, usually to a lesser extent: *E. rugosa* (Kingscote mallee), *E.*

² **Gilgai** refers to surface micro-relief formed by the shrinking and swelling of clays during alternate drying and wetting cycles. The surface eventually becomes covered by a pattern of small mounds and depressions that give the soil surface a 'pock-marked' appearance. Gilgai depressions are sometimes also called crabholes or melonholes.

³ **Dominant** generally refers to a species that is prevalent within an ecological community and influences the biotic conditions of the community. **Co-dominant** generally refers to a situation where more than one species are of equivalent prevalence and influence in a community. Where the terms refer to the tree canopy layer, the relevant measure is the tree canopy cover of individual canopy species. Dominance of *E. cneorifolia* therefore implies this species clearly has a higher tree canopy cover (e.g. >50%) than other tree canopy species that may be present (e.g. cover <10%). Co-dominance implies that *E. cneorifolia* has a similar tree canopy cover to all other tree species present.

odorata (peppermint box), *E. fasciculosa* (pink gum), *E. cosmophylla* (cup gum) or *Allocasuarina verticillata* (drooping sheoak).

In the long unburnt state, the tree canopy cover is typically 60-100% but can be as low as 20%. Canopy cover is highly variable after disturbance. It may become temporarily absent immediately after a hot fire. However, regeneration of narrow-leaved mallee is usually evident within a few months after fire, depending on seasonal conditions after the burn. The development of the canopy depends on the nature of and time interval since fire, pollarding⁴, or other disturbance. A full tree canopy eventually re-establishes in the absence of further disturbance.

Understorey (mid and ground layers)

In the long-unburnt state of the ecological community, the understorey may be absent to sparse. Some small trees or shrubs may commonly occur, for instance *Melaleuca uncinata* (broombrush), *Melaleuca lanceolata* (dryland tea-tree), *Thryptomene ericaea* (heath thryptomene) or *Correa reflexa* var. *insularis* (Kangaroo Island correa). Other locally common woody species include: *Calytrix glaberrima* (smooth fringe-myrtle), *Calytrix tetragona* (common fringe-myrtle) and *Callistemon rugulosus* (scarlet bottlebrush).

The ground layer is typically absent to sparse, often comprising just twig and leaf litter. Patches of graminoids, forbs or low shrubs may occur, for instance grasses such as *Rytidosperma* spp. (formerly *Austrodanthonia*; wallaby grasses) or lilies such as *Dianella revoluta* (black-anther flax lily).

Fire can stimulate the development of a dense understorey, including lignotuber regrowth where the mallee canopy dies back. This understorey may be highly diverse, with up to 40 or even 60 plant species per 100 m² (based on observations from the Eastern Plains Fire Trial; Rawson et al. 2012; Davies et al. 2013). Many understorey species are shrubs intermingled with herbs and sometimes vines (e.g. *Cassytha* spp. (dodder-laurels). Where fire intervals are more frequent, for instance less than 15 years, the canopy may become more open to sparse, effectively resulting in a shrubland structure. In the absence of any further disturbance, the shrubby understorey progressively thins out with time, due to limited life spans and competitive exclusion, leading eventually to the sparse understorey and regenerated tree canopy of mature or senescent patches.

A list of plant species that typically occurs in the KI Narrow-leaved Mallee Woodland ecological community is presented in [Appendix B](#). This list takes into account understorey species that may only be evident as a seed bank in long-undisturbed patches. There are 45 vascular plant species that are endemic to Kangaroo Island and another eleven species that are near-endemic (i.e. mostly on KI with minor occurrences on the mainland) (Robinson and Armstrong, 1999). Several of these occur in the ecological community, notably *E. cneorifolia* as a near-endemic species, and are identified as such in [Appendix B](#).

Id. Faunal components

The vertebrate fauna of Kangaroo Island is detailed in the biological survey by Robinson and Armstrong (1999). A number of species have been introduced to the island, including species native to mainland Australia, as well as exotic species. The discussion below focuses on those

⁴ **Pollarding** is the practice of cutting tree branches back to the trunk to stimulate regrowth. Some mallee eucalypts, including *E. cneorifolia*, have a lignotuber - an underground swelling with buds and stored reserves that allows regeneration after damage. In these mallee eucalypts, pollarding involves cutting stems at ground level to stimulate regrowth from the lignotuber (Moritz, 2006).

species presumed to have been naturally present on Kangaroo Island prior to European settlement.

There is limited information about what fauna specifically occurs within the KI Narrow-leaved Mallee Woodland ecological community. A range of fauna would likely utilise the ecological community as habitat, either as transient visitors or residents. The particular assemblages of animal species present would vary with site depending on, for instance, the state, disturbance history and condition of the patch of ecological community.

To date, the bird fauna is the best documented animal component of the KI Narrow-leaved Mallee Woodland ecological community. Davies and Overton (1998) recorded 26 bird species within the ecological community. Subsequently, Pisanu et al. (2006) observed a total of 47 native bird species in the ecological community across the Eastern Plains and the Dudley-Haines Plateau. The most diverse groups present were the Meliphagidae (honeyeaters and chats), Pardalotidae (pardalotes and thornbills), and Dicruridae (fantails and flycatchers). A list of native bird species known to occur in the ecological community is presented in [Appendix B](#).

Native mammal herbivores known to occur in the ecological community include *Macropus eugenii decres* (tammam wallaby), *Macropus fuliginosus fuliginosus* (Kangaroo Island kangaroo) and *Trichosurus vulpecula* (common brushtail possum) (Anon., 2009). These species appear to have adapted well to mixed agricultural landscapes and browse on pasture and crop plantings, as well as on native vegetation. They appear to have increased in abundance with landscape modification and their elevated grazing pressure can have a significant deleterious impact on native plant regeneration in fragmented landscapes.

The ground and litter-dwelling invertebrate fauna have been surveyed by pitfall trapping in the KI Narrow-leaved Mallee Woodland ecological community (Marsh, 2012). A total of 21 orders representing about 104 families of arthropods were captured in unburnt patches. The most numerically abundant groups were the ants (Hymenoptera: Formicidae), beetles (Coleoptera) and spiders (Araneae).

1e. Key diagnostic characteristics and condition thresholds

The key diagnostic characteristics presented here summarise the main features of the KI Narrow-leaved Mallee Woodland ecological community. These are intended to aid the identification of the ecological community, noting that a broader description is given in the other sections.

National listing focuses legal protection on remaining patches of the ecological community that are most functional, relatively natural (as described by the 'Description') and in relatively good condition. Key diagnostic characteristics and condition thresholds assist in identifying a patch of the threatened ecological community, determine when the EPBC Act is likely to apply to the ecological community and to distinguish between patches of different quality. They provide guidance for when a patch of a threatened ecological community retains sufficient conservation values to be considered as a Matter of National Environmental Significance, as defined under the EPBC Act. Patches that do not meet the minimum condition thresholds are excluded from full national protection. This means that the referral, assessment and compliance provisions of the EPBC Act are focussed on the most valuable elements of Australia's natural environment.

The KI Narrow-leaved Mallee Woodland ecological community occurs in the most heavily cleared parts of Kangaroo Island and has, itself, been heavily cleared. Patches of the ecological community may exhibit various degrees of disturbance and degradation. In many cases, the loss and degradation is irreversible, or the potential for rehabilitation is impractical

because natural characteristics and function have been removed. For instance, areas permanently converted to improved pasture are unlikely to be rehabilitated for socio-economic or for practical reasons.

Although very degraded/modified patches are not protected as the ecological community listed under the EPBC Act, it is recognised that patches that do not meet the condition thresholds may still retain important natural values and may be critical to protecting those patches that meet minimum thresholds. They may also be protected through State and local laws or schemes. Therefore, these patches should not be excluded from recovery and other management actions. Suitable recovery and management actions may improve these patches to the point that they may be regarded as part of the ecological community fully protected under the EPBC Act. Management actions should, where feasible, also aim to restore patches to meet the high quality condition thresholds outlined below.

For EPBC Act referral, assessment and compliance purposes, the national ecological community is limited to patches that meet the following key diagnostic characteristics and condition thresholds.

Key diagnostic characteristics.

First, use these to determine if the KI Narrow-leaved Mallee Woodland ecological community is likely to be present.

Landscape

- The known distribution is restricted to Kangaroo Island, South Australia.
- The ecological community typically occurs on flat plains to undulating hills.
- Soils typically are a sand and clay duplex with variable presence of ironstones, and sometimes extending onto other substrates e.g. basalt or limestone-derived soils.

Vegetation

- *Eucalyptus cneorifolia* (KI narrow-leaved mallee) is present.
 - KI narrow-leaved mallee is the dominant or co-dominant species where a mature tree canopy occurs. Other species may be present in the tree canopy, as described in the canopy layer description, above, but are never dominant on their own. The tree canopy cover reaches up to 60-100% in long unburnt sites.
 - After recent disturbance, e.g. fire, tree canopy cover may be temporarily reduced, even absent as happens immediately after a high severity fire. Under these circumstances, there should be indications⁵ that KI narrow-leaved mallee was a dominant to co-dominant component of the tree canopy prior to disturbance, and that this species has the capacity to regenerate the canopy over time.
- The understorey comprises native shrubs and herbs of variable density and composition, as described in section *1c. Vegetative components*, above.
 - In mature or senescent patches, the understorey is generally sparse with considerable bare ground and plant litter in the ground layer. Certain understorey small trees to shrubs may be present or locally common, e.g. *Melaleuca* spp. (often *Melaleuca uncinata* or *Melaleuca lanceolata* with lesser numbers of *Melaleuca acuminata*), *Callistemon rugulosus*, *Calytrix glaberrima*, *Calytrix tetragona*, *Correa reflexa* var. *insularis* or *Thryptomene ericaea*.

⁵ Relevant indicators may include: information from pre-disturbance surveys; the presence of mallee stems or stumps; and the presence of lignotuber resprouts or seedlings post-disturbance.

- Disturbances, notably hot fires, may lead to a marked increase in the diversity and density of understorey plants. The ecological community becomes predominantly shrubby with mallee regrowth soon after disturbance. The understorey thins out over time as shorter-lived shrubs and herbs progressively die out.

Condition thresholds

The KI Narrow-leaved Mallee Woodland ecological community commonly occurs as patches along roadsides that are in a long unburnt state. Therefore, many patches now exist as long, linear strips, typically with a mature tree canopy over a sparse understorey of relatively few plant species. The condition thresholds for the KI Narrow-leaved Mallee Woodland were developed with regard to the unique nature and modified state of this ecological community.

An unpublished field survey by natural resource managers on eastern KI was undertaken in an area where KI Narrow-leaved Mallee occurs along roadsides and away from roadsides, in paddocks. The survey determined the condition of 43 patches, covering 552 hectares, of the ecological community. The results indicated that a patch width threshold of 60 metres was a reliable surrogate for bushland condition. Patches of the ecological community that were less than 60 metres wide were typically degraded and tended to be heavily impacted by edge effects, such as weed invasion and drift from fertilisers. Thin strips less than 60 metres wide in paddocks also were affected by livestock grazing and had limited above-ground diversity. While a majority of individual patches within the survey area were less than 60 metres wide, collectively they accounted for only 37% of the total area occupied by the ecological community, because they were so small and narrow.

The survey findings were consistent with the observations of Davies et al. (2013) that patches with an extensive understorey of pasture or weed species, or that were grazed, did not retain a high diversity of native plant species, either above ground or in the soil seed bank. Many patches that fitted this description fell within the less than 60 metres wide category of patches. The absence of above-ground vegetation and seed banks suggests that in these narrow patches, the native ground layer would be generally difficult to restore.

These observations were used to frame the surrogates for condition thresholds for the KI Narrow-leaved Mallee Woodland ecological community.

A. Minimum condition thresholds

These represent the minimum condition of a patch for the purposes of considering any potentially significant detrimental actions involving the ecological community.

A1. Vegetation on roadside verges.

This refers to vegetation that lies along the verges of roadsides and accounts for a high proportion of the good quality patches of the ecological community that remain. Roadside verges generally occur as long, linear strips where native vegetation may lie along one or both sides of the road and interconnect with paddock vegetation. It includes verges that are irregular in shape and not necessarily linear.

Roadside vegetation at a particular point or location must be considered for protection if:

- At that point, the shortest cross-sectional mature canopy width of the vegetation is 60 metres or more. Mature canopy width is measured from canopy edge to canopy edge, ignoring canopy breaks within the vegetation of up to 20 metres. This means that strips of the ecological community along each side of a road can effectively be treated as part of a single area of vegetation where the width of the roadside break is 20 metres or less.

- Where two separate areas of the ecological community at least 60 metres wide are connected by a narrow section of the ecological community, e.g. a strip along only one side of the road, the narrow section is included in the patch if it is more than five metres wide and less than 500 metres long (i.e. the separation between the two wide areas is less than 500 metres).
- Where the tree canopy has been recently removed or reduced, e.g. due to pollarding or fire, then the mature canopy width should be calculated by assuming a mature canopy radius of 10 metres around the remaining tree and shrub stumps.

The intent here is to focus on protecting the larger roadside patches and to exclude most patches that are small, narrow, degraded and are likely to be not viable in the long term. There is provision to include some narrow areas where they have an important connectivity function, linking two wider sections.

A2. Vegetation not on roadside verges.

This refers to occurrences of the ecological community on farms, other properties and sites that are situated away from roadside verges for all, or most of their length. They occur in a range of shapes, including linear strips, such as shelterbelts and windbreaks that may follow fences, or drainage lines within properties away from roadside verges. Long, linear strips where the short edge abuts onto a roadside but the long edge occurs away from any roadside, e.g. into a paddock or other property, are included under this category.

Native vegetation at any point or location away from roadside verges must be considered for protection where it is an area of the ecological community if:

- The shortest cross-sectional mature canopy width of the vegetation is 60 metres or more. Mature canopy width is measured from canopy edge to canopy edge, ignoring canopy breaks within the vegetation of up to 20 metres.
 - Where the tree canopy has been recently removed or reduced, e.g. due to pollarding or fire, then the mature canopy width should be calculated by assuming a mature canopy radius of 10 metres around the remaining tree and shrub stumps.

Non-roadside occurrences of the ecological community are essentially limited to patches that are larger and where the understorey is relatively unmodified by land use. It is intended that thin strips of vegetation that act as shelterbelts and windbreaks are not considered for environmental protection although they play an important role in agricultural production. These have been highly modified by grazing and exotic species (pasture and weed species) and generally retain a low diversity of native plant species (Davies et al., 2013).

B. Thresholds indicative of good quality

These represent criteria additional to the minimum conditions specified under part A, above, and highlight when a patch of the ecological community is likely to be of good quality, above the minimum threshold.

The ecological community is considered to be of good quality if:

- The total continuous area of the ecological community is one hectare or more.

AND

- The cover of non-indigenous plant species in the understorey layers is less than 50% of the total perennial cover of the understorey layers⁶.

AND

- Four or more native plant species are present above-ground in the understorey layers across the patch⁷.

OR

- One or more important⁸ plant species are known to be naturally present, either from current observations, or previous surveys that have identified their occurrence in a patch. Important species are shown in Table 1 and include listed threatened species plus species considered to be of local or regional significance to KI. Note that the absence of important species does not necessarily indicate that a site is of low quality.

It is acknowledged that good quality areas of the ecological community are likely to require some ongoing management to maintain their ecological integrity. The intent of recovery efforts are twofold: to ensure that patches in good condition do not degrade in quality; and that the quality of patches in poor condition is improved to at least the minimum condition requirements, where practical. Management and recovery actions that are aimed at maintaining or improving the conservation value of a patch and based on sound advice and supporting information should not trigger the EPBC Act.

Further background information that may help with understanding the key diagnostic features and condition thresholds is given in:

Appendix A for the biology and ecology of the ecological community; and
Appendix C for threats to the ecological community.

⁶ Non-indigenous plant species are species not native to Kangaroo Island. They include: naturalised weeds (species not native to Australia plus native mainland species that do not naturally occur on KI); pasture plants; and crop species. Total perennial cover of the understorey includes all biennial and perennial vegetation plus litter, rock and bare ground that are in the mid and ground layers underneath the tree canopy. Annual species are not included.

⁷ The number of understorey plant species present can vary markedly with management regime, especially fire, as noted in the Description above. The number of species cited is a minimum based on the sparse understorey of long unburnt sites, typical of most patches at the time of this assessment. Understorey plant diversity can increase markedly in response to appropriate fire regimes.

⁸ The presence and abundance of important species also should be taken into consideration in their own right when assessing likely environmental impacts to an area of vegetation.

Table 1. Important plant species that may occur in the KI Narrow-leaved Mallee Woodland ecological community. Scientific names follow the taxonomy accepted by the Australian Biological Resources Study and are current as at February 2013.

*A National and State-listed threatened flora species*¹.

Species name	Common name	Threatened status	
		EPBC	SA NPW Act ²
<i>Acacia simmonsiana</i>	Simmons wattle	-	Rare
<i>Asterolasia muricata</i>	rough star-bush	-	Rare
<i>Austrostipa densiflora</i>	foxtail speargrass	-	Rare
<i>Beyeria subsecta</i>	Kangaroo Island turpentine bush	Vulnerable	Endangered
<i>Caladenia bicalliata</i> subsp. <i>bicalliata</i>	limestone spider-orchid		Rare
<i>Caladenia ovata</i>	Kangaroo Island spider-orchid	Vulnerable	Endangered
<i>Caladenia sanguinea</i>	crimson daddy long-legs		Rare
<i>Callitriche sonderi</i>	matted water-starwort		Rare
<i>Centrolepis glabra</i>	smooth centrolepis	-	Rare
<i>Crassula peduncularis</i>	purple crassula	-	Rare
<i>Daviesia benthamii</i> subsp. <i>humilis</i>	spiny bitter-pea	-	Rare
<i>Desmocladius diacolpicus</i>	bundled cord-bush	-	Vulnerable
<i>Diuris brevifolia</i>	short-leaf donkey-orchid	-	Endangered
<i>Grevillea halmaturina</i> subsp. <i>halmaturina</i>	prickly grevillea	-	Rare
<i>Grevillea muricata</i>	rough spider-flower	-	Vulnerable
<i>Hibbertia obtusibracteata</i>	prickly guinea-flower	-	Vulnerable
<i>Hydrocotyle crassiuscula</i>	spreading pennywort	-	Rare
<i>Lachnagrostis robusta</i>	salt blowgrass		Rare
<i>Leonema equestre</i>	Kangaroo Island phebalium	Endangered	Endangered
<i>Meionectes brownii</i>	swamp raspwort		Rare
<i>Melaleuca cuticularis</i>	salt paperbark	-	Endangered
<i>Olearia microdisca</i>	small-flowered daisy-bush	Endangered	Endangered
<i>Philotheca angustifolia</i> subsp. <i>angustifolia</i>	narrow-leaf wax-flower	-	Rare
<i>Pomaderris halmaturina</i> subsp. <i>halmaturina</i>	Kangaroo Island pomaderris	Vulnerable	Vulnerable
<i>Prostanthera chlorantha</i>	green mintbush	-	Rare
<i>Schoenus discifer</i>	tiny bog-rush	-	Rare
<i>Schoenus sculptus</i>	gimlet bog-rush	-	Rare
<i>Spyridium eriocephalum</i> var. <i>glabrisepalum</i>	MacGillivray spyridium	Vulnerable	Endangered
<i>Spyridium spathulatum</i>	spoon-leaf spyridium	-	Rare
<i>Zieria veronicea</i> subsp. <i>insularis</i>	pink zieria	-	Rare
<i>Zoysia macrantha</i> subsp. <i>walshii</i>	Manilla grass	-	Rare

Sources: Taylor (2008); Anon. (2009); Davies et al. (2013); and comments received from public and expert consultation.

¹ Some species present in the ecological community and listed as Rare in South Australia are **not** considered important species for the purposes of condition criterion B3, due to their abundance in the ecological community. These include: *Eucalyptus fasciculosa* (pink gum), *Eucalyptus phenax* subsp. *compressa* (white mallee) and *Xanthorrhoea semiplana* subsp. *tateana* (yakka).

² South Australian National Parks and Wildlife Act 1972

B. Other plant species of local or regional significance to KI.

Species name	Common name
<i>Acacia acinacea</i>	wreath wattle
<i>Acacia farinosa</i>	mealy wattle
<i>Acacia rupicola</i>	rock wattle
<i>Aphelia gracilis</i>	slender aphelia
<i>Austrostipa curticoma</i>	short-crest spear-grass
<i>Austrostipa elegantissima</i>	feather spear-grass
<i>Baumea juncea</i>	bare twig-rush
<i>Billardiera versicolor</i>	yellow-flower apple-berry
<i>Boronia coerulescens</i> subsp. <i>coerulescens</i>	blue boronia
<i>Caladenia tentaculata</i>	king spider-orchid
<i>Calandrinia brevipedata</i>	short-stalked purslane
<i>Calochilus robertsonii</i>	purplish beard-orchid
<i>Centipeda minima</i>	spreading sneeze-weed
<i>Cheiranthra alternifolia</i>	hand-flower
<i>Cyphanthera myosotidea</i>	small-leaf ray-flower
<i>Daviesia arenaria</i>	sand bitter-pea
<i>Dodonaea hexandra</i>	horned hop-bush
<i>Eleocharis acuta</i>	common spike-rush
<i>Elymus scaber</i> var. <i>scaber</i>	native wheat-grass
<i>Eremophila behriana</i>	rough emu-bush
<i>Eremophila glabra</i> subsp. <i>glabra</i>	tar bush
<i>Eutaxia diffusa</i>	large-leaf eutaxia
<i>Geijera linearifolia</i>	sheep bush
<i>Hardenbergia violacea</i>	native lilac
<i>Hibbertia platyphylla</i> subsp. <i>halmaturina</i>	guinea-flower
<i>Lagenophora huegelii</i>	coarse bottle-daisy
<i>Logania linifolia</i>	flax-leaf logania
<i>Lomandra micrantha</i> subsp. <i>micrantha</i>	small-flower mat-rush
<i>Lomandra micrantha</i> subsp. <i>tuberculata</i>	small-flower mat-rush
<i>Microlaena stipoides</i> var. <i>stipoides</i>	weeping rice-grass
<i>Myoporum brevipes</i>	warty boobialla
<i>Oxalis perennans</i>	native sorrel
<i>Pittosporum angustifolium</i>	native apricot
<i>Prostanthera asplanthoides</i>	scarlet mintbush
<i>Pultenaea insularis</i>	Beyeria bush-pea
<i>Pultenaea laxiflora</i>	loose-flower bush-pea
<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	slender wallaby-grass
<i>Senecio quadridentatus</i>	cotton groundsel

Sources: Willoughby (2001); Anon. (2009); Davies et al. (2013); comments received from public and expert consultation.

Additional considerations

The following factors should be taken into consideration when evaluating the key diagnostic characteristics and condition thresholds. This information is provided to help environmental assessment officers, consultants and others with surveying the ecological community and assessing if actions are likely to be significantly detrimental to the ecological community.

Patch. A patch is defined as a discrete and continuous area of the ecological community. However, a patch may include interruptions, such as roads, tracks or breaks, watercourses/drainage lines or localised changes in vegetation, e.g. small clumps of weeds, that do not significantly alter its overall functionality. Functionality here refers to ecological processes such as the movement of wildlife and pollinators, the dispersal of plant propagules, activities of seed dispersers and plant predators, etc. The condition thresholds allow for interruptions of up to 20 metres in patches that are 60 metres or more wide.

Buffer zone. A buffer zone is the area that lies immediately outside the edge of a patch but is not part of the ecological community. As the risk of damage to an ecological community is usually greater for actions close to a patch, the purpose of the buffer zone is to minimise this risk by guiding land managers to be aware when the ecological community is nearby and take extra care around the edge of patches. The recommended minimum buffer zone for the KI Narrow-leaved Mallee Woodland ecological community is 15 metres from the edge of a patch as determined from the outer edge of the tree canopy (or a 10 m radius from any stumps if trees have been pollarded, burnt or otherwise fallen). A larger buffer zone may be applied, where practical, to protect patches that are of very high conservation value.

The buffer zone is not part of the ecological community, so is advisory only. Where the buffer on a particular property is subject to existing land uses, such as cropping, ploughing, grazing, spraying, etc., they can continue. However, in the interests of protecting adjacent patches of the ecological community, it is requested that care be exercised in the buffer zone to minimise the risk of any significant adverse impacts extending into those patches. This is already likely to be happening.

Revegetated areas. Revegetated or replanted sites are not excluded from the listed ecological community so long as the patch meets the key diagnostic characteristics plus condition thresholds above. It is recognised that revegetation often requires longer-term effort and commitment and it may take some time for a degraded patch to reach a good quality condition.

Timing of surveys. The timing of surveys is important with respect to disturbance history because the ecological community can vary markedly in appearance, especially after a hot fire. These variations are acknowledged in the sections on vegetative components and condition thresholds, above. It is important to note what kind of disturbance may have happened within a patch, and when that disturbance occurred, as far as possible. As the KI Narrow-leaved Mallee Woodland ecological community largely comprises perennial species with a large obligate seeder⁹ component, seasonal variation is unlikely to be a significant consideration for surveys. An exception may be where seasonal, annual weeds are known to be a localised problem for a patch. However, most significant weeds present in the ecological community (see [Appendix B](#)) have a perennial life history.

⁹ Obligate seeders are plant species that recover after disturbance only by germination from seed. In the context of fire, it refers to species that regenerate from seeds stimulated to germinate by the heat and/or smoke from a fire, rather than by resprouting.

Sampling protocols. Patches can vary markedly in their shape, size and features that appear within a given patch. As a general principle, sampling should address the following:

- the area(s) with the highest apparent number of different native plant species to determine estimates of native species richness in each patch;
- any significant variation in the vegetation, landscape qualities and management history (where possible) across the patch, for instance localised weed cover, drainage lines, grazed areas, saline zones; and
- the appropriate size and number of plots or transects to provide a representative sample across the full extent of the patch.

In general, the minimum sample plot size for above-ground vegetation in the KI Narrow-leaved Mallee Woodland ecological community should be 100 m² (e.g. a 10 m x 10 m plot or equivalent), with the number of sample plots depending on the area of the patch and sufficient to be representative of diversity across the patch.

State-transition model. A state and transition model for the ecological community is described by Pisanu (2007) and illustrated in part at [Appendix A](#). Landuse and disturbance history determines the state of a patch of the ecological community. The state of a patch strongly influences its above-ground plant species diversity and resilience to further disturbance through replenishment of soil seed banks.

Soil seed bank. The soil seed bank is an important component of the KI Narrow-leaved Mallee Woodland and can give reliable information about the ‘hidden’ plant diversity of a patch. Techniques such as seed bank germination studies or seed identification can help determine what native flora are present that may not be evident above-ground. This is a relevant consideration for long unburnt sites where relatively few species typically occur above-ground. However, proper seedbank analysis is time-consuming and requires the assistance and resources of a professional biologist. Methods for determining soil seed bank analysis are described in existing studies, e.g. Rawson et al. (2012) and Davies et al. (2013). Where seed bank information is available from prior studies, or it is feasible to undertake a proper study, the soil seed bank analysis could be used to inform about the diversity and quality of a patch.

If. Surrounding environmental and landscape context

The condition thresholds outlined above do not necessarily represent the ideal state of the ecological community. Patches that are larger, more species rich and less disturbed are likely to provide greater biodiversity value. Additionally, patches that are spatially linked, whether ecologically or by proximity, are particularly important as wildlife habitat and to the viability of those patches of the ecological community into the future.

Therefore, in the context of actions that may have ‘significant impacts’ and require approval under the EPBC Act, it is important to consider the environment surrounding patches that meet the condition thresholds. Some patches that meet the condition thresholds occur in isolation and require protection, as well as priority actions, to link them with other patches. Other patches that are interconnected to other native vegetation associations that may not, in their current state, meet the condition thresholds have additional conservation value. In these instances, the following indicators should be considered when assessing the impacts of actions or proposed actions under the EPBC Act, or when considering recovery, management and funding priorities for a particular patch.

- Large size and/or a large area to boundary ratio – larger area/boundary ratios are less exposed and more resilient to edge effect disturbances such as weed invasion and human impacts.
- Good faunal habitat as indicated by patches containing diversity of landscape, diversity of plant species, contribution to movement corridors, logs, natural rock outcrops, etc.;
- High species richness, as shown by the variety of native plant species, or high number of native fauna species.
- Presence of listed threatened species.
- Areas of minimal weeds or where these can be managed.
- Evidence of recruitment of key native plant species (including through successful assisted regeneration or management of sites).
- Presence of cryptogams and soil crust on the soil surface, indicating low disturbance to natural soil structure and potential for good functional attributes such as nutrient cycling.
- Connectivity to other native vegetation patches or restoration works (e.g. native plantings). In particular, a patch in an important position between (or linking) other patches in the landscape.
- Patches that occur in areas where the ecological community has been most heavily cleared and degraded, or that are at the natural edge of its range.

1g. Corresponding vegetation/mapping units

The most recent vegetation survey of mallee communities on Kangaroo Island identifies five vegetation map units that correspond to the national KI Narrow-leaved Mallee Woodland ecological community (Mooney et al., 2008). These are SAVEG units KI1101, KI1103, KI1104, KI1108 and KI1109. Further details about these vegetation units, other earlier vegetation classifications and similar vegetation types that are not part of the national ecological community is given in [Appendix A](#).

1h. Area critical to the survival of the ecological community

The areas considered critical to the survival of the KI Narrow-leaved Mallee Woodland ecological community covers all patches that meet the key diagnostic characteristics and condition thresholds for the ecological community, plus the buffer zones, particularly where this comprises surrounding native vegetation. This is because this ecological community has a restricted geographic extent and is highly fragmented.

Note that additional areas that do not meet the condition thresholds may still be important for the survival of the ecological community because they could retain some biodiversity or habitat values. It is also important to consider the surrounding environment and landscape context, as noted in Section *If*.

1i. Geographic extent and patch distribution

Prior to European settlement, the ecological community likely occurred as two areas of continuous to near-continuous vegetation cover, across the Eastern Plains to the north coast, and on the northern to central parts of the Dudley Peninsula (Willoughby et al, 2001). The original total extent of the ecological community was over 70 000 ha. The current extent is estimated to be around 6000 ha with a geographic distribution that is highly fragmented, comprising mostly small patches dispersed amongst a largely cleared and modified landscape. Almost all known patches of the ecological community are now less than 100 ha

in size, and most are less than 10 ha in size (Mooney et al., 2008). The goals of landscape-scale restoration of the ecological community include maximising connectivity, increasing existing patch size and improving the ecological integrity of patches, as detailed in Section 5b, below.

Ij. National context and existing protection

Nationally listed threatened species

The KI Narrow-leaved Mallee Woodland ecological community provides habitat for at least six nationally-listed threatened flora species and another 25 plant species that are listed as threatened under the South Australian *National Parks and Wildlife Act 1972* (Table 1A). Other plant species are recognised to be of local or regional significance to Kangaroo Island, being uncommon on the island, though not regarded as threatened across a broader jurisdiction (Table 1B).

Three nationally listed threatened animals may use the KI Narrow-leaved Mallee Woodland ecological community as part of their habitat (Willoughby, 2001). *Sminthopsis aitkeni* (Kangaroo Island dunnart) is a nationally endangered mammal endemic to Kangaroo Island that has been reported to use the KI Narrow-leaved Mallee Woodland ecological community as part of its habitat (Davies and Overton, 1998; Willoughby, 2001). This species, however, is now considered to be restricted to the western half of the island where native vegetation remains more intact (SEWPaC, 2012).

The nationally endangered *Isoodon obesulus obesulus* (southern brown bandicoot (eastern)) also occurs on KI. This bandicoot prefers vegetation with dense ground or shrub cover, including weedy sites (SEWPaC, 2012). While the open senescent stands of the ecological community are unlikely to provide preferred habitat, burnt patches that result in increased cover and diversity of understorey vegetation might provide suitable habitat. Although the species itself has rarely been sighted, fresh diggings have been observed in burnt plots of the ecological community and a road kill specimen was collected from a road bisecting the ecological community during 2012 (Dowie, 2012).

Calyptorhynchus lathami halmaturinus (Glossy Black-Cockatoo (South Australian)) is a nationally endangered bird that requires *Allocasuarina verticillata* (drooping sheoak) as a main food source (SEWPaC, 2012). The cockatoo generally occurs in other vegetation types where *Allocasuarina* is predominant but may occasionally travel through the KI Narrow-leaved Mallee Woodland ecological community.

Threatened ecological communities recognised under State jurisdiction

South Australia does not formally list threatened ecological communities. A provisional list of threatened ecosystems in South Australia recognises two endangered ecological communities that correspond to the national ecological community. These are:

- *E. cneorifolia*, *E. phenax* ‘Kangaroo Island’ Mallee on gilgai soils on plains; and
- *E. cneorifolia*, *E. rugosa* Mallee over *Rhagodia candolleana* on glacial sediments on plains.

Native vegetation in South Australia, generally, is protected and managed through the *Native Vegetation Act 1991* and the associated *Native Vegetation Regulations 2003*. Legal clearance of native vegetation in South Australia may be permissible either through exemptions that are specified in the *Regulations* or by application to the Native Vegetation Council, an independent body responsible for matters concerning native vegetation in South Australia (Native Vegetation Council Secretariat, 2012).

Level of protection in reserves

A low proportion of the KI Narrow-leaved Mallee Woodland ecological community occurs in conservation tenure. Willoughby et al (2001) estimated that 1005 ha, or about 15 to 18% of the current extent of the ecological community is protected in reserves. Large patches of the ecological community are protected within Beyeria Conservation Park (141.7 ha) and Cape Gantheaume Conservation Park (67.6 ha) (Anon, 2009). The occurrences of *E. cneorifolia* in Dudley Conservation Park do not appear to be the ecological community as the mallee there is dominated by *E. diversifolia* and/or *E. rugosa* with *E. cneorifolia* only a minor component of the vegetation (DEP, 1987).

Further information relevant to the description of the KI Narrow-leaved Mallee Woodland ecological community is available in the following appendices.

Appendix A - *Biology and ecology of the ecological community*

Appendix B – *Lists of known component species of the ecological community.*

2. Summary of Threats

Threats to the biodiversity of Kangaroo Island, in general, are detailed in Willoughby et al., (2001) and a discussion of land use history and native vegetation management on KI is given by Mooney and Grinter (2000). Threats to listed threatened plant species present on KI, several of which occur in the ecological community, are described by Taylor (2008).

The key threats to the ecological community are ongoing and outlined below.

- Clearance of native vegetation and loss of habitat.
- Fragmentation into smaller, disconnected patches.
- Altered fire regimes, including inappropriate application of burn intensity and season, and skewed age distribution of patches. In particular, suppression of fire across eastern KI has resulted in a disproportionate amount of long-unburnt ‘senescent’ stands. Low intensity fire has been identified as a threat.
- Grazing pressure: including inappropriate grazing regimes by domestic stock and grazing of regrowth by native fauna. The populations of the brushtail possum, tamar wallaby and Kangaroo Island kangaroo have all increased, largely as a result of improved food supply becoming available through agricultural activities.
- Weed invasion, including the weeds of national significance, bridal creeper and bridal veil.
- Inappropriate application of chemicals, including inorganic fertilisers to create improved pastures; or pesticide/herbicide spray drift from agricultural lands adjacent to a patch.
- Inappropriate pollarding of mallee trees without protection from grazing impacts. Guidance on appropriate pollarding is given by Moritz (2006).
- Increased waterlogging and salinity of patches in or near to low lying depressions, especially where surrounding land has been modified by clearing.
- Potential impact from dieback due to *Phytophthora* infestations.
- Potential impacts due to climate change, including tree canopy dieback and other impacts from severe weather.

Further information about the threats to the ecological community can be found at Appendix C – Description of threats.

3. Summary of eligibility for listing against the EPBC Act criteria.

The full assessment against the EPBC Act listing criteria can be found at Appendix D - Detailed assessment of eligibility for listing against the EPBC Act criteria.

Criterion 1 - Decline in geographic distribution

The Committee notes that the KI Narrow-leaved Mallee Woodland ecological community has undergone a decline in extent in the order of 92 to 94%. The Committee considers the decline in geographic distribution of the ecological community to be very severe. Therefore, the ecological community has been demonstrated to have met the relevant elements of Criterion 1 to make it **eligible** for listing as **critically endangered**.

Criterion 2 - Small geographic distribution coupled with demonstrable threat

The Committee notes that the extent of occurrence and area of occupancy are indicative of a *restricted* geographic distribution. The patch size distribution indicates that most patches of the ecological community are highly fragmented and less than 10 ha in size, which is consistent with a *very restricted* geographic distribution. The ecological community also is subject to ongoing and demonstrable threats, as identified in Appendix C, that could cause it to be lost in the immediate future. Therefore, the ecological community has been demonstrated to have met the relevant elements of Criterion 2 to make it **eligible** for listing as **critically endangered**.

Criterion 3 - Loss or decline of functionally important species

The Committee concludes that the loss or decline of functionally important species either cannot be demonstrated or is unknown due to data deficiencies about the biology of most species. Therefore, the Committee considers the ecological community is **not eligible** for listing in any category under this criterion.

Criterion 4 - Reduction in community integrity

The Committee notes the following indicators of reduction in community integrity for the KI Narrow-leaved Mallee Woodland ecological community. Details of these are provided in Appendices D and E.

- Existing patches of the KI Narrow-leaved Mallee Woodland ecological community are typically small and show a high degree of fragmentation and disconnection across a heavily modified landscape.
- Altered fire regimes, notably fire suppression, has resulted in a strongly skewed age distribution of patches of the ecological community whereby most patches are maintained in a low diversity ‘senescent’ stage that have not been burnt for 30 years, in some cases 60 years or more.
- Inappropriate grazing by a range of herbivores (native and domestic) removes native regrowth and directly disrupts the effective regeneration of plant species.
- Serious environmental weeds infest patches of the ecological community across eastern KI.

The combined impacts of these threats has reduced the integrity of the ecological community across its range. Restoration of the ecological community is unlikely to be reasonably applied

at the landscape level in the immediate future¹⁰. The Committee considers that the change in integrity experienced by the ecological community is very severe and regeneration (in terms of restoring structural complexity, functionality and above-ground biodiversity) across the extent of the ecological community is unlikely in the immediate future. Therefore, the ecological community is **eligible** for listing as **critically endangered** under this criterion.

Criterion 5 - Rate of continuing detrimental change

There are no quantitative data about the rate of continuing detrimental change for the KI Narrow-leaved Mallee Woodland ecological community over the immediate past or projected for the immediate future. Therefore, the Committee considers the ecological community is **not eligible** for listing in any category under this criterion.

Criterion 6 - Quantitative analysis showing probability of extinction

There are no quantitative data available to assess this ecological community under this criterion. Therefore, it is **not eligible** for listing under this criterion.

4. Priority Research and Conservation Actions

4a. Research Priorities

The following research priorities would inform future priority conservation actions for the KI Narrow-leaved Mallee Woodland ecological community. A number of these will build on previous and ongoing research projects.

- Continue to build upon existing research efforts on ecological fire regimes (e.g. Eastern Plains Fire Trial) to maintain biodiversity. Key matters for further investigation include:
 - Determining short and longer-term impacts of fire frequency, intensity or mosaic patterns on different plant and animal components of the ecological community;
 - Seed viability and germination requirements for native plant species in the ecological community;
 - Effect of stand age and surrounding landscape on responses to fire;
 - Developing rapid soil seed assessment methods and seed identification techniques to better evaluate below-ground plant diversity.
 - Refine the state-transition model developed for the ecological community by Pisanu (2007) to take account of increased ecological knowledge of community dynamics that has been obtained from research projects since then.
- Research the life histories, ecological roles and habitat requirements of key flora and fauna.
- Research the key ecological processes that contribute to long term resilience of patches.
- Research into how to improve understory diversity at low quality sites, including the most appropriate restoration techniques.
- Research into appropriate and integrated methods to manage weeds that affect the ecological community.
- Survey which patches meet the condition thresholds for the ecological community and where threatened or other regionally significant species are present.

¹⁰ Immediate future is defined in the Committee's guidelines on nominating and assessing ecological communities to be within the next ten years or three generations of key long-lived species, in this case *E. cneorifolia*.

4b. Priority recovery and threat abatement actions

Habitat loss, disturbance and modification

- Avoid further clearance and fragmentation of the ecological community wherever possible.
- Implement optimal revegetation/restoration strategies at sites across the landscape, based on information from research projects.
 - Include regular monitoring to determine success of revegetation/restoration programs.
 - Management strategies also should consider any threatened and regionally important species within patches of the ecological community.
- Where possible, reinstate the diversity and connectivity of patches/habitats across the landscape through integrated and adaptive management activities. In particular:
 - Ensure that areas of particularly high quality are maintained to retain their biodiversity and landscape connectivity value; but also
 - Recognise that sites of apparently low vegetation quality, e.g. narrow windbreaks over pasture, may retain certain habitat and connectivity values that are important in heavily fragmented landscapes.
- Apply recommended buffer zones for the ecological community to minimise impacts from any adjacent developments and activities that might damage a patch.
- Avoid any disturbances to hydrology or soil structures in the surrounding landscape that may exacerbate erosion and salinity within sites prone to these issues.
- Liaise with local councils and state authorities to ensure new developments, road widening, maintenance activities, or other activities avoid or minimise any adverse impact to the ecological community.
 - Any works should take note of recommendations in existing and future management plans, e.g. road maintenance should be aware of conservation information in council roadside management plans.
- Investigate formal conservation arrangements, management agreements and covenants to protect patches on private land. This is particularly important for larger patches or areas that link patches and create wildlife corridors.

Fire

- Use a landscape-scale approach, including available knowledge on fire histories and age distribution of stands, to identify priority sites that require fire for biodiversity conservation. The approach should ensure that a representative spread of age classes and post-fire stages of the ecological community are maintained in the landscape, rather than a skewed distribution, e.g. situations where the majority of patches are long-unburnt (most >30 years) or are recently burnt (most <5 years).
- Implement appropriate fire regimes that take into account results from research. For instance, the findings of the Eastern Plains Fire Trial and other studies on fire in mallee ecosystems that detail the responses and requirements of both flora and fauna in the ecological community. This may include pollarding to influence fire severity or intensity.
- Exclude livestock from burnt or pollarded patches to enable regeneration of native plant species from resprouts or the soil seed bank.

- Ensure the fire history of all known patches continues to be monitored and covers the spectrum from large intense wildfires to small low-intensity managed burns.
- Liaise with local fire brigades and agencies and engage their support in applying ecological fire regimes to patches of the ecological community.
- Where rejuvenation of a patch is considered to be necessary and fire is impractical, use pollarding or coppicing of mallee stems to open up the tree canopy and stimulate regrowth. However, regard should be given to retaining stems with important habitat characteristics that are slow to develop, such as hollows.

Invasive species and diseases

- Identify potential new weed incursions early and manage for local eradication, where possible.
- Target management of existing weed problems to sites of high diversity or where threatened or regionally significant species are known to occur.
- Manage weeds before and after ecological burns, and during revegetation works to maximise success of restoration.
- Ensure workers are appropriately trained in the use of herbicides and what to target, and understand the importance of avoiding non-target impacts on native vegetation.
- Use appropriate hygiene to minimise the introduction or spread of plant diseases and weeds at susceptible sites; monitor for signs of new disease/weeds.
- Avoid fertiliser/chemical spray drift and off-target damage within or near to the ecological community, with regard to minimum buffer zones.

Trampling, browsing or grazing

- Strategically manage total herbivore grazing (by native and domestic animals), for instance by fencing off regrowth, revegetation areas, or sites with threatened or important species to restrict grazers.
- Control introduced pest animals through coordinated landscape-scale control programs.

Conservation information

- Continue communications with landholders/managers, relevant agencies and the public to emphasise the value of the ecological community, its significance to Kangaroo Island, and appropriate management.
- Develop education programs, information products and signage to help the public recognise the presence and importance of the ecological community, and their responsibilities under state and local regulations and the EPBC Act.
- Continue to encourage local participation in recovery efforts through local conservation groups, field days and planting projects, etc.
- Install significant vegetation markers along roads to designate areas of KI Narrow-leaved Mallee Woodland to protect and prevent inappropriate road side maintenance from occurring.

4c. Existing plans/management prescriptions that are relevant to the ecological community

These prescriptions were current at the time of publishing. Please refer to the relevant agency's website for any updated versions or new information that has been published.

Davies, R J-P and Overton, B (1998). The management of "Kangaroo Island narrow-leaved mallee" plant communities on Kangaroo Island, South Australia. Kangaroo Island Soil Conservation Board, Kingscote SA.

Dowie, D (2006b). Ecologically sustainable fire regimes for Kangaroo Island habitats – version two. Project report, Department for Environment and Heritage, South Australia, Kingscote SA.

Kangaroo Island Council (2006). Roadside vegetation management plan 2007. Kangaroo Island Council, Kingscote, SA.

Available on the Internet at: www.kangarooisland.sa.gov.au/page.aspx?u=308

Viewed: July 2012.

Kangaroo Island District Bushfire Prevention Committee (2009). Kangaroo Island bushfire risk management plan 2009-2014. Kangaroo Island Council and Native Vegetation Council, Kingscote, SA.

Available on the Internet at: www.kangarooisland.sa.gov.au/page.aspx?u=379

Viewed: July 2012.

Kangaroo Island Natural Resources Management Board (2009). Kangaroo Island natural resources management plan. Kangaroo Island Natural Resources Management Board, Kingscote SA.

Available on the Internet at: www.kinrm.sa.gov.au/Publications/KIRegionalNRMPlan.aspx

Viewed: July 2012.

Moritz, K (2006). Caring for Kangaroo Island narrow-leaved mallee. Factsheet. Kangaroo Island Soil Conservation Board and National Parks and Wildlife South Australia, Kingscote SA. Incorporated in Kangaroo Island Council (2006) as Appendix 10.

Taylor, D (2008). Draft recovery plan for 15 nationally threatened plant species on Kangaroo Island, South Australia. Second edition: 2003-2013. Department for Environment and Heritage, South Australia. Kingscote SA.

Available on the Internet at:

www.environment.sa.gov.au/Plants_Animals/Threatened_species_ecological_communities/Recovery_planning/Plans_for_threatened_plants_in_SA

Viewed: July 2012.

Willoughby, N, Opperman, A and Inns, RW (2001). Biodiversity plan for Kangaroo Island, South Australia. Department for Environment and Heritage, South Australia. Adelaide SA. A summary of plan available on the Internet at:

<http://fedpub.ris.environment.gov.au/fedora/objects/mql:16/methods/c4oc-sDef:Document/getPDF>

Viewed: July 2012.

Wilson, CG (2006). Bridal creeper (*Asparagus asparagoides*) management strategy for Kangaroo Island 2006 – 2010. Kangaroo Island Asparagus Weeds Committee, Kingscote SA.

Available on the Internet at:

www.kinrm.sa.gov.au/LinkClick.aspx?fileticket=8x2MN_XkaLg%3D&tabid=1155&mid=2805

Viewed: July 2012.

4d. Recovery plan decision

A recovery plan will be developed for the KI Narrow-leaved Mallee Woodland ecological community. This is because the actions required to conserve and promote recovery of the ecological community include short and long term activities that need to be co-ordinated at a landscape level and involve a range of stakeholder groups. Recovery planning should also continue to provide guidance to land managers and raise public awareness of conservation actions.