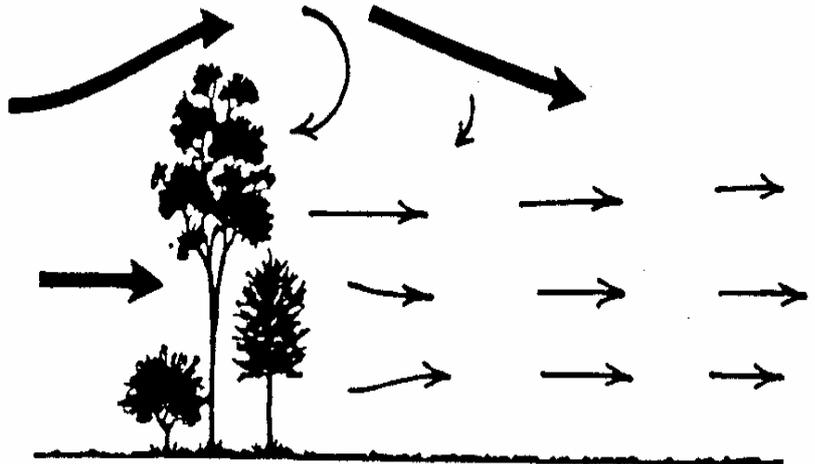


Windbreaks for the Upper South East

Introduction

Well-designed windbreaks can benefit every farm. They can be used to:

- protect crops and pastures from drying or damaging winds,
- protect livestock from cold winds,
- help to prevent soil erosion,
- protect living and working areas from strong winds,
- provide posts, firewood, timber, fodder, honey and other products,
- provide habitat for wildlife,
- act as firebreaks by slowing the rate of fire spread.



A windbreak of trees and shrubs works by filtering and breaking the force of the wind. Permeable windbreaks that let some wind pass through are most suitable. The slight movement of air through the windbreak forms a cushion of slow-moving air on both sides of the windbreak (see diagram).

Location

For best results, plant windbreaks at right angles to the winds from which protection is needed. These are not necessarily the prevailing winds. Crops are often worst affected by hot, drying winds from the north. Livestock are at greatest risk from cold winds and rain which come from the south or south-west.

To keep costs down, establish windbreaks against existing fence lines where possible, but consider the best location to match land capability boundaries. If practical, a good location for a windbreak is high in the landscape (e.g. along a ridge line) as a greater area in the lee is protected from wind. Take care to avoid planting close to windmills and do not plant under power lines.

Height

The windbreak height determines the size of the sheltered area. The taller the trees in the windbreak, the greater the area it protects. As a guide windbreaks are most effective for a distance of 12 to 15 times the height of the tallest trees, and protection of crops has been observed up to 25 times the height.

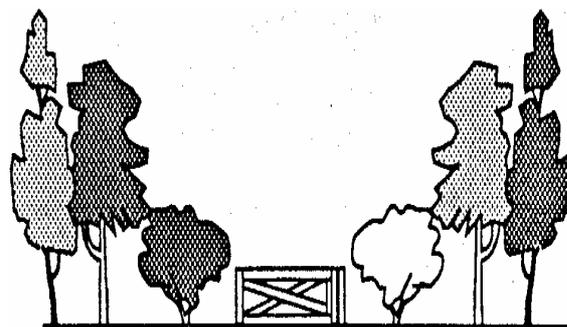
Length and gaps

Wind is deflected around the ends of windbreaks. The deflected wind can accelerate around the end of the belt causing localised crop damage. For this reason windbreaks should be long continuous lines of trees and shrubs to minimise any end effects. Gaps within the windbreak

can have the same effect so where these are essential, for example where a gate is needed, the gap should be angled at 45° to prevent the wind from accelerating through the space.



Angle the sides of the windbreak to minimise effect of gap.



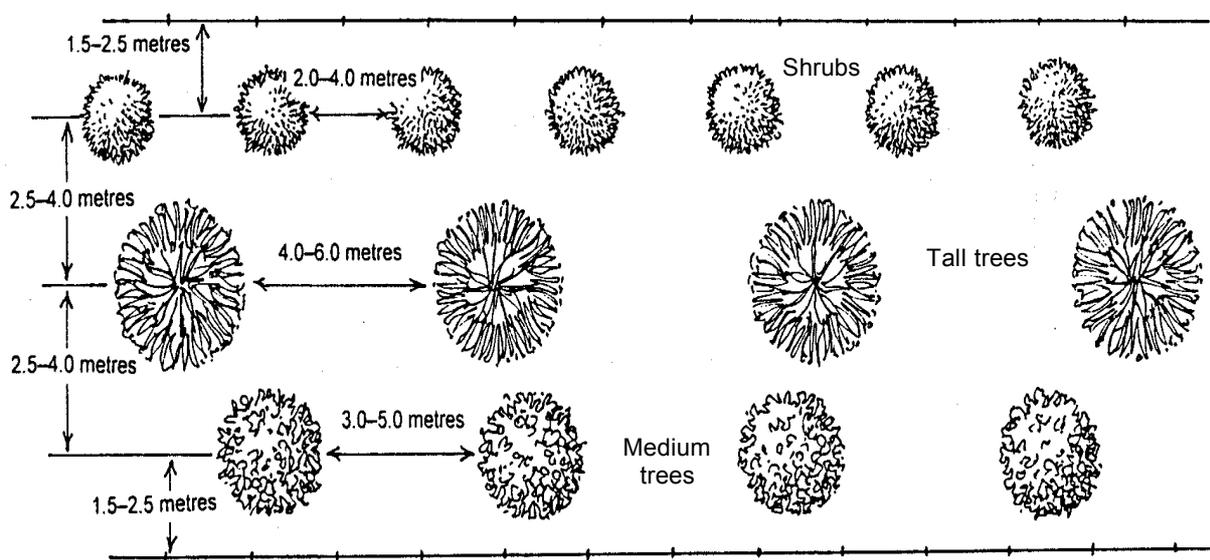
Alternatively a few short trees or shrubs can be planted on either side of the gap.

Number of rows

Windbreaks incorporating both trees and shrubs in three to six rows are effective for most farm situations. Multiple-row windbreaks are less affected by gaps caused by missing trees than single row windbreaks. Where land is limited, a staggered two-row design of tall trees and lower shrubs should be used for the best shelter effect. Single-row windbreaks should only be used where land is so valuable that only a small amount of space can be spared for tree planting - for example, on high-value horticultural land. When only one row of trees can be planted, try to use trees that have foliage from the ground up if possible. Belts, with trees only, can be established for wood production, but they may be less effective in providing low shelter for animals.

Row and plant spacing

The distance between plants in windbreaks is based on the size of suitable plants for the local climate and soils (see Appendix 1). It is also important to allow access for tractors and machinery for weed control and maintenance. Use the spacings in the diagram as a guide.



Tree spacing guide showing layout dimensions for a three row windbreak. These may change depending on species chosen or if more rows are added.

Establishment techniques

Direct seeding is a method using a specialised machine to sow a mixture of native seed straight into the ground. It is very quick, low-labour and low-cost. Recommended for all soils except heavy cracking clays where tubestock seedlings are preferred. Local nurseries and contractors specialising in farm trees include:

- SE Direct Seeding Service (Josie and Jamie Jackson), Willalooka, 8757 8276
- Eucaleuca Native Services (Ralph Scheel), Thomsons Rd, Naracoorte, 8762 2061
- Reedy Creek Nursery (wholesale), Mike Quarmby, Princes Hwy, near Kingston, 8768 7220
- State Flora, Murray Bridge wholesale outlet (Bremer Road) , 8539 2100.
- Greening Australia (statewide), 8372 0100
- Trees For Life (statewide), 8406 0500 (seedlings grown by volunteers are available to members at minimum administrative cost through the 'Tree Scheme').

Site preparation

Weed control. Many areas in the Upper South East where landholders wish to establish windbreaks carry pastures and weeds that compete strongly with new seedlings for moisture and light. To be successful with revegetation, you must get rid of *all* existing pasture and weeds well in advance of planting seedlings or direct seeding. Particular attention should be given to perennials such as sorrel, veldt grass, primrose, couch grass, kikuyu, lucerne, bracken and phalaris. This is usually achieved by spraying out the site with broad-spectrum knockdown herbicides such as glyphosate several times before planting or seeding.

Aim to start weed control 12 months *before* planting. Start in late winter or early spring and again in summer (depending on weeds present). Spray next after the following break of season and again just prior to planting if a new flush of germination has occurred. Residual herbicides (eg Oust[®], Ally[®], Goal[®], simazine) can be used for more effective weed control but they can harm seedlings if not used appropriately (note that some are not registered for use with natives).

Weed control should be carried out again in the year after planting/seeding. This can be done with shielded sprays but special over-spray mixtures can also be used.

Seek advice from revegetation consultants or contractors prior to using residual chemicals or over-sprays.

Ripping to allow better root penetration should be considered if limestone or a clay hardpan is within 10 to 15cm of the soil surface. Rip-lines in clay soils can tend to open up later in summer so only rip if absolutely necessary. For heavy soils, rip in summer or early autumn when soils are dry so that the ripper shatters the soil rather than slices through it. Slicing glazes the soil surface and prevents lateral root penetration. On the other hand, rip non-wetting sands (if needed for planting tools) only if moist for best results.

Ripping should be at least 50cm deep if possible. Use a concrete roller (at least 60 cm wide) over the rip line afterwards to help crush rocks, remove air pockets and settle the soil. Avoid rolling with narrow tractor tyres as this can cause compaction and guttering. Where planting or spraying machinery is to be used, any large rock pieces brought to the surface by ripping should be removed if they cannot be crushed.

Mounding of the soil to 50cm high and 50cm wide can help plant survival in waterlogged and saline areas. Bear in mind though that the surface of mounds will dry out quicker in summer so this technique should only be used in very wet areas. When mounding in long rows, consider leaving breaks every now and then to allow for natural water flows.

Protection

It is usually best to keep windbreaks permanently fenced to prevent gaps being created by livestock browsing on the lower limbs of established trees and shrubs. Fencing may not be required in situations of continuous cropping; in timber belts with trees only, which are not likely to suffer bark damage from stock; or in some alley farming situations with fodder shrubs where stock grazing of the windbreak is expected.

Financial assistance

Financial assistance maybe available through the Natural Heritage Trust Envirofund. Contact South East Natural Resource Management Board, Community Landcare Coordinator (8724 6033) for details.

You maybe able to claim a tax deduction in the year you incur capital expenditure on landcare measures for land in Australia provided you incur it "erecting fences to keep out livestock or vermin from areas affected by land degradation to prevent or limit further damage and assist in reclaiming the areas" or "erecting fences to separate different land classes in accordance with an approved land management plan" (ATO, Information for Primary Producers). A recoupment of the deductible expenditure is assessable under Subdivision 20-A of the *Income Tax Assessment Act 1997* (ITAA 1997). Contact the Australian Taxation Office or your taxation adviser for an information pack for primary producers.

Further information:

PIRSA Rural Solutions Environmental Consultants:
Struan Office 8762 9100.

Useful references:

- *Windbreaks*, Steven Burke, 1998, Inkata Press, Port Melbourne, Vic.
- *Direct Seeding of Trees and Shrubs*, Greg Dalton, 1993, Primary Industries (SA), Government Printer Adelaide.
- *What Seed Is That?*, 2003 2nd Edition, Neville Bonney, PO Box 37 Tantanoola SA 5280.
- *Native Trees and Shrubs of South Eastern Australia*, L. Costermans, (1992 revised edition) Weldon Publishing, Sydney. Contains photographs and descriptions.

Last update: February, 2008.

Acknowledgments: Based on a fact sheet originally prepared by Jim Burston.

Agdex: 301/31

Author: Peter Tucker and Zita Stokes, Environmental Consultants, Struan.

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Appendix 1: Species selection

When selecting species for a windbreak firstly consider what your goals are. Apart from shelter, if you wish to enhance wildlife habitat, choose a diverse range of local native species. If you wish the belt to also provide products, you will need to seek specialist advice about species suitable for timber, firewood, pollen for honey, seeds etc. Ultimately the species chosen, whether native or exotic, need to suit the soil type and climatic conditions of the site. The following soil type information and species table will help give an *indication* of some species suitable for windbreaks in the Upper South East.

Soil type is a very important consideration when planting trees. Some species will survive well on waterlogged clays, others will only thrive in well-drained sands. Choosing the wrong species for a soil type can end in poor growth and premature deaths. The table on the following pages shows native plant species which are suitable for windbreaks on eight major soil types found in the Upper South East region (defined here as the areas north of Kingston - Lucindale - Padthaway – Kybybolite up to the Coorong District Council area).

Major soil types (Upper South East)

1. **Heavy clay (grey-black, self mulching)**

A uniform clay profile, being very sticky when wet. The surface soil is self-mulching and the pH is alkaline. In uncultivated areas, gilgai are common (e.g. Wolseley district).

2. **Sand over clay (leached siliceous sands)**

A variable depth of sand over clay, ranging from 10 to 100cm, usually on flats. Soil pH is generally acidic and has a moderate water holding capacity. The upper 10 to 20cm is coloured grey-brown by organic matter.

3. **Red brown earths**

Generally found in Bordertown/Wolseley/Mundulla region, these soils have a brown sandy-loam to loam surface texture, which sets hard when dry. Good water holding capacity. Soil pH is generally neutral to slightly acidic.

4. **Deep sands**

Sandy range country with undulating to rising terrain. Accumulation of organic matter at surface. The sands have a low water-holding capacity, low soil fertility, often non-wetting and the pH is mildly acidic.

5. **Sand or loamy sand over limestone**

Typical of old inland ranges where dune limestone underlies a shallow sandy topsoil. The sand can be grey or brownish to white depending on organic matter.

6. **Loam over limestone**

For example in the Keith/Culburra/Coonalpyn area; these soils are typically shallow, grey or brown in colour, and hard setting when dry. Frequent limestone outcrops and/or free limestone in the topsoil. Soil pH is generally neutral to alkaline.

7. **Red soils (Terra Rossa)**

A red-brown soil (varying from sandy- to clay-loam) overlying limestone. Soil depth is shallow, with frequent limestone outcrops. Soil pH is generally neutral to slightly acidic in the surface but neutral to alkaline above the limestone.

8. **Calcareous coastal sands**

Deep, pale yellow loose coastal sand consisting mainly of fragments of marine shells. The upper 20 to 30cm is coloured grey-brown by organic matter. The soils are generally alkaline and have a low water holding capacity.

TREES AND SHRUBS SUITED TO WINDBREAKS IN THE UPPER SOUTH EAST

Note: this list is only a guide. If you are seeking species local to your particular area, talk to a revegetation consultant. Remember: a windbreak works best if using a mixture of trees *and* shrubs. Do not rely on only trees if they shed lower limbs as they mature. **Height** is that at maturity (range depends on site conditions); **Rainfall** is that for best survival/growth; **Waterlogging tolerance** – more ticks = better survival at sites that become waterlogged. Asterisk * = generally not suited to large-scale direct seeding either due to lack of available seed or problems with germination times. **Soil types** explained in text prior page.

Botanic name	Common name	Form	Height (m)	Rainfall (mm)	Water logging tolerance	Special notes	Soil type suitability							
							1	2	3	4	5	6	7	8
<i>Acacia brachybotrya</i>	Grey Mulga	Medium shrub	1-3	250-500			✓	✓	✓			✓		✓
<i>Acacia calamifolia</i>	Wallowa	Medium shrub	2-4	200-700	✓			✓	✓	✓		✓		
<i>Acacia cupularis</i>	Coastal Umbrella Bush	Small shrub	1-2	350-700	✓	Fast growing		✓	✓		✓	✓	✓	✓
<i>Acacia farinosa</i>	Mealy Wattle	Small shrub	1-2	300-600				✓	✓			✓		
<i>Acacia hakeoides</i>	Hakea Wattle	Medium shrub	1-4	250-500					✓			✓		
<i>Acacia halliana</i>	Hall's Inland Wattle	Small shrub	1-2.5	250-400		Spreads 4-5 m wide			✓			✓	✓	
<i>Acacia leiophylla</i>	Limestone Wattle	Medium shrub	1-2.5	500-800							✓		✓	✓
<i>Acacia mearnsii</i>	Black Wattle	Medium tree	7-10	>600		Padthaway area; fast growing		✓						
<i>Acacia melanoxylon</i>	Blackwood	Medium tree	8-15	>550	✓	Native in southerly areas		✓						
<i>Acacia microcarpa</i>	Manna Wattle	Small shrub	1-3	250-600			✓	✓	✓			✓		
<i>Acacia myrtifolia</i>	Myrtle Wattle	Small shrub	1-2	>500				✓	✓	✓	✓	✓	✓	✓
<i>Acacia paradoxa</i>	Prickly Acacia or Kangaroo Thorn	Medium shrub	2-3	>300		Fast growing; may be invasive; provides good protective habitat for small native birds	✓	✓	✓		✓	✓	✓	✓
<i>Acacia pycnantha</i>	Golden Wattle	Medium tree	4-8	>350		Fast growing; national floral emblem		✓	✓	✓	✓	✓	✓	✓
<i>Acacia rigens</i>	Needle Bush Wattle	Shrub	2-3	200-300					✓			✓	✓	
<i>Acacia rupicola</i>	Rock Wattle	Shrub	1-2.5	300-800				✓	✓		✓	✓	✓	
<i>Adriana klotzschii</i>	Coastal Bitter Bush	Shrub	1-2	>300		Coastal plant					✓			✓
<i>Allocasuarina leuhmannii</i>	Buloke, Bull Oak	Medium-tall tree	7-15	450-650	✓✓✓	Found on clays near Vic border; food source for red-tailed black cockatoo; suckers	✓		✓					
<i>Allocasuarina mackliniana</i>	Macklin's She-oak	Small shrub	1-2	400-600				✓		✓	✓			
<i>Allocasuarina muelleriana</i>	Slaty She-oak	Medium shrub	2-4	350-600				✓		✓	✓			
<i>Allocasuarina paludosa</i>	Scrub / Swamp She-oak	Medium shrub	2-3	>500	✓✓			✓						
<i>Allocasuarina pusilla</i>	Dwarf She-oak	Small shrub	1-1.5	350-750				✓		✓	✓		✓	

Botanic name	Common name	Form	Height (m)	Rainfall (mm)	Water logging tolerance	Special notes	Soil type suitability							
							1	2	3	4	5	6	7	8
<i>Allocasuarina verticillata</i>	Drooping She-oak	Medium tree	5-8	>350	✓	Excellent for firewood		✓	✓		✓	✓	✓	✓
<i>Atriplex cinerea</i>	Coast Saltbush	Small shrub	1-1.5	350-700	✓	OK for moderately saline sites; found naturally on coasts, sandy shore lines								✓
<i>Baeckea behrii</i>	Short-leaved Broombush	Small shrub	1-2	300-500				✓		✓	✓			
<i>Banksia marginata</i> *	Silver Banksia	Small-tall shrub	2-5	>400	✓	Flowers abundant in nectar provide good food source for wildlife; small on poor sands, tall on fertile loams	✓	✓	✓	✓	✓		✓	
<i>Banksia ornata</i> *	Desert Banksia	Medium shrub	1-3	400-650		Flowers abundant in nectar provide good food source for wildlife					✓			
<i>Bursaria spinosa</i> *	Christmas Bush	Medium-tall shrub	2-5	>300		Slow growing; germinates in cold months	✓	✓	✓		✓	✓	✓	
<i>Callistemon rugulosus</i>	Scarlet Bottlebrush	Medium shrub	2-4	450-700	✓✓✓	Prefers damp areas; flowers rich in nectar are food source for birds		✓						
<i>Callitris gracilis</i>	Native Pine	Medium tree	5-15	350-450		Slow growing					✓			
<i>Callitris verrucosa</i>	Scrub Pine	Small tree	2-5	250-400		Slow growing					✓			
<i>Calytrix tetragona</i> *	Fringe Myrtle	Small shrub	0.5-2	>400		Showy pink to purple flowers		✓		✓				
<i>Casuarina glauca</i> (native to NSW & QLD only)	Swamp Oak	Medium tree	10-15	>350	✓✓✓	Caution: weed potential, suckers freely; use on saline sites only	✓	✓						
<i>Dodonaea viscosa spatulata</i>	Sticky Hopbush	Medium shrub	2-4	>450				✓	✓		✓	✓	✓	✓
<i>Eucalyptus arenacea</i>	Sand Stringybark	Small tree	3-6	400-650		Hardy on poorest sands					✓			✓
<i>Eucalyptus baxteri</i>	Brown Stringybark	Medium tree	10-15	>500		Hardy on poor sands					✓			✓
<i>Eucalyptus behriana</i>	Broad-leaved Mallee Box	Medium tree	8-12	400-550	✓		✓	✓	✓					
<i>Eucalyptus camaldulensis</i>	Red Gum	Tall tree	15-25	500-750	✓✓✓	Good timber, firewood, habitat	✓	✓	✓					
<i>Eucalyptus diversifolia</i>	Coastal White Mallee	Small-medium tree	5-15	350-750		Hardy coastal tree; excellent for well-drained soils with limestone						✓	✓	✓
<i>Eucalyptus dumosa</i>	White Mallee	Medium tree	5-8	300-650					✓			✓		
<i>Eucalyptus fasciculosa</i>	Hill or Pink Gum	Medium tree	10-15	450-750		Excellent for firewood		✓	✓		✓	✓	✓	✓
<i>Eucalyptus gracilis</i>	Yorrell	Small tree	4-7	250-450					✓			✓	✓	
<i>Eucalyptus incrassata</i>	Ridge-fruited Mallee	Small tree	4-8	350-550						✓				
<i>Eucalyptus largiflorens</i>	River or Black Box	Medium-tall tree	6-15	350-550		Usually close to watercourses	✓		✓					

Botanic name	Common name	Form	Height (m)	Rainfall (mm)	Water logging tolerance	Special notes	Soil type suitability									
							1	2	3	4	5	6	7	8		
<i>Eucalyptus leptophylla</i>	Narrow-leaved Red Mallee	Small tree	2-6	200-550				✓	✓	✓		✓				
<i>Eucalyptus leucoxylon megalocarpa</i>	Large Fruited SA Blue Gum	Medium tree	6-10	450-800	✓	Rounded shrubby coastal form		✓								✓
<i>Eucalyptus leucoxylon pruinosa</i>	Inland SA Blue Gum	Medium-tall tree	8-17	450-650	✓	Blue-leaved inland form	✓	✓	✓		✓	✓	✓			
<i>Eucalyptus leucoxylon stephaniae</i>	Scrubby Blue Gum	Small tree	4-15	450-650	✓	Northern form		✓	✓		✓	✓	✓	✓		✓
<i>Eucalyptus microcarpa</i>	Grey Box	Medium-tall tree	10-20	500-600	✓✓	Found close to Victorian border	✓		✓							
<i>Eucalyptus occidentalis</i> (native to WA)	Flat-topped Yate	medium-tall tree	10-20	>350	✓✓	Caution: may be short-lived; use only on saline sites; firewood/timber	✓	✓								
<i>Eucalyptus odorata</i>	Peppermint Box	Medium tree	4-16	350-500		Mainly found around Bordertown	✓	✓	✓			✓				
<i>Eucalyptus oleosa</i>	Red Mallee	Small tree	5-8	300-450		Valued for honey production		✓	✓			✓	✓			
<i>Eucalyptus porosa</i>	Mallee Box	Medium tree	5-10	300-500	✓		✓		✓			✓				
<i>Eucalyptus socialis</i>	Summer Red Mallee	Small tree	5-10	250-450				✓		✓		✓	✓			
<i>Eucalyptus viminalis cygnensis</i>	Rough-barked Manna Gum	Medium tree	10-15	>450	✓	Preferred koala food		✓	✓	✓		✓	✓			
<i>Goodia lotifolia</i>	Golden Tip	Medium shrub	1-3	550-700								✓			✓	
<i>Hakea muelleriana</i> *	Desert Hakea	Medium shrub	1-3	350-500				✓		✓					✓	
<i>Hakea nodosa</i> *	Yellow Hakea	Medium shrub	2-3	>550	✓✓			✓								
<i>Hakea rostrata</i> *	Beaked Hakea	Small shrub	1-2	>500				✓		✓						
<i>Hakea rugosa</i> *	Dwarf Hakea	Small shrub	1-2	350-700	✓		✓	✓	✓			✓				
<i>Leptospermum continentale</i>	Prickly Tea Tree	Small shrub	1-3	>500	✓✓	Prefers damp locations		✓								
<i>Leptospermum coriaceum</i>	Green Tea Tree	Medium shrub	2-3	350-500							✓	✓				✓
<i>Leptospermum lanigerum</i>	Silky or Woolly Tea Tree	Medium-tall shrub	2-4	>600	✓✓✓	Best near natural (fresh) soaks; found mainly near Kingston area	✓	✓								
<i>Leptospermum myrsinoides</i> *	Heath Tea Tree	Small shrub	0.5-2.5	>450							✓	✓				
<i>Leucophyta brownii</i> *	Cushion Bush	Small shrub	0.5-1	400-700		OK for moderately saline sites										✓
<i>Leucopogon parviflorus</i> *	Coast Beard-heath	Medium shrub	2-3	>500		Fruits edible when ripe										✓
<i>Melaleuca acuminata</i>	Mallee Honey Myrtle	Medium-tall shrub	2-4	400-550					✓	✓		✓	✓			

Botanic name	Common name	Form	Height (m)	Rainfall (mm)	Water logging tolerance	Special notes	Soil type suitability								
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<i>Melaleuca brevifolia</i>	Dwarf Salt Honey-myrtle	Medium shrub	2-3	250-700	✓✓✓	Good for mildly saline and swampy sites; slow growing		✓	✓				✓		
<i>Melaleuca decussata</i>	Cross-leaved Honey-myrtle	Small shrub	1-3	450-600	✓✓	Flowers pink-mauve; prefers damp areas		✓							
<i>Melaleuca halmaturorum</i>	Salt Paperbark	Tall shrub	3-8	>350	✓✓✓	Excellent for very saline and swampy sites; slow growing	✓	✓							
<i>Melaleuca lanceolata</i>	Moonah / Dryland Tea Tree	Medium tree	5-10	>250	✓	Slow growing; good on limestone	✓	✓	✓			✓	✓	✓	
<i>Melaleuca uncinata</i>	Broombush	Medium shrub	1-3	350-650	✓	Good for mildly saline sites		✓	✓	✓			✓	✓	
<i>Melaleuca wilsonii</i>	Violet Honey Myrtle	Medium shrub	1-2	500-600	✓✓	Mauve flowers; prefers damp sites		✓	✓				✓		
<i>Pittosporum phylliraeoides</i>	Native Apricot	Small tree	5-7	250-450			✓	✓	✓				✓	✓	
<i>Xanthorrhoea caespitosa</i>	Yacca	Small shrub	1-2	>350		Slow growing	✓	✓	✓	✓	✓				

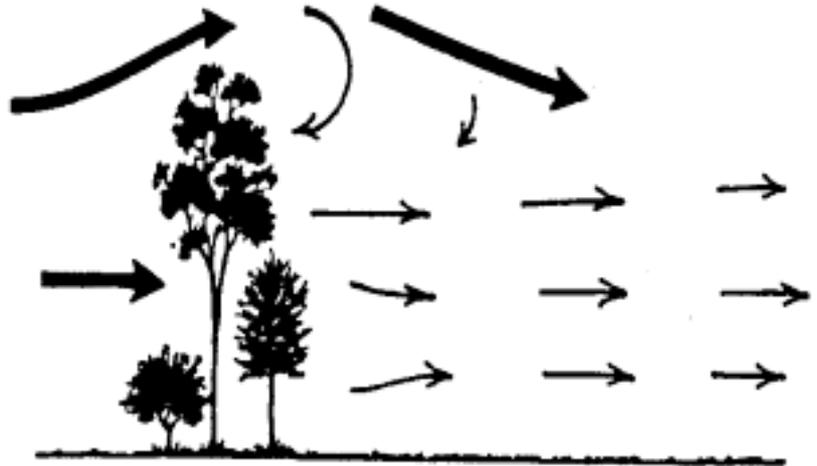


Windbreaks for the Lower South East

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Well-designed windbreaks can benefit every farm. They can be used to:

- protect crops and pastures from drying or damaging winds,
- protect livestock from cold winds,
- help to prevent soil erosion,
- protect living and working areas from strong winds,
- provide future posts, firewood, timber, fodder, honey and other products,
- provide habitat for wildlife,
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A windbreak of trees and shrubs works by filtering and breaking the force of the wind. Permeable windbreaks that let some wind pass through are most suitable. The slight movement of air through the windbreak forms a cushion of slow-moving air on both sides of the windbreak (see diagram).

Location

For best results, plant windbreaks at right angles to the winds from which protection is needed. These are not necessarily the prevailing winds. Crops are often worst affected by hot, drying winds from the north. Livestock are at greatest risk from cold winds and rain which come from the south or south-west.

To keep costs down, establish windbreaks against existing fence lines where possible, but consider the best location to match land capability boundaries. If practical, a good location for a windbreak is high in the landscape (e.g. along a ridge line) as a greater area in the lee is protected from wind. Take care to avoid planting close to windmills and do not plant under power lines.

Height

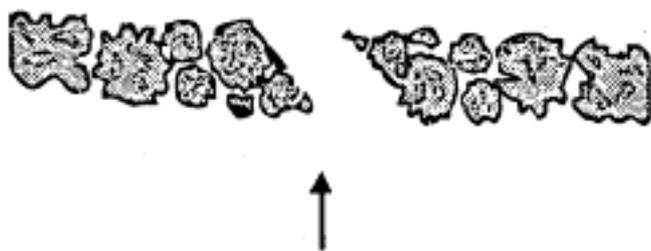
The windbreak height determines the size of the sheltered area. The taller the trees in the windbreak, the greater the area it protects. As a guide windbreaks are most effective for a distance of 12 to 15 times the height of the tallest trees, and protection of crops has been observed up to 25 times the height.

Length and gaps

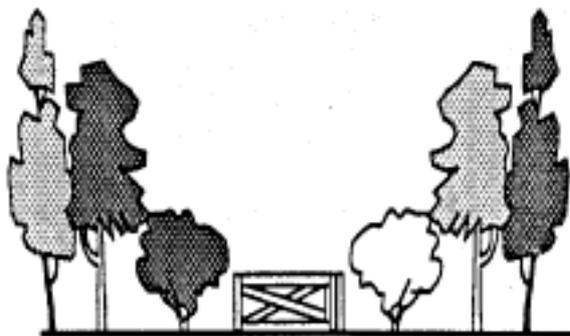
Wind is deflected around the ends of windbreaks. The deflected wind can accelerate around the end of the belt causing localised crop damage. For this reason windbreaks should be long continuous lines of trees and shrubs to minimise any end effects. Gaps within the windbreak



can have the same effect so where these are essential, for example where a gate is needed, the gap should be angled at 45° to prevent the wind from accelerating through the space.



Angle the sides of the windbreak to minimise effect of gap.



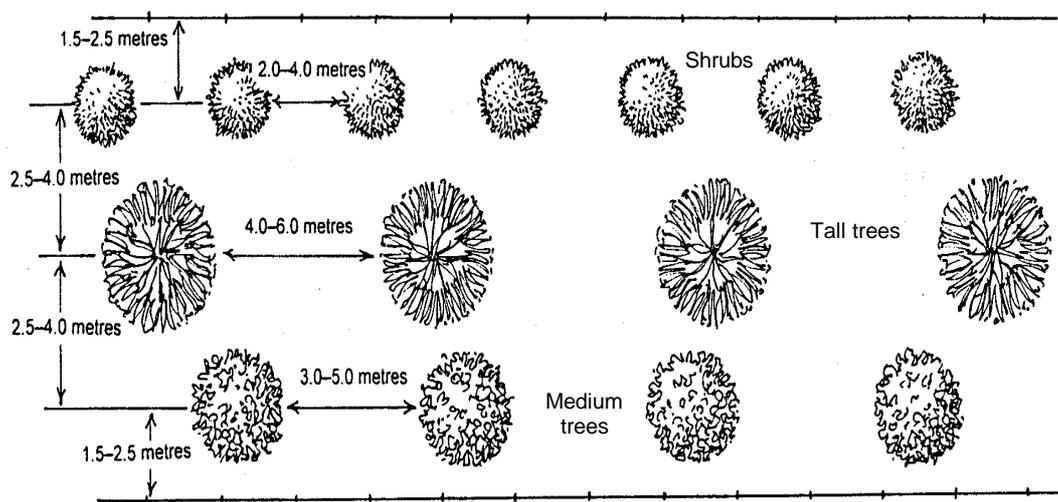
Alternatively a few short trees or shrubs can be planted on either side of the gap.

Number of rows

Windbreaks incorporating both trees and shrubs in three to six rows are effective for most farm situations. Multiple-row windbreaks are less affected by gaps caused by missing trees than single row windbreaks. Where land is limited, a staggered two-row design of tall trees and lower shrubs should be used for the best shelter effect. Single-row windbreaks should only be used where land is so valuable that only a small amount of space can be spared for tree planting - for example, on high-value horticultural land. When only one or two rows of trees can be planted, try to use trees that have foliage from the ground up if possible. Belts with trees only can be established for wood production, but they may be less effective in providing low shelter for animals.

Row and plant spacing

The distance between plants in windbreaks is based on the size of suitable plants for the local climate and soils (see Appendix 1). It is also important to allow access for tractors and machinery for weed control and maintenance. Use the spacings in the diagram as a guide.



Tree spacing guide showing layout dimensions for a three row windbreak. These may change depending on species chosen or if more rows are added.

Establishment techniques

Direct seeding is a method using a specialised machine to sow a mixture of native seed straight into the ground. It is very quick, low-labour and low-cost. Recommended for all soils except heavy cracking clays where tubestock seedlings are preferred. Local nurseries and contractors specialising in farm trees include:

- Eucaleuca Native Services (Ralph Scheel), Thomsons Rd, Naracoorte, 8762 2061
- Mimosa Native Farm Trees and Direct Seeding (Peter Feast) Eight Mile Creek, 8725 1909
- Reedy Creek Nursery (wholesale), Mike Quarmby, Princes Hwy, near Kingston, 8768 7220
- Hardy's Propagating Nursery, Mt Burr, Andrw Hardy, 8734 8365
- SE Direct Seeding Service (Josie and Jamie Jackson), Willalooka, 8757 8276
- Greening Australia (statewide), 8372 0100
- Trees For Life (statewide), 8406 0500 (seedlings grown by volunteers are available to members at minimum administrative cost through the 'Tree Scheme').

Site preparation

Weed control. Most areas in the Lower South East where landholders wish to establish windbreaks have been sown with improved *Phalaris* and clover pastures and are prone to introduced weeds and thistles, all of which compete strongly with new seedlings for moisture and light. To be successful with revegetation, you must get rid of *all* existing pasture and weeds well in advance of planting seedlings or direct seeding. This is usually achieved by spraying out the site with broad-spectrum knockdown herbicides such as glyphosate several times before planting or seeding.

Aim to start weed control 12 months *before* planting. Start in late winter or early spring and again in summer (depending on weeds present). Spray next after the following break of season and again just prior to planting if a new flush of germination has occurred. Residual herbicides (eg Oust®, Ally®, Goal®, simazine) can be used for more effective weed control but they can harm seedlings if not used appropriately (note that some are not registered for use with natives).

Weed control should be carried out again in the year after planting/seeding. This can be done with shielded sprays but special over-spray mixtures can also be used. Seek advice from revegetation consultants or contractors prior to using residual chemicals or over-sprays.

Ripping to allow better root penetration should be considered if limestone is within 10 to 15cm of the soil surface. Riplines in clay soils can tend to open up later in summer so only rip if absolutely necessary. For heavy soils, rip in summer or early autumn when soils are dry so that the ripper shatters the soil rather than slices through it. Slicing glazes the soil surface and prevents lateral root penetration.

Ripping should be at least 50cm deep, more if possible. Use a concrete roller (at least 60 cm wide) over the rip line afterwards to help crush rocks, remove air pockets and settle the soil. Avoid rolling with narrow tractor tyres as this can cause compaction and guttering. Where planting or spraying machinery is to be used, any large rock pieces brought to the surface by ripping should be removed if they cannot be crushed.

Mounding of the soil to 50cm high and 50cm wide can help plant survival in waterlogged areas. Bear in mind though that the surface of mounds will dry out quicker in summer so this technique should only be used in very wet areas. When mounding in long rows, consider leaving breaks every now and then to allow for natural water flows.

Protection

It is usually best to keep windbreaks permanently fenced to prevent gaps being created by livestock browsing on the lower limbs of established trees and shrubs. Fencing may not be required in situations of continuous cropping; in timber belts with trees only, which are not likely to suffer bark damage from stock; or in some alley farming situations with fodder shrubs where stock grazing of the windbreak is expected.

Financial assistance

Financial assistance maybe available through the Natural Heritage Trust Envirofund. Contact South East Natural Resource Management Board, Community Landcare Coordinator (8724 6033) for details.

You maybe able to claim a tax deduction in the year you incur capital expenditure on landcare measures for land in Australia provided you incur it "erecting fences to keep out livestock or vermin from areas affected by land degradation to prevent or limit further damage and assist in reclaiming the areas" or "erecting fences to separate different land classes in accordance with an approved land management plan" (ATO, Information for Primary Producers). A recoupment of the deductible expenditure is assessable under Subdivision 20-A of the *Income Tax Assessment Act 1997* (ITAA 1997). Contact the Australian Taxation Office or your taxation adviser for an information pack for primary producers.

Further information:

Rural Solutions SA Environmental Consultants, Struan, 8762 9100.

Useful references:

- *Windbreaks*, Steven Burke, 1998, Inkata Press, Port Melbourne, Vic.
- *Direct Seeding of Trees and Shrubs*, Greg Dalton, 1993, Primary Industries (SA), Government Printer Adelaide.
- *What Seed Is That?* 2003 (2nd Edition) Neville Bonney, Box 37 Tantanoola SA 5280.
- *Native Trees and Shrubs of South Eastern Australia*, L. Costermans, (1992 revised edition) Weldon Publishing, Sydney. Contains photographs and descriptions.

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Authors: Peter Tucker and Zita Stokes, Environmental Consultants, Struan.

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Appendix 1: Species selection

When selecting species for a windbreak firstly consider what your goals are. Apart from shelter, if you wish to enhance wildlife habitat, choose a diverse range of local native species. If you wish the belt to also provide products, you will need to seek specialist advice about species suitable for timber, firewood, pollen for honey, seeds etc.

Ultimately the species chosen, whether native or exotic, need to suit the soil type and climatic conditions of the site. The following soil type information and species table will help give an *indication* of some species suitable for windbreaks in the Lower South East.

Soil type is a very important consideration when planting trees. Some species will survive well on waterlogged clays, others will only thrive in well-drained sands. Choosing the wrong species for a soil type can end in poor growth and premature deaths. The table on the following pages shows native plant species which are suitable for windbreaks on five major soil types found in the Lower South East region (defined here as the areas south of Kingston - Lucindale - Padthaway - Kybybolite).

Major soil types (Lower South East)

1. *Calcareous sands*

Deep, pale yellow loose sand consisting mainly of fragments of marine shells. Mainly found in coastal areas. The upper 20 to 30cm is coloured grey-brown by organic matter. The soils are generally alkaline and have a low water-holding capacity.

2. *Red soils (Terra Rossa)*

A red-brown soil (varying from sand to clay loam) overlying limestone. Soil depth is shallow, with frequent limestone outcrops. Soil pH is generally neutral to slightly acidic in the surface, but neutral to alkaline above the limestone. Direct seeding is generally successful on these soils.

3. *Sand over clay, sandy-loam over clay, or loam over clay ('red-gum soils')*

A variable depth of sand or loam over an impervious clay layer. Soil pH is generally neutral to acidic. Limestone occurs below the clay. These soils can be subject to waterlogging in winter. Direct seeding highly recommended on these soils (out of waterlogged zones).

4. *Deep sand over clay*

These soils are predominantly found on well-drained sand dunes. The soils are acidic, low in fertility and have a poor water holding capacity. The top 10 to 15cm is grey in colour, below which is a bleached white layer, which is in turn is clearly differentiated from a yellow-brown sand horizon.

5. *Dark grey to black cracking clay soils (Groundwater Rendzina)*

Variable depth to limestone. Occur extensively in low lying regions and are subject to waterlogging or flooding during winter. Very sticky when wet. The soil pH is generally neutral to alkaline. Direct seeding not recommended on cracking clay soils.

6. *Volcanic Soils*

Undulating hills and plains covered with volcanic ash, primarily around Mt. Gamiber, Mt Shank, Lake Leake, Lake Edward and Glencoe. These soils are very fertile and well structured. Depth of ash varies. Soils buried below can terra rossa, sand, sand over flint, dark loams and red clay loams.

7. *Peat Soils*

Primarily found around Rendelsham and Eight Mile Creek, the alkaline peats have significant amounts of partly decomposed organic matter and overlay limestone and shelly material. Around Lake Leake, peats can be found that are acidic. Peats are sometimes non-wetting when dry but susceptible to waterlogging in wet seasons. They are prone to erosion when cultivated.



TREES AND SHRUBS SUITED TO WINDBREAKS IN THE LOWER SOUTH EAST

Note: this list is only a guide. If you are seeking species local to your particular area, talk to a revegetation consultant. Remember: a windbreak works best if using a mixture of trees *and* shrubs. Do not rely on only trees if they shed lower limbs as they mature. **Height** is that at maturity (range depends on site conditions); **Rainfall** is that for best survival/growth; **Waterlogging tolerance** – more ticks = better survival at sites that become waterlogged. Asterisk * = generally not suited to large-scale direct seeding either due to lack of available seed or problems with germination times. **Soil types** explained in text.

Botanic name	Common name	Form	Height (m)	Rainfall (mm)	Water logging tolerance	Special notes	Suited to soil type							
							1	2	3	4	5	6	7	
<i>Acacia cupularis</i>	Coastal Umbrella Bush	shrub	1-2	350-700			✓	✓		✓				
<i>Acacia leiophylla</i>	Limestone Wattle	small tree	1-2.5	500-800			✓	✓		✓				
<i>Acacia mearnsii</i>	Black Wattle	medium tree	7-10	>600			✓	✓	✓	✓			✓	
<i>Acacia melanoxydon</i>	Blackwood	medium tree	8-15	>550	✓			✓	✓	✓	✓	✓	✓	
<i>Acacia myrtifolia</i>	Myrtle Wattle	small shrub	1-2	>500			✓	✓	✓	✓			✓	
<i>Acacia paradoxa</i>	Kangaroo Thorn	medium shrub	2-3	>300		May be invasive	✓	✓	✓	✓			✓	
<i>Acacia pycnantha</i>	Golden Wattle	medium tree	4-8	>350			✓	✓	✓	✓			✓	
<i>Adriana klotzschii</i> *	Coastal Bitter Bush	small shrub	1-2	300-700		Mainly found in coastal areas	✓							
<i>Allocasuarina leuhmannii</i> *	Buloke	medium tree	7-15	550-850	✓✓	Naturally found only from around Hynam to Bordertown on clays				✓				
<i>Allocasuarina paludosa</i>	Scrub or Swamp Sheoak	medium shrub	2-3	>550	✓✓			✓	✓	✓	✓			
<i>Allocasuarina pusilla</i>	Dwarf Sheoak	small shrub	1-2	350-750					✓	✓				
<i>Allocasuarina verticillata</i>	Drooping Sheoak	medium tree	5-8	>500		Excellent for firewood	✓	✓	✓			✓	✓	
<i>Atriplex cinerea</i>	Coast Saltbush	small shrub	1-1.5	350-700	✓	OK for moderately saline sites; found naturally along coast only	✓							
<i>Banksia marginata</i> *	Silver Banksia	medium-tall shrub	2-5	>450	✓	Flowers abundant in nectar provide good food source for wildlife		✓	✓	✓	✓	✓	✓	
<i>Banksia ornata</i> *	Desert Banksia	medium shrub	1-3	400-650		Flowers abundant in nectar provide good food source for wildlife				✓				
<i>Bursaria spinosa</i> *	Christmas Bush	medium-tall shrub	2-5	>450		Slow growing; germinates in cold months	✓	✓	✓	✓	✓	✓	✓	
<i>Callistemon rugulosus</i>	Scarlet Bottlebrush	medium shrub	2-4	450-700	✓✓	Naturally found at and north of Wattle Range and Naracoorte			✓			✓		
<i>Calytrix tetragona</i> *	Fringe Myrtle	small shrub	0.5-2	>400		Showy pink to purple flowers			✓	✓				
<i>Casuarina glauca</i> (native to NSW & QLD only)	Swamp Oak	medium tree	10-15	>350	✓✓✓	Caution: weed potential, suckers freely; use on saline sites, heavy cracking clays only							✓	

Botanic name	Common name	Form	Height (m)	Rainfall (mm)	Water logging tolerance	Special notes	Suited to soil type						
							1	2	3	4	5	6	7
<i>Dodonaea viscosa spatulata</i>	Sticky Hopbush	medium shrub	2-4	>450			✓	✓	✓	✓		✓	
<i>Eucalyptus arenacea</i>	Sand Stringybark	small tree	3-6	450-650		Hardy on poorest sands					✓		
<i>Eucalyptus baxteri</i>	Brown Stringybark	medium tree	10-15	>550		Hardy on poor sands					✓		✓
<i>Eucalyptus camaldulensis</i>	River Red Gum	tall tree	15-25	500-750	✓✓	Select provenance for saline sites; good for timber, firewood, habitat		✓	✓			✓	
<i>Eucalyptus cornuta</i> (native to WA)	Yate Gum	medium tree	10-15	>500	✓	Caution: may be short-lived							✓
<i>Eucalyptus diversifolia</i>	Coastal White Mallee	small-medium tree	5-15	350-750		Hardy coastal tree	✓					✓	
<i>Eucalyptus fasciculosa</i>	Hill or Pink Gum	medium tree	10-15	350-750		Excellent for firewood				✓	✓		
<i>Eucalyptus leucoxylon leucoxylon</i>	SA Blue Gum	tall tree	10-25	500-750	✓	Tall form		✓	✓	✓	✓		✓
<i>Eucalyptus leucoxylon megalocarpa</i>	Large Fruited SA Blue Gum	medium tree	6-10	350-800	✓	Shrubby coastal form (hardy on clay)	✓	✓	✓	✓	✓		
<i>Eucalyptus leucoxylon pruinosa</i>	Inland SA Blue Gum	medium-tall tree	8-17	300-650	✓	Blue-leaved inland form		✓	✓	✓	✓		
<i>Eucalyptus microcarpa</i>	Grey Box	medium-tall tree	10-20	500-600	✓✓	Found in the Hynam area and north to Bordertown		✓	✓			✓	
<i>Eucalyptus obliqua</i>	Messmate Stringybark	tall tree	15-25	>600			✓	✓			✓		✓
<i>Eucalyptus occidentalis</i> (native to WA)	Flat-topped Yate	medium-tall tree	10-20	>350	✓✓	Caution: may be short-lived; good for saline sites; firewood/timber							✓
<i>Eucalyptus ovata</i>	Swamp or White Gum	medium tree	8-15	>600	✓✓✓	Naturally grows in swampy areas		✓	✓			✓	✓
<i>Eucalyptus viminalis subspecies cygnetensis</i>	Rough-barked Manna Gum	medium tree	10-15	>450	✓	Preferred koala food		✓	✓	✓			✓
<i>Eucalyptus willisii</i>	Shining Peppermint	small-medium tree	5-10	>700	✓		✓	✓	✓				
<i>Goodia lotifolia</i>	Golden Tip	medium shrub	1-3	550-700				✓	✓	✓			✓
<i>Hakea nodosa*</i>	Yellow Hakea	medium shrub	2-3	>600	✓✓			✓	✓			✓	
<i>Hakea rostrata*</i>	Beaked Hakea	small shrub	1-2	>500				✓	✓	✓			
<i>Hakea rugosa*</i>	Dwarf Hakea	small shrub	1-2	350-700	✓		✓	✓	✓	✓	✓		
<i>Leptospermum continentale</i>	Prickly Tea Tree	small shrub	1-3	>550	✓✓				✓	✓	✓		✓
<i>Leptospermum lanigerum</i>	Silky or Woolly Tea Tree	medium-tall shrub	2-4	>600	✓✓✓	Best near natural (fresh) soaks				✓		✓	✓
<i>Leptospermum myrsinoides*</i>	Heath Tea Tree	small shrub	0.5-2.5	>450							✓		
<i>Leucophyta brownii*</i>	Cushion Bush	small shrub	0.5-1	400-700		OK for moderately saline sites	✓						

Botanic name	Common name	Form	Height (m)	Rainfall (mm)	Water logging tolerance	Special notes	Suited to soil type							
							1	2	3	4	5	6	7	
<i>Leucophyta lanceolatus</i>	Lance Beardheath	medium shrub	0.5-3.0	>650	✓			✓					✓	
<i>Leucopogon parviflorus*</i>	Coast Beardheath	medium shrub	2-3	>600		Can use fruits for bush Tucker	✓	✓		✓				
<i>Melaleuca brevifolia</i>	Dwarf Salt Honey-myrtle	medium shrub	2-3	250-700	✓✓✓	Good for mildly saline and swampy sites; slow growing			✓		✓			
<i>Melaleuca gibbosa</i>	Slender Honey-myrtle	small shrub	1-2	>650	✓✓				✓		✓			✓
<i>Melaleuca halmaturorum</i>	Salt Ppaperbark	tall shrub	3-8	>350	✓✓✓	Excellent for very saline and swampy sites; slow growing			✓		✓			✓
<i>Melaleuca lanceolata</i>	Moonah/Dryland Tea Tree	medium tree	5-10	>250	✓	Slow growing; good on limestone	✓	✓	✓	✓	✓	✓		
<i>Melaleuca squarrosa</i>	Bottle Brush Tea Tree	medium shrub	2-5	>700	✓✓			✓	✓					✓
<i>Melaleuca squamea</i>	Swamp Honey-myrtle	medium shrub	1-3	>700	✓✓✓	Good for swampy sites (high rainfall)		✓	✓					
<i>Myoporum insulare*</i>	True Boobialla	medium-tall shrub	2-6	350-700			✓							✓
<i>Ozothamnus ferrugineus*</i>	Tree Everlasting	medium shrub	2-3	>650	✓				✓		✓	✓		
<i>Ozothamnus turbinatus*</i>	Coastal Everlasting	medium shrub	2-3	550-750					✓					
<i>Viminaria juncea*</i>	Golden Spray	medium shrub	2-3	>650	✓		✓		✓					
<i>Xanthorrhoea australis</i>	Yacca	small shrub	1-2	>550		Slow growing	✓	✓	✓	✓				✓
<i>Xanthorrhoea caespitosa</i>	Yacca	small shrub	1-2	>350		Slow growing	✓	✓	✓	✓				