PLANT SELECTOR REPORT FOR AREA=SOUTHERN LOFTY AND APPLICATION= LESS THAN 2HA BARE FIELD AND EXISTING OVERSTORY

UNDERSTORY										
FAMILY	GENUS	SPECIES	Common Name	Availability	Rainfall	Soil	Season	Lifeform	ES	Order
Goodeniaceae	Dampiera	rosmarinifolia	native rosemary	non standard (cutting)	400	sa, lo, cl	s, a, w, spr	g	E, P+	
Aizoaceae	Carpobrotus	rossi	pig face	non standard (cutting)	300	sa, lo, cl	s, w, spr	g u	D, E, P+, F++	
Goodeniaceae	Goodenia	varia	cut leaf goodenia	non standard (cutting)	350	sa, lo, cl, cal	s, spr	g u	D, P+	
Goodeniaceae	Scaevola	albida	small fruited fan flower	standard (tube)	450	sa, lo, cl	s, a, w, spr	g u	E, P+, F+	
Lamiaceae	Ajuga	australis	australian bugle	non standard (cutting)	400	sa, lo, cl	s, spr	g u	Sal, P+, F+	
Leguminosae	Pultenaea	pedunculata	matted bush pea	non standard (cutting)	500	sa, lo, cl	spr	g u	E, P+	
Asparagaceae	Lomandra	multiflora	iron grass	standard (tube)	400	sa, lo, cl	s, w, spr	u	D, E	
Asteraceae	Craspedia	glauca	billy buttons	non standard (cutting)	450	cl, cal	spr	u		
Asteraceae	Senecio	hypoleucus	pale grounsel	standard (tube)	500	sa, cl	spr	u		
Boraginaceae	Halgania	cyanea	rough halgania	non standard (cutting)	250	sa, lo, cl	spr	u	D	
Campanulaceae	Wahlenbergia	stricta	native blue bells	standard (tube)	450	sa, lo, cl	s, a, w, spr	u	P+	
Colchicaceae	Buchardia	umbellata	milkmaids	standard (tube)	350	sa, lo, cl	w, spr	u	D	
Compositae	Brachyscome	ciliaris var. ciliaris	variable daisy	non standard (cutting)	400	sa, lo	s, a, w, spr	u	P+	
Compositae	Chrysocephalum	apiculatum	common yellow button	standard (tube)	450	sa, lo, cl	w, spr	u	E, P+, F+	
Compositae	Chrysocephalum	semipapposum	clustered everlasting	standard (tube)	350	sa, lo, cl	w	u	D, E, P+	
Compositae	Helichrysum	leucopsideum	satin everlasting	non standard (cutting)	400	sa, lo, cl	spr	u	P+	
Compositae	Helichrysum	scorpioides	button everlasting	non standard (cutting)	400	sa, lo, cl	spr	u	P+	
Compositae	Microseris	lanceolata	native yam	standard (tube)	200	sa, lo, cl	spr	u	D, P+	
Compositae	Olearia	pannosa	twiggy daisy bush	standard (tube)	450	sa, lo, cl	s, spr	u	H	
Compositae	Vittadinia	gracilis	wooly new england daisy	standard (tube)	250	sa, lo, cl	s, spr	u	D	
Convolvulaceae	Convolvulus	remotus	grassy bindweed	standard (tube)	450	sa, lo, cl, cal	s, spr	u	Sal	
Dilleniaceae	Hibbertia	sericea	silky guinea flower	non standard (cutting)	400	sa, lo, cl, cal	s, spr	u	E	
Dilleniaceae	Hibbertia	exutiacies	spiky guinea flower	non standard (cutting)	500	sa, lo, cl	spr	u		
Dilleniaceae	Hibbertia	riparia	erect guinea flower	non standard (cutting)	400	sa, lo, cl	spr	u		
Dilleniaceae	Hibbertia	crinita	long hair guinea flower	non standard (cutting)	450	sa, lo, cl	spr	u		
Dilleniaceae	Hibbertia	virgata	twiggy guinea flower	non standard (cutting)	300	sa, lo, cl, cal	spr	u	D	
Epacridaceae	Leucopogon	virgatus	coast beard heath	non standard (cutting)	500	sa, lo, cl	spr	u		
Fabaceae	Acacia	spinescens	spiny wattle	standard (tube)	350	sa, lo	w, spr	u	H, D, Sal, E	
Fabaceae	Hardenbergia	violacea	purple coral pea	standard (tube)	450	sa, lo, cl	w, spr	u	H, E, F+	
Geraniaceae	Pelargonium	australe	austral storks bill	standard (tube)	400	sa, lo, cl	s, spr	u	Sal	
Goodeniaceae	Goodenia	amplexans	clasping goodenia	non standard (cutting)	400	sa, lo, cl	s, spr	u	H, D, P+	
Haloragaceae	Glischrocaryon	behrii	golden pennants	special order	250	sa, lo	spr	u	D	
Lamiaceae	Teucrium	racemosum	grey germander(rare)	special order	200	sa, lo, cl, cal	s, a, w, spr	u	D, P+	
Leguminosae	Cullen	australasicum	native scurf pea	standard (tube)	400	sa, lo, cl	spr	u	E,P+	
Leguminosae	Daviesia	brevifolia	leafless bitter pea	non standard (cutting)	400	sa, lo	spr	u	H, P+	

Leguminosae	Daviesia	ulicifolia	mt lofty gorse bitterpea	standard (tube)	450	sa, lo, cl	spr	u	H. P+	
Leguminosae	Daviesia	leptophylla	narrow leaf bitter pea	standard (tube)	500	sa, lo, cl	spr	u	E, P+	
Leguminosae	Dillwynia	sericea	showy parrot pea	standard (tube)	450	sa, lo, cl	s, spr	u	D, P+	
Leguminosae	Dillwynia	hispida	downy parrot pea	standard (tube)	400	sa, lo, cl	spr	u	P+	
Leguminosae	Eutaxia	microphylla	common bush pea	standard (tube)	400	sa, lo, cl	spr	u	E, P+	
Leguminosae	Gompholobium	ecostatum	dwarf wedge pea	special order	400	sa, lo	spr	u		
Leguminosae	Kennedia	prostrata	running postman	standard (tube)	450	sa, lo, cl	spr	u	E, P+, F+	
Leguminosae	Lotus	australis	australian trefoil	standard (tube)	350	sa, lo, cal	spr	u	D, P+	
Leguminosae	Platylobium	obtusangulum	common flat pea	standard (tube)	550	sa, lo	s, spr	u	P+	
Leguminosae	Pultenaea	acerosa	bristly bush pea	standard (tube)	400	sa, lo, cal	w, spr	u	E, P+	
Leguminosae	Pultenaea	laxiflora	loose flower bush pea	standard (tube)	500	sa, lo	spr	u	E, P+	
Leguminosae	Pultenaea	daphnoides	large leafed bush pea	standard (tube)	500	sa, lo, cl	spr	u	E, P+	
Leguminosae	Pultenaea	largiflorens	twiggy bush pea	standard (tube)	500	sa, lo, cl	spr	u	E, P+	
Leguminosae	Pultenaea	tenuifolia	slender bush pae	non standard (cutting)	500	sa, lo, cl	spr	u	E	
Lilliaceae	Arthropodium	strictum	chocolate lily	standard (tube)	400	sa, lo, cl	spr	u		
Lilliaceae	Chamaescilla	corymbosa	blue stars	standard (tube)	350	sa, lo, cl	spr	u	D, P+	
Lilliaceae	Dianella	revoluta	black anther flax lily	standard (tube)	400	sa, lo, cl, cal	s, spr	u	D, Sal, E, F+	
Lilliaceae	Dianella	brevicaulis	smooth flax lily	standard (tube)	400	sa, lo, cl, cal	s, spr	u	D, Sal, E	
Lilliaceae	Thysanotus	patersonii	twinging fringe lily	standard (tube)	250	sa, lo, cl	spr	u	D, P+	
Linaceae	Linum	marginale	native flax	standard (tube)	500	sa, lo, cl	w, spr	u	E	
Malvaceae	Lasiopetalum	baueri	slender velvet bush	non standard (cutting)	250	sa, lo, cl, cal	spr	u	D	
Malvaceae	Malva	behriana (weinmanniana)	austral malva	standard (tube)	350	sa, cl	s, w, spr	u	D, Sal	
Myoporaceae	Eremophila	glabra	tar bush	non standard (cutting)	350	lo, cl, cal	s, w, spr	u	D	
Myrtaceae	Baeckea	crassifolia	desert heath myrtle	non standard (cutting)	450	sa, lo, cl	a, w	u	H, D, Sal, E, P+	
Myrtaceae	Calytrix	tetragona	fringe myrtle	non standard (cutting)	400	sa, lo, cl	spr	u	E, P+	
Myrtaceae	Kunzea	pomifera	muntries	non standard (cutting)	500	sa, lo, cl	w, spr	u	Sal	
Pittosporaceae	Billardiera	cymosa ssp cymosa	sweet apple berry	standard (tube)	500	sa, lo, cl	spr	u	E	
Pittosporaceae	Cheiranthera	alternifolia	hand flower	standard (tube)	350	sa, lo, cl	s, spr	u	D	
Polygalaceae	Comesperma	volubile	twining milkwort	standard (tube)	250	sa, lo	spr	u	D, P+	
Proteaceae	Grevillea	lavandulacea	heath grevillea	non standard (cutting)	450	sa, lo, cl	w, spr	u	E, P+, F+	
Proteaceae	Hakea	carinata	erect hakea (rare)	standard (tube)	450	sa, lo, cl	spr	u	E, P+, F+	
Proteaceae	Persoonia	juniperina	prickly geebung	non standard (cutting)	450	sa, lo, cl	s	u	H, P+	
Rhamnaceae	Spyridium	parvifolium	Dusty Miller	standard (tube)	450	sa, lo, cl	spr	u		
Rutaceae	Philotheca	angustifolia	narrow leaf wax flower	special order	450	sa, lo, cl, cal	spr	u	P+, F+	
Solanaceae	Solanum	laciniatum	large kangaroo apple	standard (tube)	500	sa, lo, cl	s, spr	u	Sal, E	
Stackhousiaceae	Stackhousia	monogyna	creamy stackhousia	standard (tube)	400	sa, lo	w, spr	u		
Stercullariaceae	Thomasia	petalocalyx	paper flower	standard (tube)	450	sa, lo	spr	u	E	

Tremandraceae	Tetratheca	pilosa	pink eyed susan	non standard (cutting)	550	sa, lo, cl	s, spr	u		
UNDERSTORY										
FAMILY	GENUS	SPECIES	Common Name	Availability	Rainfall	Soil	Season	Lifeform	ES	Order
Casuarinaceae	Allocasuarina	muelleriana	slaty sheoak	standard (tube)	400	sa, lo, cl	s, spr	m	H, Sal, E	
Fabaceae	Acacia	paradoxa	kangaroo thorn	standard (tube)	400	sa, lo, cl, cal	a, w, spr	m	H, S, D, Sal, E	
Fabaceae	Indigofera	australis	austral indago	special order	500	sa, lo	spr	m	H	
Lamiaceae	Prostanthera	behriana	downy mintbush	non standard (cutting)	350	sa, lo	s, w, spr	m	D, P+	
Leguminosae	Senna	artemisioides	deset cassia	standard (tube)	250	sa, lo, cl, cal	spr	m	H, D, Sal, E	
Lilliaceae	Xanthorrhoea	quadrangulata	mt lofty grass tree	non standard (cutting)	450	sa, lo, cl	a, w	m	H, D, P+	
Lilliaceae	Xanthorrhoea	semiplana	flat leaf grass tree	non standard (cutting)	450	sa, lo, cl	w, spr	m	H, D, P+	
Myoporaceae	Myoporum	montanum	water bush	non standard (cutting)	400	sa, lo, cl	spr	m	H, E, F+	
Myoporaceae	Myoporum	petiolatum	sticky boobialla	non standard (cutting)	350	sa, lo, cl	s, w, spr	m	H, D, E, F+	
Myoporaceae	Myoporum	insulare	native juniper	non standard (cutting)	350	sa, lo, cal	spr	m	H, D, Sal, E, F++	
Myrtaceae	Callistemon	sieberi	river bottlebrush	standard (tube)	500	lo, cl	spr	m	H, E, P+	
Myrtaceae	Callistemon	teretifolius	flinders ranges bottlebrush	standard (tube)	400	sa, lo, cl	spr	m	H, E, P+	
Myrtaceae	Callistemon	rugulosus	scarlet bottlebrush	standard (tube)	400	sa, lo, cl, cal	s, spr	m	H, D, Sal, E, P+	
Myrtaceae	Leptospermum	myrsinoides	silky tea tree	standard (tube)	450	sa, lo, cl	spr	m	H, E, P+	
Myrtaceae	Leptospermum	lanigerum	wooly tea tree	standard (tube)	550	lo, cl	spr	m	H, D, E, P+	
Myrtaceae	Leptospermum	continentale	prickly tea tree	standard (tube)	500	sa, lo, cl	s, spr	m	H, Sal, E, P+	
Myrtaceae	Melaleuca	lanceolata	dryland tea tree	standard (tube)	250	sa, lo, cl, cal	s, spr	m	H, D, Sal, E, P+, F-	
Myrtaceae	Melaleuca	decussata	cross leaved honey myrtle	standard (tube)	450	lo, cl, cal	spr	m	H, D, Sal, E, P+, F-	
Myrtaceae	Melaleuca	uncinata	broombush	standard (tube)	350	sa, lo, cal	spr	m	H, D, Sal, E, P+, F-	
Myrtaceae	Melaleuca	brevifolia	swamp honey myrtle	standard (tube)	400	sa, lo, cl, cal	s, spr	m	H, Sal, E, P+, F-	
Pittosporaceae	Bursaria	spinosa ssp spinosa	christmas bush	standard (tube)	350	lo, cl, cal	spr	m	H, D, Sal, E, P+, F+	
Pittosporaceae	Pittosporum	angustifolium	native apricot	standard (tube)	250	sa, lo, cl, cal	spr	m	D, P+, F+	
Proteaceae	Banksia	ornata	desert banksia	standard (tube)	500	sa, lo, cl	a, w	m	H, P+	
Proteaceae	Banksia	marginata	silver banksia	standard (tube)	450	sa, lo, cl	s, a, spr	m	H, Sal, P+, F+	
Proteaceae	Grevillea	ilicifolia	holy grevillea	non standard (cutting)	400	sa, lo, cl	s, w, spr	m	H, P+, F+	
Proteaceae	Hakea	rostrata	beaked hakea	standard (tube)	400	sa, lo, cl	w, spr	m	E, P+, F+	
Proteaceae	Hakea	rugosa	wrinkled hakea	standard (tube)	450	sa, lo, cl	w, spr	m	E, P+, F+	
Sapindaceae	Dodonaea	viscosa ssp angustisima	narrow leaved hop bush	standard (tube)	300	sa, lo, cl, cal	s, a, spr	m	H, D, F+	
OVERSTORY										
FAMILY	GENUS	SPECIES	Common Name	Availability	Rainfall	Soil	Season	Lifeform	ES	Order
Casuarinaceae	Allocasuarina	verticillata	droopping sheoak	standard (tube)	350	sa, lo, cl, cal	a, w	o	S, D, Sal, E, F+	
Fabaceae	Acacia	melanoxylon	blackwood	standard (tube)	500	lo, cl	w, spr	o	H, S, Sal, E, F+	
Fabaceae	Acacia	pycnantha	golden wattle	standard (tube)	350	sa, lo, cl	w, spr	o	S, D, Sal, E	
Myrtaceae	Eucalyptus	socialis ssp socialis	red mallee	standard (tube)	250	sa, lo, cal	s, spr	o	S, D, E, P+, F-	

Myrtaceae	Eucalyptus	porosa	black mallee box	standard (tube)	300	sa, lo, cl, cal	s, spr	o	S, D, E, P+, F-	
Myrtaceae	Eucalyptus	gracilis	white mallee	standard (tube)	200	sa, lo, cal	a, w, spr	o	S, D, Sal, E, P+, F-	
Myrtaceae	Eucalyptus	camaldulensis	river red gum	standard (tube)	300	sa, lo, cl	s	o	S, D, Sal, E, P+, F-	
Myrtaceae	Eucalyptus	cladocalyx	sugar gum	standard (tube)	450	lo, cl, cal	s	o	S, Sal, E, P+, F-	
Myrtaceae	Eucalyptus	microcarpa	grey box	standard (tube)	500	lo, cl, cal	a, w	o	S, E, P+, F-	
Myrtaceae	Eucalyptus	obliqua	messmate stringbark	standard (tube)	800	lo, cl	s	o	S, E, P+, F-	
Myrtaceae	Eucalyptus	cosmophylla	cup gum	standard (tube)	650	sa, lo, cl	s, w, spr	o	S, E, P+, F-	
Myrtaceae	Eucalyptus	incrassata	yellow mallee	standard (tube)	350	sa, lo	s, w, spr	o	S, D, Sal, E, P+, F-	
Myrtaceae	Eucalyptus	leucoxylon	south australian blue gum	standard (tube)	500	sa, lo, cl	w, spr	o	S, Sal, E, P+, F-	
Myrtaceae	Eucalyptus	fasciculosa	pink gum	standard (tube)	450	sa, lo, cl	a, w, spr	o	S, E, F-	
Myrtaceae	Eucalyptus	viminalis	manna gum	standard (tube)	500	sa, lo, cl	s, a	o	S, E, F-	
Myrtaceae	Eucalyptus	baxteri	brown stringybark	standard (tube)	650	sa, lo, cl	s	o	S, E, F-	
Myrtaceae	Eucalyptus	leptophylla	narrow leaf red mallee	standard (tube)	200	lo, cl, cal	s, a	o	S, D, Sal, E,	
Santalaceae	Santalum	acuminatum	quandong	special order	300	sa, lo, cl, cal	s	o	D, P+	

TABLE KEY

SPECIES: *R= rare, *N= range limited to the north, *S= range limited to the south
AVAILABILITY: commercial availability of species
SOIL: soil types that the species are found in their native range sa=sand, lo=loam, cl=clay, cal=calcareous
SEASON: the flowering season sum=summer (December to February), a=autumn (March to May), w= winter (June to August), a=autumn (September to November)
LIFEFORM: g=groundcover (>1m), u=understory (1-2m), m=midstory (2-5m), o=overstory (<5m)
ES: ecosystem services provided H= hedgerow, D=drought tolerant, Sal=salinity tolerant, E=erosion control, P+=super pollinator plant nectar and pollen, F=fire tolerant

POLLINATOR PLANT SELECTOR

1. BACKGROUND

Bees and agriculture

Agriculture varies considerably in its reliance on pollinators. Some agriculture, such as almonds, apples, and pears depend almost entirely on bees for nut and fruit production. As agriculture has become more intensive and landscapes fragmentation has reduced connectivity the demand for reliable pollination services is essential. The beekeeping industry and pollinator dependant agriculture also has imminent threats the entry of exotic pests and diseases such as the highly destructive Varroa mite – which weakens bees and makes them susceptible to pathogens. We suggest that sustainable pollinator management in landscapes dominated by monocultures can be achieved through bolstering native biodiversity by using restoration to target plants that provide resources to pollinators.

Setting realistic goals

Setting realistic goals is important for all revegetation projects. The plant list generated by this web tool is necessarily biased towards provision of pollinator resources hence having a selection of these plants establish and reproduce at the chosen site is the primary goal. Depending on the planting configuration and plant selection additional goals may be realised by tailoring plant choices towards ecosystem service co-benefits. These co-benefits may value add the primary goal of revegetation for pollination services by choosing plants for fire abatement, shelter, erosion control, salinity mitigation, drought resistance, seed orchards, climate resilience or simply just to increase to biodiversity at a site level. Further information about choosing for these co-benefits can be found below.

Structural complexity

Designing the structure (plant size and spacing) of the plant community chosen is essential when choosing the co-benefits desired for a site. Although smaller shrubs may provide resources and co-benefits within the first couple of seasons the true potential of using this guide and planting a targeted habitat may take several years to eventuate. For example, most South Australian tree species will not become reproductive until 5-10 years after they are planted and only achieve structural maturity after many decades. Therefore this guide is nested as a series of questions about agricultural setting, locality and landscape to assist in making these decisions. Existing remnant vegetation can provide a reference, but the practicalities of targeting restoration for a particular functional group of plants (pollinator resources) will mean the outcome will not be analogous to the remnant vegetation.

2. BENEFITIAL PLANT TRAITS FOR POLLINATORS

Resource provision for pollinators

Bees generally require floral and nectar resources from early spring through to late autumn for nutrition and rearing broods. Nectar provides energy (carbohydrate), whilst pollen gives vital proteins and fats. Only half of the native bee species (ca300) will go to introduced plants therefore if plantings are chosen primarily to support additional pollinators in an agricultural setting ideally a diversity of three pollen and three nectar resources can provide a good diet range for native bees.

Benefits from the different plant families in the selection tool

Pollen and nectar can be provided by many plants species however choosing plant species native to the agricultural area is preferred because they are commercially available and will generally have higher survival and establishment rates than non-native species. The plant families below have floral characteristics that make them attractive to pollinators and are worth considering more generally when selecting plants for the following reasons.

Asteraceae and **Compositae** (Daisies and Asters). Native daisies such as *Chrysocephalum and Helichrysum* have shallow flowers that provide accessible nectar and pollen to pollinators. Some daisies such as *Brachycomes* also have long flowering periods, are widely available in nurseries and are compact and hardy. These families are generally well suited to complimentary understory planting but may require intensive weed management (mulch, herbicides) and herbivore management (fencing, guarding) during their establishment.

Dilleniaceae The Hibbertias (Guinea flowers) come from this family and they can deal with a wide variety of soil types that occur across the focal agricultural regions. The hibbertia flower requires buzz pollination that excludes honey bees for pollination. Flowering is short, turnover is high and they only produce pollen so planting hibbertias will need to be supplemented with nectar producing species for native bees.

Goodeniaceae includes many small herbaceous plants such as *Scaevola, Dampiera* and *Goodenia.* This family are often pioneer species that establish well but can have short generation times. They are suited well to a broad variety of soil types, including disturbed sites. They are generally non-standard tubestock (e.g. striking's from vegetative growth) because of a physical dormancy of seeds and therefore are not suitable for direct seeding.

Lilliaceae includes a wide variety of plants. Generally this family is defined by herbaceous perennials which have evolved to be reasonably shade tolerant such as *Arthropodium*, *Chamaescilla* and *Dianella.* Pollen and nectar rewards are common in the family especially in spring and they are reasonably ubiquitous to many soil types throughout the focal agricultural regions of South Australia. Best applied at a site where some overstorey is present or as a follow up planting as the over story becomes established.

Leguminoceae and **Fabaceae** (Legumes and peas). Along with providing additional soil benefits like being efficient nitrogen fixers (e.g. the legumes) this family include many core restoration plants that are very important for pollinators. A wide variety of plants from these families such as *Acacia, Eutaxia, Daviesia, Dilwynia, Hardenbergia, Kennedia, Pultanaea and Templetonia* species are all attractive to native pollinators. The wide diversity of growth forms and soil associations makes many plants from this family drought and/or salinity tolerant.

Myrtaceae (Callistemon, Gums, Myrtles and Tea trees). Many species from this family propagate well and produce prolific seed that are suited well to broader scale areas (>2ha) via direct seeding. Myrtaceaeous species also include many tight compact forms that flower profusely (e.g. tea trees and myrtles) and are ideally suited for screening or hedgerow or soil stabilisation applications in an agricultural setting.

The blooms of the Callistemon (bottlebrush) are abundant with nectar and pollen. These moderately sized shrubs are very hardy and generally flower from late spring to summer. Common species from this genus are ubiquitous in the agricultural regions easily managed and can be direct seeded as hedges wind breaks and low shelter belts in an agricultural setting.

The prolific flowering of Eucalyptus (Gum trees), along with broad flowering periods make gums very attractive to a wide range of native bee species. Mature trees are also an important source of resin for Stingless Bees and Resin Bees and can provide a very diverse range of additional ecosystem services (habitat, shelterbelts, windbreaks, erosion control, and salinity control) in an agricultural setting.

Melaleuca (Myrtle). The abundant brush-like flowers of the Melaleuca attract numerous native bees as well as birds. Varieties suit a broad range of soil types and are often drought and salinity tolerant. The species present in the agricultural districts of South Australia grow from small shrubs to small trees. They are also generally easily propagated for use in direct seeding of broad-acre restoration (>2ha).

Leptospermum (Tea Tree) are attractive to native bees as well as many other wild pollinators that will flock to the cup-shaped flowers for the volumes of nectar available. With papery layered bark, tea trees range in size from small trees to prostrate shrubs and generally occur on nutrient poor skeletal soils and higher rainfall areas of the Adelaide hills and south-east agricultural districts.

Proteaceae (Hakeas, Proteas and Grevilleas). This family have some species in flower at most times of the year, although flowering between late winter and early summer is the most common. Grevilleas in particular attract a wide range of native bees, along with nectar-feeding birds. The family ranges in size from tall shrubs to prostrate varieties that are readily available at nurseries, are hardy and low maintenance and can help to stabilise soil for degraded land in an agricultural setting.

3. POLLINATOR SELECTOR INPUT

QUESTION 1. Agricultural location

Although many forms of agriculture require pollination to some degree the three focal crops for this guide are apple, canola and lucerne because of their relative dependency and contribution to primary industry within the state. The apple growing regions of South Australia are concentrated in the higher rainfall areas of the Adelaide Hills with good clay loam soils. Canola growing in South Australia is bound by traditional cereal growing landscapes where reliable winter and early spring rain on loam through to calcareous soil profiles support broad-scale cropping. The canola areas found in the selector are Eyre Peninsula, southern and northern Yorke Peninsula and the south east. Lucerne is grown for both seed and fodder predominantly in the south east where artesian aquifers help to extend the growing region into the dryer northern mallee regions. Though the guide is themed towards these agricultural crops the fundamental logic behind this guide can suitably be used for alternative agriculture within the same area.

QUESTION 2. How big is the area?

In an agricultural settings land availability is at a premium so finding areas to set aside for restoration can be difficult. Wherever possible the plantings should be as large and as close to the crop as possible to get the most benefit. In general orchard headlands, track sidings, degraded land and paddock voids are the most likely parcels of bare land available on a farm. Though existing overstorey or scattered vegetation can be enriched with supplementary plantings too. Although pollination is the principal function of this guide considering additional benefits (ecosystem services) that might improve biodiversity, species habitat, stock shelter, wind and weed control, erosion abatement or salinity management can help to optimize the available land on offer.

Appropriate application (direct seeding or tubestock)

Direct seeding involves mechanically sowing seeds directly into the soil and relying on ambient conditions for their germination and establishment. Tubestock plants are grown and sourced from commercial plant nurseries and applied manually. The site area and aspect, the amount of existing vegetation and land legacies will ultimately determine the appropriate application method. For example unless careful planning and appropriate resources are available it would be ill advised to attempt bare-field tubestock planting in areas more than 2ha where direct seeding would be more appropriate. Though conversely the site may be too steep or rocky to safely operate machinery or plants chosen have to be grown from a striking and in these cases direct seeding would not be appropriate.

Bare field >2ha (direct-seeding application) A bare field provides many possibilities for restoration and the selector tool will give an overview of plants that suit the site. The structure and number of plant species used can be maximised for resource provision and to minimise the effect of seeds not germinating. Because direct seeding is generally done mechanically sowing can follow contour lines of the site to retain moisture and avoid the seed washing out. The cost of direct seeding may vary between $1000 to $2500 per hectare depending on locality, seed supply, delivery rate and many other site specific factors.

Bare field <2ha and existing over story (tubestock application). Available land area, site access, existing cropping and the existing vegetation obstacles may exclude the direct seeding approach and tubestock may need to be applied topically. An existing over story of trees also provides structure where understory tube stock plants will be nursed by the over story and therefore they will generally have better establishment rates. For seedlings purchased commercially the rule of thumb is that seed that propagates easily will be sold as the cheapest tubestock (referred to as standard in guide) and available for approximately $2-$3 at a commercial nursery (50 tubes to a tray for transporting). Plants that don't propagate easily from seed because they need to be grown from vegetative growth or produce low quantities of seed are more expensive $3-$4 per tube (referred to as non-standard). Special orders can be placed 6-8 months prior to delivery to ensure the regionally appropriate plants and discounts may be available for higher qualities (greater than 500 plants).

Shelterbelts (direct-seeding). Shelterbelt plantings are established and maintained for crop protection, livestock shading, and reduction of soil erosion, salinity control, and soil moisture and biodiversity improvements. Paying attention to the length of the site (the longer the better) the orientation (upwind of prevailing winds) and continuity (spacing) can improve the efficiency of a shelter belt. Hedgerows are shelterbelts that are primarily made of a shrub layer and do not include over story trees. Hedgerows may be suitable in areas where the risk of introducing roosting points for avian pest species into the landscape is too great (e.g. apples). Hedgerows begin flowering faster than most over story species but will not provide the relative amount of wind, shade and pollination resources taller shelterbelts will. Direct seeding for shelterbelts in linear plots will cost ca AUD$400 - $800 per kilometre.

4. POLLINATOR PLANT SELECTOR OUPUT

Using the plant selector

While honey bees are an important pollinator in agricultural landscapes encouraging native pollinators to these landscapes will minimise a crops dependence on a single pollinator species. Native bees work synergistically with honey bees but habitat fragmentation and degradation is a limiting factor to their diversity and abundance especially in agricultural landscapes. Therefore the purpose of this guide is to prescribe a site specific inventory of native plants that will support native pollinators and contribute to the pollination services required by crops. This web tool can be used by stakeholders in their agricultural setting to assist them in creating a native species habitat that will provide a complimentary calendar of pollinator resources throughout the year. The plant species generated from the tool will grow naturally in your area however we advise seeking professional advice (Link TFL, Greening etc etc).

Environmental factors

Matching the plants selected to the local environment is an important initial step of any successful project. Hence a minimum rainfall guide and appropriate soil types will help to identify the plants that are appropriate for the project site. Another important consideration when selecting species is that soil condition due to erosion, shallow calcretes, or land legacies like nutrient loads, weeds and compaction are all likely to diminish the establishment success of many native species. Hence some site preparation and maintenance is recommended in these circumstances (see more details here).

Refining the pollinator plant selection for additional ecosystem services

Along with the benefits to agriculture ecological restoration can conserve biodiversity and enhance the wellbeing of humans and landscapes by providing essential ecosystem services. Ecosystem services reflect the ecological, social and economic dimensions of natural resources by explicitly identifying and classifying the benefits gained from them. By using an ecosystem service approach when selecting plants not only can you prioritise pollination services to the focal crop by providing resources and habitat to pollinators throughout the year but the soil, stock, climate resilience and biodiversity of the site can also be improved. For example additional ecosystem service benefits from plants are listed in the selection tool as

Fire mitigation Selecting plants that have a high moisture content, low levels of volatile oils, and large hard leaves with simple margins will absorb heat from fires or be slower to ignite so may provide some fire resistance. Furthermore some plants can trap the embers from fires such as *Carpobrotus rossii* which acts as an arresting point to slow or change the velocity of the fires. Weed and understory fuel management will also help to reduce the combustibility of plantings.

Salt tolerance Salinized land occurs both naturally and as a result of land management in Australia. Dryland salinity (high alkalinity) in the marginal cropping areas is often a consequence where the removal of deep rooted trees causes the water table to rise. Many Australian native species have evolved traits to exclude or tolerate salinized soils so it is worthwhile considering using these species to topically treat salt scolded land in agricultural regions. The species listed have a salinity tolerance of between 4-8 $dSiemensm^{-1}$ for ground water and soil but mounding imported soil to approximately 10cm can alleviate also alkalinity for establishment.

Drought Tolerance This guide is intended to be used for plantings that will have no supplementary irrigation however it is recommended to plant when soil moisture is good. Some plants have adaptation to aridity (rainfall below 250mm annually) or varying degrees of specific drought tolerance. Particular leaf traits such as small leaves, waxy covering are efficient to conserve water and an indicator that the plant has evolved strategies to reduce evapotranspiration. Also root architecture such as the deep tap roots and lignotubers of some Eucalypts help them to tolerate low water availability and drought conditions.

Erosion control once established the foliage of pollinator habitat will intercept rainfall, and decrease evaporative losses from the soil therefore reducing surface water runoff and erosion. If gullies are forming it is important to stabilize the soil by diverting surface water runoff by shaping the gully banks and fencing the affected area more information here.

Biodiversity and connectivity. Discontinuities have emerged in historically connected biological systems due to changes in land use hence adding any suitable native vegetation will improve biodiversity. The patch size and complexity will determine how much of a benefit will be gained

Super pollinator resource.

5. LOGISTICS OF PLANTING

Site preparation and maintenance

Grazing, land legacy, and weed load all have a direct effect on the success of planted species to establish. Livestock, feral and native grazing can generally be managed by exclosure fencing which should be factored into the project costs. If the landscape has a recent cropping history is compacted and degraded some site preparation will be necessary (more details here). It is likely that most sites will have a weed load that will need to be managed prior to plant out and during establishment of plants. Three to four weeks prior to plant-out (winter to early spring for most tubestock and direct seeding) spot, strip or broad-acre spraying should occur. Non-standard soils may require additional site preparation for example erosion or alkalinity may need soil

remediation or mounding, nutrient loads may require scalping or deeper direct seeding and shallow calcretes will require ripping prior to planting. There are a number of methods available for weed control which are well described here (PIRSA WEB_8867).

Planting densities and costs

Planting densities are closely related to the plant form and desirable outcome. Over story species will produce the greatest amount of resources per plant for pollinators however many of these plants won't be reproductive (e.g. producing flowers) for 6-10yr. Mid story shrub layers will establish fast and provide resources within 1-2 years of establishment though planting them too closely will create competition and reduce the resources. Understory species have the ability to produce resources quickly as they establish however are small and might have short lifespans.

Planting parameter	Pollinator habitat (bare-field <1ha)	Pollinator habitat (existing over-story)	Pollinator habitat (bare-field >1ha)	Pollinator habitat (shelterbelt)
Over story >5m (O)	1 plant/10m	-	1 plant/5m	1 plant/5m
Mid story 2-5m (M)	1 plant/4m	1 plant/5m	1 plant/2.5	1 plant/2.5
Under story <2m (U)	1 plant/2m	1 plant/2m	-as required	-
Plants/hectare	1000 - 1500 plants/hectare	1000 - 1500 plants/hectare	1500- 2000 plants/ha	1500- 2000 plants/ha
Plant form %s	(5% U): (25 % O): (70% U)	(30% O): (70% U)	Direct seeding RECOMMENDED	Direct seeding RECOMMENDED
Planting tray (50 tubes)	(3 U): (12 O): (35 U) = 20 - 30 trays/ha	(17 O): (33 U) = 20 - 30 trays/ha	Direct seeding RECOMMENDED	Direct seeding RECOMMENDED
Approximate cost	$2500 - $4000/ha	$2500- $4000/ha	$1000-$2500/ha	$400-$800/kilometre

Additional consideration for weed (e.g. slashing, mulching and spot spraying) and herbivore management (e.g. guards and fencing) management will need to be determined for the site.