Agro-forestry Development Species Demonstration Sites

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Cover photo: A three and half year-old plantation at a FFLN demonstration site at Karoonda (Craig Neumann, 24/2/2018)

Foreword

The Farm Forestry Landcare Network (FFLN) represents an alliance between landholders, farm forestry practitioners, agricultural industries, researchers, non-government agencies, local governments and the Government of South Australia to facilitate sustainable landuse and industries using agroforestry options.

The potential of farm forestry to enhance our landscapes and communities from the economic benefits of wood product industries (e.g. firewood, timber, fibre, biofuels) and ecological benefits of more perennial farming systems (e.g. biodiversity, carbon sequestration, soil health) is immense. The FFLN encourages these sustainable developments under a shared vision of prosperous communities, vibrant industries and a healthy environment.

The success of this group is bound to the concept of open and productive sharing of ideas, learnings, information and scientific developments to enable truly collaborative and informed decisions on the best land management and industry options. The network uses the best science and genetic materials developed during the operations of the FloraSearch project and trials and combines these resources with extensive practical experience of a diverse range farmers, landholders and facilitators of community-led revegetation and farm forestry activities.

The FFLN's program of trials provide the most recent addition to these learnings by testing establishment techniques and improved genetics in real-world situations. The lessons learned from these trials will further enhance the prospects of farm forestry in the region.

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Summary

A series of FloraSearch woody crop field trials were established between 2004 and 2010 in South Australia by the Department of Environment, Water (DEW) to evaluate the potential of native plants species to produce biomass for wood fibre, bioenergy, eucalyptus oil, fodder and carbon sequestration industries. Sites were established at Murray Bridge, Roseworthy and Lucindale in 2004-2005 to undertake preliminary species performance evaluation and limited experiments to evaluate the influences of planting density and harvesting on regrowth. This work was conducted in partnerships with allied government departments in Western Australia, Victoria and New South Wales, CSIRO and the Future Farm Industries Cooperative Research Centre (CRC) as part a national network of woody crop trial sites.

In 2006, more detailed studies commenced at the Monarto Research Site to establish genetic collections of most prospective species, including a suite of prospective FloraSearch "development" species in provenance trials. This FloraSearch project was completed in 2014 with release of the report *Performance of Native Plant Species in South Australian Woody Crop Trials – FloraSearch 4* (Hobbs et al. 2014)

The unpaid volunteers of the Farm Forestry Landcare Network decided to do what they could to further both, the knowledge surrounding some of the better performing eucalypt species from the Monarto Research Site and preserve the genetics of the most promising ones. The following report provides information about what the Farm Forestry Landcare Network aims to achieve. It describes the trees chosen for inclusion in the demonstration site plantings. It gives a summary of the networks practical learnings surrounding growing the trees and establishing demonstration plantings. Finally, it provides details and assessments of each of the demonstration sites established across the South Australian Murray Mallee and Upper South East under the Farm Forestry Landcare Network's, Demonstration Site Program.

It is envisioned this document will be added to each year as the Demonstration Sites develop. New assessments will be added for each site and new sites will also be included as funding and land becomes available. The information about the trees and planting methods will also be added to and improved each year.

1 Introduction

1.1 The Farm Forestry Landcare Network

The Farm Forestry Landcare Network is a volunteer organisation of farmers, growers, researchers and industry specialists, sharing information about activities, individual projects and forestry industry research. The Group has been around for a long time under different names. It was previously known as the Agro-Forestry Working Group, when supported by Regional Development Australia Murraylands & Riverland. Then it was known as the Agro-Forestry Entrepreneurship Hub under the Chaffey Learning Exchange. The current name harks back to the groups early links to the Coorong Farm Forestry Network supported by Coorong Tatiara Local Action Plan in 1998 and is currently receiving support from The Murray Mallee Local Action Planning Association before becoming an incorporated group in its own right.

In South Australia there are only a few viable agro-forestry opportunities, yet the integration of trees into the agricultural landscape is expected to play an important part of the future agricultural mix, particularly in relation to:

- Sustainable, and carbon neutral, home heating
- Soil conservation and enrichment
- New crops to cater for low rainfall farming
- Global demand for timber
- Australia's deficit of $2 billion in forest products
- A focus on renewable products and energy sources
- Carbon farming and sequestration
- Diversified rural economies
- Oil production
- Seed banks The Aims of the Farm Forestry Landcare Network

Figure 1.1: A Farm Forestry Landcare Network Planting Team Meningie 2016

1.2 The Aims of the Farm Forestry Landcare Network

The aims of the Farm Forestry Landcare Network are:

1. The promotion of agro-forestry knowledge and opportunities.

2. Map the provision of agro-forestry knowledge, courses, services, demonstration sites, and local champions. Develop case studies to help farmers understand methods, benefits and opportunities. Provide a package of skills and resources to develop the market.

3. Establish demonstration sites of tree species suited to lower rainfall farming.

4. Develop a range of tree species suited to lower rainfall farming.

5. Work with policy initiatives to leverage the reach of government initiatives.

6. Drive interest in agro-forestry to achieve critical mass to support investment in harvesting and processing equipment and infrastructure. This includes:

- Challenges to farmers (e.g. productivity challenge).
- Focusing on non-productive land (e.g. sandhills).
- Addressing salinity (soaks/seeps).
- Options for farmers that are resistant to the establishment of environmental plantings in these instances.

1.3 The origin of the Farm Forestry Landcare Network's demonstration species

Past clearing of native vegetation for agriculture has led to increasing salinity and soil erosion in some areas. The encouraging farm forestry in the 250-650mm winter dominated rainfall zone could help alleviate the scale of these detrimental effects (Bartle et al. 2007). To achieve these goals farm forestry must be economically viable and complement, current land uses (Bennell et al. 2008, Stirzaker et al. 2002). The recognition of carbon emissions and the consequences of climate change as a critical issue has added to the potential importance of farm forestry as part of the agricultural landscape in Australia.

Commercial forestry in southern Australia is typically limited to higher rainfall regions (650 - 1000mm mean annual rainfall (MAR)) and are focused on systems using long-cycle rotations to create larger diameter logs transported to centralised processing facilities (Zorzetto et al. 1999). In lower rainfall regions, with slower growth rates, traditional sawlog harvest cycles are typically greater than 20 years (Harwood et al. 2005). These long-cycle systems are less viable in the lower rainfall regions due to the long intervals between financial investment and harvest income.

In the early 2000's, to overcome the commercial detriments of long investment return periods, a project called FloraSearch started to develop farm forestry varieties suitable for lower rainfall regions which minimise costs and maximise returns (Bartle 2001, Enecon 2001, Bennell et al. 2008, Hague et al. 2007). This improvement was achieved by selecting and developing species for shorter harvest cycles (< 10 years) and reduced investments in establishment, replanting and harvest costs by utilising of coppicing species.

The FloraSearch project was at the forefront of farm forestry research and made significant advances in developing farm forestry varieties for the dryland agricultural region of southern Australia. The project integrated scientific advances in the biology of native plant species with agriculture and economics to demonstrate that farm forestry was a real option within the wheat/sheep regions, particularly in those areas of the landscape unprofitable to crop or subject to erosion.

Early FloraSearch activity involved the laborious step-by-step process of screening the vast number of tree and shrub species found in the research area via a desk top audit of documented attributes. Potential species were then located in a field campaign to collect field data and samples. Several hundred species were selected and tested for product suitability, and those with high potential for development were advanced into field trials (Bennell et al. 2008, Hobbs & Bennell 2008, Hobbs 2008, Hobbs et al. 2008).

In 2004, 30,523 individuals were planted over 6 trial sites representing 60 species and 80 different varieties. Murray Bridge was the most extensive site with other sites at Roseworthy, Rutherglen, Coorow, Lucindale and Toolibin. Despite poor weather

conditions after establishment the mean 3-year-old survival rate across all sites was 72% and at some individual sites was 78%. This indicated that the bulk of the species selected had the survival characteristics necessary to persist in the prevailing dry conditions. In 2005 these trials were added to with another 14,359 individuals, representing another 115 species and 146 different varieties (Hobbs et al. 2008, 2009a).

Building on the early field trial results a further 4 trials were established in 2006 containing genetics from up to 8 provenances of the most promising species identified in the 2004 trials. Sites planted included Monarto (SA), Thurloo (NSW), Rutherglen (Vic) and Crossman (WA). In total the 2006 trials contain 39,520 individual plants, from 20 species, 36 sub species or varieties, and 87 provenances. The purpose of these sites is to identify superior provenances and make selections of the best germplasm from within the most promising species to become the basis of commercially-viable farm forestry crops (Hobbs et al. 2008, 2009a).

Monarto was the biggest of the 2006 trials and contained all the species, sub species and provenances being investigated. In 2013, at seven years of age, the plantings at the Monarto site were measured and the best performing species and provenances of those species were identified (Hobbs et al. 2014). The species included in the Farm Forestry Landcare Network demonstration sites are based on these results and the seed required to propagate the seedlings is collected at the Monarto trial in October each year as required.

Figure 1.2: Seed collection at Monarto 16/10/2014

2 Demonstration Site Species

2.1 Chooising the Farm Forestry Landcare Network's demonstration species

Reviews of native plants species and woody biomass industries were carried out by the Search and FloraSearch projects. (Olsen et al. 2004 a, b, Bennell et al. 2008, Hobbs and Bennell 2008, Hobbs 2008, Hobbs et al. 2008, Hobbs et al. 2009a, Hobbs et al. 2009b, Hobbs 2009) These projects identified a range of species that had potential to produce plant-based commodities. As new information was gathered the process advanced from a preliminary screening, to targeted species and provenance selections. The FloraSearch field trials in South Australia (2004-2010) contain plantings that span this continuum of species evaluations. Building on the early field trial results a further trial was established at Monarto in 2006 containing genetics from up to 8 provenances of the most promising species identified in the prior trials. The purpose of this site was to identify superior provenances and then make selections of the promising species to become the basis of commercially-viable crops. The Monarto trial contained 23,488 individual plants in total, from 20 species, 36 sub species or varieties, and 87 provenances. These numbers also include 6 individual species plantings of comparison species or species of interest and another 8 clonal hybrids. (Hobbs et al. 2014)

The most productive provenances observed at Monarto include *Eucalyptus occidentalis* from Kantanning (16.9 t/ha/yr) and *Eucalyptus cladocalyx* from the Bundaleer Seed Production Area (12.8 t/ha/yr). Two Saltgrow hybrid eucalypts lines were included and *Eucalyptus camaldulensis x grandis* [Saltgrow 18 clone] (12.6 t/ha/yr) proved to be the third best selection on site with similar accumulation rates to *Eucalyptus cladocalyx*. The other hybrid, *Eucalyptus camaldulensis x globulus* ssp. *globulus* also grew well. The best clone of these was [Saltgrow 35] (9.73 t/ha/yr). *Eucalyptus polybractea* was the most productive mallee species in this trial with some provenances producing 6.1 t/ha/yr of above ground biomass. Some other mallee species provenances produced similar amounts of biomass (*Eucalyptus loxophleba ssp. Lissophloia* 5.4 t/ha/yr, *Eucalyptus porosa* 4.3 t/ha/yr). (Hobbs et al. 2014)

In its desire to preserve the superior genetics identified at the Monarto Research Site the Farm Forestry Network collected seed from the best available eucalyptus provenances to produce seedlings to be used in demonstration sites across the Murray Mallee and Upper South East. In most cases this was the best provenances identified by DEW in 2013 but in some cases, such as the *Eucalyptus occidentalis* from Kantanning, the trees have never produced enough fruit to enable collection.so the next best provenance was used. Other species were included because they grow in very low rainfall (*Eucalyptus oleosa ssp. oleosa* and *Eucalyptus horistes)* or have desirable oil qualities (*Eucalyptus cneorifolia*).

The Farm Forestry Network chose only to include eucalypts in its demonstration sites. Firstly, because most of the other genera present at Monarto had expired having exceeded their natural life spans and making seed collection impossible. Secondly, because growers expressed a desire to establish long lived plantations in the absence of any immediate market other than firewood. Thirteen selections were made to cover a range of growing conditions and products. Those being:

• *Eucalyptus cladocalyx* [Bundaleer]	Sugar Gum	Tree
• *Eucalyptus cladocalyx* [Kersbrook]	Sugar Gum	Tree
• *Eucalyptus cneorfolia* [Kingscote]	K.I. Narrow Leaf Mallee	Mallee
• *Eucalyptus horistes* [WA]	Oil Mallee	Mallee
• *Eucalyptus loxophleba ssp. Lissophloia* [WA]	York Gum	Small tree or Mallee
• *Eucalyptus occidentalis* [Gibson]	Flat Top Yate	Tree
• *Eucalyptus occidentalis* [Jerdacuttup]	Flat Top Yate	Tree
• *Eucalyptus oleosa ssp. oleosa* [Mallala]	Red Mallee	Mallee
• *Eucalyptus petiolaris* [Koppio]	Eyre Peninsula Blue Gum	Tree
• *Eucalyptus polybractea* [Inglewood]	Blue Mallee	Mallee
• *Eucalyptus porosa* [Glenloth]	Mallee Box	Tree or Mallee
• *Eucalyptus camaldulensis x globulus* [Saltgrow 35]	Saltgrow hybrid gum	Tree
• *Eucalyptus camaldulensis x grandis* [Saltgrow 06]	Saltgrow hybrid gum	Tree

Eucalyptus cladocalyx Sugar Gum

Figure 2.1: *Eucalyptus. cladocalyx* at Monarto after 7 years

- Average height 6.9m
- Plants per hectare >2000
- Above ground Biomass (t/ha/yr.) 12.8
- Above ground CO2e Sequestration (t/ha/yr.) 23.3
- Survival rate 92%
- Wood density kg/m3 753
- Annual rainfall range 350 to 700mm
- Soil Sands to clay loams
- Flowering times January through April
- Pros Coppices readily
- Cons Frost sensitive
  Juvenile foliage toxic to stock

General

E. cladocalyx is a widely planted forestry species in southern Australia generally preferring areas of greater than 350 mm rainfall. It is noted as being very fast-growing and was a favourite planting in the first half of the 1900's. Wood uses include solid timber for use as posts, poles, general construction, railway sleepers, farm timber and firewood. Noted to have a hard, heavy timber of good strength and durability. Surveys in the Tintinara SA region in the early 2000's discovered low density variants of this species suggesting it may have potential as a pulpwood species. (Hobbs and Bennell 2008)

Distribution

E. cladocalyx naturally occur in SA in the lower Eyre Peninsula, Kangaroo Island and the Flinders Ranges but its distribution is disjointed.

Biological features

E. cladocalyx is a tree that can grows to 35 m tall. It coppices well, even without a lignotuber as it has epicormic buds present up the stem. *E. cladocalyx* has a spreading and competitive root system and if planted close excludes other plants growing beneath it. It flowers from January to April and it's best to collect seed from October to May.

Cultivation

E. cladocalyx thrives on a wide variety of soils including gravels, clay loams, sandy loams and sands. It tolerates shallow soils and a wide range of ph. It's not suitable for wet, saline or waterlogged sites and trees can die if excessively waterlogged (Marcar & Crawford 2004). It is often coppiced near ground level or pollarded at about 1 metre above the ground and allowed to regrow. It's foliage and stems have a low susceptibility to insect attack but Christmas beetle, gumtree scale, leaf beetle, sawfly and Lyctus borers have all been noted as insect pests (Marcar & Crawford 2004, Bird 2000).

In the demonstration sites

This species is perhaps one of the disappointments of the demonstration site plantings. Surviving individuals show all the rapid growth and desirable qualities *E. cladocalyx* is renowned for. But, overall mortality rates were quite high, most probably due to frost. Plants grown in frost protected situations fared far better. *E. cladocalyx* grown in tree guards seemed to survive frost better than those without guards. *E. cladocalyx* grown on higher ground away from areas frost regularly settled survived better than those planted in hollows and low points. Trees planted in heavier soils in flat areas also survived better than those in sandy soils in the same flat area. The lesson here is that this species is frost sensitive and thought needs to be given to frost protection when planting it.

Figure 2.2: *E. cladocalyx* Planted in 1900 at Magdalla and harvested on two occasions. This photo showing recent coppice growth between since 1980 and 2008

Eucalyptus cneorifolia Kangaroo Island Narrow Leafed Mallee

Figure 2.3: *Eucalyptus cneorifolia* at Monarto after 7 years

• Average height	3.3m
• Plants per hectare	>2000
• Above ground Biomass (t/ha/yr.)	2.8
• Above ground CO2e Sequestration (t/ha/yr.)	5.0
• Survival rate	87%
• Wood density kg/m3	854
• Annual rainfall range	450 to 650mm
• Soil	Sands to clay loams
• Flowering times	January through April
• Oil yield	1.45%dm
• Pros	Coppices readily
	Fragrant oil
	Bushy habit
• Cons	Water sensitive

General
E. cneorifolia is not a widely planted species but it is grown to produce eucalyptus oil on Kangaroo Island. There were once over 100 stills used to produce oil from this mallee, however, the distillation industry went into decline after the 1930s and currently only one operating distillery remains on the island to produce this mallees distinctive smelling oil for sale. (Seeds of South Australia 2018)

Distribution
E. cneorifolia naturally occur on the eastern end of Kangaroo Island and small pockets on the Fleurieu Peninsula.

Biological features
E. cneorifolia is a mallee that can grow to 10 meters tall. It coppices well, having a lignotuber at the base of the trunk. It flowers from January to April and it's best to collect seed from October to May.

Cultivation
E. cneorifolia grows on well-drained soils over laterite or limestone in dense mallee shrubland. It tolerates shallow soils and a wide range of ph. It's not suitable for wet, or waterlogged sites but is said to be moderately tolerant of saline soils and requires over 450mm annual rainfall.

In the demonstration sites
This species has proven the most difficult to establish in the demonstration site plantings. Surviving individuals tend to be small and hard to locate in the first few years but grow more rapidly after that. Overall mortality rates were very high, most probably due to a combination of dry conditions and frost. Plants grown in tree guards fared better but it's fair to say this species has not performed well. Given *E. cneorifolia's* high oil quality this is a disappointment.

Figure 2.4: Roadside *E. cneorifolia* near Waitpinga

Eucalyptus horistes Oil Mallee

Figure 2.5: *Eucalyptus horistes* at Monarto after 7 years

- Average height 2.6m
- Plants per hectare >2000
- Above ground Biomass (t/ha/yr.) 1.8
- Above ground CO2e Sequestration (t/ha/yr.) 3.1
- Survival rate 90%
- Wood density kg/m3 954
- Annual rainfall range 200 to 550mm
- Soil Sands to clay loams
- Flowering times November through January
- Oil yield 2.0%dm
- Pros Coppices readily
  Very hardy
- Cons Low mallee form
  Slow growth

General
E. horistes is also not a widely planted species outside of Western Australia where it's mainly grown to produce eucalyptus oil. (Brooker et al. 2002)

Distribution
E. horistes naturally occur on sandy soils in the wheatbelt of Western Australia from Murchison River in the north southwards to Wagin and east into the goldfields to Leonora and Norseman and as far east as Ponton Creek in the Great Victoria Desert.

Biological features
E. horistes is a slow growing mallee that can reach 8 meters tall. It coppices well, having a lignotuber at the base of the trunk. It flowers from November to January.

Cultivation
E. horistes grows on well-drained sandy or sandy loam soils over laterite or limestone. It tolerates shallow soils and a wide range of ph. It's ability to grow in areas that receive less than 250mm annual rainfall makes it an attractive proposition for oil production in those areas.

In the demonstration sites
This species has proven to be one of the most resilient species in the demonstration sites. Individuals tend to be very small and hard to locate in the first few years, but survival rates were reasonable if competition was kept in check. Mortality rates were high at sites with heavy weed loads in the first few years. Plants grown in weed free areas fared better and, while smaller than any of the other species, are doing well especially on the drier sites.

Figure 2.6: 3.5-year-old *E. horistes* with the larger *E. oleosa ssp. oleosa* to the right as a comparison at Sandalwood site 28/2/2018

Eucalyptus loxophleba ssp. lissophloia York Gum

Figure 2.7: *Eucalyptus. loxophleba ssp. lissophloia* at Monarto after 7 years

• Average height	6m
• Plants per hectare	>2000
• Above ground Biomass (t/ha/yr.)	5.4
• Above ground CO2e Sequestration (t/ha/yr.)	9.9
• Survival rate	97%
• Wood density kg/m3	707
• Annual rainfall range	350 to 600mm
• Soil	Sands to clays
• Flowering times	August through December
• Oil yield	2.4%dm
• Pros	Coppices readily
• Cons	Salt tolerant
	Inundation tolerant

General

E. loxophleba ssp. lissophloia is now a widely planted species outside of Western Australia where it's mainly grown to produce eucalyptus oil. Natural populations of *E. loxophleba ssp. lissophloia* grow in areas affected by dryland salinity and could possibly be used in the remediation of dryland salinity. (Hobbs and Bennell 2008)

Distribution

E. loxophleba ssp. lissophloia is a smooth-barked mallee of the eastern wheatbelt and the goldfields of Western Australia, extending from Bencubbin and Merredin east as far as Karonie (Cardunia Rocks), Coonana, and almost to Balladonia and to Peak Charles.

Biological features

E. loxophleba ssp. lissophloia is a mallee, to 15m tall. The presence of a lignotuber allows for a strong recovery in the plant following repeated harvest for oil or wood products.

Cultivation

E. loxophleba ssp. lissophloia is adaptable to a range of conditions including sandy and clayey sites, making it a versatile species. *E. loxophleba ssp. lissophloia* has been widely cultivated and developed because of its potential as an oil mallee. This subspecies has also been introduced to the eastern states in plantings for carbon sequestration.

In the demonstration sites

This species has had mixed results at the demonstration sites. Mortality rates were higher than expected in the first few years, but surviving trees then grow strongly. Frost doesn't seem to be a factor with strong survival at one site that had major frost mortalities.

Figure 2.8: 3.5-year-old *E. loxophleba ssp. lissophloia* at Karoonda

Eucalyptus occidentalis Flat-topped Yate

Figure 2.9: *Eucalyptus occidentalis* at Monarto after 7 years

• Average height	7.4m
• Plants per hectare	>2000
• Above ground Biomass (t/ha/yr.)	16.2
• Above ground CO2e Sequestration (t/ha/yr.)	29.5
• Survival rate	95%
• Wood density kg/m3	554
• Annual rainfall range	300 to 700mm
• Soil	Sands to loams
• Flowering times	April through August
• Pros	Salt Tolerant
	Frost Tolerant
	Coppices readily

General

E. occidentalis is a widely cultivated species in southern Australia and overseas. Known to be productive, highly adaptable and with potential for wood products Natural populations of *E. occidentalis* grow in areas affected by dryland salinity and are widely used in the remediation of dryland salinity. (Hobbs and Bennell 2008)

Distribution

E. occidentalis is a tree or mallee endemic to Western Australia, with a widespread distribution south and south-east of Perth, usually in wet, fresh-water depressions, but sometimes around salt lakes, from the southern wheatbelt and subcoastal areas north-west of Albany east to Cape Arid National Park and to the north of Mt Ragged.

Biological features

E. occidentalis is tree to 20 m tall, sometimes a mallee and forms a lignotuber (Brooker et al. 2002). *E. occidentalis* is useful in the remediation of waterlogged sites as it is tolerant of waterlogging. (Brooker et al. 2002). Flowers from April to August and seed is best collected from September through to April.

Cultivation

E. occidentalis is fast growing and known to tolerate and grow in a wide range of soils including alkaline, saline and waterlogged sites (Bird 2000). The species is also frost and drought tolerant (Marcar et al. 1995) but susceptible to insect attack (Marcar & Crawford 2004). The preferred rainfall range is generally 355 - 700 mm mean annual rainfall. *E. occidentalis* is a potential timber species for solid timber including posts, poles and firewood, as well as pulp and paper production, MDF and Fibreboard products.

In the demonstration sites

E. occidentalis was the best performing species at Monarto and continues to be an all-round good choice only doing poorly at a few of the demonstration sites. It is fairly frost tolerant with only 1 location reporting mortality from this cause. On the hardest of the small saline sites it's the only species to survive past the first year. On a larger site that proved to also have salt problems it survived only to be beaten up by feral deer. Otherwise on most sites *E. occidentalis* are the biggest strongest trees with good survival rates.

Figure 2.10: 1.5-year-old *E. occidentalis* at Tintinara

Eucalyptus oleosa ssp. oleosa Red Mallee

Figure 2.11: *Eucalyptus oleosa ssp. oleosa* at Monarto after 7 years

- Average height 3.5m
- Plants per hectare >2000
- Above ground Biomass (t/ha/yr.) 2.9
- Above ground CO2e Sequestration (t/ha/yr.) 5.2
- Survival rate 88%
- Wood density kg/m3 954
- Annual rainfall range 200 to 550mm
- Soil Sands to clay loams
- Flowering times June through November
- Oil yield 3.1%dm
- Pros Coppices readily
  Very hardy
- Cons Oil content variable
  Low mallee form

General
Little specific work has been carried out from a plantation perspective for this species, but it is one that is commonly used in revegetation programs and varies little from other eucalypts when treated in this fashion. (Hobbs and Bennell 2008)

Distribution
E. oleosa ssp. oleosa is a tree or mallee with a very wide distribution extending east from Lake Barlee and the Western Australian Goldfields to north western Victoria and south-western New South Wales.

Biological features
E. oleosa ssp. oleosa is a mallee, or rarely a tree, to 10 meters that forms a lignotuber and coppices readily. It flowers from June to November and seed can be collected year-round.

Cultivation
E. oleosa ssp. oleosa has the potential to be cultivated for biomass production on a range of soil types including shallow calcareous soils, sands, sandy loams and clays, in regions that receive a between 200 and 350mm annual rainfall. *E. oleosa ssp. oleosa* has some good oil yields recorded indicating some promise but results are highly variable across its provenances and subspecies. Ongoing work is required if this species is to be seriously considered for eucalyptus oil production as an adjunct to any biomass industry.

In the demonstration sites
E. oleosa ssp. oleosa was a good solid performer on all the demonstration sites it was included in. It grew well in most of the lower rainfall areas and while it's oil production is variable it produces more biomass than *E. horistes* wherever the two species have been planted together. A good option in low rainfall areas but at this stage larger trees such as *E. occidentalis* are more promising in the higher rainfall areas.

Figure 2.12: 3.5-year-old *E. oleosa ssp. oleosa* at Karoonda

Eucalyptus petiolaris Eyre Peninsular Blue Gum

Figure 2.13: *Eucalyptus petiolaris* at Monarto after 7 years

- Average height 4.8m
- Plants per hectare >2000
- Above ground Biomass (t/ha/yr.) 8.5
- Above ground CO2e Sequestration (t/ha/yr.) 15.9
- Survival rate 92%
- Wood density kg/m3 664
- Annual rainfall range 350 to 600mm
- Soil Sands to loams
- Flowering times July through October
- Pros Coppices readily
  Large red or white flowers
- Cons Multi-stem form

General

E. petiolaris is widely used in garden and parkland situations. It's valued for its copious flowers, which are not always the same colour as the source plant. While this species is commonly sold in nurseries as *Eucalyptus leucoxylon* 'rosea', little information is available specifically for this species in a plantation context. (Hobbs and Bennell 2008)

Distribution

E. petiolaris is endemic to South Australia's Eyre Peninsula. There are two distinct populations, one behind Port Lincoln in the Koppio Hills and the other around Cleve and Darke Peak to the north.

Biological features

E. petiolaris is a Small to medium sized trees to 20 meters tall, that forms a large lignotuber. Multistemmed individuals are not uncommon as the species has good coppice capacity from the lignotuber. *Eucalyptus petiolaris* is moderately frost tolerant. It is also one of the few Eucalypts to have a variety of flower colours, ranging from white, through pink, orange and yellow, to a brilliant red. It produces it's display of large flowers from July to October and seed is best collected in November to January.

Cultivation

E. petiolaris has the potential to be cultivated in regions that receive 300mm or more annual rainfall. Well known as an amenity plant, *E. petiolaris* has potential as feedstock for a variety of industries including pulpwood processing, wood chip and fibre products, as well as firewood and even eucalyptus oil production.

In the demonstration sites

E. petiolaris is another good solid performer on all the demonstration sites it was included in. It grew well in most of the higher rainfall areas and while it's oil production is only moderate it produces more biomass more quickly than most mallees. A good option in most areas that receive 300mm or more annual rainfall it's biggest drawback is probably it's form but for chip products this is less of an issue.

Figure 2.14: A white flowering *E. petiolaris* at Monarto

Figure 2.15: A red flowering *E. petiolaris* at Monarto

Eucalyptus polybractea Blue Mallee

Figure 2.16: *Eucalyptus polybractea* at Monarto after 7 years

- Average height 4.9m
- Plants per hectare >2000
- Above ground Biomass (t/ha/yr.) 4.8
- Above ground CO2e Sequestration (t/ha/yr.) 8.7
- Survival rate 94%
- Wood density kg/m3 770
- Annual rainfall range 400 to 550mm
- Soil Sands to clay loams
- Flowering times March through June
- Oil yield 2.4%dm
- Pros Coppices readily
  Erect mallee form

General

E. polybractea has been harvested from natural stands for eucalyptus oil production since the 1890's in NSW and Vic. The WA eucalyptus oil industry is also based on this and other species where these species are used in the mitigation of salinity problems in low rainfall areas. (Hobbs and Bennell 2008)

Distribution

E. polybractea occurs in 2 main areas, central western NSW in the Wyalong area and Victoria NW of Bendigo.

Biological features

E. polybractea is a mallee and grows to 8 meters tall, it forms a lignotuber, coppices well and has a fast growth rate. It can adapt to grow in a range of soil conditions and locations. Flowering from March to June seed can be collected year-round.

Cultivation

E. polybractea has the potential to be cultivated in regions that receive 300mm or more annual rainfall. Adaptable to a range of soils but prefers a well-drained soil in an open sunny position. Drought and frost resistant and tolerates slight to moderate salinity.

In the demonstration sites

E. polybractea has proven to be an unpredictable performer in the demonstration sites. Individuals tend to be very small and hard to locate in the first few years, but survival rates were reasonable at the higher rainfall sites and if competition was kept in check. Mortality rates were high at sites with heavy weed loads in the first few years.

Figure 2.17: 3.5-year-old *E. polybractea* at Raukkan

Eucalyptus porosa Mallee Box

Figure 2.18: *Eucalyptus porosa* at Monarto after 7 years

- Average height 3.8m
- Plants per hectare >2000
- Above ground Biomass (t/ha/yr.) 4.0
- Above ground CO2e Sequestration (t/ha/yr.) 7.3
- Survival rate 90%
- Wood density kg/m3 641
- Annual rainfall range 225 to 650mm
- Soil Sands to clays
- Flowering times May to November
- Oil yield 2.1%dm
- Pros Coppices readily
- Cons Variable form
  Oil content variable

General

E. porosa has had little specific work carried out on it from a plantation perspective, but it is one that is commonly used in revegetation programs and varies little from other eucalypts when treated in this fashion. A potential multipurpose species it has good pulpwood qualities, a reasonable oil yield and a good paper score, *E. porosa* can provide feedstock for paper manufacturing, biomass industries or pulpwood industries, coupled with oil extraction. (Hobbs and Bennell 2008)

Distribution

E. porosa is found from the Gawler Rangers and Eyre Peninsular in South Australia to north western Victoria and south western New South Wales, with isolated occurrences in New South Wales as far east as Euabalong in the central-west of that state.

Biological features

E. porosa is generally a small rough barked tree or mallee to 12m tall. This species forms a lignotuber and is known to coppice. It flowers from May to November and seed is best collected prior to flowering in May.

Cultivation

E. porosa can be cultivated on shallow stony or sandy soils unsuited to other forestry species. It often occurs on stony hill slopes with shallow soils, on shallow calcareous soils over limestone and brown earths with limestone. It is generally grown in the 350 to 650mm rainfall range be can grow in regions that receive as little as 200 mm annual rainfall. As a multipurpose tree it can provide feedstock for a variety of industrial purposes and be grown in areas of little value to agriculture or conventional forestry.

In the demonstration sites

E. porosa has a modest growth rate that probably precludes it from better sites or sites with deeper soils., but, survival rates were reasonable and if competition is kept in check the mortality rate in the first few years can be kept quite low.

Figure 2.19: 3.5-year-old *E. porosa* at Raukkan

Eucalyptus camaldulensis x globulus Saltgrow hybrid

Figure 2.20: Saltgrow *Eucalyptus camaldulensis x globulus* at Monarto after 7 years

- Average height 7.4m
- Plants per hectare >2000
- Above ground Biomass (t/ha/yr.) 9.7
- Above ground CO2e Sequestration (t/ha/yr.) 17.8
- Survival rate 82%
- Wood density kg/m3 502 to 650
- Annual rainfall range 400 to 700mm
- Soil Sands to clay loams
- Flowering times May through January
- Pros Salt tolerant

General

The Xylonova Syndicated Research and Development Program developed salt tolerant hybrids for establishing commercial plantations on saline, waterlogged and degraded land. Novel hybrids between *E. camaldulensis x E. globulus* and *E. camaldulensis x E. grandis* were developed. It was also clear that these hybrids could have applications on dryland sites not affected by salinity or waterlogging. (Sasse et al. 2000)

Test Areas

Two clonally replicated field trials testing the hybrids have been established in the southern Murray-Darling Basin. The first was a preliminary trial planted at Mt Scobie (near Kyabram, northern Victoria). A second, larger field trial was established in October 1999 at "Thornton", a property between Deniliquin and Barham in southern New South Wales. In 2006 these hybrids were incorporated into the FloraSearch Trials at Monarto and by the 2013 assessment of that site had proved to be among that best performing species at that location

Biological features

The original aim was to combine the salt tolerance of *E. camaldulensis* with the growth rate and wood quality traits of *E. grandis* and *E. globulus*. The hybrids selected have achieved this and are said to outperform the parent species in both growth rates and the breadth of environments they can be employed into

Cultivation

Saltgrow hybrid Eucalypts are aimed at turning a major environmental problem into an opportunity with fast-growing salt-tolerant eucalypt hybrids that have desirable wood properties for re-vegetation of land prone to salinity and waterlogging. The use of the Saltgrow hybrid Eucalypts is a commercial approach to retuning degraded land to production, with off-site catchment benefits provided by lowering water tables.

In the demonstration sites

In the first year of planting, 2014, no plants were available. In 2015, both *E. camaldulensis x globulus* and *E. camaldulensis x grandis* were planted into a limited number of sites. At some of these sites the hybrids have grown very well but survival has been patchy. In 2016, only the *E. camaldulensis x grandis* hybrid was obtainable and many of these were planted into small sites in the Langhorne Creek area that were suspected of having salinity issues. At one site in that area all the hybrids died out leaving only *E. occidentalis* surviving at the site. Again, no hybrid seedlings were available in 2017 and future access in unclear.

Given that these plants cost more than double the other seedlings used and suffer high mortality on many of the demonstration sites they have been employed on, it would be easy to recommend *E. occidentalis* over the hybrids in saline remediation areas. However, it is unclear if the mortality has been caused by high salinity levels, dry conditions, hard soil types or a combination of these factors. More work is required in this area and for that the hybrids need to be readily available.

Figure 2.21: 2.5-year *E. camaldulensis x globulus* Sherlock

Figure 2.22: 2.5-year *E. camaldulensis x grandis* Sherlock

Eucalyptus camaldulensis x grandis Saltgrow hybrid

Figure 2.23: Saltgrow *Eucalyptus camaldulensis x grandis* at Monarto after 7 years

- Average height 7.3m
- Plants per hectare >2000
- Above ground Biomass (t/ha/yr.) 12.4
- Above ground CO2e Sequestration (t/ha/yr.) 22.7
- Survival rate 78%
- Wood density kg/m3 502 to 650
- Annual rainfall range 400 to 700mm
- Soil Sands to clays
- Flowering times April through January
- Pros Salt tolerant

3 Planting Guide

3.1 Site Selection

There are many reasons that landholders decide to plant trees apart from the economic return from any future harvest. In many cases it's to solve an on-farm issue such as wind erosion or salinity. In other cases, it's for stock protection or simple amenity, such as a tree lined driveway. In most cases it's the need that dictates the location, and few select valuable cropping land for big blocks of trees. However, the growers in the Farm Forestry Landcare Network have shown that trees can be grown in places on a farm that are of little other economic value or that solve an issue that improves other economic returns and stock care.

Sand ridges and dunes have been a focus, as they are often exposed to erosion by cultivation and tree plantations provide an attractive economic use for these areas while helping to stabilise the sand. It must be said that loose blowing sand isn't an option for tree planting. The sand needs to be stabilised first with some kind of cover crop, such as rye corn, prior to planting trees otherwise the seedlings will perish. Farm forestry plantings give landholders a viable economic option for these areas that they wouldn't otherwise consider planting out to environmental revegetation, thus filling the gap between cropping and revegetation, while creating a landscape more varied in structure and habitat opportunities.

When choosing a site for planting it must be remembered that it isn't just the weeds, grasses and other low vegetation that compete with the seedlings. Established trees, bushes and crops also have an impact on how well the seedlings establish and grow. Planting too close to existing trees, or groups of trees, can seriously affect the survival rate of new plantings. Older eucalyptus in particular are very good at utilising any soil moisture available and cause the death of any seedlings planted too close. Some plants even release chemicals into their surrounding environment to suppress competitors from establishing in a process called allelopathy. So, positioning a new planting near existing vegetation should be avoided where possible and measures taken to limit the impact on the new plantings attempted where it's not. Deep ripping between existing vegetation and new is one method of attempting to limit this impact and several of the demonstration site growers have tried this with limited success.

On the other hand, placing seedlings close to irrigated crops, particularly if the flow of ground water is toward the plantings, can have can have advantageous effects on both survival and growth rates. Utilising trees in this way is common practice to reduce or limit the spread of salinity by intercepting water moving through the soil. Such water movement can pick up salt and concentrate it where the ground water finishes up, creating scalds and salty patches. However, it's important to intercept the water before it concentrates too much salt, so plantings need to be near the hypersaline patches not in them or the seedlings won't survive.

Figure 3.1: Stunted row with deep ripping between existing vegetation and new

3.2 Fencing

It may seem obvious, but sites need to be fenced to keep live stock from destroying the trees when they are young. The better the fencing the more unwanted grazing and incidental damage (e.g. being stepped on, etc.) the plants will suffer when they are at their most vulnerable. Rabbit proofing the enclosure will further protect the young seedlings. The ideal fence is probably one made from ring-lock mesh topped with a couple of strands of barbed wire and rabbit proof wire around the base. The rabbit proofing should initially be flat on the ground outside the enclosure and turn up the fence at right angles at the fence base. Any vermin approaching the fence is then unable to simply dig under the wire at the fences base because it's already standing on the mesh. Placing soil over this mesh also helps deter rabbits from squeezing under the fence. Some of the growers have even placed electric wires around sites to further deter stock from pushing into the planted areas.

This all costs of course and an expensive fence won't keep every unwanted guest from invading a plantation. Deer and kangaroos are quite able to leap over most farm fences and at least one grower has had extensive damage done to his plants by red deer rubbing their antlers on the more rigid trees. Another reason to keep stock out of the demonstration blocks is that the juvenile leaves of *E. cladocalyx* are mildly toxic and growers should avoid grazing the blocks until the trees are above the stocks browse range.

The fence chosen for any tree block needs to be realistically cost effective and allow the grower access and space to manoeuvre equipment should they need to do follow up weed control, replanting or harvesting later. New regrowth after harvest should be treated like seedlings and not grazed until the regrowth is tall and strong enough to cope, so maintaining the fences in position is a useful idea.

Figure 3.2: Sturdy ring lock fence protecting a windbreak planting of 8-month-old *E. Occidentalis*, at Tintinara

3.3 Weed Control

Most growers have chosen to spray out their plantations with a product like glyphosate or another broad-spectrum systemic herbicide a few weeks before planting to reduce competition over the first spring from broad-leafed weeds and grasses. In most cases this has been very effective, leaving the site quite devoid of live weeds at the time of planting. However, in some cases follow up rain has brought forth a host of spring and summer weeds to compete with the seedlings. Hard to kill grass species such as couch and veldt grasses also pose continuous competition during the first few years of growth if not effectively controlled.

Some of the best results have been achieved in previously cropped areas where weeds have been suppressed for an entire year or more prior to planting. The reduction in summer weeds, such as skeleton weed, has allowed the young trees to put on impressive growth in their first year. Whereas young trees that managed to survive in patches of couch grass are obviously held back and quite small compared to ones away from the couch grasses influence.

It appears that the best approach is to carry out weed control well before planting. Suppressing and removing weeds over the previous year reduces the weed seed load and the competition from any subsequent growth flush. Dry standing stubble seems to have little deleterious effects and may even deter birds from damaging seedlings.

Chemical weed control is expensive and time consuming but the results, if it is done well, are well worth the extra effort. However, not all farms are able to apply chemicals. Organic farmers have the exact same problems with weed competition as every other farmer but must rely on physical means to control any weed competition they may face. Tilling areas prior to planting and establishing cover crops, like rye corn, to out compete the weeds over summer and provide dry stubble to cover the planting afterwards, seem the best option available for large plantings.

Figure 3.3: Well prepared site at Sandalwood 2014. Sprayed out and ripped with a V-blade

3.4 Earth Works

Once weed control has been successfully completed, usually around two weeks after spraying, most growers chose to rip planting lines using a single tine behind a tractor. Depth varies depending on soil type, equipment available and grower preferences but a good depth seems to be around 500mm. On sloping sites, it is always best to follow the contour across the slope so that water running down hill is captured in the rip line and doesn't run along it causing erosion. Ripping is carried out to loosen the soil and make it easier for the young seedlings roots to penetrate down and find moisture. Ripping also creates softer planting conditions and a defined row to plant into. However, ripping can also allow excessive drying and create soil clumps, so it is recommended that the rip lines be compacted down lightly using a farm vehicle tyre. Running down the rip lines in this fashion removes air pockets and fissures that lead to plant stress from excessive drying. It also breaks up any clumps of soil while still leaving a soft medium to plant into. Row spacing is usually around 3 to 4 meters to allow access between the rows later for maintenance and replants.

Another addition to ripping used by several of the growers is the attachment of a V-blade. This devise sits near the top of the tine and creates a broad V-shaped furrow as the line is ripped. The use of a V-blade adds an extra layer of weed suppression by removing a small amount of soil and the plants and seed that soil may contain. The furrow also allows any water captured to be channelled into the bottom of the V where the seedlings are planted. While this method is open to some wind erosion, the benefits seem to outweigh the negative impacts. Some of the growers have improvised similar effects using other methods to create a protective row environment for the plantings. These range from flat V-shapes to moderately steep sided trenches that drop the seedlings into a sheltered spot a little below the surface of surrounding ground and closer to any moisture that may be available lower in the soil profile.

A small number of growers chose not to rip lines. Instead these used either a grader blade attachment on their three-point linkage or the bucket of a front-end loader to create individual planting divots. By angling blades or bucket they've created scoops to plant into that capture water and channel it to the plant. These methods also remove a small amount of soil and potential weeds around the planting point. The grader blade option seems efficient in very sandy soils where planting is easy. The use of a front-end loader bucket appears very time consuming but created very nice environments to plant into. The method was employed to do replants in existing rows. The tilted bucket made a steep sided corner to plant in and a gentle slope down to that corner to capture water coming down the slope.

Figure 3.4: Freshly planted site at Pyap West 2016. Sprayed out and ripped with a V-blade

3.5 Grazing Deterrent

Apart from the organic sites, all the seedlings distributed by the Farm Forestry Landcare Network have been treated with a method developed by the Victorian Institute of Animal Sciences designed as vermin protection for newly planted tree seedlings (Coleman et al. 2006). Carborundum powder is dusted over the foliage of the seedlings before planting after spraying the foliage with the following mixture:

1-part PVA glue
1-part egg powder (reconstituted or raw egg)
1-part water

The rationale is that the animal's find the gritty carborundum offensive to the feel of the plant in their mouths and move on to less gritty prospects. The egg and glue in the water mixture are simply there to hold the carborundum powder on foliage. It's also thought that the sparkle of the carborundum powder during the day and in moonlight may remind any animals that have eaten it before that it was an unpleasant experience. This treatment is quite effective and is widely used in the forestry industry. It will help where there are small populations of kangaroos and/or hares but loses its effectiveness if those populations are large and new animals keep trying the plants.

This formula will not deter birds (i.e. galahs, parrots etc) from biting the seedlings off or pulling them out of the ground. The best protection against birds' damage are tree guards, or planting into a tall stubble.

Figure 3.5: Glue, measuring jug, and eggs

Figure 3.6: Mixing drill, strainer, and sprayer

The Farm Forestry Landcare Network use the following method for making this mixture:

3 or 4 eggs, beaten well using paint stirrer.
Then add the same volume of PVA glue and the same volume of water.
Mix together well. The better the eggs mixture is beaten, the better the mixture sprays on.
Using a 1 litre plastic spray bottle. Pour the mixture through a fine strainer, to eliminate clogging of the spray jet.
Keep shaking the spray bottle regularly while spraying.
When all the foliage is wet sprinkle on the carborundum powder before it dries.

Spray bottles vary so a little trial and error is required to see how far a batch will go, but a mixture containing 3 or 4 eggs should do approximately 1,000 tree seedlings in 64 cell trays.

3.6 Planting

The seedlings are delivered in 64 cell trays. Care must be taken when removing the individual plants from the trays as plants with underdeveloped root systems can be pulled out of the growing medium. Most plants however are delivered with strong, robust root systems that can also make them hard to remove from the tray. Rather than tugging on the plant and risk breaking its stem, it's been found the plants can easily be pushed up from below with a pen or piece of dowel of similar size. Once loosened the plants can easily be lifted out of the seedling trays and placed into a kidney tray for planting. It's important at this stage that the seedlings are kept moist and not allowed to dry out prior to going into the ground.

When available, the Saltgrow clones are sourced from a licenced supplier. These seedlings have been delivered in Hiko 24 cell trays with larger soil plugs than the 64 cell trays. They can be handled in the same manner but require a pottiputki planter with an internal tube diameter of at least a 53mm.

Pottiputki planters are perhaps the easiest method of planting seedlings in medium to light soils. The depth should be set to allow the seedlings to be planted deep enough that the plug is in contact with moist soil and the top of the plug covered with soil to prevent it drying out. In loose sand this can be as much as 20mm below the surface, as the top of the soil profile can dry out rapidly. In heavy wet soils pottiputki planters are difficult to use as the sticky soil can continually clog the devise. In these conditions other devises such as narrow spades or Hamilton planters are a better option.

Planting should be timed so there is enough soil moisture to allow the seedlings to grow into summer and survive until the following Autumn rains. The Farm Forestry Landcare Network has been planting in the second half of July and early August to allow for drier Springs. This widens the plantings exposure to frosts but to date more success has been had planting early than late.

Planting spacings along the rows vary from site to site depending on the grower's preference. Most tend to be around 2 to 3 meters between plants but some feel this may lead to excessive competition when the plants get bigger, especially in the drier regions and they tend to spread out their plantings more.

Using a pottiputki planter and a kidney tray of plants strapped to their side a single person can plant hundreds of seedlings in a day. The planter simply pushes the closed beak of the pottiputki into the soil in the desired spot as deeply as the depth gauge allows. Once at the required depth the planter steps on the beaks opening mechanism allowing the beak to fully open and drops a seedling down the tube to the bottom of the hole. The pottiputki is then lifted off the seedling and the ground around the seeding healed in around the plant. Once the pottiputki is clear of the seedling the planter depresses the beaks spring loaded closing mechanism with their thumb ensuring the beak is closed before they plant the next seedling a few meters further along the row.

Unfortunately, pottiputki planters are expensive and not suitable for all conditions. In many cases other options are used by necessity but the planting depths and soil contact requirements remain the same.

Figure 3.7: A Pottiputki planter and Kidney tray

Figure 3.8: A 64 cell tray

3.7 Tree Guards

The Farm Forestry Landcare Network has never had a budget that allowed it to provide tree guards along with the seedlings it provides to its growers. However, several of the growers have obtained their own tree guards and apart from one design these all seem to foster better survival rates than sites without guards. The exception to this was a cloth design held in place by three canes. This design was time consuming to erect and almost all were blown down. Some even flapping about and damaging the very plants they were supposed to protect. All the other guards used were more rigid and held in place by 1 or 2 stakes. One design is even biodegradable. Held in place by two canes this tree guard looks a lot like a one litre milk carton and has the advantage that it never has to be removed from the site.

Survival rates appear to be better with good tree guards in place, they offer some protection from grazing animals, malicious bird damage and possibly even some level of frost protection. While they add an extra cost, it is strongly suggested that future growers consider their use.

Figure 3.9: Rigid Tree Guards used to protect replanted seedlings after heavy frost losses near Tintinara

3.8 Watering

No requirement was made of the growers to water their plantings. The species were selected to survive as dry land plantations and while rainfall boundaries were pushed with many species, failures have brought the network as much knowledge as successes. That said, watering was never ruled out, the Farm Forestry Landcare Network simply asked that the group was informed of any application of water to the plantings. A few of the growers did chose to carry out some small-scale watering in an attempt see young plants through extended dry periods. Mostly this was done with shuttles of water, delivering a small amount to each plant and in one case a temporary sprinkler was applied to a small planting. However, none of the plantings were provided with fixed irrigation or watered on a regular basis.

4 Demonstration Site Locations Map

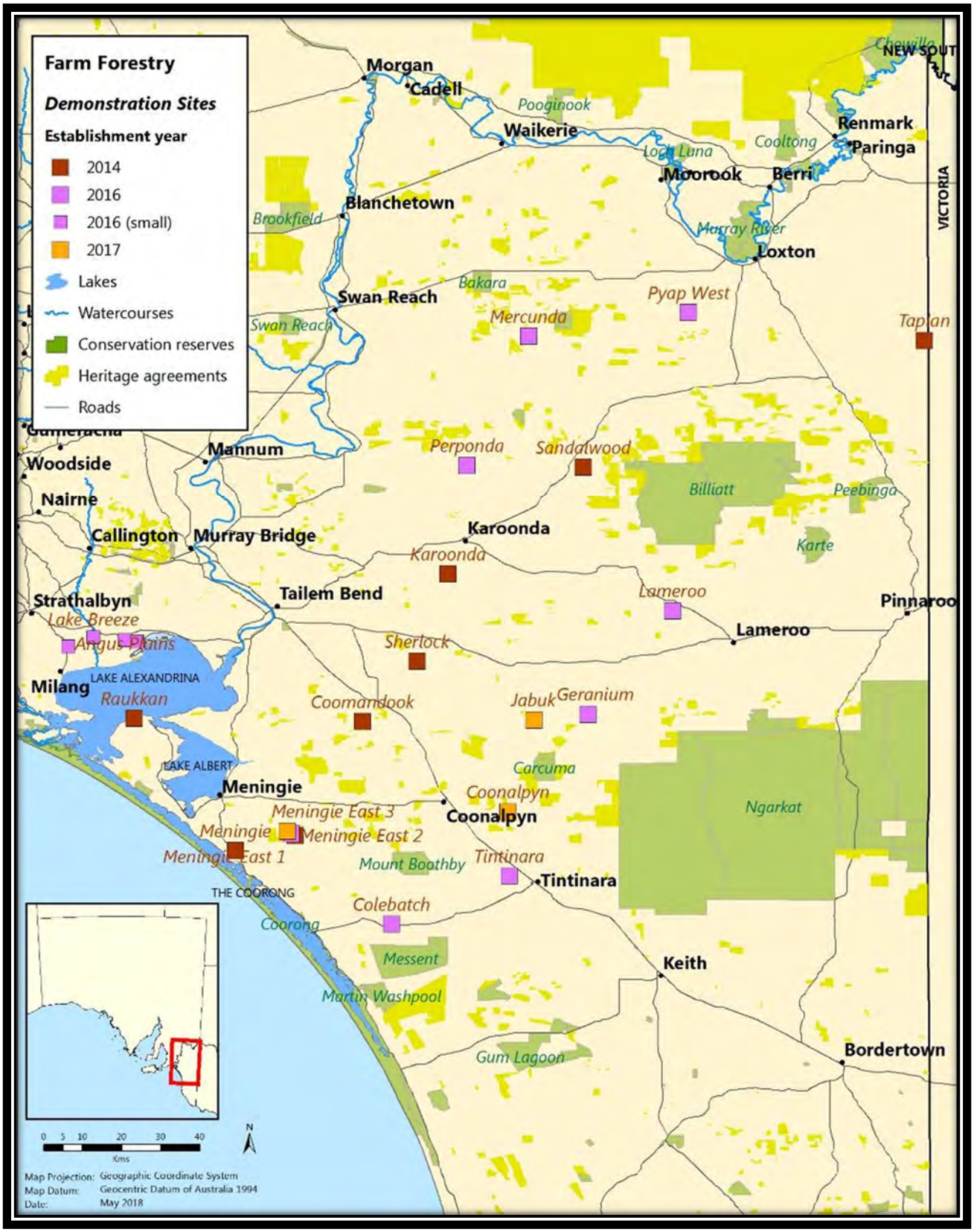

Figure 4.1: The location of Farm Forestry Landcare Network demonstration sites planted in 2014, 2016 and 2017

Appendix – The Demonstration sites

Sites Established in 2014

Sandalwood. - assessment by Ian Filmer and Craig Neumann - 24.2.18

Lat: -34.927587 Long: 140.171200

Figure A.1: Sandalwood site prior to planting 25/7/2014

First Year Assessment – 23/2/15

Overall, 459 survived out of the 825 seedlings planted (56%). Initial weed control at this site was very good and the site prepared well. The plantings were well laid out with the blocks spaced along mechanically made, wide, shallow furrows, designed to further suppress initial weed competition and deliver any rainfall to the bottom of the furrow and the awaiting seedlings. The rows run across the gentle slope, except for the western end that slopes more dramatically. Despite the harsh spring and summer rainfall conditions the plantings fared better than expected, apart from *E. cladocalyx* which it seems largely failed due to frost. The other seedlings were quite large with most *E. porosa* and *E. polybractea* seedlings surviving. *E. horistes* and *E. oleosa ssp. oleosa* also had good, if reduced, survival rates but the reduced rate of survival isn't that surprising considering how underdeveloped both species seedlings were at the time of planting.

At this site *E. loxophleba ssp. lissophloia* was probably the disappointing performer with just less than half the seedlings surviving at a site where it should have been well suited. It's not clear why this is, as the seedlings of this species were

reasonably good at the time of planting. Frost may have been a factor as the only significant competition was skeleton weed, but this was rather sparse apart from one patch at the break of slope and not the area where the *E. loxophleba* was planted.

E. cladocalyx and *E. occidentalis* were both added to the planting list for this site as they had been included further north. However, the rainfall here would also suggest they were only marginal candidates for the area. Despite that, more than half of the *E. occidentalis* survived and those survivors showed the most vigorous growth of all the species planted at the site.

From a commercial grower's viewpoint, the rates of survival of most of the mallee species, apart from *E. loxophleba* ssp. lissophloia, would have to be considered a success, especially when 2014/15's harsh growing season is considered. In a better establishment year even, *E. occidentalis* may prove viable under these conditions.

Second Year Assessment – 14/4/16

Fill-in replanting's were carried out to bring this site up to a respectable stocking level. Overall, 515 surviving plants were found after the years replanting efforts, an increase of 56 on the initial plantings that brought the site up to 64% occupancy rate. Most species on this site were thriving except for *E. cladocalyx* [Bundaleer] and it was decided to replace that species with *E. occidentalis* [Jerdacuttup] as *E. occidentalis* [Gibson] had performed reasonably well at the other end of the block. Weed control prior to replanting was well carried out, with no sign of off target damage to the existing trees and quite acceptable conditions created for the new seedlings in the existing furrow. The number of *E. loxophleba ssp. lissophloia* almost doubled and were growing well.

Third Year Assessment – 14/2/17

The trees which have been in from first planting all appear healthy and have benefitted from excellent season. Tree numbers were not counted overall, but the site was well established, with probably 75 to 80 % occupancy across the site. The previous poor establishment of *E. cladocalyx* [Bundaleer] in block 1 appears to have been overcome with around 50% survival of the *E. cladocalyx* and *E. occidentalis*. seedlings supplied in 2016

Fourth Year Assessment – 28/2/18

No new plantings were carried out here in 2017 as the site was deemed satisfactory early in 2017. Overall, 597 plants have persisted at this site filling around 72% of the original 825 planting places. Almost all the plants on this site are healthy and growing well

Block 1 now has 18, *E. cladocalyx* [Bundaleer] and 35 *E. occidentalis* [Jerdacuttup]. Originally this site was planted out with 120 seedlings and, now has a 44% occupancy rate. The surviving original *E. cladocalyx* are around 4 meters tall but most of the plants in block 1 are 2016 replants and are between 1 and 1.5 meters tall

Block 2 now has 81, *E. oleosa ssp. oleosa* up to 4 meters high (Ave 2.5 meters). This block was planted out with 120 seedlings and now has a 72% occupancy rate despite a small area on the northern side that refuses to grow anything. This block occupies the steepest part of the site, which flattens out again below these mallees which are growing beyond expectations to this point.

Block 3 now has 96, *E. horistes* that average around 1 meter in height across the block. Originally this block was planted out with 120 and now has a 80% occupancy rate. While slower growing these mallees are doing extremely well at this site, they are all healthy and few if any replants were required to achieve this result, despite the first two hard years this site had to endure.

Block 4 now has 67, *E. loxophleba ssp. lissophloia* some up to 4 meters high but probably averaging around 1 meter in height across the block. Originally this block was planted out with 91 seedlings, so the block now has a 74% occupancy rate. This is the result of two sets of replants after many of the initial seedlings failed to thrive. Hence the height disparity amongst these trees that are now growing quite healthily.

Block 5 now has 101, *E. porosa* up to 3.5 meters tall (Ave 1.5 meters). Originally this block was planted out with 117 seedlings, so the block now has a 86% occupancy rate. While some replants were carried out within this block most of the trees present are from the original planting in 2014. The height disparity is more the natural variation within this species and most of the trees in this block are healthy.

Block 6 now has 99, *E. polybractea* up to 2 meters high (Ave 1.5 meters). Originally this block was planted out with 117 seedlings, so the block now has a 85% occupancy rate. The height disparity amongst these trees is the result of two years of replants after numbers fluctuated over the first few years. However, the trees currently occupying this block appear quiet healthily and robust.

Block 7 now has 34 trees of mixed origins that include, *E. polybractea*, *E. loxophleba ssp. lissophloia* and *E. porosa*. These were surplus plants used to fill in a gap in the plantation and the individuals have performed much as they have in the solid single species blocks.

Block 8 now has 66 *E. occidentalis* [Gibson] up to 4.5 meters high (Ave 3.5 meters). Originally this block was planted out with 120 seedlings, so the block now has a 55% occupancy rate. Replants have only been partially successful in raising numbers in this block and the large trees now present too much competition to attempt any further top up plantings.

Figure A.2: 3.5-year-old *E. oleosa ssp. oleosa* at Sandalwood site 28/2/2018

Coomandook - assessment by Ian Filmer and Craig Neumann - 28.2.18
Lat. -35.514622 Long. 139.663007

Figure A.3: Coomandook Sandhill site at planting 7/8/2014

First Year Assessment - 24.2.15

The Coomandook plantings were placed on the western face of a very large steep sand dune with wide rip lines running along the dune contour. The individual species are in long thin blocks across the site and the site is surrounded by remnant vegetation on two sides, the whole area bounded by a vermin proof enclosure. There are few weeds to provide seedling competition so the lack of rainfall during the establishment period over spring and summer appears to be the biggest limiting factor.

Both *E. petiolaris* and *E. occidentalis* had survival rates between 50 and 60% at this site with the surviving plants growing strongly. Some *E. cladocalyx* survived the spring frosts and dry establishment period and while these are growing well the survival rates were only in the 15 to 30% range.

Due to restrictions with seedling numbers at the time of planting *E. porosa* and *E. polybractea* were the only mallees to be planted at this site. Both performed only moderately with around 20% survival rates, though *E. porosa* seemed to survive a little better and out grew *E. polybractea* on average.

Overall the site achieved a survival rate of 37%. Of the 745 seedlings planted, 273 survived despite the dry year and exposed site. *E. cladocalyx* performed better on this raised sandy site than in any of the lower lying sites. The site remained relatively weed free with only some skeleton weed. offering any obvious competition. Little needed to be done to the site before replanting the following season.

Second Year Assessment – 19.4.16

The previous seasons replants had been marginally successful adding 126 extra plants to the site and pushing the occupancy rate up to 54%. Veldt grass re-establishing in the rows appeared to be the biggest problem in 2016. A small amount of skeleton weed was also present. Apart from that, the site remained relatively weed free and could easily be planted into again. Some rabbit activity was also observed, the landholder was informed and carried out some control work. The young trees were marked and sprayed around in June a week before replanting. A 400-litre container of water was left on site for watering in at planting to see if that would assist establishment.

Third Year Assessment – 24.2.17

The 2016 replant produced 130 more trees on site though it was difficult to distinguish between trees 8 months old and 18 months old so the exact increase over the number of mortalities from previous plantings was impossible to tell. The site did have a gradual increase in stocking numbers over the 3 years of planting and had achieved an occupancy rate of 71%. It is known that when weed competition is substantial growth rates are reduced and that may have been the case on this site. Some of the areas of the site which are closest to the existing scrub appear to be struggling the most despite a 4 to 5-meter buffer. Ripping around the edge seems to have failed to prevent this edge affect across the bottom of the site. There was less evidence of rabbit activity than last assessment though it does not appear to be a factor in survival rates of seedlings. There was plenty of evidence of small seedlings browned off but; no evidence of plants being eaten off. It does seem that the mature veldt grass poses more competition than we might have thought. This has been the case in 1 or 2 other sites and supports the premise that a 2-year preparation to eliminate the perennial weeds may have some merit.

Fourth Year Assessment – 28.2.18

Numbers have increased slightly to a 73% occupancy rate with 543 plants recorded across the site out of a possible 745. The areas of the site closest to the existing scrub continue to defy planting attempts and a look at the site on Google Earth reveals the dry areas extending out from that scrub into the site that's not as apparent from the ground.

Block 1 now has 24, *E. cladocalyx* [Kersbrook] some up to 5 meters high (Ave 3meters). Originally this block was planted out with only 30 seedlings and now boasts a 80% occupancy rate. One of the best results for this species from the initial years of planting.

Block 2 now has 113, *E. petiolaris* some to 2.5 meters (Ave 1.5meters). Originally this block was planted out with 128 seedlings and now has a 88% occupancy rate. Most of the missing and stunted plants from this block are closest to the existing scrub.

Block 3 now has 48, *E. cladocalyx* [Bundaleer] some to 2.5 meters tall (Ave 1.5meters). Originally this block was planted out with 100 seedlings, so the block now has a 48% occupancy rate despite additional replants. Again, most of the missing and stunted plants from this block are closest to the existing scrub.

Block 4 now has 70, *E. polybractea* some to 1.1 meters tall (Ave 0.5meters). Originally this block was planted out with 128 seedlings, so the block now has a 55% occupancy rate despite additional replants. Again, most of the missing and stunted plants from this block are closest to the existing scrub and this block is affected on two sides.

Block 5 now has 89, *E. occidentalis* [Gibson] some to 3 meters tall (Ave 2.5meters). Originally this block was planted out with just 35 seedlings and the block now has a 70% occupancy rate. This block is situated away from the native scrub and is apparently unaffected by it though it has a heavy veldt grass load.

Block 6 now has 32, *E. porosa* to 2 meters tall (Ave 0.5meters). Originally this block was planted out with 35 seedlings and the block now has a 91% occupancy rate. This block is situated away from the native scrub, though it does contain a large grass tree, however the plants do not appear obviously affected by the proximity of the yakka.

Block 7 now has 95, *E. occidentalis* [Jerdacuttup] to 5 meters tall (Ave 2meters). Originally this block was planted out with 128 seedlings, so the block now has a 74% occupancy rate. Again, most of the missing and stunted plants from this block are closest to the existing scrub at the bottom of the site.

Block 8 now has a mixture of species. 12 Saltgrow *E. camaldulensis x globulus*, 5 Saltgrow *E. camaldulensis x grandis*, 11 *E. cneorifolia*, 9 *E. polybractea*, 2 *E. cladocalyx* [Kersbrook], 1 *E. petiolaris* and 13 *E. porosa*. Originally this block was planted out with 80 Saltgrow seedlings, the remnants of which are 1 to 2 meters tall, with a survival rate of 30% for the globulus cross and 13% for the grandis cross. The rest are further replants and all less than 0.5 meter in height. Again, most of the missing and stunted plants from this block are closest to the existing scrub at the bottom of the site.

Figure A.4: 3.5-year-old *E. cladocalyx* on the Coomandook Sand Hill 28/2/2018

Meningie - assessment by Ian Filmer and Craig Neumann - 28/2/18
Lat. -35.811377 Long. 139.370075

Figure A.5: Tiny *E. cladocalyx* at planting at Meningie 12/6/2014

First Year Assessment – 14/4/15

In the first year the Meningie plantings generally did very poorly with few of any species surviving (about 10%). The blocks were spaced along thin shallow rip lines across an almost flat sandy paddock. Little or no competition from the existing plantings is evident but the site is adjacent to a strip of road side vegetation. As rabbit proof fencing was never completed it isn't surprising that the site showed signs of rabbit activity but the impact of this was difficult to quantify. Little or no weed competition was evident with the site looking quite bare of vegetation apart from some dense patches of couch grass. Plants within the couch patches appear smaller but elsewhere this would appear not to be a big factor in the plants failing to thrive. It is quite possible the main problem with this site was a combination of small weak seedlings, frost and lack of rainfall throughout spring and summer. The site was also prepared a bit late so soil moisture levels were low at planting. Another factor that could have had some impact was that the rip line did not have a significant furrow to concentrate available rainfall for the seedlings.

E. petiolaris did best at this site with a 25% survival rate but no *E. cladocalyx* survived and only a few *E. occidentalis* persist. Frost appears to have had a serious effect on some of the seedlings; causing an almost total loss of *E. cladocalyx*.

Of the mallee species only *E. porosa*, *E. polybractea* and *E. cneorfolia* were planted at this site due to restricted numbers at the time of establishment. No *E. cneorfolia* have survived and less than 20% of the other two species have persisted in the first year. At the time it was suggested the biggest impediments to successful re-planting would be the presence of rabbits and the couch grass patches

Second Year Assessment – 3/5/16

The second-year survival rates were not a lot better, although there were 3 significant species survivals. *E. occidentalis* [Gibson], *E. petiolaris*, and *E. porosa*. To a lesser extent: *E. polybractea*, *E. occidentalis* [Jerdacuttup] also improved somewhat.

Disappointingly, both *E. cladocalyx* [Bundaleer and Kersbrook] were almost completely wiped out, with frost assumed to be the cause. The Saltgrow varieties were also almost completely wiped out. Again, this was attributed to frost and the dry conditions.

It was noted that the Landholder had made a great effort to clean up weeds and exclude rabbits, but again it was a poor season for rainfall.

Third Year Assessment – 23/2/17

Despite the two hard years, the landholder had increased his enthusiasm for planting and was prepared to have another go in 2016. Fortunately, 2016 was a much better rainfall season, and the replants recommend for the site were chosen from species considered safer options. After the disaster of the first two years *E. cladocalyx* was not considered again. Weed control on the site was excellent and even the couch grass patches were knocked back. It was decided that if the existing numbers held (as at 23.2.17) there was no need to provide any additional seedlings. There were approximately 590 trees on the site after 3 years of plantings. For a possible total of 830 plantings after 3 years an establishment of 71% had been achieved. It was recommended that *E. occidentalis* be used to fill any gaps in the future, and some plants were allocated for this purpose the following planting season.

Figure A.6: 3.5-year-old *E. occidentalis* flowering at Meningie 28/2/2018

Fourth Year Assessment – 28/2/18

Unfortunately, the Landholder was ill during the critical planting period and no further fill in plantings were carried out at this site. Numbers have dropped to 63% survival with resurgent competition and a dry summer weeded out some of the weaker plants. Blocks 8 and 9 continue to have few plants in them.

Block 1 now has 121, *E. petiolaris* (and 1 *E. cneorifolia*) some up to 4 meters high (Ave 2 meters). Originally this block was planted out with 128 seedlings and after a couple of poor years and two replants now boasts a 95% occupancy rate.

Block 2 now has 70, *E. porosa* some to 2 meters (Ave 0.5 meters). Originally this block was only planted out with 64 seedlings and after the two replants this rose to 85 and the block now has a 82% occupancy rate. Couch grass patches are significantly affecting the growth of some of these plants.

Block 3 now has 47, *E. polybractea* some to 2 meters but many are quite small (Ave 0.3 meters). Originally this block was planted out with 128 seedlings, so the block now has a 37% occupancy rate despite additional replants. Couch grass has also had a significant effect on the growth of some of these plants.

Block 4 now has 78, *E. occidentalis* [Jerdacuttup] some to 5 meters tall (Ave 4 meters). Originally this block was planted out with 128 seedlings, so the block now has a 61% occupancy rate despite additional replants.

Block 5 now has 33, *E. petiolaris* some to 1.5 meters tall (Ave 0.5 meters) and 31 *E. polybractea* all under a half meter tall. Originally this block was planted out with 100 *E. cladocalyx* [Bundaleer] seedlings, none of which survived, so the block now has a 64% occupancy rate of replacement plants. Again, couch grass has had a significant effect on the growth of these plants particularly. *E. polybractea*.

Block 6 now has 3, *E. cladocalyx* [Kersbrook] to 4 meters tall and 11 *E. cneorifolia* all under a half meter tall. Originally this block was planted out with 64 *E. cladocalyx* [Kersbrook] seedlings, so the block now has a 22% occupancy rate of original and replacement plants but only 5% of the original plants survived the frost.

Block 7 now has 103, *E. occidentalis* [Gibson] to 6 meters tall (Ave 4 meters). Originally this block was planted out with 128 seedlings, so the block now has a 81% occupancy rate.

Block 8 now has a mixture of species. 3 Saltgrow *E. camaldulensis x globulus*, 1 Saltgrow *E. camaldulensis x grandis*, 2 *E. cneorifolia* and 17 *E. porosa*. Originally this block was planted out with 80 Saltgrow seedlings, so the block now has an 29% occupancy rate but only a 5% survival rate of the original plantings. *E. porosa* is performing the best of the replants.

Block 9 has never been fully planted. A small number of left over plants have been placed in this area resulting in a sparse mixture of species. 1 Saltgrow *E. camaldulensis x grandis* and 2 *E. polybractea* remain.

Figure A.7: 3.5-year-old *E. occidentalis* at Meningie 28/2/2018

Taplan - assessment by Ian Filmer and Craig Neumann - 23/2/18
Lat. -34.635714 Long. 140.955036

Figure A.8: Taplan at planting 8/8/2014

First Year Assessment – 23/2/15

This site was always going to be something of a challenge being in the lowest rainfall zone attempted and placed on an organic farm where no chemical weed control was allowable. Overall 77 trees survived out of the 840 planted, a 9% survival rate. As can be seen from the photos the plantings were well laid out, competition mechanically suppressed and individual trees protected with large tree guards on a relatively flat area across a dune top. Despite this, the plantings largely failed, and that failure can be attributed to the lack of spring and summer rainfall rather than other factors. The seedlings were widely spaced and never reached the size where they may have started competing against each other. The only other significant competition on the site was skeleton weed but this was also rather sparse and probably not a competitive factor prior to summer.

E. cladocalyx and *E. occidentalis* were both added to the planting list for this site as the landholder had had some success establishing these trees in past plantings. However, the rainfall at Taplan would suggest they were not realistic candidates for this area and in this harsh establishment season both failed. No *E. cladocalyx* survived from the single provenance planted and only a few *E. occidentalis* persisted out of the two provenances planted. A small number of *E. occidentalis* appeared in plots other than their own due to some minor mix ups at the time of planting but only one was observed in the two specified plots of these species.

The other species planted at Taplan were all more suited to the site. All were mallee species that cope with moderate to low rainfalls in their natural ranges. Included in the plantings were blocks of *E. horistes*, *E. oleosa ssp. oleosa*, *E. loxophleba ssp. lissophloia* and E polybractea. Due to the late timing of propagation many of the mallee seedlings had less than optimal root

development with *E. horistes* and *E. oleosa ssp. oleosa* having the least root development and sometimes getting planted bare rooted. One omission from the Taplan site, through a lack of seedling numbers, was E porosa, a species that may suite the area in a better establishment year.

E. horistes from the dry Western Australian wheat belt is the slowest growing of the mallees included but was specifically chosen for use in the dryer regions where even other mallee species can struggle. It along with *E. oleosa ssp. oleosa* occurs naturally in the driest regions of the species planted. Both these species had several seedlings persist through the dry spring and summer with *E. horistes* having the greatest survival rate of the species planted.

Of the other mallees, *E. loxophleba ssp. lissophloia* had the next best survival rates with *E. polybractea* and *E. oleosa ssp. oleosa* having similar survival rates to each other but less than *E. horistes* or *E. loxophleba*. Apart from *E. horistes*, the species, and the provenance of *E. oleosa ssp. oleosa* used, all come from areas of higher rainfall than Taplan. *E. polybractea* grows in moderate rainfall zones in the eastern states.

While all the plots would be classed as failed from a commercial grower's viewpoint the rates of survival of the individual species under 2014/15 harsh growing season's dry unfavourable conditions was largely along expected performance lines. *E. oleosa ssp. oleosa* could probably be considered the underperformer but the genetics came from Malalla and may not be as drought tolerant as individuals found naturally in the Taplan area.

Second Year Assessment – 14/4/16

The tree site had been fenced and protected from stock. It was surprising, after a very tough year in 2015, that any seedlings were present, and looking quite fresh. It appeared there had been 6 to 10 mm of rain about 3 to 4 weeks earlier, enough to promote fresh growth. All the surviving seedlings appeared quite fresh with a good chance of survival. The landholder was undecided whether to plant again; as he believed the trees need to have one or two waterings as well as tree guards to have a chance of survival. The tree guards used at the time, a fabric circle with 3 stakes, were too time consuming and flapped about enough to damage the plants. Many of them had indeed broken away and left flail marks in the sand. Some core-flute tree guards were sourced with 1 stake threaded through 1 side of a triangle to help with the re-planting.

The site then had 148 seedlings in the original 840 spaces, an occupancy rate of just 18%. While this was another disappointing result in a low rainfall year it was about double the previous year's numbers. Numbers of all species planted rose apart from *E. polybractea* (4) and it was decided to omit that species from any future plantings at this site. *E. horistes* (37) continues to be the best performer and surprisingly *E. cladocalyx* (32) seems to be doing next best.

Third Year Assessment – 14/2/17

Approximately 430 core-flute guards and 250 stakes were supplied to the landholder along with around 1056 seedlings. On assessing the site, it appeared about 300 to 350 seedlings had been planted in guards.183 had survived at that time, with a number having re-shot after recent rain, better than 50% survival. Of the remaining un-guarded 700 seedlings, there appeared to be about 100 surviving, only around 15% survival. While it was difficult to assess the age of many of the trees it was believed there were approximately 80 to 100 trees remaining from first 2 years plantings.

A total of approximately 350 surviving trees at the time of assessment was somewhat complicated by several factors.

The landholder had re-established the site over the existing site. The older small trees remain scattered through the 2017 plantings and the new plantings didn't follow the original planting plan. Consequently, it is difficult to assess the survival rates of previous years among the new plantings.

Several seedlings had re-shot from dry stems, come back from the dead if you like, and it was not known if more would re-shoot. It was not deemed likely, but it was not impossible. A more likely scenario was that these plants would perish if stressed again.

There were sheep in the site, obviously nibbling on trees protruding above the guards and baring the stems on many of the earlier plantings. The sheep appear to be chasing the shade of the few native pines on the site and nibbling on the young trees once they are inside the fence.

Originally, we commented that the site was very well laid out, competition had been mechanically suppressed and individual trees protected with large tree guards on a relatively flat area across a dune top. Despite this the plantings largely failed, and that failure was attributed to the lack of spring and summer rainfall rather than other factors. The large tree guards also proved a hindrance. Time consuming to install, with three cane stakes, they have all been blown down and away by the third year, with many damaging the struggling plants in the process. The rigid single stake tree guards used this year have proved far more effective and survival rates within the guarded area are much improved over the rest of the site.

The seedlings were widely spaced, and none had reached the size where they could compete against each other. The only other significant competition on the site was skeleton weed but this was also rather sparse and probably not a competitive factor prior to summer. That said, none of the surviving plants from the first two years of planting had reached any reasonable size. Those that remained had almost all been damaged by livestock and were small enough that they could quite rightly be expected not to survive being further stressed.

The site remained a difficult site, with low rainfall, deep sand and skeleton weed adding to competition on the organic farm. At the time of assessment in 2017 the main threat to the surviving trees was the lack of protection from the grazing stock. The tree guards have obviously improved survival rates, with protection from the elements, and offered some protection from grazing stock until the trees grew above the guards.

Figure A.9: 3.5-year-old surviving *E. oleosa ssp. oleosa* at Taplin 23/2/2018

Fourth Year Assessment – 23/2/18

There were around 409 plants on this site when inspected in 2018. It's impossible to assess this site like others as the design, numbers of trees and species have been changed over time. Instead, each individual plant was located, identified and ticked off against each species. Individual provenances are also not able to be determined. Most plants are under a meter tall and while most looked healthy at the time of assessment, a number were struggling. However, there was no obvious new livestock damage.

E. cladocalyx has continued to persist on the site with 47 individuals present.

E. horistes has continued to persist on the site with 48 individuals present.

E. loxophleba ssp. lissophloia has increased numbers on the site with 105 individuals present.

E. occidentalis has continued to persist on the site with 72 individuals present.

E. oleosa ssp. oleosa has continued to persist on the site with 49 individuals present.

E. petiolaris has continued to persist on the site with 20 individuals present. These were only added to the site in 2017

E. polybractea has continued to persist on the site with 36 individuals present. These were re-added to the site in 2017

E. porosa has continued to persist on the site with 32 individuals present. These were added to the site in 2016

Figure A.10: Taplin 23/2/2018, not a lot of growth but 409 plants where persisting

Raukkan - assessment by Craig Neumann and Tammy May - 28/4/18
Lat. -35.506857 Long. 139.137469

Figure A.11: 6-month-old *E. cladocalyx* at Raukkan in a biodegradable tree guard 24/2/2015

First Year Assessment – 24/2/15

The Raukkan plantings have generally done very well and are in distinct blocks with the individual plants protected with tree guards. Each block is spaced along mechanically made rip lines across a moderately undulating paddock. Little or no competition from the existing plantings is evident and the site received additional watering to assist establishment over the initial dry spring and summer period after planting. The manager explained that ground was relatively dry when planting so the trees given 5/6 litres of water 3 times a week till Christmas 2014; then 1 litre a fortnight. after Christmas. Raukkan is one of the few sites which received any water.

E. petiolaris had the best survival rates at this site with almost all the plants surviving to date. Raukkan also produced the best survival rates for the two provenances of *E. cladocalyx* planted. The *E. cladocalyx* were planted on the raised part of the site with little competition from couch grass consequently two thirds or better survived the spring frosts. The two provenances of *E. occidentalis* planted did not fare as well with only about a third of the plantings surviving. Unlike the *E. cladocalyx* and *E. petiolaris*, the *E. occidentalis* was planted in the lower areas of the site and appear to have been impacted by competition from couch grass.

Because of available numbers and the space available all the mallee species, apart from *E. oleosa ssp. oleosa*, were included at this site. *E. porosa* was easily the best of the mallee species with around a 75% survival rate. The other mallee species planted at this site, *E. polybractea*, *E. cneorfolia*, *E. horistes* and *E. loxophleba* all fared more poorly managing less than 40% survival rates. *E. cneorfolia* performing the worst of the mallees planted at less than 20% survival.

Overall 559 of the 1110 seedlings planted survived. A survival rate of 50% probably helped along by the additional water.

Second Year Assessment – 3/5/16

Overall 519 of the 1110 original planting spaces were occupied, an occupancy rate of 47%. Numbers appeared to be mostly down from the previous year and it appeared very few of 2015 replants survived. Weed control was less effective for the 2015 replants and the area of couch at the northern end of the block appeared to have a detrimental effect on the plantings in that area. The site was covered with numerous other weeds, including veldt grass, that would have actively competed with the plantings over summer. It was decided not to pursue any further replants at this site.

Third Year Assessment – 24/2/17

Overall 502 of the 1110 original planting spaces were occupied, an occupancy rate of 45%. Surprisingly *E. occidentalis* had relatively poorly survival and growth rates at this site, whereas, at most other sites, it was usually a top performer. The weed load on this site was quite dense and tall, with weeds half a meter tall. Some small plants could easily have been missed in the assessment because of the extensive weed cover. The veldt and couch grass continued to be of concern and competed strongly with the plantings despite the good rainfall over the 2016-17 growing season. After nearly 3 years the stand-out species for growth and establishment were *E. porosa*, *E. petiolaris* and both provenances of *E. cladocalyx*. *E. porosa* was not as tall as the other 3 plots mentioned but was clearly the best of the mallee species planted at this site.

Figure A.12: 3.5-year-old *E. porosa* at Raukkan 28/4/2018 with *E. cladocalyx* of the same age on the rise behind them

Fourth Year Assessment – 28/4/18

Of the original 1110 seedling places 480 are now occupied, a rate of around 43%. *E. occidentalis* continues its relatively poor performance, at this site, far out stripped by both *E. petiolaris* and *E. cladocalyx*. The weed loads this assessment was much reduced on previous years. The site appears to have been slashed down to around 50mm across the entire paddock and, while there is still a low carpet of veldt and couch grass, it's less dense than previously noted. After nearly 4 years some plants are still not much more than large seedlings while *E. porosa*, *E. petiolaris*, *E. horistes* and both provenances of *E. cladocalyx* have largely grown to expected heights. *E. porosa* continues to be the best of the mallee species planted at this site.

Block 1 now has 83, *E. porosa* some up to 2 meters high (Ave 1.5 meters). Originally this block was planted out with 120 seedlings and currently has a 69% occupancy rate. As mentioned this in the best of the mallees though the block contains quite a few smaller plants and generally smaller plants than found at other site of similar age.

Block 2 now has 109, *E. petiolaris* some to 5 meters (Ave 2 meters). Originally this block was planted out with 120 seedlings and after the two replants the block now has a 91% occupancy rate. This is perhaps the best block on the site for biomass production although the size and form of the plants varies greatly.

Block 3 now has 9, *E. cneorifolia* some to 2 meters (Ave 0.8 meters). Originally this block was planted out with 105 seedlings, so the block now has a 9% occupancy rates. Easily the poorest block on the site with only a few surviving trees and several of those not much more than seedling size.

Block 4 now has 66, *E. cladocalyx* [Kersbrook] some to 6 meters tall (Ave 4 meters). Originally this block was planted out with 120 seedlings, so the block now has a 55% occupancy rate. These are easily the biggest trees on the site and one of the best blocks of *E. cladocalyx* at any of the demonstration sites. While the mortality rates for both *E. cladocalyx* were higher than *E. petiolaris*, the size of the surviving plants may have produced more biomass.

Block 5 now has 36 *E. occidentalis* [Jerdacuttup] some to 4 meters tall (Ave 1.2 meters). Originally this block was planted out with 120 seedlings, so the block now has a 30% occupancy rate. Overall this species has performed unexpectedly poorly at this site. While many of the surviving plants are little more than large seedling size, even the best examples are several meters short of what would normally be expected after 3 or 4 years growth.

Block 6 now has 29, *E. occidentalis* [Gibson] to 3 meters tall (Ave 1.5 meters). Originally this block was planted out with 120 seedlings, so the block now has a 24% occupancy rate. An even smaller *E. occidentalis* block though it didn't contain quite as many small plants.

Block 7 now has 28, *E. loxophleba ssp. lissophloia* to 2 meters tall (Ave 1.6 meters). Originally this block was planted out with 90 seedlings, so the block now has a 31% occupancy rate. Most of the remaining plants in this block look small and spindly, a far cry from similar aged *E. loxophleba* at some of the other demonstration sites of a similar age.

Block 8 now has 31, *E. horistes* to 2 meters tall (Ave 1.6 meters) and reasonably uniform across the block. Originally this block was planted out with 75 seedlings, so the block now has a 41% occupancy rate. This slow growing dry country mallee is growing quite well at this site and far better than some of the other mallees that might be expected to outperform it.

Block 9 now has 60, *E. cladocalyx* [Bundaleer] to 6 meters tall (Ave 3 meters). Originally this block was planted out with 120 seedlings, so the block now has a 50% occupancy rate. This block has the second biggest trees on the site, only to the other *E. cladocalyx* block trees were larger.

Block 10 now has 29, *E. polybractea* to 2 meters tall but the average height is only around 0.5 meters with a lot of plants not much bigger than large seedings. Originally this block was planted out with 120 seedlings, so the block now has a 24% occupancy rate. Overall a bit disappointing.

Meningie East 1 - assessment by Ian Filmer and Craig Neumann - 28.2.18
Lat: -35.776676 Long: 139.506753

Figure A.13: Feral Deer damage to 2.5-year-old *E. occidentalis* 24/2/2017

First Year Assessment – 24/2/15

Overall, 263 survived out of the 1000 seedlings planted (26.3%)

The Meningie East 1 plantings generally did well considering the lack of rainfall after establishment. Each species had been planted in individual or paired species rows across the site. Each row was spaced along a good wide rip line. The site itself is situated within a raised sand hill depression with higher areas around all four sides. While this provides some protection from winds it is susceptible to frost settling in the hollow. There are no existing plantings to provide competition at this site but some competition from couch grass and possibly lucerne is evident along with a good growth of summer weeds.

Both *E. petiolaris* and *E. occidentalis* had survival rates around 35% at this site with the surviving plants growing strongly. However, no *E. cladocalyx* survived the spring frosts. Overall *E. porosa* and *E. oleosa ssp. oleosa* had the best survival rates with around 45% of the seedlings surviving. *E. porosa* produced quite strong healthy growth to date. The other two mallee species planted at this site, *E. polybractea* and *E. cneorfolia*, fared less well with *E. polybractea* achieving only 27% survival rates and *E. cneorfolia* even worse at only 12% survival. Many of the surviving seedlings of these two species were also very small and hard to find amongst the summer weed growth. *E. cneorfolia* and to a lesser extent *E. polybractea* seedlings were under developed at planting and this may have contributed to their mortality rates. However, *E. porosa* and *E. oleosa ssp. oleosa* had similar issues and survived much better.

It was also decided to plant the Saltgrow varieties in place of failed *E. cladocalyx*.

Second Year Assessment – 3/5/16

Fill-in replanting were carried out to bring site up to respectable level of stocking, but it was a poor year for this site. Overall, 331 surviving seedlings were found after that years replanting efforts, about a 33% occupancy rate. It was now suspected there was some salinity, running from the middle of the site to S-W corner, that coincided with a large flattened patch of rye grass. Few if any trees have survived in this area and those that did were showing signs of stress. Frost was obviously having an effect; but it was suspected that something else was going on at this part of site. It was also noted that deer had invaded the site and badly battered some of the more rigid trees, possibly to remove velvet from their antlers. Rabbits were also detected in the

Southern end of site. The replacement of *E. cladocalyx* with Saltgrow *E. camaldulensis x grandis* and *E. camaldulensis x globulus*, in rows 3 to 6, only produced an extra 29 survivors, with *E. camaldulensis x globulus* (22) performing slightly better than *E. camaldulensis x grandis* (7). The replacement of *E. cladocalyx* in rows 20 and 24 was also not very successful. 5 *E. occidentalis* remained in row 20 and nothing was discovered in row 24. Away from the suspected saline area it was noted that the surviving trees appear mostly healthy and growing. The 2-year-old *E. petiolaris* seemed to be doing best with some close to 2 metres tall.

Third Year Assessment – 23/2/17

No new plantings here in 2016 and consequently no tree count was carried out at that time. The site appeared much the same, with little or no weed control in 2016. The veldt grass has provided more competition and the area is densely covered with other weeds. The area from the centre to S-W corner, that was suspected of being saline, had a very dense mat of rye grass and was obviously different to the rest of the site. The rye grass lay flat on the ground and appeared to confirm the suspicions of salinity. It would have been good to see this site prior to the original preparation when the salt affected area would have been more obvious. Rather than planting in rows across the site, the rows could have been in contour around the salted area and use the more salt tolerant species closest to the edge, avoiding planting directly into the salty patch. Many of the trees growing right along the edge are doing quite well if not smashed up by the deer.

Once again, deer had invaded and knocked around several of the more mature trees, breaking off smaller branches and rubbing through the bark. They seem to pick the stronger limbed species such as *E. occidentalis* and have greatly reduced the success of these species on the site. The bushier species such as *E. oleosa ssp. oleosa* have largely been ignored.

Outside the salt affected area many of the trees were doing well, with some up to 2 metres tall. The remaining Saltgrow varieties look to be suffering from insect attack and there may have been some drop in their number from the previous year.

Old Man Saltbush (Atriplex nummularia) could have been tried through the centre area as the site is not saline enough to yet form a salt crust. If the rye grass can survive then the Atriplex would probably survive too and soak up some of the high ground water.

Fourth Year Assessment – 28/2/18

No new plantings here in 2017. Overall, 299 plants have persisted at this difficult site filling around 30% of the original1000 seedling places. The saline patch remains obvious, as is the deer damage. On the 28/2/18 a large red deer stag was seen running past the site, easily jumping all the fences in its path. There is a heavy mixed weed load on the whole site, apart from the suspected saline area where the dense rye grass mat persists with few other plants present.

Block 1 (2 rows) now has 22, *E. polybractea* up to 1 meters high (Ave 0.5 meters). Originally this site was planted out with 80 seedlings and, now boasts a 28% occupancy rate.

Block 2 (2 rows) now has 8, Saltgrow *E. camaldulensis x grandis* up to 1 meters high (Ave 0.5 meters). Originally this block was planted out with 80 *E. cladocalyx* [Bundaleer] seedlings, none of these survived and were replaced with Saltgrow *E. camaldulensis x grandis* which also did poorly with only a 10% occupancy rate

Block 3 (2 rows) now has 14, Saltgrow *E. camaldulensis x grandis* up to 1.8 meters high (Ave 0.5 meters). Originally this block was planted out with 80 *E. cladocalyx* [Kersbrook] seedlings, none of these survived and were replaced with Saltgrow *E. camaldulensis x grandis* which did a little better, so the block now has a 18% occupancy rate.

Block 4 (2 rows) now has 55, *E. petiolaris* up to 2.5 meters high (Ave 1.8 meters). Originally this block was planted out with 80 seedlings, so the block now has a 69% occupancy rate.

Block 5 (2 rows) now has 24, *E. occidentalis* [Jerdacuttup] up to 2 meters high (Ave 1.5 meters). Originally this block was planted out with 80 seedlings, so the block now has a 30% occupancy rate. Quite extensive deer damage on these plants particularly toward the centre of the site.

Block 6 (2 rows) now has 28, *E. occidentalis* [Gibson] up to 2 meters high (Ave 1.5 meters). Originally this block was planted out with 80 seedlings, so the block now has a 35% occupancy rate. Quite extensive deer damage on these plants particularly toward the centre of the site.

Block 7 (2 rows) now has 33 *E. porosa* up to 2 meters high (Ave 1 meters). Originally this block was planted out with 80 seedlings, so the block now has a 41% occupancy rate.

Block 8 (2 rows) now has 42 *E. oleosa ssp. oleosa* up to 2.5 meters high (Ave 1.8 meters). Originally this block was planted out with 80 seedlings, so the block now has a 53% occupancy rate.

Block 9 (2 rows) now has 1 *E. cneorfolia* that's .4 meters high. Originally this block was planted out with 80 seedlings, so the block now has a 2% occupancy rate of *E. cneorfolia*. However, block 9 was replanted in 2015 with *E. occidentalis* [Gibson] and contains18 which gives them an occupancy rate of 23%. These *E. occidentalis* are smaller than the earlier rows only averaging about a meter high.

Block 10 (single row) now has 10 *E. oleosa ssp. oleosa* up to 2.5 meters high (Ave 1.8 meters). Originally this block was planted out with 40 seedlings, so the block now has a 25% occupancy rate.

Block 11 (single row) now has 5 *E. occidentalis* [Gibson] up to 1.5 meters high (Ave 0.5 meters). Originally this block was planted out with 40 *E. cladocalyx* [Bundaleer] seedlings none of which survived. In 2015 it was replanted with *E. occidentalis* [Gibson] so the block now has a 13% occupancy rate of that species.

Block 12 (single row) now has 6 *E. petiolaris* up to 2.5 meters high (Ave 1.8 meters). Originally this block was planted out with 40 seedlings, so the block now has a 15% occupancy rate.

Block 13 (single row) now has 5 *E. polybractea* up to 1 meters high (Ave 0.5 meters). Originally this block was planted out with 40 seedlings, so the block now has a 13% occupancy rate. This block was replanted in 2015 with *E. porosa*. 23 of these remain giving them a 58% occupancy rate on this block. The *E. porosa* are a little smaller, up to 1 meter in height.

Block 14 (single row) now has 1 *E. occidentalis* [Gibson] 1.5 meters high. Originally this block was planted out with 40 *E. cladocalyx* [Kersbrook] seedlings, none of these survived and were replaced with *E. occidentalis* [Gibson] seedlings, so the block now has a 3% occupancy rate of that species.

Block 15 (single row) now has 4 *E. occidentalis* [Gibson] up to 2 meters high (Ave 1.5 meters). Originally this block was planted out with 40 seedlings, so the block now has a 10% occupancy rate.

Figure A.14: The Dead Zone, the suspected saline patch where nothing grows. 24/2/2017

Karoonda - assessment by Ian Filmer and Craig Neumann - 28/2/18
Lat. -35.174300 Long. 139.859725

Figure A.15: 2.5-year-old *E. horistes* at Karoonda 24/2/2018

First Year Assessment – 23/2/15

Overall 659 trees survived out of the 1200 planted, a 54.9% survival rate. It was evident the positioning of the plantings next to an existing established tree block had influenced the conditions in the three rows running closest to those existing trees. Some scouring along these rows was evident and little weed growth could be seen until four rows in from the existing trees indicating heavy competition from those plantings. Despite this the plantings did so well in the rest of the rows that many of the species planted achieved their best survival rates at this site. The plantings were well laid out in blocks spaced along wide mechanically made furrows on the gently sloping site.

In comparison to the sites further north, the annual rainfall at this site allowed the inclusion of all the forestry species. Two provenances of both *E. cladocalyx* and *E. occidentalis* were planted as well as the most northern block of *Eucalyptus petiolaris*, which turned out to have the best survival rate of any species planted at this site. The *E. occidentalis* blocks also performed well despite the competition from the existing plantation but the *E. cladocalyx* blocks suffered around fifty percent losses.

E. oleosa ssp. oleosa was the best of the mallee species at this site and had the second-best survival rate overall behind *E. petiolaris*. *E. porosa* and *E. polybractea* seedlings had similar survival rates to E. occidentalis. While *E. horistes* and *E. loxophleba* suffered around fifty percent losses. At the time of planting the *E. polybractea*, *E. horistes* and *E. loxophleba* seedlings at this site were noted as being very small with little root development. This may be reflected in the latter two species poorer survival rates at the site, though the *E. polybractea* seedlings survived better than the others mentioned by the grower. At other sites *E. oleosa ssp. oleosa* was mentioned as being underdeveloped at planting but not at this site suggesting either better developed seedlings (luck) or an oversight by the grower as the planting was done over two days five days apart and the species he mentioned were the last planted while *E. oleosa ssp. oleosa* was the first.

Second Year Assessment – 3/5/16

A deep rip was conducted between the older windbreak and the demonstration site to reduce the competition for moisture between the two. Weed control was conducted and replanting was carried out where ever plants had failed, particularly along the western edge rows. However, this was only marginally successful and, while no count was taken, numbers only increased marginally. A small number of Saltgrow *E. camaldulensis x grandis* (14) were also added to the northern end of the site. The trees from the first year of planting were doing extremely well at this site with most mortality restricted to the 2015 replants.

Third Year Assessment – 15/2/17

After the first two hard years it was considered too difficult to establish the fill-ins between the existing shelter belt on the fence line, and the surviving 2014 and 2015 plantings. Both these existing blocks provide a high degree of competition for any attempt to increase the density on this site. However, the land holder persisted and aided by excellent spring and summer rains, has had notable success adding 62 new trees to the two western rows. Only the two western rows were counted at this site in 2017, but the 2014 and 2015 plantings continued to make excellent growth and the whole site looked most impressive. It was decided this site didn't need any more seedlings.

Figure A.16: 3.5-year-old *E. loxophleba* at Karoonda 24/2/2018

Fourth Year Assessment – 24/2/18

Of the original 1200 seedling places 812 are now occupied, a rate of around 68%. The site is well stocked with healthy trees and looks very impressive. Of the replants in the western two rows, that were so badly affected by the older windbreak, 58 of the 62 new seedlings counted in 2017 have persisted. These are still noticeably smaller than those in the rest of the site but are now established and growing well. Unfortunately, only 2 of the 14 Saltgrow *E. camaldulensis x grandis* planted above block 1 in 2015 have survived, though these are quite healthy and about 1.5 meters tall.

Block 1 now has 101, *E. oleosa ssp. oleosa* some up to 5 meters high (Ave 3.5 meters). Originally this block was planted out with 120 seedlings and after a couple of poor years and two replants now boasts a 84% occupancy rate.

Block 2 now has 71, *E. porosa* some to 4 meters (Ave 3.5 meters). Originally this block was planted out with 120 seedlings and after the two replants the block now has a 59% occupancy rate.

Block 3 now has 93, *E. petiolaris* some to 6 meters (Ave 4 meters). Originally this block was planted out with 120 seedlings, so the block now has a 68% occupancy rates.

Block 4 now has 81, *E. occidentalis* [Gibson] some to 6 meters tall (Ave 4 meters). Originally this block was planted out with 120 seedlings, so the block now has a 68% occupancy rate.

Block 5 now has 82, *E. occidentalis* [Jerdacuttup] some to 6 meters tall (Ave 4 meters). Originally this block was planted out with 120 seedlings, so the block now has a 68% occupancy rate.

Block 6 now has 80, *E. cladocalyx* [Kersbrook] to 6 meters tall (Ave 4 meters). Originally this block was planted out with 120 seedlings, so the block now has a 67% occupancy rate.

Block 7 now has 94, *E. cladocalyx* [Bundaleer] to 6 meters tall (Ave 4 meters). Originally this block was planted out with 120 seedlings, so the block now has a 78% occupancy rate.

Block 8 now has 104, *E. polybractea* to 4 meters tall but the height is quite variable and hard to give an average for. Originally this block was planted out with 120 seedlings, so the block now has a 87% occupancy rate.

Block 9 now has 76, *E. horistes* to 2 meters tall (Ave 1 meters). Originally this block was planted out with 120 seedlings, so the block now has a 87% occupancy rate.

Block 10 now has 54, *E. loxophleba ssp. lissophloia* to 5 meters tall but the average height is around 2 meters with a lot of replants only around 1.5 meters tall. Originally this block was planted out with 120 seedlings, so the block now has a 45% occupancy rate.

Figure A.17: 3.5-year-old *E. horistes* at Karoonda 24/2/2018

Sherlock - assessment by Ian Filmer and Craig Neumann - 27/2/18

Lat. -35.375644 Long. 139.789005

Figure A.18: 2.5-year-old Saltgrow *E. camaldulensis x globulus* clone at Sherlock 27/2/2018

First Year Assessment – 23/2/15

The first-year survival rate was low, about 33%, 317 surviving out of 960 seedlings planted. The plantings here were in blocks spaced along small mechanically made furrows on a relatively flat site next to a road way with existing trees. Little or no competition from the existing plantings was evident but the site was heavily covered with skeleton weed that may have had some impact over the dry summer. The mallee species more suited to the dry country further north (*E. horistes*, *E. oleosa ssp. oleosa* and *E. loxophleba*) were omitted from this site in favour of tree and mallee species more suited to higher rainfall sites. For example, this site was the most northerly planting of *E. cneorfolia*. *E. porosa* was the best of the mallee species but achieved a little less than fifty percent survival rates. The other two species planted at this site, *E. polybractea* and *E. cneorfolia*, fared

more poorly only managing ten percent or less survival rates. It was mentioned that *E. polybractea* and *E. cneorfolia* had very poor root development at the time of planting and it was suggested that this and frost may have contributed to losses. Heavy frost was also given as the main reason for the low survival rates amongst the two provenances of *E. cladocalyx* planted. This species had less than ten percent survival rates in this growing season but has been successfully planted in large blocks at this property in the past. The two provenances of *E. occidentalis* planted and the block of *E. petiolaris* were all more successful with around three quarters of the seedlings persisting despite the unfavourable establishment year and competition from summer weeds.

Second Year Assessment – 19/4/16

The second-year occupancy rates were only a little better (39%) with most blocks increasing in numbers. There were 3 significant block failures with both *E. cladocalyx* [Bundaleer and Kersbrook] and *E. cneorfolia* numbers declining. The Saltgrow varieties were also added to the plantings last season with 15, of the 40 planted, *E. camaldulensis x globulus* surviving and 34, of the 120, *E. camaldulensis x grandis* surviving. The surviving Saltgrow seedlings had the benefit of good rains in February and March and responded well. The best of these survivors gaining approx. 1.5 metres in height at near 10 months of age.

There is still no apparent effect from established windbreak (edge affect) on southern side for 2015 planting. Skeleton weed remains a major competitor over summer, although competition does not kick in till after Christmas when the trees should be reasonably established. Dry conditions and frost are believed to be the major cause of losses this season with much stronger seedlings delivered in time for planting.

The poor results of *E. cladocalyx* almost certainly can be put down to frost.

Third Year Assessment – 15/2/17

The landholder was not able to participate in this growing season. No new trees were planted, and no occupancy count was made. Partly due to less competition (skeleton weed) and the good season in 2016, the Saltgrow varieties were of a similar height to the best of the *E. occidentalis* from the previous year; most impressive for 19-month-old trees.

The surviving trees from 2014 and 2015 plantings are starting to make quite a show, and if the landholder was prepared to spray out, or control, the skeleton weed there may be good prospects of success for filling in some of the site.

Maybe not with *E. cladocalyx* but *E. occidentalis* have proven to be more tolerant of frost and competition.

E. petiolaris has also survived well at this site and, to a lesser extent, *E. porosa*.

Fourth Year Assessment – 28/2/18

Again, the landholder was not able to participate in this growing season, so no new trees were planted. However, the site is being prepared for planting in mid-2018 with good summer weed control having been carried out to reduce the skeleton weed burden on the next round of plantings. Currently the site has a 39% occupancy rate with 441 of the total 1120 plant spaces occupied. However, 358 of those places are taken up by the failed *E. cladocalyx* and *E. cneorfolia* plots. With those omitted, the total occupancy rate is 58%.

Block 1 now has 89, *E. occidentalis* [Jerdacuttup] up to 6 meters high (Ave 4 meters). Originally this block was planted out with 120 seedlings and now boasts a 74% occupancy rate.

Block 2 now has 86, *E. petiolaris* some to 6 meters (Ave 4 meters). Originally this block was only planted out with 120 seedlings and now has a 72% occupancy rate.

Block 3 now has 74, *E. porosa* some to 4 meters (Ave 2.5 meters). Originally this block was planted out with 120 seedlings, so the block now has a 62% occupancy rate.

Block 4 now has 43, *E. polybractea* some to 3.5 meters tall (Ave 2 meters). Originally this block was planted out with 120 seedlings, so the block now has a 36% occupancy rate despite additional replants in the second year.

Block 5 now has 0, *E. cneorfolia* and will be replanted with a different species.

Block 6 now has 0, *E. cladocalyx* [Kersbrook] and will be replanted with a different species.

Block 7 now has 95, *E. occidentalis* [Gibson] to 6 meters tall (Ave 3 meters). Originally this block was planted out with 120 seedlings, so the block now has a 79% occupancy rate.

Block 8 now has 2 *E. cladocalyx* [Bundaleer] and will be replanted with a different species.

Block 9 now has 15 *E. camaldulensis x globulus* and has never been replanted. These are the tallest trees on site, with some reaching 8 meters and an average height of around 6.5 meters. Originally this block was planted out with 40 seedlings, so the block now has a 38% survival rate.

Block 10 now has 37 *E. camaldulensis x grandis* and has never been replanted. These are the second tallest trees on site, with some reaching 7 meters and an average height of around 5 meters. Originally this block was planted out with 120 seedlings, so the block now has a 31% survival rate.

Figure A.19: 3.5-year-old plantation at Sherlock 27/2/2018, *E. occidentalis* in foreground

Sites Established in 2016

Perponda - assessment by Ian Filmer and Craig Neumann - 23/2/18

Lat. -34.923567 Long. 139.902640

First Year Assessment – 15/2/17

This site is sandy and undulating, from previous dune blow-out areas. The lower area is in the north east, nearest the homestead, seems to be the most affected by the blow-outs. The opposite end is higher ground to the south west and not as affected by wind erosion. While the area was sprayed out with Round Up some time before planting, on the day of assessment mature, knee height, skeleton weed was present across the site, with some heavy infestations of caltrop, particularly near the clump of mallees in the north eastern corner nearest to the homestead.

Shallow rips were made running from the south west to the north east, with a small area at the Northern end of the site running 90 degrees to most of the block due to the undulating nature of the site. The seedlings were planted into these rips at around 3-meter spacings.

While there was a heavy infestation of caltrop and skeleton weed, the surviving trees looked healthy and it was expected they would grow on. There may have been some mortality of seedlings in the worst areas of weed growth but over most of the site survival was reasonable. No doubt their condition benefitted from good spring and summer rains and a recent 37mm rain event.

The standout surviving plant species was *E. petiolaris* (81 %) with *E. occidentalis* [Gibson}, *E. polybractea* and *E. oleosa ssp. oleosa* all above 50 % survival rate. The blocks containing *E. horistes*, *E. porosa*, *E. occidentalis* [Jerdacuttup] and *E. cladocalyx* [Kersbrook] were all 30 % or less. These blocks are all at the lower end of the site in areas of more competition and possibly greater past sand blow-outs. It was noted that in these lower blocks it was difficult to find some species amongst the weed load and may well have been under counted at the time of assessment. Overall 526 of the 1088 original plantings had survived, a 48.34 % survival rate.

Second Year Assessment – 23/2/18

The landholder decided not to replant in 2017 as he thought it was too dry. Of the original 1088 seedlings 457 are still alive, a survival rate of around 42%. The site is no longer fenced, and stock have grazed the site moderately. *E. occidentalis* appears to have suffered the most damage from this grazing activity particularly the Jerdacuttup provenance that was planted closest to the existing mallees on site. The *E. occidentalis* [Gibson] provenance has also been nibbled but to a lesser extent. At the time of assessment, no other species showed any grazing damage, but this may change if the site is more extensively stocked. The trees are noticeably taller on the raised part of the site and it was theorised this was due to more weed competition and possibly greater past sand blow-outs on the lower part of the slope. Weed competition over the past growing season appears to have declined possibly because of the less generous rainfall. Skeleton weed was present across the site but at a lower density to the previous assessment. The heavy infestations of caltrop found previously near the existing mallees were no longer evident. Generally, the mallee are growing well on this site along with *E. petiolaris*.

Block 1 now has 12, *E. horistes* all under 0.5 meters tall and difficult to find amongst the weeds. Originally this block was planted out with 64 seedlings, giving it a 19% survival rate. This is an increase on the last count and is attributed to the increase in size allowing more of the plants to be discovered amongst the site's weed load.

Block 2 now has 5, *E. cladocalyx* [Kersbrook] some to 0.3 meter. Originally this block was planted out with 96 seedlings giving it only a 5% survival rate. It's unclear if frost has played any part in the decrease in numbers in this block but more generally blocks in this lower portion of the site have fared less well than those on the raised portions and these *E. cladocalyx* are no exception.

Block 3 now has 70, *E. polybractea* averaging around 0.3 meters tall. Originally this block was planted out with 128 seedlings, giving it a 55% survival rate. While this species is also difficult to pick out from the background weeds this area has less weeds and consequently the small plants are more readily seen.

Block 4 now has 40, *E. cladocalyx* [Bundaleer] averaging around 0.4 meters tall. Originally this block was planted out with 128 seedlings, giving it a 31% survival rate. While numbers have dropped the *E. cladocalyx* in this block have generally survived better and grown larger than those lower down in block 2.

Block 5 now has 53, *E. loxophleba ssp. lissophloia* averaging around 0.4 meters tall. Originally this block was planted out with 128 seedlings, giving it a 41% survival rate.

Block 6 now has 95, *E. petiolaris* averaging around 0.5 meters tall, with some to 1 meter. Originally this block was planted out with 128 seedlings, giving it a 74% survival rate. These are easily the most impressive trees on the site, in terms of survival and growth.

Block 7 now has 15, *E. porosa* averaging around 0.5 meters tall. Originally this block was planted out with 64 seedlings, giving it a 23% survival rate. This block has been most affected by the dense mats of caltrop in its first growing season and the proximity of the existing mallees on the site.

Block 8 now has 20, *E. occidentalis* [Jerdacuttup] averaging around 0.3 meters tall. Originally this block was planted out with 96 seedlings, giving it a 21% survival rate. Almost every plant in this block has been grazed to some extent and, like block 7, may have suffered some impact from the dense mats of caltrop in its first growing season and the proximity of the existing mallees on the site.

Block 9 now has 72, *E. oleosa ssp. oleosa* averaging around 0.3 meters tall. Originally this block was planted out with 128 seedlings, giving it a 56% survival rate, like *E. polybractea* and second only to *E. petiolaris* and *E. occidentalis* [Gibson].

Block 10 now has 75, *E. occidentalis* [Gibson] averaging around 0.5 meters tall, with some to 1 meter. Originally this block was planted out with 128 seedlings, giving it a 59% survival rate. These are the second most impressive trees on the site, but many are showing signs of light grazing. Like *E. petiolaris* they are planted on the highest part of the site.

Figure A.20: 1.5-year-old plantation at Perponda 23/2/2018

Mercunda - assessment by Ian Filmer and Craig Neumann - 23/2/18
Lat. - 34.626397 Long. 140.044698

Figure A.21: 1.5-year-old plantation at Mercunda 23/2/2018, *E. occidentalis* in foreground

First Year Assessment – 15/2/17

The site was part of a sheep feedlot, well fenced off to prevent stock access and well prepared. The site had been ripped east to west creating deep steep sided gutters with a soft bottom to plant into, even where it was a bit stony. The plants were spaced about 2 meters apart along the rows. The Site slopes gently down from the northern side and most of the blocks are lined up in rectangles across the slope from east to west. The combination of above average rainfall and fertilizer from the feed-lot, saw the site very overgrown with summer weeds and brome grass. Survival rates were about 44.5% overall, with surviving plants appearing to be in good health.

In places, there was evidence of salt scald, which had been identified prior to planting, by the landowner. This was one reason for choosing this site, to intercept the ground water before it rises to the surface and expands the scalded areas.

With 50% mortality across the site it could have been suggested that frost had played a part; but *E. cladocalyx* would have been more affected if this were the case and *E. occidentalis* should have been expected to have far greater survival rate in comparison. This wasn't the case in blocks 3 *E. occidentalis* [Gibson] and 4 *E. cladocalyx* [Kersbrook], although there was less difference between blocks 7 *E. occidentalis* [Jerdacuttup] and 8 *E. cladocalyx* [Bundaleer]. It is believed something else is going on at this site, but what that is isn't known. It may be that *E. occidentalis* [Gibson] is less tolerant to salt or fertiliser than *E. occidentalis* [Jerdacuttup]. *E. occidentalis* is often used in salt interception plantings due to its tolerance of moderate saline conditions so the result here is interesting and raised questions that couldn't be answered then.

The tall dense vegetation did not appear to be a threat to the survival and future growth of the trees present at date of inspection. However, the landholder was advised that if in-fills were intended in 2017, a degree of site preparation was advisable. The tall Brome Grass stems had dropped their seed heads into the rip lines and some could be seen to have germinated on the spring and summer rain. Much more could be expected to germinate the next winter. Consequently, to

have any chance of success with replants in 2017, the rip lines needed to be spot sprayed and slashing between the rows was also suggested to allow ease of access and reduce the chance of the seedlings being overgrown.

Figure A.22: Small salt scald in 1.5-year-old plantation at Mercunda 23/2/2018

Second Year Assessment – 23/2/18

The landholder decided not to replant in 2017 because of family health issues, however, he did slash between the rows. Weed competition over the past growing season had declined possibly because of the low rainfall. The landholder indicated little rain if any had fallen over the previous 10 months. Of the original 1088 seedlings, 496 were still alive and looking quite healthy, at a survival rate of around 46%. The main reason for the increase in the survival rate was the reduction in weed cover. In the previous seasons assessment many of the species had reduced counts simply because the observers couldn't find the seedlings amongst the thick weed cover obscuring the deep rip lines. This has led to an overall increase in numbers even though some mortality has occurred in some blocks. The small salt scalds are still present, and few trees survived within them. However, with trees growing well above and around these outflows it is hoped they will reduce over time. Overall the surviving trees on this site are quite large given their age suggesting they may have benefited from the extra nutrients in the soil from the sites use as a sheep feed lot.

Block 1 now has 41, *E. polybractea* all under 1 meter tall. Originally this block was planted out with 128 seedlings, giving it a 32% survival rate. This is an increase on the last count and is attributed to the increase in size allowing more of the plants to be discovered amongst the site's weed load.

Block 2 now has 89, *E. petiolaris* some to 1.5 meters (Ave. 0.8 meter). Originally this block was planted out with 128 seedlings giving it a 70% survival rate, second best performance on this site.

Block 3 now has 34, *E. occidentalis* [Gibson] some to 1.5 meters (Ave. 1 meter). Originally this block was planted out with 128 seedlings, giving it a 27% survival rate. Given the performance of the other *E. occidentalis* at this site, it would be easy to be disappointed with this result, but this block encompasses the largest salt scald which is responsible for at least some of the mortality.

Block 4 now has 49, *E. cladocalyx* [Kersbrook] some to 1.5 meters (Ave. 1 meter). Originally this block was planted out with 96 seedlings, giving it a 51% survival rate. While numbers have dropped the *E. cladocalyx* in this block have generally survived well and are growing strongly.

Block 5 now has 83, *E. oleosa ssp. oleosa* some to 1 meters (Ave. 0.6 meter). Originally this block was planted out with 128 seedlings, giving it a 65% survival rate. *E. oleosa ssp. oleosa* is easily the best performing mallee at this site, both in terms of survival rates and biomass production. The increase in numbers is again due to the initial difficulty locating the small plants in the initial assessment.

Block 6 now has 29, *E. loxophleba ssp. lissophloia* averaging around 0.5 meters tall, with some to 1 meter. Originally this block was planted out with 128 seedlings, giving it a 23% survival rate. The remaining plants all appear quite healthy and strong.

Block 7 now has 79, *E. occidentalis* [Jerdacuttup] some to 1.5 meters (Ave. 1 meter). Originally this block was planted out with 96 seedlings, giving it a 82% survival rate. This block is the best performing on site, with a great survival rate and healthy plants of an impressive size for their age.

Block 8 now has 56, *E. cladocalyx* [Bundaleer] some to 1.5 meters (Ave. 1 meter). Originally this block was planted out with 128 seedlings, giving it a 44% survival rate. Numbers in this block have declined significantly more than the other *E. cladocalyx* block but the reason for this is unclear. The remaining plants all appeared quite robust and healthy at the time of assessment.

Block 9 now has 32, *E. porosa* some to 1 meters (Ave. 0.6 meter). Originally this block was planted out with 64 seedlings, giving it a 50% survival rate. This block has changed little in numbers over the previous year and is the second best performing mallee on site after *E. oleosa ssp. oleosa*.

Block 10 now has 4, *E. horistes* averaging around 0.3 meters high. Originally this block was planted out with 64 seedlings, giving it only a 6% survival rate. This isn't a great result although no plants were found the previous assessment. This block is situated below the other blocks in a 3-row block running east to west. Whether the placement of this block has influenced the survival rate or the intense weed load in the first growing season is unknown.

Figure A.23: 1.5-year-old *E. oleosa ssp. oleosa* at Mercunda 23/2/2018

Pyap West - assessment by Ian Filmer and Craig Neumann - 23/2/18
Lat. -34.572029 Long. 140.412941

Figure A.24: Planting completed at Pyap West 14/7/2016

First Year Assessment – 15/2/17

The site was well prepared and laid out with rows running east to west along a low sandy ridge. Having been recently cropped, it had a reduced weed level even before being sprayed out and prepared. The equivalent of a deliberate two-year preparation. The benefits were obvious, the low density of weeds presented fewer competitors for resources and greater survival from there on. Some summer weed growth was evident but far less than one would expect from a site not prepared over such a long lead up time.

The site was well fenced and laid out with quite wide semi-shallow, but appropriately deep, gutters. The blocks were arranged on 8 rows each side of a centre break. Each block was approximately 30 metres x 26 metres. The landholder observed a hot dry wind event soon after planting that had caused some damage, but survival rates were still good. The soil appears to be pretty good sandy loam, rather than a pure sand hill and may even have contained some leftover crop nutrients that initially helped the plants along.

The survival rates were all reasonably satisfactory for a low rainfall area. If anything, the survival rate of *E. occidentalis* was a little disappointing. While the survival rate of *E. cladocalyx* was also probably a bit low. However, the *E. cladocalyx* rate was not unexpected as there were one or two frost events soon after planting.

All the surviving trees were in excellent condition and barring an unforeseen event should have survived well from there on, an excellent result for this part of the world. Of the original 1140 seedlings, 716 were still alive and looking quite healthy, at a survival rate of around 63%

Figure A.25: 1.5-year-old plantation at Pyap West 23/2/2018, *E. oleosa ssp. oleosa* in foreground

Second Year Assessment – 23/2/18

The landholder did some replanting in 2017, however, the dry year didn't allow many to survive and only a few blocks increased in number. Other blocks declined a little further from the previous year's counts. Weed competition over the past growing season had remained low and the landholder indicated this was more due to the dry conditions than active control measures. Though the site was spot sprayed prior to replanting. Of the original 1140 seedlings places, 727 were occupied and most looked quite healthy at the time of assessment, with an occupancy rate of around 64%. The replants being main reason for the increase over the first seasons survival rate. Overall the surviving trees on this site are very large given their age suggesting they may have benefited from the extra nutrients in the soil from the sites use as a cropping paddock and the extra weed control that afforded the site.

Block 1 now has 46, *E. cladocalyx* [Kersbrook] some to 2 meters (Ave. 1.3 meter). Originally this block was planted out with 120 seedlings, giving it a 38% occupancy rate. This was the same as last count and no new plants were observed in the plot. However, the trees that are in this block are all large and healthy.

Block 2 now has 49, *E. cladocalyx* [Bundaleer] some to 2 meters (Ave. 1.3 meter). Originally this block was planted out with 104 seedlings giving it a 47% occupancy rate. A few new plants were see in this block from the 2017 replanting but otherwise the remaining trees in the block look very similar to block 1.

Block 3 now has 63, *E. occidentalis* [Gibson] some to 2 meters (Ave. 1.3 meter). Originally this block was planted out with 112 seedlings, giving it a 56% occupancy rate. A few new plants were see in this block from the 2017 replanting but otherwise the remaining trees in the block looked very large and healthy for their age.

Block 4 now has 42, *E. occidentalis* [Jerdacuttup] some to 2 meters (Ave. 1.3 meter). Originally this block was planted out with 64 seedlings, giving it a 66% occupancy rate. A few new plants were see in this block from the 2017 replanting but otherwise the remaining trees in the block looked very much like those in Block 3. Because of the short numbers of this provenance and of *E. horistes*. It was decided to include what *E. horistes*. was available in this plot, and of the 28 spaces planted 18 remained

occupied, an occupancy rate of 64%. All the *E. horistes* are around 0.4 of a meter tall. 3 *E. cladocalyx* [Kersbrook] were also initially included in this block to fill up the remaining space and all 3 had survived and are similar in size to those in block 1.

Block 5 now has 74, *E. petiolaris* some to 1.5 meters (Ave. 0.6 meter). Originally this block was planted out with 128 seedlings, giving it a 58% occupancy rate. Numbers in this block have decreased slightly and no new plants were evident. The remaining plants are all healthy and robust at around

Block 6 now has 75, *E. loxophleba ssp. lissophloia* averaging around 0.5 meters tall, with some to 1 meter. Originally this block was planted out with 120 seedlings, giving it a 63% occupancy rate. The remaining plants all appear quite healthy and strong.

Block 7 now has 95, *E. oleosa ssp. oleosa* some to 1 meters (Ave. 0.5 meter). Originally this block was planted out with 120 seedlings, giving it a 79% occupancy rate. This block is the best performing on site, with a great survival rate and healthy plants of an impressive size for their age.

Block 8 now has 100, *E. polybractea* some to 0.6 meters (Ave. 0.4 meter). Originally this block was planted out with 120 seedlings, giving it a 83% occupancy rate. The remaining plants all appeared quite robust and healthy at the time of assessment.

Block 9 now has 51, *E. porosa* averaging some to 1 meters (Ave. 0.6 meter). Originally this block was planted out with 76 seedlings, giving it a 67% occupancy rate. Because of the short numbers of this provenance it was decided to include 10 *E. oleosa ssp. oleosa*. In the northern outside row, all 10 remain. As do 4 *E. polybractea* also used to fill this block. Both these species are growing as well as they are within their own blocks.

Block 10 now has 90, *E. oleosa ssp. oleosa* averaging around 0.5 meters high. Originally this block was planted out with 130 seedlings, giving it only a 69% occupancy rate.

Figure A.26: 1.5-year-old *E. cladocalyx* at Pyap West 23/2/2018

Colebatch - assessment by Ian Filmer and Craig Neumann - 23/2/18
Lat. -35.980296 Long. 139.729038

Figure A.27: 1.5-year-old Wind break at Colebatch 28/2/2018, *E. occidentalis* in outside rows

First Year Assessment – 23/2/17

Overall 821 surviving plants out of 1030 planted is a good result, around an 80% survival rate. The surviving trees all appear in good health with a high chance of growing on. The landholder planted the trees about the same time as they planted the lucerne pasture in the paddock alongside. Consequently, there was a magnificent stand of lucerne right up to several of these windbreaks. This isn't recommended as you'd not expect to see such good tree establishment next to such a good stand of Lucerne pasture. No doubt the good season delivered the good Lucerne establishment, and the excellent tree establishment. The good season, and the fact the Lucerne and trees were planted about the same time, may have allowed the trees to get their roots down, and keep the competing Lucerne at bay. Obviously, the site has been well prepared, with little evidence of weeds present.

However: it is doubtful that filling in the gaps will have much prospect of success without removing the competing Lucerne. The landholder had sprayed out a metre circle around each seedling before planting and planted the seedlings into a small hole protected by a biodegradable tree guard. A bit like a milk carton held in place with two canes. Each windbreak consists of 3 rows ripped and lightly compacted prior to planting. At the time of assessment not all the windbreaks were fenced but the landholder fully intends to do so before grazing the adjacent paddocks.

It should be noted that although the landholder is in the habit of watering in tree seedlings, for them to survive, no watering occurred for this planting because of the prevailing wet season. Which *E. cladocalyx* and *E. occidentalis* seedlings went where has been lost. In all the windbreaks the taller species have been planted in the outside rows and the shorter mallee species in the centre rows. Mortality was higher in the centre rows in most windbreaks.

Second Year Assessment – 28/2/18

The landholder did some replanting in 2017, apart from spraying out around the replant area they also used the bucket of a frontend loader to make to make a divot to plant into. The loader blade took out a shallow section on an angle so that any water running downhill would get caught and accumulate in the bottom corner where they planted the seedling. A lot of effort but a good planting method for maximum water capture. Of the original 1030 seedlings places, 670 were occupied and most looked quite healthy at the time of assessment, with an occupancy rate of around 65%. Despite some replants most of the windbreaks assessed had declined in overall numbers. It may be that the dryer season and competition from surrounding vegetation has had a detrimental effect. It was also noted that in windbreak A4 many of the trees showed signs of spray drift burn and it remains to be seen how well these plants recover from this off-target damage.

Windbreak A2 now has 72, *E. cladocalyx*, 41 *E. cneorfolia*, 1 *E. porosa*, 35 *E. petiolaris*, and 10 *E. polybractea*, a total of 159 down 13 plants from last assessment. Some for the *E. cladocalyx* and *E. petiolaris* were around 2 meters tall and on average around 1.2 meters. while the mallees in the centre row were between 0.5 and 1 meter tall

Windbreak A4 now has 2, *E. cladocalyx*, 22 *E. cneorfolia*, 1 *E. porosa*, 61 *E. petiolaris*, 85 *E. occidentalis* and 49 *E. polybractea*, a total of 220 down 33 plants from last assessment. Some for the *E. occidentalis* were around 2.5 meters tall and on average around 1.5 meters. The *E. petiolaris* was up to 2 meters tall and averaged 1.2 meters. The mallees were all 0.5 to 1 meter in height. The outside row on the western side was considerably taller than the same plants on the Eastern side next to the existing lucerne. Some of the trees in this windbreak showed considerable spray drift damage.

Windbreak B3 now has 6, *E. camaldulensis x grandis*, 1 *E. porosa*, 53 E. occidentalis, and 49 *E. polybractea*, a total of 129 down 43 plants from last assessment. Some for the *E. occidentalis* and *E. camaldulensis x grandis* were around 2 meters tall and on average around 1 meters. While some of the *E. polybractea* in the centre row were1 meter tall and averaged 0.6 of a meter.

Windbreak B2 now has 36, *E. cladocalyx*, 2 *E. cneorfolia*, 6 *E. porosa*, 41 *E. petiolaris*, 5 *E. polybractea* and 3 *E. camaldulensis x grandis* Some to of the *E. cladocalyx* and *E. petiolaris* are around 2 meters tall and average. 1.3 meters. While some of the *E. polybractea* in the centre row were1 meter tall and averaged 0.6 of a meter.

Windbreak B1 now has 70, *E. cladocalyx* and *E. porosa* some to 1.5 meters (Ave. 0.6 meter). The *E. porosa* occupies the centre row and is generally mush shorted than the *E. cladocalyx*.

Figure A.28: 1.5-year-old *E. occidentalis* with spray drift damage 28/2/2018

Lameroo - assessment by Ian Filmer and Craig Neumann - 24/2/18
Lat. -35.259268 Long. 140.375926

Figure A.29: Newly planted seedlings in stubble 23/6/2016

First Year Assessment – 15/2/17

This site was identified by Wayne Brown of Environments by Design. Wayne was carrying out a revegetation project on the site and consented to us planting a block within that project. Wayne sprayed, ripped and marked out the site. The site was on a low sand rise which had been subject to wind erosion and had a couple of prominent blow-outs. However, the site had been fenced off for several years, with intensive cropping outside the fenced off area. There was a carpet of dry grass, probably brome, over most of the site. There was also some skeleton weed present but not sufficient to be serious competition. The site runs east west along the sand rise with the ripped area dipping slightly down the slope to the south. The gutters were well formed and would have captured some moisture, but good rainfall fell in the spring and summer which had been of more benefit. Survival has been extremely good, as has the growth of the individual plants. Overall 749 of the original 928 plants have survived, a 81 % survival rate. In fact, the site had done so well it was decided no replants were required.

Second Year Assessment – 24/2/18

Of the original 749 seedlings planted, 788 were alive and growing strongly at the time of assessment, with a survival rate of around 85%. The increased numbers were due to the observers being able to locate the trees after an extra year's growth. Tiny thin leaved individuals previously obscured by the dry grasses were more easily seen. While other blocks declined a little the counts in many of the mallee blocks increased, more than compensating for any losses. Weed competition over the past growing season had increased but had generally remained low. Some evidence of rabbit activity was noted at this site but no damage to the demonstration plants was observed. The success of this site is a testament to good site preparation.

Block 1 has 76, *E. horistes* averaging around 0.5 meters high with some around 0.8 meters. Originally this block was planted out with 96 seedlings, giving it a 79% survival rate and 17 extra plants on the previous year's count. This is the slowest of the mallee species and in relative terms the surviving *E. horistes* are all large and healthy.

Block 2 has 90, *E. oleosa ssp. oleosa* averaging around 1.3 meters high with some around 1.5 meters. Originally this block was planted out with 96 seedlings giving it a 94% survival rate and 2 less plants than the previous year's count. An excellent block both in terms of survival, health and growth

Block 3 has 88, *E. loxophleba ssp. lissophloia* averaging around 1.2 meters high with some around 1.8 meters. Originally this block was planted out with 96 seedlings, giving it a 92% survival rate and 4 extra plants on the previous year's count. Another excellent block considering the species and the age of the plants

Block 4 has 60, *E. polybractea* averaging around 0.3 meters high with some around 0.5 meters. Originally this block was planted out with 96 seedlings, giving it a 75% survival rate and 24 extra plants on the previous year's count. While 75% has been a good result the *E. polybractea* were the worst performers amongst the mallees, still quite small as well as the lowest survival rate.

Block 5 has 48, *E. porosa* averaging around 0.5 meters high with some around 0.8 meters. Originally this block was planted out with 64 seedlings, giving it a 75% survival rate and 6 extra plants on the previous year's count. The remaining plants are all healthy and robust, a little better than the *E. polybractea* block with the same survival rate.

Block 6 has 94, *E. petiolaris* averaging around 1 meters high with some around 1.7 meters. Originally this block was planted out with 96 seedlings, giving it a 98% occupancy rate and 1 extra plants. The remaining plants all appear quite healthy, big and strong. The loss of only 2 trees since planting is remarkable.

Block 7 now has 89, *E. occidentalis* [Jerdacuttup] averaging around 1.2 meters high with some around 1.8 meters. Originally this block was planted out with 96 seedlings, giving it a 93% survival rate and 3 extra plants on the previous year's count. The remaining plants all appeared quite robust, big and healthy at the time of assessment.

Block 8 has 90, *E. occidentalis* [Gibson] averaging around 1. 2 meters high with some around 2 meters. Originally this block was planted out with 96 seedlings, giving it a 94% survival rate and no change in plant numbers from the previous year's count. The remaining plants all appeared quite robust, big and healthy at the time of assessment.

Block 9 has 68, *E. cladocalyx* [Kersbrook] averaging around .5 meters high with some around 1.5 meters. Originally this block was planted out with 96 seedlings, giving it a 71% survival rate and 2 less plants than the previous year's count. Normally a survival rate of 71% would be a success but at this site it is the weakest result and these trees are visibly smaller than the Bundaleer seed stock.

Block 10 has 85, *E. cladocalyx* [Bundaleer] averaging around 1 meters high with some around 2 meters. Originally this block was planted out with 96 seedlings, giving it a 89% survival rate and 2 less plants than the previous year's count. The remaining plants all appeared quite robust, big and healthy at the time of assessment.

Figure A.30 & A.31: 1.5-year-old plantation at Lameroo 24/2/2018

Tintinara - assessment by Ian Filmer and Craig Neumann - 27/2/18
Lat. -35.869152 Long. 140.000806

First Year Assessment – 23/2/17

Overall 920 surviving plants out of 1801 planted is a reasonable result, around a 51% survival rate. The property is flat with isolated Pink gums, *E. fasciculosa*, within the paddocks. These in paddock trees are slowly dying and the land holder has started developing fenced edge of paddock windbreaks, these are mainly 2 row plantings but windbreaks 6 and 7 are 3 rows. The landholder favours *E. occidentalis* for most of his plantings but has placed the demonstration species in 7 distinct windbreaks.

The landholder had previously expressed concern at the effects of a severe frost earlier that year, reporting that *E. cladocalyx* 0.3 to 0.5 meters in height had been frosted off and died. On inspection there were some trees which had been frosted; and some that looked sick. Some of the frosted *E. cladocalyx* will grow from the base of the plant. This was borne out in the windbreaks where green leaves could clearly be seen at the base of some trees, sometimes hidden among the surrounding dry weed burden. The dry weeds at the time was helping to protect the trees from further frost damage.

Another observation, was that both survival through the summer, and subsequent frost damage, appear to be worse where the weed competition has been heaviest.

The rip lines in paddocks 1, 2, 3 and 5 had been prepared in 2015 and the results for 2016 plantings, with the benefit of 2 years of control weeds, were much better than for the rip lines which had only been prepared in 2016. In some places the wireweed was up to 30 cm deep, and trees appeared to suffer accordingly.

Second Year Assessment – 28/2/18

The landholder did some replanting in 2017. Of the original 1801 seedlings places, 820 were occupied with an occupancy rate of around 46%. Despite some replants several the windbreaks assessed had declined in overall numbers. The landholder mentioned a bad frost killing a lot of plants the previous November and that the effect was more pronounced on the sandy soils. Still, many of the affected plants had resprouted from the base and were recovering at the time of assessment. The landholder had also employed tree guards during replanting and for some of the smaller existing plants. This was moderately successful in protecting some of the seedlings against frost. *E. cladocalyx* was particularly affected but even *E. occidentalis* in low sandy areas had been killed by the frost.

In general terms the windbreaks with longer weed control lead ins seem to have fared better than those prepared with minimum weed control effort. This affect is muddied somewhat here by the effect of frost on different soil types and species, and the hardiness of the species in the windbreak but by and large longer weed suppression appears to give an advantage to the survival of the seedlings.

Windbreak 1 now has 40, *E. cladocalyx* and 49 *E. petiolaris*, a total of 89 out of the original 177, an occupancy rate of about 50%. The block was also down 31 plants from last assessment. Some for the *E. cladocalyx* and *E. petiolaris* were around 2 meters tall and on average around 1 meters.

Windbreak 2 now has 7, *E. cladocalyx* and 33 *E. petiolaris*, a total of 40 out of the original 115, an occupancy rate of about 35%. The block was also down 33 plants from last assessment. Some for the *E. cladocalyx* and *E. petiolaris* were around 1.8 meters tall and on average around 1 meters. The *E. cladocalyx* here on the sandy soil were heavily affected by frost.

Windbreak 3 now has 144, *E. oleosa ssp. oleosa*, and 49 *E. loxophleba* ssp. lissophloia, a total of 239, out of the original 296, an occupancy rate of about 81%. The block was up 2 plants from last assessment. Some for the *E. loxophleba ssp. lissophloia* were around 1.6 meters tall and on average around 1 meters. While some of the *E. oleosa ssp. oleosa* were1 meter tall and averaged the same.

Windbreak 4 now has 3, *E. cladocalyx*, 3 *E. occidentalis* and 16 *E. oleosa ssp. oleosa* a total of 22, out of the original 141, an occupancy rate of about 16%. The block was down 13 plants from last assessment. Some of the *E. cladocalyx* and *E. occidentalis* are around 1.3 meters tall and average 1 meter. While the *E. oleosa ssp. oleosa* also averaged 1 meter. Here on sandy soil both *E. cladocalyx* and *E. occidentalis* were heavily affected by frost, *E. oleosa ssp. oleosa* less so.

Windbreak 5 now has 143, *E. cladocalyx*, a total of out 143 of the original 247, an occupancy rate of about 58%. The block was down 56 plants from last assessment. Some of the *E. cladocalyx* 2 meters tall and average 1 meter.

Windbreak 6 now has 115 E. occidentalis, 71 *E. polybractea*, 2 *E. cneorifolia*, and 15 *E. oleosa ssp. oleosa*, a total of out 203 of the original 387, an occupancy rate of about 52%. The block was up 16 plants from last assessment. Some of the *E. occidentalis* are 2 meters tall and average 1 meter. The other species are generally mush shorted and average around 0.5 meters. This windbreak only received minimal weed control prior to the first planting but is on the edge of a pivot irrigator and may have received some benefit from that.

Windbreak 7 now has 12 *E. cladocalyx*, 31 *E. polybractea*, 22 *E. petiolaris* and 19 *E. porosa*, a total of out 84 of the original 438, an occupancy rate of about 19%. This block was also up 16 plants from last assessment. Some of the *E. cladocalyx* and *E. petiolaris* are 1.3 meters tall and average 0.3 meters. The other species are generally much shorted and average around 0.5 meters. This windbreak only received minimal weed control prior to the first planting and continued to have a higher weed load than the other windbreaks.

Figure A.32: 1.5-year-old windbreak of *E. loxophleba* at Tintinara 24/2/2018

Geranium - assessment by Ian Filmer and Craig Neumann - 24/2/18
Lat. -35.497338 Long. 140.181597

Figure A.33: Finish of planting at Geranium 22/6/2016

First Year Assessment – 15/2/17

This site was also identified and prepared by Wayne Brown of Environments by Design. Wayne was carrying out a revegetation project on the site and consented to us planting a block within that project. Wayne sprayed, ripped and marked out the site. Which is located on the top of a big sand dune, on a slope, exposed to prevailing westerly winds. Pre-planting weed control was good and the rip lines evident but not too deep on the exposed site. The lines running north south across the side of the dune. The dune didn't have much vegetation at planting with nothing more than 3 or 4 centimetres high to compete with the seedlings.

When the site was assessed in February 2017 it had some veldt grass, skeleton weed and mature rye corn plants; none of which appeared dense enough to compete seriously with the trees. That vegetation cover seemed to provide good protection from the wind and there was no evidence of any soil erosion across the site.

The rip lines had not left gutters to any depth and it was difficult to identify the tree lines without first finding the young trees. The site had a very good overall survival rate: with 767 out of the 938 seedlings surviving, a 82 % survival rate. *E. loxophleba*, *E. petiolaris*, *E. occidentalis* (both provenances), *E. oleosa ssp. oleosa* and *E. horistes*, all had over 80 % survival rates. Both *E. cladocalyx* provenances were more than satisfactory, with survival rates around 80 %. So, *E. porosa* with survival rates around 45 % was a little disappointing. The surviving trees mostly appear to be healthy and should grow on. It is decided this site didn't need any replants.

Second Year Assessment – 24/2/18

Of the original 938 seedlings planted, 774 were alive and growing strongly at the time of assessment, with a survival rate of around 83%. The increased numbers were due to the observers being able to locate the trees after an extra year's growth. Tiny thin leaved individuals previously obscured by the dry grasses were more easily seen. While other blocks declined a little the counts in many of the blocks increased, more than compensating for any losses. Weed competition over the past growing season had increased and the veldt grass may be holding back some of the smaller trees. The rip lines were no longer evident at this site and it was still difficult to identify some of the lines of smaller trees without first finding a few trees.

Block 1 has 66, *E. polybractea* averaging around 0.3 meters high with some around 0.5 meters. Originally this block was planted out with 96 seedlings, giving it a 67% survival rate and 3 extra plants on the previous year's count. The remaining plants are all healthy if small and a little better than the *E. porosa* block.

Block 2 has 81, *E. horistes* averaging around 0.3 meters high with some around 0.5 meters. Originally this block was planted out with 96 seedlings, giving it a 84% survival rate and 2 extra plants on the previous year's count. This is the slowest of the mallee species and in relative terms the surviving *E. horistes* are all large and healthy.

Block 3 has 101, *E. oleosa ssp. oleosa* averaging around 0.5 meters high with some around 1 meter. Originally this block was planted out with 106 seedlings giving it a 95% survival rate and 2 extra plants on the previous year's count. An excellent block both in terms of survival, health and growth.

Block 4 has 33, *E. porosa* averaging around 0.4 meters high with some around 0.6 meters. Originally this block was planted out with 64 seedlings, giving it a 52% survival rate and 4 extra plants on the previous year's count. The *E. porosa* were the worst performers amongst the mallees here, still quite small with the lowest survival rate.

Block 5 has 81, *E. loxophleba ssp. lissophloia* averaging around 0.8 meters high with some around 1.2 meters. Originally this block was planted out with 96 seedlings, giving it a 84% survival rate and no change to the previous year's count. Another excellent block considering the species and the age of the plants.

Block 6 has 94, *E. petiolaris* averaging around 0.9 meters high with some around 1.2 meters. Originally this block was planted out with 96 seedlings, giving it a 98% occupancy rate and no change to the previous year's count. The remaining plants all appear quite healthy, big and strong. The loss of only 2 trees since planting is remarkable.

Block 7 has 92, *E. occidentalis* [Gibson] averaging around 1. 4 meters high with some around 1.8 meters. Originally this block was planted out with 96 seedlings, giving it a 96% survival rate and 2 less plants than the previous year's count. The remaining plants all appeared quite robust, big and healthy at the time of assessment.

Block 8 now has 85, *E. occidentalis* [Jerdacuttup] averaging around 1.2 meters high with some around 2 meters. Originally this block was planted out with 96 seedlings, giving it a 89% survival rate and no change to the previous year's count. The remaining plants all appeared quite robust, big and healthy at the time of assessment.

Block 9 has 69, *E. cladocalyx* [Bundaleer] averaging around 0.4 meters high with some around 1.4 meters. Originally this block was planted out with 96 seedlings, giving it a 72% survival rate and 2 more plants than the previous year's count. Quite a lot of the plants in this block are smaller than would be expected.

Block 10 has 72, *E. cladocalyx* [Kersbrook] averaging around 0.4 meters high with some around 1.2 meters. Originally this block was planted out with 96 seedlings, giving it a 75% survival rate and 3 less plants than the previous year's count. Quite a lot of the plants in this block are smaller than would be expected.

Figure A.34: 1.5-year-old plantation at Geranium 24/2/2018

Meningie East 2 - assessment by Ian Filmer and Craig Neumann - 28/2/18
Lat. -35.772283 Long. 139.498317

Figure A.35: 6-month-old plantation at Meningie East 2 24/2/2018

First Year Assessment – 24/2/17

The landholder had prepared a new site following mixed results at his first site, Meningie East 1, planted 2014 and 2015.

This site is directly behind homestead area, some 400 metres away, along a fence line aligned north to south, over a sandy rise. The northern end of the 3-row shelter belt is located at the southern end of an established woodlot, some 10 years old. 4 of the new tree lines run into the existing wood lot.

Approximately 984 seedlings were planted into the 3 rows, each row approximately 250 metres in length. This equated to a Very close seedling spacing of approximately.75 metres. The landholder wanted to try and ensure a reasonable density after any anticipated losses. Unfortunately, birds, probably cockatoos, had pulled up many of the new seedlings. How many were lost to the birds is impossible to know, but it is not unknown for birds, particularly cockatoos, to decimate plantings. In any case, losses from one reason or another have been very high.

The count was difficult due to 2 factors: -(1) there was no planting plan, and (2) There was a dense cover of weeds, mostly a thick wireweed mat, but also some veldt and annual grasses. As near as could determine there were approximately 222 trees surviving from the total of 984 planted. A survival rate of only 22.5%. and a disappointment for the landholder at the time.

Poor weed control and lack of vermin control (birds) appear to be the most likely reasons for the poor establishment rate. The 4 tree lines in the established wood lot contain approximately 37 seedlings. The survival of these was dependant on the following season getting exceptionally good growing conditions to overcome the competition from the existing trees.

It was suggested to the landholder that that there are a couple of things he could do if he wanted to replant and fill in gaps. Weed control could include the use of Treflan to improve wire weed control. To deter birds, rye corn seed could be broadcast to enable a standing crop that may discourage them from landing. The seed would need to be broadcast early to ensure a

standing crop by July / August when planting seedlings. Control of weeds may then be more difficult, although a spot spray of 1 metre diameter would reduce weeds near replants and may not jeopardise the bird control measure.

The only other way to deter malicious bird attacks of this kind is the use of tree guards. When an entire trial site in the South East was lost to corellas the use of tree guards may have prevented the loss of seedlings the following year. It may also be that the plantings in the second year just didn't peak the bird's curiosity. In any event tree guards are an expensive option and tall stubble may prove just as effective against birds as it has been suggested that the birds don't like to forage in places that obscure their view of approaching danger.

Second Year Assessment – 28/2/18

The landholder didn't replant this site in 2017, opting instead to plant at a new site and see how this site progressed without any extra planting, given the original close planting design. Of the original 984 seedlings places, 207 were still occupied and most of the plants outside the existing tree plantation to the north looked quite healthy at the time of assessment, with an occupancy rate of around 21%. It also appears that the majority of the 15 plants lost from the previous count were in the 4 short rows near the existing trees. It was suspected that competition from those advanced trees had wiped out almost everything planted in those lines.

Competition over the past growing season had declined in the rest of the site, with far less summer weeds, particularly wireweed, present.

This is another site that's impossible to assess like most of the others. The design, and species have been intermingled to such an extent at planting that each individual plant needed to be located, identified and ticked off against its species. Individual provenances were also not able to be determined. Most plants are under a meter tall and while most looked healthy at the time of assessment, a number were struggling, particularly near the existing trees. *E. petiolaris* stands out with a little under 50% survival and has done quite well at many other sites. But, whether this result is because of the plants attributes, lack of attractiveness to marauding corellas or luck is hard to determine.

E. cladocalyx has continued to persist on the site with 45 individuals present out of 240 planted. A 19% survival rate.

E. occidentalis has continued to persist on the site with 55 individuals present out of 240 planted. A 23% survival rate.

E. petiolaris has continued to persist on the site with 58 individuals present out of 120 planted. A 48% survival rate.

E. polybractea has continued to persist on the site with 27 individuals present out of 120 planted. A 23% survival rate.

E. porosa has continued to persist on the site with 15 individuals present out of 64 planted. A 23% survival rate.

E. cneorfolia has continued to persist on the site with 7 individuals present out of 120 planted. A 6% survival rate.

E. camaldulensis x grandis None of the 80 Saltgrow clones appear to have survived.

Figure A.36: 1.5-year-old *E. petiolaris* at Meningie East 2 28/2/2018

Smaller Sites Established in 2016

Langhorne Creek - assessment by Ian Filmer and Craig Neumann - 11/4/18

Lat. -35.327752 Long. 139.115113

Figure A.37: 1.5-year-old Saltgrow *E. camaldulensis x grandis* at Langhorne Creek 11/4/2018

First Year Assessment – 9/5/17

This is one of four smaller sites chosen in the Langhorne Creek area to examine the use of some of the demonstration species usefulness in slightly saline areas. The site is a square block bounded on 2 sides (north and east) by salty ponding's and scalds. The southern side is a cropping paddock and to the west is an established tree line and currently unwatered vine yard. The seedlings were planted into well-defined rip lines that ran parallel to the existing tree line on the boundary and had been lightly compacted down again prior to planting. There were 3 varieties of eucalypts planted at this site: *E. cneorifolia*, *E. occidentalis* [Gibson] and Saltgrow *E. camaldulensis x grandis*

At this site *E. occidentalis* which was expected to be the most salt tolerant was planted closest to the salt scalded areas. The Saltgrow *E. camaldulensis x grandis* was planted the next closest to the salt scald and *E. cneorifolia* was planted the furthest from the salt scald. Although the *E. cneorifolia* should have benefited from being furthest from the salt scald area, they had competition from an established shelter belt on property boundary consisting of two rows of trees.

The Saltgrow and *E. occidentalis* saplings were all healthy and had put on some impressive growth considering they were less than a year old. The Saltgrow saplings were up to 2.0 metres in height and averaged about 1.3 metres. The *E. occidentalis* saplings were up to 1.5 metres in height and average about 1.2 metres. The *E. cneorifolia* saplings were up to 0.3 metres in height and though many were smaller, most were quite healthy. Being smaller and slower growing makes *E. cneorifolia* more vulnerable to vermin and drying conditions. So, while no further plantings were warranted it was possible that *E. cneorifolia* numbers could decline

Overall 262 trees survived out of the 356 planted, a survival rate of 74%. *E. cneorifolia* have a survival rate of 62% with 79 out of 128 seedlings surviving to assessment. *E. occidentalis* had a survival rate of 79%. and 101 out of 128 seedlings surviving. The Saltgrow clones did best with a survival rate of 82% and 82 out of 100 seedlings surviving.

Second Year Assessment – 11/4/18

The rows closest to the existing tree line declined in numbers a little further from the previous year's counts and there was an obvious detrimental effect on the rows on that side. This had the biggest effect on the size and numbers of *E. cneorifolia* though some *E. occidentalis* also showed some detrimental effects on the northern ends of the first few rows. Of the 22 trees to have died in the past growing season all but 1 were *E. cneorifolia*. Away from that area the trees continued to grow with great vigour, with few fatalities or detrimental effects from growing in such proximity to the salt scalds could be seen. Weed competition within the block doesn't appear to be having much detrimental effect either.

Overall 240 trees survived out of the 356 planted, a survival rate of 67%.

E. cneorifolia have a survival rate of 45% with 58 out of 128 seedlings surviving to assessment. The tallest of these is around 0.5 meters tall and they average around 0.3 meters

E. occidentalis had a survival rate of 79%. and 101 out of 128 seedlings surviving. The tallest of these is around 4 meters tall and they average around 3 meters

The Saltgrow *E. camaldulensis x grandis* did best with a survival rate of 81% and 81 out of 100 seedlings surviving. The tallest of these is around 6 meters tall and they average around 3.5 meters

Figure A.38: Visible impact of established tree line on growth of 1.5-year-old *E. occidentalis* at Langhorne Creek 11/4/2018

Lake Breeze - assessment by Ian Filmer and Craig Neumann - 11/4/18
Lat. -35.327752 Long. 139.115113

Figure A.39: 1.5-year-old Saltgrow *E. camaldulensis x grandis* at Lake Breeze 11/4/2018

First Year Assessment – 9/5/17

This is one of four smaller sites chosen in the Langhorne Creek area to examine the use of some of the demonstration species usefulness in slightly saline areas. The plantings here consist of 2 small blocks. The first block is located at -35.320439, 139.032692, adjacent to a house and was planted with 4 rows of *E. occidentalis* [Gibson]. The block was flat, and the 4 rows ripped approximately north to south. The tree rows had a dense covering of the weed Fat Hen (Chenopodium album) 1.0 to 1.5 metres in height at the time of assessment. Many of the trees had been pegged, and some weed control had been carried out around most of the trees because there was a metre strip clear of weeds along the rows where the trees were planted. The soil is an alluvial sandy loam with little evidence of salinity. Establishment had been quite good with 89 of the 128 seedlings surviving, a 70% survival rate. Growth had varied, with the trees ranging from 0.3 to 0.9 meters tall but all looked quite healthy.

The second block is located at -35.321275, 139.026576, adjacent to a track on a surveyed road reserve and was planted with 3 rows of Saltgrow *E. camaldulensis x grandis*. The block was flat, and the 4 rows ripped approximately north to south around a row of metre high Athel Pine (Tamarix aphylla) stumps. These have probably been poisoned though some regrowth was sprouting on a few. There is some weed competition apart from the Athel Pine, mostly melon and grass. The surviving trees were all healthy and the establishment rate was again quite good, with 62 of the 100 seedlings surviving, a 62% survival rate. Growth was varied again, with the trees ranging from 0.6 to 1.5 meters tall but all.

Overall 151 trees survived out of the 228 planted, a survival rate of 66%.

Second Year Assessment – 11/4/18

Overall 137 trees survived out of the 228 planted, a survival rate of 60%. There was little competition within the *E. occidentalis* block apart from some low grasses and forbs. The surviving trees all look healthy and have put on good amounts of growth. The Saltgrow block also contains healthy trees that have grown impressively in less than 2 years. However, it was noted that the weed burden was greater in this block. Mainly grasses and low annuals, the Athel Pine appear to have been successfully killed off. It was also noted that the outside rows closest to the adjacent vineyard were taller than the other rows, possibly because of extra water

E. occidentalis block had a survival rate of 61%, with 78. out of the 128 seedlings surviving. The tallest of these was around 2.5 meters tall and they averaged around 1.8 meters.

The Saltgrow *E. camaldulensis x grandis* block had a survival rate of 59% with 59 out of 100 seedlings surviving. The tallest of these is around 3 meters tall and they average around 1.5 meters.

Figure A.40: 1.5-year-old *E. occidentalis* at Lake Breeze 11/4/2018

West Creek Station - assessment by Ian Filmer and Craig Neumann - 11/4/18

Lat. -35.331102 Long. 139.143936

Figure A.41: View showing fenced off creek line with samphire and existing trees

First Year Assessment – 9/5/17

This is one of four smaller sites chosen in the Langhorne Creek area to examine the use of some of the demonstration species usefulness in slightly saline areas. The trees had been planted in ripped and lightly compacted lines along both sides of a creek that flows through a saline area prior to emptying into Boggy Lake. The soil beside the creek is a heavy orange coloured soil which sets extremely hard when it dries. Most of the vegetation growing along the creek line is samphire and salt tolerant sedges and grasses. Previously the landholder had attempted to grow E camaldulensis along the creek and while a few small examples remain none could be said to have flourished.

The site was planted with two salt tolerant varieties, the Saltgrow *E. camaldulensis x grandis* clone and *E. occidentalis* [Gibson]. The seedlings appeared as if the two species may have been planted alternately but there were not enough surviving trees to obtain a good understanding of any such pattern. There had also been a very heavy flood late in spring which may have physically washed away some seedlings. Birds may have also played a part, as may have the weed competition, although some weed control had been carried out.

Overall 63 trees survived out of the 228 planted, a survival rate of 28%. Only 12 out of 100 *E. camaldulensis x grandis* survived at a survival rate of 12%. *E. occidentalis* faired a little better with 51 out of 128 planted, a survival rate of 40%. Growth had been slow, with most trees ranging from 30 cm to 40cm and all looked quite healthy. It was decided to replant, at least with *E. occidentalis* and possibly Salt grow plants if they became available

Second Year Assessment – 11/4/18

The site just appears too hard and saline for trees to establish, let alone thrive. Numbers at the site have obviously gone backwards and only a few (32) *E. occidentalis*, out of the 228 trees originally planted remain, an occupancy rate of only 14% despite replanting in 2017 with a further 128 *E. occidentalis*.

E. occidentalis had an occupancy rate of 25%. with 32 out of 128 seedlings spaces occupied. The tallest of these is around 1 meters tall and they only average around 0.4 meters

The Saltgrow *E. camaldulensis x grandis* none appeared to have survived from the initial planting and no replants were available in 2017.

Figure A.42: 1.5-year-old *E. occidentalis* survivor at West Creek Station 11/4/2018

Angus Plains - assessment by Ian Filmer and Craig Neumann - 11/4/18
Lat. -35.341731 Long. 138.984599

Figure A.43: In row summer weed competition (wire weed) 9/5/2017

First Year Assessment – 9/5/17

This is one of four smaller sites chosen in the Langhorne Creek area to examine the use of some of the demonstration species usefulness in slightly saline areas. The trees were planted in a block next to the wineries access road and between a house and an older environmental planting. The soil is a heavy clay loam that becomes hard and cracks when dry. This site is a certified organic property and the site was cultivated and ripped prior to planting, with the rows running north south. As an organic property no chemical weed control was possible, and although the seedlings were not planted till the first week in August, late rains and a large seed bank in the soil contributed to a dense mass of weeds. The most obvious being wire weed. Prior to assessment, the block had been slashed between the rows making it easy to negotiate. Despite this the tree rows still had a dense covering of wire weed, probably 30 cm in height, making the surviving *E. cneorifolia* seedlings difficult to locate. The seedlings that could be located had been pegged only 2 or 3 more were found during the assessment. Disappointingly establishment had been poor. Only 12 *E. cneorifolia* survived out of the 128 planted (a 9% survival rate), No Saltgrow *E. camaldulensis x grandis* survived out of the 100 planted but on a slightly better note 52 of the 128 *E. occidentalis* [Gibson] planted on the site survived.

Despite the heavy weed competition, it was not clear if any other factors added to the poor survival rates at this site. On initial inspection it was felt the site would prove a good option for the three species that were planted, and the low survival rates, given good rainfall during establishment, were quite surprised at. As in most locations *E. occidentalis* was the standout performer. Against the weed competition and whatever else is going on at this site, it still managed to achieve a survival rate of 41%.

Some leftover *E. occidentalis* had been planted a little further south, adjacent to paddock fence line west side, and a stand of Arundo Donax on the east side. Some of these trees did quite well, growing up to 0.5 meters high, while others were only 0.2 to0.3 meters high. It's difficult to explain the improved survival and stronger growth amongst the dense weed mass of couch grass and other species in this area. It may be due to some extra moisture from the irrigated *Arundo donax* site which is shallow

rooted. However, the survival rates of *E. occidentalis* here have created a puzzle as to why there was such poor results on the main site, not that far away, and questioning if weed competition was the only factor causing the poor survival rates on the main block.

Overall 64 trees survived out of the 356 planted, a survival rate of only 18%.

Figure A.44: In row weed control and replanting July 2017

Second Year Assessment – 11/4/18

Overall 240 trees survived out of the 356 planted, a survival rate of 67%. This was a great improvement on the previous season and largely due to the increased success rate of replanted *E. occidentalis* seedlings, these were difficult to distinguish from those a year older. The site was only replanted with *E. cneorifolia* and *E. occidentalis* [Gibson], as no Saltgrow *E. camaldulensis x grandis* was available. To combat weeds the soil was scalped away along the rows, between the existing plants to create wide furrows that also helped to collect water. This season the block was watered several times during the driest parts of the summer.

E. cneorifolia have an occupancy rate of 16% with 20 out of 128 seedlings seedling spaces occupied. The tallest of these is around 0.5 meters tall and they average around 0.2 meters

E. occidentalis had a survival rate of 77%. and 98 out of 128 seedlings surviving. The tallest of these is around 1 meters tall and they average around 0.8 meters. 24 of these are growing next to the Arundo Donax in dense weed competition but have managed to grow at a similar rate to those planted in the main block.

Sites Established in 2017

Coonalpyn - assessment by Ian Filmer and Craig Neumann - 27/2/18

Lat. -35.722050 Long. 139.997485

Figure A.45: 6-month-old *E. loxophleba* plants in rows at Coonalpyn 28/2/2017

First Year Assessment – 28/2/18

The landholder had prepared a new site in a wide roadside strip running 1.2 km along the north side of Walter Road, from Pascoe Road. The site is a km due south of the homestead area and fenced off from the paddocks on both sides of the road. Weed control was carried out several weeks prior to planting and 3 rows ripped parallel to the road about 3 meters apart. The soil at the site is mainly clay with a small sandy rise about 400 meters from the corner of Pascoe Road. The site was very wet at the time of planting and of the rows had ponded water in the rip lines. Approximately 1216 seedlings were planted into the 3 rows, each row approximately 1.2 kms in length. The row closest to the road was planted with different species (shorter mallees) to the 2 paddock side rows (taller species), apart from the sandy rise, over which all 3 rows were planted with *E. cladocalyx*. This was done to keep the *E. cladocalyx* out of the worst of any frost that might affect the site.

At the time of assessment approximately 940 trees had survived from the total of 1216 planted. An overall survival rate of 77%. The survival rate was a pleasant surprise as the site looked quite dry at the time of assessment with large cracks in the clay soil and dry knee-high thistles. The trees on the other hand all looked healthy, with many around 0.5 meter tall. The *E. cladocalyx* appeared to suffer most losses over the sandy rise, throwing doubt on the notion that getting them out of the frost zone wound benefit their survival. It is thought the sandy rise may have dried out faster than the clay ground contributing to the mortality rates. Frost has been noted as less intense on clay soils at another site, though that site was quite flat. The low survival rate of *E. petiolaris* is also curious as it is a good performer on most site it's been included in.

The 2 Inner rows (the *E. cladocalyx* numbers also include those in the road side row)

E. loxophleba ssp lissophloia had 64 individuals present out of approximately 64 planted. A 100% survival rate.

E. polybractea had 118 individuals present out of approximately 128 planted. A 92% survival rate.

E. occidentalis [Jerdacuttup] had 105 individuals present out of approximately 128 planted. A 82% survival rate.

E. cladocalyx [Kersbrook] had 86 individuals present out of approximately 128 planted. A 67% survival rate.

E. cladocalyx [Bundaleer] had 72 individuals present out of approximately 128 planted. A 56% survival rate.

E. porosa had 103 individuals present out of approximately 128 planted. A 81% survival rate.

E. occidentalis [Gibson] had 125 individuals present out of approximately 128 planted. A 98% survival rate.

E. petiolaris had 47 individuals present out of approximately 128 planted. A 37% survival rate.

The roadside row

E. oleosa ssp. oleosa had 41 individuals present out of approximately 64 planted. A 64% survival rate.

E. horistes had 128 individuals present out of approximately 128 planted. A 100% survival rate.

E. cneorfolia had 51 individuals present out of approximately 64 planted. A 80% survival rate.

Figure A.46: a 6-month-old *E. loxophleba* plant at Coonalpyn 28/2/2017

Jabuk - assessment by Ian Filmer and Craig Neumann - 24/2/18
Lat. -35.510908 Long. 140.057583

Figure A.47: A row of 6-month-old *E. cladocalyx* plants at Jabuk 24/2/2017

First Year Assessment – 24/2/18

This site was also identified and prepared by Wayne Brown of Environments by Design. Wayne was carrying out a revegetation project on the site and consented to us planting a block within that project. Wayne sprayed, ripped, marked out and fenced the site. The site runs south off Ladara Bore Road, up an old fence line that rises over a rolling dune. A few existing trees exist along the old broken-down fence line that runs up the centre of the fenced block. The site has 6 rows ripped from end to end with gaps left around the existing trees. Blocks 1 to 8 were planted at 3-meter spacings while blocks 9 to 11 were planted at 2-meter spacings.

When the site was assessed some skeleton weed and dry summer weeds were evident, none of which appeared dense enough to compete seriously with the trees. The surviving trees mostly appeared to be healthy and should have grown on given some rainfall.

At the time of assessment approximately 437 trees had survived from the total of 982 planted. An overall survival rate of 45%. The site was quite dry at the time of assessment, but the remaining trees mostly looked healthy, with many around 0.5 meter tall.

Block 1 had *E. occidentalis* [Gibson] with 29 individuals present out of 100 planted. A 29% survival rate.

Block 2 had *E. petiolaris* with 80 individuals present out of 128 planted. A 63% survival rate.

Block 3 had *E. cladocalyx* [Kersbrook] with 70 individuals present out of 128 planted. A 55% survival rate.

Block 4 had *E. cladocalyx* [Bundaleer] with 54 individuals present out of 128 planted. A 42% survival rate.

Block 5 had *E. occidentalis* [Gibson] with 11 individuals present out of 28 planted. A 39% survival rate.

Block 6 had *E. porosa* with 20 individuals present out of 64 planted. A 31% survival rate.

Block 7 had *E. occidentalis* [Jerdacuttup] with 28 individuals present out of 64 planted. A 44% survival rate.

Block 8 had *E. polybractea* with 49 individuals present out of 128 planted. A 38% survival rate.

Block 9 had *E. horistes* with 44 individuals present out of 64 planted. A 69% survival rate.

Block 10 had *E. loxophleba* ssp lissophloia with 12 individuals present out of 80 planted. A 15% survival rate.

Block 11 had *E. oleosa ssp. oleosa* with 40 individuals present out of 70 planted. A 57% survival rate.

Figure A.48: A 6-month-old *E. porosa* plant at Jabuk 24/2/2017

Meningie East 3 - assessment by Ian Filmer and Craig Neumann - 28/2/18
Lat. -35.766262 Long. 139.489825

Figure A.49: 6-month-old *E. petiolaris* plants in rows at Meningie East 3 28/2/2017

First Year Assessment – 28/2/18

The landholder had prepared a new site following mixed results at his other sites, planted in 2014 and 2016. The new site is due west of the homestead area, some 800 metres away, along what appears to be an old sandy roadway aligned north to south. The area was well fenced and weed control was carried out several weeks prior to planting. Approximately 1300 seedlings were planted into the 5 rows, each row approximately 4000 metres in length. The rows were effectively ripped leaving a shallow furrow to plant into.

The count was difficult due to 2 factors: -(1) there was no planting plan, and (2) There was a patchy cover of weeds, mostly melons, but also some veldt and annual grasses. As near as could determine there were approximately 513 trees surviving from the total of 1300 planted. A survival rate of 40%.

This is another site that's impossible to assess like many of the others, though individual species were planted in continuous lines along rows. Each parallel row contained different plants and the plants changed occasionally along each row. Individual provenances were also not able to be determined. Most plants are under a meter tall and most looked healthy at the time of assessment.

E. polybractea had 69 individuals present out of approximately 128 planted. A 54% survival rate.

E. occidentalis had 114 individuals present out of approximately 256 planted. A 45% survival rate.

E. loxophleba ssp lissophloia had 61 individuals present out of approximately 128 planted. A 48% survival rate.

E. porosa had 110 individuals present out of approximately 256 planted. A 43% survival rate.

E. cneorfolia had 55 individuals present out of approximately 128 planted. A 43% survival rate.

E. petiolaris had 47 individuals present out of approximately 128 planted. A 37% survival rate.

E. cladocalyx had 67 individuals present out of approximately 256 planted. A 26% survival rate.

Figure A.50: 6-month-old *E. petiolaris* plants in rows at Meningie East 3 28/2/2017

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