National recovery plan for the “Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions” ecological community

Australian Government

Queensland Government

Department of Environment, Climate Change and Water NSW

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Cover: The narrow-leaved bottle tree *Brachychiton rupestris* is a characteristic emergent tree throughout most of the geographical extent of the semi-evergreen vine thicket community. In many areas, it is now found as isolated trees in otherwise cleared landscapes. This is a particularly fine specimen in the upper Burnett district near Monto.

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Executive Summary

Community

Semi-evergreen vine thicket (SEVT) is considered an extreme form of dry seasonal subtropical rainforest (McDonald 1996). It occurs in areas with a subtropical, seasonally dry climate on soils of high to medium fertility and is generally characterised by the prominence of trees with microphyll sized leaves (2.5–7.5cm long) and the frequent presence of swollen-stemmed "bottle trees" (*Brachychiton australis, B. rupestris*) as emergents from the vegetation. The thickets typically have an uneven canopy 4–9m high with mixed evergreen, semi-evergreen and deciduous emergent tree species 9–18m high. Vines, twining or scrambling plants are prominent.

Conservation status

The Australian Government has listed "Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions" as an 'Endangered' ecological community (EC) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Six of the 10 Regional Ecosystems (REs) that make up the SEVT EC are also listed under Queensland's *Vegetation Management Act 1999* (VMA) as 'Endangered' (11.3.11, 11.4.1, 11.8.13 and 11.11.18), or 'Of Concern' (11.2.3 and 11.9.4).

The SEVT EC also includes areas of SEVT within the Brigalow Belt South and Nandewar Bioregions within New South Wales. This community corresponds to the *Notelaea microcarpa–Ehretia membranifolia–Geijera parviflora* vine thicket of Floyd (1990) and western vine thickets of Keith (2004). The community is listed as 'Endangered' under the NSW *Threatened Species Conservation Act 1995*.

Habitat and distribution summary

Remnant semi-evergreen vine thickets, often referred to as softwood scrub or bottle tree scrub are most common on undulating plains on fine-grained sedimentary rocks (frequently shale) and on basalt hills and plains. They also occur on coastal dunes, Quaternary alluvium, Tertiary clay plains, old loamy and sandy plains, or hills and lowlands on metamorphic rocks.

The SEVT EC originally covered almost 900,000ha between 19^{o} and 31^{o} latitude, with an average annual rainfall between 500 and 750mm. The total remnant extent of the SEVT EC in 2003 was less than 150,000ha (17%), with approximately 37,000ha in protected areas such as national parks and state forests (Qld EPA 2005a).

Threats summary

Threats affecting SEVT EC include:

- clearing;
- fire;
- weeds;
- grazing;
- vertebrate pests; and
- coastal development.

Overall recovery objective

The overall objective of this plan is to maintain and conserve the environmental values of the semi-evergreen vine thicket ecological community over the long term, by minimising the loss of both remnant and regrowth SEVT and improving their condition and management.

Summary of actions

The following actions are recommended:

- Complete and refine mapping of remnant SEVT EC.
- Determine the extent and condition of areas of the SEVT EC affected by invasive plant species, particularly weeds of national significance (WONS), e.g. rubber vine and lantana.
- Survey poorly known species, especially fungi, herpetofauna and invertebrates.
- Monitor selected populations of the EPBC Act-listed species across their distribution within the EC.
- Identify key areas of the SEVT EC for addition to the Queensland and NSW conservation reserve systems.
- Encourage landholders to enter into conservation agreements over semi-evergreen vine thickets.
- Liaise with landholders to develop appropriate burning practices and other procedures to minimize fire damage to remnant areas of SEVT on private and public lands.
- Determine the impact of grazing animals, both domestic and native, on remnant areas of SEVT. Develop guidelines and recommendations for fencing.
- Develop and implement a pest management program to control or manage feral animals and native animals in SEVT remnants.
- Encourage landholders through appropriate incentive programs to protect and foster regrowth SEVT and associated vegetation in buffer areas.
- Research and develop use of SEVT species for landscape rehabilitation and encourage mining companies, Main Roads and others to use native species in plantings.
- Undertake consultation with traditional owner groups to determine the level of indigenous knowledge of and association with the SEVT EC.
- Develop and implement education programs to increase the awareness of government and non-government organisations regarding SEVT conservation, and their responsibilities for SEVT protection and management.

1. General information

Conservation status

The Australian Government has listed “Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions” as an ‘Endangered’ ecological community (EC) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Queensland

Ten of 15 types of SEVT community described for the Brigalow Belt (North and South) Bioregion (Sattler and Williams 1999) are included in the EPBC Act listed SEVT EC (Table 1).

Table 1. Summary of the Regional Ecosystems (mapped by Queensland Department of Environment and Resource Management) included within the EPBC Act listed SEVT ‘Endangered’ ecological community.

Regional Ecosystem	Short description	Distribution and remnant status
11.2.3	Microphyll vine forest ("beach scrub") on sandy beach ridges	Between Townsville and Bowen and between Carmila and Gladstone. About 2500ha remain of 2950ha.
11.3.11	Semi-evergreen vine thicket on alluvial plains	Mainly in northern and central Brigalow Belt, especially the Isaac – Comet Downs and Dawson River Downs subregions. About 2500ha remain of 19,450ha pre-clearing.
11.4.1	Semi-evergreen vine thicket ± *Casuarina cristata* on Cainozoic clay plains	Mostly in Isaac – Comet Downs, Basalt Downs and Dawson River Downs subregions. About 2000ha remain of 26,000ha.
11.5.15	Semi-evergreen vine thicket on Cainozoic sand plains/remnant surfaces	Northern Brigalow Belt (Cape River Hills, Northern Bowen Basin and Isaac – Comet Downs subregions), also Mt Morgan Ranges and Banana – Auburn Ranges subregions. About 15,300ha remain of 43,700ha.
11.8.3	Semi-evergreen vine thicket on Cainozoic igneous rocks	Mostly in central and southern Brigalow Belt (Eastern Darling Downs, Dawson River Downs, Banana – Auburn Ranges, Southern Downs and Basalt Downs subregions). 26,000ha remain of 80,500ha.
11.8.6	*Macropteranthes leichhardtii* thicket on Cainozoic igneous rocks	Mostly in central Brigalow Belt (Buckland Basalt subregion). About 15,500ha remain of 29,000ha.
11.8.13	Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks	Northern Brigalow Belt (Northern Bowen Basin subregion), also Marlborough and Callide Creek Downs subregions. Less than 6500ha remain of 52,300ha.
11.9.4	Semi-evergreen vine thicket on Cainozoic fine-grained sedimentary rocks	Mostly central and southern Brigalow Belt (Arcadia, Dawson River Downs, Taroom Downs, Barakula and Southern Downs subregions). About 59,000ha remain of 540,000ha pre-clearing.
11.9.8	*Macropteranthes leichhardtii* thicket on Cainozoic fine-grained sedimentary rocks	Central Brigalow Belt (Claude River Downs, Arcadia and Dawson River Downs subregions). Approx. 12,000ha remain of 36,000ha.
11.11.18	Semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding	Central Brigalow Belt (Mt Morgan Ranges, Callide Creek Downs, Banana – Auburn Ranges, Boomer Range and Marlborough Plains subregions). 4700ha remain of 49,500ha pre-clearing.

Six of the 10 Regional Ecosystems (REs) that make up the SEVT EC are also listed under Queensland’s *Vegetation Management Act 1999* (VMA) as ‘Endangered’ (11.3.11, 11.4.1, 11.8.13 and 11.11.18), or ‘Of Concern’ (11.2.3 and 11.9.4).

In addition to the 10 REs that make up the SEVT EC, there are another five vine thicket communities recorded within the Brigalow Belt (11.8.9, 11.10.8, 11.11.5, 11.11.21 and 11.12.4) in Queensland. Regional Ecosystems 11.8.9 and 11.11.21 are limited in extent and have an 'Of Concern' status under the VMA.

Seven SEVT REs (12.8.21, 12.8.22, 12.9/10.15, 12.11.4, 12.11.13, 12.12.17 and 12.12.18) occur in western and northern areas of the South East Queensland Bioregion. Three REs (12.8.21, 12.8.22 and 12.9/10.15) have 'Endangered' status under the Queensland VMA, but all have been excluded from the EPBC Act listing. However they are included in the scope of the draft of the South-East Queensland Rainforest Recovery Plan. There is also a single very restricted SEVT community (13.11.7) within the Stanthorpe and Nandewar subregions of the New England Tableland Bioregion (Queensland), which could be considered for listings along with the SEVT communities in the (NSW) Nandewar Bioregion. There are also two SEVT REs (8.12.16 and 8.12.28) that occur in the Central Queensland Coast Bioregion. The distribution of the SEVT communities in central and southern Queensland is shown on Map 1.

New South Wales

The SEVT EC also includes areas of SEVT within the Brigalow Belt South and Nandewar Bioregions within New South Wales. This community corresponds to the *Notelaea microcarpa–Ehretia membranifolia–Geijera parviflora* vine thicket of Floyd (1990) and western vine thickets of Keith (2004). This community has not been mapped systematically, but has been listed as 'Endangered' under the NSW *Threatened Species Conservation Act 1995* (TSC Act). It occurs mainly in the Northern Basalts (BBS) and Inverell Basalts (Nandewar) subregions (Curran 2006).

International obligations

This ecological community is not listed under any international agreements. Actions in this plan are consistent with Australia's international obligations.

Affected interests

The following organisations may be affected by the implementation of recovery actions.

Natural Resource Management Regional Bodies

Burdekin Dry Tropics NRM (BDT NRM)
Condamine Alliance (CA)
Fitzroy Basin Association (FBA)
Queensland Murray Darling Committee Inc. (QMDC)
South West NRM Inc. (SW NRM)
Border Rivers - Gwydir Catchment Management Authority
Namoi Catchment Management Authority

Organisations representing landholder and public interests

AgForce Queensland
Australian Conservation Foundation (ACF)
Queensland Farmers Federation (QFF)
Queensland Resources Council (QRC)
Queensland Conservation Council (QCC)
The Wilderness Society
WWF Australia
NSW Nature Conservation Council
National Parks Association (NSW)
NSW Farmers' Association
NSW Minerals Council

Local Governments (Queensland)

Banana Shire
Blackall-Tambo Region
Burdekin Shire
Central Highlands Region
Charters Towers Region
Dalby Region
Gladstone Region
Isaac Region
Mackay Region
Murweh Region
North Burnett Region
Rockhampton Region
Roma Region
South Burnett Region
Southern Downs Region
Toowoomba Region
Townsville City
Whitsunday Region

Local Governments (New South Wales)

Armidale Dumaresq Shire
Glen Innes Severn Shire
Gunnedah Shire
Gwydir Shire
Inverell Shire
Liverpool Plains Shire
Moree Plains Shire
Narrabri Shire
Tamworth Region
Tenterfield Shire

Queensland Government

Department of Employment, Economic Development and Innovation (DEEDI)
Department of Environment and Resource Management (DERM)
Department of Main Roads (DMR)
Queensland Transport (QT)

New South Wales Government

Department of Environment, Climate Change and Water (DECCW)
Department of Natural Resources (DNR)
Department of Primary Industries (DPI)

Indigenous groups

Red Chief Local Aboriginal Land Council
Narrabri Local Aboriginal Land Council
Other Traditional Owner groups

Consultation with Indigenous people

Implementation of recovery plan actions includes consideration of the role and interests of Aboriginal people whose country incorporates SEVT. Documenting Indigenous knowledge and traditional management practices for SEVT EC should occur as one of the actions of this recovery plan. Traditional owners will be encouraged throughout the life of this plan to be involved in further consultation and implementation of recovery actions.

The recovery plan was provided to Aboriginal Community Support Officers and Aboriginal Land Management Facilitators from the relevant NRM Regional Bodies and Catchment Management Authorities. Within the Namoi Catchment, Red Chief Local Aboriginal Land Council and Narrabri Local Aboriginal Land Council expressed interest in receiving further information regarding implementation of the plan. As per Action 4.1, consideration should be given to consultation with these groups when undertaking on-ground works in the relevant areas (see http://www.alc.org.au/about/organisation/RALCS/RALCS.html).

Benefits of this plan to other species and communities

The actions recommended in this plan will benefit threatened species for which the SEVT EC is habitat (Table 2). SEVT frequently grows in close association with communities dominated by brigalow *Acacia harpophylla*, which is also listed as an ‘Endangered’ ecological community

under the EPBC Act. Actions recommended for this plan will also contribute towards recovery of the Brigalow EC.

In addition to the species listed in Table 2 there are several NCA and EPBC Act threatened plants that occur in or adjacent to other (unlisted) Brigalow Belt SEVT communities. Such species include the 'Endangered' *Atalaya collina*, *Cassinia australiana, Decaspermum struckoilicum, Macrozamia serpentina, Capparis humistrata, Tectaria devexa* var. *devexa* and the 'Vulnerable' *Bursaria reevesii*, *C. thozetiana*, *Neoroepera buxifolia*, *Omphalea celata* and *Polianthion minutiflorum*.

The vine thicket species *Coatesia paniculata*, *Sarcochilus dilatatus* and *Tinospora smilacina* have very restricted distributions in New South Wales and are listed as 'Endangered' under the TSC Act.

The bush stone-curlew, Australian brush-turkey, glossy black-cockatoo, little pied bat, black-striped wallaby, eastern long-eared bat, brigalow scaly-foot, brush-tailed rock-wallaby, and black-breasted button-quail all primarily occur or are frequently found in semi-evergreen vine thickets and are listed as threatened species under either Queensland, New South Wales or Commonwealth legislation (see Table 2).

Table 2. Plants and animals that frequently or primarily occur in the SEVT EC and are listed as threatened under Queensland, New South Wales or Commonwealth legislation.

Scientific name	Common name	Commonwealth status[1]	Qld status[2]	NSW status[3]	Habitat (RE)
Plants					
Brachychiton sp. (Blackwall Range R.J.Fensham 971)			E		11.8.13
Cadellia pentastylis	Ooline	V	V	V	11.9.4
Callitris baileyi	Bailey's cypress		R	E	11.8.3
Clematis fawcettii		V	V	V	11.8.3
Croton magneticus		V	V		11.8.13
Denhamia parvifolia		V	V		11.9.4
Eucalyptus raveretiana	Black ironbox	V	V		11.3.11
Fontainea fugax			E		11.5.15
Phebalium distans	Mt Berryman Phebalium	*Has been nominated for listing under EPBC Act*			
Pomaderris clivicola		V	E		11.5.15
Senna acclinis				E	
Sophora fraseri		V	V	V	11.8.3
Zieria vagans			E		11.5.15
Zieria verrucosa			V		11.5.15, 11.9.4
Animals					
Alectura lathami	Australian brush-turkey			E (Nandewar & Brigalow Belt South Bioregions)	

Scientific name	Common name	Commonwealth status[1]	Qld status[2]	NSW status[3]	Habitat (RE)
Burhinus grallarius	Bush stone-curlew			E	
Calyptorhynchus lathami	Glossy black-cockatoo		V	V	11.9.4
Chalinolobus picatus	Little pied bat		R	V	
Macropus dorsalis	Black-striped wallaby			E	
Nyctophilus timoriensis	Eastern long-eared bat	V	V	V	
Paradelma orientalis	Brigalow scaly-foot	V	V		
Petrogale penicillata	Brush-tailed rock-wallaby	V	V	E	
Turnix melanogaster	Black-breasted button-quail	V	V	E	

[1] *Environment Protection and Biodiversity Conservation Act 1999*
[2] *Nature Conservation Act 1992*
[3] *Threatened Species Conservation Act 1995*

Social and economic impacts

Vine thickets originally occupied large areas of fertile soils, but in their undeveloped state were of very little grazing value. The ground strata of these communities are generally sparse and provide little forage. The density of the vegetation made management of livestock very difficult, hence the term “scrubber” for wild stock.

When cleared, the fertile soils support cropping and dense grass pastures, and the development schemes of the 1960’s and 1970’s were extremely successful in terms of economic return.

The key to recovery of the ‘Endangered’ semi-evergreen vine thickets in the Brigalow Belt and Nandewar Bioregions is to halt and reverse decline in their area and condition. The approach recommended is to restrict managers of significant areas of the SEVT EC to pre-existing uses, and to use education, financial incentives and support to facilitate improvements in SEVT condition and extent. As such there is no impediment to perpetuation of current usage of an area of SEVT EC.

Successful implementation of recovery actions designed to improve the condition and extent of SEVT, including financial assistance and incentives, are anticipated to produce social and economic benefits.

2. Biological information

Community description

Semi-evergreen vine thicket (SEVT) is considered an extreme form of dry seasonal subtropical rainforest (McDonald 1996). It occurs in areas with a subtropical, seasonally dry climate on soils of high to medium fertility and is generally characterised by the prominence of trees with microphyll sized leaves (2.5–7.5cm long) and the frequent presence of swollen-stemmed "bottle trees" (*Brachychiton australis, B. rupestris*) as emergents from the vegetation (e.g. Webb 1959, 1968; Webb & Tracey 1981, 1994). True bottle trees are absent from the New South Wales vine thickets, although the related kurrajong (*Brachychiton populneus*) is found in many stands. While canopy leaves are predominantly microphyll sized (McDonald 1996), stenophylly (i.e. narrow leaves) and pendulous leaves are also characteristic of some tree species in southern areas (Williams 2003).

The thickets typically have an uneven canopy 4–9m high with mixed evergreen, semi-evergreen and deciduous emergent tree species 9–18m high (Webb 1978). Vines, twining or scrambling plants are prominent (Fensham 1995; Gunn & Nix 1977; McDonald 1996) and often smother the canopy where structural damage has occurred (Fensham 1995). Some tree and vine species are facultatively semi-deciduous, i.e. they lose some or most of their foliage during prolonged dry periods (Williams 1999).

There is considerable variation in the height and density of the canopy and the number of strata in SEVT vegetation (McDonald 1996). In Queensland, the thickets become lower and more open in rocky situations and/or with decreasing rainfall (McDonald 1996). In New South Wales local thickets of densely spaced trees and shrubs frequently alternate with gaps in which trees and shrubs are absent or sparsely scattered (Williams 2003).

Remnant vine thickets in Queensland, often referred to as softwood scrub or bottle tree scrub (McDonald 1996, 2006), are most common on undulating plains on fine-grained sedimentary rocks (frequently shale) and on basalt hills and plains (based on Qld EPA 2005b). They also occur on coastal dunes, Quaternary alluvium, Tertiary clay plains, old loamy and sandy plains, or hills and lowlands on metamorphic rocks (Qld EPA 2005b). They are often associated with elevated, freely drained sites (McDonald 1996).

Within a given region species richness declines as rainfall decreases and/or becomes more seasonal (Fensham 1995; McDonald 1996). The floristic composition of the vegetation varies from north to south and from east to west, but communities form a continuum rather than discrete entities (Fensham 1995; McDonald 1996).

The following sections present an overview of the listed SEVT ecological community in Queensland and New South Wales. The broad extent of the SEVT EC is shown in Map 1. Descriptions of each component RE in Queensland and vegetation type in New South Wales are provided in Appendix 2.

For descriptive convenience, this overview, and the following review of threatening processes, are structured around three geographic units;

1. Northern SEVT (Brigalow Belt North (Environment Australia 2000))
2. Central SEVT (Brigalow Belt South (Queensland))
3. Southern SEVT (Brigalow Belt South and Nandewar (New South Wales))

The division between the northern and central SEVTs approximates to the Tropic of Capricorn (23°25.5'S).

Northern semi-evergreen vine thickets
The semi-evergreen vine thickets in this area are floristically diverse and occur across a broad range of landforms and geological substrates. Almost 450 plant species have been recorded in detailed surveys within the northern SEVT and areas to the north in the Einasleigh Bioregion (Fensham 1995). Nearly 50 percent of the plant species are restricted to semi-evergreen vine thicket (i.e. they are obligate SEVT species).

Although a large number of plant species occur within the community, only a few species are always present. These include the trees broad-leaved bottle tree *Brachychiton australis*, yellow tulip *Drypetes deplanchei,* small-leaved ebony *Diospyros humilis*, helicopter tree *Gyrocarpus americanus*, brush wilga *Geijera salicifolia*, yellow lemon *Pouteria cotinifolia* and strychnine *Strychnos psilosperma* and the vines *Cissus reniformis* and *Jasminum didymum*. Common emergent trees range from those that are fully deciduous (e.g. *Brachychiton australis*, *Gyrocarpus americanus*) to those that are semi-evergreen (e.g. ribbonwood *Euroschinus falcata*, Burdekin plum *Pleiogynium timorense*). Lower canopy species also show a great range in their deciduousness.

Vine thickets on volcanics are characterised by boonaree *Alectryon oleifolius*, *Grewia scabrella*, *Croton arnhemicus*, *Gyrocarpus americanus* and nipan or split-jack *Capparis lasiantha* (McDonald 1996).

Central semi-evergreen vine thickets
The semi-evergreen vine thickets in the Brigalow Belt South (Queensland) are also floristically diverse and heterogeneous, especially in the canopy layer (Speck *et al.* 1968; Story *et al.* 1967; Gunn & Nix 1977) and often also in the shrub layer (Gunn & Nix 1977; McDonald 1996). The floristic diversity is lower than recorded by Fensham (1995) for 'northern SEVT'. The proportion of obligate SEVT plant species appears to be lower than in 'northern SEVT', for example only 27 percent in vine thickets in the far west of the area (Neldner 1984).

Vine thickets in the drier inland areas are generally structurally simpler than those in sub-coastal areas, and may be reduced to a single tree layer. The density of trees and shrubs 3m or more tall may range from c. 900 stems/ha to almost 4,800 stems/ha (McDonald 1996).

Narrow-leaved bottle tree *Brachychiton rupestris* is virtually always present as an emergent. Other species that may be locally present as emergents include brigalow *Acacia harpophylla*, broad-leaved bottle tree *Brachychiton australis* and belah *Casuarina cristata* or less often *Acacia fasciculifera*, southern siris *Archidendropsis thozetiana*, ooline *Cadellia pentastylis*, ribbonwood *Euroschinus falcata,* crow's ash *Flindersia australis,* Queensland ebony or Hooker's bauhinia *Lysiphyllum hookeri*, bandicoot plum *Terminalia porphyrocarpa* and vinetree *Ventilago viminalis*. Emergents generally range in height from 11±3m to 16±3m but may reach 25m, and contain a mixture of evergreen, semi-evergreen and deciduous species.

A wide range of other tree species may be present locally in the canopy. Tree species frequently present may include *Backhousia angustifolia*, *B. kingii*, silver croton *Croton insularis, Denhamia oleaster,* peach bush *Ehretia membranifolia,* wilga *Geijera parviflora,* bonewood *Macropteranthes leichhardtii,* small-fruited mock olive *Notelaea microcarpa* and yellow lemon *Pouteria cotinifolia* var. *pubescens.* The canopy trees range in height from 6±2m to 8±3m or less often 12±3m (Gunn & Nix 1977; see also McDonald 1996). In the Central Highlands between Moura and Springsure *Macropteranthes leichhardtii* becomes dominant, and may form a mono-specific canopy layer (Gunn & Nix 1977; McDonald 1996; Nix et al. 1992).

The central vine thickets commonly have a shrub understorey 2±1m high, although in places where the canopy is very dense, shrubs may be absent (Gunn & Nix 1977). Species common in the shrub layer include soft acalypha *Acalypha eremorum*, scrub boonaree *Alectryon diversifolius*, *Everistia vacciniifolia*, currantbush *Carissa ovata*, *Croton phebalioides*, *Exocarpos latifolius*, *Geijera parviflora, Pittosporum spinescens* and *Triflorensia ixoroides*.

Common vines/lianes present in the vegetation include *Clematicissus opaca*, *Cissus oblonga*, *Trophis scandens*, *Jasminum didymum*, *Marsdenia* spp., *Sarcostemma viminale* subsp. *brunonianum*, *Secamone elliptica*, *Parsonsia lanceolata* and *Tylophora* spp. (Speck *et al.* 1968; McDonald 1996).

The herbaceous ground layer is usually sparse or may be absent. In some areas mosses may be prominent in the vegetation (Gunn & Nix 1977; Neldner 1984).

Southern semi-evergreen vine thickets

The semi-evergreen vine thickets in New South Wales are part of the *Notelaea microcarpa–Ehretia membranifolia–Geijera parviflora* vine thicket suballiance (suballiance #32) of Floyd (1990). They have also been called mixed stands (Beadle 1981) and western vine thickets (Keith 2004). The vegetation (particularly in northern areas of its distribution) is similar to that in the 'central SEVT' area in Queensland (Curran 2006; see also Nix *et al.* 1992).

Relative to the small size of the vine thicket patches, the vegetation is floristically rich in shrubs, small trees and vines (Williams 1999). The plant species diversity of the vine thickets (<100 species recorded in the vegetation type; Benson *et al.* 1996) is, however, much lower than the diversity of the vine thickets in Queensland. Vine thickets in New South Wales are also generally more open than those in Queensland (Floyd 1990), contain fewer deciduous species (Benson *et al.* 1996) and probably contain fewer obligate SEVT species (Curran 2006).

The vine thickets occur mainly on hills on light clay soils derived from basalt (Benson *et al.* 1996) but also occur in areas with sandy loams derived from sediments (Williams 1999).

The vine thickets are dominated by a variety of low tree and shrub species, with the species composition varying from north to south, possibly due to rainfall differences (Benson *et al.* 1996). Characteristic canopy species include red olive plum *Elaeodendron australe* var. *integrifolium,* peach bush *Ehretia membranifolia,* wilga *Geijera parviflora,* native olive *Notelaea microcarpa,* yellow lemon *Pouteria cotinifolia* var. *pubescens* and wallaby apple *Pittosporum spinescens.* The trees and tall shrubs are usually 2–10m tall (Floyd 1990).

Emergent trees often associated with the vine thickets include *Eucalyptus* spp., white cypress pine *Callitris glaucophylla*, belah *Casuarina cristata* and kurrajong *Brachychiton populneus*. These trees usually dominate the adjacent woodlands.

Vines frequently present include *Parsonsia* spp.*,* wonga wonga vine *Pandorea pandorana* and desert jasmine *Jasminum didymum* subsp. *lineare.*

Ooline *Cadellia pentastylis*, which is associated with vine thickets in Queensland, may be locally dominant in vegetation in northern New South Wales and occurs in similar areas to vine thickets (Floyd 1990; McDonald 1996). This community is not however included as part of the listed SEVT ecological community in New South Wales (based on NSW Scientific Committee (1998); see Environment Australia 2001).

Ecology

Little detailed information is available on the reproduction of semi-evergreen vine thicket plants. In northern areas near Townsville in Queensland, Kahn & Lawrie (1987) reported that SEVT plant species appeared to flower and fruit in most 'reasonable' seasons, but that few seedlings

and young plants seemed to establish in undisturbed thickets, although recovery of some species (either from seedlings or vegetative regrowth) after mechanical disturbance and burning could be strong. They indicated that bare basalt surfaces provided a particularly unfavourable habitat for seed establishment and suggested that good wet seasons may be needed for this.

In central and southern areas of the Brigalow Belt in Queensland, McDonald (1996) found that of 51 SEVT tree species for which data were available, 27 species germinate readily but 24 species need some form of treatment. Thirty-four of the 79 tree species for which information was available were able to resprout vegetatively, e.g. by producing basal sprouts or shooting from lateral roots, with bonewood *Macropteranthes leichhardtii* also regenerating by layering of branches.

McDonald (1996) also noted that many canopy and emergent tree species have wind-dispersed fruit, while lower canopy and understorey species most commonly have bird-dispersed fruit. He considered there were sufficient frugivorous bird species in vine thicket remnants in Queensland to maintain seed dispersal and hence the diversity of these plant species. He also noted that locally favourable sites associated with watercourses were extremely significant for providing refugial niches for plant species more typically found in higher rainfall areas and/or dependent on birds for seed dispersal.

In the northern Brigalow Belt in Queensland, obligate SEVT plant species (which comprise approximately 50 percent of all plant species in the vegetation) are fire sensitive (Fensham 1995). Both Fensham (1996) and McDonald (1996) noted that in Queensland, fire may kill many SEVT canopy species, especially on the margins of the thickets. However some SEVT plant species are relatively fire tolerant. In northern areas, these include species in the genera *Alphitonia*, *Alyxia*, *Atalaya*, *Breynia*, *Croton*, *Diospyros*, *Notelaea* and *Myrsine* (Kahn & Lawrie 1987). In drier vine thickets in central and southern areas of Queensland, McDonald (1996) noted that bitter bark *Alstonia constricta*, narrow-leaved backhousia *Backhousia angustifolia*, currantbush *Carissa ovata*, peach bush *Ehretia membranifolia* and bonewood *Macropteranthes leichhardtii* were also able to regenerate vegetatively after fire.

Distribution

In Queensland, the listed ecological community covered approximately 878,500ha of land prior to European clearing activities (calculated from Accad *et al.* 2006), occurring as discrete patches within other vegetation types, especially brigalow *Acacia harpophylla* forest. Other vine thicket REs covered a further 273,000ha, for a total estimated area prior to clearing of 1,152,000ha of SEVT vegetation within the Brigalow Belt Bioregion (see Map 2).

In 2003 only about 146,000ha of the listed SEVT EC in the Brigalow Belt Bioregion remained, about 17 percent of its pre-clearing extent (calculated from Accad *et al.* 2006). The remnant vine thicket patches are mostly scattered from coastal dunes and river deltas in the vicinity of Townsville and Ayr through the northern and central parts of the Brigalow Belt Bioregion to its south-eastern parts between Jandowae and Killarney on the Queensland/New South Wales border (Qld EPA 2005a) (see Map 3). Substantial areas of remnant SEVT (>500ha) are found in 23 of the 32 subregions, with more than 50 percent (78,000ha) accounted for by six subregions, namely Arcadia, Buckland Basalts, Claude River Downs, Dawson River Downs, Northern Bowen Basin and Southern Downs (see Map 4 and Appendix 3).

In the Eastern Darling Downs subregion in Queensland, the listed SEVT ecological community is contiguous with similar vegetation in the South East Queensland Bioregion. Further north in sub-coastal areas of the Marlborough Plains subregion, the microphyll/notophyll vine forest component of listed RE 11.8.13 is contiguous with similar regional ecosystems in the Central Queensland Coast Bioregion (Qld EPA 2005a). A major area (4760ha, approx. 35 percent) of RE 11.5.15 extends into the Broken River subregion of the Einasleigh Uplands Bioregion.

In New South Wales there is currently no accurate data on the original extent of the listed SEVT ecological community (Curran 2006). It has been estimated that several thousand hectares remain in the Brigalow Belt South and Nandewar Bioregions (Keith 2004; RACD 2004; DEC 2004). Remnants usually occur as isolated patches scattered in other shrubby vegetation (Curran 2006) and are located on the North West Slopes east of Moree and north from the Liverpool Plains, with major occurrences in the vicinity of Gunnedah, Bingara and Narrabri (Benson *et al*. 1996; Curran 2006; Williams 1999) and the region between Yetman, Graman and Crooble (Holmes 1979; Pulsford 1983).

The subregions within which mapped SEVT remnants predominantly occur are listed in Appendix 3 for each regional ecosystem (Qld) and vegetation type (NSW). In Queensland, remnants may also be present in other subregions not shown in the table.

Appendices 4 and 5 summarise the areas of remnant listed SEVT REs for local government areas (LGAs) and NRM regions respectively. Appendix 5 also lists areas of each SEVT held under different forms of tenure in each NRM region (see Map 5).

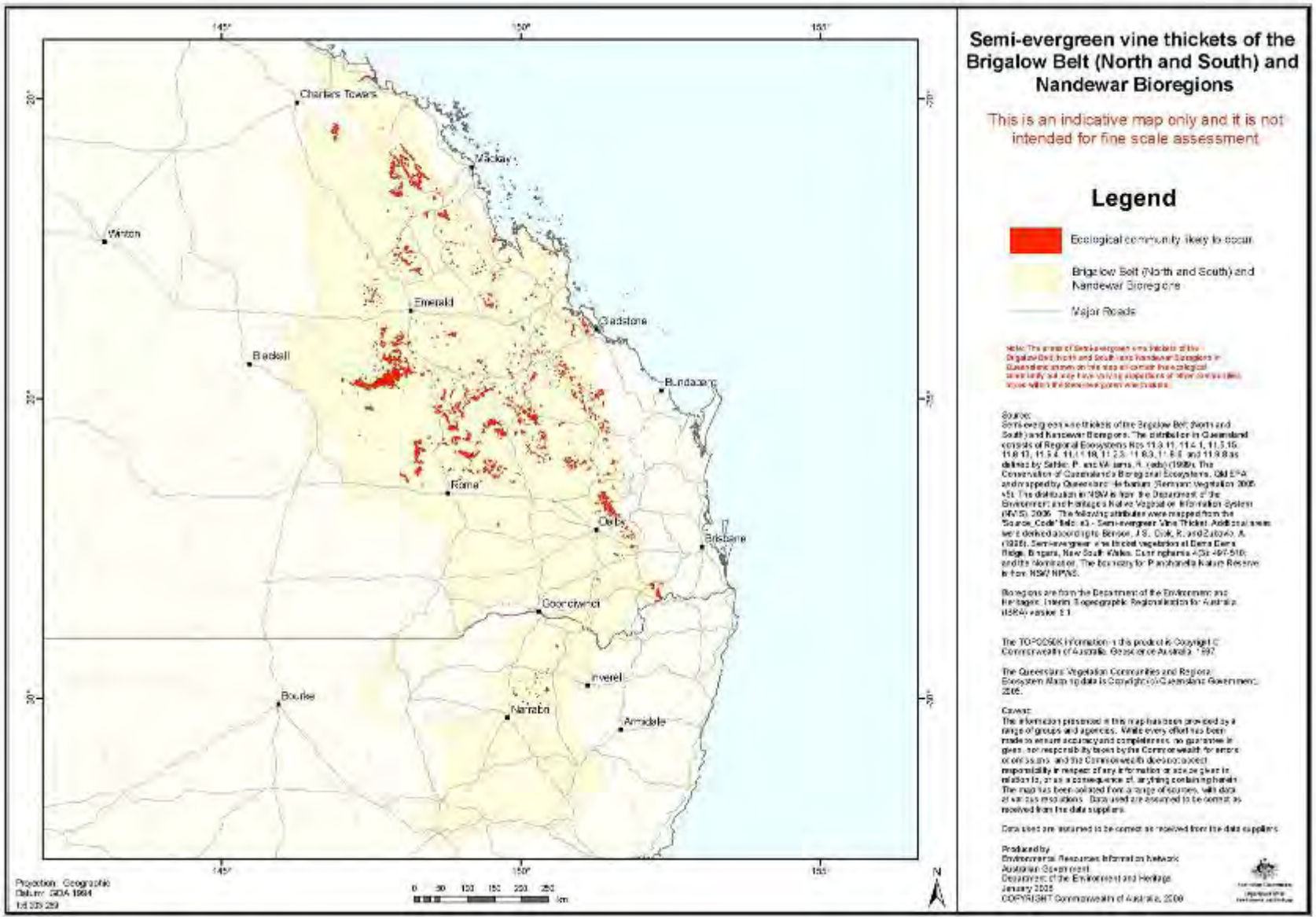
Conservation

Protected areas in Queensland containing remnants of the listed SEVT ecological community are shown in Appendix 6 for each component regional ecosystem. The most significant reserves in Queensland with listed SEVT vegetation are Carnarvon National Park (14,100ha), Palmgrove NP (6250ha), Expedition NP (4460ha), Bunya Mountains NP (1940ha) and Dipperu NP (1841ha).

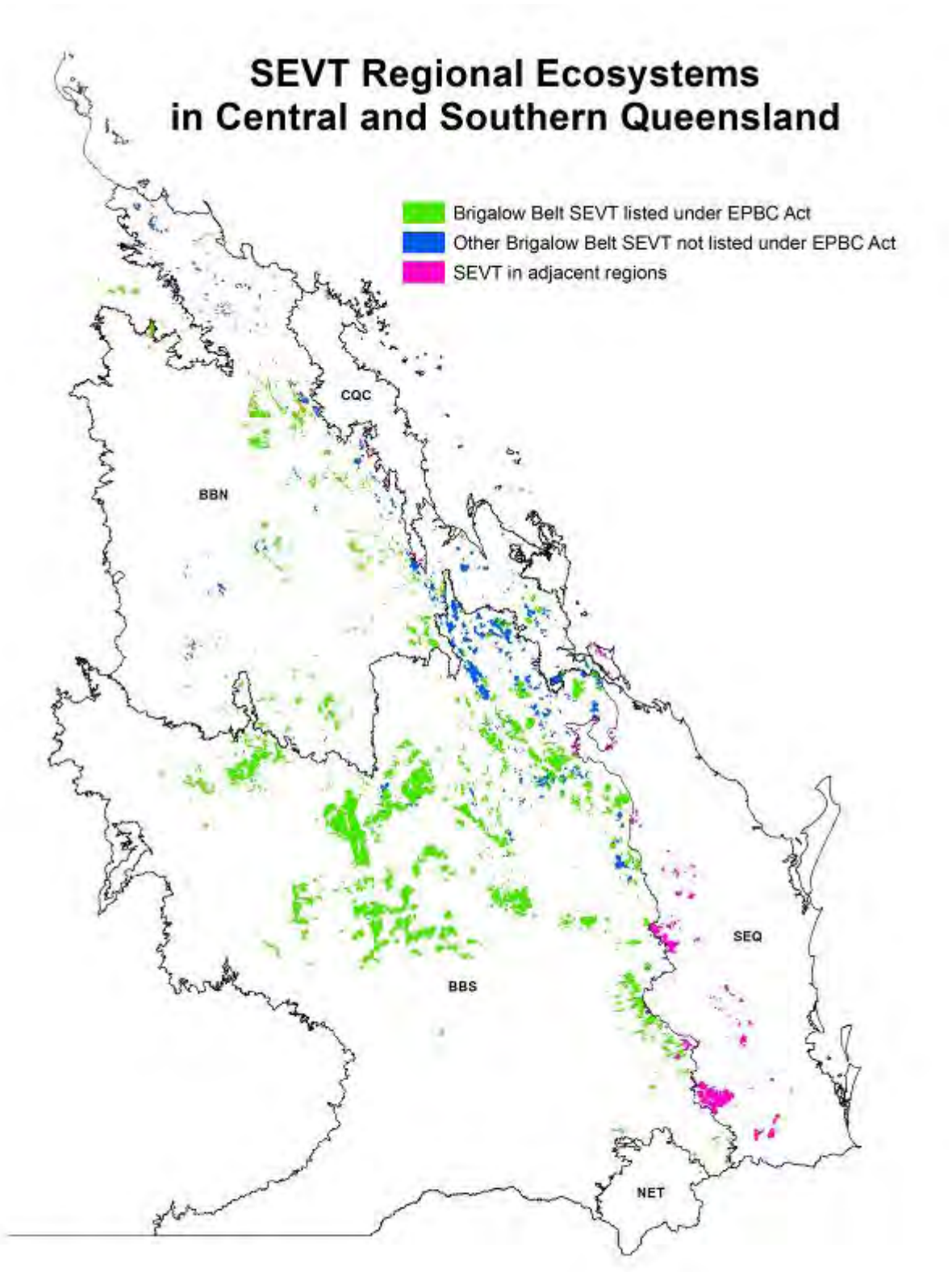
SEVT remnants located in these reserves do not adequately represent either the present or the original diversity of these communities in Queensland, and off-reserve conservation measures will be important for those types inadequately represented in protected areas (Fensham 1996).

Fensham & Streimann (1997) noted that protection of the moss flora associated with semi-evergreen vine thickets in northern areas in Queensland would be best achieved by the preservation of a large vine thicket patch rather than preserving several small patches, and by ensuring protection of the SEVT habitat across the spectrum of geological substrates on which the community occurs.

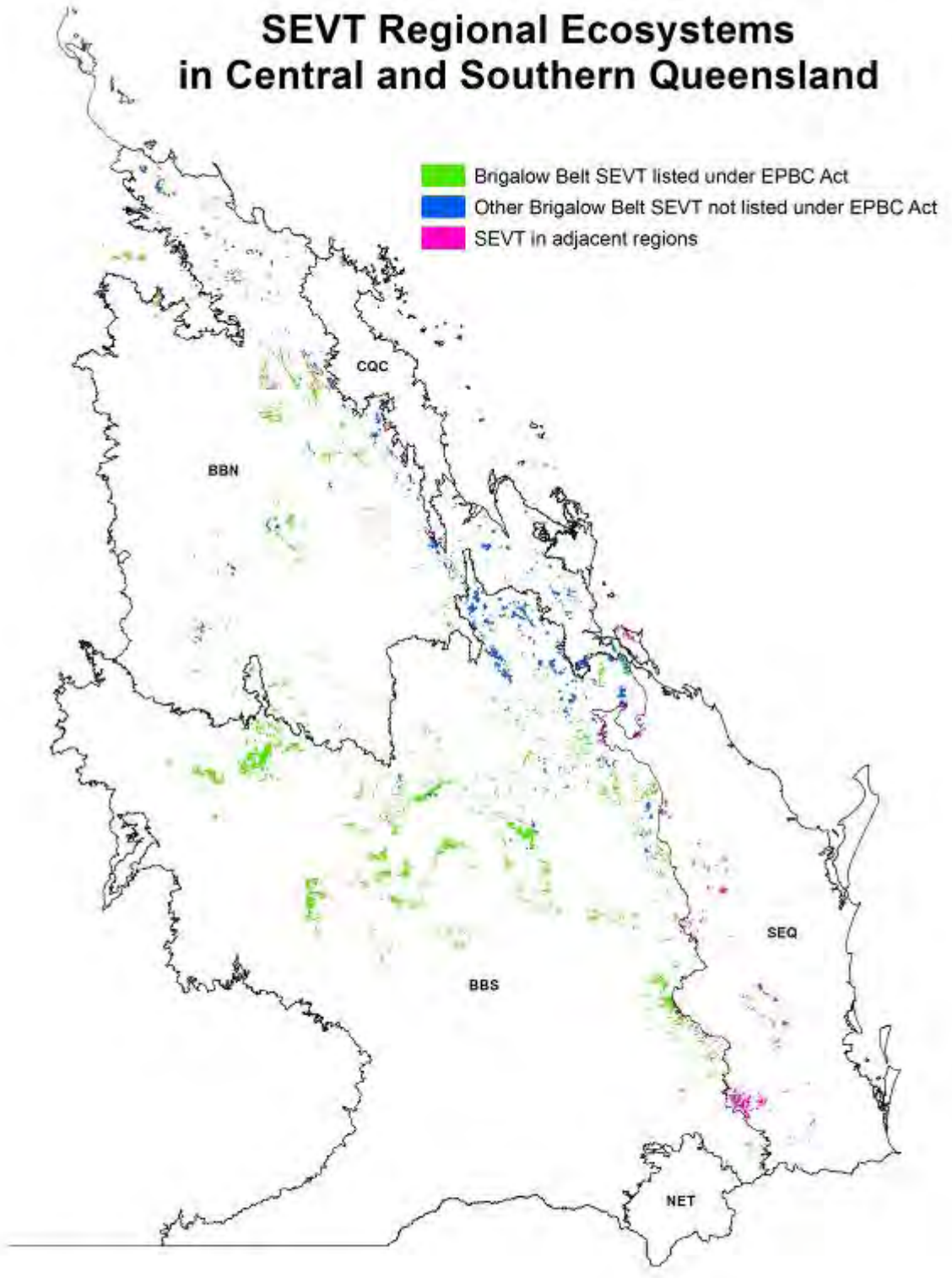
In New South Wales listed vine thickets currently occur in two protected areas. Planchonella Nature Reserve contains 200ha of SEVT (Curran 2006; Hunter 2002) and there are several small, unmapped patches in recent additions to Mt Kaputar NP.



Map 1. Distribution of the SEVT ecological community of the Brigalow Belt (North and South) and Nandewar Bioregions.



Map 2. Distribution of (pre-clear) SEVT REs in central and southern Queensland



Map 3. Distribution of remnant SEVT REs in central and southern Queensland

3. Threats

Over most of its range the listed SEVT EC has been extensively cleared for cropping and grazing and/or pasture in Queensland (Benson 1987; McDonald 1996; Qld EPA 2005b). In the central and northern Brigalow Belt Bioregion most of this clearing took place between 1960 and 1990 as part of major agricultural development schemes (McDonald 1996). During this period 70 percent of semi-evergreen vine thicket vegetation in the northern Brigalow Belt is thought to have been converted to pasture (Fensham 1996).

Across the Brigalow Belt in Queensland, the size of remaining listed vine thicket remnants ranges from <2ha to >1000ha (Qld EPA 2005a). Of the almost 4,000 remnants recorded, 62 percent are 10ha or smaller in size (see Appendix 7). Eighty-seven percent of patches are 50ha or less in size and only 3 percent of patches >100ha in area. In New South Wales, recent studies have shown that although some large patches of vine thicket and associated vegetation have been reported (Benson *et al.* 1996), most 'pure' vine thicket patches are <1ha in area within the more extensive shrubby woodland matrix in which they occur (Curran 2006).

The main on-going threats to SEVT remnants include clearing, inappropriate fire regimes, invasion by introduced plant species and increased grazing by domestic stock and native animals (Curran 2006; McDonald 1996; Qld EPA 2005b). Regional Ecosystem 11.2.3, which occurs in coastal areas in Queensland, is also considered under threat from coastal development (Qld EPA 2005b).

Clearing

Broad-scale clearing (greater than 2ha) of remnant vegetation for agricultural and pastoral purposes ceased in Queensland in 2006 under the VMA. Allowances are made under the Act for construction of roads and clearing of fencelines and firebreaks, which may result in further fragmentation of remnants. These disturbances also provide opportunities for invasive grasses and shrubs, which greatly increase the susceptibility of vine thicket fragments to fire damage (see below).

One of the few purposes for which broad-scale clearing is still permitted is mining. Currently the coal industry has nearly 700,000ha under mining lease (ML) or mineral development licence (MDL) within the Bowen Basin, and more than 3 million hectares under exploration permit (Fitzroy Basin Association 2007). Slightly less than 3000ha of the SEVT EC are held under ML or MDL and a further 33,000ha under exploration permit. The RE most under threat from mining is RE 11.8.13, which has 980ha (15 percent of its remnant extent) under ML or MDL, and 4100ha (65 percent) under exploration permit.

Fire

Although fire is considered a general threat, studies over a wide geographic area have found little evidence of fire damage within extensive undisturbed semi-evergreen vine thickets in either Queensland (Fensham 1996; McDonald 1996) or New South Wales (Curran 2006).

In Queensland, the remnants are often, but not always, located in areas protected from fire by the topography and/or substrate (Fensham 1995). Additionally, the sparse ground layer and relatively moist microclimate are also thought to restrict entry of wildfire into vine thicket vegetation (Kahn & Lawrie 1987; Fensham 1995).

Fire becomes a serious threat where fuel characteristics have been changed by the presence of introduced grass pasture species such as buffel grass *Pennisetum ciliare* or green panic *Megathyrsus maximus* var. *pubiglumis* in areas adjacent to thickets (Fensham 1996; McDonald 1996) or where thickets have been invaded by lantana *Lantana camara* (Fensham *et al.* 1994; Fensham 1996). McDonald (1996) indicated that repeated fires and the slow rate

of regeneration in vine thicket vegetation were causing rapid attrition of roadside SEVT remnants and many hill slope fragments in Queensland. In New South Wales, there is more emphasis on cropping than on sown pastures and build-up of fuel in areas adjacent to remnants appears to be less of a problem (Curran 2006).

In a climate-change scenario of increasing temperatures and lower and more erratic rainfall, it is probable that unplanned, high-intensity fires will become a greater threat throughout the Brigalow Belt and Nandewar Bioregions, especially to the more fragmented remnants occupying more marginal habitats.

Weeds

The major weed species considered to pose a threat to semi-evergreen vine thickets in Queensland, because they facilitate the incursion of fire into them, are the pasture species buffel grass *Pennisetum ciliare* and green panic *Megathyrsus maximus* var. *pubiglumis* and the pasture weed parthenium *Parthenium hysterophorus* (Fensham 1996; McDonald 1996).

The most widespread introduced species in the SEVT EC is velvet tree pear *Opuntia tomentosa* (McDonald 1996). Other introduced species recorded in Queensland vine thickets include the shrub lantana *Lantana camara*, the vines rubber vine *Cryptostegia grandiflora* and Brazilian nightshade *Solanum seaforthianum* and herb coral berry *Rivina humilis* (Fensham 1996; McDonald 1996). Prickly pear *Opuntia stricta* var. *stricta* is the most common introduced plant recorded in listed vine thickets in New South Wales (Benson *et al.* 1996), although African boxthorn *Lycium ferocissimum* and Coolatai grass *Hyparrhenia hirta* may be locally common in some places (Curran 2006).

Of these weed species, only *L. camara* and *C. grandiflora* are considered to pose a serious threat (Fensham 1996; McDonald 1996). The latter two species are ranked as numbers four and five (respectively) of the top 20 weeds of national significance (WONS) (Thorp & Lynch 2000), with dry rainforest being considered one of the prime habitats for *C. grandiflora* (Humphries *et al.* 1991). Both species can cause broad-scale displacement of native plants, while lantana promotes the spread of fire into vine thickets (Fensham *et al.* 1994; Fensham 1996).

In northern areas *L. camara* does not appear to occur in inland areas with <600mm mean annual rainfall and is usually associated with eastern vine thickets (Fensham 1996) in moister sub-coastal areas (McDonald 1996). *Cryptostegia grandiflora* is present in inland and eastern parts of Brigalow Belt North and northern parts of Brigalow Belt South. It is most prolific around vine thicket margins or where the overstorey canopy is open because of the rocky substrate (Fensham 1996; McDonald 1996). Fensham (1996) noted *C. grandiflora* was absent from vine thickets between 20º45’S and 22º15’S.

Various forms of disturbance of semi-evergreen vine thickets are thought to promote invasion by weeds. For example McDonald (1996) considered that trampling by cattle, and death of canopy trees from fire, both promoted invasion by introduced pasture grass species. Fensham (1996) reported a positive correlation between the presence of pigs and *L. camara* in northern areas in Queensland, and indicated that pigs appeared to facilitate the weed’s invasion.

Fensham (1996) also noted that mechanical disturbance in vine thickets from strip clearing for fences or for mineral exploration facilitated colonisation by weeds such as *L. camara* and *C. grandiflora*.

Certain weed species are capable of invading apparently undisturbed vine thickets. Green panic *Megathyrsus maximus* var. *pubiglumis* grows freely in relatively shady situations, as do *Rivina humilis* and *Ageratum conyzoides*.

Grazing

In 'northern SEVT' areas in Queensland Fensham (1996) found little or no evidence of damage from either cattle or pigs in most vine thicket remnants, although Kahn & Lawrie (1987) noted that cattle grazing can open up the understorey layer. McDonald (1996) found extensive trampling damage and associated invasion by pasture grasses in vine thickets in central and southern Queensland. Curran (2006) has found evidence of severe overgrazing by sheep and cattle in some vine thicket patches in New South Wales, although these mostly appear to be more open thickets in marginal areas or patches that have been disturbed.

Exclusion of domestic livestock may not necessarily lead to an improvement in terms of recovery of the ground stratum and/or regeneration of canopy species in semi-evergreen vine thickets. In Queensland, availability of crops and planted pastures, and the loss or removal of predators, particularly dingoes, has resulted in many areas of remnant or regrowth vine thicket carrying large numbers of native macropods, especially the black-striped wallaby *Macropus dorsalis*. As an example, although cattle have been excluded for more than 40 years, the lower strata of remnant vine thickets on Brigalow Research Station are in very poor condition, with extensive surface erosion and an absence of herbage or regeneration of shrub and canopy species (R.W. Johnson pers. comm.). White *et al.* (2003) reported estimated densities of black-striped wallabies of up to 10 per hectare, and although they feed predominantly on grass, they do take significant amounts of browse (trees, shrubs and vines) during dry periods. Although more common in Queensland, black-striped wallabies have a considerably restricted distribution in NSW and are listed as 'Endangered' under the TSC Act.

In a comparison of grazing in brigalow and poplar box communities by black-striped wallabies and cattle, Baxter, Moll and Lisle (2001) concluded that the greatest effects on structure and species composition of pasture were caused by cattle. They reported however that the dry weight of pasture consumed by wallabies was more than three times that taken by cattle. The economic impact of these losses and the lack of other effective control options led many landholders to clear the areas where they sheltered. This resulted in substantial loss of vine thicket and brigalow remnants in the Central Highlands prior to passage of the VMA.

Other vertebrate pests

Although no widespread evidence of feral pig damage was found in northern vine thickets, Fensham *et al.* (1994) noted that where pigs did occur, their digging appeared to kill some trees by severing their roots which also resulted in the canopy layer becoming more open. They also destroy brush turkey mounds and disturb fallen and decaying trees. Pigs do not appear to be common in vine thickets in either central or southern vine thickets and where present mostly appear to affect only ground layer species (Curran 2006).

Foxes and rabbits occur throughout the Brigalow Belt and Nandewar Bioregions, but it is not known what impact they have on the vine thicket ecosystem.

Horsup *et al.* (1993) recorded the cane toad *Bufo marinus* in eight of nine SEVT sites surveyed in the central-eastern Brigalow Belt of Queensland. They have extended their range westward to Carnarvon National Park (Mt Moffatt) and are considered responsible for a recent abrupt decline in observations of the northern quoll *Dasyurus hallucatus*.

Coastal development

Although more than 80 percent remains of the pre-clearing extent of vine thickets on coastal beach ridges (RE 11.2.3), this community is under threat from the impact of weeds and clearing for coastal development. Almost half the remnant area (1195ha) is held under freehold tenure, with 600ha in Whitsunday Region and 510ha in Rockhampton Region. The Capricorn Coast near Rockhampton is one of the most-rapidly growing areas in Queensland

(2.2 percent population growth in 2003-4), while demand for residential land is increasing in coastal areas around Townsville and Bowen.

Summary of threats

Fire and invasive plants are considered the most serious threats, particularly in the northern and central SEVT divisions (see Table 3), followed by the impact of grazing animals and on-going clearing and fragmentation.

Table 3. Current threats impacting on the SEVT EC

Threat	Northern SEVT	Central SEVT	Southern SEVT	Overall rating
1. Clearing	moderate	low	moderate	moderate
2. Fire	moderate/high	moderate/high	low	moderate/high
3. Weeds	moderate/high	moderate/high	moderate	moderate/high
4. Grazing	moderate	moderate	moderate	moderate
5. Other pests	low	low	low	low
6. Coastal development	moderate	n.a.*	n.a.	low

*** Not applicable**

4. Recovery objectives, performance criteria and actions

Overall objectives

The overall objective of this plan is to maintain and conserve the environmental values of the semi-evergreen vine thicket ecological community (SEVT EC) over the long term, by minimising the loss of both remnant and regrowth SEVT and improving their condition and management.

Specific objective 1

Identify and evaluate the extent, biodiversity value and condition of remnant and regrowth areas of SEVT EC in the Brigalow Belt (North and South) and Nandewar Bioregions.

Performance criteria

1.1 A system of benchmarks and condition indicators is developed for each of the regional ecosystems or vegetation types making up the SEVT EC.

1.2 Key areas of SEVT EC are surveyed and ratings of conservation value given based on biodiversity and condition.

1.3 Documented knowledge of semi-evergreen vine thickets and associated flora and fauna species is increased.

Action 1.1 Complete mapping of remnant SEVT EC in NSW and refine mapping of the Queensland SEVT remnants where necessary.

The methodology followed for mapping of the vegetation of the Brigalow Belt South and Nandewar Bioregions in New South Wales involved; (1) a gap analysis to determine sampling sites; (2) a full floristic survey of each bioregion; (3) air photo interpretation (API) and production of a composite API vegetation layer for use in the modelling process; (4) classification of the survey data to produce vegetation groups or units; (5) derivation of a probability surface for each vegetation unit, undertaken by modelling its plot data against various environmental surfaces, then constrained by API and (6) integration of constrained models into final composite vegetation maps (extant and predicted) (DEC 2004).

The modelled distributions and areal extent of remnant vegetation units are considered reasonably accurate in the case of the Nandewar study, but not in the Brigalow Belt South study (DEC 2004). Thus the extant area of 1046ha of SEVT (vegetation unit 114) in the Nandewar Bioregion is probably a reliable estimate, whereas the extant area of 16,153ha derived for vine thicket (unit 192) in the Brigalow Belt South is a considerable overestimate. The real figure is probably closer to that for the Nandewar Bioregion, but can only be determined by undertaking systematic re-interpretation of the most up-to-date air photos available across the region. Minimal ground-truthing should be necessary, given the comprehensive site data collected by Curran (2006).

Regional ecosystem mapping over much of the Brigalow Belt North is being revised to map all remnants down to 5ha in extent, the recommended minimum area for 1:100,000 scale mapping (Neldner *et al.* 2005). The recommended minimum area for map polygons adopted in earlier studies was 20ha.

A significant proportion of the mapped extent of the SEVT EC is made up of heterogeneous polygons (discrete areas delineated on the map), which contain two or more regional ecosystems. This may represent situations where separate vegetation patterns are detectable on aerial photography, but occupy areas that are below the minimum limits for the scale of mapping. It may also represent situations in which two regional ecosystems are known to

occur, but cannot be reliably distinguished on the aerial photography. Thus RE 11.9.4, which often has emergent brigalow *Acacia harpophylla*, is often difficult to separate from RE 11.9.5, in which brigalow is dominant.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW).

Estimated cost: $150,000

Action 1.2 Evaluate methodologies for condition assessment in the SEVT EC and establish benchmark sites for each component regional ecosystem.

Eyre *et al.* (2006) provide the following definition of vegetation condition – "the structural, compositional and functional aspects of a mature and relatively undisturbed ecosystem important for the maintenance of biodiversity values." They have produced a condition assessment methodology, BioCondition, which is similar to those developed in Victoria (Parkes *et al.* 2003) and New South Wales (Oliver & Parkes 2003, Gibbons *et al.* 2005).

The methodology has been developed mainly in eucalypt forest and woodland ecosystems and may need to be modified for application to the SEVT EC. Catterall *et al.* (2004) found that similar structural attributes were potentially useful surrogates for fauna at a series of regenerated rainforest sites, but relatively few attributes were correlated with rainforest taxa when analyses were restricted to young replanted sites.

Apart from site attributes, BioCondition also assesses the context of the landscape surrounding the site (Eyre *et al.* 2006). Three attributes are scored; the size of the patch of vegetation being assessed, the degree of connectivity between the patch and adjacent native vegetation and the context (amount of native vegetation retained proximal to the site), measured by a 1-kilometre radius buffer. The landscape attributes are best determined by GIS analysis, and also form part of the biodiversity planning assessments (Biodiversity Assessment and Mapping Methodology) undertaken by the Queensland DERM.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW).

Estimated cost: $10,000

Action 1.3 Determine the extent and condition of areas of SEVT affected by invasive plant species, particularly weeds of national significance (WONS).

Rubber vine *Cryptostegia grandiflora* occurs throughout most of the northern and eastern Brigalow Belt south to the northern Burnett catchment, with outlying populations west and south of Emerald. There is a major gap in its distribution between Nebo and the St Lawrence district. It has invaded vine thickets across a range of land zones from beach ridges and swales and alluvial plains to isolated volcanic peaks. It grows vigorously, competing with vine thicket species for light and soil moisture, and has become dominant in many vine thicket stands.

The rubber vine rust *Maravalia cryptostegiae* is present in most populations, and has been responsible for a general and marked reduction in flowering and fruiting, except in some near coastal situations. The heavy leaf fall caused by the rust has opened up dense smothering canopies and permitted some recovery of vine thicket structure. It has also created a body of fuel, which has allowed many infestations to be more effectively controlled by fire. This option should be treated with caution, given the fire-sensitivity of most vine thicket species.

Lantana *Lantana camara* is mostly confined to the higher rainfall eastern areas of the Brigalow Belt Bioregion. Its vigour and the dense fuel it provides can lead to progressive and rapid destruction of infested vine thicket stands by fire, e.g. the Forty Mile Scrub in north

Queensland. A number of biological control agents have been released against lantana, but have been largely ineffective.

It is important that the distributional limits of both rubber vine and lantana be determined within the Brigalow Belt (cf. Fensham 1996) and that where possible steps are taken to control outlying populations.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW), DNR (NSW).

Estimated cost: $200,000

Action 1.4 Survey poorly known species.

Systematic floristic surveys have now been undertaken throughout the geographical and environmental range of semi-evergreen vine thickets in the Brigalow Belt and Nandewar Bioregions (Fensham 1995, McDonald 1996 & Curran 2006). In contrast, apart from Horsup et al. (1993) in the eastern central Brigalow Belt, systematic surveys of vertebrate fauna in vine thickets have been limited to a few local government areas in Queensland (Bauhinia, Booringa and Taroom Shires – Crossman & Reimer 1986) and the Brigalow Belt and Nandewar Bioregions in New South Wales.

Vine thickets are known to be significant for their invertebrate fauna; for example Stanisic (1998) reported that 78 of the 132 species of land snails recorded from the Brigalow Belt Bioregion showed a preference for vine thicket or related closed forest. Monteith (1999) has also commented on the significance of the vine thicket habitat and there is an urgent need for systematic intensive surveys across the bioregions. Distribution patterns within less mobile organisms such as land snails (35 species restricted or locally restricted (Stanisic 1998)) may identify local biological refugia, and these taxa would also be valuable as indicators of environmental change.

Apart from Fensham & Streimann's (1997) paper on the moss flora of the northern SEVT, little is known of the cryptogam flora of the SEVT EC. Surveys of fungi, particularly the microrrhizal species, should be a priority, given their significance in moist rainforest ecosystems (Hopkins *et al.* 1996).

Biological soil crusts (comprising assemblages of mosses, liverworts, lichens, bacteria, fungi and other microbes) can be used to provide a rapid assessment of degree to which soils cycle nutrients and resist erosion (e.g. Tongway 1995, Eldridge & Koen 1998).

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW), Queensland Museum, Australian Museum, Universities.

Estimated cost: $100,000 (field work conducted in conjunction with A1.1, 1.2 and 1.3)

Action 1.5 Identify key ecosystem components and processes and determine their response to common management practices.

Many aspects of the reproductive biology of the predominant vine thicket tree and shrub species are still poorly understood. Although many species regenerate freely through vegetative means, for example *Ehretia membranifolia* and *Macropteranthes leichhardtii,* they also flower and fruit regularly. Others such as wilga *Geijera parviflora* appear to be obligate seed-regenerators and may be in danger of disappearing from many smaller and/or more isolated remnants.

It appears that major recruitment events occur extremely infrequently, perhaps only once or twice in a century. Data from Brigalow Research Station suggest that the last such event occurred during the extremely wet years of the 1950's.

There is an urgent need to understand soil processes relating to water and nutrient availability, and the role of soil crusts and mycorrhizal relationships (see above). The significance of nutrient cycling and patterns of litterfall and decay have yet to be determined for these communities.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW), Universities.

Estimated cost: $200,000

Action 1.6 Monitor selected populations of the EPBC-listed species *Cadellia pentastylis, Cossinia australiana, Denhamia parvifolia, Macropus dorsalis, Paradelma orientalis, Turnix melanogaster* and *Zieria verrucosa* across the SEVT EC.

Sites containing threatened flora and fauna should be identified and subject to ongoing monitoring.

Plant species recommended for monitoring include: *Cadellia pentastylis, Cossinia australiana, Denhamia parvifolia*, and *Zieria verrucosa*. Animal species recommended for monitoring include: Black-striped Wallaby, Brigalow Scaly-foot and Black-breasted Button-quail.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW), Universities.

Estimated cost: $150,000 (field work conducted in conjunction with A1.1, 1.2, 1.3 and 1.4)

Specific objective 2

Establish a comprehensive, adequate and representative system of SEVT EC areas across the Brigalow Belt (North and South) and Nandewar Bioregions, protected either by reservation or conservation agreements (including MOU's).

Performance criteria

2.1 Key SEVT sites are identified and most appropriate forms of protection determined.

2.2 The area and representativeness of SEVT EC in protected areas is increased.

Action 2.1 Increase the extent and representativeness of SEVT EC within the conservation estate.

The reserved status of three of the listed SEVT regional ecosystems is quite unsatisfactory, namely 11.5.15 (0.8 percent reserved), 11.8.13 (2.4 percent) and 11.11.18 (0.1 percent). Remnant areas of these REs should be a priority for addition to the conservation estate.

All other RE's have at least 10 percent of their remnant extent within the national park estate, but this representation is often quite uneven when considered at the subregional level. In general, the northern subregions tend to be under-represented. Only in the case of RE 11.9.8 (60.8 percent reserved) are all subregions represented in the conservation estate.

Although RE 11.8.6 is well reserved (44.5 percent), this representation is confined to a single subregion (11.23 – Buckland Basalts). Two other subregions (11.10 Basalt Downs and 11.15 Claude River Downs), which account for almost 20 percent of the remnant extent of this RE, are not represented in the national park estate.

Regional Ecosystems 11.8.3 and 11.9.4 together comprise more than 60 percent of the total remnant extent of SEVT within the Brigalow Belt Bioregion and are moderately well reserved (10.6 percent and 17.4 percent respectively). Both however are unevenly represented, with major subregional remnants being unsampled, i.e. (11.8.3) subregions 11.06 Northern Bowen Basin, 11.15 Claude River Downs and 11.26 Southern Downs and (11.9.4) subregions 11.06, 11.11 Isaac-Comet Downs, 11.18 Mt Morgan Ranges, 11.22 Banana-Auburn Ranges and 11.25 Taroom Downs.

Potential contributors: DERM and NSW DECCW.

Estimated cost: $3,000,000

Action 2.2 Encourage landholders to enter into conservation agreements over semi-evergreen vine thickets.

Negotiation of conservation agreements, such as nature refuges in Queensland, which attach to the title and cover all or part of a parcel of land, can be mutually beneficial for landholders and biodiversity. Landholders with nature refuges are eligible for the State Government's Green Rewards (land tax and transfer duty reimbursement). In addition, landholders may be entitled to benefits under proposed changes for leaseholders under the *Land Act 1994* and may be advantaged in seeking grants for conservation works (eg. fencing, watering points) through Natural Resource Management Regional Bodies may also be available from the State Government's NatureAssist program for nature refuges, through a competitive tender process.

DERM Nature Refuge Officers undertake property assessments, negotiation of the nature refuge and provide follow-up advice and assistance with management. Relevant conditions for nature refuge agreements over 'Endangered' semi-evergreen vine thickets might include fencing and limiting grazing to short periods to reduce grassy fuels. Photo-monitoring or more detailed occasional surveys of flora and perhaps fauna are also recommended conditions for Conservation Agreements.

In New South Wales, the Conservation Partners Program offers a range of protection options. The Conservation Agreement option ensures permanent legal protection for a property and is equivalent to the Nature Refuge in Queensland, the Wildlife Refuge can have its status changed when required by the owner.

An alternative to a perpetual conservation agreement would be to consider a Land for Wildlife agreement or similar agreement coordinated by local councils. These arrangements are non-binding and encourage and support landholders to provide habitat for native plants and animals on their property.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW).

Estimated cost: $80,000

Specific objective 3

Ensure 'best-practice" management is applied to sites containing the SEVT EC.

Performance criteria

3.1 Information needs and priorities for research are identified.

3.2 Weed and fire reduction management plans are put in place for key areas of the SEVT EC on public and private lands.

3.3 The integrity and connectivity of vine thicket fragments are improved by encouraging the regeneration of native woody species in buffer zones surrounding and linking the fragments.

3.4 Monitoring is established for selected populations of threatened species across the SEVT EC and these populations are extant in 2012.

3.5 Feral animal management plans are developed and implemented for key areas of the SEVT EC on public and private lands. Feral animal populations are controlled in important SEVT remnants.

3.6 Guidelines for appropriate fire frequency and burning regimes are developed for use by land managers.

Action 3.1 Liaise with landholders and other natural resource managers to develop appropriate burning practices and other procedures to minimise fire damage to remnant areas of SEVT on private and public lands.

This may include construction of firebreaks, use of low-intensity, cool season fuel reduction burns, use of strategic aerial ignition to "break-up" the impact of planned burns and defend against wildfires and encouragement of buffer areas of re-growth vegetation (SEVT or other low-fuel communities such as brigalow *Acacia harpophylla*).

Many vine thicket remnants are located adjacent to and upslope of dense pastures dominated by buffel grass *Pennisetum ciliare*. It is important to work with landholders to ensure that burning of these pastures is undertaken in ways that minimize as much as possible damage to the remnants. In particular, burning should be undertaken under relatively cool conditions with high soil moisture and ensuring that fires burn downslope rather than upslope.

Areas of vine thicket within a woodland or forest matrix are generally protected from fire by their structure and microclimate and/or position in the landscape, but it may be necessary to reduce fuel loads in surrounding fire-prone communities to minimise the risk of wildfires entering the vine thickets under extreme weather conditions.

Development of guidelines for appropriate burning regimes will assist land managers to design and implement appropriate site management plans. Research into the response of SEVT to fire intensity and fire interval is required to support such guidelines.

Potential contributors: DERM, NSW DECCW, Universities, NRM regional bodies (Qld), CMAs (NSW), and Qld & NSW Rural Fire Services.

Estimated cost: $80,000 (conducted in conjunction with A2.2)

Action 3.2 Determine through exclosure trials the impact of grazing on remnant areas of SEVT. Develop guidelines and recommendations for fencing.

Native and feral animals and domestic livestock, predominantly cattle, impact upon vine thicket vegetation in a number of ways; through grazing (often selectively) of the ground stratum, through trampling and other mechanical damage to shrubs, vines, etc. (opening up of the community), formation of tracks, leading to soil erosion and introduction of weed species in their droppings and on their coats. Vine thickets are used as shade and shelter (e.g. during the winter months) and those in close proximity to water, e.g. along creek lines, may be subjected to very heavy use and damage, particularly during protracted drought periods. In New South Wales, Benson *et al.* (1996) considered stock should be excluded from vine thickets as heavy grazing and trampling may limit the regeneration of a range of plant species.

It is desirable that the more significant remnant vine thickets be fenced to exclude stock, native and feral herbivores. This may need to be combined with provision of alternative

watering points for domestic stock, e.g. bores or earth tanks. These should be located at a sufficient distance that stock are less likely to seek out the vine thicket(s) for shade.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW).

Estimated cost: $100,000

Action 3.3 Develop and implement a pest management program to control feral animals in SEVT remnants.

Large numbers of feral stock (scrubber cattle and brumbies) cause considerable damage in some conservation reserves and there needs to be an assessment of this impact, fencing of the more critical sites and strategies for feral animal removal.

The control of pigs in northern areas is considered important to prevent the vine thickets being opened up and invaded by *Lantana camara* (Fensham 1996; Fensham *et al.* 1994). Development of a pest management plan will involve estimating the size of feral animal populations in Qld and NSW reserve systems, and key remnants on other land tenures. Appropriate control measures should then be implemented to remove feral animals, including escaped stock, pigs and goats.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW).

Estimated cost: $100,000 (conducted in conjunction with Action 3.2)

Action 3.4 Develop strategies to minimise adverse impacts of native macropods, particularly the black-striped wallaby *Macropus dorsalis* where it is overabundant in Queensland, on remnant SEVT and other vegetation used as shelter.

While the black-striped wallaby is considered overabundant in Qld, it is listed as 'Endangered' under the NSW *Threatened Species Conservation Act 1995*.

There is an urgent need to carry out exclosure studies to assess the impact of *M. dorsalis* and other macropods on vine thickets and associated vegetation used as shelter and to determine the capacity of the community to regenerate.

In Queensland, extensive use is made of barrier fences to exclude black-striped wallabies from crops and pasture. Fencing of remnants leads, at least in the short term, to even greater pressure on the shelter vegetation and complete fencing may lead to localised extinction in all but the largest fragments.

The type of fencing (electric or mesh) and if the latter, the size of the mesh, are also important, especially in terms of their possible impact on other wildlife, e.g. echidnas and reptiles such as bearded dragons. Some form of compromise may be necessary, which minimises disruption to non-target wildlife while reducing the overall wallaby population.

White *et al*. (2003) summarise a range of management options aimed at optimising black-striped wallaby densities in Queensland. The role of predators, particularly dingoes, is discussed, noting the need to balance possible stock losses against the gains in pasture and crop production from reduced wallaby grazing.

Potential contributors: DERM, NRM regional bodies (Qld).

Estimated cost: $150,000 (conducted in conjunction with A3.2)

Action 3.5 Encourage landholders through appropriate incentive programs to protect and foster regrowth SEVT and associated vegetation in buffer areas around and in corridors linking remnant SEVT.

This action links with Action 2.2. Several initiatives have been taken to encourage the management of both remnant and regenerating native vegetation by private landholders. These include (in Queensland) the Vegetation Incentives Program and the NatureAssist program (Queensland Department of Environment and Resource Management) and (in New South Wales) the Conservation Partners Program.

The two Queensland programs provide financial incentives to landholders through a competitive tender process to landholders. The NatureAssist scheme develops partnerships with landholders who establish nature refuges, and provides assistance for a range of activities which include managing areas to allow for natural regeneration. The Vegetation Incentives Program is aimed solely at areas of regenerating (non-remnant) native vegetation.

The Conservation Partners Program offers a range of protection options. The Conservation Agreement option ensures permanent legal protection for a property and is equivalent to the Nature Refuge in Queensland, The Wildlife Refuge can have its status changed when required by the owner. Landholders with Conservation Agreements are eligible for rate exemptions and funding for on-ground work.

Landholders should be encouraged and assisted through these programs to protect and enhance areas of remnant and regenerating SEVT EC. Regrowth SEVT vegetation is relatively restricted, because of its susceptibility to fire, but steps should be taken to identify key areas for protection. Areas of regrowth non-SEVT vegetation (e.g. brigalow and eucalypt woodland) should also be protected where they have the potential to enhance connectivity and provide buffers against fire and weed invasion into SEVT remnants.

Large areas of the SEVT EC, brigalow communities and associated native vegetation in the central and northern Brigalow Belt are now under the management of coal mining companies. The coal industry is presently working with the Fitzroy Basin Association and government regulators to develop an industry-focused biodiversity strategy for the Bowen Basin (Fitzroy Basin Association 2007).

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW), NSW DNR, coal industry group.

Estimated cost: $100,000 (in addition to existing programs)

Action 3.6 Undertake studies of the impact of invasive shade-tolerant grasses and other ground stratum species such as *Rivina humilis* and *Ageratum* spp.

Buffel grass *Pennisetum ciliare* is probably the greatest overall threat to remnant vine thicket vegetation. It forms dense stands which carry intense fires, especially in the late spring or early summer period. Vine thicket margins are progressively damaged and colonised by buffel and remnants are gradually lost.

Buffel grass however does not readily invade otherwise undisturbed vine thickets, but another sown pasture species, green panic *Megathyrsus maximus* var. *pubiglumis* is extremely shade-tolerant and is prominent in many remnants as far west as the Carnarvon Ranges. It grows up to 1m high and under favourable conditions forms a dense layer, which overtops other native herbs and grasses, as well as seedling trees and shrubs. It forms a thick layer of trash, which decays slowly and carries fire in situations which would otherwise be fire-free.

Studies are needed to determine whether green panic and other shade-tolerant species such as *Rivina humilis* are impacting adversely upon other plant or animal (e.g. herpetofauna or invertebrates) components of this community.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW).

Estimated cost: $100,000

Action 3.7 Research and develop use of semi-evergreen vine thicket species for landscape rehabilitation in areas where SEVT would naturally have occurred prior to clearing, and encourage mining companies, local authorities and others to use native species in plantings.

Vine thicket species are being planted in minesite rehabilitation projects at Mt Etna and Bajool near Rockhampton. Establishment and on-going maintenance costs are considerable, however (up to $150,000 per hectare) and in general can be justified only in strategic situations such as corridors along streams and linking key vine thicket remnants. Vine thicket species often require supplementary watering during establishment and are mostly very slow-growing. Plantings are prone to invasion by weeds, especially grasses, and may require several maintenance treatments over the first 3-5 years.

Many tree species however play an important and increasing role in amenity plantings as both shade trees and as ornamentals. Examples include *Brachychiton* spp., *Flindersia australis, Cadellia pentastylis*, *Lysiphyllum hookeri* and *Cassia tomentella*.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW), LGAs and Universities.

Estimated cost: $50,000

Specific objective 4

Encourage involvement of landholders and the community in the conservation and management of the SEVT EC.

Performance criteria

4.1 One or more SEVT Conservation Management Networks are established and operating across the Brigalow Belt North and South Bioregions.

4.2 Ten percent of private landholders with SEVT EC participate in the conservation of SEVT by 2012.

4.3 Public awareness/education programs are developed and implemented and community awareness is increased.

4.4 Aboriginal interest in management of SEVT EC sites has been identified and involvement facilitated if required.

Action 4.1 Establish a Semi-evergreen Vine Thicket Conservation Management Network.

The Conservation Management Network would have two broad objectives; (1) to raise awareness and (2) to facilitate information-sharing and education about vine thicket communities.

It would use as a model the Grassy Box Woodland Conservation Management Network (GBWCMN), established in 1998 (McLeish 2006). The GBWCMN has formed partnerships with organisations across seven catchments in New South Wales, including Catchment

Management Authorities, educational institutions, research groups, Landcare groups and individuals to provide field days, forums and workshops determined by the members' needs and interests. Currently the GBWCMN has 689 members, 368 of whom are private land managers.

Since the Fitzroy River Catchment contains more than 100,000ha of the total remnant area of 150,000ha, it would be appropriate for a vine thicket conservation management network co-ordinator/facilitator to potentially be hosted by the Fitzroy Basin Association.

Potential contributors: NRM regional bodies (Qld), CMAs (NSW), and DECCW (NSW).

Estimated Cost: $50,000

Action 4.2 Undertake consultation with traditional owner groups to determine the level of indigenous knowledge of and association with the SEVT EC.

Use existing networks of Aboriginal Land Management Facilitators within NRM groups and CMAs to consult with traditional owner groups and document indigenous knowledge and management practices for SEVT.

Potential Contributors: NRM regional bodies (Qld), CMAs (NSW) and traditional owners.

Estimated Cost: $30,000

Action 4.3 Consult with and involve traditional owners when conducting works in SEVT EC.

Traditional owners, represented by the Red Chief Local Aboriginal Land Council and the Narrabri Local Aboriginal Land Council, have expressed interest in the implementation of the recovery plan. Should actions be carried out in these areas contact should be made with representatives of these groups to advise which actions will be undertaken and to assess interest in assisting with implementation.

These groups have knowledge of the vine thicket and it is an important part of their cultural heritage.

Potential Contributors: CMAs (NSW), traditional owners, NSW DECCW, researchers.

Estimated Cost: $5000

Specific objective 5

Enhance the ability of government and non-government organisations at the national, regional and local levels (including consent authorities) to recognise and incorporate SEVT EC conservation issues into all planning processes.

Performance criteria

5.1 All government and non-government organisations involved in planning, management, development and development control of land/vegetation in the Brigalow Belt (North and South) and Nandewar Bioregions are aware of the issue of SEVT EC conservation and have incorporated this matter into their functions.

Action 5.1 Develop and implement an education program to increase the awareness of government and non-government organisations regarding SEVT conservation, and their responsibilities for SEVT protection and management.

Develop and implement an education program, including advisory material and training opportunities, to organisations involved in planning, management, development and development control of land/vegetation in the Brigalow Belt (North and South) and Nandewar Bioregions. Promote awareness of SEVT EC conservation and options for incorporating this matter into their functions and plans, and improve knowledge of legal obligations regarding SEVT.

Potential contributors: DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW), Local Government.

Estimated cost: $60,000

Table 4. Summary of recovery objectives, performance criteria and actions.
Relationships between specific objectives, performance criteria, actions and potential contributors are summarised in Table 5. Each action is assigned a priority rating of High (H), Medium (M) or Low (L)

Recovery Objectives	Performance Criteria	Actions	Potential Contributors	Priority
1. Identify and evaluate the extent, biodiversity value and condition of remnant and regrowth areas of SEVT EC in the Brigalow Belt (North and South) and Nandewar Bioregions.	1.1 A system of benchmarks and condition indicators is developed for each of the regional ecosystems or vegetation types making up the SEVT EC. 1.2 Key areas of SEVT EC are surveyed and ratings of conservation value given based on biodiversity and condition. 1.3 Documented knowledge of semi-evergreen vine thickets and associated flora and fauna species is increased.	1.1 Complete mapping of remnant SEVT EC in NSW and refine mapping of the Queensland remnants.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs	**H**
		1.2 Evaluate methodologies for condition assessment in the SEVT EC and establish benchmark sites for each component regional ecosystem.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs	**H**
		1.3 Determine the extent and condition of areas of the SEVT EC affected by invasive plant species, particularly weeds of national significance.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs	**M**
		1.4 Survey poorly known species, especially fungi, herpetofauna and invertebrates.	DERM, NSW DECCW, Queensland Museum, Australian Museum, Universities	**M**
		1.5 Identify key ecosystem components and processes and determine their response to common management practices.	DERM, NSW DECCW, Queensland Museum, Australian Museum, Universities	**H**
		1.6 Monitor selected populations of the EPBC-listed species across their distribution within the EC.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs	**M**
2. Establish a comprehensive, adequate and representative system of SEVT EC areas across the Brigalow Belt (North and South) and Nandewar Bioregions, protected either by reservation or conservation agreements (including MOU's).	2.1 Key SEVT sites are identified and most appropriate forms of protection determined. 2.2 The area and representativeness of SEVT EC in protected areas is increased.	2.1 Increase the extent and representativeness of SEVT EEC within the conservation estate.	DERM, NSW DECCW	**H**
		2.2 Encourage landholders to enter into conservation agreements over semi-evergreen vine thickets.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs, NSW DNR	**H**

Recovery Objectives	Performance Criteria	Actions	Potential Contributors	Priority
3. Ensure 'best-practice" management is applied to sites containing the SEVT EC.	3.1 Information needs and priorities for research are identified. 3.2 Weed and fire reduction management plans are put in place for key areas of the SEVT EC on public and private lands. 3.3 The integrity and connectivity of vine thicket fragments are improved by encouraging the regeneration of native woody species in buffer zones surrounding and linking the fragments. 3.4 Monitoring is established for selected populations of threatened species across the SEVT EC and these populations are extant in 2012. 3.5 Feral animal management plans are developed and implemented for key areas of the SEVT EC on public and private lands. Feral animal populations are controlled in important SEVT remnants. 3.6 Guidelines for appropriate fire frequency and burning regimes are developed for use by land managers.	3.1 Liaise with landholders and other natural resource managers to develop appropriate burning practices and other procedures to minimize fire damage to remnant areas of SEVT on private and public lands.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs, NSW DNR, Qld & NSW Rural Fire Services	**H**
		3.2 Determine through exclosure trials the impact of grazing animals, both domestic and native, on remnant areas of SEVT. Develop guidelines and recommendations for fencing.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs, NSW DNR	**H**
		3.3 Develop and implement a pest management program to control feral animals in SEVT remnants	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs, NSW DNR	**H**
		3.4 Develop strategies to minimise adverse impacts of native macropods, particularly the black-striped wallaby *Macropus dorsalis* where it is overabundant in Queensland, on remnant SEVT and other vegetation used as shelter.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs, NSW DNR	**H**
		3.5 Encourage landholders through appropriate incentive programs to protect and foster regrowth SEVT and associated vegetation in buffer areas around and in corridors linking remnant SEVT.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs, NSW DNR	**M**
		3.6 Undertake studies of the impact on the SEVT EC of invasive shade-tolerant grasses and other ground stratum species such as *Rivina humilis* and *Ageratum* spp.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs, NSW DNR, LGAs (Qld & NSW), Universities	**L**
		3.7 Research and develop use of semi-evergreen vine thicket species for landscape rehabilitation in areas where SEVT would naturally have occurred prior to clearing, and encourage mines, main roads and others to use native species in plantings.	DERM, NSW DECCW, NRM regional bodies (Qld), NSW CMAs, NSW DNR	**M**

Recovery Objectives	Performance Criteria	Actions	Potential Contributors	Priority
4. Encourage involvement of landholders and the community in the conservation and management of the SEVT EC	4.1 One or more SEVT Conservation Management Networks are established and operating across the Brigalow Belt North and South Bioregions. 4.2 Ten percent of private landholders with SEVT EC participate in the conservation of SEVT by 2012. 4.3 Public awareness/education programs are developed and implemented and community awareness is increased. 4.4 Aboriginal interest in management of SEVT EC sites has been identified and involvement facilitated if required.	4.1 Establish a Semi-evergreen Vine Thicket Conservation Management Network.	NRM regional bodies (Qld), NSW CMAs, NSW DECCW,	**H**
		4.2 Undertake consultation with traditional owner groups to determine the level of indigenous knowledge of and association with the SEVT EC.	NRM regional bodies (Qld), NSW CMAs, traditional owners (Qld & NSW)	**M**
		4.3 Consult with and involve traditional owners when conducting works in SEVT EC.	CMAs (NSW), traditional owners, NSW DECCW, researchers.	**H**
5. Enhance the ability of government and non-government organisations at the national, regional and local levels (including consent authorities) to recognise and incorporate SEVT EC conservation issues into all planning processes.	5.1 All government and non-government organisations involved in planning, management, development and development control of land/vegetation in the Brigalow Belt (North and South) and Nandewar Bioregions are aware of the issue of SEVT EC conservation and have incorporated this matter into their functions.	5.1 Develop and implement an education program to increase the awareness of government and non-government organisations regarding SEVT conservation, and their responsibilities for SEVT protection and management.	DERM, NSW DECCW, NRM regional bodies (Qld), CMAs (NSW), Local Government	**M**

5. Management practices

Semi-evergreen vine thickets occur naturally as discrete patches associated with other vegetation types. Surviving fragments outside protected areas are frequently located in agricultural landscapes (e.g. see Fensham 1996) where the risk of weed invasion, fire incursion or clearing for fences may be high. Studies in the northern Brigalow Belt of Queensland have shown that the species richness of mature plants in semi-evergreen vine thickets decreases as the density of *Lantana camara* increases, even though the density of saplings, seedlings and the soil seed bank are similar in areas with heavy and light infestations (Fensham *et al.* 1994).

For the above reasons, it is important to manage semi-evergreen vine thickets on a whole-of-landscape basis. This should include 'integrated management of feral animals, exotic plant species and fire in the matrix of vegetation types that contain dry rainforest as well as the rainforest patches themselves' (Fensham 1996). In Queensland, fire management may require maintaining other native vegetation types adjacent to or surrounding vine thicket patches. For example, brigalow *Acacia harpophylla* and lancewood *A. shirleyi* forests appear to provide natural buffers that prevent fire incursion into vine thicket vegetation (Fensham 1995; Kahn & Lawrie 1987; McDonald 1996), especially when present downslope of the thickets (McDonald 1996).

It is also important to maintain the size and integrity of vine thicket patches. Fensham (1996) reported a positive correlation between native species richness and patch area, with small patches generally having fewer species than large patches. Dissection of thickets by roads or fences promotes weed invasion which, as noted above, in turn can reduce the diversity of native species. Such disturbance also increases edge effects such as increased light levels, which also may limit the regeneration of some plant species (Curran 2006).

The control of fire and pigs in northern areas is considered important to prevent the vine thickets being opened up and invaded by *Lantana camara* (Fensham 1996; Fensham *et al.* 1994). Fensham (1996) also considered it important to try to prevent rubber vine *Cryptostegia grandiflora* from invading areas where it was absent at the time of his study.

Fensham (1996) concluded that in pastoral country in the northern Brigalow Belt of Queensland conservation of semi-evergreen vine thickets was compatible with the cattle grazing industry provided no further remnants were cleared. In New South Wales, however, Benson *et al.* (1996) considered stock should be excluded from vine thickets as heavy grazing and trampling may limit the regeneration of a range of plant species.

6. Costs of recovery

Estimated cost of recovery ($ per year)

Action	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
1.1 Complete mapping of remnant SEVT EC in NSW and refine mapping of the Queensland remnants.	100,000	50,000	0	0	0	**150,000**
1.2 Evaluate methodologies for condition assessment in the SEVT EC and establish benchmark sites for each component regional ecosystem.	10,000	0	0	0	0	**10,000**
1.3 Determine the extent and condition of areas of the SEVT EC affected by invasive plant species, particularly weeds of national significance.	40,000	40,000	40,000	40,000	40,000	**200,000**
1.4 Survey poorly known species, especially fungi, herpetofauna and invertebrates.	20,000	20,000	20,000	20,000	20,000	**100,000**
1.5 Identify key ecosystem components and processes and determine their response to common management practices.	60,000	60,000	40,000	40,000	0	**200,000**
1.6 Monitor selected populations of the EPBC-listed species across their distribution within the EC.	30,000	30,000	30,000	30,000	30,000	**150,000**
2.1 Increase the extent and representativeness of SEVT EC within the conservation estate.	600,000	600,000	600,000	600,000	600,000	**3,000,000**
2.2 Encourage landholders to enter into conservation agreements over semi-evergreen vine thickets.	40,000	40,000	40,000	40,000	40,000	**200,000**
3.1 Liaise with landholders and other natural resource managers to develop appropriate burning practices and other procedures to minimize fire damage to remnant areas of SEVT on private and public lands.	30,000	30,000	20,000	0	0	**80,000**
3.2 Determine through exclosure trials the impact of grazing animals, both domestic and native, on remnant areas of SEVT. Develop guidelines and recommendations for fencing.	50,000	50,000	0	0	0	**100,000**
3.3 Develop and implement a pest management program to control feral animals in SEVT remnants	20,000	20,000	20,000	20,000	20,000	**100,000**
3.4 Develop strategies to minimise adverse impacts of native macropods, particularly the black-striped wallaby where it is overabundant in Queensland, on remnant SEVT and other vegetation used as shelter.	10,000	10,000	10,000	10,000	10,000	**50,000**
3.5 Encourage landholders through appropriate incentive programs to protect and foster regrowth SEVT and associated vegetation in buffer areas around and in corridors linking remnant SEVT.	20,000	20,000	20,000	20,000	20,000	**100,000**
3.6 Undertake studies of the impact on the SEVT EC of invasive shade-tolerant grasses and other ground stratum species.	20,000	20,000	20,000	20,000	20,000	**100,000**
3.7 Research and develop use of semi-evergreen vine thicket species for landscape rehabilitation in areas where SEVT would naturally have occurred prior to clearing, and encourage mines, main roads and others to use native species in plantings.	30,000	20,000	0	0	0	**50,000**
4.1 Establish a Semi-evergreen Vine Thicket Conservation Management Network.	10,000	10,000	10,000	10,000	10,000	**50,000**

Action	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
4.2 Undertake consultation with traditional owner groups to determine the level of indigenous knowledge of and association with the SEVT EC.	15,000	15,000	0	0	0	**30,000**
4.3 Consult with and involve traditional owners when conducting works in SEVT EC.	1000	1000	1000	1000	1000	**5000**
5.1 Develop and implement an education program to increase the awareness of government and non-government organisations regarding SEVT conservation, and their responsibilities for SEVT protection and management.	20,000	20,000	20,000	0	0	**60,000**
TOTAL	**1,126,000**	**1,056,000**	**891,000**	**851,000**	**811,000**	**4, 735,000**

7. Evaluation of recovery plan

Progress will be monitored and evaluated annually. An independent external reviewer will be contracted within five years from adoption as a national recovery plan to review and evaluate performance of the plan.

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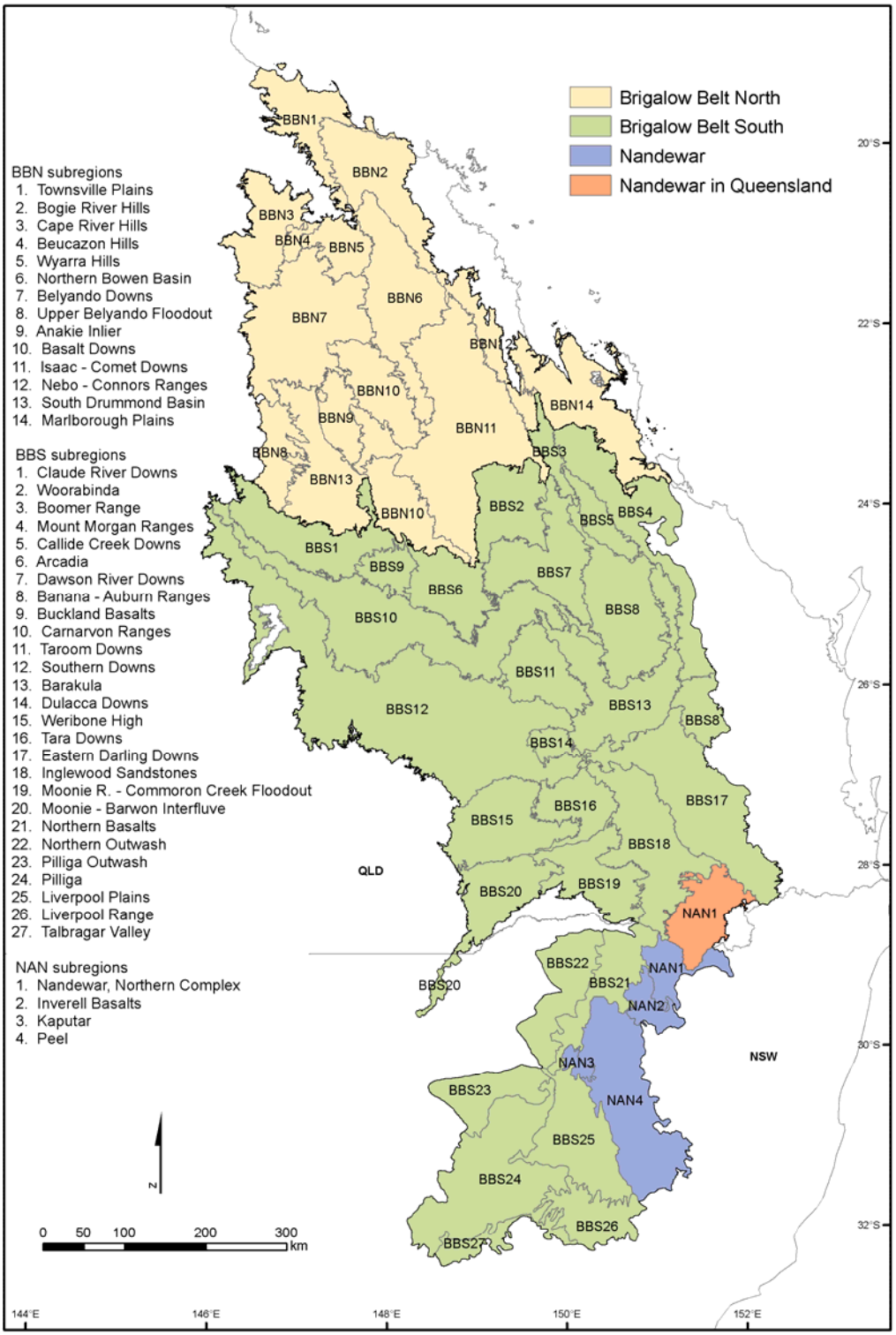
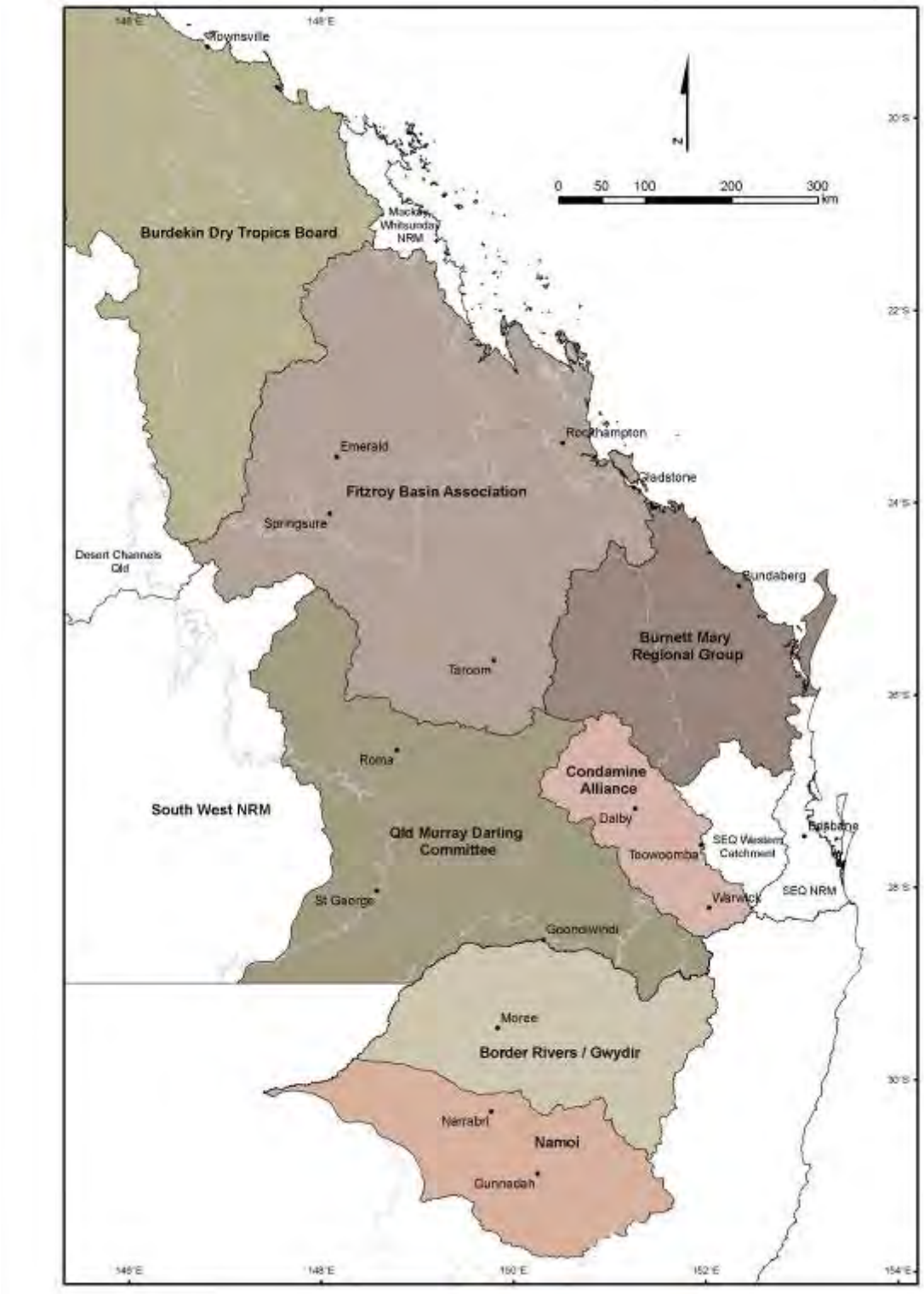
Appendix 1



Map 4. Subregions of the Brigalow Belt and Nandewar Bioregions.



Map 5. QLD Natural Resource Management Regional Bodies and NSW Catchment Management Authorities.

Appendix 2

Description of EPBC Act listed regional ecosystems in Queensland and New South Wales

1. Microphyll vine forest ("beach scrub") on sandy beach ridges (RE 11.2.3) (Qld EPA 2006)
This regional ecosystem is low microphyll rainforest. The height, density and floristic composition of the vegetation shows large variation, but there are usually several storeys of trees and shrubs, and a sparse ground cover (Christian *et al.* 1953).

It occurs on Quaternary coastal dunes and beaches. The sand dunes have become stabilised and often contain narrow linear depressions (Christian *et al.* 1953). The sandy soils are undifferentiated, but there may be some mottling in the subsoil (Christian *et al.* 1953).

2. Semi-evergreen vine thicket on alluvial plains (RE 11.3.11) (Qld EPA 2005b)
This regional ecosystem is predominantly semi-evergreen vine thicket or semi-deciduous notophyll rainforest, but in coastal regions also includes small areas of notophyll vine forest.

It occurs on Cainozoic alluvial plains. In the Ayr and Home Hill areas it is associated with gently sloping higher country associated with river deltas on sandy soils (Christian *et al*. 1953).

3. Semi-evergreen vine thicket ± *Casuarina cristata* on Cainozoic clay plains (RE 11.4.1) (Qld EPA 2005b)
This regional ecosystem is semi-evergreen vine thicket ranging from 'northern SEVT' to 'central SEVT' and 'southern SEVT'. In central areas the trees bitter bark *Alstonia constricta*, red ash *Alphitonia excelsa*, whitewood *Atalaya hemiglauca*, silver croton *Croton insularis* and wilga *Geijera parviflora* may also be prominent in the canopy layer with many other species (Gunn & Nix 1977). The canopy varies in height from 6±2 m to 8±3 m, and the emergent layer from 11±3 m to 15±5 m (Gunn & Nix 1977). A moderately dense to dense shrub layer 2±1 m high may also be present in places (Gunn & Nix 1977).

In western 'central SEVT' areas, the trees yellowwood *Terminalia oblongata*, *Everistia vacciniifolia* and *Erythroxylum australe* are commonly present (Story *et al.* 1967). In the eastern parts of 'central SEVT' belah *Casuarina cristata* trees may be emergent from the semi-evergreen vine thicket in some areas, with narrow-leaved bottle tree *Brachychiton rupestris* rare or absent (Speck *et al.* 1968).

The vine thickets occur on Cainozoic clay plains including those formed from extensively weathered Tertiary basalt. In central areas, the plains are usually level to gently undulating or rolling and the vegetation associated with crests and upper slopes, or less often the middle and lower slopes (Gunn & Nix 1977; Speck *et al.* 1968). Slopes are usually <5 percent (Gunn & Nix 1977; Story *et al.* 1967) but in places may be steeper (Gunn & Nix 1977).

The soils range from deep texture contrast soils to clays and clay loams, to moderately deep to deep cracking clays (Gunn & Nix 1977; Speck *et al.* 1968).

4. Semi-evergreen vine thicket on Cainozoic sand plains/remnant surfaces (RE 11.5.15) (Qld EPA 2005b)
This regional ecosystem is semi-evergreen vine thicket ranging from 'northern SEVT' to 'central SEVT' in which red ash *Alphitonia excelsa*, bitter bark *Alstonia constricta*, *Denhamia oleaster*, scrub poison tree *Excoecaria dallachyana* and wilga *Geijera parviflora* may be prominent in the canopy layer with many other species, and brigalow *Acacia harpophylla*, narrow-leaved bottle

tree *Brachychton rupestris* and crow's ash *Flindersia australis* common emergents (Gunn & Nix 1977). A species-rich shrub layer 2±1 m may also be present (Gunn & Nix 1977).

The vine thickets usually occur on remnant Tertiary surfaces and sometimes also on eroded scarp slopes and or areas of duricrust. The soils are moderately deep to deep red and yellow earths or texture contrast soils (Gunn & Nix 1977; Story *et al.* 1968).

5. Semi-evergreen vine thicket on Cainozoic igneous rocks (RE 11.8.3) (Qld EPA 2005b)
This regional ecosystem is semi-evergreen vine thicket, which may have emergent brigalow *Acacia harpophylla*, belah *Casuarina cristata* and *Eucalyptus* spp. It includes the 'northern SEVT' and 'central SEVT' and similar vegetation further south (Fensham & Fairfax 1997; Vandersee 1975). *Acacia harpophylla* and/or *Casuarina cristata* may be common in southern parts of the central area (Gunn & Nix 1977; Speck *et al.* 1968) and further south (Vandersee 1975). In western parts of the central area, mountain coolibah *Eucalyptus orgadophila* and *Casuarina cristata* occur as emergents in drier sites (Neldner 1984). *Eucalyptus orgadophila* may also be a prominent emergent in the south (Vandersee 1975). Other *Eucalyptus* species, crow's ash *Flindersia australis* and hoop pine *Araucaria cunninghamii* may be local emergents in more humid areas in the eastern parts of the central area (Gunn & Nix 1977). Emergent trees range in height from 14±3 m to 16±5 m (or rarely to 25 m, Neldner 1984), over canopy trees from 8±2 m to 12±3 m hight (Gunn & Nix 1977). A floristically rich shrub layer may be present or absent (Gunn & Nix 1977).

The thickets are associated with Cainozoic igneous rocks (basalt), and are restricted to steep hillsides. Slopes commonly range from 10–20 percent, but may be as high as 80 percent (Gunn & Nix 1977; Vandersee 1975). Soils are frequently shallow to very shallow clay loams and light to medium clays (Gunn & Nix 1977; Neldner 1984; Speck et al. 1968; Vandersee 1975), sometimes with stony surfaces (Gunn & Nix 1977).

6. *Macropteranthes leichhardtii* thicket on Cainozoic igneous rocks (RE 11.8.6) (Qld EPA 2005b)
This regional ecosystem is bonewood *Macropteranthes leichhardtii* thicket in the 'central SEVT' area. *M. leichhardtii* may sometimes form an almost mono-specific canopy layer 6±2 m tall (Gunn & Nix 1977), or occur with other typical SEVT species such as silver croton *Croton insularis*, *Denhamia oleaster*, wilga *Geijera parviflora* and yellowwood *Terminalia oblongata* (Gunn *et al.* 1967; Story *et al.* 1967) forming a canopy 8±2m tall (Gunn & Nix 1977). The trees brigalow *Acacia harpophylla*, bottle trees *Brachychiton rupestris* and *B. australis* and wilga *Geijera parviflora* may be present locally as emergents 15±3 m tall (Gunn & Nix 1977; Gunn *et al.* 1967). A shrub stratum may be present or absent (Gunn & Nix 1977; Gunn *et al.* 1967; Story *et al.* 1967).

The thickets occur on Cainozoic igneous rocks (basalt) on steep hills. Habitats include steep rocky slopes bounding bluffs of benches (with slopes to 80 percent, Gunn *et al.* 1967), benched slopes, and areas below scarps (Gunn & Nix 1977; Gunn *et al.* 1967; Story *et al.* 1967).

The soils are usually shallow to very shallow, gravelly, stony or rocky soils, with basalt boulders present on the surface in some places (Gunn & Nix 1977; Gunn *et al.* 1967; Story *et al.* 1967).

7. Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks (RE 11.8.13) (Qld EPA 2005b)
This regional ecosystem is predominantly 'central SEVT' with tree species such as silver croton *Croton insularis*, *Denhamia oleaster*, wilga *Geijera parviflora*, bonewood *Macropteranthes leichhardtii* and many others in the canopy layer (Gunn & Nix 1977; Story *et al.* 1967), and brigalow *Acacia harpophylla* and narrow-leaved bottle tree *Brachychiton rupestris* as scattered emergents in places (Gunn & Nix 1977). The canopy trees are usually 8±2 m tall, and the emergent trees 14±3 m tall (Gunn & Nix 1977).

In the south-east part of the ‘northern SEVT’ area microphyll/notophyll vine forest forms part of this regional ecosystem (see Forster & Barton 1995).

The vine thickets occur on Cainozoic igneous rocks (basalt) in lowland areas on gently undulating plains, rises and low hills. The slopes are generally <5 percent (Story *et al.* 1967), and the soils shallow to moderately deep clay loams, uniform or gradational soils, or light to medium clays (Speck *et al.* 1968; Gunn & Nix 1977).

8. Semi-evergreen vine thicket on Cainozoic fine-grained sedimentary rocks (RE 11.9.4) (Qld EPA 2005b)
This regional ecosystem is predominantly ‘central SEVT’ and includes similar vegetation further south (Vandersee 1975). Emergent tree species include brigalow *Acacia harpophylla*, bottle trees *Brachychiton rupestris* and *B. australis*, ooline *Cadellia pentastylis*, belah *Casuarina cristata* and poplar box *Eucalyptus populnea*. Tree species often present in the canopy include *Alectryon pubescens*, bitter bark *Alstonia constricta*, whitewood *Atalaya hemiglauca*, silver croton *Croton insularis*, *Denhamia oleaster*, wilga *Geijera parviflora*, *Lysiphyllum carronii* and many other species (Galloway *et al.* 1974; Gunn & Nix 1977; Gunn *et al.* 1967; McDonald 1996; Speck *et al.* 1968; Story *et al.* 1967). Warrior bush *Apophyllum anomalum*, wild pomegranate *Capparis loranthifolia* and *Geijera parviflora* are often more common inland and narrow-leaved backhousia *Backhousia angustifolia* and brush wilga *Geijera salicifolia* more common in eastern areas (McDonald 1996). Bonewood *Macropteranthes leichhardtii* is absent from the vegetation. The canopy trees range from 6±2 m to 8±3m tall, and the emergent trees from 11±3 to 14±4 m or more tall (Gunn & Nix 1977; Neldner 1984).

The vine thickets occur on Cainozoic to Proterozoic consolidated, fine-grained sediments on undulating rises or crests and slopes of steep hills. The substrate is frequently derived from shale (Gunn *et al*. 1967; Neldner 1984; Speck *et al.* 1968; Story *et al.* 1967), although it is sometimes associated with areas that have been subject to basalt enrichment. Slopes may be 5-40 percent in central areas (Gunn & Nix 1977) and 8-30 percent or more in southern areas (Vandersee 1975).

Soils are frequently shallow to moderately deep, light, medium or heavy clays, loams or clay loams and occasionally texture contrast soils, or moderately deep to deep cracking clays (Galloway *et al.* 1974; Neldner 1984; Speck *et al.* 1968; Story *et al.* 1967; Vandersee 1975).

9. *Macropteranthes leichhardtii* thicket on Cainozoic fine-grained sedimentary rocks (RE 11.9.8) (Qld EPA 2005b)
The regional ecosystem is thicket in the ‘central SEVT’ area in which bonewood *Macropteranthes leichhardtii* achieves high levels of dominance. Other tree species may be present, including scrub boonaree *Alectryon diversifolius*, bitter bark *Alstonia constricta*, silver croton *Croton insularis*, *C. phebalioides, Denhamia oleaster,* wilga *Geijera parviflora* and vinetree *Ventilago viminalis* in the canopy and bottle trees *Brachychiton rupestris* and *B. australis*, *Geijera parviflora* and occasionally brigalow *Acacia harpophylla* as emergents (Gunn & Nix 1977; Gunn *et al.* 1967; McDonald 1996). The canopy layer is usually 8±2 m tall, rarely to 12 m, and the emergent layer 15±3 m or more tall (Gunn & Nix 1977; McDonald 1996).

The thickets are associated with Cainozoic to Proterozoic consolidated, fine-grained sediments. These sediments are frequently formed from shale (Gunn & Nix 1977; Gunn *et al.* 1967; Story *et al.* 1967). The topography is commonly lowlands with slopes to 15 percent, but includes low ridges and escarpments where the slopes may be to 40 percent or locally to 80 percent (Gunn & Nix 1977; Gunn *et al.* 1967).

The soils include shallow to moderately deep texture contrast soils, occasionally cracking clays, and shallow loams and clays on ridges and escarpments (Gunn & Nix 1977; Gunn *et al.* 1967; Story *et al.* 1967).

10. Semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding (RE 11.11.18) (Qld EPA 2005b)
This regional ecosystem is semi-evergreen vine thicket in the 'central SEVT' area. A large number of tree species occur in the canopy layer, including silver croton *Croton insularis*, *Denhamia oleaster*, *Macropteranthes leichhardtii* and *Owenia acidula* (Gunn & Nix 1977; Speck *et al.* 1968). Brigalow *Acacia harpophylla*, bottle trees *Brachychiton ruprestris* and *B. australis* and red bauhinia *Lysiphyllum carronii* may occur as scattered emergents (Gunn & Nix 1977; Speck *et al.* 1968). The canopy is usually 8±3 m tall, and the emergents 14±3 m tall (Gunn & Nix 1977).

The vine thickets occur on undulating plains and rises formed on Mesozoic to Proterozoic moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. The slopes are usually <5 percent (Gunn & Nix 1977; Speck *et al.* 1968). The soils are usually shallow to moderately deep, loams, clay loams, light to medium clays or occasionally cracking clays (Gunn & Nix 1977; Speck *et al.* 1968).

Description of listed vegetation types in New South Wales

11. *Notelaea microcarpa–Ehretia membranifolia–Geijera parviflora* vine thicket (based on Benson *et al.* (1996), Curran (2003), Floyd 1990, McDonald (1996) and Williams (1999))

The most characteristic tree species of the vine thicket canopy are narrow-leaved red olive plum *Elaeodendron australe* var. *integrifolium*, peach bush *Ehretia membranifolia*, wilga *Geijera parviflora* and native olive *Notelaea microcarpa*. In northern areas (north from Yallaroi), trees such as yellow lemon *Pouteria cotinifolia* var. *pubescens* and large-fruited orange thorn *Pittosporum spinescens* may also be locally dominant. Tree species dominant in adjacent woodlands often occur as emergents above the vine thicket canopy (Floyd 1990; Williams 1999). They include silver-leaved ironbark *Eucalyptus melanophloia*, white box *E. albens*, white cypress pine *Callitris glaucophylla*, belah *Casuarina cristata* and kurrajong *Brachychiton populneus*.

Other characteristic tree and shrub species include bitter bark *Alstonia constricta*, red ash *Alphitonia excelsa*, boonaree *Alectryon oleifolius*, *A. subdentatus*, wild orange *Capparis mitchellii*, *Croton phebalioides*, *Hovea longipes*, *Maytenus cunninghamii*, shiny-leaved canthium *Psydrax odorata* subsp. *australiana* and vinetree *Ventilago viminalis*.

Characteristic understorey shrubs include *Beyeria viscosa, Breynia oblongifolia*, currant bush *Carissa ovata* and *Spartothamnella juncea*. Vine species often present include gargaloo *Parsonsia eucalyptophylla*, wonga vine *Pandorea pandorana* and desert jasmine *Jasminum didymum* subsp. *lineare*, or less frequently *Parsonsia lanceolata* and small-leaved clematis *Clematis microphylla*.

The vine thickets occur mainly on hills in the southern parts of their distribution, and also on flattish footslopes in northern areas (Curran 2006). They are usually associated with deep, loamy, high nutrient basaltic soils (Benson *et al.* 1996) but also occur on sandy loams (Williams 1999).

Appendix 3. Areas (ha) of SEVT regional ecosystems in each subregion (Queensland).

IBRA	Subregion	No.	11.02.03	11.03.11	11.04.01	11.05.15	11.08.03	11.08.06	11.08.13	11.09.04	11.09.08	11.11.18	Total	Pre	%rem
EIN	Broken River	9.04				4761							**4761**	**4828**	**98.61**
BBN	Townsville Plains	11.01	1149	379									**1528**	**1966**	**77.72**
BBN	Bogie River Hills	11.02	158		117		406		240	782		318	**2021**	**4174**	**48.42**
BBN	Cape River Hills	11.03				3693							**3693**	**4996**	**73.92**
BBN	Wyarra Hills	11.05				119	12						**131**	**132**	**99.24**
BBN	Northern Bowen Basin	11.06		15	14	2486	2295		4590	3208		212	**12820**	**47479**	**27.00**
BBN	Anakie Inlier	11.09					760						**760**	**783**	**97.06**
BBN	Basalt Downs	11.10			69		4962	1514		76			**6621**	**14904**	**44.42**
BBN	Isaac - Comet Downs	11.11		1060	1545	544	7		320	1245			**4721**	**46070**	**10.25**
BBN	Nebo - Connors Ranges	11.12		403	6		196		155	13		173	**946**	**4220**	**22.42**
BBN	South Drummond Basin	11.13					51	257			34	209	**551**	**1922**	**28.67**
BBN	Marlborough Plains	11.14	1173	268	2	228			25			218	**1914**	**10287**	**18.61**
BBS	Claude River Downs	11.15					3116	1101		238	8597	18	**13070**	**28076**	**46.55**
BBS	Woorabinda	11.16				66					204		**270**	**795**	**33.96**
BBS	Boomer Range	11.17		6	8							312	**326**	**4335**	**7.52**
BBS	Mount Morgan Ranges	11.18		124		1715	79		169	117		3211	**5415**	**47140**	**11.49**
BBS	Callide Creek Downs	11.19		12			495		446	628		25	**1606**	**40649**	**3.95**
BBS	Arcadia	11.20					75	146		9518	504		**10243**	**99853**	**10.26**
BBS	Dawson River Downs	11.21		95	119	3	256			11420	1204		**13097**	**123746**	**10.58**
BBS	Banana - Auburn Ranges	11.22		60	107	299	459		364	908		9	**2206**	**36686**	**6.01**
BBS	Buckland Basalts	11.23					1380	12402			1253		**15035**	**25819**	**58.23**
BBS	Carnarvon Ranges	11.24					919	115		7936	97		**9067**	**22922**	**39.56**
BBS	Taroom Downs	11.25					8			3548			**3556**	**77179**	**4.61**
BBS	Southern Downs	11.26					2820			12402			**15222**	**115727**	**13.15**
BBS	Barakula	11.27			76	1401	2		51	5367		3	**6900**	**64093**	**10.77**
BBS	Weribone High	11.29								54			**54**	**653**	**8.27**
BBS	Eastern Darling Downs	11.31					8205			1435			**9640**	**46942**	**20.54**
BBS	Inglewood Sandstones	11.32					89						**89**	**1627**	**5.47**
	Total		**2480**	**2422**	**2063**	**15315**	**26592**	**15535**	**6360**	**58895**	**11893**	**4708**	**146263**	**878481**	**16.65**

Appendix 4. Areas (ha) of SEVT ecosystems in each Queensland local authority area.

LGA	11.2.3	11.3.11	11.4.1	11.5.15	11.8.3	11.8.6	11.8.13	11.9.4	11.9.8	11.11.18	Total	%Total
Banana Shire Council		149	126	35	599		530	19055	51	190	**20735**	0.142
Blackall Tambo Regional Council						19					**19**	0.0001
Burdekin Shire Council	129	329									**458**	0.003
Central Highlands Regional Council		86	93	553	5749	15350		10977	11847	447	**45102**	0.308
Charters Towers Regional Council				8461							**8461**	0.058
Dalby Regional Council					4576			4639			**9215**	0.063
Gladstone Regional Council	51	100			29					2063	**2243**	0.015
Issac Regional Council	152	1035	1599	2427	5622		4121	3512		113	**18581**	0.127
Mackay Regional Council			61		29						**90**	0.0006
Murweh Shire Council					1612	172		564			**2348**	0.016
North Burnett Regional Council			178	3154	106		499	1616		796	**6349**	0.043
Rockhampton Regional Council	968	719	10				25			673	**2395**	0.016
Roma Regional Council					2831			17206			**20037**	0.137
South Burnett Regional Council				230	730			389			**1349**	0.009
Southern Downs Regional Council					1303			275			**1578**	0.011
Toowoomba Regional Council					2102			153			**2255**	0.015
Townsville City Council	77	52									**129**	0.0009
Whitsunday Regional Council	1105			463	1372		1187	494		426	**5047**	0.034
Total	**2482**	**2470**	**2067**	**15323**	**26660**	**15541**	**6362**	**58880**	**11898**	**4708**	**146391**	

Appendix 5. Area of SEVT regional ecosystems in Queensland conservation reserves (DERM estate).

Conservation Estate	11.02.03	11.03.11	11.04.01	11.05.15	11.08.03	11.08.06	11.08.13	11.09.04	11.09.08	11.11.18	Total
Abbott Bay Resources Reserve	16										**16**
Allies Creek State Forest								462			**462**
Amaroo State Forest				76							**76**
Bania Forest Reserve				76							**76**
Barakula State Forest								49			**49**
Beecher State Forest										11	**11**
Beilba State Forest								69			**69**
Belington Hut State Forest								1088			**1088**
Blair Athol State Forest					265						**265**
Bowling Green Bay National Park	1	18									**19**
Boxvale State Forest								27			**27**
Bundoora State Forest					74						**74**
Bunya Mountains National Park					1924			14			**1938**
Camboon State Forest				16							**16**
Cape Upstart National Park	96										**96**
Capricorn Coast National Park	10										**10**
Carminya State Forest							25				**25**
Carnarvon National Park					296	7092		673	6035		**14096**
Coominglah State Forest			55	1248	98		150	97			**1648**
Dalgangal State Forest								10			**10**
Diamondy State Forest					83			0			**83**
Dipperu National Park (Scientific)		508	1333								**1841**
Doonkuna State Forest								13			**13**
Expedition National Park								4463			**4463**
Expedition Resources Reserve								389			**389**
Expedition State Forest				25				21	45		**91**
Grevillea State Forest		16		15			17				**48**
Gurgeena Conservation Park				36							**36**
Gurgeena State Forest				35							**35**
Gurulmundi State Forest								33			**33**
Gwambagwine State Forest								154			**154**
Highworth Bend Conservation Park								19			**19**
Homevale National Park							140				**140**
Isla Gorge National Park								190			**190**

Appendix 5 (continued). Area of SEVT regional ecosystems in Queensland conservation reserves (DERM estate).

Conservation Estate	11.02.03	11.03.11	11.04.01	11.05.15	11.08.03	11.08.06	11.08.13	11.09.04	11.09.08	11.11.18	Total
Jandowae State Forest								17			**17**
Jarrah State Forest								19			**19**
Junee State Forest							45				**45**
Koko State Forest								431			**431**
MacKenzie Island Conservation Park	10										**10**
Magnetic Island National Park	2	14									**16**
Malmaison State Forest				78							**78**
Minerva Hills National Park					62						**62**
Mount Dumaresq Conservation Park					70						**70**
Mount Hope State Forest					64	56					**120**
Mount Leura Conservation Park					115						**115**
Mount Nicholson State Forest					36			9	0		**45**
Mount Scoria Conservation Park							5	6			**11**
Mount Stowe State Forest										38	**38**
Mundell State Forest								122			**122**
Mundowran State Forest				56							**56**
Nuga Nuga National Park								53	345		**398**
Overdeen State Forest								220			**220**
Palmgrove National Park (Scientific)								5380	871		**6251**
Peak Range National Park					309						**309**
Pile Gully State Forest				41							**41**
Pluto Timber Reserve						16					**16**
Precipice National Park								170			**170**
Reinke Scrub Conservation Park				30							**30**
Roundstone State Forest								36			**36**
Rundle Range National Park		33									**33**
Shoalwater Bay Conservation Park	164										**164**
Stones Country Resources Reserve								14			**14**
Taboonbay State Forest								71			**71**
Tellebang State Forest				56			1				**57**
Theodore State Forest					24			112			**136**
Warranna State Forest								227			**227**
Waterton State Forest 1								65			**65**
Total	**299**	**589**	**1388**	**1788**	**3420**	**7164**	**383**	**14723**	**7296**	**49**	**37099**

Appendix 6. Area (ha) and tenure of SEVT REs in Queensland NHT regions

NRM area	RE	F'hold	L'hold	NP	SF	Other	Total
Burdekin Dry Tropics Board	11.02.03	625	222	114		192	**1153**
	11.03.11	187	19	34		139	**379**
	11.04.01	60	68				**128**
	11.05.15	203	10385			1	**10589**
	11.08.03	759	1589		253	1	**2602**
	11.08.13	1759	2291			0	**4050**
	11.09.04	356	2604			0	**2960**
	11.11.18		486				**486**
Burdekin Dry Tropics Board Total		**3949**	**17664**	**148**	**253**	**333**	**22347**
Burnett Mary Reg Group NRM Inc	11.04.01	111	12		55		**178**
	11.05.15	1631	85	65	1602	9	**3392**
	11.08.03	710	14		110	0	**834**
	11.08.13	348	0		168		**516**
	11.09.04	2041	61		1267	2	**3371**
	11.11.18	785	10		1	0	**796**
Burnett Mary Reg Group NRM Inc Total		**5626**	**182**	**65**	**3203**	**11**	**9087**
Condamine Alliance	11.08.03	5837	13	1977	72	14	**7913**
	11.09.04	1215	28	18	10	11	**1282**
Condamine Alliance Total		**7052**	**41**	**1995**	**82**	**25**	**9195**
Fitzroy Basin Association	11.02.03	490	163	191		329	**1173**
	11.03.11	938	490	542	29	91	**2090**
	11.04.01	204	166	1335		55	**1760**
	11.05.15	671	534	1	124	4	**1334**
	11.08.03	4817	6501	760	213	1	**12292**
	11.08.06	1905	6375	7085	72	0	**15437**
	11.08.13	943	632	145	26	46	**1792**
	11.09.04	17125	12758	10962	2002	2125	**44972**
	11.09.08	532	4011	7258	44	47	**11892**
	11.11.18	2716	562	5	52	91	**3426**
Fitzroy Basin Association Total		**30341**	**32192**	**28284**	**2562**	**2789**	**96168**
Mackay Whitsunday NRM Group	11.02.03	78	26			54	**158**
Mackay Whitsunday NRM Group Total		**78**	**26**			**54**	**158**
Qld Murray Darling Committee Inc	11.08.03	856	511	6		3	**1376**
	11.09.04	2058	3568		71		**5697**
Qld Murray Darling Committee Inc Total		**2914**	**4079**	**6**	**71**	**3**	**7073**
South West NRM Inc	11.08.03		1615	16			**1631**
	11.08.06		94	1			**95**
	11.09.04		611				**611**
South West NRM Inc Total			**2320**	**17**			**2337**
Total		**49960**	**56504**	**30515**	**6171**	**3215**	**146365**

Appendix 7. Numbers and areas of fragments of remnant SEVT regional ecosystems (Queensland)

Numbers of polygons

REs	Total	< 10 ha	Ppn	10-100 ha	Ppn	> 100 ha	Ppn
11.2.3	124	82	0.66	42	0.34		
11.3.11	146	106	0.73	39	0.27	1	0.01
11.4.1	70	58	0.83	11	0.16	1	0.01
11.5.15	270	159	0.59	96	0.36	15	0.06
11.8.3	713	368	0.52	320	0.45	25	0.04
11.8.6	225	116	0.52	93	0.41	16	0.07
11.8.13	144	83	0.58	58	0.40	3	0.02
11.9.4	1950	1315	0.67	605	0.31	30	0.02
11.9.8	172	86	0.50	76	0.44	10	0.06
11.11.18	172	92	0.53	78	0.45	2	0.01
Total	**3986**	**2465**	**0.62**	**1418**	**0.36**	**103**	**0.03**

Areas of polygons

Total	< 10 ha	Ppn	10-100 ha	Ppn	> 100 ha	Ppn
2159	499	0.23	1660	0.77		
2389	488	0.20	1571	0.66	329	0.14
1972	282	0.14	459	0.23	1230	0.62
13246	834	0.06	5243	0.40	7169	0.54
25878	2640	0.10	17033	0.66	6205	0.24
15888	929	0.06	6014	0.38	8945	0.56
5716	653	0.11	3078	0.54	1985	0.35
67076	7272	0.11	40553	0.60	19251	0.29
11875	385	0.03	6060	0.51	5430	0.46
5492	435	0.08	4849	0.88	209	0.04
151692	**14418**	**0.10**	**86521**	**0.57**	**50752**	**0.33**