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Bee Friendly

A planting guide for European honeybees and Australian native pollinators

by Mark Leech

From the backyard to the farm, *the time to plant is now!*

Front and back cover photo: honeybee foraging on zinnia Photo: Kathy Keatley Garvey

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Acacia acuminata

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Note: Plants listed as weeds should not be planted. Your local nursery can provide you with advice as to whether a plant is a listed weed.

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Banksia spinulosa

Foreword

The Australian honeybee industry provides essential benefits to the agricultural and horticultural sector through managed and incidental pollination services. Urban environments also benefit from the activities of honeybees. Planting bee forage for honeybee nutrition can offer major benefits to the industry and to society.

However, listed weeds should not be planted. Local nurseries will provide advice about which plants are listed as weeds in your area.

This planting guide for bee forage is particularly timely as there is increasing public concern for the wellbeing and survival of global honeybee populations following the reported colony collapse disorder in the United States and Europe, and the threat to the Australian industry of the destructive varroa mite. This guide to planting choices from the backyard to the bush, right across the nation, will assist with increasing the available bee food.

Australia's flora is varied, with often highly productive trees and understorey plants that are well suited to the needs of the Australian honeybee industry. There is, however, uncertainty about the long-term availability and security of the existing natural resource. Dramatic changes in availability have come from land clearing, wildfire, agricultural practices and the change in land tenure from active management to conservation and the potential exclusion of honeybees. The existing resource is significant but decreasing in available area, so planting bee forage to offset major land use change and secure the food base for pollinators is a national concern.

Individuals, gardeners, municipalities, government land management authorities and farmers can make a difference. Perennial pastures for semi-arid lands, biofuel plantations, carbon farming, biodiverse planting and revisiting existing plantation development can all deliver significant regional benefits. This guide gives some ideas and choices of species to bring about improved outcomes for honeybees and the Australian pollen- and nectar-using fauna, including mammals, insects and birds.

This research investment was funded from industry revenue matched by funds provided by the Australian Government; the resulting guide is an addition to RIRDC's diverse range of over 2200 research publications. It forms part of our Honeybee R&D program, which aims to improve the productivity, profitability and biosecurity of the Australian beekeeping industry.

Most of RIRDC's publications are available for viewing, free downloading or purchasing online at www.rirdc.gov.au. Purchases can also be made by phoning 1300 634 313.

Craig Burns
Managing Director
Rural Industries Research and Development Corporation

Acacia aneura

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Mark Leech

Basil

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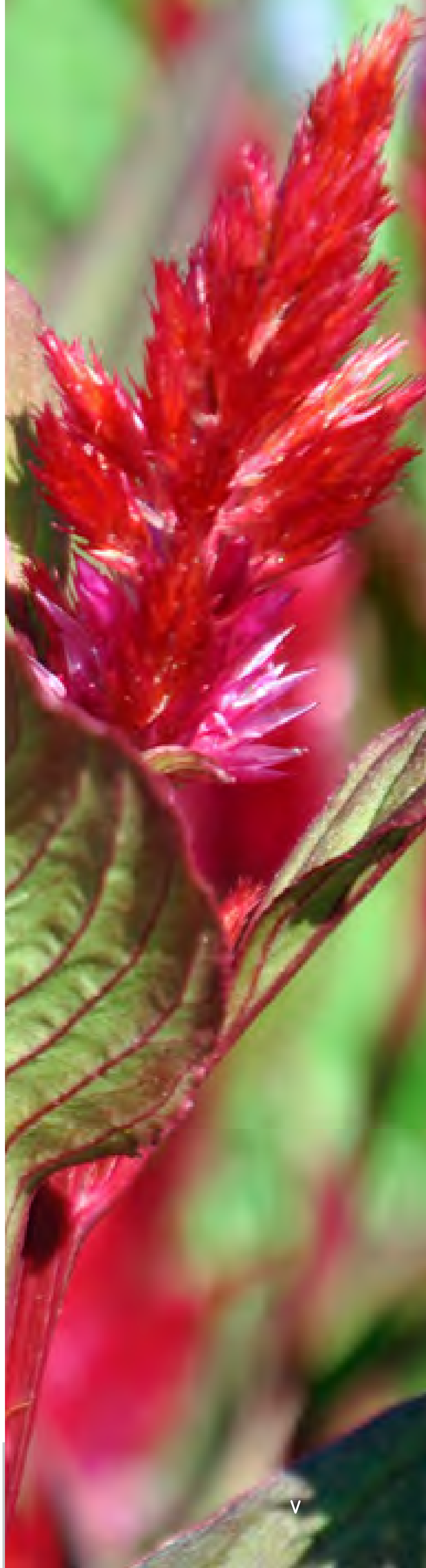


Celosia

Thryptomene saxicola

Iceland popp, *Papaver nudicaule*

A good garden layout

About this book

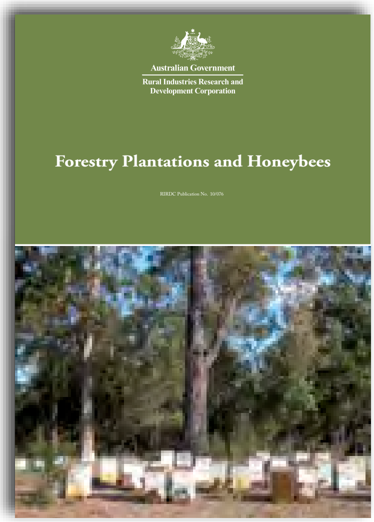
The world has become aware of the plight of the honeybee. The reported collapse of honeybee populations in North America and Europe, and fear of a food crisis, have led people around the world to become concerned. Shrinking resources, increased urbanisation, ever-expanding corporate agriculture with its push for monoculture, greater use of insecticides and herbicides, changes to grazing practices, a global warming trend and climatic change are all placing pressure on honeybee and native pollinator populations. It is in this context that this book was produced, to guide planting decisions in favour of plants that benefit honeybees and native pollinators.

Australia has a rich natural melliferous (honey-producing) flora as well as many introduced plants that provide abundant pollen and nectar. Use of this guide would enhance the melliferous resource in various settings in the landscape by informing planting decisions in favour of good pollinator forage with a focus on honeybees. The project to produce an Australian planting guide for pollen- and nectar-producing plants evolved from an idea of the Northern Tablelands Branch of the NSW Apiary Association (D Cannon 2010, pers. comm.).

The Australian honeybee industry manages about 570 000 registered hives and relies to a great extent on natural flora (Somerville 2010a). Increasingly, reports and inquiries emphasise that the resource base is shrinking through continued land clearing for agriculture, urbanisation and infrastructure, changed agricultural practices, and a demonstrated risk of government-managed natural forests being taken out of multiple-use management and put under conservation tenures such as national parks (Benecke 2003; CIE 2005; Australian Parliament 2008; Somerville 2010a). As Benecke noted:

> The resource base on which the industry depends is shrinking. More of the nation's melliferous flora is being incorporated into conserved areas and ensuring continued access to these areas has taxed the energies of state and federal beekeeper bodies.

The 2008 parliamentary inquiry into the future of the honeybee industry reported that resource security—access to the floral resources on which honeybees depend—is one of the two most crucial issues facing the honeybee industry. The inquiry recommended that the Australian Government provide incentives for planting and conservation of melliferous flora (Australian Parliament 2008). This present publication is in part a response to that inquiry. All planting helps, regardless of scale, although it will be large broadacre plantings in the rural landscape that effect significant outcomes or have any chance of limiting a resource deficit (Somerville 2010a).



Forestry Plantations and Honeybees, by Doug Somerville, investigates the potential capacity of plantation forestry to contribute to the Australian honeybee floral resource base. This RIRDC report is aimed at assisting the beekeeping industry in clearly identifying the systems and restraints under which it operates. The readership includes foresters and those with a concern for the future viability of the Australian beekeeping industry. (Available from https://rirdc.infoservices.com.au/items/10-076.)

Australia: a complex environment

The Australian honeybee industry is dependent on natural flora, some environmental weeds, and to a lesser extent agricultural crops and horticulture. Migratory beekeeping (the movement of hives to follow floral events) is a necessary model that has given Australia its relatively high per hive honey yield. Reliance on natural floral, not agricultural, crops has given the Australian industry a marketing advantage, the absence of chemical use in the majority of the resource being an important selling point (Somerville 2010a).

With a few notable exceptions, honey flows are notoriously unreliable. Even a good flowering of a usually productive species does not always result in a good crop (Clemson 1985). The complex interaction of climatic variability, rainfall fluctuations and geography is known to affect flowering frequency, flowering abundance and nectar flows. Intra-species variation is reported across different sites and may relate to site conditions and genetics (Clemson 1985; Paton 2008; Somerville 2010a). This can range from a species being a non-producer in the north of its distribution to being a major commercial species in its southern range. Alternatively, some species produce almost wherever they are planted.

Commercial beekeepers have a deep knowledge of the flora in the areas in which they work. Some have a working knowledge of flora and local factors affecting flowering and honey flows over a range of 2000 km, from southern Victoria into southern Queensland. Their willingness to provide one-on-one input for this project was greatly appreciated.

Urban renaissance

Urban beekeeping is becoming one of the most popular 'hobbies' in the Western world, significant interest and growth being reported from as far afield as London, Tokyo, Toronto and New York. This renewal of interest could be a response to concerns about honeybee survival and global food security.

Data

A number of books and reports, including RIRDC's floral data for each state, provide a good base of floral information and more detail than is appropriate for this book—for example, Pellet (1920), Howes (1945), Crane et al. (1984), Clemson (1985), Goodman (1973), Boomsma (1972), Coleman (1962), Smith (1969), Beuhne (1922) and Blake & Roff (1996). Some are very comprehensive and form the current definitive text for the area covered. But none provids a guide to decision making about what to plant where.

This publication provides for informed decisions about plants that benefit honeybees. Plants grown in gardens, annual crops and perennial pastures might begin producing beneficial flowers in the year of planting, whereas streetscape, urban open spaces and farm plantings can take a number of years to productively flower. Enhancing the pollen and nectar resource through plantings across the landscape, from backyards to the broader rural environment, is an ambitious goal.

New pathways

Planting strategies and funding opportunities are explored in this publication so as to find ways of enhancing the melliferous flora in both urban and rural environments. The existing plantation estate does not provide for the honeybee industry and there must be a major change in the approach to planting melliferous flora across the landscape (Somerville 2010a). Extensive planting is considered through existing and new programs and innovative partnerships. International examples were studied in order to identify opportunities for Australia to enhance its bee forage 'bank'.

Species selection

Selection of plants is first based on the species preferred by beekeepers, within climate zones across the landscape using a criteria such as drought tolerance, length and frequency of flowering, honey yield, pollen value, appropriateness to site, ease of establishment and maintenance, natural distribution and adaptability. A continual floral sequence using the limited species presented can be achieved by mixing and matching species with the alternative climate zones and landscape units. Plants listed as weeds should not be planted. Your local nursery can provide advice as to whether a plant is a listed weed.

How to use this guide

The guide is written from the perspective of where you are standing—for example, 'in my backyard in Cairns' or 'in a paddock in the Western Australian wheat belt'. From that perspective, the first division is the landscape unit, of which there are four: gardens, streets, urban open spaces and rural.

These units are presented in chapters, each with a discussion about situation, trends and opportunities followed by the species pages—first by climate zone, then by plant layer.

It's easy. First, where are you? Then look at the climate zone map and there you have it. For example:

- a Cairns backyard—you are in the domestic gardens section and the warm/humid climate zone. This determines your species selection.
- a paddock in the WA wheat belt—you are in the rural section and the hot/arid climate zone. This determines your species selection.

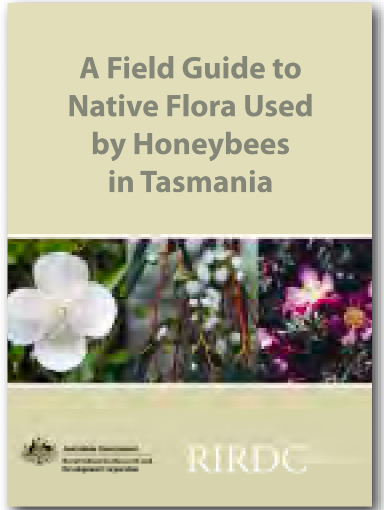
The species pages

The species pages contain the 193 species, native and exotic, that were chosen to represent a selection of useful bee forage. Many of the plants are known as top producers of both pollen and nectar; a few are nectar only; and some are pollen only. There is not enough room to include all the good and reliably producing native species known to beekeepers; what is provided is a sample.

Images of the species are self-explanatory, and wherever possible an image of the flower and mature plant is provided. Most of the eucalypts have a close-up of the flowers, buds and/or fruit to help with identification. The information provided is succint. More is in the publications listed in the bibliography and documents on the internet.

Brief descriptive information is used:

- Height and width or horizontal spread are given where known.
- To provide a greater degree of latitude, an informal, more flexible approach to the vertical layers is used.
- While the terms 'herb', 'shrub' and 'tree' have been used, they are not applied in a strict sense, providing more of a continuum.



A Field Guide to Native Flora Used by Honeybees in Tasmania, by Mark Leech, is a user-friendly tool for beekeepers, to help them identify Tasmanian native flora likely to be used by and beneficial to honeybees. It is an essential element of a suite of products that describe Tasmania's honeybee industry and the floral resources used by honeybees. (Available from https://rirdc.infoservices.com.au/items/09-149).

The following guide is applied:

Herb layer	0–2 m
Shrub layer	0.5–6.0 m
Trees	From 6 m up

Woodiness is not used as a criterion since a prostrate shrub can be placed in the herb layer and a shorter, multi-stemmed tree can be in the shrub layer.

Plant descriptions are kept simple. Some botanical terms are used: a glossary is provided at the end of the book to assist with interpretation.

Conditions

The conditions of climate, rainfall, aspect and soil for each species are summarised in a table such as the one below.

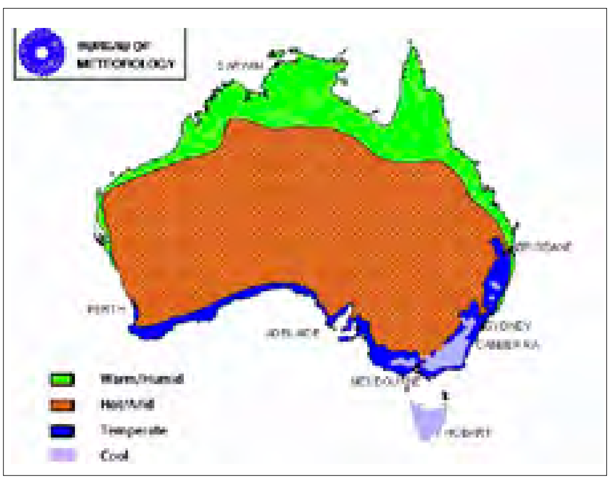
Climate

A 4-climate-zone model is used. It is a simplistic approach given the scope of the work and is based on the Australian Bureau of Meteorology 6-climate-zone map of tropical, mild tropical, semi-arid, arid, temperate and cool.

Climate	• Temperate hot/arid • Frost hardy
Rainfall	• 500 mm, very drought tolerant
Aspect	• Full sun, partial shade
Soil	• Sandy loam to heavier clay • Waterlogged soils • pH > 6.5 to < 8.5 • Very salt-tolerant ECe 800–1600 mS/m

The 4-zone model used:

- warm/humid—combines tropical (hot humid summers) with mild tropical (warm humid summers)
- hot/arid—combines semi-arid (hot dry summer mild winter) with arid (hot dry summer cold winter)
- temperate—warm summer cold winter
- cool—mild/warm summer cold winter



In all broad climate zones there will be cross-overs and many regional and subregional climates with microclimates occurring in all landscapes. Within species, climate options were determined by the known origin of the plant and its cultivated extent. Many Australian natives have very broad tolerances, providing a much larger matrix from the limited species choice.

Rainfall

Minimum rainfall for reasonable growth is included. This will assist selection for the water-wise garden. It should be noted that best growth, flowering and foliage development usually occur under optimum water conditions. It is generally only plants that come from warm/humid zones that require constant soil dampness. Details of drought tolerance are provided as a relative indication of how long plants can survive without water and respond following watering or rain.

Aspect

Details of aspect are provided as an indication of shade and wind tolerance.

Soil

Most plants require well-drained soils, although a few tolerate inundation and waterlogging. An indication of soil tolerance and structure is given without being technical—for example 'light sandy to heavier clay'.

Soil pH range is indicated when known. Soil pH is a controlling variable, affecting many chemical processes. It specifically affects plant nutrient availability by controlling the chemical forms of the nutrient. The optimum pH range for most plants is between 6.0 and 7.5, but many plants have adapted and thrive at pHs outside this range.

Tolerance of salinity, where known, is given as a range of electrical conductivity (EC), measured as milliSiemens per metre (mS/m).

Uses

Many plants and trees can be used in a variety of places in the landscape—gardens, streetscapes, and so on—and for a variety of purposes.

Descriptions of known uses and opportunities are provided and where the wood of a tree is used some more technical information is given—colour of heartwood, durability, hardness, ease of work, and air dry density in kilograms/cubic metre.

If a plant, shrub or tree, or part of one, is used in herbal or traditional medicine that is noted, but no descriptive information about alleged health benefits is given.

Apiculture

The information about honey and nectar production, yield reliability and product description comes from beekeepers, published sources and international searches. It varies greatly in detail and descriptive terms. Crane et al. (1984), in their global survey, often reported honey yield per hectare, an Eastern European reporting method that can include hive stores rather than actual honey take. Likewise, hive yields can vary between total hive weights and actual takes. This information should be used as an indication only since it is far from definitive and the sources are variable.

Other researchers have used anecdotal information from beekeepers and report in terms of numbers of 27-kg tins produced (Birtchnell & Gibson 2008).

Boomsma (1972) provided the following standard that gives a great degree of latitude:

Yield/quality	Description
Honey yield	
Good or (high)	An extractable surplus yielded
Average	No surplus, colony vigour maintained
Poor	Colony vigour recedes
Pollen yield	
Good	An obvious surplus stored
Moderate (or average)	No stores, colony maintains strength
Poor	Colony loses strength
Pollen quality	
Good or (high)	Bees breed freely, colony increases in strength
Average	Bees breed, colony maintains strength
Poor	Bees fail to breed, colony loses strength

This is a very simplified approach since the reality is complex. For example, protein research demonstrates that a drop in the level of specific amino acids can affect honeybee vigour and longevity (Somerville 2001, 2005; Manning 2008).

Honey colour reporting also varies from personal description to the International Pfund Honey Grade and the official Australian Standard. Where known, the Australian standard is used; otherwise the descriptions as reported are used.

Australian Honey Colour Standard	Pfund Honey Colour Grade range (mm)
White	0–34
Extra light amber	35–48
Light amber	48–65
Pale amber	65–83
Medium amber	83–100
Amber	101–114
Dark amber	>114

Aroma, taste, viscosity and granulation or crystallisation all vary in description.

Floral sequence

Beekeepers have extensive knowledge of the flora their bees use, flowering times, and conditions affecting bud onset and flowering.

FLOWERING SEQUENCE

J F m a m j j a s o n **D**

The representation shown here makes no attempt to be specific. The range some species can have is vast— from tropical northern Queensland to Tasmania in some instances—and the flowering onset can vary greatly within that range.

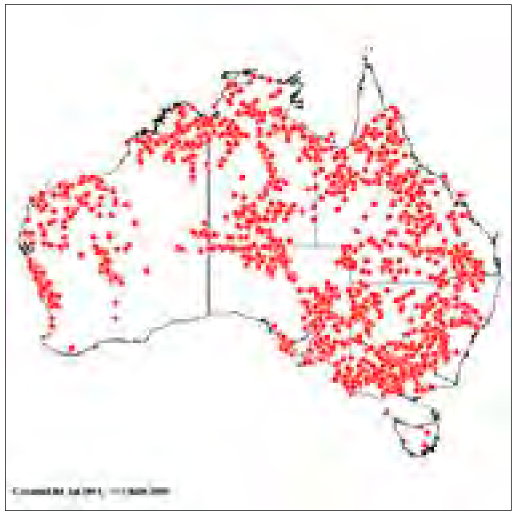
The representation of flowering range is as follows:

- Where flowering is limited to a specific range, bold capital letters in black are used.
- The background, where there is no known flowering, is depicted in a light grey lower case font.
- Some species flower continually throughout the year:
  - If heavier flowering occurs it appears as black bold capitals.
  - If random light flowering occurs it is black lower case.

Maps

The distribution map for native species is from the most current herbarium collections from the Australian Virtual Herbarium < http://chah.gov.au/avh/>.

The combined specimen data from each herbarium's collection provide the most complete picture of the distribution of Australia's flora to date. This usually indicates the known natural occurrence. Many species have a very limited natural occurrence; for example, *Eucalyptus caesia* (gungurra or silver princess) is limited to a small area in south-west Western Australia but is widely planted in Australian gardens.



Jacaranda in flower

Urban sites: general

There is a growing trend in Australia and internationally to improve the sustainability and biodiversity of urban landscapes in ways as varied as creating 'green' streets and revegetating open space (Housing NSW 2010). The trend involves community and neighbour participation and extends to community gardens, with examples of community bee gardens as educational displays and productive spaces (Wills 2010).

The increased awareness of communities and governing authorities of the need to enhance 'green space' outcomes—from planter boxes, hard pavement replacement, street trees and community gardens to large parks and revegetated areas—provides a timely opportunity to improve bee forage. It would appear to be a favourable time to increase bee forage plantings: many local government areas have a policy for urban beekeeping, providing the legal setting; communities are aware of a potential food crisis in some regions of the world; and there is general concern for the collapse of honeybee populations in some regions.

Melliferous planting for enhanced pollen and nectar supply benefits a wide range of insects and animals. Many honeybee-attracting plants such as many of the Australian native species are also great bird attractors, increasing the biodiversity of built environments and adding to ecosystem services.

A programmed approach to educating the community about the benefits of increasing bee forage will improve the understanding of honeybees and their benefits, which is also likely to help overcome some people's fears about stings and swarms.

Cities as apiary sites

Australian cities have historically provided bee forage and honey flows. Jolly (2011) reports that in the early 1880s there were about 200 beekeepers in the Adelaide metropolitan area.

Raymont (1920) noted that 'the flora in the city limits city apiaries to six or so hives'. Urban apiary sizes are now often limited by regulation to the area of land on which they are sited.

Cities all over the Western world are embracing beekeeping as an interesting, rewarding hobby and one that offers commercial benefits. The list of cities reporting bee projects and increased interest in beekeeping continues to grow—London, Paris, Berlin, Tokyo, Toronto, New York and San Francisco being just a few. Australian cities are also showing increased awareness, with beekeeping courses sold out and urban apiaries increasing in number (Malfroy 2011; Norris 2011; L Fenlon 2011, pers. comm.).

A balcony beehive next to water gum, *Tristaniopsis laurina,* in an inner Sydney suburb Photo: Doug Purdie

Lyndon Fenlon inspecting his hives on the Intercontinental Hotel, in the heart of Melbourne Photo: Nicola Pilkington

Lyndon Fenlon of the Urban Honey Co. in Melbourne is developing urban honey production as a systematic opportunity to harvest the resources of our cities (Fenlon 2011, pers. comm.). Not to miss out on the global trend to place hives on public buildings, he is negotiating with the owners of prominent locations in the cityscape.

The Ginza Honey Project in Tokyo has created global interest in the possibilities of city-based beekeeping as reported by National Geographic (Ryall 2008). The Ginza, an internationally renowned shopping precinct in central Tokyo, is a pesticide-free area, and the honey produced from this rooftop project is used in some exclusive locally made products (Yonida 2009).

Cities safer than the countryside?

French beekeeper Nicolas Géant has established his bees on the roof of the famous Grand Palais on the Champs Elysées in Paris. Géant claims, 'Urban beekeeping is the future of apiculture. Most of the beekeepers have taken their hives back to the city because they realized bees were dying 30 percent more in the countryside' (Guest 2010).

It may seem paradoxical, but pollution in the countryside is more toxic to bees than that in cities. 'For 10 years now, the city of Paris has banned all the chemical products from its gardens', Géant explained (Guest 2010). This is similar to the pesticide-free Ginza Precinct in Tokyo. Bethge (2008) noted that in Germany cities are ideally suited for bees: they develop well in the milder city environment that provides a constant nectar source.

Corporate involvement

Corporate interest and involvement are growing, as evidenced by the Fairmont Group, an international chain of hotels and resorts. As part of the brand's 20-year commitment to the environment, six of its hotels have established hives on rooftops and in on-site herb gardens. From Canada to Kenya these hotel apiaries produce honey that is used by the hotel chefs in their food and cocktails; the honey is also sold in hotel stores.

Fairmont Royal York bee hives

While these projects may seem unusual, they are evidence of a growing trend in urban beekeeping and corporate responsibility that appears to be creating greater awareness of honeybees and their forage requirements.

In response to colony collapse and threats to the US apiary industry, Häagen-Dazs, a well-known ice cream brand, launched the 'Häagen-Dazs Loves Honeybees' campaign in February 2008, committing significant funding to both the University of California Davis and Pennsylvania State University for honeybee research. Its contribution to UC Davis resulted in a bee garden as a demonstration, education and research tool. The purpose of the Honeybee Haven garden is to provide a year-round food source for honeybees. One of the design criteria in the competition that was held was that the Honeybee Haven should inspire the development of honeybee gardens in a variety of settings, including backyards, public gardens, agricultural easements, urban rooftops and other urban spaces (UC Davis 2009).

The winning design for the Häagen-Dazs Honeybee Garden at the Harry Laidlaw Jr Honeybee Research Facility, UC Davis, California

The Häagen-Dazs funding for Penn State University resulted in the development of 40 demonstration gardens under their university's Master Gardener program. The aim of the program is to educate home gardeners in how they can provide safe havens for honeybees and other pollinators. The program offers workshops, a certification system for pollinator-friendly gardens, and point-of sale-material at retail nurseries to help inform gardeners' planting decisions (ENS 2009).

Other universities have been involved with demonstration bee gardens, generating considerable interest over a number of years. Ohio State University Extension Honeybee Lab in association with Tri-County Beekeepers Association has managed a bee garden since 1994. The garden has over 80 species of pollen- and nectar-producing garden plants. Open to the public daily, it presents information on bee forage for gardeners and beekeepers (OSU 2011).

Corporate sponsorship is also occurring in Australia. After the recent launch of a hair-care range containing royal jelly, L'Oréal Paris has been inspired to become involved in the fight for Australia's honeybees (AHBIC 2009). It has made a significant financial contribution to partner research with Pollination Australia. Involvement of the corporate world in funding research and the establishment of demonstration sites and gardens will greatly improve understanding and awareness of the needs of honeybees and other pollinators for sustainable forage across the landscape.

The urban forest

The concept of the urban forest involves a different way of considering urban vegetation. Urban forest is defined as the totality of trees and shrubs on all public and private land in and around urban areas and is measured as a canopy cover percentage of the total area. It is internationally recognised as a primary component of the urban ecosystem and an essential part of a 'liveable' and economically sound community (North Sydney Council 2011).

Urban forestry concerns the study and management of a city's urban forest, which consists of the trees, shrubs and other vegetation in parks, along streets, in yards, on unbuilt land and in urban natural areas. The urban forest provides important benefits to all residents of a city. Trees in the city significantly improve the livability and vitality of our community and provide numerous environmental services including reductions in air pollution, greenhouse gases and stormwater runoff (City of Vancouver 2007).

Hives in a community garden, placed on a purpose-built carport roof to allay fears of bee stings Photo: Doug Purdie

In Australia in 2003 the NSW Local Government Association conference endorsed an urban forest policy. The policy aims to improve urban forest planning, management and practices in all NSW local government areas, so that communities receive maximum benefit from their urban forest (NSC 2011).

Recognition of the urban forest concept offers the opportunity to influence the availability of bee forage in an integrated way, rather than with ad hoc plantings of ornamental trees that might provide some opportunistic forage. It moves away from trees as individuals and ornaments to their being essential infrastructure. It also assigns an equal or greater value to the 'green infrastructure' of the forest, providing for improved allocation of funds to manage and enhance the urban forest.

> Diversity is the key to a sustainable urban forest. An urban forest diverse both in age and in species is more resilient and ensures that no single event, pest, or disease wipes out a significant proportion of the city's trees at any one time. (City of Vancouver 2007)

Home gardens, urban agriculture and community gardens

Gardening of all kinds—ornamental, productive or a combination of both—is a wonderful activity that can be carried out at home, regardless of the amount of space available. Pot and balcony gardens are popular with city-based apartment dwellers: they provide a connection to the natural environment and can be very productive in terms of herbs, vegetables and fruits, albeit on a small scale. Suburban gardens have traditionally provided much home produce, and there is growing interest in home gardening and the contribution it can make to sustainable food systems.

A traditional Melbourne front garden with figs, olives and lemon trees Photo: Mark Leech

Where individuals lack gardening space, community gardens and urban farms provide an opportunity to become involved in urban food production.

Planting bee forage for all seasons contributes significantly to the productivity of the garden, and the cumulative effect of increased quality bee forage ultimately helps produce healthier bee populations—both managed honeybees and the many native bees that co-exist.

A recent development in Pittsburgh, in the United States, has been the creation of community apiaries, an extension of the concept of community gardens focused on providing plants and space for colonies of managed honeybees. The first community or cooperative apiary in the US was pioneered by not-for-profit organisation Burgh Bees and opened in May 2010. Using a vacant lot, the group worked with local authorities and secured a five-year lease. They have since begun developing a second community apiary. Meyer Grelli, the organisation's founding president, explained that the Homewood apiary is the first of its kind in the US. The apiary hosts five hives used exclusively for teaching beekeeping and offers space for newly trained beekeepers to keep their own hives. The garden provides bee forage and is maintained by volunteers. It has led to increased awareness of the essential contribution honeybees and native pollinators make to food production and healthy ecosystems (Green 2010).

The United States' first urban apiary, an initiative of Burgh Bees in Pittsburgh PA

> Hives are a wise use of green space. They are a help to the environment and add diversity to the community, in terms of how different plots of land are used. (Page 2011)

Vegetable box vegetable garden Photo: Mark Leech

Genesis Park Community Garden, in the Bronx, New York, is now home to at least three beehives, each of which produces up to 136 kg of honey a year. Garden coordinator Roger Repohl sees the relationship with the bees as a symbiotic ecological one:

> The bees help us get higher-quality fruit and more productivity, and provide our community with a delicious local product: honey. In return we help them grow and prosper. (Repohl 2007)

Mark Winston, Professor of Apiculture and Social Insects at Fraser University in Burnaby, Canada, noted:

> It's a wonderful way to produce food in the city, both through producing honey and through their significant pollination capabilities, … The backyard beekeepers are doing a great service to all of us in the city by providing the pollinators in backyard gardens. (Scallan 2010)

Australia's Centre for Education and Research in Environmental Strategies, or CERES, at Merri Creek in East Brunswick, Melbourne, is an award-winning, not-for-profit environment and education centre and urban farm.

Concern about bees is leading to an increase in urban environmental awareness. With increased awareness and understanding the bees' plight and need for a mixed diet has provided a lobbying point for more street trees for bee forage in New York City (Linderman 2010). Many Australian streets are planted with beneficial plants and trees, both native and exotic. This has been more by accident than by design, and the addition of bee forage as a decision criterion for species selection will help build the future resource.

Across the urban landscape there are many opportunities for enhancing bee forage by choosing plants that provide pollen—in early spring for the build-up of bee populations, in autumn for winter stores, and throughout the warmer months for honey flows.

A green wall could provide significant bee forage: Musée du Quai Branly, Paris Photo: Joyce Benson

Available land

Our thinking is often limited to land that is currently in use or where bees obviously forage, such as urban gardens and orchards, but a number of opportunities exist in the greater urban environment, in areas currently unused or under-used. These include the verges of highways, stream and creek reserves, railway reserves, sports fields and golf courses. Land that is temporarily unused offers the possibility of temporary use through an annual crop, and then there are rehabilitation sites such as old land-fill areas. Future resources may be more 'vertical', with an increase in 'living walls', 'green walls' or 'bio-walls': plants are grown vertically, often to reduce building heat and/or to treat water.

Golf courses

Barnbougle Dunes links golf course, Bridport, Tasmania Photo: Mark Leech

Golf courses cover large tracts of land, often privately owned, in or near urban environments. In Australia they occupy five per cent of the urban area of our major capital cities (Dawson 2000). They tend to offer stable management and are not usually in peril of urbanisation.

Managers are beginning to understand the importance of the wildlife habitat golf courses provide. While usually portrayed as impeccably manicured playing fields, they do provide large tracts of remnant vegetation and planted wildlife refuge. Sympathetic management of out-of-play areas can provide excellent habitat that will benefit pollinator insects, as well as many other types of wildlife. Foraging plants can be introduced to a golf course by creating either natural habitat in out-of-play areas or flower borders in more formal parts of the course, such as by the clubhouse or pro shop (Shepherd 2002).

The opportunity exists to plant melliferous species when planting new areas or replacing existing plants. The Xerces Society along with the US Golf Association has produced a guide to establishing and managing native pollinator habitat on new and existing golf courses. In some areas the course may be the only sizeable area of green space with relatively natural vegetation.

If some simple steps are taken to establish patches of native wildflowers and nesting sites, golf courses can support thriving populations of pollinators, including honeybees, which in turn will help maintain healthy plant communities in wild lands and support full harvest on farms and in backyards (Shepherd 2002).

The degree to which golf courses contribute to urban nature conservation depends on the extent to which ecological criteria are incorporated in golf course design and management practices (Hodgkison 2006).

GolfAustralia is committed to enhancing environmental outcomes, including through habitat maintenance and management. In 2005 the Australian Golf Course Superintendents Association and GolfAustralia launched the Australian Golf Environment Initiative; they communicate regularly through their *Keeping It Green* newsletter <http://environment.agcsa.com.au>. The relatively new and world-acclaimed Barnbougle Dunes links course near Bridport in Tasmania demonstrates a commitment to maintenance of natural habitat and environmental sustainability. This augurs well for the enhancement and maintenance of bee forage in these relatively large tracts of land.

Railway reserves

Unused reserve areas can become a management concern for the responsible authority. Planting low-maintenance bee forage species may provide a low-cost means of controlling weeds and an extensive resource for honeybees. Melbourne, for example, has some 372 km of electrified urban rail. If 50 per cent of it were available, and assuming 5 m of space for planting, that would provide an additional 93 ha of dedicated bee forage. This becomes a significant area if multiplied across the nation.

Design principles

General design principles and specific requirements are discussed in the urban group of chapters— 'Domestic gardens', 'streetscapes' and 'urban open spaces'. Plants should be selected using criteria that relate to melliferous characteristics, space, available resources, amenity, utility, maintenance and budget. Selected plants should not be listed weeds and, wherever possible, should be non-toxic and low irritant. Other more specific criteria are discussed in the chapters that follow.

The value of trees and urban vegetation

Urban trees sequester and store carbon as cellulose (J Lord 2010, pers. comm.). The stored carbon is an asset that can become financially realisable through tradable carbon credits. There are a number of programs for determining the quantity of stored carbon in plantations and forests. The US Forest Service's Centre for Urban Forest Research has developed a Carbon Tree Calculator that can estimate the amount of stored carbon in street trees across 16 climate zones in the United States (USDA Forest Service 2011). It also provides estimates of above-ground dry biomass for potential use and, with appropriate inputs, can provide estimates of energy saved in buildings shaded by trees. Tools such as this, combined with alternative markets for standing trees and second-life uses, may provide the financial incentive to plant more trees, a useful case in favour of increasing the planting of larger long-lived bee forage trees.

North Sydney Council has used the latest modelling to calculate the asset and dollar value of benefits provided by its urban forests. It has estimated the replacement value of trees at $22 million, with an annual net return in benefits of $3 million, from an area of approximately 1100 ha (North Sydney Council 2010). This does not account for the value of bee forage and product yield—in itself substantial. The NSW Government inquiry into urban beekeeping estimated that there are 50 000 managed hives in urban NSW, producing 1 million kg of honey plus other hive products and pollination services (NSW Government 2000).

As the momentum in urban beekeeping increases there is a need to gain a better understanding of the urban environment's potential for sustainable production from its planted and natural floral resources.

Frontline defence

Urban beekeepers in Melbourne are being used in the latest frontline disease detection program. Bee Force, a pilot project launched in April 2011, has engaged 10 urban beekeepers trained in early detection methods. The trial is based around the Port of Melbourne, a busy container port where exotic pests could enter and have devastating impacts on Australian agriculture. Of particular importance is early detection of varroa mites and similar destructive exotic pests. Australia is one of the few varroa-free countries in the world, and early detection is essential.

These urban beekeepers are playing a significant role in protecting Australia's commercial agricultural production and suburban gardens. Many home garden fruit and vegetable plants are dependent on bees for pollination (RIRDC 2011).

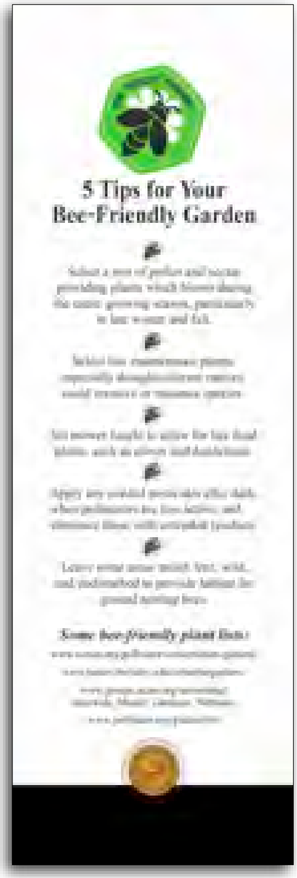
Where to now?

The urban environment in Australia has provided a valuable resource for beekeepers since European settlement. The flora in domestic and public gardens and open spaces give bees a continual floral sequence, often in sheltered locations. Urban floral variety is almost endless, giving bees a balanced diet and at least a choice. Globally and within Australia there is an increased awareness of the benefits and potential of the urban floral resource for honeybees. It is a resource that is robust and secure within a range of tenures from home gardens to golf courses. The idea of producing locally and reducing food miles has popular appeal. Now is the time to consider enhancing urban forests' bee forage by making choices in favour of plants that provide quality nectar and pollen throughout the year. Strategic decisions by the home gardener through to local governments and other land managing authorities will provide an enhanced future resource and benefit us all.

Lyndon Fenlon of the Urban Honey Co. is a volunteer beekeeper in the Bee Force project in Melbourne Photo: Tahnia Trussler

Acacia acuminata

Domestic gardens



A useful bookmark reprinted with permission Partners for Sustainable Pollination (2011)

A home gardener can do a great deal. By planting bee-attracting plants you are contributing to honeybee and native bee nutrition. If you follow a few simple guidelines, you can plant species that provide significant nectar sources and very beneficial pollen. Urban environments around the world are often considered a good source of year-round pollen and nectar. Gardens that specifically support honeybees will secure resources, improve urban apiary yields, and provide for other pollinators such as nectariferous birds, butterflies and native bees.

Just as Plato said 'Beauty is in the eye of the beholder', garden layout and design are equally subjective. While the emphasis of this publication is on planting for bee forage, appearance, sustainability, maintenance and food production are taken into account. 'Sustainability' is used to refer to drought tolerance, nutrient requirements, longevity and maintenance.

A bee garden can be as limited as a single pot-plant or as extensive as an entire garden, complete with large trees, ornamentals, shrubs and vegetables. Vegetable garden and home orchard yields can be improved by planting 'bee-friendly' plants between rows or at the ends of beds (Barrette 2010).

A balanced use of native and exotic plants is encouraged. Native plants can be selected for drought tolerance and are more attractive to native birds and other pollinators. Many exotic plants also have a place in urban garden settings, for their floral and structural beauty, melliferous properties and provision of food, especially in the case of culinary herbs. Deciduous trees, mostly exotic, provide cooling shade in the summer and let light in during winter, particularly in southern areas. Whether you are planting a vegetable garden with herb borders, a 'low-maintenance' native garden or a formal entrance in any of the four climate zones, a number of shared design principles apply.

Lavender is very attractive to bees
Photo: Mark Leech

A honeybee working oregano planted in a pot Photo: Mark Leech

Bee garden design criteria

Bees like a varied diet, so plant many flowering species that are beneficial to bees. Beneficial plants include natives and 'heirloom' or open-pollinated varieties; avoid modern hybrids and 'pollen-free' plants. It is important to have at least four different species flowering at any time and to have continual flowering throughout the year. In cold-climate regions abundant winter flowering can cause problems for the colony (Somerville 2002).

Plantings should be in multiples, clumps or layers from the ground up (Barrette 2010). It is preferable to plant larger swathes with wide borders and beds that are filled with a variety of plants that flower throughout the year.

A well-laid-out garden with clumps of species Photo: Mark Leech

General gardening advice for attracting bees and other pollinators

The following advice is adapted from the Xerces Society's Pollinator Conservation Program (Shepherd 2004).

- **Don't use pesticides**. Most pesticides are not selective. By using pesticides, one risks killing off the beneficial insects along with the pests. If you must use a pesticide, start with the least toxic one and follow the label instructions to the letter.
- **Use local native plants**. Many native plants are very attractive to honeybees. They are also usually well adapted to your growing conditions and can thrive with minimum attention. In gardens, heirloom varieties of herbs and perennials should be used. Single-flower varieties may also provide good foraging.
- **Use a range of colours**. Bees have good colour vision to help them find flowers and the nectar and pollen they offer. Flower colours that particularly attract bees are blue, purple, violet, white and yellow.
- **Plant flowers in clumps**. Flowers clustered into clumps of one species will attract more pollinators than individual plants scattered through the habitat patch. Where space allows, make the clumps 1 m or more in diameter.
- **Include flowers of different shapes**. Open or cup-shaped flowers provide the easiest access and shorter floral tubes are important for honeybees. Other pollinators, including native bees, butterflies and birds, benefit from differing flower shapes.
- **Have a diversity of plants, flowering all season**. A varied diet is essential for the well-being of honeybees and other pollinators.
- **Plant where bees will visit**. Bees favour sunny spots over shade and need some shelter from strong winds.
- **Provide accessible water**. Bees need access to water. Provide easy access, either through wet sand or pebbles; do not drown the bees.

Corymbia ficifolia, red flowering gum, is very attractive to bees and has been planted in many parts of the world Photo: Mark Leech

Pincushion hakea is a small native shrub loved by bees Photo: Linda Manning

Late winter and early spring flowering is important to provide pollen and nectar for bees. The colonies begin to build their numbers during this time and therefore require an increased food supply, having depleted their winter stores. Similarly, a summer gap may occur, when plants have set fruit or seed; again, it is important to maintain the food supply during this period. Many of the eucalypts flower in summer. A classic choice for both domestic and other urban environments is the Western Australian red flowering gum (*Corymbia ficifolia*). It is widely planted throughout Australia and the world. If it is protected from frost during the establishment phase it is quite hardy. Pellett (1920) described this as the one of the greatest honey producers he had ever known—'a brilliant bloom in clusters, a beautiful sight'.

Shelter from wind is important. Bees do not like working in windy conditions, although it is important to keep bee plants in open, sunny positions to allow the bees better access.

Smaller trees provide excellent garden features and can produce abundant flowers that progressively open, giving the bees a significant resource in one location.

Bees need water but can often drown in open water. Wet sand, a pool with shallow edges or a birdbath full of stones can all be used to create suitable water sources.

Garden preparation

Australia is the driest habitable continent in the world and yet we are the highest consumers of water per capita. Drought conditions are a regular feature of our climate. Even with abundant rainfall in either winter or summer zones, it is usually not enough to keep catchments at satisfactory levels. We are very wasteful in our water use, using more than is replaced—not fixing a leaking tap, for example. Ensuring that the ground is covered with good mulch and that the soil is well drained means we are making effective use of our water allocation.

While this publication is more aimed at plant selection than gardening techniques, there are a number of things common to most gardens, whether in the cold climate of the south-eastern highlands or in tropical northern Queensland. Good soil drainage to a depth of 30 cm is standard practice for most plantings.

Given the vast differences in climate and soils, further detail about your region should be sought from a local source. There are many good points of reference for gardening advice: a local nursery, organic and permaculture groups, and local gardeners, for example. They are usually happy to chat with someone who is interested. There are also numerous online opportunities, and your local library is a trustworthy resource.

Plant selection

The focus of this publication is plants that produce abundant high-quality pollen and nectar and are suited to the landscape zone. Climatic requirements of plants have been determined on the basis of where they originate and are known to grow and, while many are very adaptable and have been grown from Western Australia to southern Queensland, this is not always the case. Within the plant descriptions, an indication is given as to which broad climate zones the plants may grow in. Similarly, exotic plants that have originated from a tropical region may be restricted in their potential range in Australia due to water availability and winter temperatures. Although they might grow outside their natural habitat they might not produce. This is extremely variable within species, climate zones and across the landscape.

Native hibiscus from the dry Great Australian Bight region is grown from Tasmania to the subtropics Photo: Mark Leech

Some high-yielding nectar species were selected that can cause colony decline in natural settings due to a lack of pollen; examples are yellow box (*Eucalyptus melliodora*) and mugga (*Eucalytpus sideroxylon*). However, pollen lack is usually not a problem in most urban settings due to the variety of species flowering at any given time of the year. Increased honeybee and native bee populations in domestic gardens will cause increases in vegetable and fruit yields as a result of better pollination. Most culinary herbs and some vegetables, such as asparagus, are excellent sources of pollen, while celery (*Apium graveolens*) yields excellent nectar (Pellett 1920).

In the garden setting emphasis is given to food plants—culinary herbs, some vegetables, berries, shrubs and fruit trees. The plants selected range from cool to warm/humid climates. Where known and appropriate, native foods are included. Selection is coupled with the desire to create a pleasing aesthetic in the landscape and, again, there is the opportunity to mix and match within the species provided.

Floral calendar

Many authors say the most important design criterion for a bee-friendly domestic garden is floral abundance and continuous flowering throughout the year (Somerville 2002; Shepherd 2004; Barrette 2010; Goodman 2010; IBRA 2008). Given the broad scope of this book and the limited chance of all species from a climate zone being planted in one location, the emphasis is on bee forage and appropriateness for the landscape. For each species, the climate zones it is likely to succeed in are noted. With this matrix there is a much better chance of gaining a full floral sequence.

It must be emphasised that the species list presented is not definitive; other species could have been included had the scope of this pubication not been limited. In all, 192 species are included across three plant layers, four landscape units and four climate zones.

Mexican bush sage (*Salvia leucantha*)

Garden species selection

The following pages detail the native and exotic species that were chosen to represent a selection of useful bee forage for gardens. They are organised according to climate categories:

- cool
- temperate
- warm/humid
- hot/arid.

Cool climate garden species

The following table summarises the garden species selected for cool climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Lavendula* spp.	Lavender	C	G S U F	N	P	•	•										•
	Melissa officinalis	Lemon balm	CT	G S U F	N	p	•	•	•	•								•
	Origanum vulgare	Oregano	CT	G	N		•	•	•								•	•
	Mentha piperita	Peppermint	CT	G F	N	P	•	•	•									•
SHRUB	*Grevillea montis-cole*	Grevillea montis-cole	CT	G S U	n	p	•	•	•							•	•	•
	Ribes spp.	Flowering currants	CT	G F	N	p									•	•	•	
	Rubus idaeus	Raspberry	CT	G F	N	P	•								•	•	•	•
	Vaccinium corymbosum	Blueberry	C	G F	N		•	•	•	•	•						•	•
TREE	*Prunus lusitanica*	Portugal laurel	CT	G U	n	P										•	•	•
	Citrus limon	Lemon	CT W H	G U F	N	P	•	•	•	•	•	•	•	•	•	•	•	•
	Malus spp.	Apple	CT H	G F	n	P									•	•		
	Eucalyptus leucoxylon var. *Macrocarpa rosea*	Large-fruited yellow gum	CT H	G S U F	N				•	•	•	•	•	•	•	•	•	•

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Lavender

Lanvandula spp.

FLOWERING SEQUENCE

J F m a m j j a s o n **D**

Features

Perennial to sub-shrub

H 1.2 m W 1.2 m

A typical cottage garden with much bee activity Photo: Mark Leech

Lavender is a cool-climate perennial herb famous for its perfume. French lavender, *L. dentata*, is advisable for the subtropics as it handles humidity. Flowers are densely clustered on spikes above the grey–green foliage. They should be pruned back after flowering. Propagation by division or cuttings.

Origin: Asia, now widespread.

Conditions

Climate	Cool
Rainfall	Drought tolerant once established
Aspect	Full sun, does not tolerate shade
Soil	Dry sandy to gravelly well-drained. Responds well to application of dolomite, pH 6.4–8.3

Uses

A plant of many uses. It is characteristically aromatic and is used dried for potpourri and for the sock and 'undies' drawers. The essential oil is antiseptic. Lavender has many uses as a herbal remedy and the flowers are edible.

Bees find lavender very attractive Photo: Mark Leech

Apiculture

Lavender is very attractive to bees, producing high-quality pollen and one of the world's most prized honeys. The Spanish company HISPAMIEL (2011) describes the honey as white to amber in colour; 30–48 mm Pfund; can be a little dark if honeydew is present. Floral aroma with an extraordinarily intense and persistent lavender component with phenolic notes. Sweet taste with acidic notes. If it is dark-coloured, it can have salty notes. Can tend to crystallise in medium-sized crystals.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	80–180 kg/ha	Extra light amber	Good body	Very smooth butter-like	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	290–350 kg/ha	Yellow	High	High	Annual

HERB

Lemon balm

Melissa officanalis

Features

Perennial herb

H 90 cm   W 90 cm

A hardy easy-to-grow perennial with a distinctive lemony fragrance when the leaves are bruised. Vigorous clump-forming self-seeder that can be contained in a pot. The inconspicuous small pale-yellow to pale-lilac flowers appear in late spring and last throughout summer. Plant should be cut back regularly to produce fresh young growth.

Origin: Southern Europe.

FLOWERING SEQUENCE

J F M A m j j a s o n **D**

Lemon balm is highly regarded as bee forage Photo: Christopher Bailey

Conditions

Climate	Cool, temperate
Rainfall	Drought tolerant
Aspect	Full sun to semi-shade
Soil	Any soil

Uses

Can be used as a low-traffic lawn substitute and as a border plant, releasing its fresh scent as it is brushed against. Most often used as lemon tea, as a lemon peel substitute and to flavour salads.

Apiculture

Melissa is the Greek word for honeybee, a reference to the strong attraction the plant holds for the creature. The plant flowers throughout the summer. The honey is described as delicate with a light pinkish colour. Among other countries, melissa honey is produced in Canada and the Ukraine (Yorish 2001)

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	170–290 kg/ha	Light pinkish			Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
				57–138 kg/ha	Annual

HERB

Oregano

Origanum vulgare

FLOWERING SEQUENCE
JFM amjjaso **ND**

Features

Perennial herb to low shrub

H 0.9 m

Bees love oregano, even from isolated pot plants Photo: Mark Leech

A green herb that is easy to grow. The aromatic leaves are oval-shaped to 3.8 cm, the small flowers vary in colour from white to lilac–purple. Pungency of the leaves is directly related to the amount of sunlight. Propagate from seed or root cuttings.

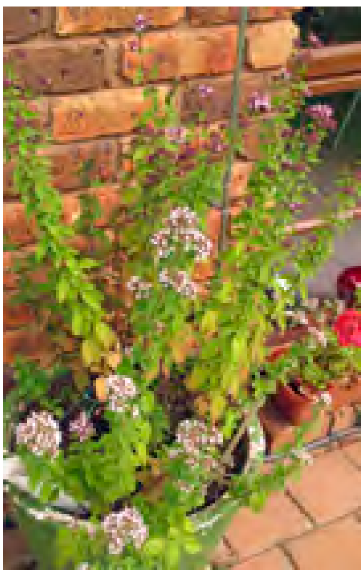
Origin: Mediterranean.

Conditions

Climate	Cool, temperate
Rainfall	500 mm
Aspect	Sunny
Soil	Well-drained neutral to alkaline soil, pH 6.0–8.0

Uses

This well-known culinary herb is a wild form of marjoram, with a stronger flavour and coarser texture. Its pungency increases with drying.



Oregano planted in a pot Photo: Mark Leech

Apiculture

Bees are attracted to this plant throughout its flowering.

It is considered to yield a high-quality honey of good flavour and aroma (Howes 1945). Howes also noted that in UK gardens it is unlikely to be grown in sufficient quantity to produce a unifloral but would add favourably to other honey. This would most often be the case in Australia.

The most famous honey produced in Cyprus is gathered from wild oregano plants growing on the slopes of the mountains. Kantara wild oregano honey is darker in colour and richer in nutrients than any other oregano honey; it probably comes from another species, *Origanum syriacum* var. *bevanii*. A sub-shrub endemic to Cyprus and Turkey (Kantara Honey 2011).

Peppermint

Mentha x piperita

HERB

Features

Perennial herb

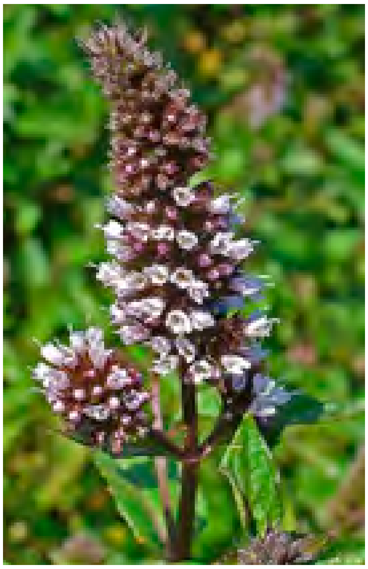
H 30–60 cm   W spreading

A well-known herb long used as a refreshing, cooling flavour. A low-growing plant that has small pointed, dark-green leaves with a coarsely toothed margin and a purplish tinge to 9 x 4 cm. The leaves and stems are slightly hairy and the stems are square in section. The tiny purple flowers are arranged around the stem, a verticillaster or thick, blunt spike. Mints spread by rhizomes and can become a problem in gardens. To prevent spreading in the domestic garden, sink a bottomless container 45 cm into the ground and 5 cm above or plant above ground in pots.

Origin: Mediterranean.

FLOWERING SEQUENCE

J F M a m j j a s o n **D**



Peppermint flowers are very attractive to honeybees Photo: H Zell GFDL

Conditions

Climate	Cool, temperate, frost hardy
Rainfall	Garden watered
Aspect	Full sun to part-shade
Soil	Wide tolerance, moist. pH 6.1–7.8

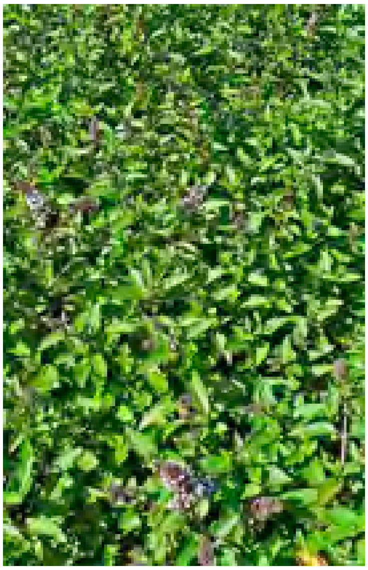
Uses

Mentha x *piperita* is the main species/hybrid used for the production of essential oil. It is a wonderful addition to any garden provided its growth is contained or it is grown above ground. Its strongly aromatic leaves and flowers can be used fresh or dried. It is used as a refreshing cold drink or infused as a tea and has a long tradition in herbal medicine.

Apiculture

Grown as a herb in the garden, peppermint can be another beneficial bee plant. Where it is grown as a crop for essential oil it produces a well-known (Europe and US) unifloral honey. The Honey Traveler website provides the following description: 'Peppermint honey crystallises into a dense fine buttery consistency, easily softened in warm water. The honey has a strong musky aroma, which when combined with the menthol packs a powerful punch. The flavour is strong but surprisingly good, medium sweet with a lingering after taste. It is amber coloured in liquid form'.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	To 230 kg/ha	Amber		Fine	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
				To 340 kg/ha	Annual



Peppermint plant Photo: H Zell GFDL

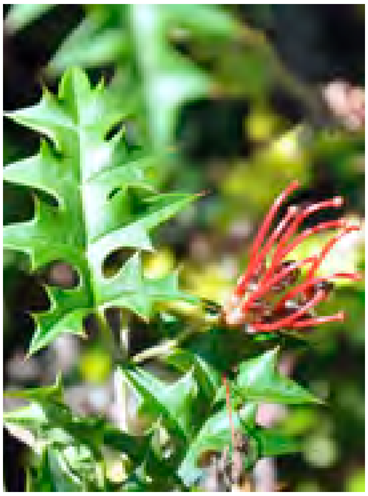
SHRUB

Grevillea ‘montis-cole’

Grevillea montis-cole

FLOWERING SEQUENCE

J F M a m j j a s **O N D**



Attractive holly leaf and the ‘spider’ flower of *Grevillea montis-cole* Photo: Mark Leech

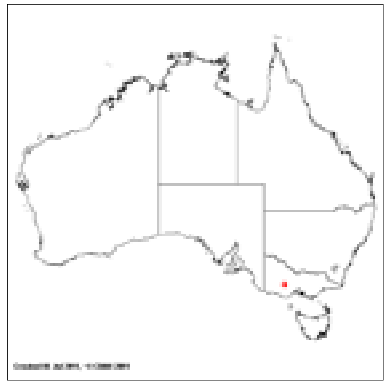
Features

Scrambling shrub

H 1.0–1.5 m

Fast-growing, scrambling or semi-erect shrub. The large leaves are glossy green, discolourous, deeply lobed and dense, to 7 x 5 cm, with triangular spine-shaped teeth. The pale-green and red flower heads to 6 cm long are one-sided clusters of many curved tubular flowers with a protruding bright-red style. This is a vulnerable species in its natural environment. Propagate from seed and cuttings.

Origin: Victoria.



Conditions

Climate	Cool, temperate
Rainfall	700 mm
Aspect	Full sun
Soil	Well-drained, various

Uses

Like many grevilleas, *G. montis-cole* can be widely used in gardens, streets and public spaces. It could also be used on farm as a permanent groundcover on laneway banks.

A rambling border of *G. montis-cole*
Photo: Mark Leech

Apiculture

Many grevilleas have a flower structure suited to honeybees. They are of considerable value as they produce significant nectar over a long-flowering period. Many flower during the spring build time, when hives’ requirements for pollen and nectar are high. Some produce small volumes of beneficial pollen.

SHRUB

Flowering currants

Ribes spp.
Blackcurrant, redcurrant

Features

Perennial shrubs

H 1.5 cm W 1.0 m

The blackcurrant is small multi-stemmed shrub with long, arching canes. The dark green leaves are alternate and simple, palmately lobed with 5 lobes and a serrated margin, to 5 x 5 cm. The flowers are reddish–green to brown with 5 petals, to 6 mm diameter and in racemes to 10 cm. The fruit is dark purple to blackish with glossy skin, to 1 cm diameter. The edible fruit has a persistent calyx. Easily grown from hardwood and softwood cuttings. Soil should be kept moist at fruiting—essential for fruit development.

Redcurrants are a similar-sized perennial shrub with leaves arranged alternately, palmately lobed. The inconspicuous flowers are in pendulous racemes to 8 cm. The fruits, 5–8 per raceme, ripen to a bright red, best picked by the raceme. Cut out dead wood. Easily grown from cuttings.

Origin: Europe, Asia.

FLOWERING SEQUENCE
j f m a m j j a **S O N** d

A blackcurrant plant Photo: Thue

Conditions

Climate	Cool, temperate, frost tolerant (protect fruit)
Rainfall	Moist soil
Aspect	Full sun to partial shade
Soil	Well-drained sandy to clay, pH 5.6–6.5

Uses

Blackcurrants are grown commercially for blackcurrant juice, jam and flavouring. They are also grown for essential oil from their fruit buds. They make a valuable addition to the home garden with their highly nutritious fruit, containing up to 3 times the daily requirement of vitamin C. Each plant can produce up to 5 kg of fruit.

Redcurrants also make a great addition to a garden; they are a little less productive than blackcurrants but, depending on variety, can produce 3–4 kg per bush. They are also a nutritious berry but contain much less vitamin C than blackcurrants.

Apiculture

These currants produce a small surplus of honey and good pollen. The honeys are described as pale and mild (Agric WA 2011). The currants of the fruit garden are all good bee plants and yield pollen fairly early in the season (Howes 1945).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
Blackcurrant		Pale			Annual
Redcurrant	100 to 200 kg/ha	Pale			Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
Black & red		Green-grey	Average	Average	Annual

Bright, bold redcurrants Photo: Lukas Riebling GNUFDL

SHRUB

Raspberry

Rubus idaeus

FLOWERING SEQUENCE

J f m a m j j a **S O N D**

Features

Deciduous perennial cane.

H 1.5–2.25 m

Fast-growing canes. Many cultivars are available and many of them do not require staking. Leaves are compound having 3–5 leaflets on vegetative, primocane and 3 on flowering cane. Leaflets are green, smooth and slightly hairy above to white and hairy underneath with coarsely serrate or lobed margins. Flowers, small and white to pinkish to 1 cm across, are in terminal clusters of 2–5 flowers. Fruit is a small rounded aggregate cluster, becoming deep red when ripe. Propagates from basal shoots and can become invasive if not tended. Buy certified disease-free canes.

Origin: Europe.

R. idaeus flowers are open and easily accessed Photo: © Mikesjournal.com, used with permission

Conditions

Climate	Cool, temperate
Rainfall	600 mm
Aspect	Morning sun, afternoon shade, sheltered
Soil	Well-drained, rich, pH 5 to 7

Uses

A great garden addition in any cooler area, providing abundant fresh berries. Grown commercially on berry farms for fresh fruit, puree, juice and dried fruit.

Lush raspberries Photo: Fir0002 Flagstaffotos

Apiculture

Depending on the cultivar, raspberries flower from September to January persisting for 3 to 6 weeks. The flowers secrete large volumes of nectar that is very attractive to bees (Crane et al. 1984). With floral-scented overtones, the honey has the almost unique characteristic of an aftertaste of the fresh fruit, with a distinctive fresh finish that is both pleasantly sweet and tart (www.localharvest.org 2011).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	20–>200 kg/ha	White		Rapid	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		White-grey-yellow	Average to very good	Average to very high	Annual

SHRUB

Blueberry

Vaccinium corymbosum

FLOWERING SEQUENCE
J F M A M j j a s o N D

Features

Deciduous shrub

H 1–4 m

Blueberries greatly benefit from visiting bees Photo: Zachary Huang, http://beetography.com

Fast growth rate. Erect deciduous shrub to 4 m, usually 1.3–2.0 m in cultivation. Grown as canes from rootstock. Leaves are small, entire ovate or elliptic to 5 cm. Flowers are white to cream, petals joined to form a tubular or urn-shaped corolla to 12 mm pendent, usually in a short raceme of 7–10 flowers on upper part of 1-year-old wood. Fruit is a false berry, plump and grey–blue when ripe. Propagate by layering or cuttings.

Origin: North America.

Conditions

Climate	Cool
Rainfall	1000 mm
Aspect	Full sun
Soil	Well-drained, light, pH 4.5 to 5.2

Uses

Blueberries are widely grown as a commercial crop, from northern New South Wales to Tasmania, with different cultivars relating to site and climate. Blueberry bushes make an attractive and productive addition to the home garden, providing up to 7 kg of fruit per bush.

Apiculture

Widely grown in the eastern United States and Canada as a commercial fruit crop with smaller areas in Australia, New Zealand and South America. Honey descriptions are from the US. Bees collect nectar and pollen from the small tubular blueberry flowers. The pollen, while low in crude protein at 13.9%, is balanced in its amino acids. Rhodes (2006) noted that the honey is considered a table honey, is light amber to amber, rich, dense, very smooth, with an aroma of green leaves and a hint of lemon and a fruity flavour with a delicate aftertaste. It tends to crystalise.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	22–40 kg/hive	Light amber to amber	Dense, full body	Moderate rate	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Poor 13.9% cp	Average	Annual

TREE

Portugal laurel

Prunus lusitanica

FLOWERING SEQUENCE
j f m a m j j a s **O N D**

Features

Large evergreen shrub

H 6.0 m   W 6.0 m

One of the best-known evergreen ornamentals, *P. lusitanica* is found in South Australia, Victoria and Tasmania. The bark is dark brown; the leathery, dark green, glossy leaves are up to 12 x 5 cm. The sweetly scented small white flowers have five petals and grow in upright spikes to 20 cm. Plant produces an inedible fruit that is a deep purple colour.

Origin: Portugal, Spain.

Elegant floral spikes of Portugal laurel
Photo: Mark Leech

Conditions

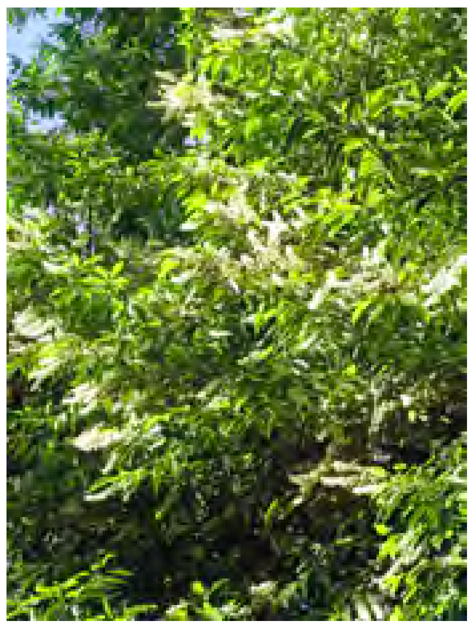
Climate	Cool, temperate
Rainfall	Drought tolerant
Aspect	Full sun or part shade
Soil	Moist, well-drained soil, sandy loam to heavy clay, pH <6 to >8

Uses

The main use for Portugal laurel is hedging or screening; it can handle frequent clipping and exposure to cold wind. It can also be left without being cut back to grow out as a flowering bushy tree. Often used in topiary and a dye is obtained from the leaves and fruit.

Apiculture

Spring-flowering, it provides very useful pollen and nectar to support hive building.



Floral abundance Photo: Mark Leech

TREE

Lemon

Citrus limon

FLOWERING SEQUENCE

j f m a m j j a s o n d

Lemon orchard Photo: Protasov A&N/ Shutterstcock.com

Features

Small evergreen tree

H 4.0–5.0 m

Attractive small trees with glossy green leaves, fragrant waxy white flowers and producing up to 3 crops a year. Once tree is fruit bearing, flowers and fruit are on the tree most of the time.

Origin: China.

Conditions

Climate	Cool, temperate, hot/arid, warm/humid, frost sensitive
Rainfall	Not limiting if kept watered
Aspect	Cool, temperate, hot/arid, warm/humid
Soil	Well-drained, pH 6.1–7.8

Uses

Lemons are the most popular citrus fruit and are grown in home gardens from the tropics to cool climates. 'Lisbon' grows in hotter Mediterranean climates, 'Eureka' in more humid, and 'Meyer' in colder areas.

Apiculture

Lemon, the perfect bee flower Photo: SunnS/Shutterstock.com

The honey is described by Crane et al. (1984) as light amber, with an acid flavour and a delicate aroma characteristic of the plant. Spain produces lemon honey commercially. HISPAMIEL (2011) describes the honey: 'Very light yellow colour, white, max. 30 mm Pfund. Weak floral aroma, with notes of methyl antranilate. Sweet taste with slightly acidic notes that are hardly noticeable. Slow crystallisation'.

Honey	Yield	Colour	Density	Crystal	Frequency
	15–60 kg/hive	Light amber		Slow	1–2 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Medium	Medium	Annual

TREE

Apple

Malus spp.

Features

Deciduous fruit tree

H 1.5–8 m

This important commercial orchard tree that relies on honeybees for pollination and successful fruit set makes a valuable addition to most backyards, and the modern dwarf varieties can be used in small spaces. They need to be cross-pollinated from another variety—often crab apples are used (*M. floribunda* var.) in suburban areas. Abundant white flowers in early spring.

Origin: Central Asia.

Uses

Apple trees, whether dwarf, potted on a balcony or a larger tree growing in a backyard, are a very useful addition to the urban pollen 'bank'. The wood is brownish-yellow to orange, very dense and hard with interesting grain. Used for small turned objects such as mallet heads.

FLOWERING SEQUENCE

j f m a m j j **a S O** n d

Apple blossoms are attractive, easy-access flowers for bees Photo: IDAL/Shutterstock.com

Conditions

Climate	Cool, temperate, hot/arid, cold nights
Rainfall	500 mm
Aspect	Full sun, sheltered
Soil	Well-drained fertile soil

Apiculture

Many cultivars are annual producers of abundant good-quality pollen. Honey is produced, but yield varies globally. Often a flower gap follows apple blossom and any stored honey from apple gets used in the hive. The yields reported by Crane et al. (1984) of 36 hg/hive and 1.3–3.6 kg/hive/day came from exceptional seasons in British Columbia and Maine. The short flowering season and adverse weather at the time of flowering tend to operate against a honey surplus. The honey is described by Crane et al. (1984) as amber colour with the aroma of apples. Flottum (2009) describes the honey as light amber with a distinctive but pleasant flavour.

Apple orchards in late winter-spring provide valuable bee forage Photo: Vladitto/Shutterstock.com

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Hive use	Amber		Fast, fine	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Pale yellow	Very good	Poor–very good	Annual

TREE

Large-fruited yellow gum

Eucalyptus leucoxylon ssp. megalocarpa

FLOWERING SEQUENCE
jf**MAMJJASOND**

Features

Small tree

H 4–9 m   W 5–8 m

Very attractive pendulous flowers in the afternoon autumn sun Photo: Mark Leech

Moderate- to fast- growing attractive small tree with large, pendulous flowers. The bark is rough at the base; upper trunk and branches deciduous with a smooth white or yellow surface. The flowers can be from cream to bright red. Grafted versions are more true to colour and height.

Origin: South Australia.

Conditions

Climate	Cool, temperate, hot/arid, frost hardy.
Rainfall	400 mm, drought tolerant once established
Aspect	Full sun
Soil	Well-drained various from sandy to heavy clay, very adaptable, pH 5.0–8.5

Uses

A widely planted, very hardy, adaptable tree suited to many uses, including as a garden and park specimen and street trees. It withstands drought, frost and smog and tolerates compacted soils. It could also be used on farm as an attractive lower component of shelterbelts.

Apiculture

Apiculture benefits are the same as for *E. leucoxylon*, which is highly attractive to bees. The cultivated form may be a more regular producer. *E. leucoxylon* is an excellent nectar producer, with surpluses occasionally greater than 100 kg/hive and regular production of more than 50 kg/hive every second year. A light amber honey with a distinct, pleasant flavour. It is pollen deficient (Boomsma 1972; Clemson 1985).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	15–60 kg/ hive	Light amber		Slow	1–2 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Medium	Medium	Annual

Temperate climate garden species

The following table summarises the garden species selected for temperate climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Origanum majorana*	Marjoram	C T	G	N			●	●	●								
	Salvia officinalis	Sage	C T W H	G S U	N											●	●	●
	Borago officinalis	Borage	C T H	G F	N	P	●	●								●	●	●
	Satureja montana	Winter savory	C T	G S U F	N		●	●										●
SHRUB	*Eucalyptus caesia*	Gungurra	T H	G S U F	N	P						●	●	●				
	Banksia spinulosa	Hairpin banksia	C T W	G S U F	n	p				●	●	●	●	●				
	Hakea laurina	Pincushion hakea	C T W H	G S U F	n	p				●	●	●	●	●				
	Passiflora edulis	Passionfruit	T W	G	N	P		●	●	●			●	●	●	●	●	
TREE	*Eucalyptus erythrocorys*	Red cap gum	T H	G S U F	N	P			●	●	●	●						
	Citrus reticulata 'Hickson'	Hickson mandarin	T W	G F	N	p									●	●	●	
	Prunus spp. *Plum*	Plum	C T	G S U F	n	P								●	●			
	Diospyros kaki	Persimmon	T	G F	N										●	●	●	

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Marjoram

Origanum marjorana

FLOWERING SEQUENCE
j **F M A** m j j a s o n d

Features

Perennial low shrub

H 60 cm

Marjoram flowers Photo: Javier Martin

Easy but slow to grow. Flowers are tiny white and purple, growing in clusters around the stem; leaves are greyish–green. Plant tends to have a sprawling habit. Propagate from seed or cuttings.

Origin: North Africa, Turkey.

Conditions

Climate	Cool, temperate, frost hardy
Rainfall	500 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained, most soils. Slightly alkaline, pH 6.1–7.8

Uses

Sweet marjoram retains its flavour after drying. It is an excellent culinary herb with a sweeter, more spicy flavour than closely related oregano. It is also used in herbal medicine.

Marjoram, a culinary favourite Photo: Forest & Kim Starr

Apiculture

Honey is light with a greenish tinge, minty flavour, excellent to taste.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	167–204 kg/ha	Light			Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Brownish–grey			Annual

Sage

Salvia officinalis

HERB

Features

Perennial herb

H 90 cm W 90 cm

A fast-growing hardy perennial. Soft, greyish–green leaves and spikes of lavender-blue to purple flowers. Propagate from seed, cuttings or rooted divisions.

Origin: Mediterranean, North Africa.

FLOWERING SEQUENCE

j f m a m j j a s **O N D**

An attractive border combining sage Photo: Jorge Salcedo/Shutterstock.com

Conditions

Climate	Cool, temperate, hot/arid, warm/humid
Rainfall	Drought tolerant once established
Aspect	Full sun
Soil	Very well drained light sandy soil

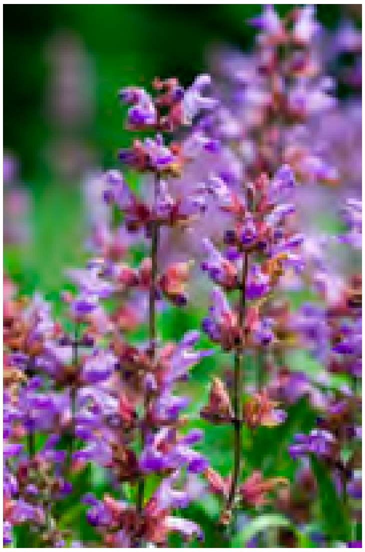
Uses

A traditional culinary herb that has also been used in herbal medicine. Can be grown successfully in containers.

Apiculture

Bees are very attracted to sage. The honey is light in colour and has a slightly herbal flavour with a floral aftertaste. The most popular honey in the western United States, described as yellowish–brown, strong herbal aroma, a heavy-bodied honey that has a medium rate of crystallisation to a fine grain (C Farrell 2011, pers. comm.). Croatian sage honey is highly regarded for its traditional medicinal qualities. The herb is considered a minor source of pollen in Italy (Crane et al. 1984).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	200 to>400 kg/ha	White	Full bodied	Medium to slow fine	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
				Minor	Annual



Sage is a very attractive bee plant Photo: Peter Radacsi?Shutterstock.com

HERB

Borage

Borago officinalis

FLOWERING SEQUENCE

J F m a m j j a s **O N D**

Features

Annual herb

H 70 cm W 60 cm

A borage field Photo: Tamara Kulikova/Shutterstock.com

Fast-growing, hardy clump-forming herb. Flowering 6 weeks after germination, borage bears loose clusters of 5-petalled, star-shaped blue flowers with white centres and black stamens. It is one of the few herbs that can grow in semi-shade. Propagate from seeds, cuttings or root division.

Origin: Mediterranean.

Conditions

Climate	Cool, temperate, hot arid
Rainfall	Fairly drought tolerant
Aspect	Full sun to partial shade
Soil	Well-drained loam, neutral pH

B. officinalis Photo: Brandon Blinkenberg/Shutterstock.com

Uses

A delicate herb with a faint cucumber-like flavour. Flowers are also edible and sometimes crystallised for cake decoration.

Apiculture

Very attractive to bees. Honey has a distinctive, clear appearance with a subtle aroma and delicate flavour. It is rather viscous and a little difficult to extract.

In Canada the plant requires good moisture to yield nectar, and yields can be substantial (Wendell 2011, pers. comm.). Not to be confused with blue borage honey from New Zealand, which is from *Echium vulgare*, viper's bugloss.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	230–350 kg/ha, >90 kg/hive	Very light	Heavy body, very viscous	Fast, 1 month, fine	Not annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Creamy	Good	70–185 kg/ha	Annual

Winter savory

Satureja montana

HERB

Features

Perennial shrub

H 0.4 cm W 0.3 m

An evergreen shrub with a moderate growth rate. The pungent, glossy dark green leaves are opposite, oval–lanceolate to 2 cm x 5 mm. Tiny white-to-lilac flowers appear in terminal spikes in mid to late summer.

Origin: Mediterranean.

FLOWERING SEQUENCE

J F m a m j j a s o n **D**

Satureja spp. Winter savory is more pungent than summer savoury (*S. hortensis*) Photo: Studio 37/Shutterstock.com

Conditions

Climate	Cool, temperate, frost hardy
Rainfall	Drought tolerant
Aspect	Full sun
Soil	Well-drained sandy to loam. pH <6 to >8. Grows on very poor limestones

Uses

A culinary herb often used with beans. The leaves can be used fresh or dried, in salads and to make tea. It has a tangy marjoram-like flavour and is also used in herbal medicine. Can be used as a ground cover and handles harsh, exposed conditions.

Apiculture

The honey ranges from amber yellow to light green. Its flavour and aroma are of medium intensity, with floral notes, hints of mint, and what is described as 'wet earth' (Marcelli Formaggi 2011). It crystallises quite rapidly, forming very fine crystals and assuming a soft consistency. Another description of taste has it as persistent, with notes that recall slightly bitter coffee.

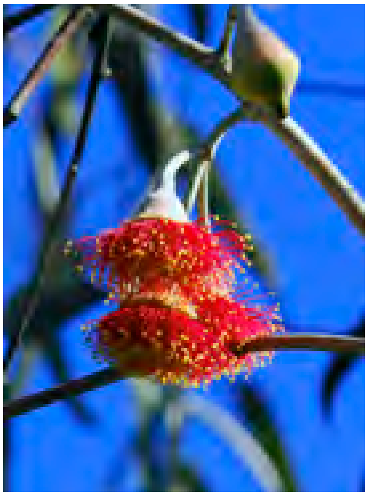
Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
		Amber to light green		Rapid to fine	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
					Annual

SHRUB

Gungurru

Eucalyptus caesia
Silver princess

FLOWERING SEQUENCE
j f m a m **J J A** s o n d



E. caesia, a beautiful Australian tree Photo: Mark Leech

Features

Mallee to small tree

H 4–5 m

One of the most attractive small eucalypts and grown in gardens, parks and public places, gungurru has silver pendulous branches, with bark peeling off the trunk in reddish flakes revealing fresh red or green bark. The leaves are silver–grey to 10 x 3 cm. The buds are in threes 2 cm long, cap pointed. The clusters of large reddish to pink flowers point down and the urn-shaped fruit to 3 x 3 cm are mealy-white. An attractive package. Juveniles are frost tender, and the tree is not wind firm while young and needs to be staked. It is lignotuberous and should respond to hard pruning if needed.

Origin: Western Australia.

Conditions

Climate	Cool, temperate, hot/arid
Rainfall	400 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sandy to heavy clay, pH <6.6 to >8

Silver princess, elegant in any setting Photo: Sean Mack

Uses

A beautiful specimen widely planted in cool temperate and hot/arid climates for its characteristic elegant display. It is planted as a domestic garden feature and in streetscapes and urban open spaces. Can contribute to low shelter.

Apiculture

Gungurru is known to be very attractive to honeybees and produces a honey yield.

SHRUB

Hairpin banksia

Banksia spinulosa

FLOWERING SEQUENCE

j f m **A M J J A** s o n d

Features

Compact shrub

H 1.5 m

Moderate to fast growth rate. A rounded or multi-stemmed shrub. Leaves are variable to 8 cm x 2–6 mm, often with a serrated margin; the proud cylindrical floral spikes are to 18 x 6 cm. The orange–yellow flowers often have a darker purplish prominent style, producing a very attractive flower spike in autumn and winter. Shrub is very showy, with many flower spikes, and is a great bird attracter.

Origin: Victoria, New South Wales, Queensland.

The beautiful flower spike of *B. spinulosa* Photo: Mark Leech

Conditions

Climate	Cool, temperate, warm/humid
Rainfall	500 mm, drought tolerant
Aspect	Full sun to part shade
Soil	Well-drained, light to moderately heavy soils. Acid to neutral pH, but will tolerate slightly alkaline

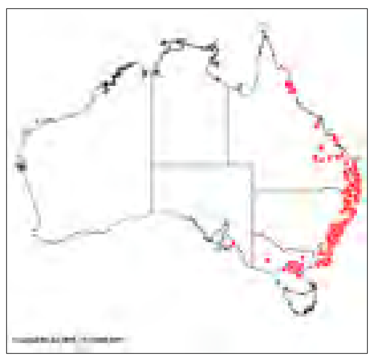
Uses

This highly adaptable species can be grown in a broad range of conditions, from coastal exposure to inner city smog. It is a very useful garden addition and a good farm windbreak component. Flower spike is used in floral art.

Apiculture

Highly attractive to bees. This is an important nectar source for winter hives, making a useful planting on home wintering sites. Planted on farm, it would allow over-wintered hives to be ready for spring build and the new crop.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
		Dark amber	Thin		Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
				Low	Annual



SHRUB

Pin-cushion hakea

Hakea laurina

FLOWERING SEQUENCE

j f m **A M J J A** s o n d

Features

Large shrub to small tree.

H 2–6 m W 5 m

Very attractive 'pin-cushions' attractive to birds and insects Photo: Linda Manning

Fast growth rate. Much admired for its attractive flowers and widely planted across Australia and internationally. A compact shrub to small tree; bluish–green leaves to 20 x 3 cm; and the red flowers are in dense spherical clusters to 5 cm, protruding yellow styles, giving the pin-cushion appearance. Plant requires staking while young and protection from frost until about 1 m high. It has been grown in gardens across the country in a wide variety of soils. It is susceptible to the rootrot fungus *Phytophthora cinnamomi*. Propagation from seed and cuttings (half ripe).

Origin: Western Australia.

Conditions

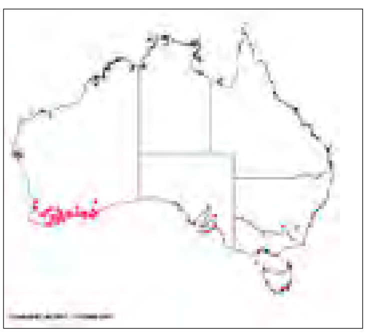
Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	400 mm
Aspect	Full sun
Soil	Well-drained sandy to clay. Tolerates lime

Uses

Suitable as low shelter if planted in a group or with other trees. It is planted as a street tree and used for hedging in Italy and the United States and recommended for planting in Perth streets. A very handsome plant for use in most urban situations, it attracts many different birds. Also makes great cut flowers.

Apiculture

No specific information. Pin-cushion hakea is known to be very attractive to bees (L Manning 2011, pers. comm.). The Western Australian hakeas are often producers of both nectar and pollen. Coleman (1962) reported *H. scoparia*, *H. lissocarpha* and *H. recurva* as being producers of good quantities of good-quality pollen and nectar.



Passionfruit

Passiflora edulis

FLOWERING SEQUENCE

j **F M A** m j **J A S O N** d

Features

Climbing woody perennial

H 2 m

Many cultivars available. A vigorous climbing vine with fast-growing canes. Leaves are deeply lobed, glossy, dark green above and paler, dull-green below, to 7.5–20 cm long. White flowers are single, fragrant, 5–7.5 cm at each node on new growth. The attractive flower is made up of 3 large green bracts, 5 greenish–white sepals and 5 white petals. Five stamens with large anthers form a dominant central structure. Flowers are self-sterile in the purple varieties and must be insect pollinated as the pollen is too large and sticky for wind pollination. Managed honeybees, while not as effective as large bees, are needed in larger numbers to successfully pollinate. Fruit is round to ovoid, 3.5 to 7.5 cm wide, with a tough smooth, waxy skin, dark purple to pale yellow with a very appealing juicy pulp, with a guava-like sweet–tart flavour. Propagation: seeds, cuttings and layering (Morton 1987).

Origin: South America.

Beautiful structure of a passionfruit flower Photo: Leonardo Re-Jorge GFDL

Conditions

Climate	Temperate, warm/humid, frost tender
Rainfall	600 mm with high humidity or 900 mm
Aspect	Full sun
Soil	Well-drained, light to heavy sandy loams, pH 6.5–7.5

Uses

An excellent garden addition; will grow in all climate zones if protected from frost and extreme heat. They need a strong structure to grow on, bearing after 1–2 years and producing abundant excellent fruit.

Apiculture

Honeybees collect pollen and nectar from passionfruit (Free 1993), and nectar flows are reportedly good (www.agric.wa.gov.au 2011).

TREE

Red cap gum

Eucalyptus erythrocorys

Illyarie, illyaria

FLOWERING SEQUENCE

j f **M A M J** j a s o n d

Features

Mallee to small tree

H 5–8 m W 2–4 m

The amazing display of *E. erythrocorys*
Photo: www.travelling australia.info

A fast-growing mallee form popular for its dominating red buds and contrasting lime-yellow flowers. The flowers can be 7 cm across with 4 tufts of stamens in the corners. Bark is smooth and flaky; leaves are deep green, leathery, long and sickle-shaped to 25 x 4 cm. The buds are large and showy, with a vivid red cap and emerald-green calyx. Branches often break due to the weight of the buds and fruit. Responds well to heavy pruning and coppices readily.

Origin: Western Australia.

Conditions

Climate	Temperate, hot/arid, frost hardy
Rainfall	500 mm, drought tolerant
Aspect	Full sun
Soil	Light sand to heavy clay. Tolerates alkaline and salt conditions

Uses

This is mainly used as a showy specimen tree in gardens and parks. It is being used in Israel for desert rehabilitation and the provision of extensive bee forage (Eisikovitch 2011, pers. comm.).

Apiculture

Recognised as a honey producer and beneficial to bees.

TREE

Hickson mandarin

Citrus reticulata 'Hickson'

Features

Large shrub to small tree

H 4 m W 2 m

Moderate growth rate. A relatively compact typical citrus tree with glossy green leaves. The tree is usually thorny, with slender twigs, broad or slender lanceolate leaves having minute, rounded teeth and narrowly winged petioles. The waxy white flowers are borne singly or a few together in the leaf axils (Morton 1987).

Hicksons have a medium to large fruit with a relatively thin, easy-peel skin. They have between 10 and 15 seeds and have a very long post-harvest life—several months in the refrigerator—without deterioration. They are gross feeders and need fertilising in July, November and March. Propagate by grafting.

Origin: South-east Asia. Hickson is an Australian cultivar originating in Roma, Queensland.

FLOWERING SEQUENCE

j f m a m j j a **S O N** d

Mandarin flowers are very attractive to honeybees Photo: Antonio Bondi

Conditions

Climate	Temperate, warm/humid, frost tender
Rainfall	700 mm, mildly drought tolerant
Aspect	Full sun, wind protection
Soil	Well-drained soil enriched with compost or manure. Intolerant of waterlogging, pH 5–8

Uses

Mandarins are excellent home garden trees trees—compact, decorative and very productive. They are also grown in orchards as a commercial crop.

Abundant fruit on a 9-year-old Hickson mandarin Photo: Daleys Fruit

Apiculture

Mandarin as a citrus species produces significant volumes of pollen and nectar. It is usually associated with the flowering of other citrus and is unlikely to yield a unifloral honey. The *Honey Traveler* (www.honeytraveler.com/ 2011) describes mixed citrus honey containing mandarin as light amber to white, thick and very sweet, with a delicate fruity aroma. It is slow to crystallise.

Citrus honey has made up to 25% of Californian honey production and also is produced in Florida and Texas and in a number of other countries surrounding the Mediterranean, including Israel, Spain and Italy. Crane et al. (1984) reported *C. reticulata* as producing significant honey yields in China, Pakistan and the former Soviet Union. The average yield per hive in Israel is 31.4 kg (Dag et al. 2001). The pollen of citrus species containing seed in their fruit is produced in variable quantities and crude protein is just below the 20% standard set by de Groot (1953) for honeybee nutrition. However, all essential amino acids are above the standard requirements (Somerville 2001).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	31.4 kg/ hive	White to light amber	Heavy body	Medium	Annual (1–2yr)
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			18.6 % cp good amino acids	Varies	Annual (1–2yr)

TREE

Plum

Prunus spp.

FLOWERING SEQUENCE

j f m a m j j **A S** o n d

Features

Small deciduous fruit tree

H to 10 m   W to 5 m

Moderate growth rate. Upright multi-branched small deciduous tree. Flowering is in late winter–spring, depending on the variety. European plums (*P. domestica*) tend to be earlier than Japanese plums (*P. salicina*); all vary in size but can be kept compact. With over 200 varieties available, there is a fruit taste and size to suit everyone. The European plums are often slightly smaller, bluish with yellow flesh and sweet and juicy; 'Angelina' is a favourite. Many varieties need cross-pollination so it is important to have available a cross-pollinator: seek advice from your local plant nursery. Plant in a sunny, sheltered site. Propagate by grafting.

Origin: Asia.

A bee collecting pollen from a plum flower Photo: Aphaia GFDL

Conditions

Climate	Cool, temperate, frost hardy
Rainfall	500 mm, garden watered
Aspect	Full sun, shelter from wind
Soil	Well-drained various, pH 6.5

Uses

Plums of many varieties are available to Australian gardeners. They are an easily managed domestic garden fruit tree that can be pruned to picking height. Prune plum varieties are the most widely grown commercially for the dried fruit market. The European variety 'Angelina', a prolific bearer, is a free-stone, yellow-flesh fruit that is very sweet and juicy—a great fresh fruit and used for making liqueur.

Typical heavy fruiting of European plums Photo: Tobias Schuler CC-BY-2.0-de

Apiculture

Plums need bees: without adequate cross-pollination, fruit set and size are significantly reduced. Plums are a source of pollen and nectar for honeybees at a time when hives are low in stores and begin to build. Poor weather at flowering time can reduce the benefits to the hives. Clemson (1985) considered that plums, especially prune varieties, are outstanding pollen producers. However, it has been noted by Somerville (1999) and others that there may be weeds flowering at the same time with more favourable pollen that distracts the bees.

TREE

Persimmon

Diospyros kaki

FLOWERING SEQUENCE
j f m a m j j a **S O N** d

Features

Small deciduous fruit tree

H 6 m W 4 m

The persimmon's attractive and abundant fruit, Melbourne, April Photo: Mark Leech

Moderate growth rate and a spreading habit. Produces a brilliant autumn display of leaf colour and yellow–orange fruit. Leaves emerge glossy bronze in spring and turn green then gold to orange–red in autumn; they are elliptic, 7.5 to 17.5 cm. The flowers are yellowish–white to 2 cm, with outfolded prominent green sepals extending beyond the corolla. Flowers give way to the very attractive baseball-sized fruit that turns yellow–orange. Propagate by grafting.

Origin: China.

Conditions

Climate	Temperate
Rainfall	450 mm, require watering in fruiting stage, dry in ripening
Aspect	Full sun
Soil	Well-drained various soils. Intolerant of waterlogging

Uses

A very decorative small fruit tree that has been undervalued in Australia due to the older astringent varieties. However, if left on the tree until mushy ripe, the fruit can either be eaten fresh, with a delicious flavour, or frozen and eaten later. The non-astringent varieties can be eaten crisp once colour is achieved or similarly be left on the tree to ripen. They have very high vitamin C content. Commercially grown persimmons have great potential to fill export markets in the off season in Asia.

Apiculture

Persimmons are attractive to honeybees, providing both nectar and honey. Mulder (2011) considers their nectar production similar to that of the US native, *D. virginiana*, one of Oklahoma's major honey-producing plants. The unifloral honey is water–white.

Warm/humid climate garden species

The following table summarises the garden species selected for warm–humid climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Celosia* sp.	Celosia	W H	G S U T	N		●	●										●
	Coriandrum sativum	Coriander	C T W H	G F	N		●	●	●									●
	Ocimum basilicum	Basil	C T W	G	n	p	●	●	●	●	●							●
	Nemesia spp.	Nemesia	C T W H	G S U	n	p	●	●	●	●	●	●	●	●	●	●	●	●
SHRUB	*Psidium guajava*	Guava	T W	G F	N	P	●	●	●	●	●	●	●	●	●	●	●	●
	Macadamia integrifolia	Macadamia	W	G U F	N	P							●	●	●	●		
	Averrhoa carambola	Carambola	W	G S U F	N		●	●	●	●	●	●	●	●	●	●	●	●
	Musa spp.	Banana	T W	G U F	N	P	●	●	●	●	●						●	●
TREE	*Backhousia citriodora*	Lemon-scented myrtle	W	G S U F	n	p	●	●	●									●
	Citrus aurantifolia	Lime	C T W	G U F	N	P	●	●	●	●	●	●	●	●	●	●	●	●
	Persea americana	Avocado	T W	G F	N	P									●	●	●	
	Tetradium daniellii	Bee bee tree	C T W H	G S U F	N		●	●										●

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

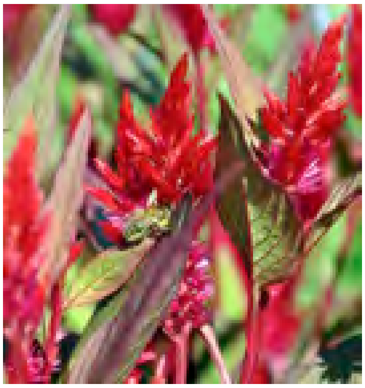
HERB

Celosia

Celosia spp.

FLOWERING SEQUENCE

J F m a m j j a s o n **D**



Celosia is very attractive to bees Photo: Mark Leech

Features

Annual

H 30–90 cm

Striking colour is perhaps the best description of this flower group derived from *Celosia argentea* var. *cristata*, now with many cultivars. This easily grown annual is a warm climate species striking a bold presence in red, orange, yellow, purple and creamy-white. Leaves obovate, lanceolate, strongly veined, green to 15 cm. The large bright-coloured flower heads to 25 cm (dependent on cultivar) are made up of hundreds of small, densely packed, tiny flowers. They require warm/humid to hot weather and need to be kept moist and in full sun. Propagate from seed.

Origin: Asia.

Conditions

Climate	Warm/humid, hot/arid, frost and cold sensitive
Rainfall	Drought intolerant
Aspect	Full sun
Soil	Well-drained various

A mobile flower bed with celosia, St Mary's Cathedral, Sydney Photo: Mark Leech

Uses

These are amazing, versatile plants. Their extremely bright colours make them excellent bedding and pot plants in all urban environments. They are exceptional cut flowers, adding vibrancy to any display, keeping their colour and not falling apart when dried. Little is known in Western nations about the plant's edibility, but it is an important green vegetable in Africa, India and Indonesia. Especially used in Nigeria, Benin and nearby nations because of its preference for hot, humid climates. The leaves, young stems and flowers can be made into a stew or nutty-flavoured side dish. It has a pleasant, mild flavour, lacking the bitterness of some salad vegetables (Stone 2011).

Apiculture

Celosia has been noted as a good nectar producer and attractive to honeybees (Gruver 2006). Observations by the author suggests the plant is favoured by honeybees.

HERB

Coriander

Coriandrum sativum

FLOWERING SEQUENCE
J F M a m j j a s o n **D**

Features

Annual herb

H 0.9 m W 0.3 m

Rapid growth rate. Leaves can be harvested 4–7 weeks after sowing. Leaves are variable in shape, parsley-like at the stem base and becoming more dill-like near the flower. The flowers are small, white to pinkish in terminal heads. Some strains bolt: this can be reduced by shading in hot weather and not allowing soil to dry out.

Origin: Mediterranean.

Coriander flowers Photo: troika/Shutterstock.com

Conditions

Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	Requires summer moisture
Aspect	Sunny and partial shade
Soil	Well-drained sandy loam, neutral pH

Uses

A wonderful addition to herb gardens, coriander is a pungent herb used extensively as food around the world. Best known in Australia in Asian and Indian curries and salads, where it is used fresh at presentation to impart the flavour. All parts of the plant are edible—roots, stems, leaves, flowers and seeds. Also used traditionally in herbal medicine.

Apiculture

Coriander honey as a unifloral is produced in Eastern Europe, Italy and Iran. It is a medium amber colour with a sharp, spicy aroma and is thought to have medicinal properties.

Honey	Yield	Colour	Density	Crystal	Frequency
	200–500 kg/ha (Ukraine)	Light amber to brown		1–2 months coarse grain	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
					Annual

Coriander is suited to growing in pots Photo: H Brauer/Shutterstock.com

HERB

Sweet basil

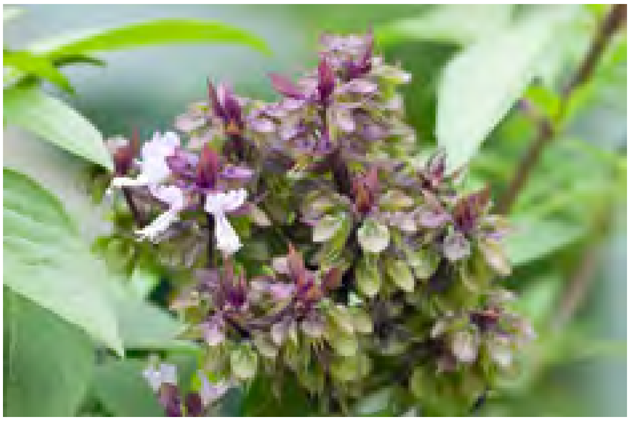
Ocimum basilicum

FLOWERING SEQUENCE
J F M A M j j a s o n **D**

Features

Annual

H 15–75 cm   W 15–60 cm



Basil flowers can also be used in food
Photo: Wutthichai/Shutterstock.com

The soft freshness of basil Photo: Ocimum basilicum 1_magicinfoto Shutterstock

A must-have Mediterranean herb, a deliciously aromatic annual growing to about 75 cm. The stem is also soft and succulent. The plant has large, soft, fragrant bright-green leaves to 11 x 6 cm and small white to purple flowers in terminal spikes appear in autumn. Picking out the flower heads will keep the leaves growing; once flowering occurs, leaf growth stops on that stem. A good practice is to leave some stems to flower for bees while keeping leaf production going. There are many cultivars.

Origin: Mediterranean.

Conditions

Climate	Cool, temperate, warm/humid, frost tender
Rainfall	600 mm
Aspect	Full sun
Soil	Well-drained

Uses

A well-known and much-loved culinary herb, sweet basil can be grown in pots on decks or balconies. The leaves are best used fresh or added at the end of cooking to maintain flavour.

Apiculture

Basil flowers are attractive to bees, and the plant complements any herb garden. A study in Saudi Arabia found a high level of bee activity on *O. basilicum,* collecting pollen and nectar (Al Gamdi 2004).

HERB

Nemesia

Nemesia spp.

Features

Annual, perennial

H 20–40 cm

FLOWERING SEQUENCE
J F M A M J J A S O N D

Annual nemesias are compact, free-flowering plants used in many situations and producing a great variety of colours, in late spring and summer. The small snapdragon-like flowers, often scented, come in a range of colours, from white to yellow, orange, red, pink, purple and blue and in combination. Dark green leaves are lanceolate with variously toothed margins paired along slender, erect 4-sided stems. Plants thrive in warmer climates and can be grown in summer in cooler climates. Grow in a sunny position in well-composted soil. They require regular watering but should not be over-watered. Flowering can be prolonged by dead-heading. The perennial *N. caerulea* is a fast-growing mound-forming sub-shrub that flowers throughout the year, with winter abundance.

Origin: Africa.

Brightly coloured nemesias make a great addition to a bee-friendly garden Photo: Gala Kan/shutterstock.com

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost tender
Rainfall	600 mm (not limiting when watered)
Aspect	Full sun to shade, sheltered from wind
Soil	Well-drained, various

Uses

Nemesias provide a very colourful addition to any size of garden. A bold, colourful bedding plant, they are also used in window boxes and pots. Very good as a cut flower and long-lasting in posies.

Apiculture

This versatile plant is very attractive to bees, especially when planted in groups in borders and beds.

SHRUB

Guava

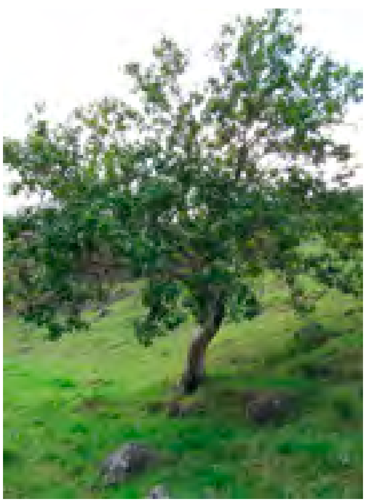
Psidium guajava

FLOWERING SEQUENCE

j f m a m j j a s o n d

All year round in tropics

Guava fruit and flower remains Photo: Forest & Kim Starr



Guava tree, Hawaii Photo: Forest & Kim Starr

Features

Shrub to small tree

H 10 m

Fast grower. This popular tropical fruit tree is easily recognised by its thin, coppery bark that flakes, revealing a green layer with an attractive 'bony' look. Dark green leathery leaves with prominent parallel veins are aromatic when crushed. White flowers with 4–5 petals are fragrant, either single or in small axillary clusters to 2.5 cm diameter. Petals are quickly shed, revealing a prominent tuft of about 250 white stamens tipped with pale yellow anthers. Fruit is glossy green ripening to yellow has a strong, sweet musky aroma when ripe, and is pear or oval shaped to 10 cm long. Fruit is produced within 2–4 years of seeding, and peak production is reached at 15 years.

Extensively planted in most tropical, subtropical and Mediterranean regions of the world. There are many commercial cultivars. It is readily propagated from seed or cuttings; commercial stock is grafted.

Origin: Mexico, Peru.

Conditions

Climate	Temperate, warm/humid, frost tender
Rainfall	380 mm requiring irrigation
Aspect	Full sun
Soil	Well-drained to water retentive, sands to heavy clay, pH 4.5–9.4

Uses

Extensively grown in plantations as a commercial crop. It is ideally suited as a compact fruit tree for warm/humid zone home gardens, providing an attractive tree and abundant nutritious fruit.

Apiculture

Guava produces copious volumes of high-quality pollen and the flowers are regularly visited by honeybees for pollen and nectar. Honey is light yellow, has a 'thin' viscosity and a pleasant flavour. Unifloral honeys are produced and readily identified from high pollen loads (Lakshmi 1998).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
		Light yellow	Thin		Good
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		White	Good	High	Annual

SHRUB

Macadamia

Macadamia integrifolia var.

Features

Small tree

H 2–6 m

FLOWERING SEQUENCE
j f m a m j **J A S O** n d

Also called Queensland nut, smooth-shelled macadamia, bush nut, nut oak, bauple nut, bopple nut, this attractive small roundish evergreen rainforest tree grows at a fast to moderate rate. The cultivated form tends to be smaller, while in its natural environment the tree can grow to 20 m. The trunk is rough but not fissured. Glossy dark green leathery leaves in groups of 3 on branchlets. Leaves to 14 cm with entire margins on adult leaves and holly-like spiky margins on new growth. Flowers creamish–white in pendulous racemes to 30 cm. The fruit has a green leathery pericarp to 2.5–3.5 cm, surrounding a smooth brown, very hard nut, the kernel of which is whitish, edible and highly regarded. The tree is widely planted in the tropics and subtropics as a productive garden specimen and a major commercial plantation tree. There are many varieties available. Propagation by seed (7–10 years to bear fruit) or grafted stock.

Macadamia flowers yield abundant nectar Photo: Tau_olunga_GFDL

Origin; New South Wales, Queensland.

Conditions

Climate	Warm/humid, frost intolerant
Rainfall	1000 mm
Aspect	Full sun to part shade
Soil	Well-drained sandy to heavier clay. Best deep rich soils, pH 5.5–6.5, salt intolerant

Uses

Macadamia trees are a very attractive garden ornamental and a very productive nut producer. They are widely cultivated as a smallish domestic tree and, of great commercial importance, grown in plantations. Many consider the nut to be the perfect nut; unlike other nuts, it is higher in fats than in protein.

Apiculture

Honey is produced as a unifloral from hives used to pollinate the macadamia nut crop. It can produce up to a super every 3 weeks or potentially 2 supers during pollination. Honey is light amber with a sweet aroma and a delicate, nutty flavour. Stace (1996) reported that bees work macadamia more for nectar than for pollen; the pollen appears to be variable in both its crude protein content and the essential amino acid isoleucine. Bees working macadamias need to go on to a good-quality pollen source.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	25–50 kg/hive (NSW average 26 kg/hive	Light amber	Medium	Slow	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Variable 16–22% cp	High	Annual

SHRUB

Carambola

Averrhoa carambola

Starfruit

FLOWERING SEQUENCE

j f m a m j j a s o n d

Features

Small tree

H 3–5 rarely 10 m

Slow growth rate. A multi-stemmed large shrub to small tree with a rounded crown. The trunk has smooth or finely fissured light brown bark. The dark green leaves are alternate and pinnate to 15–20 cm, with 7–9 pendent leaflets, ovate to 9 cm. The leaf top is smooth, the underside whitish and finely hairy. The leaves are light and touch sensitive. The pink, purple-streaked flowers to 6 mm have 5 re-curved petals. Flowers are in terminal panicles to 5 cm. The orange–yellow fruits are very showy, oblong, 5 to 6 angles, to 15 x 9 cm, thin waxy skin with crisp yellow juicy flesh. Propagation is from seed, budding or grafting.

Origin: Moluccas.

Carambola flowers Photo: Tau'olunga GFDL

Conditions

Climate	Warm/humid, very frost tender when young
Rainfall	Subtropical
Aspect	Full sun
Soil	Prefers deep, well-drained clay loam, good in sandy to heavy clay, pH 6.1–7.8

Uses

A very decorative fruit tree, popular in home gardens and parks as an ornamental. Highly productive and will bear on 2-year grafted stock. Commercially grown as a fresh exotic fruit, it has also been used in traditional medicine.

Apiculture

Bees actively seek out carambola for nectar (Damon 2011, pers. comm. Morton 1987).

The very attractive starfruit Photo: ARS USDA

SHRUB

Banana

Musa spp.

FLOWERING SEQUENCE

J F M A M j j a s o **N D**

Features

Herbaceous perennial

H 6–9 m   W 3–4 m

Banana flower Photo: Ruestz GFDL

Fast growth to flower stage. A large herb with a juicy pseudostem, a cylinder of leaf-petiole sheafs. Leaves are tender, smooth and oblong with deeply lobed edges, 4–15 arranged spirally unfurling as the plant grows, to 2.75 m x 60 cm. The inflorescence, a transformed growing tip, is a terminal spike. A large oval tapering purple-clad bud opening to reveal whorls of double-row, white, toothed, tubular flowers. Female flowers form the bottom rows with a layer of hermaphrodites before the male flowers. The male flowers are shed a day after flower clusters open; fruit grows from the female flowers. The plant is rhizome-forming—its regenerative mechanism.

Origin: Moluccas.

Conditions

Climate	Temperate, warm/humid
Rainfall	500 mm for survival, species dependent 1200 mm commercial crop
Aspect	Full sun
Soil	Well-drained loam, wide range, pH 5.5–7.5

Uses

Bananas are a widely grown, very productive garden plant, easy to grow and regenerate. Dwarf varieties are easier to harvest. They are beautiful landscape plants but do produce quite a lot of debris.

Apiculture

Very attractive to bees (Damon 2011, pers. comm.). Crane et al. (1984) noted that bananas are a major nectar producer in tropical America and a very abundant pollen producer. The honey produced varies from dark in Jamaica and Coffs Harbour (Agric WA 2011) to light in other parts of Australia.

TREE

Lemon-scented myrtle

Backhousia citriodora

Features

Tall shrub to small tree

H 15 m

Fast growth rate. A well-known bush tucker plant. The leaves are a glossy fresh green and highly lemon-scented, oval and veined to 10 cm with slightly toothed margins and a pointed apex. The young foliage is reddish and the young shoots and undersides of the leaves are often hairy. The profuse creamy–white five-petalled flowers to 1 cm diameter are borne on the tops of branches. Propagates readily from cuttings.

Origin: Queensland.

FLOWERING SEQUENCE

J F M a m j j a s o n **D**

Lemon myrtle's profuse flowers make a great show Photo: Brian Walters

Conditions

Climate	Warm/humid, frost tender when young
Rainfall	800 mm, drought sensitive
Aspect	Full sun to part shade
Soil	Well-drained heavy texture. pH neutral

Uses

Lemon myrtle is an excellent garden specimen. Its profuse flowering and foliage make it very attractive. As a food source it excels. Its leaves, crisply lemon-scented, have the highest known concentration of citral oil, >90% of its oil content (en.wikipedia.org 2011). It is grown commercially in plantations for its oil and its leaves, which are used dried as a culinary product. It is used to impart a strong lemon flavour in tea. Lacking the acid of lemon, its does not curdle dairy products. Its essential oil shows antimicrobial activity.

Apiculture

Highly attractive to bees. Little information is available on its nectar or pollen productivity and value.

TREE

Lime

Citrus aurantifolia

FLOWERING SEQUENCE
J F M A M J J A S O N D

Features

Evergreen small tree

H 3–6 m W 3 m

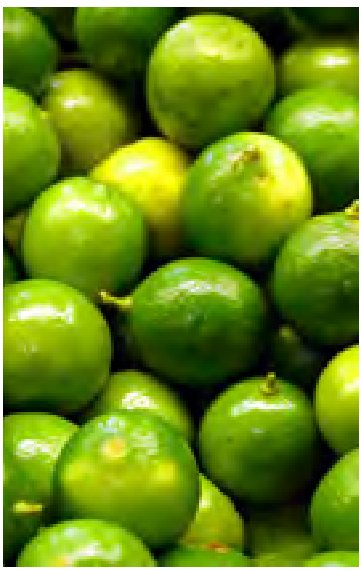
Tahitian lime, beauty in simplicity Photo: Jamie McIlwraith

Moderate growth rate. Attractive rounded shrub to small tree with dense foliage. The glossy green leaves are elliptic to ovate, to 7 cm long. Characteristic citrus flowers, white with waxy petals; fruit greenish–yellow with smooth, thin skin. The Tahitian lime is thornless and has a broader climate tolerance; all are frost tender but grow as far south as Tasmania. These plants flower in the 2nd year after planting, becoming more regular after 4 years. Multiple flowering occurs in warmer climates, providing fruit year round.

Origin: Asia.

Conditions

Climate	Cool, temperate, warm/humid, very frost tender
Rainfall	900 mm
Aspect	Full sun
Soil	Well-drained, sands to clays, pH 5–8, best fruiting 6–7



Harvested lime fruit Photo: Steve Hopson Creative Commons

Uses

A worthy addition to any tropical garden; pleasant aroma, compact size and always carrying fruit. Can be grown in temperate and colder zones but must be protected from frost.

Apiculture

Very attractive to bees, flowers can appear all year. Information relates to mixed citrus that included lime. Crane et al. (1984) reported the pollen is a medium source and the nectar is a major to medium source; honey is light amber with a delicate flavour and pleasant aroma.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
Mixed citrus	15–20 kg/ hive	Light amber			Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Average	Average	Annual

TREE

Avocado
Persea americana

Features
Small tree

H 9 cm W m

Moderate to fast growth rate. The leaves are alternate, dark green and glossy on the upper surface, whitish on the underside; variable in shape to 40 cm long. Flowering is profuse: tiny, pale-green or yellow–green flowers are borne in racemes near the branch tips. Best fruit and fastest bearing are from grafted stock.

Origin: Mexico, Central America.

FLOWERING SEQUENCE

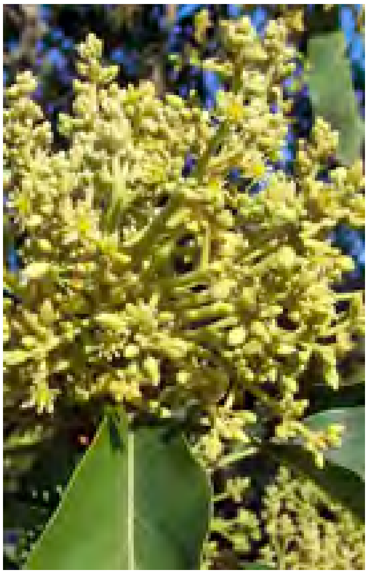
j f m a m j j a **s o n** d

A honeybee on the very open, easily visited avocado flower Photo: GNFDL

Conditions

Climate	Temperate, warm/humid
Rainfall	600 mm (variety dependant)
Aspect	Full sun
Soil	Well-drained, pH 6.5–7

Uses
Avocados are commercially valuable and are cultivated in tropical and Mediterranean climates throughout the world. They make a great addition to the home garden; more compact and self-fertile varieties are available, but best fruit comes from cross-pollination. The fruit is well known as a highly nutritious and desirable food. It is green to dark-skinned and pear-shaped and ripens after harvesting.



The profusion of avocado flowers Photo: GNFDL

Apiculture
Avocado is an important food and bee forage shrub. It yields significant honey crops and average-quality pollen. The honey is distinctly dark, heavy-bodied and slow to crystallise. It is described as very dark amber with a mellow spicy, aroma, a rich flavour with a hint of molasses, and buttery.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Medium to major	Dark amber	Heavy body	Slow	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Average 24.4% cp	Average	Annual

TREE

Bee bee tree

Tetradium daniellii

FLOWERING SEQUENCE
J F m a m j j a s o n **D**

Features

Small deciduous tree

H 15 m W 15 m

A bee on bee bee blossom Photo: Zachary Huang, http://beetography.com

Fast early growth. An attractive deciduous tree with a spreading habit. It is a good size for larger gardens and produces a wonderful floral show in mid-summer. It has smooth grey bark and glossy dark green compound leaves to 50 cm long made up of 7–11 leaflets, changing to yellow–green to yellow in autumn. A feature of the tree is the summer flowering—fragrant masses of large, flattened clusters of small white flowers. It bears bright red fruit containing shiny black seeds. Propagate from seed.

Origin: Asia

Conditions

Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	800 mm, moderately drought tolerant
Aspect	Full sun
Soil	Well-drained sandy loam to clay loam, pH 5.5–6.5

The bee bee tree, a favourite
Photo: Wikimedia Commons

Uses

A very under-used tree, ideally suited as a specimen in domestic gardens and parks and as a street tree. It would also be useful on farm as a nectar source.

Apiculture

As the name suggests, this is a bee magnet. Little known in the West, originating from Korea and south-west China, it is highly sought after by beekeepers and produces a medium amber honey with a mild syrupy aftertaste (Flottum 2009).

Hot/arid climate garden species

The following table summarises the garden species selected for hot/arid climates.

Plant type	Botanical Name	Common Name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Alyogyne heugelii*	Native hibiscus	C T W H	G U			●	●	●	●	●	●	●	●	●	●	●	●
	Thymus spp.	Thyme	C T H	G S U	N	P	●	●							●	●	●	●
	Mentha spicata	Spearmint	C T W H	G F	n	p	●	●										●
	Pelargonium rodneyanum	Magenta storksbill	C T H	G S U	n	p	●	●	●	●	●						●	●
SHRUB	*Banksia speciosa*	Showy banksia	T H	G U F	n	p	●	●	●	●	●							
	Acacia victoriae	Elegant wattle	W H	G U F										●	●	●	●	●
	Eucalyptus viridis	Green mallee	T H	G S U F	N	p	●	●	●			●	●	●		●	●	●
	Eremophila duttonii	Emu bush	H	G S U F	n	p	●	●									●	●
TREE	*Eucalyptus oleosa*	Red mallee	T H	G U F	N	p	●	●	●	●	●	●						
	Eucalyptus torquata	Coral gum	T H	G S U F	N	P								●	●			
	Citrus glauca	Desert lime	W H	G F	N	P									●	●		
	Melaleuca lanceolata	Dry land tea tree	T H	G S U F	N	P	●	●	●	●	●	●	●			●	●	●

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Native hibiscus

Alyogyne huegelii

FLOWERING SEQUENCE
J F m a m j j a S O N D

Features

Small to medium shrub

H 2 m   W 1.5 m

The flower makes a bold, beautiful statement Photo: Mark Leech

Fast growth rate. A very hardy medium-sized shrub. Leaves to 7 cm are deeply lobed; 5-petal flowers are up to 12 cm in diameter. Like other members of the Malvaceae, its flowers last only 1–3 days. However, it is a vigorous producer and is covered with flowers from spring through summer. It is wind sensitive and will become straggly if not protected. Best pruned after spring flowering.

Origin: Western Australia, South Australia.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid. Prefers hot dry summers, cool wet winters
Rainfall	200 mm, very drought tolerant
Aspect	Sunny and protected from wind
Soil	Well-drained various. Intolerant of waterlogging

Native hibiscus make a colourful addition across climate zones Photo: Mark Leech

Uses

A very attractive 'hibiscus'-looking flower that provides bold, bright colour as a specimen garden plant.

Apiculture

Bee-attracting year round. Little known about its value.

HERB

Thyme

Thymus spp.

FLOWERING SEQUENCE

J F m a m j j a **S O N D**

Features

Perennial herb/low shrub

H 40 cm

Tiny aromatic leaves on erect stems. Small lilac flowers in summer. Cut back heavily after flowering. A huge genus, with over 400 species and many cultivars. Propagate from late-spring cuttings.

Origin: Mediterranean.

Thyme is an excellent culinary border
Photo: Peter Radacsi/Shutterstock.com

Conditions

Climate	Cool, temperate, hot/arid
Rainfall	Very drought tolerant
Aspect	Sunny
Soil	Well-drained alkaline soils, low fertility

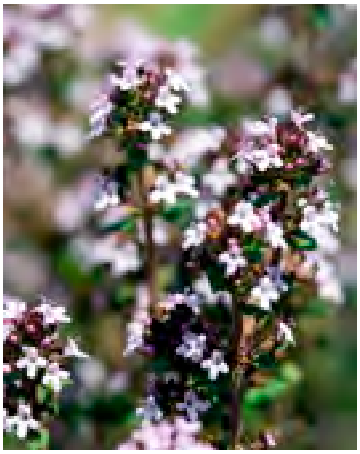
Uses

Thyme is a popular cooking herb with well-known antiseptic, anti-microbial and anti-fungal properties. It can be used as a culinary border and is a must-have in any herb garden. *T. serpyllum* is a great creeper and groundcover that will withstand some foot traffic.

Apiculture

Honey is light with a greenish tinge and minty flavour, excellent to taste. A traditional Greek honey since ancient times renowned for its exceptional honey from wild thyme, *T. capitatus*. New Zealand thyme honey is produced from escaped garden thyme, *T. vulgaris,* that is naturalised in Central Otago. HISPAMIEL (2011) describes it as 'light amber to amber colour, 40–84 mm Pfund. Floral aroma with a distinctive phenolic component to thyme. Sweet taste, with distinctive acidic notes. Does not tend to crystallise'.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	>500 kg/ha	Golden amber	Good body	Slow	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
				Major source France	Annual



T. vulgaris Photo: Peter Radacsi/ Shutterstock.com

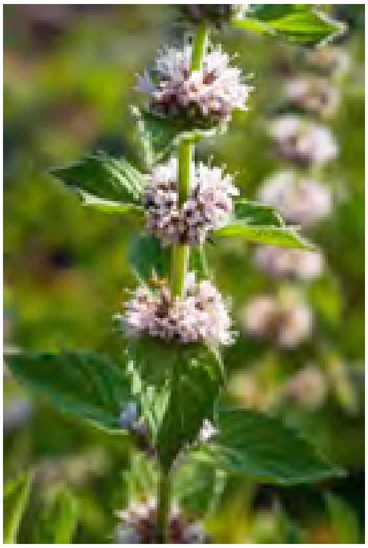
HERB

Spearmint

Mentha spicata

FLOWERING SEQUENCE

J F m a m j j a s o n **D**



Spearmint flowers produce an abundance of nectar Photo: Lidar/ Shutterstock.com

Features

Perennial herb

H 60 –90 cm

This hardy fast-growing perennial is rhizomatous and can be invasive. Its leaves grow to 9 x 3 cm and are a lighter green than those of peppermint. They are slightly crinkled, with a serrated margin and an acute tip. The many small white or pale pink flowers are arranged in slender spikes. The whole plant has a sweet smell.

Origin: Mediterranean.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost hardy
Rainfall	Soil kept moist or irrigated in dry climates
Aspect	Full sun to part shade (hotter regions)
Soil	Well-drained sandy loam to clay, moist, pH 6.0–7.5

Uses

This is perhaps the oldest known mint and is widely cultivated as a herb and for its essential oil. It is grown almost worldwide in domestic and urban gardens, where it should be potted or contained to prevent uncontrolled spreading. It is a useful groundcover. It is also grown as a crop on farms, where it often requires irrigation.

Apiculture

Spearmint leaves have a refreshing aroma Photo: Kietr/Shuterstock.com

Spearmint provides surplus nectar when planted in large enough areas, particularly as a field crop for essential oil. Its honey is a medium amber colour and crystallises easily. It has a strong aroma supported by a touch of menthol and a spearmint nuance. It is medium sweet with a short aftertaste (www.honeytraveler.com 2011).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	>200 kg/ha	Medium amber		Fast	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
				>300 kg/ha	Annual

.

HERB

Magenta storksbill

Pelargonium rodneyanum

Features

Herbaceous perennial

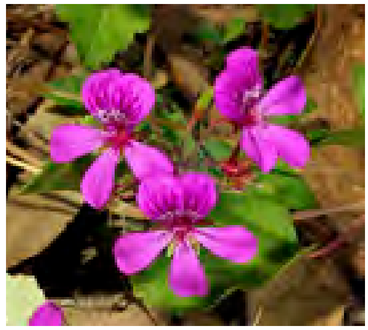
H 45 cm   W 50 cm

Fast growth rate. A small perennial herb with short trailing stems. Leaves soft, light to dark green, oval to narrow oval, with shallow lobes. The deep-pink 5-petalled flowers with magenta markings on the lower petals are long-flowering, from summer to autumn. The roots develop tubers. Can be propagated by a number of means—tuber division at the end of winter, cuttings in spring and summer, clump division, and seed. Plant is commercially cultivated and available in nurseries potted. It benefits from hard pruning in winter.

Origin: South Australia, Victoria, New South Wales.

FLOWERING SEQUENCE

J F M A M j j a s o **N D**



Magenta storksbill Photo: Brian Walters

Conditions

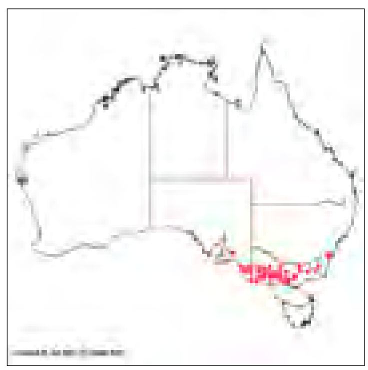
Climate	Cool, temperate, hot/arid, frost hardy
Rainfall	Moderately drought tolerant
Aspect	Full sun, part shade
Soil	Well-drained, various

Uses

A useful spreading groundcover or can be potted, used as a bedding display plant or in rockeries.

Apiculture

Regularly visited by honeybees.



SHRUB

Showy banksia

Banksia speciosa

FLOWERING SEQUENCE
JFMAMjjasond

Features

Shrub to small tree

H 1–8 m

Amazing foliage and flower spike Photo: Mark Leech

Fast growth rate. The dark green discolourous leaves are white underneath to 45 cm long and divided into small triangular lobes. The large flower spikes to 12 x 10 cm are cream to yellow. This tree is fire sensitive, non-lignotuberous and grows rapidly from seed after a bushfire. It is extremely susceptible to the rootrot fungus *Phytophthora cinnamomi*, which kills it quickly.

Origin: Western Australia.

Conditions

Climate	Temperate, hot/arid
Rainfall	400mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sandy

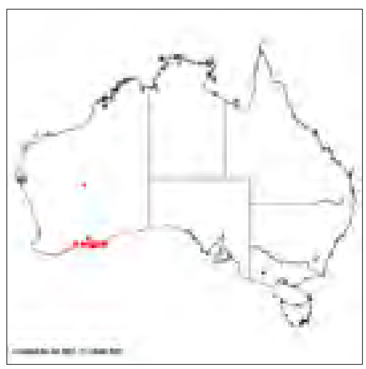
Showy banksia can have flower spikes all year Photo: Mark Leech

Uses

A wonderful garden specimen known for both its large flower spikes and its very attractive foliage. It is useful in revegetation for sand and erosion control. *B. speciosa* is a commercial cut flower and it could be grown as a commercial component of farm shelter.

Apiculture

Attractive to bees for pollen and nectar.



SHRUB

Elegant wattle

Acacia victoriae

Prickly wattle

Features

Shrub to small tree

H 5–9 m

Moderate growth rate, very wide geographic range across inland Australia. A straggling habit, often with prickly stipules when young, smooth to finely fissured bark. Green to greyish–green phyllodes narrowly oblong, lightly curved to 8 cm x 8 mm. Flowers are pale yellow to white; 10–30 flowers in a globose head of 2–15 heads in an axillary raceme. Flowers August to December.

Origin: Western Australia, South Australia, Victoria, New South Wales, Queensland, Northern Territory.

FLOWERING SEQUENCE

j f m a m j j **A S O N D**

Elegant wattle in full bloom Photo: R B Maslin www.worlwidewattle.com

Conditions

Climate	Hot/arid, warm/humid, moderately frost hardy
Rainfall	100 mm, drought tolerant
Aspect	Full sun
Soil	Sand to heavy clay, pH <6.5–>7.5

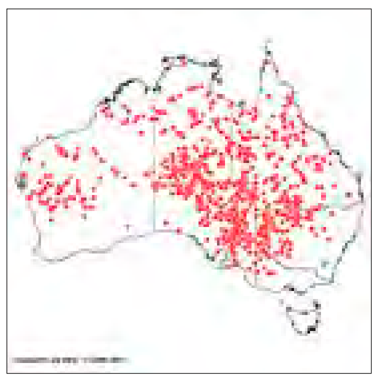
Uses

A suitable garden plant used as a domestic screen or hedge in parks. Farm use as a low windbreak; used in soil stabilisation and mine rehabilitation. The most important modern commercial 'bush tucker' plant. Highly productive and seed yield can be up to 10 kg/tree. Wood has an ADD of 804 kg/m^3; dark reddish–brown heartwood; limited use due to size but possibly in small products and turnery.

Apiculture

An arid zone pollen producer it is important to honeybees and was reported by Boomsma (1972) as producing beneficial pollen in Alice Springs. Flowering does not appear to be dependent on rainfall.

Honey	Yield	Colour	Density	Crystal	Frequency
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	Poor to good	Annual to irregular



SHRUB

Green mallee

Eucalyptus viridis

FLOWERING SEQUENCE

J F M a m **J J A** s **O N D**

Planted green mallee Photo: jennihx

Features

Mallee to small tree

H 2–9 m

Moderate growth rate. This very hardy plant can be either a shrub or a small tree with a lignotuber producing one to many trunks. The long, narrow leaves are usually a dark, intense, lustreless green to 13.5 x 1.3 cm. The bark at the base of the stem is 'box'-like; the rest is smooth gum-type bark. Good bird-attracting species. Coppices readily.

Origin: South Australia, Victoria, New South Wales, Queensland.

Conditions

Climate	Temperate, hot/arid, frost hardy
Rainfall	Very drought tolerant
Aspect	Full sun
Soil	Tolerates well-drained sand to waterlogged heavy clay.

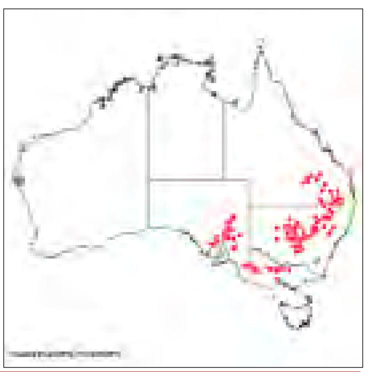
Uses

As a mallee species, it provides low shelter. It is an adaptable and hardy park and street tree and an attractive garden specimen. The wood is a mustard colour, extremely hard and dense. Mallee roots are valued firewood, burning very slowly while giving excellent heat. It is an oil-producing species.

Apiculture

Green mallee is a major honey producer across its natural range. Buds appear on new growth between October and January, and flowering occurs mainly from late spring into summer. It produces a major crop every 2 to 4 years. The honey has a warm, medium flavour with butterscotch tones and a good density. The pollen is attractive to bees but may be lacking in volume or protein quality and colonies may suffer. Water and shade are very important for honeybee management in the natural environment of green mallee as flowering occurs at the hottest time of the year.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	53 kg/hive	Light	Good		2–4 yrs
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Poor to average		2–4 yrs



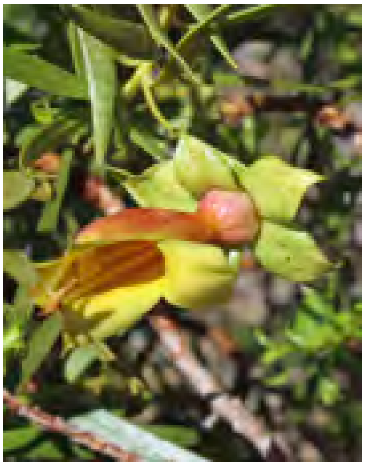
Green mallee floral abundance Photo: Mark Leech

SHRUB

Emu bush

Eremophila duttonii

FLOWERING SEQUENCE
J F m a m j j a s o **N D**



Emu bush close-up Photo: Roger Fryer and Jill Newland

Features

Small shrub

H 0.5–4.0 m

Moderate to slow growth rate. A greyish–yellow bushy shrub. The sticky, darkish green, shiny leaves are narrow lanceolate to 5cm x 8 mm, often crowded towards the ends of branches. The red to yellow tubular flowers are solitary in axils, to 3.5 cm, the upper lip of 4-pointed lobes and a rounded bottom lobe with stamens and style protruding. Flowers from winter to mid-summer. The rounded fruits are about 10 mm in diameter. Best propagated by grafted cuttings onto *Myoporum* rootstock.

Origin: Western Australia, South Australia, New South Wales, Queensland, Northern Territory.

Conditions

Climate	Hot/arid, frost hardy
Rainfall	200 mm, very drought tolerant
Aspect	Full sun
Soil	Well-drained sandy soils.

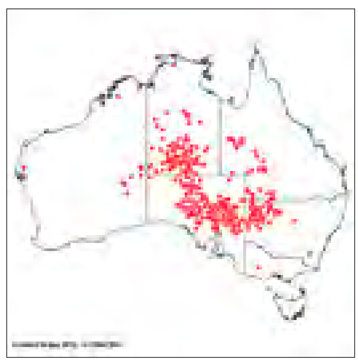
Emu bush in the landscapce Photo: Roger Fryer and Jill Newland

Uses

An interesting desert plant that can be used in an arid region garden. Also useful in streetscape and park plantings and as a low component in farm shelter and biodiversity plantings. It has been an indigenous medicinal plant and extracts have exhibited high anti-microbial activity (Smith et al. 2007).

Apiculture

This attractive, hardy arid land species provides very useful quantities of nectar and pollen throughout winter and spring.



TREE

Red mallee

Eucalyptus oleosa

Features

Mallee

H 3–10 m W 3–8 m

Moderate growth rate. A very hardy mallee. The bark on the trunk is grey, fibrous and box-like tending to smooth and deciduous, ribbon-like and reddish or white. The leaves are narrow, leathery, shiny green, lanceolate to 12 x 2 cm and can have many oil dots. Flowers are creamy–yellow.

Origin: Western Australia, South Australia, Victoria, New South Wales.

FLOWERING SEQUENCE

J F M A M J j a s o n d

Red mallee Photo: Dean Nicolle

Conditions

Climate	Temperate, hot arid, frost tolerant
Rainfall	250 mm, drought tolerant
Aspect	Full sun
Soil	Sandy to clay. Tolerates saline and alkaline conditions

Uses

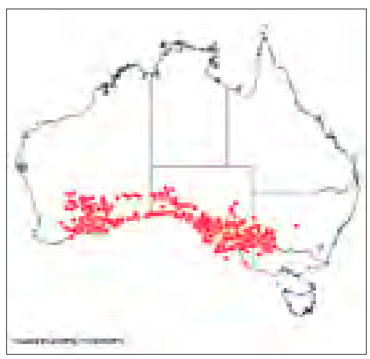
An attractive garden specimen with its red upper bark and profuse cream to yellow flowers, red mallee provides a good low shelter component in windbreaks. It has a high leaf oil content and may be planted extensively for oil, biofuel and carbon credits. Used traditionally as a durable round post and a high-value firewood, the wood is reddish–brown and very hard. *E oleosa* is being used as a commercial planting to rehabilitate salt-affected farmland in Western Australia.

Red mallee buds Photo: Dean Nicolle

Apiculture

Buds appear at different times and are carried for about a year. An important honeybee species across its extensive range—WA, SA, Victoria and south-west NSW. It is a prolific flowerer and produces large surpluses of honey every 2 to 5 years, with a small annual surplus in between. It regularly produces moderate volumes of average-quality pollen. The honey is medium amber, of mild flavour and good density (Clemson 1985).

Honey	Yield	Colour	Density	Crystal	Frequency
	Average 35 to >60 kg/hive	Light amber	Good		2–5 yrs
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Low to moderate		Average	Low to moderate	2–5yrs



TREE

Coral gum

Eucalyptus torquata

Coolgardie gum

FLOWERING SEQUENCE

j f m a m j j **A S** o n d

Features

Small tree

H 4–0 m   W 4–8 m

Coral gum, orange variety Photo: Rob Manning

A small to medium-sized, graceful, well-shaped and spreading tree with rough, persistent bark on the trunk and often also on the larger branches. The leaves are lanceolate, to 12 x 2 cm, greyish–green in colour. The flower buds are very distinctive, having a rough, corrugated base to both the bud itself and the cap, which tapers to a long point. The flowers are large, to 35 mm in diameter, and normally coral pink, but white-, cream- and red-flowered plants are known. Flowering is very conspicuous and occurs in spring to summer. Often flowers at age 2 years.

Origin: Western Australia, South Australia, Victoria, New South Wales.

Conditions

Climate	Temperate, hot/arid, grows in dry summers
Rainfall	300 mm, drought tolerant
Aspect	Full sun to partial shade
Soil	Well-drained sand to heavy clay, pH 6.0–8.5

Coral gum in Israel Photo: Dan Eisikovitch

Uses

This is a very attractive small tree for planting in a wide variety of climates as a specimen. It is also widely used as a street tree and in parks and other public open spaces. It is particularly suited to the hot/arid zone.

Apiculture

Coral gum is a known gum nectar and honey producer and where the trees occur in sufficient number it provides a good pollen supply (Clemson 1985).

Widely planted in Israel, where it produces large quantities of pollen and nectar; known as good bee trees (D Eisikovitch 2011, pers.comm.; A Dag 2011, pers. comm.).

TREE

Desert lime

Citrus glauca

FLOWERING SEQUENCE

j f m a m j j a **S O** n d

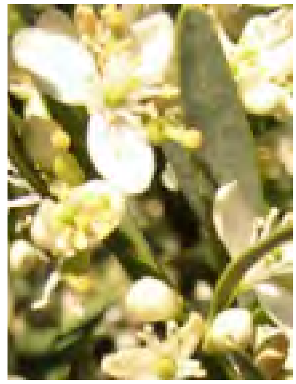
Features

Medium shrub to small tree

H 1–7 m

Moderate growth rate. The foliage is greenish–grey, with oblong leaves to 50 x 5 mm. The stems are spiny with irregularly spaced thorns. White to greenish flowers are 1 cm in diameter. The small greenish–yellow fruits, which are globular and about the size of a large grape, look like mini-oranges. The fruits are edible and have a strong citrus flavour. It is the quickest citrus tree species to set fruit after flowering. Grown from seed, it takes about 10 years to bear, but less than half this time if grafted.

Origin: New South Wales, Queensland.



The fresh flower of the desert lime Photo: www.australiandesertlimes.com.au

Conditions

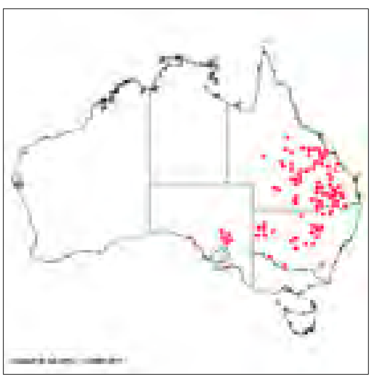
Climate	Hot/arid, warm/humid, frost hardy
Rainfall	220 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained, tolerates poor soil, will grow on heavy clay

Uses

A rising star in the 'bush tucker' industry, desert limes also provide an opportunity to grow an indigenous citrus in your arid zone garden.

The fruit can be used in any product or process where 'normal' limes or lemons are used, the main difference being their small size, lack of peel and more intense flavour. Desert limes require no preparation. They are very nutritious, having high levels of vitamin C and other beneficial compounds (www.desertlimes.com.au 2011).

Abundantly flowering desert limes in a plantation Photot: www.australiandesertlimes.com.au



Apiculture

As a member of the *Citrus* genus desert limes provide high-quality pollen and if in sufficient number could give a unique honey yield. Jock Douglas of Australian Desert Limes (2011, pers. comm.) said a beekeeper had hives on young desert limes in his plantation and reported good results.

TREE

Dryland tea tree

Melaleuca lanceolata

Moonah, black tea-tree, western tea-tree, Rottnest Island tea-tree

FLOWERING SEQUENCE

J F M A M J J a s **O N D**

Features

Shrub to small tree

H 3–8 m W 3–5 m

Melaleuca lanceolata Photo: 1_ Melburnian GFDL

Moderate to fast growth rate. A domed dull-green crown; bark is finely cracked, rough and dark grey. The leaves are numerous, alternate, linear, lanceolate to 15 x 3 mm. Flowers are white to cream in groups of 3 densely packed in bottlebrush-like spikes to 5 x 3 cm. The woody capsules are rounded or egg-shaped to 5 mm. Has a very wide geographic range, from the west coast of Western Australia to south-east Queensland, and is able to tolerate extremes.

Conditions

Climate	Temperate, hot/arid
Rainfall	200 mm, very drought tolerant
Aspect	Full sun
Soil	Various, sandy to heavier clay, tolerates occasional inundation, moderate salinity to 8 dSm-1, and alkaline, pH <6.5–>7.5

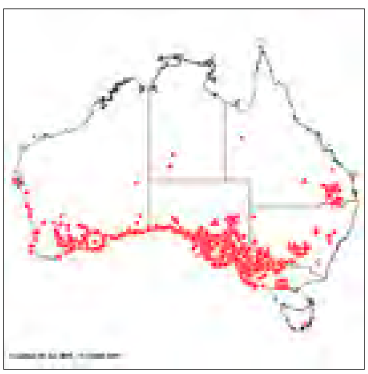
Origin: Western Australia, South Australia Victoria, New South Wales, Queensland.

Uses

This versatile tree has many uses—as an ornamental planting, a maintenance-free street tree and a hedging plant. On farm it provides excellent shelter and is a useful windbreak component or copse. It produces high-quality firewood and at ADD >750 kg/m^3 is suited to small turning.

Apiculture

Blake & Roff (1996) reported *M. lanceolata* as being of medium to minor importance for honey and of major importance for pollen in Queensland. Boomsma (1972) noted that it produces high volumes of good-quality pollen and good honey yields in South Australia. Blake & Roff (1996) described the honey as having a strong, harsh flavour with a displeasing aroma; it granulates to a coarse white grain and is considered a third-grade honey suited to manufacturing. Appreciation can change, though: *Leptosermum scoparium*, manuka, was once thought of as a pollutant of better honeys, not a table honey; now, due to its bio-activity, it is highly sought after, even as a unifloral table honey.



Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	40 kg/hive	Light	Average	Medium. White grain	1–2 yrs
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	High	1–2 yrs

Streetscapes

This chapter relates specifically to the street environment, dealing with the hierarchy of transport infrastructure—from pedestrian-only areas to highways. While street environments provide greater challenges to tree survival, they can collectively provide a significant floral resource for honeybees and other nectar- and pollen-using species.

'Streetscape' is used to describe the appearance of street scenes, including the appearance of buildings, footpaths, gardens and the roadway itself. The discussion here focuses on criteria applied in the design and management of the streetscape as it relates to the planted environment, covering trees, shrubs and herbaceous plants. A review of the published and posted literature of a number of Australian local government streetscape and street tree strategies reveals that in many cases existing and recommended trees produce useful pollen and nectar. This may be a function of their appearance, floral abundance and seasonal beauty, with little if any reference made to their bee forage qualities.

Water gum, *Tristaniopsis laurina*, a tree from subtropical rainforests, growing in a Tasmanian street Photo: Mark Leech

Mindful of the design criteria and the multiple factors that affect plant sustainability in this challenging environment, the plants chosen will provide good honeybee forage. Many trees and plants used in the streetscape tolerate a broad range of conditions: urban environments can create very different conditions to those in a plant's original climate zone. For example, the subtropical rainforest species *Tristaniopsis laurina*, water gum, can be found flourishing along Tasmanian streets and is equally at home in Darlinghurst, Sydney (D Purdie 2011, pers. comm.).

The value of street trees and other plants

Trees, appropriately planned and selected, significantly improve the livability of urban environments, from the CBD to the suburbs. Trees are the most important form of vegetation in the streetscape and can transform city streets and provide aesthetic, environmental, social, cultural and economic benefits.

Trees and supporting vegetation—shrubs and herbaceous plants—can transform the character of the environment within the hierarchy of streets. They can create an individual sense of place for each street or neighbourhood or all of a city. For example, a street named Lime Ave is lined with *Tilia* spp., lime tree, and

Tilia spp. well-known in Europe and North America for its quality nectar and pollen Photo: Mark Leech

is a well-known 'leafy' street where houses are sought after. Trees benefit residents, commuters and visitors visually, emotionally and physically by softening streetscapes and providing an improved environment for pedestrians.

Trees also provide a number of other benefits, all with some intrinsic value but often difficult to quantify. The concept of the urban forest as 'green infrastructure' and studies aimed at quantifying the value of trees to a community have elevated their economic importance and influenced the allocation of funds. Trees and supporting vegetation in street plantings:

- improve environmental amenity by improving the atmosphere, providing summer shade, reducing glare, filtering dust, diminishing street noise and reducing wind speed
- reduce runoff by intercepting rainfall and reducing erosion
- reduce the 'heat island effect' in cities by shading darker pavement surfaces and buildings, helping to reduce temperature build-up by several degrees
- provide seasonal variation and beauty, with colour changes to leaves of deciduous trees, flowering, and interesting bark texture and colour
- improve biodiversity, enhancing urban wildlife habitat and providing food through fruit, pollen, nectar and seeds
- increase property values and improve retail sales
- help control traffic, reducing speeds and providing reference points
- can create local character and a sense of place, reflecting the history of an area
- provide valuable year-round food sources for bees—pollen, nectar and propolis.

Street tree selection

Many street trees in Australia provide excellent bee forage, even though their selection has most likely been based on the plants' appearance and floral display, not their pollen or nectar. It is fortunate that often the quality of bee forage and floral show are synonymous. The aim is to provide a species choice that is based on proven performance as streetscape vegetation while providing excellent bee forage for pollen and nectar throughout the year.

The urban environment—and more specifically the streetscape—is significantly altered from a natural state. Plants, and particularly trees, have to thrive in soils that can be compacted or waterlogged, can often be in prolonged drought-like conditions, lack root space, and are subject to increased air pollution and higher temperatures.

It is important to realise that there is not one perfect street tree, urban environment or bee forage plant. This guide is limited in its selection and may not have plants suited to your specific requirements as the urban environment is a complex mix of microclimates and soil conditions. Additional help can come from local gardeners, arborists, horticulturists, landscape designers, nurseries, advanced tree nurseries and beekeepers who may be able to help with tree and plant selection. Bee forage is the dominant criterion for the plants selected in this publication, but they have also been chosen on the basis of their proven performance within the varied streetscape environments of the nation. Street tree selection should take into account relative plant tolerances and adaptability and integration into surrounding planting themes.

Elizabeth Street, Sydney, adjacent to Hyde Park Photo: Mark Leech

The basic considerations relating to tree selection can be summarised as follows:

- Biological requirements relate to a tree's ability to tolerate urban conditions. The species selected should have high tolerance levels that will allow establishment and sustained growth while producing desired benefits with low management inputs. Root space to sustain the potential tree size is also important.
- Ecological factors include tree diversity and maintaining and enhancing existing areas of native and remnant indigenous vegetation. Select plants that do not have the potential to become woody weeds and adversely affect natural systems.
- Functional and spatial factors include the trees' ability to be pruned so as to meet required clearances. They also relate to the tree's root system and its impact on adjacent infrastructure and above-ground and below-ground restrictions and maintenance requirements. Use tree species that are known to have low litter drop—leaves, flowers, fruit and bark.
- Aesthetic factors include trees' ability to enhance the visual amenity of a streetscape or area, without negatively affecting surrounding infrastructure and taking account of heritage values.
- Tree longevity is a factor since the longer a tree is allowed to grow in a site the greater will be the benefits to the landscape and the return on investment.
- Availability is important. The selected trees will need to be commercially available to provide the desired numbers and sizes for planting programs.
- Finally, using tree species known for their structural integrity and stock that are known to have received appropriate formative treatment whilst in the production nursery is important (City of Port Phillip (2010).

Native, exotic or both?

It appears from the literature that many local government authorities have a balanced view as to the use of indigenous, native and exotic species (North Sydney Council 2006, City of Port Philip 2010). There have been trends in tree species use since European settlement of Australia, from a predominance of exotic broad-leaved deciduous species to more recent trends of using native species. Proven performance of a selected species for a given situation and environment should be a prime consideration. Indigenous species found in the local natural environment to which they are adapted may struggle in the altered urban setting with its changed environment. Changes can include soil compaction, high nutrient levels, impeded drainage, unseasonal heat and higher pollution levels.

Australian natives from other parts of the country may be just as exotic to the local environment as non-native species. For example, *Eucalyptus caesia*, gungurra, originates from a very small area of south-west Western Australia but is planted and grows successfully all across Australian urban environments and internationally. Similarly, many native species are grown widely and often in different climate zones from their origin.

Eucalyptus saligna, Sydney blue gum, thriving in a Melbourne street
Photo: Mark Leech

Proven performance is important as the purchase and establishment of street trees is costly. Exotic species have been cultivated for centuries and carefully bred for performance in urban settings. Many are propagated from cutting or grafting, ensuring uniformity of size, shape and growing habit (North Sydney Council 2006). Broad-leaved deciduous trees provide excellent shade in summer while allowing light through in winter, and they tend to have a higher tolerance of pollutants.

Indigenous, native and exotic species all provide valuable bee forage for both pollen and nectar. One of the most widely planted eucalypts in the world, *Eucalptus camaldulensis* (ICRAF 2011), provides abundant nectar and quality pollen while the European and North American *Tilia* spp., lime or linden also provides abundant nectar and high honey yields (Crane et al. 1984).

Bees in the streetscape

Streetscape planting, be it a planter box of lavender and marigolds next to a busy bus stop or mature trees in a churchyard, contributes to the rich feast honeybees have access to in a city and urban streetscape. Planter boxes of favourable bee forage next to bus stops might not be recommended, but neither the bees nor the people seemed disturbed.

Streets are often themed with one tree species and might not provide good bee forage. Streets that are planted with good pollen- and nectar-producing species will be highly favoured by the nearest bee population, which may be 3 km away. However, with the global increase in urban beekeeping, hive density in urban environments is likely to increase and the better bee forage streets will be in higher demand.

Inner city apiaries occurring in unseen locations such as on rooftops and even balconies will provide the bee populations for 'downtown' bee forage. With many flowers in bloom at any time of the year, cities with their diverse landscape and planting opportunities provide a varied diet for honeybees and other nectariferous insects and birds. Well-managed urban apiaries can produce significant amounts of honey: one Australian inner city apiarist has reported regular annual takes of 60–80 kg, while a community garden in New York reportedly produced up to 136 kg per hive from three hives (Repohl 2007).

Although urban bees are not totally protected from the vagaries of the weather, urban environments do tend to have more moderate climates.

Broad-leaved paperbark, *Melaleuca quinquenervia*, valuable bee forage in Darlinghurst, Sydney Photo: Purdie

George Street, Sydney—bees and buses! Photo: Mark Leech

Streetscape species

The following pages detail the native and exotic species that were chosen to represent a selection of useful bee forage for streetscapes. They are organised according to climate categories:

- cool
- temperate
- warm/humid
- hot/arid.

Cool climate streetscape species

The following table summarises the streetscape species selected for cool climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Rosmarinus officinalis*	Rosemary	C T W H	G S U	N							•	•	•	•	•		
	Lobularia maritima	Alyssum	C T W H	G S U	n	p	•	•	•	•	•	•	•	•				
	Grevillea gaudichaudii	Gaudi-chaudi	C T W H	G S U F	n	p	•	•	•	•					•	•	•	•
	Gazania spp.	Gazania	C T H	G S U		P	•	•	•	•	•	•	•		•	•	•	•
SHRUB	*Grevillea asplenifolia*	Fern-leaf grevillea	C T W	G S U F	n	p							•	•	•	•		
	Ceanothus spp.	Californian lilac	C T	G S U	n	P	•	•	•	•	•				•	•	•	•
	Hebe spp.	Hebe	C T	G S U	n	p	•	•	•	•	•	•	•	•	•	•	•	•
	Escallonia spp.	Escallonia	C T W H	G S U	n	p	•	•	•								•	•
TREE	*Liriodendron tulipifera*	Tulip tree	C T	G S U F	N	p									•	•	•	
	Malus ioensis	Crab apple	C T	G S U	n	p									•	•		
	Eucalyptus pauciflora	Snow gum	C T	G S U F	N	P	•	•	•	•	•	•	•	•	•	•	•	•
	Corymbia eximia	Yellow bloodwood	CT	GSUF	n	P								•	•	•		
	Prunus cerasifera	Cherry plum	C T	G S U	n	P								•	•			

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producing plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Rosemary

Rosmarinus officinalis

FLOWERING SEQUENCE
j f m a m **J J A S O** n d

Features

Shrub

H 1.5 m W 1.5 m

Rambling rosemary Photo: Mark Leech

An evergreen erect woody shrub with dark green spiky, narrow leaves with silver undersides. Pale blue flowers in clusters of two or three 2.5 cm long appear in winter and spring. Prostrate varieties will creep over surfaces and blanket the ground in areas that are too dry, sandy or rocky for most groundcovers.

Origin: Mediterranean.

Conditions

Climate	Cool, temperate, hot/arid, warm/humid
Rainfall	>200mm
Aspect	Full sun
Soil	Well-drained poor alkaline soil. Add dolomite if acid.

Uses

A pungent herb used in meat dishes, especially lamb. It makes a fragrant low hedge; prune back after flowering. It has been used since ancient times in herbal medicine and its oil is antibacterial.

Apiculture

The delicate-flavoured honey is very sweet, balsamic, with slight sour traces and medium aftertaste, excellent aroma and light colour, light yellow when liquid and whitish when solid. It is produced as a unifloral honey in many European countries. Spanish company HISPAMIEL describes it as very light yellow colour, white, max 35 mm Pfund. Delicate aroma, slightly balsamic, not too intense but perceptible. Generally sweet taste. Crystallises very quickly in fine but sharp crystals.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	60 kg/hive	Water white–pale yellow		Rapid, fine	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Low	Low	Annual

HERB

Alyssum

Lobularia maritima
Sweet Alice, sweet alyssum

Features

Annual to perennial

H 5–20 cm

A low-growing woody perennial often grown as an annual; forms clumps. It is covered in delicate, white, pink and purple flowers. Flowers are arranged in terminal clusters and have a fragrance that resembles warm honey. Leaves are narrow to 2.5 cm long and covered with tiny white hairs. It is widely planted in borders and garden beds in all urban settings. Propagates readily from seed.

Origin: Mediterranean.

FLOWERING SEQUENCE
J F M A M J J A s o n d

A cottage favourite, sweet alyssum
Photo: Kanwarjit Singh Boparai/
Shutterstock.com

Conditions

Climate	Cool, temperate, hot/arid, warm/humid
Rainfall	400 mm
Aspect	Full sun to partial shade
Soil	Light sandy loam, widely tolerant, pH 6.5–7.5

Uses

This repeated flowerer makes a great border, gap filler and groundcover.

Apiculture

This abundant flowering groundcover is reportedly a good pollen producer, providing a constant supply. Important through winter and coming into spring. It is easily established as a low component in any setting.

HERB

Grevillea gaudichaudii

Gaudi chaudi

FLOWERING SEQUENCE
J F M A m j j a **S O N D**

Features

Prostrate shrub

H 0.4 m   W 5 m

The ever beautiful toothbrush flower of G. x *gaudichaudii* Photo: Melburnian GFDL

Fast growth rate. A vigorous prostrate shrub. A natural hybrid of *G. acanthifolia* and *G. laurifolia*. Leaves are oak-like; 5–9 pointed lobes to about 10 cm long; new growth has a bronze tint. The deep burgundy to crimson toothbrush inflorescence is made up of many small flowers arranged in a one-sided terminal raceme that sits above the foliage. An excellent long-flowering groundcover. Responds to tip pruning; propagate from cuttings. Widely planted.

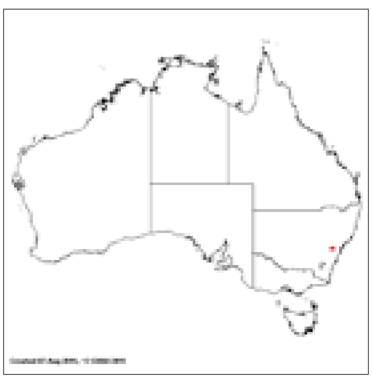
Origin: New South Wales.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost hardiness increases on sharply drained sands.
Rainfall	Drought tolerant, responds to some summer water
Aspect	Full sun
Soil	Well-drained, various, pH 6.5–7.5

Uses

An excellent attractive, vigorous, hardy groundcover suited to many situations in the garden, streetscape or urban open space. A great bank or groundcover, trails over retaining walls and grafted to *G. robusta* to form a graceful weeping standard. It could be used as a groundcover component in on-farm biodiverse plantings.



Apiculture

Clemson (1985) noted that the main benefit of grevilleas to honeybees is the provision of stimulating nectar supplies in late winter and spring for colony build-up. Can supply some pollen. An occasional surplus is yielded.

HERB

Gazania

Gazania spp.

Features

Perennial

H 30 cm

FLOWERING SEQUENCE
J F m a m j j a S O N D

Fast growth rate. A showy, hardy perennial. They are commonly used as groundcovers and can be planted en masse to cover large areas or embankments. Gazania is a tough, low-growing perennial herb with silvery-green, long, narrow, often lobed leaves and brightly coloured daisy-like flowers in orange, yellow and bronze tones. It is widely used in gardens and as a landscaping plant. It is prone to weediness and has naturalised in a number of areas. *G. rigens* is probably the showiest but there are many cultivars to choose from.

Origin: South Africa.

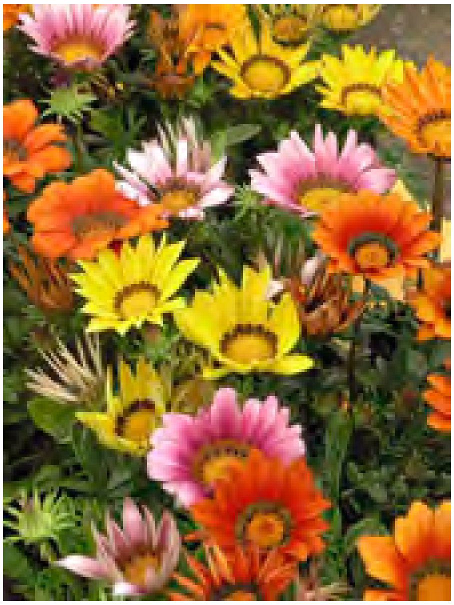
A native bee with a pollen load Photo: Kathie Nichols/shutterstock.com

Conditions

Climate	Cool, temperate, hot/arid
Rainfall	Very drought tolerant
Aspect	Full sun
Soil	Well-drained, various

Uses

A much used landscaping species, being drought, pollution and salt-tolerant. Popular on steep banks, requiring minimal maintenance. Should not be planted near bush edges or remnant vegetation. Not suitable as a cut flower: the flowers close.



A bed of brightly coloured gazania Photo: Margo Harrison/shutterstock.com

Apiculture

Flowering in spring through summer and at other times of the year. They close up on overcast days. The pollen has been described as very nutritious, with a high antibiotic value within the hive (R Heese 2010, pers. comm. 2010).

SHRUB

Fern leaf grevillea

Grevillea asplenifolia

FLOWERING SEQUENCE

j f m a m j **J A S O** n d

G. asplenifolia flower Photo: Mark Leech

Features

Bushy shrub

H 2–4 m

Fast growth rate. The leaves are long and may be deeply divided, rarely toothed, to 25 cm. The flowers are large, deep red and shaped like a toothbrush, occurring most of the year. The styles have bright lime-green tips, making a great contrast. Very hardy. Propagate by seed and cuttings.

Origin: New South Wales.

Conditions

Climate	Cool, temperate, warm/humid, frost hardy
Rainfall	650 mm, drought hardy
Aspect	Full sun, partial shade
Soil	Well-drained

Uses

Another bird-attracting *Grevillea*, ideal in gardens, street median spaces and urban parks.
It can be used as a low screening plant or hedge. It could also be grown on farm as low cover to benefit birds and provide bee forage. A good foliage plant and cut flower.

G. asplenifolia shrub Photo: Mark Leech

Apiculture

Many grevilleas have a flower structure suited to honeybees and are of considerable value as they produce significant nectar over a long-flowering period. Many flower during the spring build time when hives' requirements for pollen and nectar are high. Some produce small volumes of beneficial pollen.

California lilac

Ceanothus spp.

SHRUB

FLOWERING SEQUENCE

J F M A M j j a S O N D

Features

Deciduous shrub

H to 3 m W 2 m

A fast-growing hardy shrub able to withstand drought, heat and cold. With 50 species and many cultivars, these western US plants vary from rambling groundcovers to tall shrubs. Dense, leathery, deeply veined dark green leaves and masses of often bright blue flowers in rounded heads on short spikes. They are mainly summer flowering, but some flower in spring and autumn.

Origin: United States.

California lilac is a very useful species for road verges Photo: Mark Leech

Conditions

Climate	Cool, temperate
Rainfall	Very drought tolerant
Aspect	Full sun
Soil	Well-drained, various

Uses

An excellent coastal planting able to tolerate salt spray and strong winds. It is a great feature plant in a home garden and has many uses in streetscapes and urban open spaces planting.

Apiculture

A bee magnet said to produce good honey. Richter (1911) noted that in California it occasionally produces a surplus of honey with abundant yellow pollen. A Tasmanian beekeeper recorded that one 3-year-old bush kept a hive busy (R Heese 2010, pers. comm.).

SHRUB

Hebe

Hebe spp.

FLOWERING SEQUENCE
J F M A M J J A S O N D

Features

Perennial large shrub

H 60 cm to 2 m

The bright year-round flowering is a great attraction Photo: Mark Leech

Fast-growing compact evergreen shrub. Leaves are opposite and alternate, forming a 'square' pattern down the stems. Known for their long flowering year round. Flowers in spikes from white to purple depending on species and cultivar.

Origin: New Zealand.

Conditions

Climate	Cool, temperate, frost hardy
Rainfall	500 mm, drought tolerant
Aspect	Full sun, part shade
Soil	Well-drained sandy to heavy clay. Alkaline tolerant

Uses

Widely planted; attractive, long-flowering, hardy evergreen shrub. Used as hedging plants, roadside verge plants and in parks. Tolerant of salt spray, suited to coastal sites.

A characteristic median strip planting Photo: Mark Leech

Apiculture

Some species, such as the New Zealand koromiko, *H. stricta*, produce a surplus and a beneficial pollen that is white to dull yellow. The honey of this hebe is light amber and a delicate flavour (Walsh 1978). Hebes, still sometimes called veronicas, are very attractive to honeybees, observed foraging when the weather was about 10ºC.

SHRUB

Escallonia

Escallonia spp.

Features

Small to medium shrub

H 3.0 m W 3.0 m

Fast-growing evergreen shrub. Small leaves are glossy, medium to dark green, with finely toothed margins. Fragrant small tubular flowers are white through pink to red, usually in terminal clusters. Flowers are hermaphrodite (both male and female) and require insect pollination. Most plants require pruning to maintain vigour and control shape. Propagation is from cuttings. There are 40 species and many varieties available, suiting most climates.

Origin: Andes, South America.

FLOWERING SEQUENCE

J F M a m j j a s o **N D**

Escallonia flowers are bee magnets
Photo: ndrwfgy CC Generic

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost hardy
Rainfall	Drought tolerant
Aspect	Full sun, coastal
Soil	Well-drained light sandy to heavy clay, pH <6.5 to >8

Uses

An excellent shrub suited to hedging. This very hardy plant is tolerant of wind and salt spray and is considered a frontline coastal species. It is widely used in landscaping from the home to the broader urban environment.

Apiculture

Escallonia is a bee magnet regularly visited for nectar and pollen.

Escallonia in full bloom in bee forage street island Photo: Angilbas

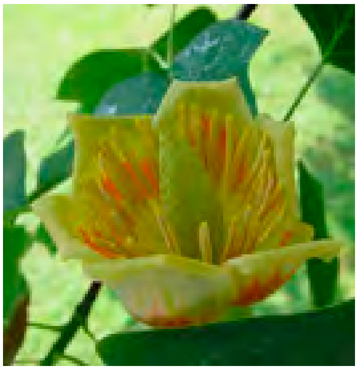
TREE

Tulip tree

Liriodendron tulipifera

FLOWERING SEQUENCE

j f m a m j j a **S O N** d



Stunning tulip-like flower Photo: Wikimedia Commons

Features

Large deciduous tree

H 30 m

A fast-growing deciduous hardwood with a very distinctive large, squarish, usually 4-lobed leaf 10–20 cm across. The equally unique tulip-shaped chartreuse and orange flowers, 5–7 cm across, appear in spring or early summer, first flowering when the tree is about 10 years old. Native to the eastern US, the tree is widely planted in the southern hemisphere and in Canada. Propagates readily by seed.

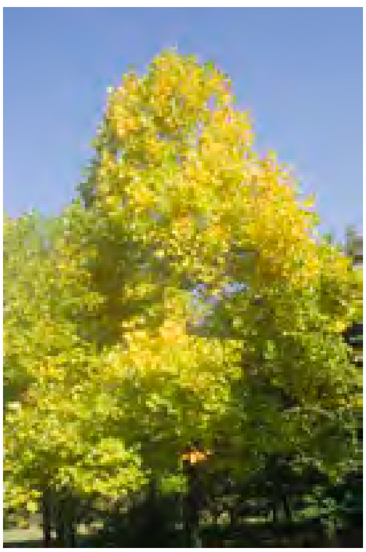
Origin: United States.

Conditions

Climate	Cool, temperate
Rainfall	750 mm
Aspect	Full sun to part shade
Soil	Wide range of soils, best in well-drained, moist, fertile acid to neutral pH soils

Uses

Tulip poplar is widely planted as a specimen tree in parks and public gardens. Smaller growing cultivars, such as ‘Fastigatum’, are popular garden specimens and street trees. Tulip wood, a low-density hardwood, often greenish in colour, fine-grained and easily worked, is used extensively in construction, pattern making and musical organs. It was originally used by native American tribes in Pennsylvania and Virginia for dugout canoes.



Tulip tree Photo: riekephotos/ Shutterstock.com

Apiculture

This is a major honey tree in the eastern US. Tulip poplar honey is produced from southern New England to southern Michigan and south to the gulf states east of the Mississippi. The honey is reddish to dark amber in colour, with a distinctive quince-like flavour. Tree is a heavy nectar producer, reported to ‘rain’ nectar in a breeze. 20-year-old trees can produce 1.8 kg honey.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	35–45 kg/ hive	Reddish to dark amber	Heavy body	Very slow	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Cream	37.1%	Abundant	Annual

TREE

Crab apple

Malus ioensis

Features

Small deciduous tree

H 6 m W 4 m

Slow growth rate. This widely planted, very showy, hardy street tree never fails to impress. The bark is greyish–brown, shiny, becoming scaly. The leaves have a distinctly serrated margin. Known for its masses of flowers, mildly fragrant, double in groups of 3–5. The flowers, a delicate pink, open up to provide easy access for bees.

Origin: United States.

FLOWERING SEQUENCE

j f m a m j j a **S O** n d

Delicate flower of the crab apple Photo: Mark Leech

Conditions

Climate	Cool, temperate
Rainfall	500 mm
Aspect	Full sun
Soil	Well-drained, various

Uses

An excellent specimen tree and widely planted, providing a spring spectacle.

Apiculture

Known to support bees through the production of pollen and nectar. Important for cross-pollination with eating apples.

A typical spring street tree scene in Tasmania Photo: Mark Leech

TREE

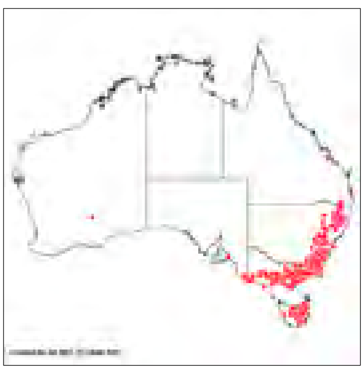
Snow gum

Eucalyptus pauciflora
Cabbage gum, white sallee

FLOWERING SEQUENCE
J F M A M J J A S O N D

Flowers like snow. Profuse flowering of *E. pauciflora* Photo: Mark Leech

Snow gum is at home in many situations Photo: Mark Leech



Features

Small tree

H 8–20 m

Tree often has a short, twisted trunk and a crown that spreads wide, with large main branches. The name is derived from the conditions it can easily survive in—cold and snow. Snow gum has a fairly light coloured, smooth bark that is shed in irregular patches, giving a characteristic mottled look. It has thick, waxy leaves, up to 15 x 3 cm, with prominent parallel venation, that tend to 'rattle' in the wind and can have a pendulous habit. The white flowers form clusters of 7–15 or more. Tree coppices vigorously and is extremely hardy. Altitudinal range: sea level to 1500 m. Propagation from seed.

Origin: South Australia, Victoria, Tasmania, New South Wales.

Conditions

Climate	Cold, temperate, very frost hardy
Rainfall	550 mm, very drought tolerant
Aspect	Full sun, very exposed
Soil	Well-drained, various, tolerates imperfect drainage

Uses

Snow gums are a very attractive, hardy tree with a weeping habit, useful in higher altitudes or exposed streetscapes. They provide great shelter for animals and livestock in higher alpine regions where other species struggle to survive. Can be used for a windbreak, shade, fence posts, fuel wood, bee forage, and in parks. The wood is best used for fuel since the timber value is negligible.

Apiculture

This is a very profusely flowering eucalypt, yielding honey of the white gum type—clear, transparent, golden in colour, but not of high density (Beuhne 1922).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	High	Light amber	Fair		2–3 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			High	High	2–3 years

TREE

Yellow bloodwood

Corymbia eximia

Features

Small to medium tree.

H 8–15 m W 12–16 m

Medium growth rate. This narrow domed tree has brown to yellow–brown bark that is tessellated, flaky and persistent on the small branches. The adult leaves are dull bluish–green. They are thick, leathery, lanceolate and sickle-shaped to 12–20 x 1.3–3.0 cm. The creamy-white flowers are in a terminal inflorescence. Propagation is from seed.

Origin: New South Wales.

Conditions

Climate	Cool, temperate, frost tender when young
Rainfall	Very drought tolerant
Aspect	Full sun
Soil	Various, but succeeds in poor shallow and sandy soils. Tolerates waterlogging

Uses

Yellow bloodwood is often used as a street tree, but it is susceptible to frost. The leaves turn yellowish in winter but return quickly to green in the spring warmth. It is an excellent specimen tree in gardens or open space and is useful for windbreaks and as a good bird attracter.

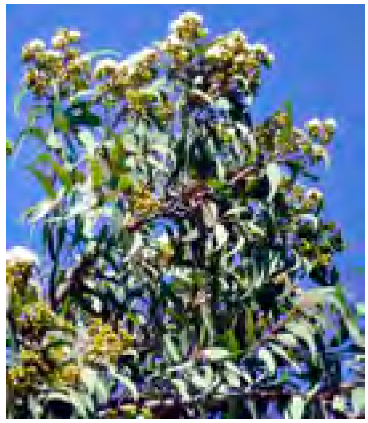
Apiculture

Clemson (1986) noted that it only produces small volumes of honey but is a prolific pollen producer. The honey is light amber, has good density and acceptable flavour, and can exhibit the bloodwood 'stringyness'. A heavy crop is produced every 3 to 4 years.

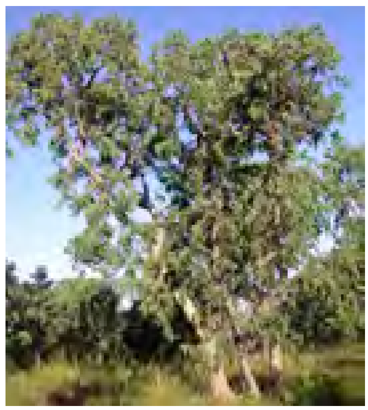
Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Low	Light amber	Good body		3–4 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	High	3–4 years

FLOWERING SEQUENCE

j f m a m j j **A S O** n d



Yellow bloodwood flowers Photo: Mark Leech



C. eximia Photo: Dean Nicolle

TREE

Cherry plum

Prunus cerasifera

FLOWERING SEQUENCE

j f m a m j j **A S** o n d

Early flowering in August, Launceston, Tasmania Photo: Mark Leech

Features

Small deciduous tree

H 5–6 m W 4–5 m

Moderate to fast growth rate. A small flowering plum. Bark is dark brown to purple brown, branchlets are red. 'Nigra' has very attractive purple leaves, ovate with toothed margins to 4–6 cm long. Single-variety flowers are 5-petalled and up to 2 cm in diameter. With many varieties, flower colour varies from white to bright pink. Fruit is a drupe 2–3 cm in diameter. Propagation from cuttings.

Origin: Balkans.

Conditions

Climate	Cool, temperate, very frost hardy.
Rainfall	500 mm, moderately drought tolerant
Aspect	Full sun
Soil	Well-drained, light sandy to heavier clay, pH <6 to >8. Prefers moist soil

A classic late winter-spring streetscape in a cool climate Photo: Mark Leech

Uses

P. cerasifera 'Nigra' purple-leafed form is a widely planted street tree and ornamental providing profuse spring flowering, an excellent foliage contrast and edible fruit. The purple-leaved varieties have purple fruit that makes an excellent dark-coloured jam. Suited to planting under power lines and on small sites.

Apiculture

Crawford (2000) considers cherry plum to be a good bee plant, providing both pollen and nectar. Clemson (1985) noted that *Prunus* spp. provide outstanding pollen and with nectar provide stimulus for brood rearing. Pollen is a brownish yellow. Because flowering is in late winter, flying conditions and hive strength may limit the opportunity to store nectar. With temperatures often still less than 13°C bees will either not fly or will only fly short distances between rain showers (Somerville 1999). Urban hives will benefit from the often widely planted *P. cerasifera* varieties.

Temperate climate streetscape species

The following table summarises the streetscape species selected for temperate climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Scaevola aemula*	Fairy-fan flower	C T W H	G S U F	n	p	●	●	●	●				●	●	●	●	●
	Callistemon subulatus	Dwarf bottlebrush	T	G S U F	n	p	●									●	●	●
	Carpobrotus glaucescens	Pigface	C T W H	G S U F			●	●	●	●	●	●	●	●	●	●	●	●
	Grevillea 'Bronze Rambler'	Bronze rambler	C T	G S U	n	p	●	●	●	●	●	●	●	●	●	●	●	●
SHRUB	*Callistemon* 'Harkness'	Harkness bottlebrush	C T W H	G S U F	n	p				●	●				●	●	●	●
	Banksia prionotes	Acorn banksia	T H	G U F	N	P		●	●	●	●	●						
	Abelia grandiflora	Glossy abelia	C T W	G S U	n	p	●	●	●									●
	Melaleuca wilsonii	Violet honey myrtle	T H	G S U F	n	p									●	●	●	
TREE	*Tristaniopsis laurina*	Water gum	C T W H	G S U F	N		●											●
	Melaleuca quinquenervia	Broad-leaved teatree	T W	G S U F	N	P		●	●	●	●	●	●					
	Corymbia ficifolia	Red flowering gum	C T H	G S U F	N	P		●	●	●	●				●			●
	Acacia doratoxylon	Currawong	T H	G S U F		p									●			

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Fairy fan-flower

Scaevola aemula

FLOWERING SEQUENCE
J F M A m j j A S O N D

Features

Perennial

H 20–40 cm

A landscape pot with *S. aemula* in Potsdam, Germany Photo: BotBln GNUFDL

A fast-growing mainly prostrate spreading plant. Its wiry stems are covered in yellowish hairs. The thick leaves are dark green, obovate to wedge-shaped with toothed margins. The lower leaves are up to 8 cm long reducing to 1 cm near the flowers. The fan-shaped flowers to 3 cm in diameter are purple, blue to mauve, with a white or most often yellow centre in spikes to 24 cm. Widely planted internationally in colder climates, from Niagara Falls in Canada to Potsdam in Germany, where they flower through the summer into autumn and the first frost. Many cultivars are available. Propagate by cuttings.

Origin: South Australia, Victoria, New South Wales, Queensland, Northern Territory.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	200 mm
Aspect	Full sun
Soil	Well-drained, various

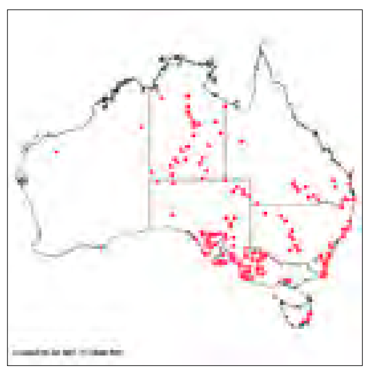
Uses

This attractive long-flowering native plant is used as a groundcover and in hanging baskets. Its value has been widely demonstrated where a long-flowering, covering, hardy plant is needed. It is also an attractive addition to rockeries.

The attractive fan-shaped flower Photo: Brian Walters

Apiculture

Much visited by honeybees.



HERB

Dwarf bottlebrush

Callistemon subulatus

Features

Small to medium shrub

H 1–3 m   W 1–2 m

Moderate to fast growth rate. A small, erect shrub. Densely arranged pale green leaves with black gland-dots, stiff, narrow and sharply pointed, 2–5 cm x 2–4 mm. Flowers are crimson 'bottlebrush' spikes, 4–6 x 3–4 cm. Fruit capsules are cup-shaped to 5 mm. Prune after flowering to maintain shape. Propagate from seed or cuttings.

Origin: Victoria, New South Wales.

FLOWERING SEQUENCE

J f m a m j j a s **O N D**

An attractive bottlebrush flower Photo: Eric in SF GFDL

Conditions

Climate	Temperate, frost hardy
Rainfall	Drought tolerant once established
Aspect	Full sun
Soil	Well-drained various, light sandy to heavier clay. Will tolerate some waterlogging

Uses

A very hardy shrub that can be used as a hedge or a screen in any urban setting.

Apiculture

Callistemons provide nectar and some pollen, assisting with brood rearing (Clemson 1985).

HERB

Pigface

Carpobrotus glaucescens

FLOWERING SEQUENCE
J f M A M J J A S O N D

Features

Prostrate succulent perennial

H 30 cm   W 2 m

Native pigface Photo: Daniel Langois GFDL

Moderate to fast growth rate. A trailing succulent with reddish stems and bluish–green leaves that root at nodes along the stem, forming a thick groundcover. Leaves are thick, succulent, triangular in cross-section to 10 x 1.5 cm. The large pink–purple daisy-like flowers, 4–6 cm across, occur mainly in October to January, but sporadically throughout the year. Plant produces a succulent edible fruit. Propagate by seed, cuttings and best by layering.

Origin: Victoria, New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost tender.
Rainfall	Drought tolerant
Aspect	Full sun to partial shade
Soil	Well-drained

Uses

This very salt-tolerant frontline sand dune species is widely used as a groundcover in landscaping, useful in home gardens and as a streetscape groundcover. It can be used on farm in coastal areas to bind sands and to add to biodiversity as a ground component. It has had a traditional food use, the succulent leaves when peeled tasting like salty apples, kiwi and even strawberry; they are also cooked and eaten. The juice of the leaves is said to be a mild topical anaesthetic. The flesh of the juicy fruit has a sweet fig-like flavour.

Apiculture

Honeybees are known to regularly visit pigface flowers.

HERB

Grevillea bronze rambler

Grevillea 'Bronze Rambler'

Features

Evergreen groundcover

H 0.3 m W 4 m

Fast growth rate. A very vigorous mat-forming groundcover. Dark green leaves, deeply dissected, each lobe ending in a short pointed tip. Yellowish–green veins on the upper surface of the leaf contrast with the dark green; underside is a mat of silvery hairs. New growth is bronze. The burgundy red 'toothbrush' inflorescence is a raceme to 6 cm. The flower style is to 2.5 cm, emerging pink and darkening to crimson with a contrasting yellowish–green pollen presenter. The flowers are in profusion throughout most of the year. Propagate by cutting to preserve the cultivar.

Origin: Cultivar *G. rivularis* x G. 'Poorinda Peter'.

FLOWERING SEQUENCE
J F M A M J J A S O N D

The classic toothbrush flower of grevillea bronze rambler Photo: www.grevilleas.com.au

Conditions

Climate	Cool, temperate, frost hardy
Rainfall	Drought tolerant
Aspect	Full sun
Soil	Well-drained sandy to heavier clay

Uses

An excellent vigorous, hardy groundcover able to create fast cover on banks and batters.

Apiculture

Grevilleas contribute pollen and nectar and may assist with colony stimulation in spring.

A wonderful landscape feature plant Photo: www.grevilleas.com.au

SHRUB

'Harkness' bottlebrush

Callistemon 'Harkness'

FLOWERING SEQUENCE
j f m **A M** j j a **S O N D**

The large bold 'bottlebrushes' are very attractive to bees Photo: Mark Leech

Features

Tall shrub or rounded bush

H 6 m W 4 m

Considered one of the best callistemon cultivars, its light green oblong lanceolate leaves to 13 cm contrast with the masses of large bright red flower spikes in late spring and early summer. It can flower a second time in autumn. Flowers profusely after 2 years' growth. Wonderful bird-attracting plant. It will grow in all Australian climates. If straggly, prune heavily to promote new growth.

Origin: SA Cultivar of *C. viminalis* 1937.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	500 mm, drought tolerant
Aspect	Full sun
Soil	Sand to heavy clay. Tolerates occasional inundation/waterlogging

Uses

An excellent street tree, well proven over many years. Its great show—flowers lasting for 6 weeks—ability to tolerate difficult conditions and relatively compact size make it a valuable addition. Thrives in limited soil space of median cut-outs. Can be pruned like a tree and makes an attractive lawn feature.

An extravagant show Photo: Mark Leech

Apiculture

Many callistemons are very attractive to bees during spring and early summer. They provide nectar and pollen for hive use (Clemson 1985).

SHRUB

Acorn banksia

Bansksia prionotes
Orange banksia

FLOWERING SEQUENCE
j **F M A M J** j a s o n d

Features

Tall shrub to small tree

H 4–10 m

Fast growth rate. The bark is light grey, thin and mottled to smooth. Very attractive foliage, dull green long narrow saw-toothed leaves to 30 x 2 cm. 'Acorn' describes the large, whitish–grey and orange flower spikes, to 15 x 8 cm that open from the bottom up. The flower spike progressively turns bright orange as the flowers open up. Like other banksias, it is a great bird-attracting plant. Suited to cultivation in areas with a dry summer climate but is difficult to maintain in areas of high summer humidity. It does not have a lignotuber and relies on seed to germinate after fire.

Origin: Western Australia.

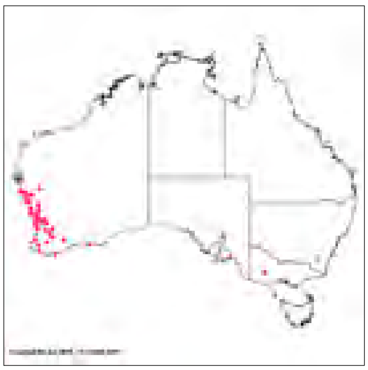
B. prionotes with abundant flowering
Photo: Wikimedia Commons

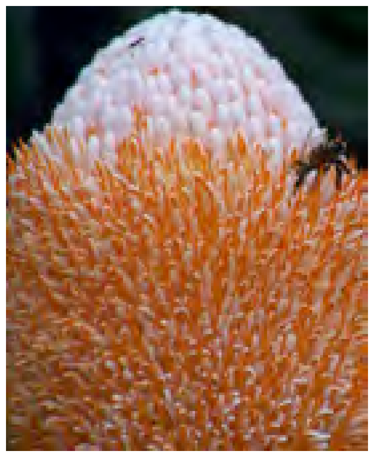
Conditions

Climate	Temperate, hot/arid, moderately frost hardy
Rainfall	400 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sandy soils, salt-tolerant, pH <6.5 to < 8.5

Uses

A popular garden plant that is useful in park plantings. It can be container grown. A long-lasting cut flower used in floral art. As farm shelter it can be used as a windbreak component or for revegetation of sandy sites. It is highly susceptible to *Phytophthora cinnamomi* dieback.





Honeybee on *B. prionotes* Photo: Wikimedia Commons

Apiculture

Coleman (1962) noted that acorn banksia is a producer of good quantities of good-quality honey and pollen, but this appears limited to its northern range.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Good				Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	Good	Annual

SHRUB

Glossy abelia

Abelia grandiflora

FLOWERING SEQUENCE

J F M a m j j a s o n **D**

Features

Small shrub

H 1.5 m W 1.5 m

Profuse flowering on glossy abelia
Photo: Wouter Haganss

Moderate to fast growth rate. Evergreen shrub with arching branches and a rounded shape. Glossy dark green to bronze green leaves, opposite, oval to 3.8 cm. White, pink-tinged tubular or bell-shaped flowers 8mm wide x 2 cm long, axillary or in terminal clusters. Propagate by hardwood cuttings in winter 20–25 cm long.

Origin: India, Himalayas, China, Japan.

Conditions

Climate	Cool, temperate, warm/ humid, frost hardy
Rainfall	Moderately drought hardy
Aspect	Full sun, partial shade
Soil	Deep well-drained loam

Uses

A useful border foundation or hedge plant. Widely used in streetscapes and park plantings.

Apiculture

Visited by honeybees for both pollen and nectar (Arbrol 2004).

SHRUB

Violet honey myrtle

Melaleuca wilsonii

FLOWERING SEQUENCE

j f m a m j j a **S O N** d

Features

Shrub

H 1.5 m W 2.5 m

Fast growth rate. This is a widely planted hardy small to medium sized shrub. It is long-lived and drought and frost tolerant and maintains its vigour year round, providing a floral abundance in spring with its violet sprays. The tiny leaves are decussate (having a cross-like arrangement when viewed from above), linear and pointed. Flower spikes are deep pink to mauve–purple. They appear in spring, carried on last year's wood, and may be very long, producing an attractive display.

Origin: South Australia, Victoria.

Bees love *M. wilsonii* Photo: Mark Leech

Conditions

Climate	Temperate, hot arid
Rainfall	Drought tolerant
Aspect	Full sun to part shade
Soil	Sandy, gravelly to clay

Uses

M. wilsonii can handle short-term waterlogging. Its dense foliage provides cover for native birds, and the species is ideal for bonsai. Larger members of the genus have been used in fencing and boat building.

Apiculture

Bees love these flowers and can always be seen working them on sunny days. The species is mentioned in Beuhne (1922) as part of the Victorian honey flora. It is included here because it is a widely planted, highly attractive garden specimen, providing supporting pollen and nectar.

TREE

Water gum

Tristaniopsis laurina
Kanuka

FLOWERING SEQUENCE
J f m a m j j a s o n **D**

Bees love water gum flowers Photo: Brian Walters

Features

Small to medium tree

H 5–20 m

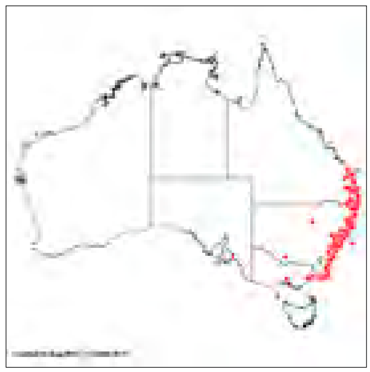
The smooth bark is greyish in colour and peels off, leaving a patchiness of pink and grey.

Leaves are glossy, dark green, silky underneath, narrow, elliptical to 13 x 2.5 cm, grouped together towards the end of branchlets. The bright yellow flowers are small, to 1 cm, and resemble the tea tree (*Leptospermum*) flowers, with five rounded petals. The bright yellow floral abundance provides a very attractive streetscape.

Origin: Victoria, New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid
Rainfall	750 mm
Aspect	Prefers damp situations such as along streams
Soil	Moist, well-drained soils, shady loam to clay



Uses

T. laurina can be planted in gardens, along streets and in parks and could provide a component of farm shelter. The heartwood is pinkish darkening to red, ADD is about 900 kg/m^3; fine interlocked grain. Used for flooring, mallets and tool handles (Bootle 2001).

Apiculture

Tree can provide a good surplus of honey, estimated at 1 kg/tree in a two-week period from street trees. It produces a greenish honey and has sold well as a highly priced unifloral in local produce markets (D Purdie 2011, pers. comm.). It provides useful stores and brood stimulation (Clemson 1985).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	40 kg/hive	Green tinge			Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**

Water gum is very adapatable and suited to many environments Photo: Mark Leech

TREE

Broad-leaved tea tree

Melaleuca quinquenervia
Belbowrie, paper-bark tea tree

Features

Small to medium tree

H 5–20 m

A moderate to fast growth rate. An attractive paper-bark, widely planted as a street tree. It is very hardy and adaptable, useful in frontline coastal plantings. The leaves are dull green, leathery, usually with 5 veins running lengthwise, to 7.5 x 2.5 cm. A bird-attracting species that makes a striking specimen tree. Propagate from seed.

Origin: New South Wales, Queensland.

FLOWERING SEQUENCE
j **F M A M J J** a s o n d

Conditions

Climate	Temperate, warm/humid, frost sensitive
Rainfall	500 mm
Aspect	Full sun
Soil	Withstands seasonal inundation and saline and brackish soils. pH <6.5 to >7.5

Uses

Widely planted as a street tree, *M. quinquenervia* is also a useful farm forestry tree for shelter, timber, firewood, bark, oil and honey. It is hardy in a range of climates and is particularly useful for poorly drained sites. It is an attractive tree that is very useful for landscaping. The white, papery trunk is particularly appealing. It is used as oyster stakes in smaller sections with the bark on. The bark is used in potting mix, as insulation and in floral art. The wood is useful for fence posts, is used as boat knees from the natural bend, and wood products include flooring and light construction. With an ADD of 750 kg/m^3, the wood tends to dull tools due to high silica (Bootle 2001).

Belbowrie, Darlinghurst, Sydney Photo: Doug Purdie

Apiculture

M. quinquenervia honey is variously described as inedible to distinct and favoured, which may come from its broad habitat range—from Sydney to New Guinea and Indonesia. It has become an aggressive environmental weed in the Florida wetlands. The honey is described as dark amber with a strong caramel flavour and aroma and weak density; it granulates quickly, with grains varying from fine creamy to coarse brown. The smooth candied form is popular locally in Queensland. Bees breed well on the abundance of very high-quality pollen along with ample nectar (Clemson 1985; Blake & Roff 1996).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Ave 33 kg/hive	Dark amber	Weak	Rapid, fine to coarse	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Abundant	Creamy	Very high 35%	Abundant	Annual

TREE

Red flowering gum

Corymbia ficifolia

Features

Small tree

H 6–10 m

Moderate growth rate. Very restricted in its natural distribution in south-west Western Australia, it is one of the most widely planted eucalypts in south-eastern Australia and internationally.

A compact eucalypt: scaly, rough and persistent bark, light grey to yellowish beneath. The adult leaves are hard, glossy green, strongly discolorous and broadly lanceolate to 15 x 5.5 cm.

The characteristic flowers form from terminal peduncles of 3 to 7 large club-shaped buds to 7 x 3 cm. The large woody fruit are often urn-shaped to 3.5 x 3.3 cm.

Origin: Western Australia.

FLOWERING SEQUENCE

j **F** **M** **A** **M** j j a **S** o n **D**

C. *ficifolia* causing a bee frenzy—typical in most places it is planted Photo: Mark Leech

Conditions

Climate	Cool, temperate, hot/arid (seedlings very frost tender)
Rainfall	500 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sandy to heavy clay

Uses

Widely planted as a street tree, *C. ficifolia* is very showy, with long-flowering often bright red flowers; it is hardy and adaptable to most soil conditions.

It does not tolerate prolonged summer humidity and is very frost tender as a seedling. Once established, it is frost hardy and tolerates moderate coastal exposure.

C. *ficifolia*—a feature wherever it is grown
Photo: Mark Leech

Apiculture

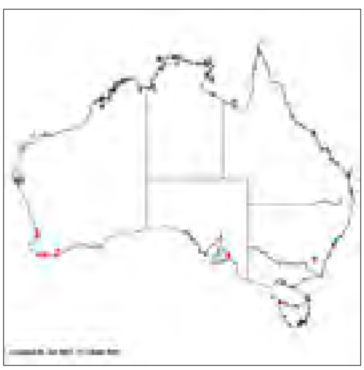
C. ficifolia is usually a prolific producer of nectar wherever it is planted. The typical image of the flower has bees almost fighting to get to the nectar.

The tree's productivity has been known for a long time, even in the US in the early 1900s, as evidenced by Frank Pellet (1920):

> The scarlet bloom is one of the greatest honey producers I have ever known. The honey is of a fine flavour, water white. You can see the nectar wave in the flower cup as you shake it.

Crane et al. (1984) described the honey as of pleasant flavour with colour depending on the country of origin—like straw, rather dark or water white. Walsh (1978) described it from New Zealand as rather dark with a pronounced eucalypt flavour. This wide variation in colour could be a result of species confusion. The consistent message, however, is that *C. ficifolia* is an abundant nectar producer. It also produces small amounts of useful pollen.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	High	Water white	May be stringy	Slow	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Cream	Average	Small	Annual



TREE

Currawong

Acacia doratoxylon

Features

Small to medium tree

H 4–8 m

A moderately fast growing attractive acacia. The bark is corrugated, dark greyish–brown to black on the trunk. The leaf-like phyllodes are dark green, thick, semi-glossy, linear, flat and mostly straight or slightly curved to 7–20 cm x 8–10 mm with a curved tip. The bright yellow flowers are arranged in crowded cylindrical spikes. Propagate by scarified seed.

Origin: Victoria, New South Wales, Queensland.

Conditions

Climate	Temperate, hot/arid, frost hardy
Rainfall	250 mm, drought tolerant
Aspect	Full sun
Soil	Light sandy loams to heavy clays, pH <6.5–7.5

Uses

A good garden and park tree and maintenance-free street tree. Good for farm shelter and shade. May be used as a specialty timber, with a medium to dark brown wood similar to that of the sought-after *A. melanoxylon* (Tasmanian blackwood), used in turnery and as a cabinet timber.

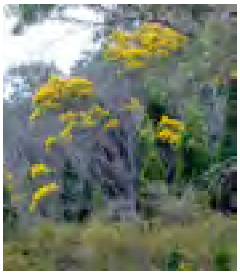
Apiculture

Clemson (1985) noted currawong to be an outstanding source of pollen for bees. The analysis of Somerville (2001) shows that while its crude protein level, at 24.9%, is considered good, it has a lower than required level of the amino acid isoleucine.

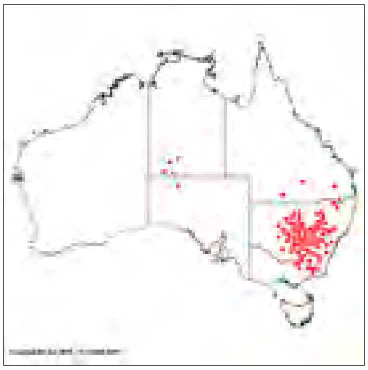
FLOWERING SEQUENCE

j f m a m j j a **S** o n d

Currawong flowers—bold bright yellow
Photo: yallaroo.com



A. doratoxylon Photo: A O'Halloran



Water gum in streetscape

Warm/humid climate streetscape species

The following table summarises the streetscape species selected for warm to humid climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Grevillea* 'Mason's hybrid'	Grevillea 'Mason's hybrid'	C T W	G S U F	n	p	●	●	●	●	●			●	●	●	●	●
	Verbena spp.	Verbena	T W	G S U	n	p	●	●	●	●								●
	Zinnia spp.	Zinnia	T W	G S U	n	p	●	●	●	●						●	●	●
	Cuphea hyssopifolia	Mexican heather	T W	G S U	n	p	●	●	●	●	●	●	●	●	●	●	●	●
SHRUB	*Callistemon* 'Howie's Fire Glow'	'Howie's Fire Glow' bottlebrush	C T W H	G S U F	n	p									●	●	●	●
	Buckinghamia celsissma	Ivory curl	T W	G S U F	N	P	●	●							●	●	●	●
	Leptospermum madidum	Weeping tea tree	T W	G S U F	n	p	●	●	●	●	●	●	●	●	●	●	●	●
	Melaleuca linariifolia	Flax-leaved paperbark	T W	G S U F	n	p										●	●	●
TREE	*Lophostemon confertus*	Brush box	C T W	G S U F	N	P	●	●								●	●	●
	Jacaranda mimosifolia	Jacaranda	T W	G S U	N		●									●	●	●
	Guioa semiglauca	Guioa	T W	S U F	N	p									●	●	●	
	Grevillea robusta	Silky oak	C T W H	G S U F	N	P	●	●										●

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producing plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Grevillea 'Mason's Hybrid'

Grevillea 'Mason's Hybrid'
Ned Kelly

FLOWERING SEQUENCE
J F M A M j j **A S O N D**

Features

Prostrate shrub

H 1.5 m W 2 m

The outstanding flower head is very attractive to bees Photo: Mark Leech

Fast-growing hybrid; rambling low shrub. The apricot-coloured flowers with their red styles form in racemes to 12 x 10 cm. The flowers are present year round and are very attractive to nectarivorus birds and insects. It responds well to light pruning, which promotes vigorous growth.

Origin: Hybrid of *G. bipinnatifida* (WA) and *G. banksii* (Qld) (1980).

Conditions

Climate	Cool, temperate, warm/humid
Rainfall	550 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained, moist but not waterlogged

A bold rockery planting Photo: Mark Leech

Uses

An ideal garden specimen often used in streetscapes and urban open space rockeries. It could also be grown on farm as low cover to benefit birds and provide bee forage.

Apiculture

Many grevilleas have a flower structure suited to honeybees. They are of considerable value as they produce significant nectar over a long flowering period. Many flower during the spring build time, when a hive's requirements for pollen and nectar are high. Some produce small volumes of beneficial pollen.

Verbena

Verbena spp.

HERB

Features

Herbaceous annuals and perennials

H 15–100 cm

Fast growth rate. Sprawling to erect habit. Leaves are small, bright to dark green, opposite and divided to 2.5–7.5 cm. Slender stalks bear flattened clusters of flowers. Easy-care plants. Dead-heading prolongs blooming. Propagate annuals by seed; perennials by seed, cuttings or division.

Origin: Tropical and subtropical America.

FLOWERING SEQUENCE

J F M A m j j a s o n **D**

Attractive dense clusters of flowers
Photo: Becky Sheridan/Shutterstock.com

Conditions

Climate	Temperate, warm/humid
Rainfall	Drought tolerant
Aspect	Full sun
Soil	Well-drained, moisture-retentive soil

Uses

Used for borders, groundcovers and hanging baskets as it comes in a wide variety of colours and habits. Used in herbal medicine.

Apiculture

Important to use the shorter tube varieties for honeybees. Howes (1945) considered them good bee plants and reported bees freely working *V. hasta* and *V. stricta* for nectar and pollen at Kew in the UK. Richter (1911) reported that some verbena species yield honey. They are generally considered valuable bee forage in garden plantings.

HERB

Zinnia

Zinnia spp.

FLOWERING SEQUENCE
J F M A m j j a s **O N D**

Features

Annuals and perennials

H 15–80 cm   W 25–30 cm

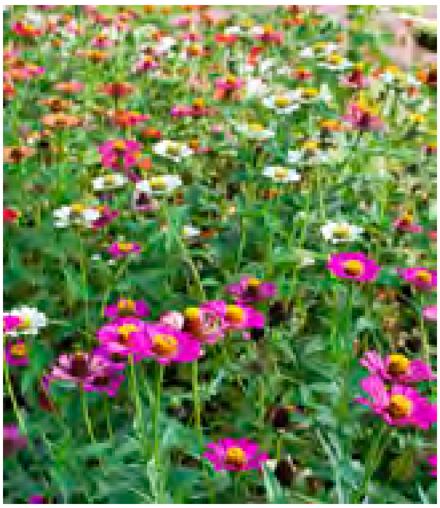
Honeybee foraging on zinnia Photo: Kathy Keatley Garvey

Fast growth rate. An excellent display of long-lasting blooms. Zinnias are from the aster family, with 20 species and many varieties and cultivars, something to suit most situations. Leaves are opposite and sessile, pale to mid-green and vary in shape from linear to ovate. Flowers are daisy-like and vary from simple, double to ‘pompom’ forms with an extensive colour range. Regular dead-heading will prolong flowering. Propagate easily from seed.

Origin: Southern US, Mexico and South America.

Conditions

Climate	Temperate, warm/humid, frost tender
Rainfall	Keep soil moist, tolerate dry periods
Aspect	Full sun
Soil	Well-drained, best in rich humus, tolerate poorer soils



A field of zinnias Photo: patpitchaya/Shutterstock.com

Uses

Zinnias give a profusion of bright colour from spring to autumn. They are useful as borders and bedding plants in the home garden, streetscape or park.

Apiculture

Zinnias provide beneficial pollen and nectar for bees and are an attractive, long-flowering addition to bee forage wherever planted. With late autumn flowering they provide valuable inputs to the hive.

HERB

Mexican heather

Cuphea hyssopifolia

False heather

Features

Perennial sub-shrub

H 30–60 cm W 25–75 cm

Fast growth rate. A compact, rounded, densely branched sub-shrub. Leaves are glossy green, lanceolate to 2 x 1.3 cm arranged alternately along the stems, giving a fern-like appearance. The lavender-coloured flowers are small and trumpet-shaped, with 6 spreading petals and green calyx tube. Flowers are single in leaf axils. Flowering is profuse throughout the year in warmer climates. Propagate from seed, tip cuttings and clump division.

Origin: Mexico, Guatemala.

FLOWERING SEQUENCE

j F M A M j j a s o n d

The dainty flower of Mexican heather
Photo: Melburnian GFDL

Conditions

Climate	Temperate, warm/humid, frost tender
Rainfall	600 mm but kept moist. Slight drought tolerance
Aspect	Partial shade (best leaf colour) to full sun
Soil	Well-drained various, pH 6.6–7.8

Uses

An excellent permanent groundcover and border plant providing almost continuous flowering in more tropical settings. It is widely adaptable, however, and grows well in cooler climates. It can be grown in containers and hanging baskets. Caution: it has become an invasive weed in Hawaii.

Apiculture

A profusion of flowers for most of the year in subtropical and tropical climates. *C. hyssopifolia* is a bee magnet, with bees gathering both pollen and nectar.

The profuse flowering of *C. hyssopifolia*
Photo: Forest & Kim Starr CC BY 3.0

SHRUB

‘Howie’s Fire Glow’ bottlebrush

Callistemon ‘Howie’s Fire Glow’

FLOWERING SEQUENCE
j f m a m j j a **S O N D**

Features

Large shrub

H 4 m W 2 m

A bold red display Photo: Mark Leech

Fast growth rate. This cultivar provides a wonderful show of mass large red flower spikes. New foliage has a bronze tinge and bark is grey fissured. Flower spikes are large and bright red, with a yellow dusting.

Origin: Cultivar.

Conditions

Climate	Cool, temperate, hot/arid, warm/humid, frost hardy
Rainfall	500 mm, drought tolerant
Aspect	Full sun
Soil	Wide tolerance

An excellent nectar and pollen support plant Photo: Mark Leech

Uses

A great garden feature plant and useful in streetscapes and parks. It attracts honeyeaters and native insects as well as being a bee magnet.

Apiculture

Bees collect nectar and pollen from most callistemons for use within the hive. Callistemons provide useful supporting forage for healthy hives (Clemson 1985).

SHRUB

Ivory curl

Buckinghamia celsissima

FLOWERING SEQUENCE

J F m a m j j a **S O N D**

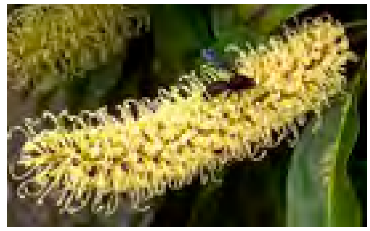
Features

Large shrub to small tree

H 7–8 m

Fast growth rate. A very decorative large shrub to small tree in cooler climates with foliage to the ground; will grow to a taller forest tree in north Queensland. Bark is rough and dark brown. Leaves glossy light green, velvety beneath, elliptical, entire margins to 8–16 x 3–7 cm. Juvenile leaves are lobed and new growth is bronze. Flowers are grevillea-like, white to cream, in large racemes to 20 cm and appear from 3-year-old plants. The fruit is a follicle 1.5–3.0 cm long. Propagate from seed.

Origin: North Queensland.



Ivory curl flower with unidentified insect Photo: Brian Walters

Ivory curl's abundant flowers Photo: Brian Walters

Conditions

Climate	Temperate, warm/humid, very frost tender when young
Rainfall	650 mm based on growth in Melbourne. Keep ground moist
Aspect	Full sun to part shade
Soil	Well-drained, moist various. Prefers high organic content

Uses

A widely cultivated specimen tree from north Queensland to Victoria. In cooler climates it is smaller but still provides an amazing, albeit less abundant, floral display. An easy-care garden specimen and widely planted street tree.

Apiculture

Vasse (2011, pers. com.) reports that in north Queensland the bees 'hammer' ivory curl through spring, building well on it. It produces good pollen and a light mild-flavoured honey, possibly similar to macadamia.

SHRUB

Weeping tea-tree

Leptospermum madidum

FLOWERING SEQUENCE
J F M A M J J A S O N D

Features

Large shrub to small tree

H 2–4 m W 2–4 m

A graceful weeping habit Photo: Kimberley Environmental Horticulture

Slow to moderate growth rate. A large pendulous shrub. The bark is very attractive, peeling, flaking and smooth, pinkish-brown when fresh and ageing to creamish-white. The leaves are linear to 7 cm long and give a fresh aroma when crushed because of the monoterpene-rich oils. The tiny white flowers are inconspicuous. Propagate from cuttings.

Origin: North Queensland, Northern Territory.

Conditions

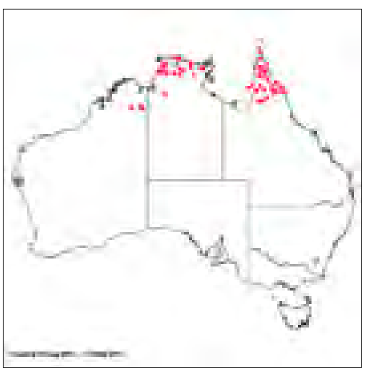
Climate	Temperate, warm/humid
Rainfall	Tropical but moderately drought tolerant
Aspect	Full sun
Soil	Well-drained various. Tolerates infertile and waterlogged soils

Uses

An excellent specimen plant with a graceful, weeping habit. Suited to street tree and garden planting or as a park specimen.

Apiculture

Leptospermums provide pollen and nectar, often thixotropic; specialist equipment required to extract honey.



SHRUB

Flax-leaved paperbark

Melaleuca linariifolia

Snow in summer

Features

Large shrub to small tree

H 5–10 m W 3–6 m

Fast growth rate. A large shrub to small tree with a rounded, dense crown. Bark is whitish thick paperbark. Leaves are dull green 2–4 cm x 1–3 mm, tapered at both ends with a prominent midrib, arranged in pairs along branches. Flowers are arranged in 'fluffy' white terminal spikes 2.5–5 x 2.5 cm dominated by 5 bunches of long stamens. Seed capsules are cup-shaped to 3 x 3 mm. Plants are covered in flowers from late spring to early summer across most of its extensive range. Propagate by seed or cuttings.

Origin: New South Wales, Queensland.

FLOWERING SEQUENCE

j f m a m j j a s **O N D**

The fine 'fluffy' flower spikes of *M. linariifolia* Photo: Tatiana Gerus CC Generic 2.0

Conditions

Climate	Temperate, warm/humid, frost hardy
Rainfall	500 mm. Drought tolerant
Aspect	Full sun
Soil	Well-drained. Light sandy to heavier clay. Tolerates occasional inundation, salt-tolerant, pH <6 to 8

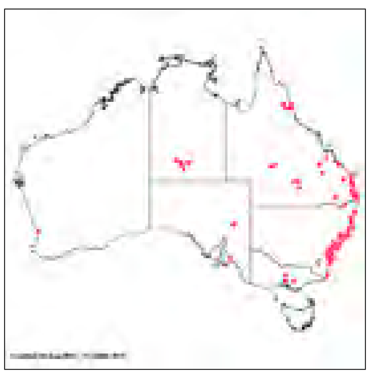
Uses

A very attractive specimen tree, equally at home in the garden, as a street tree, in parks or as a component of a farm shelterbelt. It tolerates coastal exposure, frost, drought and tropical temperatures and is particularly useful for wetter clay sites.

M. linariifolia covered in masses of white flowers like 'snow in summer' Photo: Tatiana Gerus CC Generic 2.0

Apiculture

M. linariifolia provides stimulating pollen and nectar for colony build-up. Clemson (1985) noted that an occasional honey surplus is produced in New South Wales and the honey is dark and strongly flavoured.



TREE

Brush box

Lophostemon confertus

FLOWERING SEQUENCE

J F m a m j j a s **O N D**

Brush box flowers Photo: Mark Leech

Features

Medium street tree to large forest tree

H 5–40 m W 5 m

Fast growth rate. This wet forest coastal species has been widely planted as a street tree. It is a shorter open-grown evergreen, to 15 m, with a rounded dense crown. The trunk, flaky at the base, is an attractive reddish–brown changing to light yellow–green in summer. The glossy, thick, dark green leaves are ovate to lanceolate,18 x 6 cm. The flowers, to 1 cm across, are borne in terminal clusters, are white with broad wavy-edged petals and have characteristic feathery stamens grouped in clusters of five. Propagate from seed.

Origin: New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid
Rainfall	600 mm
Aspect	Full sun to shade
Soil	Prefers well-drained loams, wide tolerance, tolerates occasional inundation

Brush box in a Launceston street—a long way from home Photo: Chris Moore

Uses

Widely grown as an attractive, hardy street and park tree, its dense crown providing good shade. In these situations it does not usually grow higher than 15 m. Provides a tall component to farm shelter.

A major timber tree, producing a sought-after dense ADD 900 kg/m^3 fine-grained pinkish–brown timber used for flooring (Bootle 2001).

Apiculture

As a forest tree, brush box is an unpredictable nectar producer; under favourable conditions it is a very high yielder. Buds appear on new growth in late spring and early summer, and flowering follows shortly after. As an urban tree, it appears to be more reliable. The honey is strong flavoured, light coloured and crystallises rapidly.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average 80 27–135 kg/hive	Extra white to light amber	Good	Rapid to hard candy	2–3 years
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Minor to good		Minor to good	Minor to good	2–3 years

Jacaranda

Jacaranda mimosifolia

Features

Medium deciduous tree

H 3–20 m W 5–20 m

Fast growth rate. A very attractive spreading medium-sized tree. The bark is pale brown, furrowed, with a scaly appearance. Green to dark green, feathery, fern-like compound leaves with 15–20 pinnae, 10–15 pair leaflets. The flowers are trumpet-shaped to 4 cm in striking blue–purple clusters of 40–80 and 15–20 cm long. The persistent fruit is a brown–black rounded woody capsule to 7 cm with a wavy edge that splits to release seed and can stay attached to the tree. Jacarandas are widely planted throughout tropical and temperate zones of the world. Pretoria in South Africa is known as Jacaranda City and Grafton in New South Wales has an annual Jacaranda Festival. Propagate from seed or cuttings.

Origin: Brazil, Argentina.

FLOWERING SEQUENCE

J f m a m j j a s **O N D**

Jacaranda's beautiful floral display Photo: Mark Leech

Conditions

Climate	Temperate, warm/humid, very frost tender when young
Rainfall	650 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sandy loam. Intolerant of waterlogging and clay

Uses

A widely planted street tree, considered one of the most beautiful trees in the world. It has a graceful, spreading crown and its feathery leaves provide softness. It is best known for its masses of blue–purple flowers—even the carpet of blue it makes on the ground. It is also a wonderful addition to a large garden, but give it enough room and do not use it to shade your pool. It is a hungry feeder, so is best not planted near flower beds.

Apiculture

Jacaranda flowers are full of nectar and the trees in north Queensland buzz with bees; even fallen flowers are likely to contain a bee seeking the abundant nectar. A unifloral honey is unlikely since they flower at the same time as many other species (Damon 2011, pers. comm.).

Jacaranda in flower in January in a Melbourne park Photo: Mark Leech

TREE

Guioa

Guioa semiglauca

FLOWERING SEQUENCE

j f m a m j j a **S O N** d

Features

Small to medium tree

H 8–10 m (in cultivation) 20 m (in forest)

Guioa Photo: Suzanne Pritchard

Fast growth rate. Rounded bushy evergreen tree; bark smooth, grey to dark grey often mottled with red–brown vertical stripes. Leaves pinnate, dark green shiny, glaucous under, 6–10 leaflets to 10 cm, midrib extending to a tiny tip. Flowers are small, yellowish–green in axillary or terminal panicles. Flowering across its range is from September to November. Fruit is a 3-lobed green capsule to 12 mm wide—very attractive to birds.

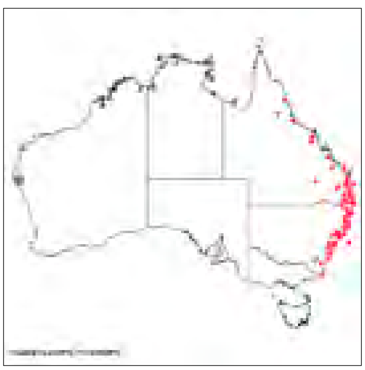
Origin: New South Wales, Queensland.

Conditions

Climate	Temperate, warm/humid
Rainfall	550 mm
Aspect	Full sun to partial shade
Soil	Well-drained, various well composted soils, pH 6.0–7.5

Uses

In cultivated situations this is a compact, attractive tree. It is used as a street tree and could provide a rainforest component in farm or biodiversity plantings in more sheltered sites. The flowers are very attractive to bees and the fruit attracts many different birds.



Apiculture

It is a bee magnet, producing a heavy flowering usually every second year, with good honey surpluses in the favourable years. The honey is described as pale with an acceptable acidic flavour and is highly aromatic with a sweet scent; it rapidly granulates to a fine grain (Clemson 1985).

TREE

Silky oak

Grevillea robusta

Australian silver oak

Features

Medium tree

H 15–25 m

Moderate to fast growth rate. Silky oak grows as an upright tree with a fairly thin crown. Its leaves are 15–25 cm long and are divided and pinnate. The underside of the leaves is silky and silvery—hence the name. The tree flowers heavily and is very attractive, especially on streetscapes. The flowers are 'toothbrush'-shaped and copper in colour. It is susceptible to frost when young but drought resistant once established. Widely planted—North and South America, Asia and Africa. Propagate by seed or cuttings.

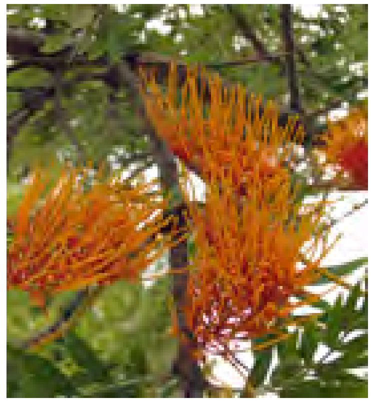
Origin: New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid, hot arid
Rainfall	500 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sand to clay loam

FLOWERING SEQUENCE

J F m a m j j a s o n **D**



Silky oak's striking flowers Photo: Mark Leech

Uses

G. robusta is widely planted as a street tree and in parks from the tropics to Tasmania to Alice Springs. It can be used as a windbreak on farms and for sawn timber. The wood is silky golden-brown, with an oak texture and prominent ray (ADD 620 kg/m^3). As fine timber it is used for furniture making and for the frame-work in windows because it is rot resistant (Bootle 2001).

Apiculture

Blake & Roff (1996) noted that silky oak is a good source of pollen on the Atherton Tableland. The golden flowers are attractive to bees, making it an important honey plant. The honey is dark amber, of high density and with a pronounced flavour (www.icraf.com 2011; Crane et al. 1984).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
		Dark amber	Thick	Rapid	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	High	Annual

Silky oak in a Tasmanian street Photo: Mark Leech

Howies fire glow bottlebrush

Hot/arid climate streetscape species

The following table summarises the streetscape species selected for hot/arid climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Grevillea* 'Poorinda Royal Mantle'	Grevillea 'Poorinda Royal Mantle'	C T W H	G S U	n	p							•	•	•	•		
	Melaleuca incarna	Grey honey myrtle	T H	G S U	n	p						•	•	•	•	•	•	
	Coreopsis grandiflora	Coreopsis	C T W H	G S U	n	p	•	•	•	•					•	•	•	•
	Myoporum parvifolium	Creeping boobialla	C T H	G S U F	n	p	•	•							•	•	•	•
SHRUB	*Eremophila mitchellii*	Budda	W H	G S U	N	P				•	•			•	•			
	Eucalyptus incrassata	Yellow mallee	H	G S U F	N		•			•	•	•	•	•	•	•	•	•
	Grevillea insignis	Grevillea insignis	T H	G S U F	n	p								•	•	•	•	•
	Eucalyptus lansdowneana	Crimson mallee	H	G S U F	N	P	•	•	•	•	•	•	•	•	•	•	•	•
TREE	*Eucalyptus utilis*	Moort	T H	G S U F	N	P	•					•	•	•	•	•	•	•
	Eucalyptus occidentalis	Flat-topped yate	T H	G S U F	N	P				•	•	•	•					
	Melia azederach	White cedar	T W H	G S U	n	p									•	•		
	Eucalyptus porosa	Mallee box	H	G S U F	N	P	•								•	•	•	•

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Grevillea 'Poorinda Royal Mantle'

Grevillea 'Poorinda Royal Mantle'

FLOWERING SEQUENCE
j f m a m j **J A S O** n d

Features

Prostrate shrub

H 40 cm W 6 m

Grevillea 'Poorinda Royal Mantle' is a stunning groundcover Photo: Mark Leech

Fast-growing *Grevillea* 'Poorinda Royal Mantle' is a cultivar that is thought to be a cross between *G. laurifolia* and *G. willisii*. It is a spreading prostrate shrub that becomes a flowering groundcover. The blooms are 'toothbrush'-shaped and their colour can range from magenta to bright red. The leaves are up to 15 cm long and are entire. The plant can withstand a moderate frost. This grevillea requires quite a large amount of room to grow as it spreads over the ground. Propagate from cuttings.

Origin: Victoria.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost hardy
Rainfall	400 mm, drought tolerant
Aspect	Full sun or moderate shade
Soil	Well-drained, various

Uses

The main use of *G.* 'Poorinda Royal Mantle' is when a large area needs to be covered with foliage. The shrub is relatively maintenance free, with no known pests, and is frost hardy.

Apiculture

Grevilleas are attractive to bees for nectar and pollen and as hive support (Clemson 1985).

HERB

Grey honey myrtle

Melaleuca incarna

Features

Prostrate to large shrub

H 1–3 m   W 2 m

Moderate to fast growth rate. Large, spreading, pendulous shrub with a 'woolly' appearance. Prostrate forms are available to 1.5 x 1.5 m. Leaves are grey–green, elliptic to 1.5 cm. One of the most widely cultivated melaleucas. White, cream to yellow flower spikes to 3–4 cm form in spring. Best if watered in dry months to keep lush. Propagate from seed or 5–8 cm tip cuttings.

Origin: Western Australia.

FLOWERING SEQUENCE

j f m a m j **J A S O N** d

Melaleuca incarna Photo: Brian Walter

Conditions

Climate	Temperate, hot/arid, moderately frost hardy
Rainfall	450 mm, moderately drought tolerant
Aspect	Full sun
Soil	Well-drained various from sandy to heavier clay, tolerates occasional inundation

Uses

A very graceful ornamental for the garden, street or public space. It can be used as an effective hedge or border. Suited to cut foliage, even long sprays last in water.

Apiculture

Known to be regularly visited by large numbers of bees. No published data.

Melaleuca incarna Photo: Mark Leech

HERB

Coreopsis

Coreopsis grandiflora
Tickseed

FLOWERING SEQUENCE
J F M A m j j a S O N D

Features

Perennial

H 40–120 cm W 40–90 cm

Coreopsis, a beautiful bee flower Photo: Alvesgaspar CC

Fast-growing hardy perennial grown for its showy daisy-like flowers. The flowers, to 7.5 cm in diameter, are borne on stiff, wiry stems with dark green simple lanceolate leaves to 10 cm. Dense basal leaves form an effective groundcover. An easy-care plant that will succeed in many different environments. Pest and disease free. Dead-head to maintain flowering through summer until winter. Propagate from seed, stem cuttings or clump division.

Origin: United States.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost hardy
Rainfall	Garden watering
Aspect	Full sun, drought tolerant
Soil	Various, tolerates low fertility and coastal conditions.

Uses

A great border plant that gives an intense show to any garden. Low-maintenance plant able to survive in poor, exposed sites.

Apiculture

A bee-attracting flower for both pollen and nectar. Seldom planted in large enough areas to determine yield. Howes (1945) noted that both the annual and perennial forms of coreopsis receive attention from honeybees seeking pollen and nectar.

HERB

Creeping boobialla

Myoporum parvifolium

Features

Evergreen prostrate shrub

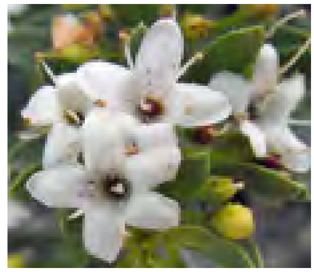
H 15 cm W 1.0 m

Fast growth rate. A rampant trailing groundcover. Light, bright green leaves, narrow, oval to 6 cm x 8 mm. Flowers are starry, white, spotted purple in groups of 1–3 in axils. Propagate by layering in summer and autumn.

Origin: South Australia, Victoria.

FLOWERING SEQUENCE

J F m a m j j a **S O N D**



Creeping boobialla: sweet flowers
Photo: Stickpen

Conditions

Climate	Cool, temperate, hot/arid, frost tolerant
Rainfall	300 mm, Drought hardy
Aspect	Full sun, tolerates wind, coastal exposure.
Soil	Well-drained various, pH 4.5–7.0

Uses

Considered Australia's best native groundcover for suppressing weeds. A wonderful landscaping species that trails, cascades and hangs. Suitable for pots, hanging baskets and rockeries. This very hardy species will grow in most conditions with little maintenance. A great garden addition used by councils for roadside and nature strip planting forming a naturally dense weed mat. A useful salt-tolerant coastal planting.

Apiculture

Attracts bees throughout flowering season. Other members of the genus are *M deserti, M. montanum* (Clemson [1986]) and *M. platycarpum* (Boomsma [1972]).

A useful, easy-care median strip cover
Photo: Mark Leech

SHRUB

Budda

Eremophila mitchellii
Sandalwood

FLOWERING SEQUENCE
j f m **A M** j j **A S** o n d

Features

Shrub to small tree

H 0.5–10 m

The outstanding floral abundance of budda Photo: Wikimedia Commons

Often grows as a multi-stemmed shrub but can be a single-stemmed tree to 10 m under favourable conditions. It is a very attractive, hardy shrub with a profusion of small white or creamy bell-shaped flowers to 12–18 mm. The smooth bright-green leaves are linear lanceolate to 6 x 0.7 cm, usually hooked with a point. The abundant flowers are fragrant and woolly inside, with pink dots.

Origin: New South Wales, Queensland.

Conditions

Climate	Warm/humid, hot/arid, frost hardy
Rainfall	300 mm, very drought tolerant
Aspect	Full sun
Soil	Well-drained clay soils, slightly acid to slightly alkaline

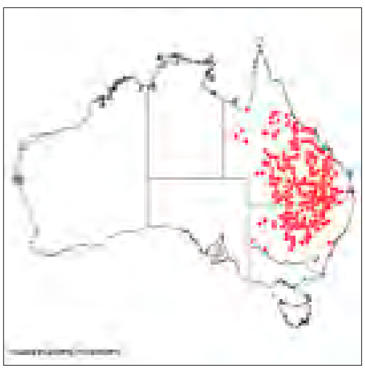
Uses

An ideal garden plant, with its neat habit and masses of flowers, suited to hot/arid climates. The wood is extremely hard and contains aromatic oil; the reddish–brown heartwood when dry finishes very well. It is aromatic firewood—a pleasant camping experience. Although a native, it is considered a weed in arid grazing lands The wood is termite resistant due to the eremophilane oil (Wang et al. 2008).

Apiculture

This arid to subtropical plant is considered of medium to major importance to beekeepers in New South Wales and Queensland. Its abundant pollen is considered high quality (R Dewar 2010 pers. comm.) and produces significant flows of light-coloured honey that is slow to crystallise. It can flower twice a year, in spring and autumn, with favourable conditions.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	60 kg/hive	Light to amber		Slow	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	High		High 25%	High	Annual



SHRUB

Yellow mallee

Eucalyptus incrassata
Giant angular mallee, ridge-fruited mallee

FLOWERING SEQUENCE
J f m **A M J J A S O N D**

Features

Mallee

H 2–10 m

A hardy multi-stemmed mallee-form shrub to small multi-stemmed tree with a moderate growth rate. Rough bark on the trunk to smooth on upper trunk and branches. The leaves are dull green, thick to 12 x 3 cm. The flowers are white to yellow and considered very showy, flowering for a long period. It is a bird-attracting native.

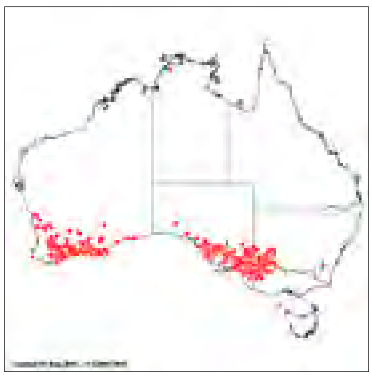
A well-formed yellow mallee Photo: Dean Nicolle

Conditions

Climate	Hot/arid, frost tolerant
Rainfall	250 mm, very drought tolerant
Aspect	Full sun
Soil	Well-drained sandy

Uses

It is a useful low component in shelterbelts and is used as a park and street tree, being smog tolerant. It is also a useful small garden specimen. It is salt-tolerant and hardy for revegetation in salt-affected and sandy soils. It coppices well and produces good firewood.



Apiculture

Provides smaller volumes of honey and pollen annually. Known to produce heavy crops at up to 5-yearly intervals (Boomsma 1972).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Small, large	Medium amber			Small/year Large 5 year
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
				Small, large	Small/year Large 5 year

Flowers of the yellow mallee

SHRUB

Grevillea insignis

Grevillea insignis

FLOWERING SEQUENCE
j f m a m j j **A S O N D**

Features

Bushy shrub

H 1–5 m   W 2.5 m

Obviously attractive to bees Photo: Mark Leech

Fast-growing, bushy, erect shrub. The holly-like blue–green leaves to 8 x 3.5 cm, elliptical or ovate with prickly margins. New growth is a bronze colour. Racemes of cream or pink ‘spider’ flowers.

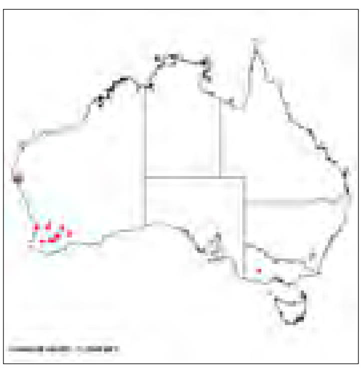
Origin: Western Australia.

Conditions

Climate	Temperate, hot/arid
Rainfall	400 mm, drought hardy
Aspect	Full sun, partial shade
Soil	Well-drained gravelly sand to loam

Uses

Another bird-attracting grevillea, ideal in gardens, street median spaces and urban parks. It could also be grown on farm as low cover to benefit birds and provide bee forage.



Apiculture

Many grevilleas have a flower structure suited to honeybees. They are of considerable value because they produce nectar over a long flowering period. Many flower during the spring build time, when a hive’s requirements for pollen and nectar are high. Some produce small volumes of beneficial pollen (Clemson 1985).

SHRUB

Crimson mallee

Eucalyptus lansdowneana

FLOWERING SEQUENCE
j f m a m j J A S O n d

Features

Small shrub to mallee

H 2–6 m

Moderate growth rate. This short mallee-form shrub is very showy, with pendulous leaves and an abundant floral show. The bark is smooth and deciduous except at the base. The dark green pendulous leaves are broad lanceolate to 15 x 4 cm. The flowers are in clusters of 4–10 and vary in colour from creamy to bright crimson and reddish–purple. Buds and fruit are characteristically 1–4 ribbed.

Origin: South Australia.

Slender mallee form of *E. lansdowneana*
Photo: Dean Nicolle

Conditions

Climate	Hot/arid, moderately frost hardy
Rainfall	300 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sands to heavier clay soils. Tolerates alkaline soils

Uses

This very attractive small mallee eucalypt is ideally suited to mass planting as low windbreaks or native hedging. It provides a compact garden specimen and is suited to limited spaces in the streetscape. It is good firewood and is used for fencing.

Apiculture

Crimson mallee can flower at any time of the year, but an abundance occurs from winter to spring. It generally produces an average honey yield, occasionally high. Plentiful pollen of good quality is produced annually (Boomsma 1972)

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average to high	Light amber			Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	High	Annual

Crimson mallee flower and buds Photo: Dean Nicolle

TREE

Moort

Eucalyptus utilis
(formerly *E. platypus* var. *heterophylla*)

Features

Mallee to small tree

H 1.5–10 m

A fast-growing mallee with a dense, rounded crown. The bark is smooth and light brown, ageing to grey, and the leaves are elliptical to orbicular to 8 cm. The flowers are prolific, cream to yellowish–green. Buds are horn shaped 2–3 cm, cap twice as long as calyx.

Origin: Western Australia.

FLOWERING SEQUENCE
J f m a m **J J A S O N D**

A compact tree suited to urban environments Photo: Barry Oldfield

Conditions

Climate	Temperate, hot arid
Rainfall	400 mm, drought tolerant
Aspect	Full sun, part shade
Soil	Tolerates some waterlogging

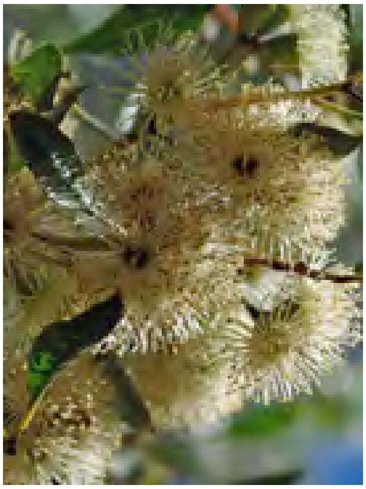
Uses

E. utilis is often used on farms for shelterbelts as it is fast-growing and dense with foliage to the ground, providing excellent low shelter. Useful in establishing bee forage because it flowers from a young age.

Apiculture

Moort flowers every year and quite heavily every third or fourth year. It produces a mild, light honey with a good 'mouth feel' (L Manning 2011, pers. comm.). In the early 1960s it was considered one of the better honey flows in WA (Coleman 1962), but tree numbers have been reduced by clearing.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Very good	Light			Annual, heavy 3–4 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Very good	Very good	Annual heavy 3–4 years



Moort's floral abundance Photo: Barry Oldfield

TREE

Flat-topped yate

Eucalyptus occidentalis

Swamp yate

FLOWERING SEQUENCE

j f m **A M J J** a s o n d

Probably flat-topped yate growing in Perth Photo: Linda Manning

Features

Mallee to small tree

H 3–20 m W 5–10 m

Fast to moderate growth rate. A multi-stemmed mallee form to a small tree with a single stem. It has a spreading, open crown with a characteristic flat top. The bark is black to dark grey, rough and flaky for about half the trunk and then smooth whitish–grey, a strong contrast. The adult leaves are glossy green, narrow lanceolate to 16 x 2.5 cm. It coppices vigorously and responds well to pruning.

Origin: Western Australia.

Conditions

Climate	Temperate, hot/arid, moderately frost hardy
Rainfall	300 mm, very drought tolerant
Aspect	Full sun
Soil	Well-drained to waterlogged. Wide tolerance, sand to heavy clay, pH 6.5 to >7.5. Some show extremely high salinity tolerance: >16dS/m

Uses

In its mallee form *E. occidentalis* is a useful garden addition and can be used in many different environments. It is used as a street tree and in parks. It is also grown overseas as a farm forestry tree in windbreaks and for fuelwood, shelter, building poles and posts, sawn building material, pulpwood and charcoal (www.icraf.com 2011).

Apiculture

It has been very successfully planted as bee forage in Israel (A Dag 2011, pers. comm.) It is known to start flowering in the first year of growth, an excellent trait for planted bee forage. Coleman (1962) noted that it produces good quantities of excellent honey and good-quality pollen. While it flowers annually, it may produce a surplus irregularly due to poor weather. An amber-coloured, light-textured, sweet honey that is good in cooking and desserts, not overpowering in taste or smell. It candies very quickly, and has to be used within two weeks of extracting. Bees build up on this honey (L Manning 2011, pers. comm.).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Good	Amber	Light body	Rapid	Weather depend annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	Good	Annual

TREE

White cedar

Melia azedarach

FLOWERING SEQUENCE

j f m a m j j a **S O** n d

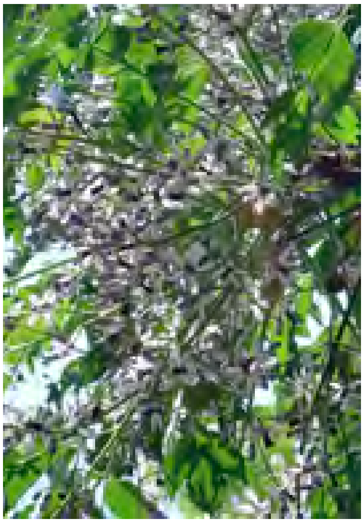
Features

Small deciduous tree

H 6–10 m W spreading.

Fast growth rate. One of the few winter deciduous Australian natives. The attractive striped appearance of the trunk arises from the narrow furrows in the brown bark. The dark green bi-pinnate leaves have toothed leaflets to 7 x 2 cm. The chocolate-scented, star-shaped pink to lilac flowers to 2 cm wide are in conspicuous axilliary clusters. It can be grown from seed or cuttings. The fruit is poisonous and the tree has weedy properties. Propagate from seed and cuttings.

Origin: New South Wales, Queensland.



Wonderful shade and beautiful flowers of the white cedar Photo: Paola Fiscar_ GNU FDL

Conditions

Climate	Temperate, warm/humid, hot/arid, frost tender when young, moderately frost hardy
Rainfall	300 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained various

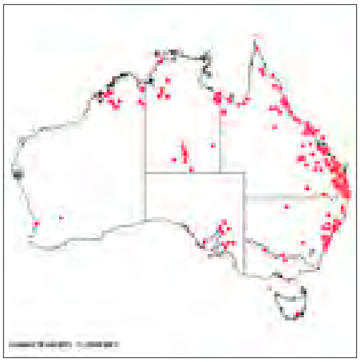
Uses

This is a wonderful shade tree in hot summer climates. It is widely planted as a park and street tree, providing excellent shade, often in car parks. The hard seeds are used in art and craft and to make beads. It should not be planted near playgrounds or schoolyards because of its poisonous fruit. It is not recommended for planting on farm.

White cedar tree Photo: Dean Nicolle

Apiculture

White cedar's flowers are very attractive to honeybees and it provides support for spring build.



TREE

Mallee box

Eucalyptus porosa

FLOWERING SEQUENCE

J f m a m j j a **S O N D**

Features

Shrub mallee to small tree

H 3–10 m

Typical mallee form of *E. porosa* Photo: Dean Nicolle

Moderate growth rate. An often twisted–trunk mallee shrub to small tree. It has a brown, rough, fibrous box-like bark on the trunk and larger branches. It can have smooth green, yellow–brown bark on the upper trunk and branches. The leaves have a characteristically fresh green look, with coarse venation, narrow to broad lanceolate to 12 x 2.5 cm. Buds are club-shaped to 5–7 mm; fruit pear-shaped, 4–6 mm long. The flowers are whitish, and flowering is from September to January.

Origin: South Australia, New South Wales.

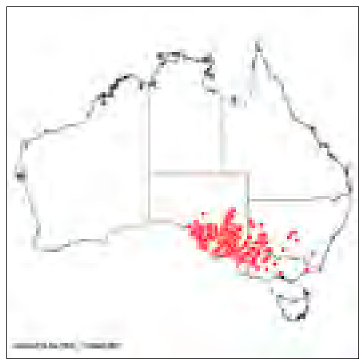
Conditions

Climate	Hot/arid, frost hardy
Rainfall	250 mm, very drought tolerant
Aspect	Full sun
Soil	Well-drained various. Tolerates shallow alkaline and saline soils

Flowers and buds of mallee box Photo: Yonatan Mantalon

Uses

Mallee box is an attractive tree in cultivation, extremely hardy and suitable for broad-scale roadside planting. The wood is light brown, heavy and moderately durable—a good fuel wood.



Apiculture

Birtchnell and Gibson (2008) report that mallee box can produce more than 4 tins/hive (>108 kg/hive). Boomsma (1972) noted that it yields annual small amounts and every 2–4 years produces high yields of light amber honey. Every two years it provides adequate amounts of average quality pollen.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	27–54 to >100 kg/hive	Light amber			2–5 years
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Good		Average	Good	2 year

Urban open spaces

Sydney's Hyde Park, an example of a classic formal park of the 1800s Photo: Mark Leech

Urban open space, usually considered to be the larger parks and gardens, is a subset of the urban forest continuum. It is considered here as a distinct yet integral element of the urban forests greenscape. These larger spaces provide for larger trees, groves or tracts, reserves and remnants. They are represented by the larger formal parks established in the 1800s to the more contemporary trend of networked green space, regardless of its origin or ecotype. Networking via green corridors provides for improved sustainability for plants and animals and a potential forage continuum for honeybees.

Park development in Australia has followed or led global trends, from formal promenading parks (such as those for the upper classes in the earlier 1800s) to the larger parks of the democratic reformers, mixing the classes with a more utilitarian function of open spaces, providing sports fields and escapes from the urban environment. More recent trends include the requirement to incorporate environmental services in park design—increased biodiversity through greater use of remnant and indigenous vegetation, run-off management, streamside reserves, and wildlife corridors and habitat. This creates awareness of the need to provide for bee forage planting across the urban landscape.

Corymbia ficifolia in Carlton Gardens, Melbourne, a classic bee tree Photo: Mark Leech

'This colourful history of park-making has endowed Australian cities with a wide variety of parks and green spaces' (Byrne & Snipe 2010).

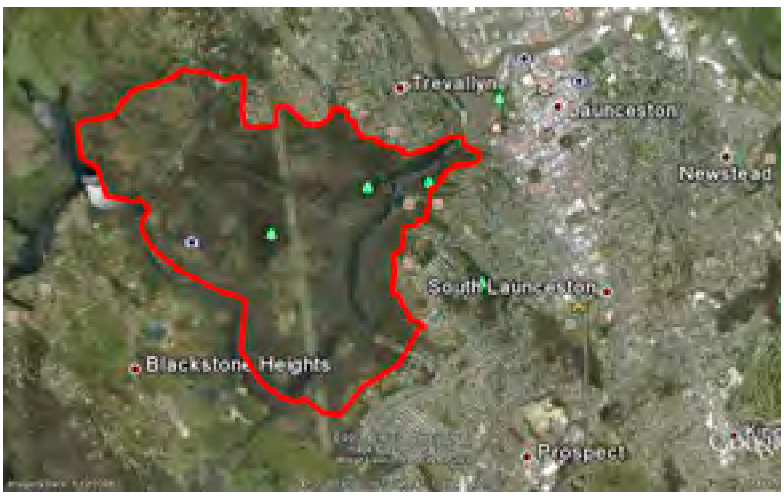
The literature is consistent in reporting the benefits of green cities, urban forests and urban open spaces (once considered parks and gardens) as becoming an integral component of a city's or municipality's infrastructure. Open space has a significant positive effect on social, environmental and economic outcomes. The benefits to a community of urban open spaces and contact with nature are well documented (for example, Rogers 1999; City of Burlington 2000; City of Melbourne 2003; Harnik & Welle 2009):

> Open space is not only for recreation and conservation of environmental and cultural values; it is the foundation of urban liveability. It underpins many social, ecological and economic benefits that are essential to the healthy functioning of the suburban environment. (Parks Victoria 2002)

Social benefits can be associated with human physical and mental health and improved social behaviour. Environmental attributes include reduced air pollution, decreased energy consumption, storm water management, and improved biodiversity. Economic factors include increased property values, improved retail sales, increased productivity, improved aesthetics and an urban identity.

Australian capital and regional cities are home to some very significant urban parklands. Most of them were established at the time of the cities' founding or early development in the 1800s. This includes Perth's Kings Park, incorporating 400 ha of woodland and native vegetation, and Mt Coot-tha Reserve in Brisbane, an impressive 1500 ha.

Launceston, a regional city of some 106 000 people, has a reserve system that is the envy of much larger populations. The Cataract Gorge Reserve, a short walk from the CBD, preserves both the spectacular natural features of the gorge on the South Esk River and the historic gardens. This adjoins Trevallyn State Reserve, protecting an area of natural woodland. Combined, they form a large contiguous reserve of 632 ha containing many threatened species and providing indigenous and exotic planted melliferous flora such as *Bursaria spinosa* (prickly box), which produces a highly desirable honey.



Launceston's Gorge and Trevallyn Recreation Reserves, 632 ha, minutes from the CBD Source: Google Earth (2011)

The Gold Coast's Green Heart is an ambitious and visionary approach to creating new green spaces and linking existing green infrastructure. The scale of opportunity is enormous. Located at the centre of the urban footprint, the Green Heart will become one of the largest urban parkland systems in the world. It will be a space of such quality and scale that it will rebalance the image of the city and contribute greatly to the quality of life and prosperity of the Gold Coast. This large network of green spaces will provide major tourism, environmental, flood management and educational benefits for the Gold Coast City. (Urbis JHD 2007).

The Gold Coast 'Green Heart' networked open space vision UrbisJHD (2007)

Urban open spaces + urban forest + green infrastructure = bee heaven?

The great variety in green infrastructure in Australia's towns and cities provides many benefits (social, environmental and economic), making cities more liveable. The opportunity to provide environmentally friendly bee havens is increasing as many cities around the world ban pesticide and herbicide use in some precincts (Guest 2010; Yonida 2009).

This is not a new phenomenon. Jolly (2011) reports that in the 1880s James Robertson's apiary of 17 hives in the Adelaide suburb of North Unley was well situated to forage among the flora of the park lands.

In contrast with rural environments, it is unlikely that there will be broad-acre use of herbicides or pesticides in urban settings, so they are bee friendly more by accident than design. The use of domestic pesticides can also be moderated by educating users about the most bee-friendly times or situations in which to apply chemicals or providing advice on the use of alternative solutions. In Germany and France it is reported that many beekeepers prefer these chemical-reduced city environments (Bethge 2008; Guest 2010).

The opportunities for planting bee forage in larger urban open spaces are enormously variable—from large specimen trees such as yellow box (*Eucalyptus melliodora*) to extensive formal plantings for seasonal floral display and large areas of natural revegetation. With a greater understanding of the opportunities for providing bee forage, it is hoped that municipal park and land managers will embrace planting beneficial bee forage. This will offer multiple benefits for wildlife, including nectariferous birds, native pollinators and honeybees. Ideally, local authorities would provide a floral calendar showing the locations of the main bee forage populations.

Yellow box, *Eucalyptus melliodora*, Royal Botanic Gardens, Melbourne Photo: Mark Leech

Urban open spaces species

The following pages detail the native and exotic species that were chosen to represent a selection of useful bee forage for urban open spaces. They are organised according to climate categories:

- cool
- temperate
- warm/humid
- hot/arid.

Cool climate urban open spaces species

The following table summarises the urban open spaces species selected for cool climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Nepeta cataria*	Catmint	C T	G U F	N	p	•	•	•	•	•							•
	Papaver nudicaule	Iceland poppy	C T H	G S U		P							•	•	•	•	•	•
	Centaurea cyanus	Cornflower	C T	G U	N	p	•	•						•	•	•	•	•
	Myosotis spp.	Forget-me-not	C T	G S U	n	p	•	•					•	•	•	•	•	•
SHRUB	*Callistemon salignus*	Willow bottlebrush	C T W H	G S U F	n	p									•	•		
	Rosa	Roses	C T W H	G S U		P	•	•	•	•					•	•	•	•
	Symphoricarpos albus	Snowberry	C	G S U	N	p	•	•										•
	Leptecophylla juniperina	Mountain pinkberry	C T	G U F	N					•	•	•	•	•	•	•	•	
TREE	*Tilia* spp.	Lime tree	C T	G S U F	N		•											•
	Castanea sativa	Sweet chestnut	C T	G U F	N	P										•	•	•
	Eucalyptus tricarpa	Red ironbark	C T H	S U F			•	•				•	•	•	•	•	•	•
	Acacia baileyana	Cootamundra wattle	C T	G S U F		P						•	•	•	•	•		

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in whic appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Catmint

Nepeta cataria
Catnip

FLOWERING SEQUENCE
J F M A M j j a s o n **D**

Features

Perennial herb

H 100 cm   W 90 cm

Catmint is highly attractive to bees and cats! Photo: Mark Leech

Catmint has upright branching stems with soft grey–green, hairy aromatic leaves and white (or pink or lavender) flowers in clusters along the ends of the stems in summer and autumn. Prune hard after flowering to maintain plant vigour.

Origin: Eurasia.

Conditions

Climate	Cool, temperate
Rainfall	Garden watered, allow to dry slightly between watering
Aspect	Full sun to partial shade
Soil	Any well-drained soil

Uses

An extremely attractive plant for bees and cats. Many cats are attracted by the smell of the chemical nepetalactone, which is released when the leaves are bruised. This is an inherited trait, so not all cats are affected. Often grown as groundcover and a hedging plant, catnip has also been used as a rat and mouse repellent. It is used in herbal medicine.

Apiculture

A very useful plant to grow in the bee garden. Monofloral honey is produced from catmint in Eastern Europe. The honey has been described by Crane (1975) as piquant flavoured and mild.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	100–500 kg/ha			Granulates smoothly	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**

Iceland poppy

Papaver nudicaul

HERB

FLOWERING SEQUENCE

j f m a m j **J A S O N D**

Features

Annual/perennial

H 60 cm

This short-lived perennial is better treated as a biennial or annual. Large 6.5 cm flowers are lightly fragrant with fabulous pastel colours. A rosette of pale-green foliage forms before the emergence of the slender, erect stems that carry the flower heads. The delicate 'tissue paper'saucer-shaped blooms come in a wide variety of colours—yellow, orange, red, pink and white.

Origin: Siberia.

Iceland poppies' bloom is a perfect landing pad Photo: Mark Leech

Conditions

Climate	Cool, temperate, hot/arid (if kept moist)
Rainfall	600 mm
Aspect	Full sun, sheltered
Soil	Well-drained, rich, pH 6.1–7.8

Uses

The only poppy suited to being a cut flower: it does not drop its petals as freely as other species (Hooper & Taylor 2006). Poppies make wonderful mass bed plantings and colourful borders.

Apiculture

Poppy pollen is extremely attractive to the honeybee and is available throughout the long flowering period, in some cases from July to Christmas. Nectar is gathered.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Very good	High	Annual

A mass planting of Iceland poppies, a feast for bees Photo: Mark leech

HERB

Cornflower

Centaurea cyanus

FLOWERING SEQUENCE

J F m a m j j **A S O N D**

Features

Annual

H 50–90 cm

A field of cornflowers Photo: Murat Subatli/Shutterstock.com

The narrow cottony leaves are lanceolate to 4 cm. The deep blue to white flower heads to 3 cm diameter. Requires good air circulation to avoid mildew. Should be watered regularly.

Origin: European, now worldwide.

Conditions

Climate	Cool, temperate
Rainfall	600 mm, drought tolerant
Aspect	At least half day sun
Soil	Freely drained rich soil, pH 6.6 to 7.8

Uses

A useful bedding and border flower. Also an excellent cut flower: blooms retain their bright colour when dried. The flower is edible and can be used in salads; it is used to flavour the famous Lady Grey™ tea. The cornflower is the national emblem of a number of countries and is strongly associated with German royalty.

Apiculture

Although cornflowers are very attractive to honeybees, few regions produce a unifloral honey. Kornblumen-Honig (cornflower honey) is a rare delicacy that is harvested in very few regions of Germany. It is a full-bodied, highly aromatic honey with a tangy, slightly bitter aftertaste (http://imkerei-ahrens.de 2011). It is also described as intensely yellow and very aromatic, almost spicy.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	113–170 kg/ha	Light brown–golden	High		Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
					Annual

Centaurea cyanus Photo: Margo Harrison/Shutterstock.com

HERB

Forget-me-not

Myosotis spp.

FLOWERING SEQUENCE

J F m a m j **J A S O N D**

Features

Annual, biennial, perennial

H 15–60 cm

These dainty plants are useful for bedding, borders and groundcovers. Flowers are blue, pink or white with yellow centres, flat to 1 cm diameter and 5 lobed. The most familiar species is *M. sylvatica*. This easy-to-maintain plant prefers moist conditions and semi-shade. It establishes readily from seed and tends to continually re-establish.

Origin: Europe, New Zealand.

Forget-me-not bee Photo: Zuender/ Shutterstock.com

Conditions

Climate	Cool, temperate
Rainfall	600 mm
Aspect	Part shade
Soil	Well-drained

Uses

A very attractive and useful bedding plant and groundcover that can be used across the urban landscape.

Apiculture

Forget-me-nots are always attractive to bees, as reported throughout the literature (for example, Howes 1948, Clemson 1985). Bees collect pollen and nectar from *Myosotis*.

A bed of *Myosotis* Photo: bendzhik/ Shutterstock.com

SHRUB

Willow bottlebrush

Callistemon salignus
White bottlebrush

FLOWERING SEQUENCE
j f m a m j j a **S O** n d

Features

Large shrub to small tree

H 3–8 m   W 4 m

The characteristic 'willow' leaves are an additional attraction Photo: Mark Leech

Fast growth rate. Attractive whitish paperbark trunk, semi-pendulous habit, willow-like leaves bright pink–coppery when new, and creamy–yellow flower spikes. Adult leaves are grey–green to 8 x 1 cm, flower spikes to 8 x 3 cm.

Origin: South Australia, Victoria, New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid, hot arid
Rainfall	500 mm, moderately drought tolerant once established
Aspect	Full sun
Soil	Well-drained, moist, sandy to heavy clays, tolerates waterlogging and brackish sites

Uses

A good street tree. Its attractive pendulous habit and other features make it a worthy addition to a larger garden or park. Useful for wetter sites in farm shelter and rehabilitation.

Apiculture

Blake & Roff (1996) and Clemson (1985) agree that this is a valuable tree for pollen and nectar. It produces abundant nectar and pollen that stimulates colonies to breed and build up in strength in spring, ready for major honey flows. It can occasionally produce a small surplus in favourable conditions.

SHRUB

Rose

Rosa spp.

Features

Perennial shrubs and climbers

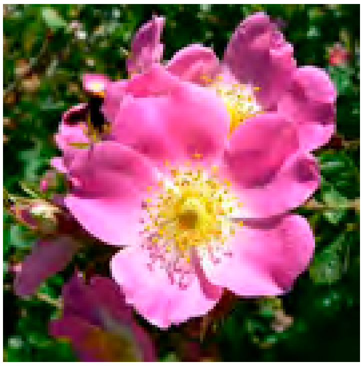
H 25 cm–3 m

The roses most suited to honeybees are the less complex single-flower varieties that represent the wild origins of this amazing range of domesticated plants. There are single roses to suit most conditions and sites, from climbers to standard roses. Rose cultivation requires some attention, although the older and wild varieties tend to be more robust. The easy-to-grow singles include Carabella shrub rose, bred for Australia conditions; disease-resistant Duponti, a full-foliaged spreading shrub rose with large single milky-white perfect flowers shading to a golden centre; and Frulingsmorgen shrub rose, with prolific large single blooms and hot and cold tolerant (www.honeysuckle-cottage.com.au 2011). There are literally thousands of roses, and advice should be sought from nurseries or specialists in heritage roses. Roses grow well from cuttings.

Origin: Europe, North Africa, Asia.

FLOWERING SEQUENCE

J F M A m j j a **S O N D**



Single open roses are attractive to bees
Photo: Stan Shebs GNUFDL

Conditions

Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	500 mm
Aspect	Full sun, shelter from wind
Soil	Well-drained various

Uses

Rose are appreciated the world over as symbols of beauty and love. They enhance any garden, streetscape or park and are widely grown commercially for the cut flower industry. Rose petals are edible, eaten fresh in salads or crystallised for use in cake decoration. Rose hips are used in tea and to produce jelly, jam and syrup and are very rich in vitamin C. They have been used in herbal medicine.

Apiculture

The single and more open double roses are most suited to bees. It would also appear that the lighter colours and sweet-perfumed roses are favourites. Howes (1945) noted that the pollen of the rose, like that of the apple, is greedily gathered by bees.

SHRUB

Snowberry

Symphiocarpos albusd

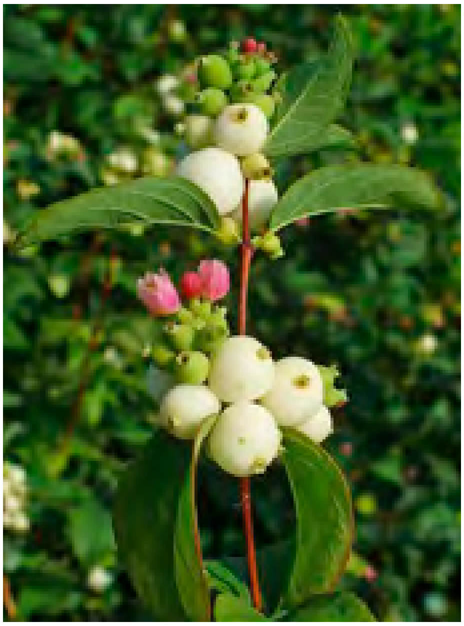
FLOWERING SEQUENCE

J F m a m j j a s o n **D**

Features

Large deciduous shrub

H 3 m   W 2 m



The attractive luminous white fruit of snowberry Photo: H Zell GFDL

Moderate growth rate. An erect multi-stemmed deciduous shrub. Bark is tan to greyish and often splits lengthwise. Leaves are medium green above, paler below, with 5–7 leaflets generally oval but can be entire or lobed on the same plant, to 2–6 cm. Pinkish–white flowers, perfect, small and bell-shaped to 6 mm in racemes of up to 16 flowers. In winter the luminous white fruit to 15 mm makes a stark contrast to the bare branches.

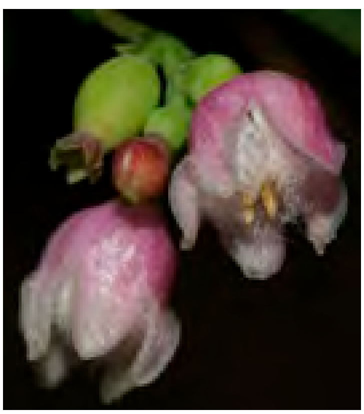
Origin: United States.

Conditions

Climate	Cool, very frost hardy
Rainfall	300 mm, drought tolerant
Aspect	Full sun to shade
Soil	Well-drained light sandy to heavier clay, pH 5.6–7.8

Uses

Snowberry, a native of North America, is a browse plant for a number of native animals there. It is a very attractive garden ornamental and park planting with its luminous white berries, and is tolerant of urban pollution and coastal spray. Snowberries make excellent hedging plants; they respond to pruning and need to be contained between borders, paths and or lawns. Although they contain saponins, a very large quantity would need to be eaten by a human to have toxic effect. They had a use in traditional and herbal medicine and in soap making.



Snowberry flower Photo: Walter Sigmund GFDL

Apiculture

Unifloral honey is produced in the Rocky Mountains region. The honey is white to extra-light amber with rich distinctive floral flavour and a butterscotch aftertaste. It is of minor importance for pollen (Crane et al. 1984).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	100–>400 kg/ha	White to extra-light amber		Slow	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Minor	Minor	Annual

SHRUB

Mountain pinkberry

Leptecophylla juniperina

FLOWERING SEQUENCE

j f m **A M J J A S O N** d

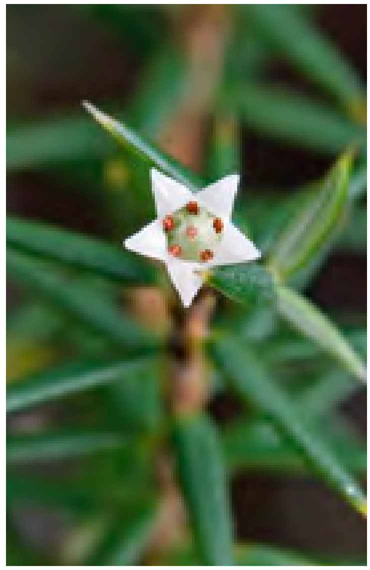
Features

Small to large shrub

H 0.6–5 m

Moderate to slow growth rate. This species occurs in Tasmania, Victoria and New Zealand and appears to grow larger in New Zealand (Walsh 1978; Leech 2009). Blackish bark and branches, small light green needle-like leaves 10–15 mm long. Flowers are minute, white, bell-shaped. Propagate from cuttings.

Origin: Tasmania, Victoria, New Zealand.



Mountain pinkberry's minute flower Photo: JJ Harrison GFDL

Conditions

Climate	Cool, temperate
Rainfall	600 mm
Aspect	Partial shade
Soil	Well-drained sandy to heavier clay

Uses

This prickly shrub is a useful garden addition with its attractive pink berries. It can be grown as a dividing hedge but should be in partial shade and prefers to be an understorey plant. Could be used on farm as an understorey component to increase biodiversity.

Apiculture

In New Zealand Walsh (1978) noted that it yields nectar freely, giving a heavy flow in some seasons. Honey extracts easily and is medium-amber with a mild flavour. Myles Kean (2011, pers. comm.) of Triabunna, Tasmania, reports that it requires mild winter conditions. It is difficult to manage because it is winter flowering in Tasmania from April to September, and it is hard to find hives strong enough to collect the honey. It produces no pollen, but abundant pollen is produced at the same time by other understorey species and hives build in strength. Its honey is almost white with a yellow tinge, very mild flavour and thin due to winter collection. It crystallises very rapidly to a white, very fine grain that stays naturally soft—a natural creamed honey.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	30 kg/hive (Tas)	White to medium-amber	Thin (Tas)	Rapid very fine	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**

Attractive berries of *L. juniperina* Photo: JJ Harrison GFDL

TREE

Lime

Tilia spp.
Linden

FLOWERING SEQUENCE
J f m a m j j a s o n **D**

Features

Deciduous tree

H 27 m   W 15 m

A valuable street tree, *T. europaea*
Photo: Mark Leech

A hardy tree that grows best in deep moist soil. Leaves tend to be heart-shaped with toothed margins, darker green on the upper surface and pale underneath. The pale-yellow flowers are in clusters backed by a finger-like bract.

Origin: Europe.

Conditions

Climate	Cool, temperate
Rainfall	650 mm minimum
Aspect	Full sun
Soil	Wide tolerance of soil types

Uses

An excellent tree for shade, streetscape, parks and shelterbelts. It is relatively drought intolerant but very tolerant of pollution. There are European examples of long-lived trees—more than 800 years old. Extracts of linden flower are used in cosmetics and shampoos.

The timber is soft and easily worked; it has very little grain and a density of 560 kg/m^3. It is a popular wood for model building, intricate carving and musical instruments.

Bees are very attracted to lime flowers
Photo: Mark Leech

Apiculture

Honey	Yield	Colour	Density	Crystal	Frequency
	600–1000 kg/ha	Water clear		Medium to fast	Annual, larger crops 5–8 years
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
		Pale yellow	Low	Low	Annual, larger crops 5–8 years

TREE

Sweet chestnut

Castenaea sativa

Features

Large deciduous tree

H 30 m   W 15 m

FLOWERING SEQUENCE
j f m a m j j a s **O N D**

A relatively fast-growing, long-lived, broad-leafed deciduous hardwood. The oblong–elliptic glossy green leaves grow to 20 cm long and have coarse marginal teeth and prominent veins. The flowers are in showy spike-like creamy-yellow catkins. The fruit is a prickly burr enclosing 1–5 edible nuts each 1.3–2.5 cm in diameter. Chestnuts are susceptible to blight and weevils. Propagate from seeds or cuttings.

Chestnut in flower Photo: Carsten Medom Madsen/Shuttersock.com

Origin: Western Asia.

Conditions

Climate	Cool, temperate
Rainfall	900 mm, very drought tolerant once established
Aspect	Full sun
Soil	Well-drained sandy slightly acidic

Uses

C. sativa is a great summer shade tree suited to larger parks, estate gardens and grand entrances. It produces edible nuts, very popular as gourmet fresh-roasted nuts in Europe. Nut production is between 1–5 t/ha and 25 kg/tree in many European countries. The nuts are also ground into gluten-free flour. The timber is highly regarded, durable and used for carpentry, turnery, basketry, barrels, fence posts and fuel.

Apiculture

The nectar flow is for 3–4 weeks and follows the robinia flow in some European countries. Honey colour is from a light amber to almost black, depending on the amount of honeydew it contains. The honey has a strong aromatic flavour with a slightly bitter after-taste. Due to its high fructose content, it crystallises very slowly (Crane et al. 1984; www.honeytraveller.com 2011). The Spanish company HISPAMIEL (2011) describes the honey as amber to dark amber colour, 70 mm max. Pfund. It has a floral aroma, with clearly distinctive woody components, and a sweet taste with some salty notes.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	25 kg/hive 26–500 hg/ha	Light amber–dark if honey dew	Thin	Very slow, fine	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	High	Dull–bright yellow	High	High	Annual

TREE

Red ironbark

Eucalyptus tricarpa

FLOWERING SEQUENCE
J F m a m J J A S O N D

Features

Medium to large tree

H 10–30 m W 8–15 m

E. tricarpa usually has groups of 3 buds and cream to white flowers Photo: Mark Leech

Slow to moderate growth rate. An impressive evergreen tree known for its almost black, rough, deeply fissured bark. The grey–green–bluish leaves are also a feature, contrasting with the bark. Leaves are lanceolate, curved to 9.5–22 x 1–2 cm. The flowers are whitish, usually in groups of 3. The fruit is cylindrical to goblet-shaped. Propagate from seed.

Origin: Victoria, New South Wales.

Conditions

Climate	Cool, temperate, hot/arid, mildly frost hardy
Rainfall	350 mm, very drought tolerant
Aspect	Full sun
Soil	Well-drained sandy to heavy clay, pH 6.5– >7.5, salt and waterlogging intolerant

Uses

Red ironbark is perhaps an iconic tree, with its intensely dark, fissured trunk and contrasting foliage making it very appealing. It is widely planted as a street and park tree and has been the subject of much research aimed at finding trees suitable for growing on farm in drier climates. Its wood is very dense, with an ADD of 1130 kg/m^3, and, while hard to work, is popular for high-end furniture. It has very high in-ground durability (Class1), such that posts removed after 35 years have been re-used. It is also a preferred slow-burning firewood.

Apiculture

Perhaps unique among the eucalypts, a number of red ironbark provenances have distinct genetic flowering seasons—referred to by beekeepers as summer- or early-, mid- and winter-flowering ironbark.

The summer-flowering provenances produce larger quantities of honey, with average yields of 55 kg/hive common and much higher yields in peak years. The pollen yield is, however, poor. Flowers appear 6–8 weeks after bud set and last from January for 8–10 weeks.

Winter provenances can cause health problems in a hive in cold, damp conditions. In mild winters the bees respond very rapidly to the first pollen.

The honey from *E. tricarpa* is described as light amber or lighter, mild to taste, aromatic with a heavy body, and slow to crystallise to a very fine texture (Lynton Briggs 2011, pers. comm.).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average 55 kg/hive	Light amber	Heavy body	Fine	1–2 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**

Red gum provides is an attractive shade tree Photo: Mark Leech

TREE

Cootamundra wattle

Acacia baileyana

FLOWERING SEQUENCE

j f m a m **J J A S O** n d

Features

Large shrub to small tree

H 3–8 m W 8 m

Cootamundra's showy blossom Photo: Ross Flint

Fast growth rate. A widely planted, hardy attractive acacia. The bark on the trunk and branches is smooth, grey to brown. The silver grey bipinnate leaves to 3 x 1 cm are characteristic. Flowers are in bright-yellow globular heads, in elongated showy racemes. Propagate from seed.

Origin: New South Wales.

Conditions

Climate	Cool, temperate, frost hardy
Rainfall	450 mm, drought tolerant
Aspect	Full sun to part shade
Soil	Well-drained to heavy wet soils

Uses

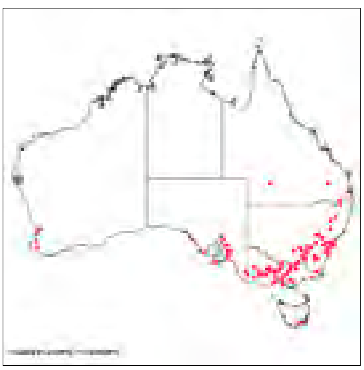
Widely planted as a striking ornamental in gardens, streetscapes and parks. It can be trimmed as a hedge and tolerates mild coastal exposure. It provides a nitrogen-fixing low shelter component in windbreaks.

A. baileyana has become a known environmental weed beyond its limited natural range.

Apiculture

Clemson (1985) noted that Cootamundra wattle produces a good supply of valuable winter pollen. Somerville (2001) reported the crude protein content as being 28.6%; this is considered a level that will assist with hive increase.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good 28.6%	High	Annual



Temperate climate urban open spaces species

The following table summarises the urban open spaces species selected for temperate climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Salvia leucantha*	Mexican sage	C T W	S U F	N			●	●	●	●	●	●	●				
	Echium candicans	Pride of Madeira	C T W H	G U	N	p	●	●	●							●	●	●
	Clematis pubescens	Common clematis	T	G S U F	n	P					●	●	●	●	●	●	●	
	Monarda didyma	Bee balm	C T	G S U	N		●	●	●	●					●	●	●	●
SHRUB	*Banksia grandis*	Bull banksia	T	G S U F	n	P	●								●	●	●	●
	Hakea trifurcata	Two-leaf hakea	T H	G U F	N	P				●	●	●	●	●	●	●		
	Eucalyptus cosmophylla	Cup gum	T	G S U F	N	p			●	●	●	●	●	●	●	●	●	●
	Banksia serrata	Saw-tooth banksia	C T	G U F	N	P	●	●	●	●								●
TREE	*Angophora costata*	Smooth-barked apple	T W H	S U F	N	P	●									●	●	●
	Corymbia maculata	Spotted gum	T	S U F	N	P	●	●	●	●	●	●	●	●				
	Banksia integrifolia	Coast banksia	C T W	G S U F	N	P					●	●	●	●	●			
	Eucalyptus robusta	Swamp mahogany	T W	S U F	n	P					●	●	●	●				

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producing plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Mexican sage

Salvia leucantha

Purple sage

FLOWERING SEQUENCE

j **F M A M J J A** s o n d

Features

Perennial

H 1.3 m W 2 m

A bee making the most of an autumn flower Photo: Mark Leech

This very useful, elegant perennial flowers from late summer or autumn into winter. It grows in a loose, spreading mound with vertical, to drooping sprays of purple flowers. The narrow willow-like leaves are greyish–green puckering on top and white–woolly, underneath to 13 cm. The stems are fast-growing, conspicuous and white–woolly bearing elongated arching clusters of white flowers from purple to lavender blue calyxes. The abundant flowers extend beyond the foliage, making a spectacular display. Prune to the ground when flowering finishes in August.

Origin: Central America, Mexico.

Conditions

Climate	Cool, temperate, warm/humid
Rainfall	Moderately drought tolerant
Aspect	Full sun
Soil	Well-drained sandy loam to heavy clay

Mexican sage in a formal setting Photo: Mark Leech

Uses

Mexican sage, with its striking long-lasting inflorescences, can be used in formal gardens in perennial beds and as part of a Mediterranean garden with rosemary and lavender, providing excellent bee forage. It is a useful low-hedging plant and one of the few salvias that can be used as a cut flower. While the flower drops off, the calyxes are very persistent. It can be used in floral art as the calyxes retain their colour after drying.

Apiculture

Mexican sage is a source plant for the very popular sage honey of the western United States. It is light in colour and has a herbal flavour with a floral after-taste.

HERB

Pride of Madeira

Echium candicans

FLOWERING SEQUENCE

J F M a m j j a s **O N D**

Features

Perennial shrub

H 2. 1 m   W 2.4 m

This majestic architectural plant, with its impressive blue spikes with red accents from the stamens, provides a great feature. It uses minimal water and is a recommended drought-tolerant plant. Described as a biennial, it often lives much longer if cared for. The flower spikes, up to 50 cm long, develop in the second year. It should be cut back after flowering to stimulate new growth.

Origin: Madeira.

Honeybee on Pride of Madeira flower Photo: Mark Leech

Conditions

Climate	Cool, temperate, hot/arid, warm/humid
Rainfall	Minimal water required
Aspect	Sunny
Soil	Most except water-logged clays, pH 6.0–10.0

Uses

E. candicans can be used in many situations, as a garden feature, by roadsides and for erosion control. It has tremendous potential for bee forage. It is a salt-tolerant coastal planting. Care must be used in handling its leaves and stems: the hairs can cause a skin irritation.

Apiculture

Pride of Madeira is extremely attractive to bees, preferred over most nearby flowering plants. It reportedly produces a very high-quality honey. Pollen is considered of only average quality.

Pride of Madeira, with its majestic flower spikes, is covered in bees during sunny weather Photo: Mark Leech

HERB

Common clematis

Clematis pubescens

FLOWERING SEQUENCE
j f m a **M J J A S O N** d

Features

Evergreen perennial climber

H 2–4 m W 1–2 m

Common clematis Photo: Gnangarra creative commons.wikemedia.org

Fast growth rate. An evergreen dioecious woody creeper that can develop into a small shrub. Leaves are dark green and heart-shaped; flowers are cream to white and star-shaped. A showy mass of flowers through late winter and spring. Propagate from seed (cool room) and cuttings.

Origin: Western Australia.

Conditions

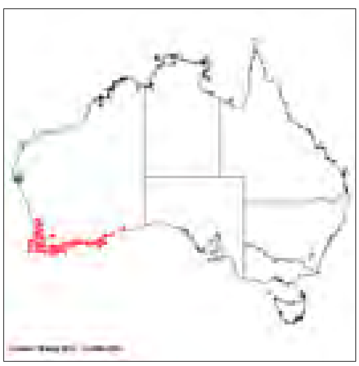
Climate	Temperate
Rainfall	300 mm
Aspect	Full sun to shade
Soil	Well-drained from sand to sandy clay

Uses

A very attractive native. The elegant flowers are followed by interesting 'fluffy' seeds. A useful addition to on-farm biodiversity planting.

Apiculture

Coleman (1962) noted that *C. pubescens* is an excellent pollen plant and produces useful honey. It is widespread throughout its natural environment in south-west Western Australia.



HERB

Bee balm

Monarda didyma

Features

Herbaceous perennial

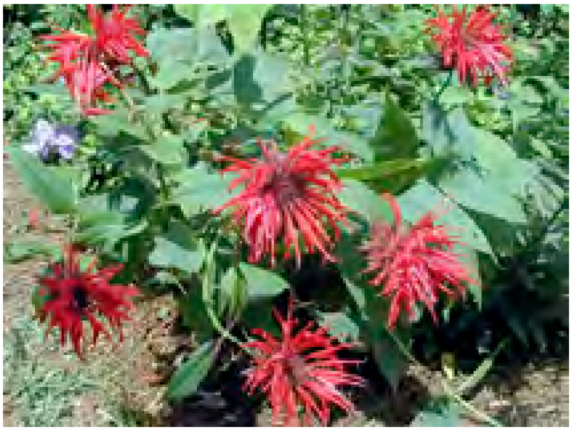
H 0.9–1.2 m W 0.6–0.9 m

A fast-growing clump-forming herbaceous perennial characteristic of the mint family, with square stems and opposite leaves. A very showy plant, coarser than the true mints (*Mentha* spp.). Leaves are dark green, ovate–acuminate, toothed margins to 15 x 5 cm. The scarlet flowers are in terminal tufts. Individual flowers are narrowly tubular to 3.8 cm, tightly clustered in 5 cm diameter heads. Susceptible to powdery mildew; resistant cultivars are available.

Origin: United States.

FLOWERING SEQUENCE

J F M A m j j a **S O N D**



M. didyma Photo: Jacob Kline

Conditions

Climate	Cool, temperate, frost hardy
Rainfall	Keep soil moist
Aspect	Full sun to partial shade
Soil	Well-drained, rich, moist, pH <6.8

Uses

This is a very showy plant, attracting butterflies, bees and other nectarivorous insects. The bruised leaves have a minty flavour. It has been used in herbal medicine and is an attractive cut flower.

Apiculture

Bee balm, or horsemint, honey as a unifloral is a truly wonderful varietal honey. It is medium coloured with a minty flavour (Flottum 2009) and is produced in Texas as a unifloral. According to Ross (2011), the honey is medium dark and has a minty or slightly citrus flavor and smell and never crytsallises. The plant seems to produce best under hard conditions.

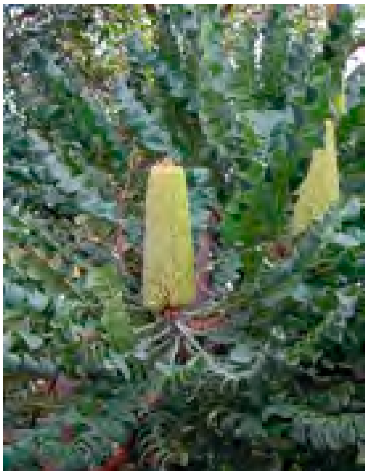
SHRUB

Bull banksia

Banksia grandis

FLOWERING SEQUENCE

J f m a m j j a s o n d



Bull banksia's impressive spikes Photo: Linda Manning

Features

Shrub to small tree

H 1.5–10 m W 3 m

Slow growth rate. Bull banksia's distinctive leaves are glossy dark green to 45 x 10 cm and deeply triangularly lobed to the midrib. The yellow floral spikes are big, to 30 x 8 cm. Plant is susceptible to the rootrot fungus *Phytopthora cinnamomi*. While slow to flower, it can be grown just for its spectacular foliage, which is confined to the outer branches on mature specimens. It can be grown in a container.

Origin: South-west Western Australia.

Conditions

Climate	Temperate
Rainfall	560 mm
Aspect	Full sun
Soil	Well-drained sandy

Uses

The plant is suitable for parks and roadsides and as a street tree. It could be grown on farms in shelterbelts, for bees and for the woody capsules, which have an international market for wood turning.

Apiculture

Bull banksia is an important component of WA bee forage, bridging the gap between parrot bush (*B. sessilis*) and jarrah (*E. marginata*). It produces good volumes of poor-quality honey and high-quality pollen (Coleman 1962).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Good				Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	Good	Annual

SHRUB

Two-leaf hakea

Hakea trifurcata
White bush, kerosene bush

FLOWERING SEQUENCE
j f m **A M J J A S O** n d

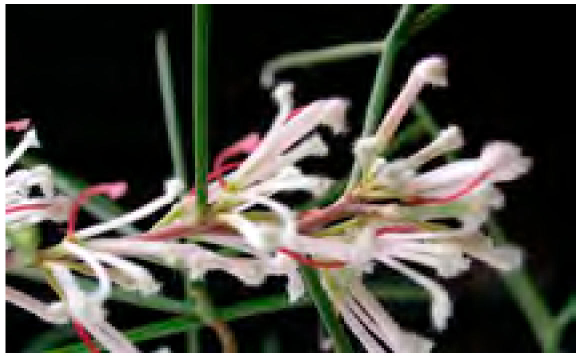
Features

Small to medium shrub

H 4–2.5 m W 2 m

A fast-growing, very hardy, dense shrub. It has two types of leaves present at the same time—typical *Hakea* 'needles', terete to 7 cm x 1.3 mm, and flat lanceolate leaves to 6 x 2 cm, scattered throughout the bush. The inflorescence has up to 10 white flowers. Plant lives for 16 or more years and grows to 4 or 5 m in well-watered situations (L Manning 2011, pers. comm.).

Origin: South-west Western Australia.



Two-leaf hakea flowers Photo: Wikimedia Commons

Conditions

Climate	Temperate, hot/arid, moderately frost hardy
Rainfall	400 mm drought tolerant
Aspect	Full sun
Soil	Well-drained sand over limestone or laterite, loam, gravel

Two-leaf hakea flowers abundantly—an important bee shrub Photo: Wikimedia Commons

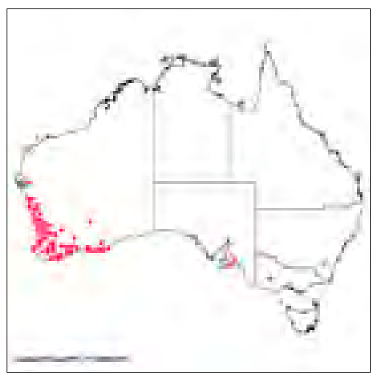
Uses

A low shelter component on farm and suited to a bee farm application. While very prickly, it may be suited to urban settings as a living fence. It produces wood with a prominent medullary ray and is suited to decorative objects.

Apiculture

Considered one of the great honey plants of Western Australia, *H. trifurcata* grows quickly and flowers early. It flowers through winter and is good for rearing brood. In a good year it produces a large amount of nectar and will even produce enough in a drought year to keep bees alive. It is the main component of WA 'wildflower' honey. A very smooth, light honey, a little aromatic and with a distinctive floral flavour.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average to good	Light			Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	Good	Annual



SHRUB

Cup gum

Eucalyptus cosmophylla

FLOWERING SEQUENCE

j f **M A M J J A S O N D**

Features

Mallee to small tree

H 1–5 m W m

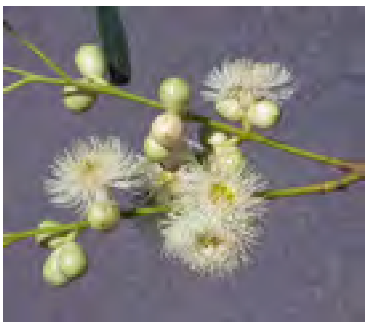
Roadside cup gum Photo: Dean Nicolle

Fast growth rate. A multi-stemmed mallee-form to occasional small tree. Bark is pale grey–buff, with small patches from bark flakes. Adult leaves thick, oval, alternate, occasionally an oblique base to 12–20 x 4–5 cm. The large, attractive buds to 1.8 cm long appear in threes, yellowish with red spots, caps round and beaked. The flowers are white, fruits are hemispherical and stalkless to 1.7 cm long x 2 cm wide. A coppicing species. Propagates readily from seed.

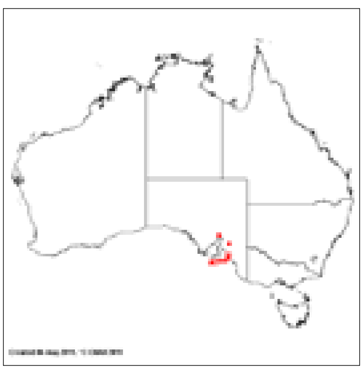
Origin: South Australia.

Conditions

Climate	Temperate, frost hardy
Rainfall	600 mm
Aspect	Full sun to partial shade
Soil	Sandy to heavy clays, withstands waterlogging, tolerates moderate alkalinity



Cup gum buds and fruit Photo: Dean Nicolle



Uses

Its small size, decorative buds and abundant flowers make it an attractive garden specimen. It is also used as a street tree, being smog tolerant. A useful windbreak tree on farm. The wood is red, easily worked, suited to small cabinet and turned work. It is a durable post wood and acceptable firewood.

Apiculture

Cup gum is a regular producer of useful amounts of honey and 1 in 4 years provides a significant honey crop. Boomsma (1972) noted it has a high yield of very poor quality pollen. In surveying beekeepers, however, Paton (2004) found that 55% of beekeepers using *E.cosmophylla* sites were there primarily for pollen.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Hive to high yield	Amber			1–4 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Poor to good	High	1–4 years

SHRUB

Saw-tooth banksia

Banksia serrata

FLOWERING SEQUENCE

J F M A m j j a s o n d

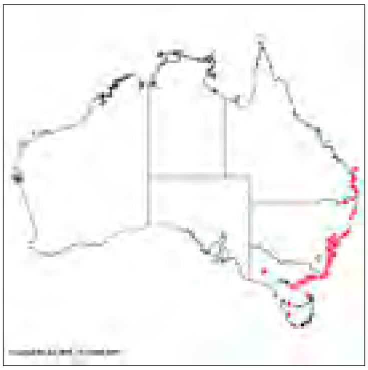
Features

Large shrub to small tree

H 5–15 m

This is a beautiful character specimen tree, with its gnarled, thick, rough bark. Its leaves are large, oblong and saw-toothed to 16 x 4 cm. The flower spikes are short, cylindrical grey–green to orange–red 15 x 8 cm. Like most banksias, it is very attractive to birds, honeyeaters, seed eaters and insect eaters.

Origin: Tasmania, Victoria, New South Wales, Queensland.



B. serrata in the Royal Sydney Botanic Gardens, Sydney Photo: Mark Leech

Conditions

Climate	Cool, temperate
Rainfall	650 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained poor sandy soil

Uses

B. serrata is a great frontline coastal species, very resistant to wind and salt spray. It makes a useful addition to shelterbelts and as a specimen tree in larger domestic gardens and public parks. It is used for cut flowers and in floral art. It has dense wood for a banksia, at 720 kg/m^3, reddish to purple with a prominent medullary ray. It has drying problems due to high shrinkage and must be dried slowly. It is a decorative non-structural wood suited to cabinet work and turnery (Bootle 2001).

Apiculture

The species is important because it provides winter stores and can be relied on most years. It can produce significant nectar surpluses. The honey is dark, fast crystallising, with a characteristic aroma and flavour.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	20–54 kg/hive	Dark amber		Rapid	1–6 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good 33%	Minor	Annual

B. serrata flower head—so characteristic of the Australian bush Photo: Mark

TREE

Smooth-barked apple

Angophora costata

Sydney red gum, rusty gum, cabbage gum, brittle gum

FLOWERING SEQUENCE

J f m a m j j a s **O N D**

Features

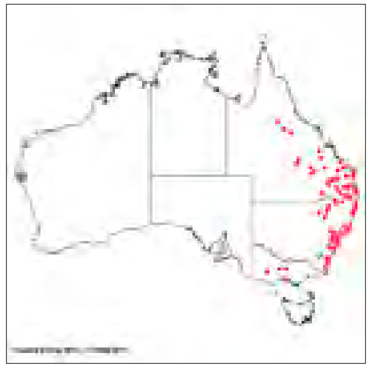
Medium tree

H 15–25 m W 15 m

Smooth-barked apple at Lady Macquarie's Chair, Sydney Photo: Mark Leech

Fast growth rate. A very attractive tree, often planted for its beautiful orange–reddish smooth deciduous bark, shedding in scales or plates, leaving a dimpled surface that turns grey with age. The trunk is often gnarled and twisted. The leaves are opposite, bright green, 13 x 3 cm. New leaves are bright red. The flowers are pure white and very showy in terminal clusters. A good tree for koalas.

Origin: New South Wales, Queensland.



Conditions

Climate	Temperate, warm/humid, hot/arid, mildly frost hardy
Rainfall	600 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained soils from skeletal sandy loam on sandstone to heavy clay

Uses

A. costata is widely planted as a street tree and an ornamental feature in public gardens and urban open spaces. It would make a good pollen support in bee forage planting. Timber is light pinkish–brown, moderately coarse-textured with numerous gum veins. Very hard but not durable, it is used for fencing and firewood (ADD 990 kg/m^3) (Boland et al. 1997; Bootle 2001). It is subject to wind damage because the branches are brittle and break off.

Apiculture

Rarely produces a honey surplus. Honey is a palatable woody flavour, dark amber with reddish tints. It produces smaller volumes annually and is a producer of abundant high-quality pollen. The pollen is excellent in brood rearing and building colonies for major honey flows; excess pollen is stored (Clemson 1985).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average 24 kg/hive	Dark amber	Good	Slow–medium brown	Annual to irregular 5 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Creamy	Good	High	Annual

A. costata fruit Photo: Mark Leech

TREE

Spotted gum

Corymbia maculata

FLOWERING SEQUENCE

J F M A M J J A s o n d

Features

Large tree

H 15–45 m

This is a fast-growing, straight-stemmed, densely crowned, attractive tree with characteristic smooth mottled bark to the ground. Adult leaves are dark green on the upper surface and sometimes paler under, alternate, broad lanceolate to narrow lanceolate 10–25 x 2.5–6 cm. Flowers are terminal in groups of 3 (rarely 7) (Boland et al. 1997; Clemson 1985).

Origin: Coastal Victoria, New South Wales, south-east Queensland.

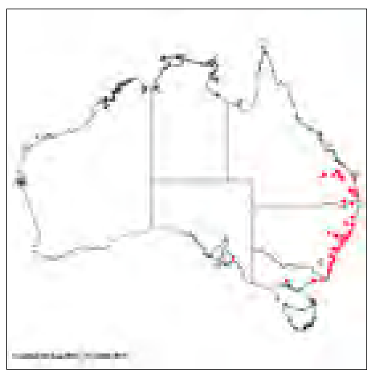
Spotted gum buds Photo: buds Dean Nicolle

Conditions

Climate	Temperate, slightly frost tender when young
Rainfall	450 mm
Aspect	Full sun
Soil	Well-drained clay loam to heavy clay pH <6.5 to >7.5

Uses

C. maculata is a popular and attractive street tree and park specimen, it is adaptable to many sites and soil conditions, including highly compacted urban street soils. It has great potential as a farm forestry species in the 500–800 mm zone and is an excellent tall windbreak component. Its timber is moderately dense (ADD 950 kg/m^3) and moderately durable and has been widely used in construction, flooring, furniture and plywood. It is the most commonly used wood for impact-resistant tool handles (Boland et al. 1997; Bootle 2001).



Apiculture

A very important tree for the honeybee industry. Buds are held for 1–2 years and flowering occurs over an extended period from December to August depending on location. It produces heavy honey crops every 4–10 years and moderate crops every 2–4 years. Prolonged periods of cold nights, frosts and sunny days are needed for the best flows. Spotted gum produces abundant high-quality pollen

(24.7–33.3% cp) (Somerville 2005). The honey is a light to medium amber colour, with a medium to strong aroma and caramel after-tones.

Honey	Yield	Colour	Density	Crystal	Frequency
	34 kg/hive	Medium amber			Moderate 2–4 years
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	High		Very good, to 33.3%	High	4 years

Spotted gum in Sydney Photo: Mark Leech

TREE

Coast banksia

Banksia integrifolia

Features

Medium tree

H 15 m   W 5 m

Fast growth rate. A versatile evergreen tree. The bark is grey, rough and thick. Leaves are oblong to 100 x 22 mm, dark green on the upper surface and silvery under. The flowers are arranged in large spikes to 140 x 70 mm. It is the most widely distributed banksia, growing along the east coast of Australia from sea level to 1500 m altitude and up to 200 km inland. It is suitable for coastal planting where resistance to wind and salt spray is important. Very attractive to many bird species—honeyeaters, insect eaters and seed-eating birds.

Origin: Victoria, New South Wales, Queensland.

FLOWERING SEQUENCE

j f m a **M J J A S** o n d

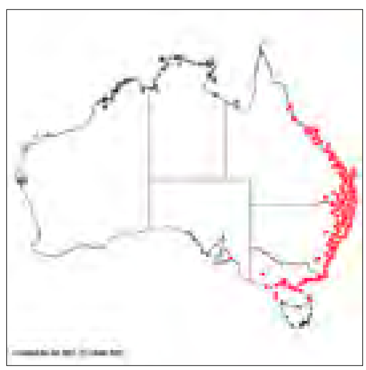
Coast banksia—a highly productive tree
Photo: Mark Leech

Conditions

Climate	Cool, temperate, warm/humid (southern)
Rainfall	850 mm
Aspect	Full sun
Soil	Well-drained, various, from sand to clay, pH <7.5

Uses

This very versatile tree is a suitable street and specimen tree in larger gardens and parks. It is a good windbreak tree; its timber is non-durable and has an ADD of 560 kg/m^3. The wood, which is difficult to dry due to shrinkage is an attractive reddish–brown with a prominent medullary ray; it is suited to cabinet work and turning (Bootle 2001). The floral spikes are used for cut flowers and floral art.



Apiculture

This autumn-flowering species is highly sought after by beekeepers. It produces abundant pollen and nectar, providing vital winter stores. The honey is dark amber, like that of many banksia species, and crystallises rapidly to a coarse, hard consistency that can be difficult to reliquify. It has a buttery, velvety texture and malty, woody flavour.

Honey	Yield	Colour	Density	Crystal	Frequency
	Up to 80 kg/ hive	Dark amber	Thick	Fast, coarse	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Yellow	Medium	High	Annual

B. integrifolia Photo: Mark Leech

TREE

Swamp mahogany

Eucalyptus robusta
Swamp messmate

Features

Small to large tree

H 12–30 m   W 8–12 m

A fast-growing coastal species, usually up to 15 m but will grow much taller in favourable conditions. A very adaptable and hardy tree, growing in wet sites where other trees cannot survive. The reddish–brown bark is rough, fibrous, spongy and persistent to the smaller branches. The dense crown is of thick, glossy dark green, discolourous, broad lanceolate leaves to 18 x 8 cm. The abundant white to cream flowers are axilliary in groups of 9–15. Provides good koala food.

Origin: New South Wales, Queensland.

FLOWERING SEQUENCE
j f m a **M J J A** s o n d

Wonderful open flower of swamp mahogany Photo: Rob Manning

Conditions

Climate	Temperate, warm/tropical
Rainfall	650 mm, moderately drought tolerant
Aspect	Full sun, partial shade
Soil	Various, tolerates acid to alkaline and slightly saline, seasonal inundation

Uses

Swamp mahogany was the first Australian street tree, planted in 1812 along the original road to Lady Macquarie's Chair in Sydney, now within the Royal Sydney Botanic Gardens and still alive. It is a very wind-firm tree and will tolerate severe coastal exposure. It tends to be a shorter tree, to 15 m, in cultivation and is very attractive to birds. It is widely planted overseas for timber and has been used in Australia as a marine borer-resistant timber or pile in wharf construction, as a durable post and for farm buildings.

Apiculture

A winter-flowering species, swamp mahogany provides valuable stores for winter and spring build-up, but where there are adverse winter conditions there can be a problem with bee loss as a result of their flying in poor weather. It is a reliable regular producer of a smallish honey yield of dark amber, highly aromatic honey of an acceptable flavour and reasonable density. The regularity of pollen production for valuable winter stores makes it a valued tree (Clemson 1985; Blake & Roff 1996).

Honey	Yield	Colour	Density	Crystal	Frequency
	17 kg/hive	Dark amber	Acceptable		1–2 year reliable
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Average	Light cream	Average	Average	1–2 year reliable

E. robusta, a long-lived street tree, one of the first planted in Australia Photo: Mark Leech

Warm/humid climate urban open spaces species

The following table summarises the urban open spaces species selected for warm/humid climates.

Plant type	Botanical Name	Common Name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Hardenbergia violacea*	Happy wanderer	C T W H	G U F	n	p					●	●	●	●	●	●		
	Grevillea pteridifolia	Golden grevillea	W	G S U F	N		●	●	●	●	●	●	●	●	●	●	●	●
	Tropaeolum spp.	Nasturtium	C T W H	G S U F			●	●	●						●	●	●	●
	Angelica gigas	Giant angelica	T W	G S U F	n	p	●	●	●	●	●	●	●	●	●	●	●	●
SHRUB	*Callistemon viminalis*	Red bottlebrush	T W F	G S U F	n	p	●	●								●	●	●
	Grevillea baileyana	White oak	T W	G S U F	n	p	●									●	●	●
	Xanthostemon chrysanthus	Golden penda	T W	G S U	n	p	●	●	●					●	●	●	●	●
	Syzygium luehmannii	Small-leaved lilly pilly	C T W	G S U F	n	p											●	●
TREE	*Alphitonia petriei*	Sarsaparilla	W	U F	N	P								●	●	●		
	Eucalyptus populnea	Bimble box	W H	U F	N	P	●								●	●	●	●
	Eucalyptus melanophloia	Silver-leaved ironbark	W H	S U F	N	P	●	●							●	●	●	●
	Eucalyptus microcarpa	Grey box	T W H	F	n	p	●	●	●	●								

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

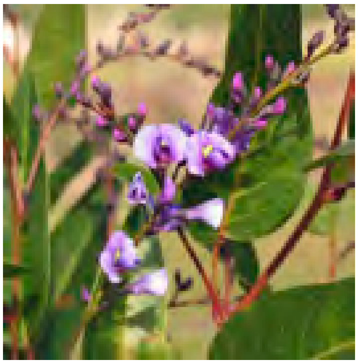
HERB

Happy wanderer

Hardenbergia violacea

FLOWERING SEQUENCE

j f m a **M J J A S O** n d



A continuous show of purple-violet Photo: Mark Leech

Features

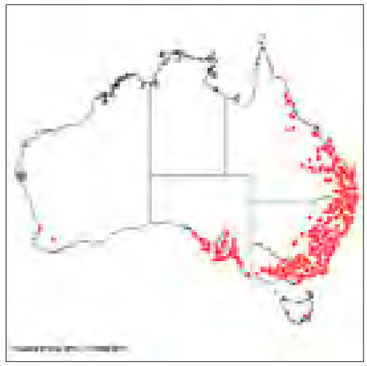
Climber, scrambler, groundcover

This attractive hardy native provides very useful cover on a trellis or a fence as a groundcover or even in a pot. It has oblong heart-shaped leaves from 4 to 15 cm long with prominent veins. Small and delicate, rich mauve–purple flowers appear from early spring. The lanceolate leaves are glossy dark green, with prominent veins to 10 cm. Plant should be cut back after flowering to prevent it becoming too woody and maintain its vigour. It is best to select from the same climatic region, to ensure the greatest vigour and best flowering.

Origin: South Australia, Tasmania, Victoria, New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost hardy
Rainfall	500 mm, drought tolerant
Aspect	Full sun to partial shade
Soil	Well-drained sandy loam to heavy clay, alkaline tolerant



Happy wanderer is a hardy, vigorous climber Photo: Mark Leech

Uses

These are great plants for garden beds, banks and retaining walls, mass plantings, rock gardens, bush gardens and containers. They enhance biodiversity in farm planting. Being leguminous, they provide a soil nitrogen benefit.

The boiled leaves produce a sweet tea.

Apiculture

Happy wanderer is very popular bee forage, although little is known of its specific value to honeybees. It makes a good supporting plant and could find a place in most gardens. It is listed as being used by commercial honeybees at two sites on the York Peninsula (Paton et al. 2004).

Golden grevillea

Grevillea pteridifolia (prostrate form)

Fern leaf grevillea, golden tree, silky grevillea, Darwin silky oak, ferny-leaved silky oak

FLOWERING SEQUENCE

J F M A m j j a S O N D

Features

Prostrate to tall shrub

H 60 cm to 6 m W 5 m

Fast growth rate. A prostrate spreading grevillea that can become a tall shrub. The bark is dark, hardened and furrowed. Leaves are greyish–green, deeply divided, fine and fern-like, pinnately divided into many fine segments 10–20 cm x 0.1–0.2 cm, with rolled-back margins. New growth is covered in silvery fine hairs. The orange feature flowers are toothbrush-like and one-sided on densely crowded racemes 8–15 cm long. Flowering is profuse and the flowers are full of nectar, attracting birds, bats and insects. Flowers appear from April to November. Prostrate form grows true from seed.

Origin: Queensland, Northern Territory, Western Australia.

The attractive golden flower of *G. pteridifolia* Photo: John Elliott

Conditions

Climate	Warm/humid
Rainfall	1000 mm
Aspect	Full sun, sheltered in cooler zones.
Soil	Well-drained various. Tolerates waterlogged soils

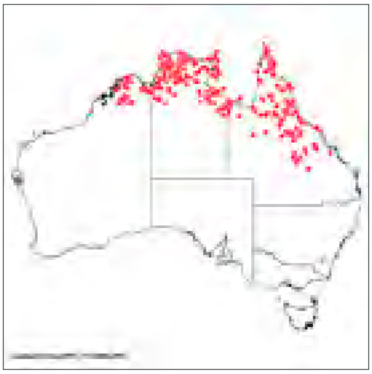
Uses

Golden grevillea is very popular in cultivation in the subtropics and tropics. It will grow in cooler climates in a sunny, sheltered position. The prostrate form is an excellent landscaping species for covering banks and bare areas. The upright form is equally at home in the landscape as a specimen tree in the home garden or to add to biodiversity in farm plantings. An excellent revegetation species for former mine sites (M Damon 2011, pers. comm.). A hybrid of *G. pteridifolia* x *G. banksii* ‘Honey Gem’ grows Australia wide.

Apiculture

G. pteridifolia is an excellent source of nectar and produces a surplus of medium amber honey of good flavour and medium body that is slow to crystallise (M Damon 2011, pers. comm.).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	30 kg/hive	Medium amber	Medium body	Slow	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**



HERB

Nasturtium

Tropaeolum spp.

FLOWERING SEQUENCE
J F M a m j j a **S O N D**

Features

Herbaceous annual and perennial

H 30 cm W 1 m

Nasturtium flower is edible Photo: Roger Kratz

Fast growth rate. Many cultivars from climbing varieties to dwarf bushy types. The pale green leaves are kidney-shaped with a wavy margin to 13 cm across, borne on long petioles. The 5-petalled flowers to 5 cm diameter come in a multitude of colours, typically yellow, orange and red. The 5 sepals are joined into a cuplike calyx, 1 sepal being modified into a nectar-bearing spur. Propagate from seed soaked before sowing.

Origin: Andes.

Conditions

Climate	Cool, temperate, warm/humid, hot arid
Rainfall	Moderately drought tolerant
Aspect	Full sun to part shade
Soil	Well-drained, less fertile best (more flowers)

Uses

An attractive plant, spreading or potted depending on variety. Used to cover unused areas of the garden and fences and banks; dwarf varieties add cheerful colour to borders and beds. All parts of the plant are edible, containing a fragrant mustard oil; flowers make a colourful addition to salads, leaves provide tang. The immature buds can be used as a caper substitute; mature seeds can be roasted and eaten or used like pepper.

Apiculture

Bees are attracted to nasturtiums for pollen; the nectar is out of reach.

HERB

Giant angelica

Angelica gigas
Korean angelica

FLOWERING SEQUENCE
J F M A m j j a S O N D

Features

Herbaceous biennial

H 1.8 m   W 50 cm

Fast growth rate. Erect herbaceous perennial with bold architectural features. Stems are purplish and ribbed. Leaves are glossy dark green, triangular ovate in outline to 20–40 x 20–30 cm with 3 parts. The flower head is 5–8 cm across and flowers are deep red to purplish.

Origin: China, Japan, Korea.

A bee feast! Photo: Zachary Huang, http://beetography.com

Conditions

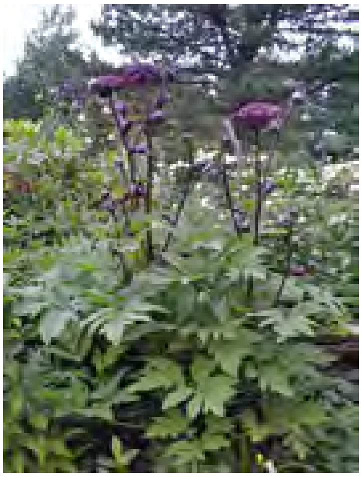
Climate	Temperate, warm/humid, frost hardy
Rainfall	Keep moist
Aspect	Full sun to semi-shade
Soil	Well-drained light sandy to heavier clay, tolerates a broad pH range from <6 to >8

Uses

A bold feature with lush foliage and dramatic umbels on rigid stems, used as a specimen or background plant. The leaves are edible and the stems can be crystallised; all parts, including roots and seeds, have a mild liquorice flavour. Used in herbal medicine.

Apiculture

Angelica is a bee magnet and a prolific producer of pollen and nectar.



The very architectural angelica Photo: Ulf Eliasson GFDL

SHRUB

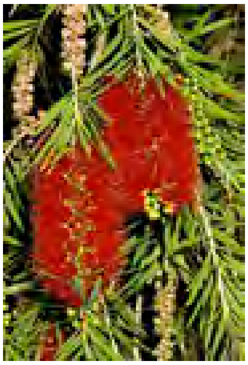
Red bottlebrush

Callistemon viminalis

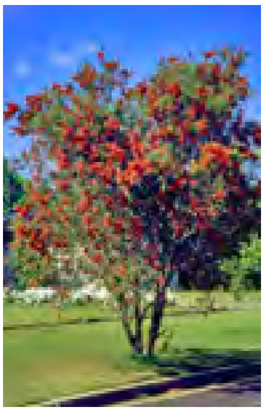
Drooping bottlebrush, red tea tree, river bottlebrush

FLOWERING SEQUENCE

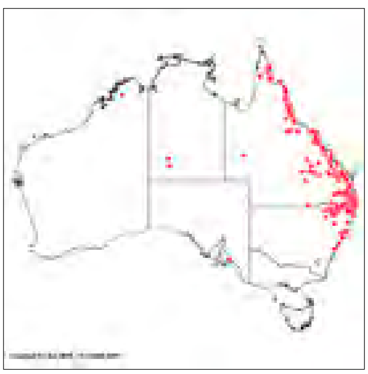
JF mamjjas **OND**



Classic red bottlebrush
Photo: Brian Walters



C. viminalis Photo: Brian Walters



Features

Tall shrub to small tree

H 2.5–10 m

Fast-growing shrub, from a compact cultivar to the largest of the callistemons. Bark is dark grey and furrowed; small branches are slender and drooping, giving a pendulous look. Young leaves are bronze red and downy; adult leaves are dull green, lanceolate, to 7.5 cm x 6 mm, with a prominent midrib and pointed. The profuse crimson cylindrical spikes of flowers to 15 x 5 cm are typical and make this a very attractive specimen. Flowering can occur in spring, summer and autumn depending on conditions. Extensively planted overseas.

Callistemons hybridise easily and have given rise to a large number of cultivars of this hardy, attractive genus.

Origin: New South Wales, Queensland.

Conditions

Climate	Temperate, warm/humid, hot/arid. Light frost only.
Rainfall	300 mm, drought tolerant
Aspect	Full sun
Soil	A wide tolerance

Uses

An outstanding feature plant wherever it is planted. A useful garden addition, taller forms making excellent street trees. A handy hedging and screening species. It is used for cut flowers and makes a great bird and insect attraction to shelterbelts.

Apiculture

C. viminalis makes a very useful contribution of both pollen and nectar to the spring build requirements of the hive. Blake & Roff (1996) noted that the honey has weak density and poor flavour.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Hive		Weak		Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Average	Average	Annual

SHRUB

White oak

Grevillea baileyana

Findley's silky oak, Bailey's silky oak

FLOWERING SEQUENCE

J f m a m j j a s **O N D**

Features

Large shrub to small tree (in cultivation)

H 6–10 m W 4 m (can grow to >20 m in natural environment)

Fast growth rate. In cultivation it is branched from the base with a tall, shrubby habit. Mottled grey and white bark. Juvenile leaves are large, to 50 cm, deeply lobed to 15 cm, with 3–9 rectangular or tapering lobes. Adult leaves deep glossy green with a rich golden bronze underside to 20 cm. Flowers are borne in lacy cream to white terminal racemes to 15 cm, with 10–12 spikes occurring together. Known for its profuse show of white flower sprays contrasting with the bronze underside of its leaves. The juvenile leaf form can be prolonged by pruning. This attractive specimen is very adaptable and is grown from tropical north Queensland to Melbourne. Propagate by fresh seed or cuttings of juvenile growth.

Origin: north Queensland.

Bees enjoying the floral abundance of white oak Photo: Chris Harvey

Conditions

Climate	Temperate, warm/humid, slightly frost hardy
Rainfall	650 mm based on growth in Melbourne. Water in dry summer, drought tolerant.
Aspect	Full sun to part shade
Soil	Well-drained and various, salt tolerant

Uses

A highly attractive specimen in most situations. It is equally at home in windbreaks on farms as it is in most urban settings. The blooms and leaves provide excellent cut flowers and foliage, with a long vase life. The exceptional floral sprays are used in bouquets and floral art, the foliage drying true to colour.

G. baileyana, known for its cut flowers and foliage Photo: Tatiana Gerus CC 2.0 Generic

Apiculture

Grevilleas provide good nectar for brood stimulation and supporting pollen (Clemson 1985).

SHRUB

Golden penda

Xanthostemon chrysanthus

FLOWERING SEQUENCE

J F M a m j j **A S O N D**

Features

Tall shrub to small tree

H 5–8 m

Golden penda's exquisite flowers
Photo: Ethel Ardvark CC BY 3.0

Moderate to fast growth. Golden penda is the floral emblem of Cairns. It is an outstanding small tree that is widely planted for its foliage and profuse bold flowering. The brown to grey bark is rough and scaly. The mid to dark green leaves are glossy and lanceolate, 10–22 x 3–4.5 cm, with new red tips. The flowers are bright golden–yellow grouped in dense spherical terminal heads to 15 cm in diameter. The flowers are dominated by staminal filaments up to 30 mm and the styles up to 45 mm. Each stamen terminates with a prominent pollen presenter or anther. Plants can flower after 2 years and flowering is from late winter to autumn. *X. chrysanthus* responds well to pruning and can be maintained as a large shrub. Propagation by cuttings maintains type.

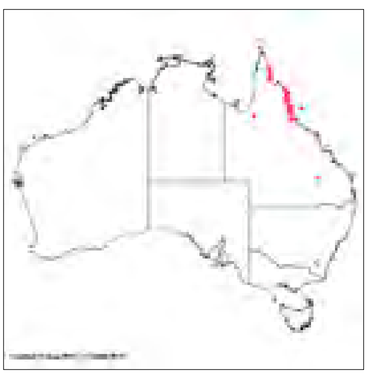
Origin: Queensland.

Conditions

Climate	Temperate, warm/humid
Rainfall	800 mm
Aspect	Full sun
Soil	Well-drained, well-composted, moisture retentive

Uses

Golden penda is very adaptable to all but the driest or coldest of areas. It is an outstanding specimen tree for use in all urban environments. Plant is a good cut flower.



Apiculture

Cairns beekeeper Maurice Damon (2011) noted that golden penda is 'Very good to excellent for bees, providing nectar and pollen. Bees really get stuck into it when flowering, so that the trees are humming'.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Hive		Weak		Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Average	Average	Annual

Profuse flowering of *X. chrysanthus*
Photo: Tatters :) CC BY 2.0

SHRUB

Small-leaved lilly pilly

Syzygium luehmannii

Riberry, cherry satinash, small-leaved water gum, creek cherry, water myrtle

FLOWERING SEQUENCE

j f m a m j j a s o **N D**

Riberry flowers with a spider web Photo: Rus Glover, Woolgoolga Rainforest Products

Abundant fruit of *S. luehmannii* Photo: Peter Woodard

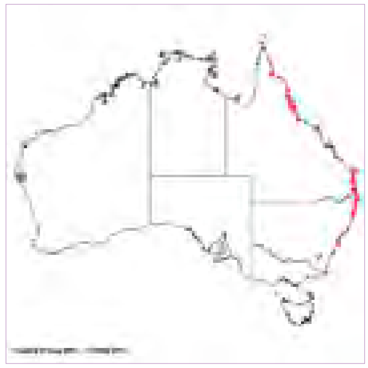
Features

Large shrub to small tree

H 4–8 m (in cultivation) to 30 m in rainforest

Slow growth rate. A dense, rounded large shrub to small tree when grown in cultivation. It is known to grow to 30 m in a natural rainforest setting. Leaves are glossy dark green, opposite, simple and entire, oval to lanceolate, with a rounded base and drawn out to a blunt point at the apex, to 2–5 cm long. New growth is pink to red. Flowers are cream to white and showy in panicles at the end of branchlets, 4–5 petals 1.5 mm long with many stamens 2–5 mm long. Propagate by cuttings.

Origin: New South Wales, Queensland.



Conditions

Climate	Cool, temperate, warm/humid, very frost tender when young
Rainfall	600 mm
Aspect	Full sun to partial shade
Soil	Well-drained sandy loam

Uses

Perhaps the most widely planted Australian rainforest tree, *S. luehmannii* makes a great garden specimen with its showy flowers and wonderful edible red berries. It is used as a street tree but is probably better placed in a park where fallen berries are less of a problem. A popular gourmet native food, the berries are used to make a unique flavoured jam, cordials and in curries, stews and even icecream. It makes a refreshing summer drink. Related to the clove, the plant is readily pruned, making it a useful hedge plant, and is used in windbreaks.

A riberry plantation Photo: Rus Glover

Apiculture

Rus Glover, from Woolgoolga Rainforest Products, commercial growers of riberry, notes that, like most syzygiums, *S. luehmannii* attracts large numbers of honeybees and native bees since it is a prolific flowerer with a large amount of pollen and a reasonable amount of nectar.

TREE

Sarsaparilla

Alphitonia petriei

Pink ash, white ash, pink almond

FLOWERING SEQUENCE

j f m a m j j **A S O** n d

Features

Tall shrub to small tree

H 6–10 m W 4–6 m

Very fast growth rate. A dense, spreading dark green canopy when open grown, the branches tending to form layers. Bark is smooth. The attractive glossy leaves are discolourous, almost white underneath, rusty when young, elliptic to oblong ovate to 17 x 7.5 cm. When crushed the bark and leaves give off a strong aroma of oil of wintergreen, a component of sarsaparilla, toothpaste and liniment. The tiny cream to greenish flowers are in large panicles at the end of branchlets or in leaf axils.

Origin: Queensland.

Sarsaparilla's attractive horizontal layering Photo: Stephanie Haslam

Conditions

Climate	Warm/humid
Rainfall	750 mm
Aspect	Sunny
Soil	Well-drained, various

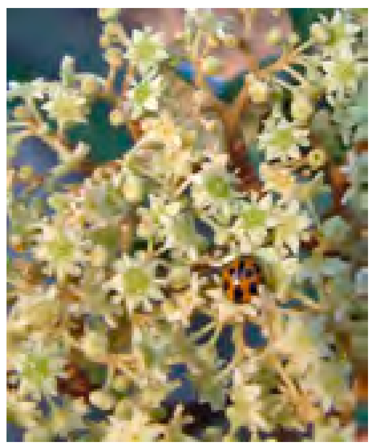
Uses

A pioneer species that makes a great contribution as a specimen tree in parks, where its aggressive rooting is less of a problem. Can grow 3 m in a year given the right conditions. Wood darkens to a rich red–orange with some coloured stripes, ADD 740 kg/m^3, straight and fine-grained. A non-commercial species used for veneer, joinery, flooring and ornamental turning (Bootle 2001).

Apiculture

Blake & Roff (1996) reported sarsaparilla as a major nectar and pollen plant on the Atherton Tableland. This was supported by discussion, with Rod Marti (2011, pers. comm.) noting that bees build very well on rainforest edges where sarsaparilla is a dominant species.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Major source	Light amber			2–3 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Major source	Major source	2–3 years



A welcome visitor to the tiny abundant flowers Photo: Stephanie Haslam

TREE

Bimble box

Eucalyptus populnea

FLOWERING SEQUENCE

J f m a m j j a **S O N D**

Features

Small to medium tree

H 10–20 m

Bimble box with its characteristic poplar-like leaves Photo: Wikimedia Commons

Moderate growth rate with a light to dark grey 'box'-like bark. The leaves are glossy green and poplar-like—hence the species name. They are on long slender stalks and round, ovate to 10 x 7.5 cm.

Origin: New South Wales, Queensland.

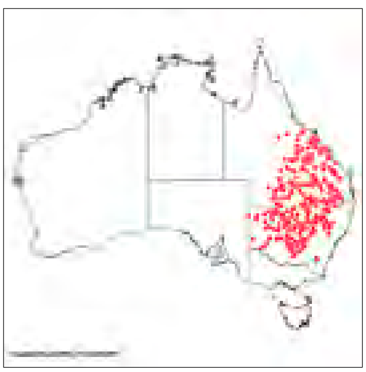
Conditions

Climate	Warm/humid, hot/arid, frost tolerant
Rainfall	250 mm, very drought tolerant
Aspect	Full sun
Soil	Various—loam to heavy clay

Uses

It is used for shade and shelter and is a good firewood tree that regenerates from coppice. The dark-coloured wood, wavy grain, hardness and density (ADD 1090 kg/m^3) make it a popular fine product wood. It has been used in woodwind instruments and the burls are sought after. It is highly durable (Class 1) and has been used in heavy construction and inground posts. Good koala food.

Apiculture



Bimble box is an erratic producer, but flowers with river red gum, providing a very marketable honey. As a unifloral it is considered a good-quality honey, light amber, of medium density and with a pleasant flavour, fresh and fruity with a crisp finish (Melita 2011).

Honey	Yield	Colour	Density	Crystal	Frequency
	39 kg/hive	Light amber	Good		3 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		White – cream	Good	Medium to good	3 years

TREE

Silver-leaved ironbark

Eucalyptus melanophloia

FLOWERING SEQUENCE

J F m a m j j a **S O N D**

Features

Small to medium tree

H 6–20 m

Moderate growth rate. Form is very dependent on the fertility of the site: stunted, poor form on infertile sands and gravels to a better formed medium-sized tree on more fertile soils. The bark is dark grey to black and deeply fissured. This contrasts with the pale silvery-grey leaves, almost sessile, ovate to broad lanceolate to 10.5 x 5.5 cm. The blossoms are axilliary and terminal umbels of 3–7 white flowers. The fruit and branchlets are characteristically glaucous.

Origin: New South Wales, Queensland.

A poorly formed example of silver-leaved ironbark in the Australian National Botanic Gardens, Canberra Photo: Mark Leech

Conditions

Climate	Hot/arid, warm/humid
Rainfall	200 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sands to heavier clays

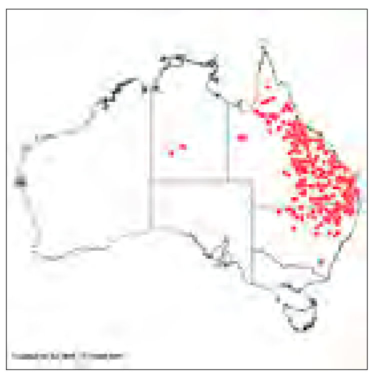
Uses

This is a useful shade tree and is used a as street tree in arid regions. Its wood is red, heavy and durable (ADD 1090 kg/m^3), used for fencing and farm construction (Boland et al. 1997).

Apiculture

In inland areas of Queensland, appears to be a regular honey yielder, every second year (Blake & Roff 1996). Clemson (1985) noted, however, that it requires good rain just before flowering, with heavy flows occurring every 3–4 years in western New South Wales. The honey is described as aromatic, white to light amber, of good density, granulating slowly to a coarse grain. It produces good supplies of pollen, but the isoleucine (an essential amino acid) content is below the minimum requirement of 4% (Stace 1996). It is noted that the abundant pollen produced compensates in part, and bees can still work the very heavy flow (Somerville 1999).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	52 kg/hive	White to light amber	Good	Slow to coarse grain	2–4 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Average 20–23 % cp	High	2–4 years



TREE

Grey box

Eucalyptus microcarpa

Inland grey box, western grey box, brown box

FLOWERING SEQUENCE

JFMAmjjasond

Grey box flowers and buds Photo: Paul, Heathmont Honey

Features

Medium tree

H 8–25 m

Slow-growing, spreading tree with a fibrous light to dark grey bark on the trunk and lower branches and a smooth, grey–brown bark on the upper branches. The leaves are glossy green, leathery and concolourous, lanceolate to 15 x 3 cm.

Origin: Victoria, New South Wales, Queensland.

Conditions

Climate	Temperate, hot/arid, warm/humid
Rainfall	450 mm
Aspect	Full sun
Soil	Light soils with clay subsoil to heavier soils

Uses

A useful farm forestry species as a component in shelterbelts and for shade. On farm it has been used for durable posts and firewood. Its wood is very dense (ADD 1120 kg/m^3) and extremely durable (Class 1), one of the hardest woods. The pale brown wood with interlocked grain is difficult to work but has been used in heavy construction, wharves and shipbuilding and now in flooring. It was used extensively in the Australian Parliament's House of Representatives chamber.

E. microcarpa Photo: Paul, Heathmont Honey

Apiculture

The buds appear on new growth in summer and flowering begins 2 months later. Known throughout its extensive range as a good honey producer, but its pollen is of poor quality and causes hives to lose strength. Hives need supporting pollen plants or to be moved to good pollen sites. The honey is gold to dark amber in colour and of medium density, with buttery hints following through to rich, mellow tones in the mouth with a slight caramel after-taste (amazingbees.com.au 2011).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average 26 kg/hive	Medium to dark amber	Medium	Moderate–fast	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Moderate	Cream	Poor	Moderate	Annual

Hot/arid climate urban open spaces species

The following table summarises the urban open spaces species selected for hot/arid climates

Plant type	Botanical Name	Common Name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Thryptomene saxicola*	Thryptomene	C T W H	G S U	n	p					●	●	●	●	●	●		
	Grevillea junperina	Prickly spider flower	C T W H	G S U F	n	p	●	●							●	●	●	●
	Iberis sempervirens	Candy tuft	T H	G S U	n										●	●	●	●
	Lampranthus spectabilis	Trailing ice plant	C T W H	G S U	n	p									●	●	●	
SHRUB	*Banksia menziesii*	Firewood banksia	T H	G S U	N	P			●	●	●	●	●	●				
	Eremophila deserti	Ellangowan	T H	G S U F	n	P				●	●	●	●	●	●	●	●	
	Eucalyptus diversifolia	Stoney mallee	T H	S U F	N	p							●	●	●	●	●	●
	Geijera parviflora	Wilga	W H	G S U F	N	P							●	●	●	●	●	●
TREE	*Euclyptus cladocalyx*	Sugar gum	T H	S U F	N	P	●	●	●	●								●
	Eucalyptus cornuta	Yate	T H	G S U F	N	P	●	●	●	●	●		●	●	●	●	●	●
	Eucalyptus ochrophloia	Napunyah	H	U F	N					●	●	●	●	●	●	●		
	Eucalyptus intertexta	Gum-barked coolibah	H	S U F	N	P	●			●	●	●	●					●

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producing plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Thryptomene

Thryptomene saxicola

FLOWERING SEQUENCE
j f m a **M J J A S O** n d

Features

Small shrub

H 1 m W 1.5 m

T. saxicola, an attractive long-flowering border Photo Mark Leech

A compact evergreen shrub with leaves and flowers similar to those of tea tree and honey myrtle. The small obovate leaves grow to 10 mm, with abundant small white to pink flowers in the leaf axils, mainly flowering in winter and spring. This species is widely cultivated in Australia and overseas. It is a kangaroo-proof plant.

Origin: South-west Western Australia.

Conditions

Climate	Cool, temperate, hot/arid, warm/humid (southern)
Rainfall	500 mm
Aspect	Full sun and part shade
Soil	Well-drained sandy, pH acid to neutral

Uses

This species and other members of the genus are useful as domestic garden specimens and for park and roadside planting. With their long-flowering, abundant sprays of flowers and tolerance of heavy pruning they also make a useful cut flower species, lasting well; florists use them as a filler. *T. calcyna* has white flowers and is grown in plantations for the cut flower industry.

Thrymptomene flower, tiny and attractive Photo: Mark Leech

Apiculture

A number of the thryptomenes are useful bee plants. In New South Wales *T. hexandra* and *T. micrantha* provide good stimulus with pollen and nectar in spring and can produce a surplus (Clemson 1985). *T. saxicola* is very good for attracting native bees.

HERB

Prickly spider flower

Grevillea juniperina
Juniper grevillea

Features

Groundcover to small shrub

H 0.5–4 m W 1.5–6 m

Fast-growing, dense groundcover to small spreading shrub. The prickly green linear leaves to 5–35 mm are pungent. The spider-like flowers appear in clusters in leaf axils and at branch ends. Flower colour varies from greenish–yellow to apricot and red. Flowers prolifically most of the year and can be planted in most climate zones. Responds well to pruning but is killed by fire.

Origin: New South Wales, Queensland.

FLOWERING SEQUENCE
J F m a m j j a **S O N D**

The spider flower of *J. grevillea* Photo: www.grevilleas.com.au

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost hardy
Rainfall	Drought tolerant
Aspect	Dappled shade to full sun
Soil	Adaptable, from sandy to heavy clay

Uses

This very adaptable grevillea is useful across the landscape. The prostrate form can be used in gardens as a border and fill. Its use in streetscapes and parks can vary from covering large areas to embankments beside highways and feature rockeries. Similarly, on farm it can be used as a groundcover. Being prickly, it provides cover for small birds, which often nest in it.

Prostrate groundcover form of *G. junperina*, an excellent rockery or road bank cover Photo: Mark Leech

Apiculture

As with many grevilleas, this is a prolific nectar producer in spring and summer and is beneficial to bees (Clemson 1985).

HERB

Candy tuft

Iberis sempervirens

FLOWERING SEQUENCE
j f m a m j j a **S O N D**

Features

Small perennial shrub

H 30 cm W 60 cm

Candytuft Photo: heron GFDL

A low-growing, spreading perennial often used as a groundcover. Characterised by oblong dark green leathery leaves to 4 cm and dense rounded heads of 4-petalled white flowers. A long-flowering hardy species producing masses of flowers in spring and summer. Dead-head to encourage flowering and prevent running to seed. Prune after flowering to encourage dense growth. Stems root where they contact the ground—useful for division.

Origin: Mediterranean, western Asia.

Conditions

Climate	Temperate, hot/arid, frost hardy
Rainfall	Drought tolerant
Aspect	Full sun
Soil	Well-drained, various, tolerates alkaline soils

Uses

An excellent border and edging plant, candy tuft provides a wonderful cascade on embankments and over garden walls.

Apiculture

Candy tuft is beneficial to bees, providing nectar(Tew 2011; Howes 1945).

HERB

Trailing ice plant

Lampranthus spectabilis
Pigface

Features

Prostrate perennial succulent

H 40 cm   W 70 cm

Fast growth rate. Sprawling evergreen succulent, providing excellent groundcover. The grey–green 3-sided, keeled leaves to 8 cm are in contrast to the vibrant, rose-pink to red daisy-like flowers to 6.5 cm in diameter. This plant provides a carpet of bright colour. Cut back lightly after flowering to eliminate fruit capsules and maintain vigour.

Origin: South Africa.

FLOWERING SEQUENCE
j f m a m j j a **S O N** d

The groundcover succulent trailing ice plant Photo: Martin Garnham/ Shutterstock.com

Conditions

Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	Drought tolerant
Aspect	Full sun
Soil	Well-drained various

Uses

A very effective groundcover and soil binding plant, forming an effective barrier against weeds. *L. multiradius* in New South Wales and *L. glaucus* in Western Australia have become naturalised.

Apiculture

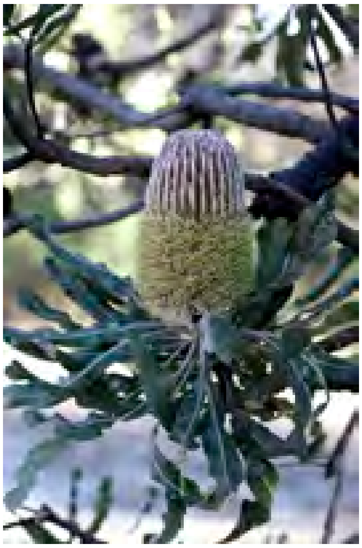
Producers of abundant pollen and nectar, requiring insect pollination and particularly attractive to honeybees.

SHRUB

Firewood banksia

Banksia menziesii
Menzies banksia

FLOWERING SEQUENCE
j f **M A M J J A** s o n d



A stunning flower head Photo: Linda Manning

Features

Small spreading shrub to small tree

H 1.5–10 m

Often with gnarled thick grey bark, *B. menziesii* has grey–green leaves that are oblong to 25 x 4 cm with toothed margins. The large terminal flower spikes are a distinct 'acorn' shape as the flowers open and are orange–red in colour to 12 x 8 cm. The plant produces a lignotuber and regenerates from it and/or seed after fire.

Origin: Western Australia.

Conditions

Climate	Temperate, hot/arid
Rainfall	400 mm
Aspect	Full sun to part shade
Soil	Well-drained sandy

Uses

A common garden specimen and street tree and also found in parks. It could provide useful shelter on farms.

B. menziesii Photo: Wikimedia Commons

Apiculture

Firewood banksia flowers annually but does not yield annually (Coleman 1962). It produces a light honey with an almond after-taste.

Honey	Yield	Colour	Density	Crystal	Frequency
	Good	Light	Medium		Irregular yield
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	Good	Irregular yield

SHRUB

Ellangowan

Eremophila deserti

Turkey bush, dogwood, poison bush, pencil bush

Features

Small shrub to small tree

H 0.3–4 m

Medium growth rate. Rounded, compact shrub to shapely small tree. Bark is grey–brown with 'wart-like' swellings. Leaves are dull green, flat, thick and linear to 2.0–5.5 cm x 3–8 mm, margins entire, apex acute and hooked. Scented white bell-shaped flowers with 5 rounded lobes are axillary in groups of 1–4 mm to 5–10 mm long. Flowering from April to November, varying according to location. Propagation by seed is difficult; hardwood cuttings are more successful.

Origin: Western Australia, South Australia, Victoria, New South Wales, Queensland.

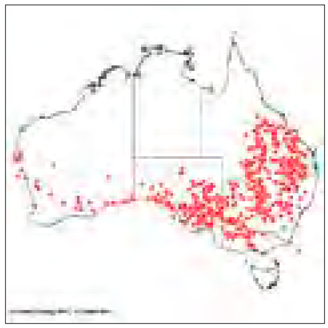
FLOWERING SEQUENCE

j f m **A M J J A S O N** d

The tiny flower of Ellangowan, a valuable pollen and nectar source Photo: Patricia Gardner

Conditions

Climate	Temperate, hot/arid, frost hardy
Rainfall	150 mm, extremely drought tolerant
Aspect	Full sun, shade intolerant
Soil	Well-drained sandy to heavy clay. Tolerates alkaline soils, pH <6 to >8



Uses

This hardy shrub flowers profusely and provides an excellent display of small white flowers. It should not be planted on stock routes or in laneways where stock are likely to move. Reports of stock poisoning relate to stressed stock being driven on stock routes with little else to eat. Normally the plant is browsed by stock without ill effect (Graham 2011).

Apiculture

Ellangowan is very widely distributed in arid Australia and has different flowering times—in Western Australia from April to November, New South Wales from July to September and Queensland from July to October. It is considered by Blake & Roff (1996) to be a major pollen source for beekeepers working the Channel Country of south-west Queensland, also providing a honey surplus. Clemson (1985) emphasised the high quantity and quality of pollen but noted the dark honey can cause problems with lighter honeys produced at the same time. Stace (1996) reported the crude protein content as between 21.6 and 23%, with the important amino acid isoleucine being below the recommended 4.0% of crude protein minimum (DeGroot 1953). However, Stace (1996) considered the large volume of pollen produced to be suitable for collection as bee food.

Ellangowan as a small bush Photo: Patricia Gardner

SHRUB

Stony mallee

Eucalyptus diversifolia

FLOWERING SEQUENCE
j f m a m j **J A S O N D**

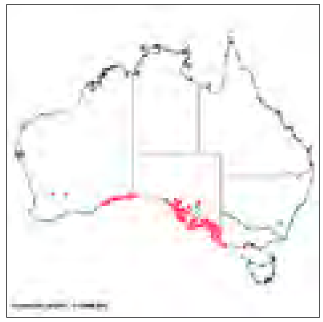
Features

Mallee to small tree

H 4– 6 m.

Stony mallee as thick mallee scrub
Photo: Dean Nicolle

A moderately fast growth rate. Varied form, from a small spreading tree to a multi-stemmed mallee. It has greyish–white ribbony bark and its dense foliage can reach the ground. Leaves are thick and narrow to 12 x 2 cm. A good bird-attracting species.



Origin: Western Australia, South Australia, Victoria.

Conditions

Climate	Temperate, hot/arid, frost tolerant
Rainfall	400 mm, drought tolerant
Aspect	Full sun
Soil	Sand to heavy clay, tolerates alkaline soils

Uses

Used for low shelter and as a street tree and park specimen. It coppices readily and provides useful firewood. A profusely flowering species, it is used for cut flowers. It is salt and wind tolerant, providing frontline coastal shelter.

Stony mallee buds and flowers Photo: Dean Nicolle

Apiculture

The honey is amber in colour and the yield, which is either average or good, occurs in alternate years. An occasional copious nectar flow may remain uncollected when the sugar content is too low. Pollen production is moderate; the annual yield of average quality enables sufficient breeding to replace normal winter losses (Boomsma 1972).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	To 80 kg/hive	Amber			2 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Average	Average	1 year

SHRUB

Wilga

Geijera parviflora

Features

Large shrub to small tree

H 6–8 m W 5 m

Moderate to slow growth rate. A beautiful, pendulous shrub of symmetrical form with rough, fissured bark and dark green to yellowish–green linear leaves to 20 x 1 cm, aromatic when crushed. The small flowers are citrus-like, waxy white and star-shaped in terminal clusters, flowering from spring through to summer. The fruit is an inconspicuous, oval, hard nut to 7 mm. Foliage becomes a very dark green when grown in partial shade. Difficult to propagate from seed and cuttings but, once established, it is extremely hardy.

Origin: South Australia, Victoria, New South Wales, Queensland.

FLOWERING SEQUENCE

j f m a m j **J A S O N D**

A citrus-like tiny flower very open to bees Photo: Peter Woodard

Conditions

Climate	Hot/arid, warm/humid, moderate frost tolerance
Rainfall	350 mm, very drought tolerant
Aspect	Full sun to partial shade
Soil	Well-drained, sandy to heavier soils

Wilga leaves, flowers and fruit Photo: Brian Walters

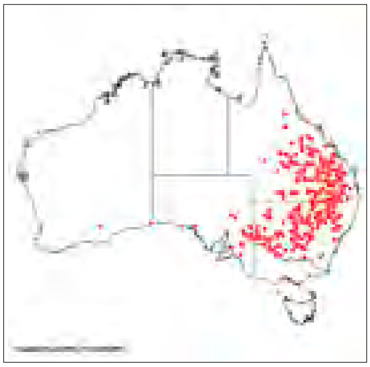
Uses

A most attractive large shrub to small tree that holds its place in any situation. It is compact enough to be a good addition to a garden landscape and a useful, hardy and adaptable street tree. On farm it can be used in shelterbelts; sometimes it is used for drought fodder.

Apiculture

Boomsma (1972) noted that in South Australia wilga produces an average honey flow, sufficient to stimulate hive brood. Clemson (1986) supported this, reporting it is of particular value in supplying pollen and nectar for stimulating brood rearing. Flowering is very dependent on favourable rainfall in autumn and spring.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
		Light amber to dark			Annual (weather)
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	High	Annual (weather)



TREE

Sugar gum

Eucalyptus cladocalyx

FLOWERING SEQUENCE

J F M A m j j a s o n **D**

Features

Small to medium tree

H 15–30 m

Sugar gum Photo: Dean Nicolle

A fast-growing tree. Sugar gum has been widely planted in Australia, especially in western Victoria, since the 1870s. It is characterised by its colourful, often patchy, smooth gum bark—off-white, grey, yellowish–grey and bluish–grey. The leaves are glossy green, strongly discolourous and lanceolate to 15 x 2.5 cm.

Origin: South Australia.

Conditions

Climate	Temperate, hot/arid, seedlings frost sensitive
Rainfall	350 mm, drought tolerant
Aspect	Full sun
Soil	Sands and gravel to clay loams, pH >4 to <10. Salinity low to moderate, 200–800 mS/m

Uses

Variety 'Nana' is the shorter growing provenance, very suited to amenity planting and as a maintenance-free street tree. The taller provenances are preferred for farm forestry in low-rainfall regions. It has been widely planted as a windbreak and coppiced for firewood and is now planted as a fine furniture timber. It has a durability rating of Class 1 and has a fine interlocked grain (ADD 1100 kg/m^3). An exceptionally hard, strong timber used in the round as posts and for stockyards (Boland et al. 1997). It is a blond-coloured timber and, although difficult to work, polishes to a light ginger–orange colour. Improved seed is produced from seed orchards. The foliage can cause stock poisoning.

Apiculture

Sugar gum buds form in January and are carried for about a year with flowering commencing in December and January. In many parts of Australia it is considered an excellent nectar and pollen source, producing annual yields of a choice honey. Large natural stands on Kangaroo Island provide an annual unifloral honey. The premium honey is light in colour with a delicate, sweet, fruity flavour. It may be pollen deficient and require appropriate management to prevent hive decline.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Good	Light	Good		Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Varies, poor to medium	Good	Annual

TREE

Yate

Eucalyptus cornuta

FLOWERING SEQUENCE

J F M A M j **J A S O N D**

E. cornuta's showy buds and bold yellow flowers Photo: Linda Manning

Features

Mallee to medium tree

H 3–25 m

Fast-growing. Occasionally small and bushy in poorer coastal areas, taller in cultivation. Bark on the trunk is dark brown, fibrous to deeply furrowed and smooth or deciduous on branches. Leaves are dull, blue–green lanceolate to 12 x 2 cm. Yate is known for its attractive long, thin, horn-shaped buds and its showy clusters of green to bright yellow flowers.

Origin: Western Australia.

Conditions

Climate	Temperate, hot/arid, frost hardy
Rainfall	500 mm, very drought tolerant
Aspect	Full sun, partial shade
Soil	Sandy loam to heavier clay, waterlogged soils, pH <6.5 to <8.5. Very salt tolerant, EC 800–1600 mS/m

Uses

Very ornamental: used in parks, as a street tree but drops branches, on farm for shade and as a windbreak tree. Handles waterlogged and salt-affected areas and is a salt spray–tolerant second line coastal planting. Its pale yellow–brown timber (ADD 1130 kg/m^3) is one of the hardest and strongest timbers in the world (Boland et al. 1997).

Apiculture

The honey is reported as choice, with a light to medium colour and a fairly strong flavour. It crystallises rapidly to a fine grain (Coleman 1962). Yate is not currently known, and Coleman reported in 1962 that it was almost wiped out. This could become a resurrected honey species if enough is planted. Flowering was reported by Coleman as December to February and by Florabase WA as January to May and July to November.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	High	Light medium		Rapid, fine	2 year
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			High	High	2 year

TREE

Napunyah

Eucalyptus ochrophloia
Yapunyah

Features

Small to medium tree

H 10–20 m

Napunyah's trunk is often short and can be divided into two or more large stems 3–5 m above the ground. The leaves are dull green, long and narrow to 18 x 1.8 cm. The tree is distinguished by the dark, rough bark at the base of the trunk and the smooth upper trunk, with glossy red–brown or red bark shedding in short ribbons.

Origin: Northern New South Wales, south-west Queensland.

FLOWERING SEQUENCE

j f m **A M J J A S** o n d

Napunyah woodland in south-west Queensland Photo: www. travelling-australia.info

Conditions

Climate	Hot/arid
Rainfall	Drought tolerant
Aspect	Full sun to partial shade
Soil	Sandy to heavy clay soils, temporary inundation

Uses

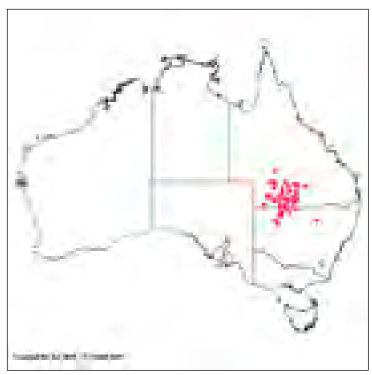
The wood is suitable for fuel, fencing, and heavy construction timber. The tree can provide light shade and is a good source of honey. Leaves can be used as fodder.

Apiculture

This is a prolific nectar producer in the Paroo River system. It is very pollen deficient and has to be supported by pollen producers such as *Muehlebeckia cunninghamii* (lignum), which may produce a honey surplus. Species that yield in drier conditions include wilga (*Geijera parviflora*), budda (*Eremophila mitchellii*) and ellangowan (*Myoporium deserti*) (Clemson 1985).

Napunyah honey is pale and clear with bright gold highlights. It has a delicate aroma with scents reminiscent of lemon tart, marzipan and almond. There is a slight tannic edge, which contributes to the lingering flavour and cuts any overwhelming sweetness (Melita 2011).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average 56 up to 200 kg/hive	Extra light amber	Very viscous	Rapid, very fine	1–2 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Poor		1–2 years



Gum-barked coolibah

Eucalyptus intertexta

FLOWERING SEQUENCE
J f m **a M J J** a s o n **D**

Features

Mallee to medium tree

H 5–24 m W 5–12 m

Fruit of *E. intertexta* Photo: Dean Nicolle.

Fast-growing. Bark is brownish and scaly and persistent on the lower trunk, irregularly to full trunk; above is grey–white to red–brown, shedding in short ribbons Adult leaves are dull greyish–green, thick, narrow lanceolate to lanceolate, to 13 x 2.5 cm. White flowers occur as a mixture of simple axillary 7-flowered umbels and terminal panicles (Boland et al. 1997).

Origin: Western Australia, South Australia, New South Wales, Queensland, Northern Territory.

Conditions

Climate	Hot/arid
Rainfall	125 mm, very drought tolerant
Aspect	Full sun
Soil	Well-drained sandy, pH 6.0 to 7.5

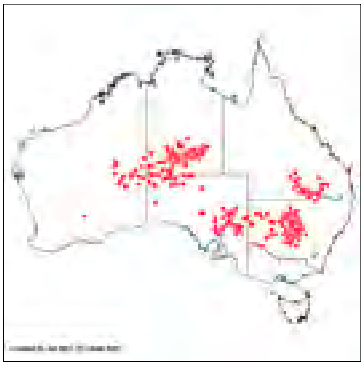
Uses

A potential tree for streetscapes and open space. Also a useful farm tree for shade, firewood and farm construction. Its red interlocked grain wood is very dense and moderately durable (ADD 1100 kg/m^3) (Boland et al. 1997). The burls from coolibah are prized by woodturners.

Apiculture

Clemson (1985) described *E. intertexta* as one of the more valuable honey producers of New South Wales. The honey is very pale, of good density and flavour. The pollen is of good quality. Boomsma (1972) noted the honey as pale amber and that in South Australia the tree produces most years.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	To 54 kg/hive	Light amber	Very good		1–4 years
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Moderate		Average	Moderate	1–4 years



Gum-barked coolibah in arid conditions
Photo: Dean Nicole


Silver banksia

Rural areas

An integrated farm forestry layout using natural features and optimising opportunity Photo: Mike Castley PFT

Planting trees on farms has become an integral part of most agricultural enterprises. Trees are planted for many reasons, among them revegetating degraded sites, erosion control, windbreaks, shade, drought fodder, managed forests, plantations and beauty. 'Farm forestry' has been a confusing term, meaning anything from large-scale industrial plantings in a farm context to alley farming or agroforestry, mixing widely-spaced commercial tree planting with agriculture. Race & Freudenberger (2003) defined farm forestry as the management of trees and shrubs integrated with agricultural systems designed for multiple products and benefits.

The species used on farms have changed over the years, from predominantly exotic conifers as windbreaks and driveway plantings to a broad palette of species. Species choice is dependent on what the site can sustain, the desired outcomes, the design, the funding source and legislation. Revegetation programs often require indigenous species or near-local species, whereas commercial plantings have tended to be limited to monoculture plantings of eucalypts or conifers.

Why plant trees at all and why plant for bees? The profitability of growing trees and native vegetation on farms is complex:

> While profit relates to the difference between costs and returns, the decision-making process for farm forestry may well go beyond

> the simple notion of the dollar return. Farm forestry provides multiple benefits from shelter, shade, control of land degradation, and increased biodiversity to improvement in capital value through enhanced landscape values. (Leech 2006)

Moreover, as Reid (2008) suggested, rather than just being a source of income, forests are a capital asset, part of the farm's infrastructure.

Somerville (2010a) emphasises that one of the most serious risks to the future viability of the Australian beekeeping industry is the loss of access to government-owned forested lands due to changes in management philosophy that exclude the keeping of bees. He also explains that smaller rural plantings will not be of any significant benefit to commercial beekeeping but that large-scale, multi-species melliferous plantings that are well-designed across the landscape will help:

> Known floral species that produce nectar and pollen should be considered in re-vegetation and other rehabilitation projects. This should not only include larger tree species but also shrubs and understorey plants known to contribute to the overall volume of nectar and pollen available. (Somerville 2010a)

In times past inclusion of melliferous species in the planting mix would rarely have been considered. However, with increased global awareness of the need to maintain healthy honeybee populations and a move towards bio-richness in rural land management, opportunities for broad-acre on-farm melliferous planting are emerging (Murphy 2009). Recent initiatives could provide vast areas of improved bee forage. Projects include biofuel farming of mallee species, perennial shrubs and herbaceous plants for animal fodder, carbon farming, alley farming and landscape restoration. Some of the species proposed are known as good bee forage, producing regular yields of high-quality honey and pollen. In the case of oil mallee farmed for biofuel examples are green mallee (*Eucalyptus viridis*) and mallee box (*E. porosa*) (Turnbull 2010a, 2010b; Boomsma 1972). Perennial shrubs used for fodder in grazing systems that are also potential bee forage include mallee saltbush (*Rhagodia preissii*) and river saltbush (*Atriplex amnicola*) (J Emms 2011, pers. comm.). Recent work on tedera (*Bituminaria bituminosa*) demonstrates a similar capacity for the introduced perennial legume (D Real 2011, pers. comm.).

The Partners for Sustainable Pollination Bee Friendly Farming logo Photo: Kathy Kellison

An innovative program in the United States, Partners for Sustainable Pollination, or PFSP, aims to improve farmers', land managers' and gardeners' awareness of good bee forage. They promote the concept of 'bee pasture' as a composite not only of annuals and perennials but also of shrubs and pollen- and nectar-producing trees (K Kellison 2010, pers. comm.). PFSP collaborates with beekeepers, growers and scientists to improve the health of honeybees and support native pollinators. The self-certification Bee Friendly Farming™ initiative, an outreach program primarily promoted by PFSP, educates consumers and encourages support for land management practices aimed at healthy honeybees and improved populations of native pollinators. The program realises the value of smaller scale plantings and understands that larger scale landscape plantings are needed to adequately meet the nutritional needs of managed honeybee colonies (PFSP 2009).

The Trees for Bees program, initiated in 2009 by the Federated Farmers of New Zealand, Landcare Research and the Oceania Pollinater Initiative, has adopted a catchy slogan—'Smart Farming for Healthy Bees'—to encourage bee-friendly land management. The program has produced 10 brochures, one for each of New Zealand's regions, identifying both native and exotic plants that are suitable non-weed bee forage.

Planting design

The design of any on-farm planting should take account of the whole property as well as the catchment landscape. Choosing to plant melliferous plants may require a rethink of the planting layout and design for optimisation of flowering potential and bee access. If planned sympathetically with the retention of existing native vegetation, farm forestry can produce significant conservation benefits (Salt et al. 2004).


A melliferous planting in the Canberra region Photo: Des Cannon

> On farm tree planting projects to provide shelter for livestock, protect water quality, stabilise riparian areas and provide windbreaks all provide opportunities to choose floral species that have multiple uses. Selecting reliable nectar and pollen-producing flora will increase the floral resource to honeybees and provide a food source to encourage the establishment and retention of native nectariferous animals including birds, mammals and insects. (Somerville 2010a)

Native forests

Australia's private native forests, both freehold and leasehold, make up about 70% of the nation's forested cover of 147 million hectares. Most of them have a history of exploitation since European settlement and are generally not well managed. Private native forests are a very important resource, environmentally, socially and economically. They provide essential environmental services and continue to contribute significantly to Australia's wood supply. They are also of fundamental and increasing importance to beekeepers, providing a broad range of native flora and hive sites, including winter and breeding sites.

Often neglected, our private native forests can be managed to provide enhanced flowering opportunities for the honey crop trees. Thinning and selective harvesting open up the canopy and provide space for crowns to expand, offering increased flowering opportunities. New silviculture systems introduced into state-managed wet forests in Tasmania's 'aggregated retention' have demonstrated increased flowering of leatherwood (*Eucryphia lucida*) where it is adjacent to an open area (Leech 2005).

Native forests in good condition generally have an abundance of species in the understorey, often providing pollen-producing plants that support the honey flows of many of the dominant eucalypts, which can be pollen deficient. Maintenance of a healthy understorey in private native forests requires careful stock management and often lengthy periods of stock exclusion. However, careful grazing in some forest types can be beneficial and provide necessary disturbance for the regeneration of some species. 'Lock it and leave it' is not often good management: it can result in overstocking, reduced regeneration of understorey species and increased fire hazard.

In parts of the United States forests are managed to favour trees that honeybees particularly like, such as basswood (*Tilia americana*) and black gum (*Nyssa sylvatica*), providing extra light, water and nutrients for those trees, as well as exposing the crowns to maximise the surface area for flower production (Hill 1998).

Well-planned farm shelter Photo: Mike Castley PFT

Shelter

Windbreaks and shelterbelts at least 3 rows wide and 20 times tree height (TH) in length provide effective reduction in wind speed, can reduce transpiration and erosion, improve temperatures, minimise stock and crop losses and improve pasture, stock and crop productivity. Planting wider, multiple-species shelterbelts with an understorey component and introducing some 'ground wood' can significantly increase on-farm biodiversity. If there is a focus on choosing a variety of melliferous flora, a significant contribution can be made to bee health and honey production.

Farm shelter gives another opportunity for increasing bee forage as one of the multiple benefits provided by improving on-farm native and exotic vegetation. While planting native species tends to produce the greatest biodiversity benefits, even monoculture plantations have more biodiversity than pasture (Race & Freudenberger 2003).

Simple design principles suggest an effective reduction in wind speed out to 20H and a minimum length of 20H and a wind porosity of 50%. Multiple species, including melliferous timber-producing species and fodder shrubs with some quality pollen plants in an understorey or edge planting, will provide benefits for biodiversity, timber or firewood and bee forage. Shelterbelt width should not be less than three rows to a maximum of eight, ideally replicated across the property at 20H intervals. Farm machinery access should be considered for between-row management. Effective fencing is important, especially in the early establishment phases and to manage grazing if fodder trees or shrubs are grown.

Pollen- and nectar-producing shrubs should preferably be planted on the leeward side of the plantation, gaining shelter from the wind. However, where this coincides with the south side, shading in spring can cause problems with flowering and nectar production, although it could provide benefits in hotter climates with summer-flowering species. The design of windbreaks should take account of the prevailing winds, temperatures and flowering times.

Thinned *Eucalyptus nitens* 'Elverton', Blessington, Tasmania Photo: Mark Leech.

Traditional plantations

Plantations are typically planted on farm for wood production with a single or limited number of species and are planted relatively close together to give the trees better form for sawn wood production. Even if the species planted is a preferred nectar- and/or pollen-yielding tree, the tree spacing is too 'tight' to allow full crown development and optimal flowering. However, there may be some benefit from edge trees with crowns developing on the outside edge. If the plantations are short-rotation pulpwood plantations it is unlikely that they will be of any benefit to beekeepers. Somerville (2010a) noted short-rotation plantations with harvest cycles of 8 to 15 years are unlikely to have entered a regular flowering pattern and will be of little use to managed honeybees.

Longer term sawlog rotations may provide pollen and nectar resources if the species planted are melliferous and management of the plantation provides for an increase in tree crown growth. An increase in crown architecture is achieved by progressively thinning plantations, with crown space becoming a lead decision criterion, optimising total crown surface area and flowering. The diversity of bee forage could be increased in plantations by under-planting, with appropriate understorey plants providing pollen and nectar in support of the targeted plantation species. The outer edges of plantations can also be planted with melliferous species; this could be more economically achieved by direct seeding a species such as prickly box (*Bursaria spinosa*), a prolific seed producer and a species that can produce high yields of nectar given appropriate climatic conditions (J Wolfhagen 2010, pers. comm.).

Improving biodiversity outcomes

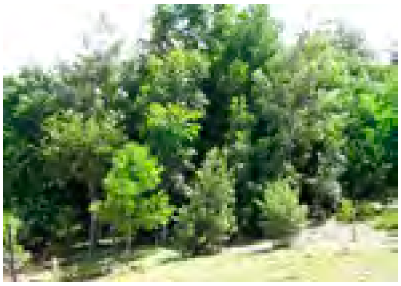
Work by CSIRO has shown how farm forestry biodiversity can be improved. The studies suggest that the habitat values of commercial plantings can be improved by establishing mixed-age stands; increasing rotation length; planting buffers of local native trees, shrubs and grasses; including in their plans native streamside vegetation or incorporating old native trees with hollows and fallen timber; and targeting plantations near isolated patches of native forest to improve habitat connectivity (Polglase 2008). Planting decisions influenced by melliferous flora choices will offer benefits for honeybee populations and contribute to improved biodiversity.

Revegetation

There may be opportunities to enhance remnant vegetation in areas that are marginal apiary sites. As well as improving the ecosystem services provided by native forests, a focus on preferred melliferous species or those present in the remnant could ultimately improve the honey and pollen yields and make the site viable. Such approaches to restoration and improvement are long term. Many eucalypts do not flower significantly for 10 to 15 years and are unlikely to provide commercial returns for many years after the costs of planting and fencing have been incurred.

Bio-rich plantations

Murphy (2009) introduces the concept of bio-rich plantations for creating sustainable 'natural' forest units on farmland. The goal is to establish areas large and diverse enough to be self-regenerating, with longevity of 200 years. This concept of planting design provides a means of introducing diverse bee forage providing both pollen and nectar flowering at different times. If the areas are large enough, it could be a step towards non-migratory beekeeping.



A biodiverse farm planting in southern Queensland Photo: Private Forestry Service Queensland

Restoration of ecosystem services involves conserving and enhancing the ability of native vegetation to regenerate. Natural regeneration is a complex interaction of climate, soil conditions, the availability of propagules (fungal spores, plants seeds and suckers) and reduced levels of competitors and predators (Freudenburger & Langston 2006). While considerable research needs to be done to more fully understand complex regenerative mechanisms and biodiverse associations, natural regeneration is the most cost-effective long-term vegetation management on farms.

Riparian zone: a bee forage opportunity

Access to clean water is vital for intensive grazing industries and the wider community. Improved management of riparian zones and associated biodiversity can contribute to better on- and off-farm water quality (Jones-Lennon & Aarons

2004). Significant efforts have been made in the nation to improve watercourse management by fencing and revegetation. Some planted species will be of benefit to honeybees. There remain, however, large areas of unplanted riparian zones in the streamside reserves in tree plantations on formerly cleared agricultural land. Environmental codes of practice for the forest industry require varying widths of reserves, often dependent on stream classification according to catchment size. These unplanted areas can exceed 30 m in width on either side of a watercourse and take up significant amounts of space.

These unplanted areas could be revegetated with bee forage and in many cases are well suited to *Leptospermum* spp., offering potential for establishing high-value bioactive plantings and a long-term solution to weed problems. Streams also provide unhindered flight paths for bees—an apparent win–win solution.

Horticultural crops

Research in Queensland by CSIRO has shown that revegetation with native species in horticultural cropping areas can assist with natural pest management (Schellhorn 2007). A further benefit is the potential bee forage that native vegetation provides, which can increase the pollinating bee populations. Species can be chosen that provide appropriate gaps in the flowering sequence as well as beneficial pollen and nectar resources.

Grazing systems

Semi-arid land provides significant melliferous resources for the apiculture industry, with the public mallee lands of Victoria reportedly producing one-third of the state's honey crop (Land Conservation Council 1989).

Intensive grazing systems and changes to agricultural practice have often been the cause of loss of traditional bee forage. Cell grazing and plant breeding in dairy systems have reduced the availability of white clover for the once prized 'white' honey it yields. A new approach to extensive grazing in the semi-arid zone that uses some of the intensive approaches of 'crash' grazing could provide extensive bee forage in more arid grazing lands. The Enrich™ grazing systems project in Australia is evaluating a range of related activities for the potential to incorporate Australian native shrubs in livestock crop farming systems (Revell et al. 2008).

Enrich™ program Stage 2: *Rhagodia preissii* in flower Photo by Jason Emms

The Australian native flora possesses much greater diversity of plant functional types than occurs in our typical agricultural systems. By using different functional types such as grasses, herbs, shrubs and trees, there is an opportunity to occupy different ecological niches within a complex plant community since these differing plant types can exploit limiting soil resources such as water and nutrients to different depths and grow and flower at different times of the year (Revell 2008). This on-farm initiative could provide extensive year-round flowering and a significant new melliferous resource.

Carbon farming a potential incentive?

The potential for long-term plantings to provide carbon sequestration and storage could constitute an incentive for land managers to plant bee forage that provides fodder, crop and environmental services. Carbon schemes requiring long-term commitments could encourage planting of long-lived bee forage trees that will ultimately yield high-value timber, offering such attributes as second-life stored carbon in furniture and housing.

The Autralian Government Department of Climate Change and Energy Efficiency initiated the development of a carbon offsets scheme (DCCEE 2010). The Carbon Farming Initiative is to provide new economic opportunities for farmers, forest growers and landholders and help the environment by reducing carbon pollution. New Zealand farmers and farm foresters are planting trees and shrubs that will give a carbon benefit under the NZ Emmissions Trading Scheme and could underwrite a honey crop. The NZ National Buisness Review (2010) reports that:

> Planting manuka on 100 ha with a carbon price of $25 will yield a return of $300 000 … this could underpin a manuka honey business with top grade active manuka fetching $50/kg and ordinary $12/kg. (NBR 2010)

Funding opportunities

Rural landowners will adopt new opportunities if there are triple-bottom-line benefits. Rural innovators and opinion leaders are often implementing pioneering work before the establishment of government incentives and are often the leaders of change in their social networks (Rogers 1995). While government incentives offer some form of 'leg up' they are not a sustainable economic platform. Triple-bottom-line outcomes provide for economic, social and environmental value.

A hypothetical example of uptake for multiple benefits would be the adoption of melliferous perennial shrubs and herbs for land restoration, stock fodder, bee forage, tradeable stored carbon and tradeable biodiversity credits. Programs such as Enrich™, introducing perennial shrubs into fodder systems, demonstrate that alternative farming systems can benefit farm economics (Wallace 2010). While adoption and uptake may pose difficulties with the intial capital investment and a short-term production decrease, there is huge potential for the program to develop in arid-land grazing areas and potentially higher rainfall country (J Emms 2011).

Private joint ventures, leases and other arrangements

Funding trees on farms may come from private external sources if a sound business case can be demonstrated. Opportunities exist for the development of private joint ventures for timber production where the parties provide different inputs for a share of the final crop. Different computer models have been developed that account for the input and output share of the parties (Private Forests Tasmania 2007). This opportunity could expand in the future to include tradeable rights and options such as stored carbon, emissions reduction through changed management, biodiversity or environmental services credits, even forests planted for high-value bio-active honey production. There could also be a market for environmental philanthropy to increase diverse bee forage through establishing large areas of bio-rich farm forests.

This is already happening in New Zealand, where farmers lease manuka sites to beekeepers, farmers and investors planting manuka for both carbon sequestration and honey production. In some cases farmers are paid a per-hive fee and receive a share of the crop (usually 10–20%). In other instances the farmer owns the hives while the beekeeper provides hive management and the crop is shared. There are many models that could be used, but it is most important that the parties are clear about their roles, commitments and returns. A simple contract to protect all parties is advisable.

Regulation

All states and local government authorities have differing legislation, codes of practice and requirements relating to vegetation establishment and management. The role of local government authorities varies widely across Australia. In most cases they are responsible for land use planning and may require landowners to obtain a permit before establishing or harvesting trees. Land managers and landowners are encouraged to contact their local government authorities to determine the approvals that are required.

There remain some conflicts about sustainable land use, particularly in relation to riparian zones, their protection and use (Smethurst 2008). Riparian zones offer large tracts of land that are often in great need of revegetation and provide excellent opportunities for bee forage.

Fire

While in many parts of Australia wildfire is inevitable, it does not necessarily mean disaster or total destruction. In extreme fire weather most species will burn and most fences and tree guards will be destroyed, at least in part. However, in less extreme conditions, good preventive work can save a planted investment. Well-constructed and -maintained firebreaks are fundamental, providing firefighting access and a defensible line from which to work. Fuel management aims to reduce the fuel load. Fuel can be reduced by grazing, mowing, cultivating, herbicide application, controlled burning or any practice that influences what grows on the site (Cremer 1990). Dams and access to water are also important, although this can be problematic in arid areas.

Species selection is more complex. Most Australian drier forest species are well adapted to mild wildfires, having regenerative mechanisms that ensure the survival of the species and population. These may be lignotuberous root systems or epicormic shoots—the 'green sprouts' we often see on blackened tree trunks not long after a fire event.

Landowners and managers are advised to develop and implement a fire management plan that identifies and removes or reduces fire risks on their property and encourages recovery after a fire (CFA 2007). They should contact their fire authority to find out about their legal responsibility for managing fuels, establishing firebreaks and controlling fires.

Direct seeding is a good low-cost way of establishing biodiverse vegetation Photo: Mike Castley PFT

Establishment methods

Successful establishment of plants or seeds is essential, be it in a garden or over hundreds of hectares. Detailed advice is available from gardening, revegetation and farm forestry books, websites, nurseries, agriculture departments and consultants. Establishment is part of an ongoing process of management and starts with good site preparation, which may begin the season before planting with weed control—mechanical, chemical, biological, grazing, fire or a combination thereof. Early weed control is best, and neglect of weed management can have disastrous consequences. Notwithstanding, weed management can include using weeds as shelter or nurse plants, minimising costs without compromising longer term outcomes. Such practices can also provide a bee forage benefit. Indeed, the questions of weed management and what is a weed need careful consideration. Many of the best pollen and nectar plants are weeds somewhere in the world, and the Australian honeybee industry relies on environmental weeds such as Paterson's curse, willows and gorse. The author does not advocate the planting of weeds but recognises their current importance to the beekeeping industry.

Direct seeding is a method of relatively cheap establishment often used in revegetation projects. It greatly increases the capacity of an operator to establish vegetation, reducing the costs of providing biodiverse and productive farm outcomes (Bird 2000). Seed is easier to handle than seedlings, and a mixture of trees, shrubs and groundcovers is more easily direct seeded than planted as seedlings. Direct seeding may involve the collection and use of local species, which provides an additional benefit. Differing rates of germination mean that the establishment process is closer to natural regeneration, thus providing better habitats for wildlife. However, direct seeding is not suited to all sites since it requires good follow-up rain and is perhaps less reliable than planting (Holt 1999; Castley 2008).

Planting seedlings also calls for good planning, advanced weed control, the right choice of species and advanced ordering from a nursery. Cultivation may simply involve spade planting, or it may require deep ripping and ploughing. Planting should be done when the ground is moist and there is a high likelihood of follow-up rains. Planting and preparation require more site-specific advice.

All established plants, regardless of the establishment method, need protection from browsing wildlife and domestic stock. Appropriate fencing is another subject requiring specific advice since it relates to the type of animals being excluded, budgetary constraints, and availability of materials, equipment and labour.

Species choice for enhancing bee forage

The species presented in the following pages provide a limited choice and are by no means the only species. The decision criteria for species choice will vary with each landowner, beekeeper and site. Many species have a very narrow natural range but are grown widely outside that range. When introducing something new it is important to determine its weediness, its ability to grow in the site's conditions, and whether it meets additional criteria such as some or all of the following:

- **beneficial bee forage—**nectar only, pollen only, or both
- **suitability for the site conditions—**including rainfall, temperature, frost, wind, salt air, soil pH, fertility, salinity, drainage composition and soil structure
- **amenity—**what the plant will ultimately look like (size, shape, colour, flowers and fruit)
- **growth rate**
- **longevity—**a short-lived plant or one that will provide benefits for generations
- **time—**until first flowering
- **flowering season—**regularity and length
- **fruit—**edible by humans and/or stock
- **fodder—**provision of fodder for stock and at specific times of the year
- **wood—**provision for making objects, construction timber or fibre
- **fuel—**utility as conventional firewood or biofuel
- **carbon—**compatability with the carbon scheme
- **maintenance and management—**relatively maintenance free or needing ongoing attention

- **other benefits and uses—**such as cut foliage and flowers, seed and essential oils.

The importance of a good diet for bees must be emphasised. Somerville (2002) has explained that planting three or more pollen producers that will flower at the same time provides insurance should any one fail in a particular season. While some trees can be relied on to produce regular high-quality crops of honey, they can lack certain other characteristics. For example, mugga (*Eucalyptus sideroxylon*) is pollen deficient and good pollen support is needed through other plants flowering at the same time or immediately after it. Sufficient pollen producers with pollen not lacking any essential nutrients will ensure strong hives and optimum honey harvest. Rhodes and Trueman (1999) noted that good pollen sites are valuable to beekeepers, helping to provide large, long-lived bee populations.

Rural species

The following pages detail the native and exotic species that were chosen to represent a selection of useful bee forage for rural areas. They are organised according to climate categories:

- cool
- temperate
- warm/humid
- hot/arid.

Cool climate rural species

The following table summarises the rural species selected for cool climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Fagopyrum esculentum*	Buckwheat	C	G F	N			●	●	●								
	Perovskia atriplicifolia	Russian sage	C T	G F	n	p	●	●	●	●								
	Agastache foeniculum	Anise hyssop	C T W H	F	N	P	●	●	●	●								●
	Trifolium repens	White clover			N	P	●	●	●					●	●	●	●	●
SHRUB	*Bursaria spinosa*	Sweet bursaria	C T H	G U F	N	P	●	●	●							●	●	●
	Banksia marginata	Silver banksia	C T	G U F	N	P	●	●	●	●	●				●	●	●	●
	Leptospermum scoparium	Manuka	C T	G S U F	N	P	●	●								●	●	●
	Daviesia ulicifolia	Gorse bitter pea	C T W H	G U F	n	p							●	●	●	●	●	
TREE	*Eucalyptus globulus*	Tasmanian blue gum	C T	U F	N	P	●	●				●	●	●	●	●	●	●
	Eucalyptus crebra	Narrow-leaved ironbark	C T W	F	N	P								●	●	●	●	●
	Eucalyptus macrorhyncha	Red stringybark	C T H	F	N	P	●	●	●	●								
	Eucalyptus bridgesiana	Apple box	C T	F	N	P	●	●	●	●								

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producing plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Buckwheat

Fagopyrum esculentum

FLOWERING SEQUENCE

j **F M A** m j j a s o n d

Features

Annual crop

H 100 cm

Bees visit buckwheat early in the day
Photo: Danis Derics/Shutterstock.com

A fast-growing annual crop that is widely planted in the northern hemisphere. It does well on low-fertility, acid soils. It is neither a cereal nor a grass but instead the seed of a fruit. Flowering starts 4–6 weeks after sowing and can continue for 4–15 weeks.

Origin: Siberia, Central Asia.

Conditions

Climate	Cool, frost tender
Rainfall	700 mm
Aspect	Full sun
Soil	Light to medium textured well-drained soils; sandy loams, loams and silt loams

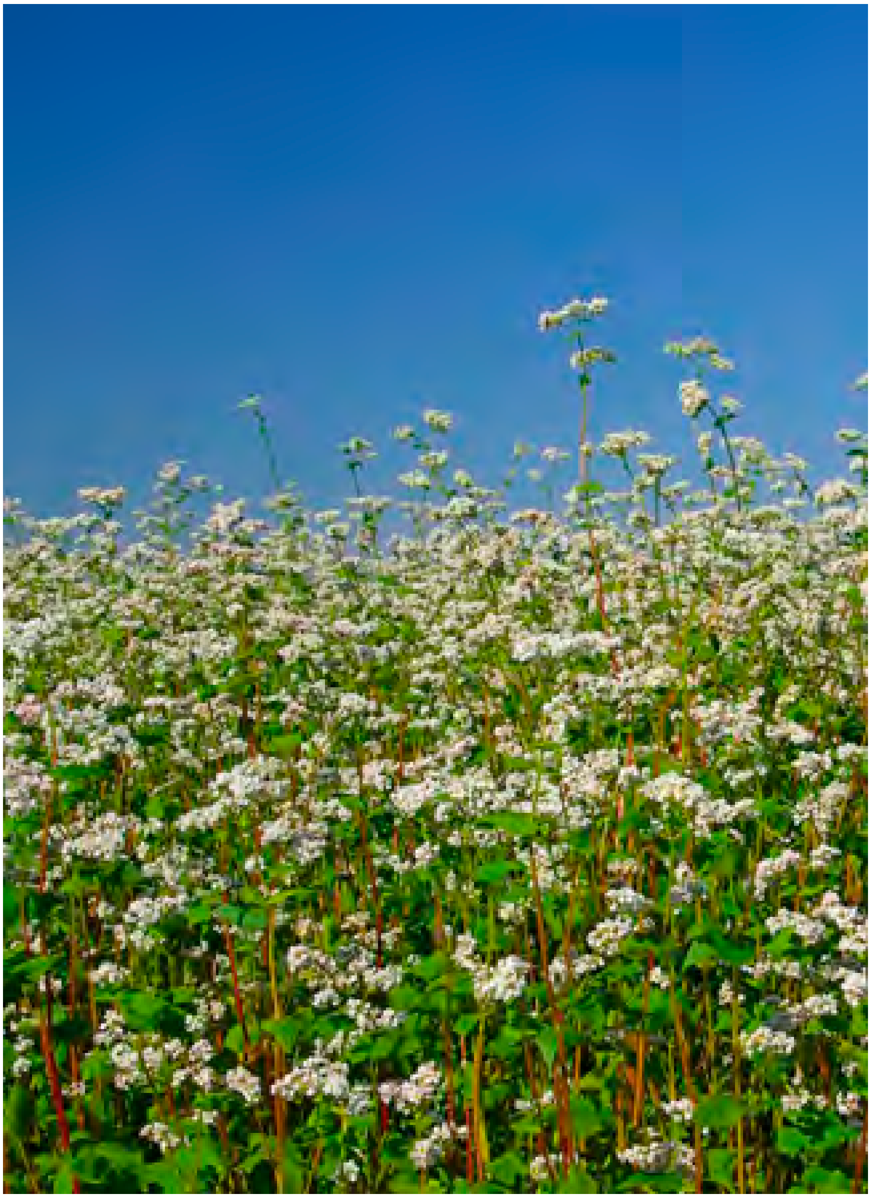
Uses

Buckwheat has become a prized grain: it is gluten free and known as the 'meat of the fields' for its high protein content. It is a significant crop in Russia and China. It provides good green manure, breaking down rapidly once ploughed in.

Apiculture

Buckwheat flowers are very fragrant and are attractive to bees. The honey is strongly flavoured, dark and full bodied. It is highly favoured in the United States, attracting a premium price. It has a sharp, spicy aroma and taste with bitter tones. The scent of wood and clay is characteristic, with a powerful malty, molasses flavour (www.honeytraveler.com 2011). Nectar flow is promoted by adequate moisture combined with clear, still days and cool nights. Normally the plant only yields nectar in the morning, creating a hive management difficulty and angry bees in the afternoon.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	68 kg/hive 50–500 kg/ha	Dark	Dense	Fast	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**



A field of buckwheat Photo: LianeM/ Shutterstock.com

Russian sage

Perovskia atriplicifolia

FLOWERING SEQUENCE

J F M A m j j a s o n d

Russian sage is a bee magnet Photo: Wouter Hagens

Features

Perennial herb

H 1.2 m W 1.5 m

Drought tolerant, salt spray and wind tolerant. Russian sage is neither Russian nor a sage but is named after a Russian general. It is of the mint family from south-west and central Asia. It thrives in sunny positions and requires little maintenance. Foliage is aromatic greyish, silver–green and the flowers are woolly spires of mauve/blue to pale blue. It should not be overwatered or fertilised as it will grow lanky and lose its bold blue colour. It also provides a wonderful winter show of silvery skeleton-like stems. Best managed by pruning back to the base after flowering.

Origin: Afghanistan, Pakistan.

Conditions

Climate	Cool, temperate, tolerates extreme cold, very frost hardy
Rainfall	Extremely drought tolerant
Aspect	Prefers sunny position
Soil	Most well-drained soils

A field of *P. atriplicifolia* Photo: Jura/ Shutterstock.com

Uses

A very ornamental garden shrub with its floral flush and its wonderful fine frame of silver–grey stems contrasting with other garden plants to great effect. It is a good frontline coastal plant. It can be dried for potpourri. The flowers are edible and may be used in salad, but the leaves are inedible. It is a potential broad-acre bee forage plant.

Apiculture

A bee magnet. It is very attractive to bees but there is little information on its pollen and nectar value.

HERB

Anise hyssop

Agastache foeniculum

Features

Perennial herb

H 90–150 cm   W 30 cm

Fast growth rate. An erect, hardy perennial. The dark green leaves are prominently veined, ovate to lanceolate with a fine, white, hairy underside, to 7.5 x 5 cm. It produces dense spikes of small blue to purple flowers to 10 cm. The plant is neither a mint nor a liquorice species, the name most likely coming from the flavour and aroma of the plant. Both the flowers and the leaves are edible and widely used. Propagation is by seed or basal cuttings.

Origin: North and Central America.

FLOWERING SEQUENCE

J F M A m j j a s o n **D**

Even with few flowers the spikes still look colourful Photo: Wayne Ray

Conditions

Climate	Cool, temperate, frost hardy
Rainfall	Drought tolerant
Aspect	Full sun
Soil	Well-drained, light sandy to medium loams, pH <6 to >7.5

Uses

This is a 'must have' plant in the kitchen garden, with flowers and leaves that combine liquorice flavour with mint—a sweet rather than spicy flavour. It is used to garnish fruit salads, for iced tea and tea, and where anise spice would be used. It is proposed as a bee forage farm plant. Unless its nectar-yielding properties are known for a given area, it is recommended that a number of varieties be grown in a trial plot on farm to see what actually works since the literature indicates a lot of variation in honey yield (plants.bees.net 2011).

Apiculture

Anise hyssop has a boom-and-bust history as a bee forage plant in the United States. After a number of studies to determine its productivity, it is now considered an exceptional bee forage plant (plants.bees.net 2011). It has a relatively long flowering period and produces copious amounts of nectar and pollen. It is important to select varieties that have shorter nectar tubes to favour foraging by *Apis mellifera*. The honey is of light colour and delicate flavour,with a dense body and a wonderful aroma.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	430 – >3000 kg/ha	Very light	Heavy body	Medium	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		White		High	Annual

HERB

White clover

Trifolium repens

Dutch clover

FLOWERING SEQUENCE

J F M a m j j **A S O N D**

Features

Herbaceous annual or perennial legume

H 7.5 – 50 cm

A field of white clover Photo: Laitr Keiowi/shutterstock.com

Fast growth rate. A prostrate, spreading, soft herbaceous legume. With a stoloniferous growth habit, the creeping stems bear rich green compound leaves with 'heart'-shaped, finely serrated leaflets to 20 x 20 mm. Leaflets may be marked with a white crescent. Leaves and roots develop at nodes along the stolon. The rounded flower heads consist of 40–100 pea-shaped white to pinkish florets each to 9 mm long. White clover requires good rain and soil moisture to bloom prolifically.

Origin: Mediterranean, now widely spread and naturalised.

Conditions

Climate	Cool, temperate, warm/humid
Rainfall	750 mm, requires good summer rain or irrigation
Aspect	Full sun
Soil	Well-drained heavier, moisture-retaining, pH >4.5

Uses

White clover is a very important agricultural pasture species, widely grown in the temperate world. It is used for grazing, pasture hay and groundcover in horticulture. *T. repens* is highly important in the dairy, meat and wool industries, where it greatly increases yields because of its high nutritive value (OGTR 2008). White clover can increase soil nitrogen due to the relationship with the nitrogen-fixing bacterium *Rhizobium trifolium*.

Apiculture

Flowering time depends on where white clover is within its range—in Australia's southern climate from November to March and northern, warmer climates from August to October. Changed grazing practices, pasture mixes and fertiliser use have reduced the once dominant clover honey production, although clover honey remains a major contributor to honey output. It tends to be the honey standard—the honey we think of as honey.

Clover honey is light coloured, tending toward light amber depending on where it is harvested. Its aroma is delicate, sweet and flowery with hints of freshly cut grass or hay, suggestive of spicy cinnamon and plums. Its taste is clean, mild and very sweet and lingers in the mouth. The honey crystallises quickly into a fine-grained solid white mass. For this reason it is often creamed (www.honeytraveler.com 2011).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	37 kg/hive	Extra light	Weak	Rapid to fine	1–2 year
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Moderate to high		Average 22.1 to 25.9% cp	Moderate to high	1–2 year

White clover's classic ball of little flowers Photo: Martin Fowler/ shutterstock.com

SHRUB

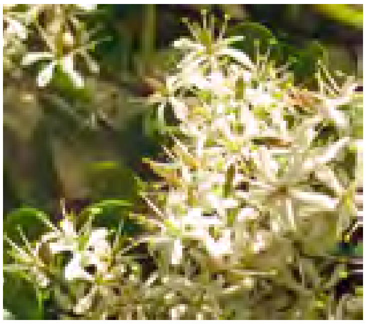
Sweet bursaria

Bursaria spinosa

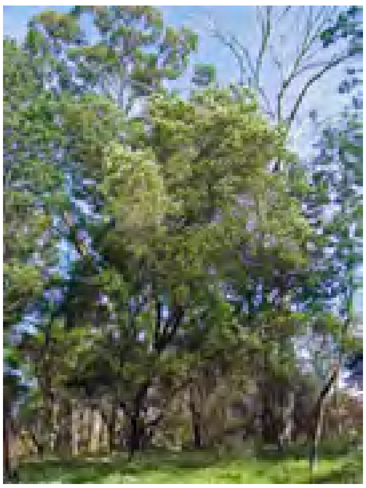
Prickly box, blackthorn, Christmas bush

FLOWERING SEQUENCE

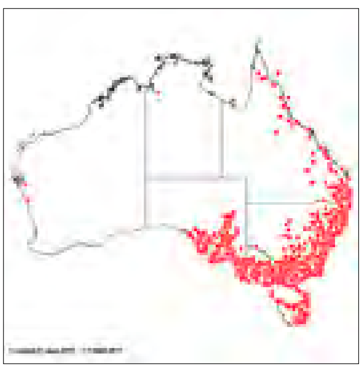
J F M a m j j a s **O N D**



B. spinosa, a mass of sweet aroma Photo: Mark Leech



B. spinosa in open forest Photo: Mark Leech



Features

Shrub to small tree

H 2–9 m

Fast growth rate. Prickly box is found growing across the nation, apart from in the Northern Territory. Its name derives from the thorns that cover this tall shrub. The bark is very dark in colour and scaly. The leaves are small and oval in shape to 4.5 x 1.2 cm, while the fruits are flattened heart-shaped capsules—'bursa', meaning pouch. When flowering, *B. spinosa* is covered in dense pannicles of small white flowers to 1 cm in diameter, at the end of branches that have a pleasant sweet fragrance.

Origin: Western Australia, South Australia, Victoria, Tasmania, New South Wales, Queensland.

Conditions

Climate	Cool, temperate, hot/arid, frost hardy
Rainfall	250 mm, drought tolerant
Aspect	Full sun, part shade
Soil	Well-drained various, rich alluvial to low fertility

Uses

Sweet bursaria is not commonly planted but has great potential both in gardens and on farm. It could potentially be used as a hedge as it is quite dense, as well as hardy and frost resistant. When cultivated, it can be very compact. It also has the potential to be direct-seeded as low shelter in farm forestry shelterbelts. The wood is very dense and almost white, is tough and fine grained; it seasons well but its uses are limited by its small size. The leaves contain the oil aesculin, which absorbs ultra-violet light. *B. spinosa* is a very important wildlife plant, attracting insects and providing habitat for small birds.

Apiculture

B. spinosa can provide a significant yield of honey when weather conditions and ground moisture are favourable. Yields of over 100 kg/hive have been achieved in Tasmania within a few weeks (J Wolfhagen 2008, pers. comm.). The honey must be extracted as soon as the bees cap the cells or it sets like rock and can only be used as bee food. It produces one of the finest creamed honeys, with a delicate aroma and pale buttery colour.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	>100 kg/hive	Yellow	Good	Very rapid, fine	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Medium	Yellow	Good	Medium	Annual

SHRUB

Silver banksia

Banksia marginata

FLOWERING SEQUENCE

J F M A M j j a **S O N D**

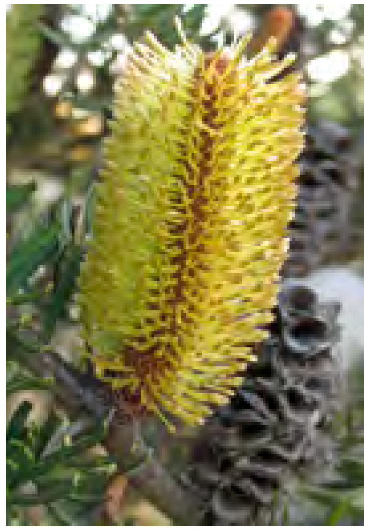
Features

Shrub to small tree

H 1.5–12 m   W 5 m

Moderate growth rate. Rounded shrub to small, straggly tree. Leaves 5 x 1–2 cm with a dark green upper surface and a silvery underside. The flowers form a greenish–yellow cylindrical spike to 9 cm. Plant occurs in varying habitats from sea level to more than 1000 m. It is phosphorus intolerant and susceptible to the rootrot fungus *Phytophthora cinnamomi*. It can be pruned to a single stem.

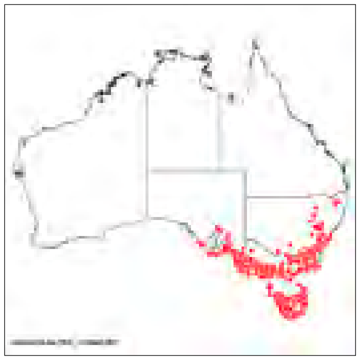
Origin: Tasmania, Victoria, South Australia, Australian Capital Territory, New South Wales.



Banksia flowers are very attractive to honeybees and other insects and birds
Photo: Mark Leech

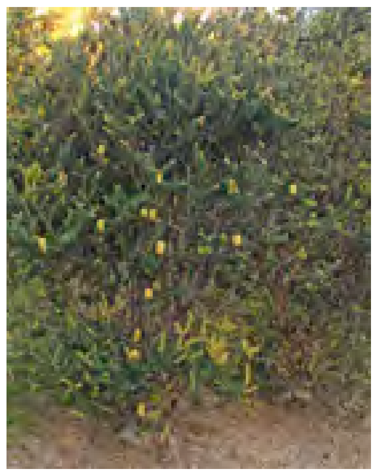
Conditions

Climate	Cool, temperate
Rainfall	500 mm, drought tolerant
Aspect	Full sun to partial shade
Soil	Well-drained various, tolerates waterlogging and alkaline conditions



Uses

A very hardy plant able to withstand severe conditions—drought, wind and salt spray. It is a useful component of windbreaks and farm shelter and for stabilising sand. It can be used in gardens and parks. The wood has a reddish–brown heartwood, is coarse grained and soft, with a prominent medullary ray. It is difficult to dry due to shrinkage but, once dry, is exceptionally stable. Good for small decorative objects and turnery. The dead wood makes the best fuel for the beekeeper's smoker, the smoke given off being clean, cool and of not unpleasant odour (Beuhne 1922).



The typical straggly form of silver banksia
Photo: Mark Leech

Apiculture

Silver banksia is a useful spring and autumn species that yields lower quality pollen. Good nectar and pollen yields are possible after soaking autumn rains.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	0–20 kg/hive	Dark amber		Fast	Occasional
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Cream white	Average	High	Annual

SHRUB

Manuka

Leptospermum scoparium

FLOWERING SEQUENCE

J F m a m j j a s **O N D**

Features

Shrub to small tree

H 2–7 m W 2 m

L. scoparium Photo: Mark Leech

A fast-growing plant forming dense scrub on formerly cleared land. It has been developed into many commercial ornamental cultivars, usually with pink to red flowers.

The original plant has white flowers, 5 petals 1–2 cm across, massed along the stem. Leaves are narrow, pointed 1–3 cm long. Very hardy. Propagation from seed and cuttings.

Origin: Tasmania, Victoria, New South Wales, New Zealand.

Conditions

Climate	Cool, temperate
Rainfall	550 mm
Aspect	Full sun
Soil	Well-drained to imperfect drainage from sandy loams to heavy clays

Uses

Commonly called tea-tree, manuka has been used as a tea substitute and acclaimed as a tea of excellent quality. For the best flavour, it must be brewed longer than normal black tea. It makes a very useful hedging plant in gardens, parks and on farm. Its potential as a bee plant for the production of high-value medically active honey is of great interest. Farmers in New Zealand lease large tracts of manuka stands to beekeepers, a great use of poorer agricultural land. Manuka can also be used for carbon farming and is useful for erosion control and site rehabilitation.

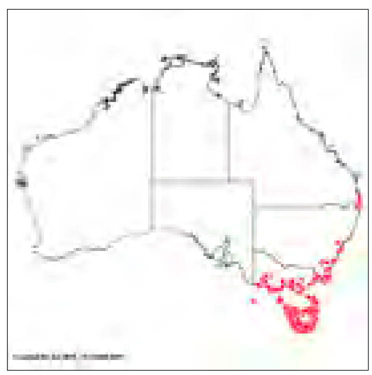
Manuka is a rapid primary coloniser
Photo: Mark Leech

Apiculture

Manuka honey has become one of the most sought after and valuable honeys in the world. It has long been known as an exceptional 'healing' honey and is now scientifically identified as a potent antimicrobial. New Zealand manuka is well-known, and there are identified sources from Australian populations. This requires more research. Honeytraveler.com (2011) offers a good description:

> Manuka honey is a distinctively flavoured honey with thixotropic properties. This means that it is gel-like in liquid form, and becomes less solid when stirred or shaken. It is slow to granulate and forms coarse crystals, for this reason it is often creamed. Its colour is dark cream to tan or dark brown. It is aromatic with damp earth and heather notes and a cool menthol (or eucalyptus) taste and rich flavour of mineral, barley sugar and herbs. It is medium sweet with a slightly bitter aftertaste. In its creamed form, the honey has a cool, smooth feel in the mouth. It is particularly good as comb honey.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	3–20 kg/hive	Dark amber	Thixotropic	Slow, coarse	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Muddy white	Average	Average	Annual



SHRUB

Gorse bitter pea

Daviesia ulicifolia

FLOWERING SEQUENCE

j f m a m j **J A S O N** d

Gorse bitter pea is a good pollen source
Photo: Melburnian GFDL

Features

Small to medium shrub

H 0.5–2 m

Medium to fast growth rate. This much-branched prickly shrub is characterised by dark green, pungent narrow phyllodes, 5–20 x 0.5–6 mm, with a prominent midrib on the upper surface, usually sessile. Flowers are yellow–red pea-shaped 1–3 on short stalks in axils. Fruits are pods 5–8 x 3–5 mm. Susceptible to the rootrot fungus *Phytophthora cinnamomi*. Propagate from scarified seed.

Origin: Western Australia, South Australia, Victoria, Tasmania, New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost hardy
Rainfall	250 mm, drought tolerant
Aspect	Full sun to partial shade
Soil	Well-drained, various light sandy to heavier clays

Uses

Gorse bitter pea provides an attractive ‘egg and bacon’ flower display in late winter, spring and summer. It is a useful barrier plant because of its prickles. Its prickly nature also provides protection for small birds, and the plant makes a useful addition to on-farm biodiversity.

Apiculture

A useful understorey plant providing essential pollen and some nectar for spring build.

TREE

Tasmanian blue gum

Eucalyptus globulus

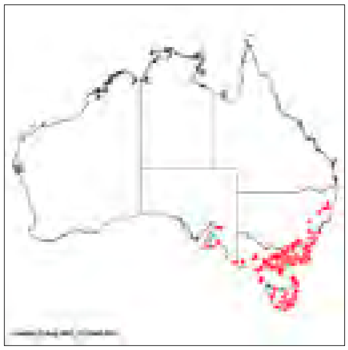
Features

Tall tree

H 20–60 m

Fast growth rate. This tree has a tall, straight trunk but a fairly thick crown in comparison with other eucalypts. The bark is smooth and sheds in ribbon-like strips. The tree's name derives from the bluish colour of the young foliage on square stems. Adult leaves are dark green, thick, glossy, to 40 x 6 cm, and hang vertically. The buds are bluish (like the juvenile foliage) and 'wart-like'. The flowers are creamy. Propagate by seed.

Origin: South Australia, Victoria, Tasmania, New South Wales.



Conditions

Climate	Cool, temperate
Rainfall	750 mm (can survive 500 mm, but grows only 20–25 m)
Aspect	Full sun
Soil	Deep, well-drained loams

Uses

E. globulus is one of the most widely planted commercial eucalypt species. It is commonly used for tall windbreaks on farms as it is very wind-firm. It can also be used for farm forests and for shade in parks. Its other uses for farm forestry include fence posts, fuel, sawn timber, bee forage, and ornamental. It can be used in light and heavy construction.

Apiculture

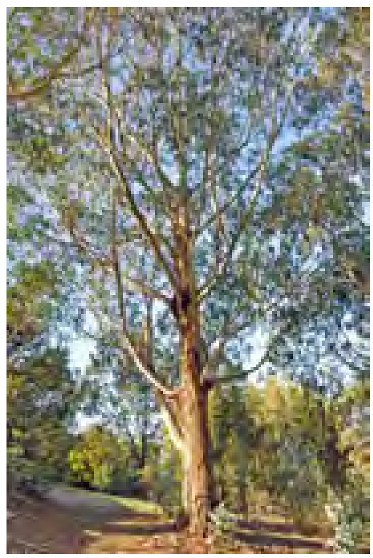
Blue gum produces small volumes of honey and pollen regularly, with significant crops occurring every 3 to 7 years. The tree demonstrates a strong sequential flowering beginning on the east side then moving to the west (H Hoskinson 2010, pers. comm.). The honey is light amber in colour, with a heavy body and a distinctive flavour. The pollen is cream to white with high crude protein content. Bees build well on blue gum sites.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	5–>60 kg/hive	Light	Dense	Medium	Annual, large crops 3–7 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Cream to white	High 29.6%	Average	Annual

FLOWERING SEQUENCE

J F m a m **J J A S O N D**

Blue gum in prolific flower Photo: Mark Leech



Blue gum is at home in parks as well as on farms Photo: Mark Leech

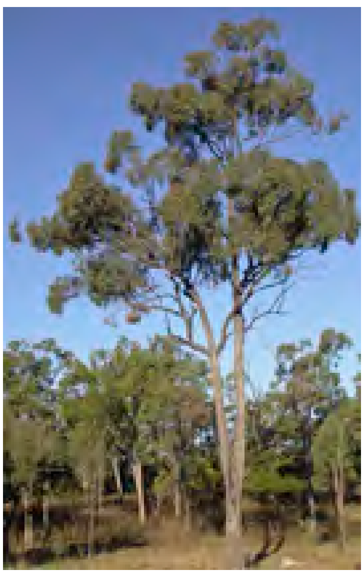
TREE

Narrow-leaved ironbark

Eucalyptus crebra

FLOWERING SEQUENCE
j f m a m j j **A S O N D**

E. crebra flowers Photo: Ethel Aardvark CCBY3.0



Narrow-leaved ironbark Photo: Dean Nicolle

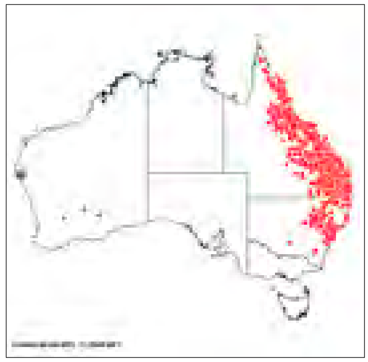
Features

Medium to tall tree

H 12–25 m.

This medium-sized tree can attain heights of 30–35 m on the best sites. It has a typically hard, deeply furrowed, almost black bark. It is usually straight stemmed with a scraggly, open crown. The leaves are slaty grey and very narrow to 12 cm x 15 mm. It is a good bird-attracting species.

Origin: New South Wales, Queensland.



Conditions

Climate	Cool, temperate, warm/humid, very frost tolerant
Rainfall	500 mm, drought tolerant
Aspect	Full sun
Soil	Heavy loams and sands over clay

Uses

This generally straight-formed tree is useful in farm forestry for its heavy, durable timber and in windbreaks. The deep red, dense timber (ADD 1090 kg/m^3) is used for heavy construction (Bootle 2001). It is a useful street and park tree and is smog tolerant and adaptable to different soils.

Apiculture

Good yields require adequate rain and occur every 2–5 years. The honey is a very light colour, has a 'heavy body' and a mild, sweet flavour; it and crystallises slowly, with a whitish coarse grain. While the pollen can be abundant its protein content is average but lacking in isoleucine, an amino acid essential to bee health. With abundant nectar and pollen, colonies grow rapidly and swarm management is important. Special care is required to ensure the longer term health of hives.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average 35 >80 kg/hive	Extra white–light amber	Heavy body	Slow, coarse whitish	2–5 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Light cream	Average	High	2–5 years

TREE

Red stringybark

Eucalyptus macrorhyncha

Features

Medium to tall tree

H 20–35 m

A moderate growth rate. The bark is fibrous and brown or rusty red and persistent to the small branches. The lanceolate leaves are glossy green to 15 x 2 cm.

Origin: South Australia, Victoria, New South Wales.

FLOWERING SEQUENCE

J F M A m j j a s o n d

Red stringybark Photo: Dean Nicolle

Conditions

Climate	Cool, temperate, hot/arid, frost tolerant
Rainfall	550 mm, moderate drought tolerance
Aspect	Full sun to partial shade
Soil	Well-drained clay loam to heavy clay, pH <6.5–7.5

Uses

A good stand-alone paddock tree, red stringybark provides good shade and grass will grow up to the trunk. It is also useful for windbreaks and timber. The wood (ADD 900 kg/m^3) is light pinkish–brown, moderately fine textured, slow to dry and durable for above-ground uses (Bootle 2001).

Apiculture

Red stringybark carries its buds for about two years before flowering. Flowering is usually from January to April. *E. macrorhyncha* is not considered a reliable honey producer but is included here because it produces heavy crops of nectar and pollen. The honey is bright, highly coloured and with a reddish tinge. It has strong, aromatic woody flavour, a finish similar to caramelised walnuts, and a rich, bold, toffee-like flavour with smoky, earthy undertones (www.beechworthhoney.com.au 2011). Pure red stringybark honey never crystallises, is exceptionally high in mineral content, and has the second lowest glycaemic index rating of any Australian honey (44). This is one of the finest varieties of honey in the world (www.malfroysgold.com.au 2011).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average 50 to 15–108 kg/hive	Amber reddish tint		Never	2–5 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			High	High	2–5 Years

E. macrohyncha buds Photo: Dean Nicolle

TREE

Apple box

Eucalyptus bridgesiana

FLOWERING SEQUENCE

J F M A m j j a s o n d

Features

Medium tree

H 25 m W 15 m

Apple box on Red Hill, Canberra Photo: Wikimedia Commons

Apple box is characterised by fibrous, flaky, thick bark on the trunk and larger branches and leathery, glossy green leaves, lanceolate to 20 cm x 2 cm. The buds are egg-shaped to 8 x 5 mm; flowers are cream to white.

Origin: Victoria, New South Wales, Australian Capital Territory, Queensland.

Conditions

Climate	Cool, temperate, very frost hardy
Rainfall	650 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sandy loam to heavy clay, pH <6.5 to 7.5

Uses

Known for its frost hardiness and suited to areas of poor cold-air drainage, apple box is useful as stock shelter in cold, exposed sites. The wood is non-durable and difficult to split but was used for butchers' chopping blocks. With colours reported as yellows to orange tints, the wood can be used for indoor furniture.

Apiculture

The buds appear in summer and last for about a year before flowering occurs, usually in early February and lasting for 2 months. Producing ample good-quality pollen and an adequate annual honey flow, apple box is very useful for building hive strength going into winter.

The honey is amber in colour and has a rich bold wood flavour reminiscent of molasses (www.beechworthhoney.com 2011).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average 30 kg/hive		Average	Fast	2–4 years
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Abundant		Good 24%	Abundant	2–4 years

Temperate climate rural species

The following table summarises the rural species selected for temperate climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Phacelia tanacetifolia*	Lacy phacelia	C T H	G F	N	P	•	•	•	•	•	•				•	•	•
	Lotus corniculatus	Bird's foot trefoil	C T	F	N	P	•	•	•						•	•	•	•
	Melilotus albus	White sweet clover	C T W	G F	N	P	•											•
	Brachyscome ciliaris	Variable daisy	C T W F	G S U F	n	P									•	•	•	•
SHRUB	*Banksia ericifolia*	Heath-leaved banksia	C T	G U F	N	P				•	•	•	•	•				
	Pultenaea villosa	Hairy-leaved pea	T W	G S U F	n	P									•	•		
	Banksia sessilis	Parrot bush	T H	G U F	N	P					•	•	•	•	•	•	•	•
	Eucalyptus loxophleba	York gum	T H	F	N	p	•	•		•	•	•	•	•	•	•	•	•
TREE	*Eucalyptus leucoxylon*	South Australian blue gum	C T H	G S U F	N					•	•	•						
	Eucalyptus blakelyi	Blakely's red gum	T H	F	N	P	•									•	•	•
	Eucalyptus melliodora	Yellow box	T H	S U F	N		•	•							•	•	•	•
	Corymbia calophylla	Marri	T	S U F	N	P	•	•	•	•								•

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Lacy phacelia

Phacelia tanacetifolia

FLOWERING SEQUENCE
J F M A M J j a s O N D

Features

Annual

H 0.6 m W 0.3 m

Lacy phacelia, great bee forage Photo: Boudikka/Shutterstock.com

Fast growth rate: in flower 6 weeks after germination. Foliage is ferny and flowers appear in flat-topped clusters, purple to white. A versatile cover crop used extensively in Europe as a bee forage plant. It is increasingly used in California in vineyards. Requires moist soil for germination but can tolerate dry conditions later.

Origin: United States.

Conditions

Climate	Cool, temperate, hot/arid, requires 100 frost-free days.
Rainfall	Moderately drought tolerant, minimum 200 mm
Aspect	Sunny
Soil	Most soils, prefers free-draining sandy loam, pH 6.4–8.6

Uses

As a cut flower lacy phacelia has strong stems and a long vase life; it is available early spring. A useful cover crop and green manure, it is being used in vineyards and apple orchards. Can be sown between rows of potatoes and dug in as green manure (Howes 1945). It has also been used as a fodder crop. Attractive to beneficial insects, including syrphid flies. Catches excess nitrates. Sowing rate 8–14 kg/ha drilled.

Lacy phacelia flower Photo: Peter Eggerman/Shutterstock.com

Apiculture

Lacy phacelia is an extremely beneficial pollen and nectar plant, said to be one of the top 20 in the world (Gilbert 2003). Its strongly scented nectar attracts bees from early morning until late in the day. Multiple sowing can provide for a continuous nectar flow. Avoid planting near a crop to be pollinated unless there is a floral gap: it is extremely attractive to bees. Phacelia is planted by beekeepers in Finland for autumn bee forage (Kirk 2005).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	100–1700 kg/ha	Amber – light green	Flows freely	Rapid almost white	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Dark blue	High 30% cp	115 kg/ha	Annual

HERB

Bird's foot trefoil

Lotus corniculatus

Features

Perennial herbaceous legume

H 30 cm W 50 cm

Fast growth rate. A clover-like plant, sparsely pubescent leaves with 5 asymmetrical pointed leaflets to 17 x 8 mm. Bold, bright-yellow flowers with a red tinge in an inflorescence with up to 8 flowers 17 mm long. It has a deep tap root and grows where lucerne and clover do not survive because of acidity, waterlogging or summer drought.

Origin: Europe, Asia.

FLOWERING SEQUENCE

J F M a m j j a **S O N D**

Bold yellow pea-like flower of trefoil
Photo: Fredrik Lähnn

Conditions

Climate	Cool, temperate
Rainfall	650 mm, moderately drought tolerant
Aspect	Full sun
Soil	Well-drained sandy to clay, pH >4.7; avoid significant soil aluminium

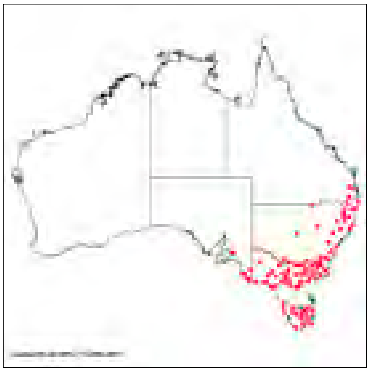
Uses

A perennial pasture species suited to oversowing into native grasses. Suited to intermittent grazing, it is highly nutritious and is eaten by sheep and cattle. Grazing exclusion during flowering maximises flowering for honeybee forage. It can produce cyanogenic glucasides, but poisoning is rare (DPI New South Wales 2004).

Apiculture

The flowering period is indeterminate and can be from spring to autumn. *L. corniculatus* an excellent source of pollen and nectar. Honey is described as white to extra-light amber and fairly strong, with a distinctive metallic after-taste (Flottum 2009).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	13–37 kg/ha		Heavy body	Rapid	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Average to high	Light brown to light grey	Average to high	Average to high	Annual



HERB

White sweet clover

Melilotus alba
Bokhara

FLOWERING SEQUENCE
J f m a m j j a s o n **D**

Features

Herbaceous biennial legume

H 0.3–2.6 m

White sweet clover Photo: Estormiz

Fast growth rate. An erect herbaceous legume. Leaves are dull green, glabrous alternate trifoliate, with the upper leaves oblong to 1.5 to 5 cm. Flowers are white to 6 mm in long racemes of 20 –80 flowers, 8–28 cm long. Propagate by seed.

Origin: Asia.

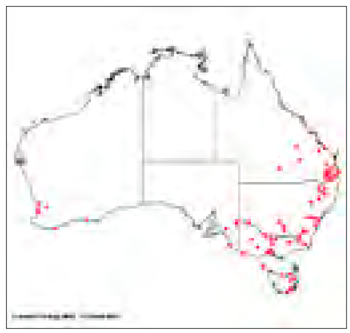
Conditions

Climate	Cool, temperate, warm/humid
Rainfall	400 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained deep medium-to-heavy textured soils, natural to a wide range from sands to heavier clays, pH 6.5–8.5, intolerant of high acidity

M. alba, sweet to bees and can produce high honey yields Photo: Zachary Huang, http://beetography.com

Uses

M. albus can be used on alkaline and saline soils to provide productive summer forage and green manure. Hughes (2009) reports high herbage production and nutritive value. It can also be grown as a useful garden addition, providing excellent bee forage.



Apiculture

A top honey plant with high bee activity all day, *M. albus* reportedly produces 2–5 kg/hive/day and 495 kg/ha in Udmurtia, Russia (Kolbina 2007). Pellet (1920) noted that it can produce up to 90 kg/hive. It grows well over the entire state of Oklahoma and is one of its major nectar- and pollen-producing plants (Mulder 2011). The honey is a light colour with a lightly peppery taste, good body, and a medium rate of granulation. The plant is also valued for its pollen.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	To 90 kg/hive	Light	Good body	Medium	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Yellow to dark yellow	High	High	Annual

HERB

Variable daisy

Brachyscome ciliaris

Features

Perennial

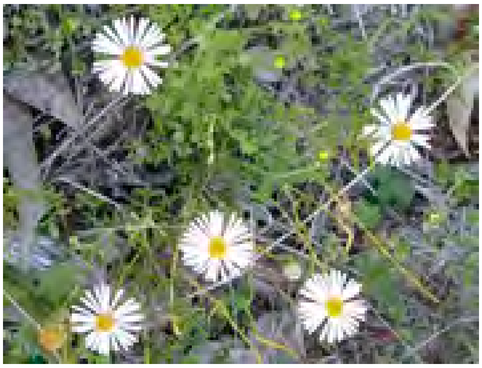
H 40 cm W 30 cm

A fast-growing native perennial. The colourful flowers with their yellow centres range from white through to pink and lilac and have many fine petals. The single flowers to 18 mm across are borne on slender stalks to 40 mm. The bright-green hairy leaves are pinnate to 6 cm and lobed.

Origin: Australia.

FLOWERING SEQUENCE

j f m a m j j a **S O N D**



The classic daisy flower of *B. ciliaris* is very attractive to honeybees Photo: Joan Overeem

Conditions

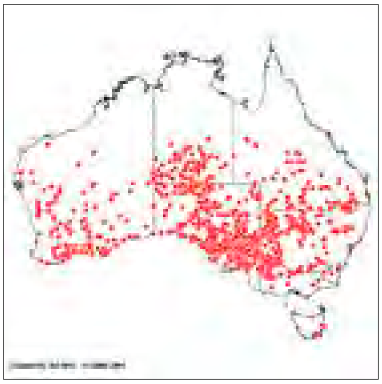
Climate	Cool, temperate, warm/humid, hot/arid, frost tender
Rainfall	250 mm, drought tolerant
Aspect	Full sun
Soil	Most soils

Uses

Ideal for rockeries and garden edges. Makes a great show when planted en masse. Could be planted as a ground component of farm shelter or on lane edges.

Apiculture

With favourable rainfall this plant produces abundant amounts of pollen and is a very useful supporting plant at spring build (Clemson 1985).



Small herbaceous plants are important to pollinators Photo: Joan Overeem

SHRUB

Heath-leaved banksia

Banksia ericifolia

FLOWERING SEQUENCE
j f m **A M J J A** s o n d

Features

Large shrub

H 5 m W 4 m

The dwarf variety provides a good fit and a wonderful display Photo: Ross Flint

Fast growth rate. A rounded bushy robust plant with bright green linear leaves to 2 cm. The very showy reddish–orange flower spikes to 30 x 6 cm appear in autumn and winter.

Origin: New South Wales.

Conditions

Climate	Cool, temperate
Rainfall	500 mm
Aspect	Full sun to partial shade
Soil	Well-drained light- to medium-acid soils

Uses

Perhaps one of the best-known banksias, *B. ericofolia* provides a wonderful floral display as a garden specimen and can be used as a windbreak and understorey planting. It is wind resistant and can withstand moderate coastal exposure. Used as a cut flower.

The showy spikes look great in a garden Photo: Ross Flint

Apiculture

B. ericifolia can start producing within 5 years of planting or recovery from fire. It produces a high-quality pollen with crude protein content greater than 30% (Somerville 2005). Nectar is produced annually but the pollen is more erratic, which can cause problems with the winter harvest. Poorer quality pollen can cause the hive to decrease in size and nosema, a hive disease, can become a problem.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	5–40 kg/hive	Light		Fast	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Orange	High 30%	High	Irregular

SHRUB

Hairy-leaved pea

Pultenaea villosa

Hairy pea bush, hairy tick bush

FLOWERING SEQUENCE

j f m a m j j a **S O** n d

Features

Small shrub

H 1–2 m

A fast-growing, graceful weeping shrub, much branched. The leaves are small to 5 mm and covered with short hairs, giving a greyish appearance. The flowers are pea-shaped with 4 petals—'standard', 'keel' and 2 'wings'—15 x 10 mm. Flowering density is high: best grown as a specimen plant. It has no known pests or diseases.

Pultenaea spp. are commonly referred to as 'bush peas' and together with *Dillwynia* spp. and *Phyllota* spp. are referred to as 'eggs and bacon' with the characteristic yellow-and-red flowers. Propagate by scarified seed.

Origin: New South Wales, Queensland.

Rambling *P. villosa* with its 'eggs & bacon' flowers Photo: Mark Leech

Conditions

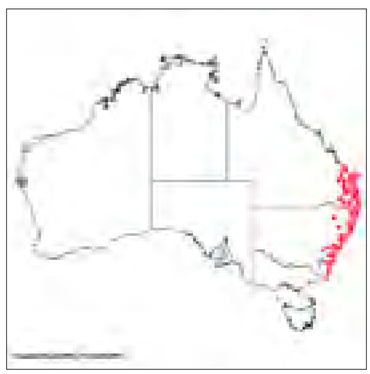
Climate	Temperate, warm/humid, frost tolerant
Rainfall	650 mm, drought hardy
Aspect	Partial shade, at least ½ day sun
Soil	Sand to heavy clay

Uses

Makes a great specimen plant. Left to grow 'out', *P. villosa* can be grown as a low informal hedge with light pruning and is suited to gardens, streetscapes and urban open space. It is a useful 'ground' component in more biodiverse farm forestry and is a good revegetation plant.

Apiculture

Many of the pultenaeas provide pollen and some nectar. *P. villosa*, flowering in September and October, provides an abundance of high-quality pollen with a crude protein content of 31% (Somerville 2001). It is considered a major source of pollen and with the nectar it produces provides for brood rearing and possibly stores (Clemson 1985). This is an essential addition to rural bee forage planting.



Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	For bees				Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			High 31%	High	Annual

SHRUB

Parrot bush

Banksia sessilis

FLOWERING SEQUENCE

j f m a **M J J A S O N D**

Features

Shrub to small tree

H 6 m   W 4 m

Parrot bush flower Photo: Linda Manning

The dark green to blue–green leaves of *B. sessilis* have spiky margins and are 7 x 3 cm. It is a prolific flowerer with its showy, pale-yellow flower domes. Its proteaceous root clusters enable it to survive in nutrient-deficient soils. It seeds prolifically and annually in the absence of fire. It is very attrctive to birds, especially honeyeaters and wattlebirds.

Origin: south-west Western Australia.

Conditions

Climate	Temperate, hot/arid, moderately frost hardy
Rainfall	400 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sands, slightly alkaline soils best

Uses

Parrot bush could provide low shelter in a farm windbreak and be significant on-farm bee forage, flowering extensively in its third year. It is an aggressive coloniser of disturbed and open areas and a useful plant in revegetation of appropriate sites. May be used as a cut flower, dried and in floral art. It is highly susceptible to dieback caused by the rootrot pathogen *Phytophthora cinnamomi*.

Apiculture

Parrot bush honey is dark in colour and light in texture with maple overtones. Coleman (1962) described it as possibly the greatest honey producer in Western Australia as it produces annually. It is highly prized by beekeepers.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	High	Dark			Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good	Good	Annual

York gum

Eucalyptus loxophleba

Features

Medium tree

H 3–15 m

A fast-growing mallee species of the Western Australian Wheat Belt. The form generally depends on the subspecies—from a multi-stemmed mallee, ssp. *lissophloia*, to the single stemmed ssp. *loxophleba*. It has rough, persistent bark and pale green leaves to 12 cm x 15 mm.

Origin: Western Australia.

FLOWERING SEQUENCE

J F m A M J J A S O N D

Open-grown York gum Photo: Dean Nicolle

Conditions

Climate	Temperate, hot/arid, frost tolerant
Rainfall	350 mm drought tolerant
Aspect	Full sun
Soil	Prefers sandy loam, tolerates heavier clays, pH <6.5 to 7.5, salt tolerant

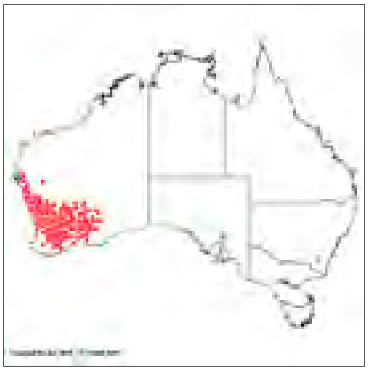
Uses

In its different forms York gum it is a useful farm forestry tree for shade, biomass feedstock for renewable energy, essential oil recovery, alley farming, shelterbelts and potentially carbon sequestration. It is used for recovery of salt-affected land and revegetation. The heartwood is very dense reddish–brown (ADD 1070 kg/m^3) with a fine interlocked grain. The wood can be used for ornamental and turned work (Bootle 2001). The highly decorative burls are much sought after.

Apiculture

York gum is an excellent source of pollen and honey from about September to December each year. The honey is of medium amber colour, with a slightly sweet character; it candies smooth, making an excellent creamed honey. Coleman (1962) noted that it seems to need hot weather and usually flows every second year.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	High	Medium amber		Fine	2 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Poor	Useful	2 years



TREE

South Australian blue gum

Eucalyptus leucoxylon

Yellow gum

FLOWERING SEQUENCE

j f m **A M J** j a s o n d

Features

Small to medium tree

H 10–25 m

SA blue gum with a full crown Photo: Dean Nicolle

This fast-growing attractive tree is a valuable nectar producer. It has 4 subspecies and in the form 'Rosea' is widely planted as a specimen tree for its attractive and abundant red-to-pink flowers.

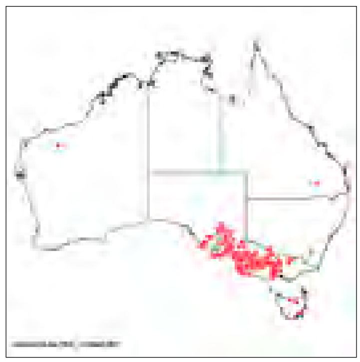
Origin: South Australia, Victoria, New South Wales.

Conditions

Climate	Cool, temperate, hot/arid, frost tolerant
Rainfall	400 mm drought tolerant once established
Aspect	Full sun
Soil	Well-drained sandy loam, limestone, loam or clay soils, heavier soils, alkaline and salt-tolerant

Uses

A versatile tree widely planted in gardens and parks and as a street tree. It is used in windbreaks and for on-farm shelter. The heartwood (ADD 1010 kg/m^3) is pale brown with pink and yellow tints and interlocked grain (Bootle 2001).



E. leucoxylon buds and flowers Photo: Dean Nicolle

Apiculture

An excellent nectar producer, with surpluses occasionally greater than 100 kg/hive and regular production of more than 50 kg/hive every second year. The light amber honey has a distinctive pleasant flavour. The plant is pollen deficient.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	>50 kg/hive	Light amber			2–5 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Poor	Poor	2–5 years

TREE

Blakely's red gum

Eucalyptus blakelyi

FLOWERING SEQUENCE

J f m a m j j a s **O N D**

Features

Small to medium tree

H 10–24 m   W 13 m

Moderate growth rate. Bark mostly smooth, pale, shedding in flakes with grey, creamy-yellow and pink mottles. Leaves are equally dull green or grey–green on both sides. Flowers are creamy white. The tree is susceptible to defoliation by lerps and Christmas beetles.

Origin: New South Wales.

Flower of Blakely's red gum Photo: Mark Leech

Conditions

Climate	Temperate, hot/arid, very frost tolerant
Rainfall	600 mm, drought tolerant
Aspect	Full sun to partial shade
Soil	Well to poorly drained from sandy loam to heavy clay, pH <6.5 to 7.5, slight alkaline tolerance

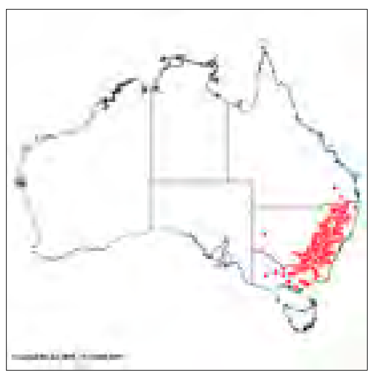
Uses

The tree is a useful farm shelter and windbreak component and is a vigorous coppicer. A pink to reddish–brown heartwood, interlocked grain (ADD 980 kg/m^3), very durable and hard (Bootle 2011). Used as fence posts and firewood; turns well, with numerous gum-vein features, and is used in fine furniture.

Apiculture

Flowering frequency depends on seasonal conditions; heavy flowering occurs every 2–3 years. Buds appear on new growth in summer and mature by the following spring. The honey is amber, slightly turbid, of good density and with a characteristic flavour. Large volumes of good pollen help bees breed well (Clemson 1985).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Average 24 kg/hive	Amber slightly turbid	Good	Average	2–5 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Cream	Good 25%	High	2–5 years



Blakely's red gum, Canberra Photo: Mark Leech

TREE

Yellow box

Eucalyptus melliodora

Features

Medium to large tree

H 15–30 m

‘Melliodora’ means odour of honey. This is a slow-growing graceful tree, densely crowned and slightly pendulous. The trunk bark is rough, fibrous and yellowish–brown to grey with yellow inner bark; it is very variable, from almost all rough to smooth. Bark on the branches is smooth, white to grey. Adult leaves are lanceolate to 7–10 cm x 10–15 mm. The flowers are simple, axillary and can be in pendulous terminal panicles of 7 flowers. The buds are 7–8 x 5–6 mm and club to diamond-shaped.

Origin: Victoria, New South Wales, Queensland.

FLOWERING SEQUENCE

J F m a m j j a **S O N D**

Yellow box buds and flowers Photo: Dean Nicolle

Conditions

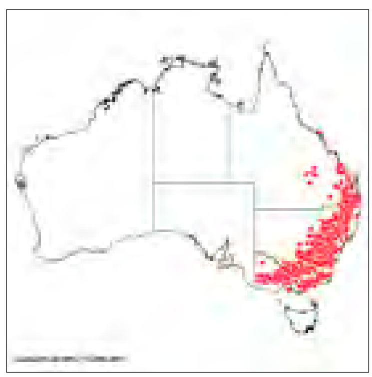
Climate	Temperate, hot/arid, frost tolerant
Rainfall	380 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained light sandy loam to heavy clay, pH <6.5 to 7.5

Uses

Yellow box is useful in farm forestry for windbreaks and shade and is used as a park specimen tree and street tree. The yellowish–brown wood is very dense (ADD 1100 kg/m^3) and very durable. It has been used in heavy engineering construction, bridges, railway sleepers and posts. Its interlocking grain gives a decorative finish in modern furniture and turned objects (Boland et al. 1997; Bootle 2001).

Apiculture

This species produces inadequate pollen for brood rearing, and hives will deteriorate in the absence of good supporting pollen. If planting on farms, good pollen-producing species that flower concurrently should be added to support this excellent honey producer. The honey has a beautiful light amber colour and is aromatic, with a mild distinctive flavour that is smooth and buttery on the tongue. Fairly sweet, it is dense and slow to crystallise if monofloral. With favourable weather conditions yellow box can produce heavy honey flows (Clemson 1985).



Honey	Yield	Colour	Density	Crystal	Frequency
	75 kg/hive	Light amber	Thick	Very slow	1–5 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Poor	Poor	1–5 years

A yellow box specimen with an excellent open crown Photo: Dean Nicolle

TREE

Marri

Corymbia calophylla
Red gum

Features

Medium to tall tree

H 6 m to >40 m

This fast-growing forest species often associated with jarrah (*E. marginata*) and karri (*E. diversicolour*) is a prolifically flowering attractive tree. The bark is tessellated, brown to grey–brown and often has exudations of reddish resin. The large flowers are generally cream–white but variable to occasionally pinkish. The fruits are large, woody and urn-shaped to 4 x 3 cm. The large, glossy green leaves are strongly discolourous, to 15 x 4 cm.

FLOWERING SEQUENCE

J F M A m j j a s o n **D**

Abundant flowering typical of marri
Photo: Linda Manning

Conditions

Climate	Temperate
Rainfall	600 mm
Aspect	Full sun
Soil	Adaptable but prefers well-drained sandy loam

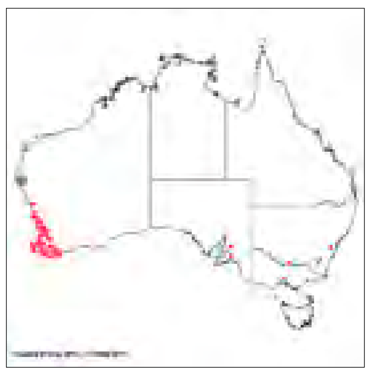
Uses

As a farm forestry species marri can be used as a tall component of shelter. Open grown, it is much shorter and useful as a park specimen, providing excellent shade, and as a street tree. It is less frost tender than its widely planted close relative *C. ficifolia* and could grow across climate zones. The wood is honey coloured (ADD 850 kg/m^3), with a coarse interlocked grain with gum features; it works easily and finishes well (Bootle 2001). It is becoming appreciated as a fine furniture timber.

Apiculture

Marri is one of the most abundantly flowering eucalypts. It provides both a regular annual flow of honey and excellent pollen, enabling brood rearing and queen breeding. It has an abundant flow every 2–3 years but can be adversely affected by very hot weather (Smith 1969). The honey is described as an excellent flavoured light amber and is highly antimicrobial.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	High	Light amber		Fine	Annual 2–3 years abundant
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Very high	Very high	Annual 2–3 years abundant



Phacelia flower

Warm/humid climate rural species

The following table summarises the rural species selected for warm/humid climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Cichorium intybus*	Chicory	T W	G S U F	n	P	●	●	●								●	●
	Cucurbita maxima	Pumpkin	C T W H	G F	N	P	●	●	●									●
	Medicago sativa	Lucerne	C T W	F	N	P	●	●										●
	Helianthus annuus	Sunflower	C T W H	G U F	N	P	●	●	●									●
SHRUB	*Dodonaea viscosa*	Sticky hopbush	C T W H	G S U F	n	p	●	●							●	●	●	●
	Leptospermum polygalifolium	Jelly bush	T W H	G S U F	N	P									●	●	●	●
	Boronia rosmarinifolia	Forest boronia	T W H	G S U F	n	p	●	●	●	●	●						●	●
	Jacksonia scoparia	Dogwood	C T W H	G U F	n	P								●	●	●		
TREE	*Angophora floribunda*	Rough-barked apple	C T W	U F	N	P	●	●										●
	Eucalyptus sideroxylon	Mugga	T W H	S U F	N		●	●	●	●	●	●	●	●	●	●		
	Corymbia citriodora	Lemon-scented gum	T W	S U F	N	P						●	●	●	●			
	Acacia implexa	Lightwood	C T W H	G S U F		P	●	●	●									●

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Chicory

Cichorium intybus

FLOWERING SEQUENCE
J F M a m j j a s o N D

Features

Perennial herb

H 20–180 cm

Chicory flower, traditionally called blue sailor Photo: alvesgaspar GFDL

Fast growth rate. Wild form is an erect herb 20–100 cm; cultivated forms vary in shape as a compact leafy 'vegetable'. Flowers are bright blue 2–4 cm across, petals have toothed ends. Flowers from summer until autumn. Propagate by seed.

Origin: Northern Europe.

Conditions

Climate	Temperate, warm/humid
Rainfall	>650 mm (for best growth), moderately drought tolerant
Aspect	Full sun
Soil	Well-drained sandy, moderate fertility conditions, heavier soils; pH 5.5–7.5

Uses

A truly multi-purpose plant that has been known throughout history and was cultivated by the ancient Egyptians. All parts of the plant are edible: the roots can be boiled, steamed or roasted and ground as a coffee substitute; the fresh leaves can be eaten raw or cooked; the flower buds can be blanched and the flower petals eaten in salads. There are many varieties and cultivars. Leaf varieties include witlof and radicchio. Chicory roots contain insulin, a polysaccharide alternative to sucrose and a food additive. As a pasture, chicory provides very palatable and nutritious feed for stock. Trials are being undertaken for pasture mixed with legumes to provide chicory with nitrogen and improved stock outcomes (NSW Government 2011).

Apiculture

Chicory is a beneficial nectar and pollen plant, producing a white to off-white pollen; a honey surplus is occasionally produced given enough plants and the right conditions. The unusual honey is greenish–yellow with the flavour of chicory (Howes 1945).

Pumpkin

Cucurbita maxima

HERB

FLOWERING SEQUENCE

J F M a m j j a s o n **D**

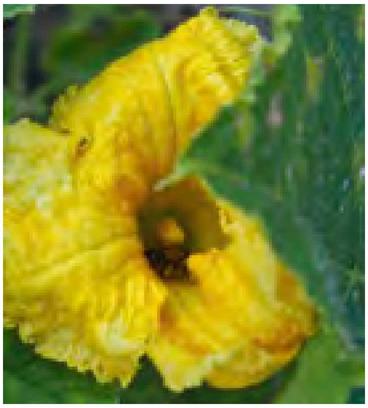
Features

Prostrate annual vine

H 40 cm W 10 m

Fast growth rate. A monoecious (male and female flowers on a single plant) trailing vine to 10 m. Leaves and vines are rough with coarse, almost prickly hairs. Leaves are large and roughly heart-shaped, with a wavy margin to 35 cm on hollow long leaf stalks. Tendrils from the base of the leaf stalks attach to anything as the vine radiates out. The distinct male and female flowers are both orange–yellow with green veins, the five petals being joined to give a bell-like appearance, to 10 cm on a 20 cm stalk. Male flowers, which are slightly smaller with a cylinder of fused stamens in the centre, are produced first in clusters. Female flowers come later, with a distinct rounded swelling, the ovary, beneath the flower. Five frost-free months are needed to produce mature fruit. Plant as soon as the soil is warm enough.

Origin: South America.



Pumpkin flower and bee Photo: Doug Purdie

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, very frost tender
Rainfall	Irrigated
Aspect	Full sun
Soil	Various

Uses

An easy-to-grow garden vegetable that can have excellent keeping qualities depending on the variety. They can be used as a weed mat, to cover unused areas, even trailed on fences with fruit hung in old stockings. They are cropped extensively for both human and stock food.

Apiculture

Bees actively work this long-flowering plant and are essential for effective pollination. Pollen is from the male flowers and nectar from the female. The pollen is a good quality and Blake & Roff (1996) noted that pumpkin growing areas are often some of the best for beekeeping. The honey is described as a medium–light colour of good quality, the colour and flavour varying depending on the variety.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	51 to 100 kg/ha	Medium–light	Good body		Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Rich yellow	Good 26.4%	High	Annual

HERB

Lucerne

Medicago sativa

FLOWERING SEQUENCE

J F m a m j j a s o n **D**

Features

Herbaceous perennial

H 1.5 cm W 1.0 m

Pea-like flower of lucerne Photo: Victor Selvas

Lucerne has erect soft stems and a deeply penetrating taproot. The stems, arising from a woody base, are 30–120 cm long. Leaves are trifoliolate; leaflets are narrow, oblong to ovate or obovate, to 28 x 15 mm, dentate near apex, glabrous on the upper surface and slightly pubescent on the lower surface. Purple, blue or, rarely, white pea-like flowers to 13 mm are borne in a small spike at the upper end of the plant.

Origin: Asia Minor.

Conditions

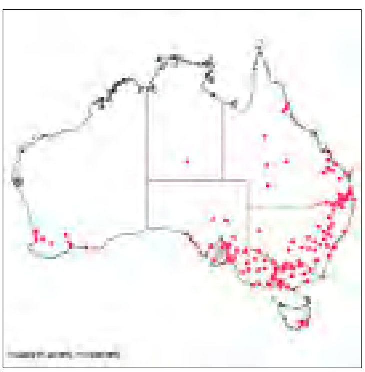
Climate	Cool, temperate, warm/humid
Rainfall	350 mm, moderately drought tolerant
Aspect	Full sun
Soil	Sandy to clay, pH >5.5

Uses

A widely planted pasture species grown for green feed, hay and silage. It is very productive in the right environment, producing a number of harvests each year.

Apiculture

The highest honey yields from lucerne are obtained from seed crops that are allowed to continue to flower; size of the yield is determined by soil moisture and temperature. Hay and silage crops are often harvested before or during flowering, reducing the yield. The honey is described as white to extra-light amber, with an unusual, slightly acid but pleasant taste and a mildly floral aroma. Sought after as a mild honey that can be used for a variety of purposes, from blending with other honey to use in baking.



Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	26–136 kg/ hive, 25–1060 kg/ha	White to extra-light amber	Good body	Rapid to hard fine grain, whitish	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Cream to lemon-yellow	Average 19.4–24.1 % cp	Average to high	Annual

HERB

Sunflower

Helianthus annuus

Features

Herbaceous annual or perennial

H 1–2 m

FLOWERING SEQUENCE

J F M a m j j a s o n **D**

A picture-book sunflower crop Photo: Soyka/shutterstock.com

Fast growth rate. Erect, often unbranched annual herb. Heart- to oval-shaped leaves with 3 main veins to 30 x 20 cm. The flower head is terminal on the stem to 40 cm in diameter; it rotates to face the sun and can be droopy. The flower head is made of 1000 to 4000 florets, each with 1 ovary and 5 anthers; the perfectly arranged florets are surrounded by attractive yellow 'petals'. Cropping varieties usually have 1 flower head, other cultivars can have more, with smaller heads on lateral branches. Sunflower has a highly efficient root system with a strong tap root.

Origin: North America.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	250 mm
Aspect	Full sun, shade intolerant
Soil	Deep well-drained various, pH 4.5–8.7, intolerant of waterlogging

Uses

Sunflowers are a very ornamental and useful addition to home gardens and as park specimen plantings. Giant sunflowers are not the best cut flowers but smaller cultivars are excellent. Suited to many climates, including subtropical and tropical zones (warm/humid), sunflower can be used innovatively as a crop windbreak and inter-row planted. Its main cropping is broad acre for oil seed or bird and human consumption. It is now widely cropped in the US, Europe, China, South America, Africa and Australia.

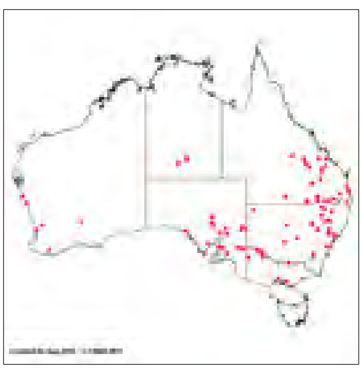
Apiculture

Sunflower is a minor but useful producer of nectar and honey. It is avidly worked by bees, which collect honey from extra floral nectaries beneath the flower heads. It produces a marketed unifloral honey as vast areas are grown around the world; the largest honey volume is produced in the Ukraine—25 000–30 000 tonnes a year (www.itsukraine.com 2011). Care must be taken with increasing pesticide use. The honey is consistently described as amber with a characteristic aroma and flavour, granulating rapidly to a fine grain. A generous description is given by the French beekeepers Miellerie Chailan:

> Sunflower honey is bright yellow, not very sweet, dry, with an aroma of pollen, slightly herbaceous. It has a lively, pleasant taste, and in France is often called the traditional honey. Sunflower honey always has a creamy quality and a fine texture, which is easy to spread. (Miellerie Chailan 2011)

Clemson (1985) noted that in New South Wales the crop maintains breeding conditions.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	To 30 kg/hive to 69 kg/ha	Amber	Thick body	Rapid to fine grain	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Yellow	Low 13.8 –18.5% cp	High	Annual



SHRUB

Sticky hopbush

Dodonaea viscosa

Broad-leaved hopbush, sticky, hopbush, giant hopbush

Features

Bushy shrub to small tree

H 1.5–5 m W 1.5 m

Fast-growing, erect shrub to small tree. The genus is very variable and is subdivided into 7 subspecies. The glossy green, discolourous, sticky leaves are oblanceolate with a rounded apex, to 1–15 cm x 8 mm. The inconspicuous flowers are pale green and the fruits are pale purplish–reddish to green and 'hop'-like, to 12 x 16 mm with 3 or 4 wings. The species is widespread in Australia, the Pacific, North America and the tropics. It is recommended to choose a specific subspecies for a habitat similar to that of its natural distribution. Sticky hopbush does not coppice and is killed by hot fire.

Origin: Widespread in Australia, New Zealand, US, South Africa, tropics.

FLOWERING SEQUENCE

J F m a m j j a **S O N D**

Characteristic 'hop'-like winged fruit Photo: Ross Flint

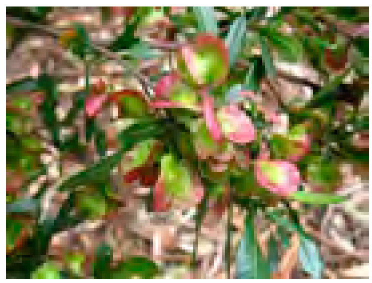
Conditions

Climate	Cool, temperate, warm/humid, hot/arid, mildly frost tolerant
Rainfall	120 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained sand to heavy clay, pH 5.6 to >7.5

Uses

A very hardy plant used in gardens and urban planning as a hedging plant. The fruit are well recognised, and the plant may be used for cut flowers. It can be used in site rehabilitation and revegetation projects.

D. viscosa has been a traditional medicine and has recently been tested for its medicinal activity. In preliminary studies it has shown great potential, having anti-inflammatory, analgesic and antifungal properties at the clinical level (Pengally 2008; Pirzada et al. 2010).

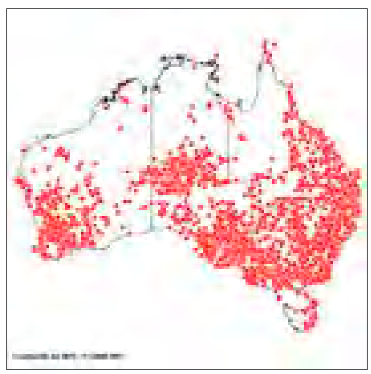


The inconspicuous petal-less flowers of sticky hopbush Photo: Forest & Kim Starr

Apiculture

Sticky hopbush is known to be a useful pollen and nectar producer that benefits hives in the spring, when it flowers. It produces a surplus in New Zealand, where it is commonly known as *ake ake*, and the honey has been described as light amber with a strong flavour (Walsh 1978).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	0–20 kg/hive	Light amber			Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
		Green–yellow		Average	Annual



SHRUB

Jelly bush

Leptospermum polygalifolium

Common tea-tree, wild may, broom bush

FLOWERING SEQUENCE

j f m a m j j a **S O N D**

Features

Shrub to small tree

H 0.5–7 m

A pink variety of jelly bush as a garden ornamental Photo: Mark Leech

Fast growth rate. Dull green leaves are narrow, elliptic without a point, to 0.5–2.2 cm, and give a lemony scent when crushed. The flowers are 5 petalled, sessile, usually white, sometimes off-white to pale pink. This is a highly variable complex group; it is very hardy and provides a reliable floral offering. There are 6 subspecies. Propagate from seed or cuttings.

Origin: New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	550 mm, drought tolerant
Aspect	Full sun
Soil	Sand to sandy clay loam, tolerates periodic flooding

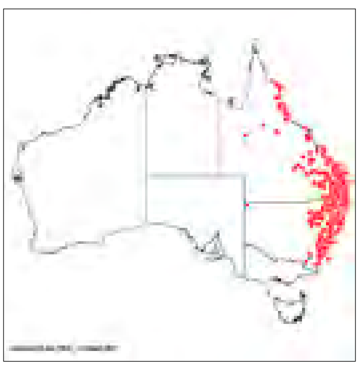
Uses

Widely planted as a garden ornamental, jelly bush is also a valuable river stabiliser since it lies down when flooded. Suited to on-farm planting for unifloral honey production and the high-value medi-honey market.

Apiculture

The honey is dark amber with a strong aroma and is a good colony-building source. Jelly-like and difficult to extract with conventional equipment, it can have very high anti-microbial properties. The active constituent, methylglyoxal, has been found to be effective against a range of organisms, including methicillin-resistant *Staphylococcus aureus*. Jelly bush can be grown well outside its natural range and is a candidate for on-farm planting for high-value honey production.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
		Dark amber	Thixotropic		Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
				Average	Annual



The typical white flower of the jelly bush
Photo: Mark Leech

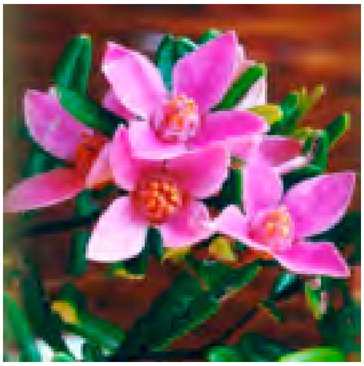
SHRUB

Forest boronia

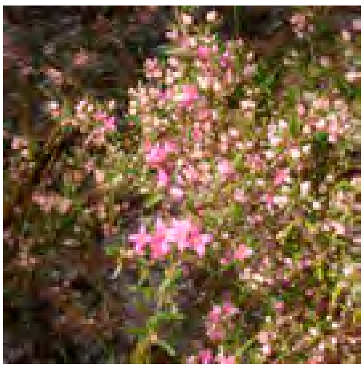
Boronia rosmarinifolia

FLOWERING SEQUENCE

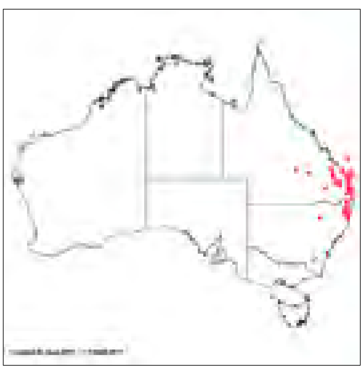
J F M A M j j a s o **N D**



B.rosmarinifolia flower Photo: Stephanie Haslam



B. rosmarinifolia bush Photo: Stephanie Haslam



Features

Shrub

H 1.2 m W 1 m

Moderate to fast growth. A loosely branched shrub. Leaves are spread out in pairs along branchlets. They are whitish underneath, narrow, rosemary-like to 40 x 3 mm, and highly aromatic. The small bright pink (occasionally white) 4-petalled flowers to 9 mm in diameter are borne on the branchlets between leaf pairs.

Origin: New South Wales, Queensland.

Conditions

Climate	Temperate, warm/humid, hot/arid
Rainfall	500 mm
Aspect	Full sun, part shade
Soil	Well-drained various

Uses

Boronias are very desirable garden plants and make a useful contribution to planting anywhere in the landscape. On farm they contribute to increased biodiversity in mixed-species plantings.

Apiculture

The pollen is eagerly gathered by bees and assists with colony build-up in spring. Nectar is produced for the hive (Blake & Roff 1996).

SHRUB

Dogwood

Jacksonia scoparia

FLOWERING SEQUENCE

j f m a m j j **A S O** n d

Features

Large shrub to small tree

H 4 m W 2 m

Moderate to fast growth rate. A pendulous dull or greenish–grey bush with dark grey, deeply fissured bark. With numerous angular branches, the plant appears almost leafless. Leaves are reduced to scales but occasionally small oval leaves appear on young growth. The pea-like flowers are sweetly perfumed, bright yellow to orange and sometimes marked with a red blotch. Propagation is relatively easy from scarified seed soaked in boiling water or from cuttings.

Origin: New South Wales, Queensland.

Dogwood's attractive flower Photo: Stephanie Haslam

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, frost hardy
Rainfall	350 mm, drought tolerant
Aspect	Full sun, part shade
Soil	Well-drained, light sand to loam

Uses

These casuarina-like, small, lightweight shrubs with abundant flowers make an attractive addition to the garden and are useful for screening, shade or as a specimen. Hardy and relatively maintenance free, they add to biodiversity in urban open spaces. On farm they increase biodiversity in mixed plantings.

Pendulous, casuarina-like *J. scoparia* Photo: Stephanie Haslam

Apiculture

Dogwood is a valuable and dependable source of high-quality pollen, enabling brood rearing. It is readily gathered and colonies build rapidly when flowering is abundant. It also provides nectar to the hive (Clemson 1985; Blake & Roff 1996).

TREE

Rough-barked apple

Angophora floribunda

FLOWERING SEQUENCE

J F m a m j j a s o n **D**

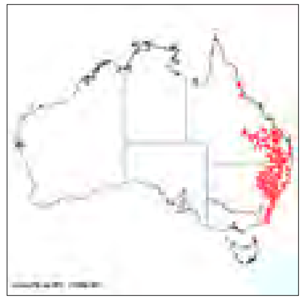
Features

Small to medium tree

H 15–25 m

Rough-barked apple as a forest component Photo: Wikimedia Commons

Fast growth rate. The tree often has a short trunk and a spreading crown. The bark is grey, thick, rough, friable and furrowed, persistent to the smaller branches. Leaves, in pairs, are dull green, discolourous, and oblong to ovate to 12 x 2.5 cm. The flowers are bunched in terminal corymbose panicles—large bristly bunches with up to 7 creamy-white flowers up to 2 cm wide with 5 tooth-like sepals, 5 small semi-circular petals and numerous stamens. Altitudinal range: sea level to 1100 m.



Origin: Victoria, New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid
Rainfall	500 mm
Aspect	Full sun to semi shade
Soil	Well-drained sand to loam, keep moist, pH <6 to >8

Uses

A medium to large tree more suited as a park specimen but listed by some municipalities as a hardy street tree requiring little maintenance. Used in farm shelter and windbreaks, it is a useful firewood. The heartwood is pink to reddish–brown (ADD 850 kg/m^3); it contains faults and is mostly used for palings and fuel. It has also been used for butchers' chopping blocks and dance floors (Bootle 2001).

Rough-barked apple floral display Photo: Wanderer

Apiculture

Considered a very important source of abundant pollen that is of sufficient quality, crude protein 22.3–22.9% (Somerville 2001) and its amino acid composition is not compromising. It can yield honey up to 30 kg/hive (Blake & Roff 1996) but it is a very dark honey with a strong flavour and is not considered a table honey. It is, however, beneficial for winter feeding.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	30 kg/hive	Dark	Dense	Coarse	1–5 years
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	High	Creamy	Good 22.6%	High	1–5 years

TREE

Mugga

Eucalyptus sideroxylon

FLOWERING SEQUENCE

J F M A M J J A S O n d

Features

Medium tree

H 15–35 m

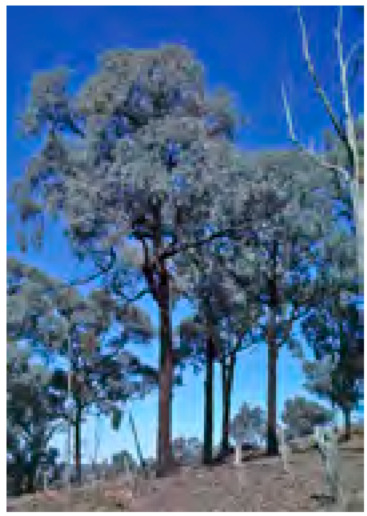
Medium growth rate. A hardy evergreen with a solitary trunk. The eye-catching bark is persistent, hard, very thick, deeply furrowed and reddish–brown to black in colour. The leaves are lanceolate, grey–green or ash coloured to 12 x 2 cm. Coppices vigorously from low stumps. Propagate from seed.

Origin: Victoria, New South Wales, Queensland.

Mugga flowers Photo: Dean Nicolle

Conditions

Climate	Temperate, warm/humid, hot/arid, frost hardy
Rainfall	450 mm, drought tolerant
Aspect	Full sun
Soil	Sand through to heavy clay, pH 6.5–>7.5, tolerates alkaline soils, very salt tolerant



Mugga on a dry site Photo: Dean Nicolle

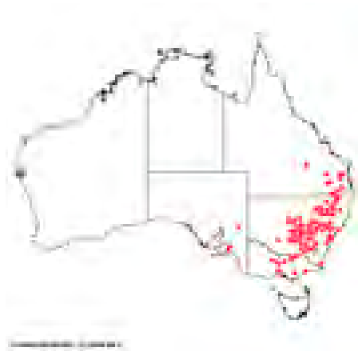
Uses

Mugga is a desirable street and park tree with its very striking ‘black’ trunk. It is an important farm forestry tree in lower rainfall areas. The heartwood is very durable: fence posts are known to be re-used after 35 years in the ground. Dark reddish–brown, it has been used in heavy construction and is a high-value firewood. The attractive, dense wood (ADD 1090 kg/m^3) is gaining popularity in finer cabinet work and woodturning.

Apiculture

One of the most reliable honey-producing trees in Australia and a prolific nectar producer across its range. The light amber honey is of high quality, good flavour and rapid fine crystallisation. Its density depends on the weather during flowering. Spring rains are crucial to flower bud development; buds appear on new growth in late spring and early summer and are carried for 5–8 months. Flowering can start in January, reaches a maximum in July and ends in September–October. Lack of pollen is a concern in the mugga honey flow and must be managed well. Hives are either fed pollen supplements or placed on good pollen sites before the mugga flow; sites with good supporting pollen are highly sought after (Clemson 1985; Briggs 2011, pers. comm.).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	Ave 35 (14–93)	Light	Good, weather depend	Rapid, fine	2–4 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Poor	Poor	2–4 years



TREE

Lemon-scented gum

Corymbia citriodora

FLOWERING SEQUENCE

j f m a m **J J A S** o n d

Lemon-scented gum buds Photo: Dean Nicolle

Features

Medium to large tree

H 15–50 m

Fast growth rate. A very attractive tree that has been planted across a broad climatic range, from Western Australia to north Queensland. The powdery white bark is shed in thin, curly flakes. The leaves are glossy green, concolourous and narrow lanceolate to 23 x 3.5 cm; when crushed they give a lemony scent due to citronellal. The tree flowers throughout the year, across its natural distribution. With a sparse canopy providing filtered shade, the tree is lignotuberous and coppices vigorously. Closely related to *C. maculata.* Good koala food.

Origin: Queensland.

Conditions

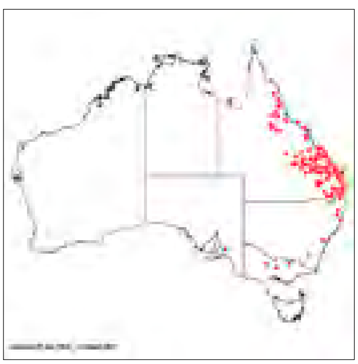
Climate	Temperate, warm/humid
Rainfall	500 mm, moderately drought tolerant
Aspect	Full sun
Soil	Well-drained sand to medium clay, pH 4–<10, tolerates mild salinity

Uses

C. citriodora is widely planted as a street tree and feature tree. Its farm forestry use has increased significantly since the early 1990s due to its fast early growth and good form. It is a major Australian hardwood species (ADD 950 kg/m^3), yellowish–brown to red brown and used extensively in heavy construction, house construction, flooring, veneer and boatbuilding (Bootle 2001). It is the wood of choice for high-impact handles such as those on axes. Widely planted in the tropics and subtropics as a coppiced pole crop for building materials and fuel.

Apiculture

The buds are persistent for 12 to 15 months before breaking (Blake & Roff 1996). An early season producer, it is sought after in mild coastal locations for building colonies. It is rated highly by Queensland beekeepers—number 3 nectar plant and number 1 for pollen in the 1999 Queensland apiary industry Natural Resource Database (Rhodes & Trueman 1999), whereas Clemson (1985) noted that it is of minor value for pollen in New South Wales. It produces abundant pollen, with a crude protein content reported between 24.7% and 33%; it is, however, deficient in the amino acid isoleucine, 7.5–15% below De Groot's standard of 4.0 for bees (De Groot 1954).



Honey	Yield	Colour	Density	Crystal	Frequency
	70 kg/hive	Extra light amber to darker		Very firm	1–3 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			High 24–33%	Very high	1–3 years

An avenue of C. *citriodora*, Kings Park, Perth Photo: Wikimedia Commons

TREE

Lightwood

Acacia implexa

Hickory wattle, broad-leaved wattle

FLOWERING SEQUENCE

J F M a m j j a s o n **D**

A. implexa Photo: Wikimedia Commons

Features

Small tree

H 6–12 m W 5 m

Fast growth rate. Adapted to many different environments and soils, this smaller version of blackwood (*A. melanoxylon*) is very attractive and summer flowering. The bark is rough and greyish with underlying orange streaks. The phyllodes are sickle-shaped to 15 x 2 cm. The flowers are creamy-yellow, borne in globular heads in loose axillary racemes. It has a large altitudinal range, from sea level to 1320 m. Coppices vigorously and responds to pruning.

Origin: Victoria, New South Wales, Queensland.

Conditions

Climate	Cool, temperate, warm/humid, hot/arid, moderately frost hardy
Rainfall	500 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained, sand to heavy clay, pH <6.5–7.5

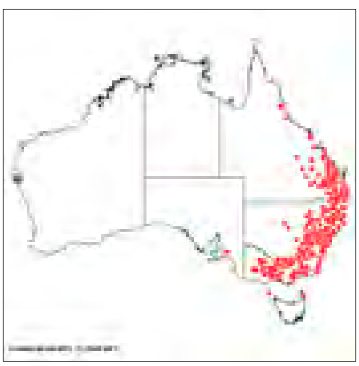
Uses

A useful and attractive compact garden, street and park tree with a high tolerance of different site conditions. As a farm forest tree it provides high-quality firewood and has potential as a high-quality fine furniture timber for use in turnery. The heartwood has copper tones and is a reddish–brown (ADD 800 kg/m^3), has minimal shrinkage on drying and polishes to a natural lustre (Bootle 2001).

Apiculture

The pollen is beneficial to bees (Clemson 1985).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good 25%	Good	Annual



Hot/arid climate rural species

The following table summarises the rural species selected for hot to arid climates.

Plant type	Botanical name	Common name	Climate	Uses	Nectar	Pollen	J	F	M	A	M	J	J	A	S	O	N	D
HERB	*Glycine canescens*	Silky glycine	T W H	G S U F	N							•	•	•	•	•	•	
	Bituminaria bituminosa var. *albomarginata*	Albo tedra	H	F	N										•	•		
	Cullen australasicum	Native scurf-pea	T H	F	N		•	•	•	•	•	•	•	•	•	•	•	•
	Chamaecytisus palmensis	Tagasaste	T W H	C S U F	N	P								•	•	•		
SHRUB	*Eucalyptus dumosa*	White mallee	T H	F	N	P	•	•										
	Eucalyptus gracilis	Yorrell	H	G S U F	N								•	•	•	•		
	Eucalyptus socialis	Christmas mallee	T H	F	N	P	•										•	•
	Banksia ornata	Desert banksia	T H	G U F	N	P				•	•	•	•	•	•	•		
TREE	*Acacia aneura*	Mulga	H	G S U F		P								•	•			
	Eucalyptus dealbata	Hill gum	T H	F	N	P									•	•	•	•
	Eucalyptus microtheca	Coolibah	H	S F	N	P	•											•
	Eucalyptus camaldulensis	River red gum	T W H	U F	N	P	•	•									•	•

Note: The following abreviations are used to show where each species might be planted in a landscape unit other than the one in which it appears: G—garden; S—street; U—urban open spaces; F—farm or rural; N—relatively high nectar-producting plant; n—relatively low nectar-producing plant; P—relatively high pollen-producing plant; p—relatively low pollen-producing plant.

HERB

Silky glycine

Glycine canescens

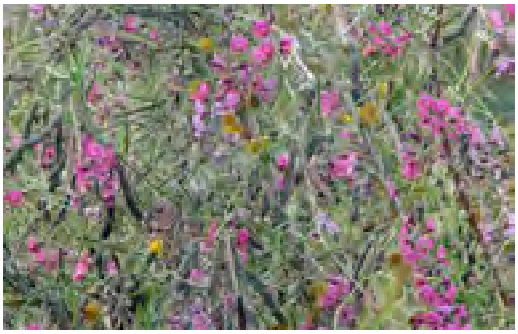
FLOWERING SEQUENCE

j f m a m **J J A S O N** d

Features

Herbaceous perennial

H 0.2–1.0 m W 0.3 m



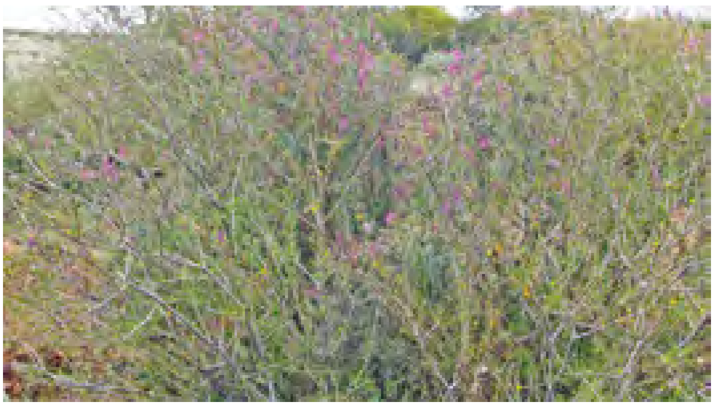
The attractive purple pea flower of *G. canescens* Photo: Philip Maher

Fast growth rate. A scrambling, twining herb. Leaves are dark green, compound trifoliate; leaflets hairy lanceolate to 6 cm x 8 mm. The pea-like flowers are pink to purple, 9 mm wide.

Origin: Western Australia, South Australia, Victoria, New South Wales, Queensland, Northern Territory

Conditions

Climate	Temperate, hot/arid, warm/humid
Rainfall	200 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained, various, sandy to clay



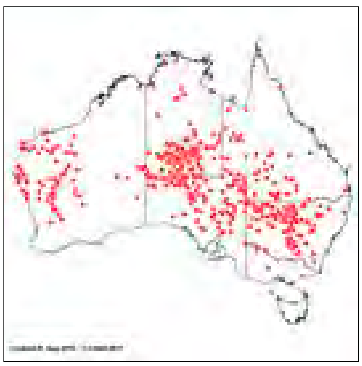
Silky glycine is a wiry survivor of harsh environments Photo: Philip Maher

Uses

This plant is considered to add to the biodiversity of plantings in all situations. It is a non-vigorous climber and will creep through other plants. It is being researched for its potential as a semi-arid perennial for vertical grazing systems (Revell 2011).

Apiculture

There is no information relating to the pollen and nectar of this species, but it is closely related to the soybean (*Glycine max*). Soybean crops yield honey under certain circumstances and the honey has been described by a panel of trained tasters in Minnesota, US: a dark-coloured honey, the aroma sharp, flowery to molasses, prune, with a high, fruity, green to molasses prune flavour and a lingering after-taste. In contrast, Clemson (1986) reported soybean honey as a light-coloured good-quality honey; this is supported by Crane et al. (1984). As a crop it is subject to regular pesticide use.



Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
G. max	14–45 kg/hive	White to extra light amber	Thin to medium	Rapid	Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
G. max		Grey to brown			Annual

HERB

Albo tedera

Bituminaria bituminosa var. *albomarginata*
Arabian pea, pitch trefoil

Features

Herbaceous perennial

H 20–100 cm

Fast growth rate. A prostrate to erect legume. Mid-green pubescent trifoliate leaves, leaflets petiolate, linear lanceolate to broadly ovate.

The inflorescence is a dense head of blue or violet flowers on long stems. The plant has a strong smell of bitumen or shoe polish: an Italian common name translated is 'stinking clover'.

Origin: Canary Islands.

FLOWERING SEQUENCE
j f m a m j j a **S O** n d

Tedera, Canary Islands Photo: Frank Vincentz GFDL

Conditions

Climate	Hot/arid, frost tender
Rainfall	150 mm, very drought tolerant
Aspect	Full sun
Soil	Well-drained, deep sand to shallow soils, pH 4.7 to 8.5

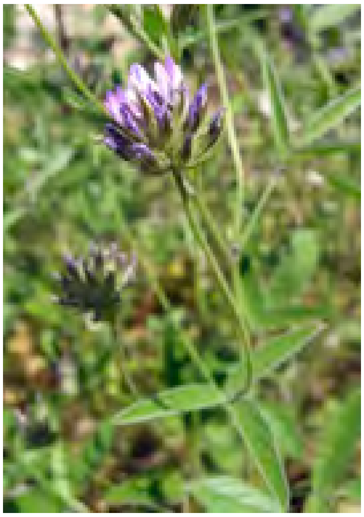
Uses

Tedera is being trialled as a beneficial perennial pasture species for low-rainfall regions in Australia. It is very drought tolerant, retaining its leaves even in extreme conditions. It has the same digestibility in sheep as good-quality lucerne (D Real 2011, pers. comm.). Its planting potential is vast in the low-rainfall grazing and cropping zones of Australia.

Apiculture

Tedera is a honey-producing plant on the island of Tenerife in the Canary Islands. It produces a unifloral honey described as very light in colour with yellow accents, a strong floral aroma, warm and fruity flavour with hints of coconut. It crystallises at a medium rate. The plant could provide extensive bee forage in arid Australia.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
		Very light with yellow		Medium	Annual
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**



Tedera flower Photo: Tigerente GFDL

HERB

Native scurf-pea

Cullen australasicum

Native verbine, cullen

FLOWERING SEQUENCE
j f m a m j j a S O N d

Features

Perennial sub-shrub

H 0.5–2.5 m W 0.5–1.5 m

Native scurf-pea in its natural environment, Warriner Creek, South Australia Photo: Lesley Brooker, Perth

Fast growth rate. An erect, much branched shrub. The compound dark-green leaves are trifoliate with leaflets glabrous above, pubescent below and denticulate margin. Leaves to 12 cm and leaflets to 5 x 3 cm. The small flowers are light pink to purplish, to 8 mm long, in axillary racemes. The flowers become widely spaced. Flowers throughout the year after rain but mainly in spring.

Origin: mainland Australia.

Conditions

Climate	Temperate, hot/arid, frost tender when young
Rainfall	230 mm, drought tolerant
Aspect	Full sun
Soil	Tolerates moderate waterlogging, salinity. Loam to clay, pH >5.5

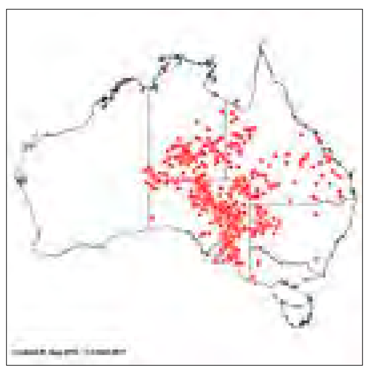
Uses

C. australasicum is being trialled as a semi-arid perennial pasture legume. It has shown significant potential as a persistent, nutritious fodder and will assist with soil water recharge and drought proofing (Kobelt et al. 2008).

A native bee on *C. australasicum* Photo: Lesley Brooker, Perth

Apiculture

Honeybees have been observed regularly visiting this plant. *Psoralea*, a genus closely associated with *Cullen,* has a species, *P. pinnata* Taylorina, that produces excellent honey and pollen and was described by Coleman (1962) as one of the best honeys produced in Western Australia.



Tagasaste

Chamaecytisus palmensis

Tree lucerne

Features

Shrub to small tree

H 1.5–7 m

Fast growth rate. A tall perennial legume with long drooping, softly hairy, leafy branches. Bark is rough, yellowish–grey. Leaves are greyish–green trifoliate; leaflets narrow, 5–30 mm, slightly paler beneath with velvety, hairy young growth. Flowers are scented, white and like pea flowers, in clusters in leaf axils. Established by direct seeding or planting.

Origin: Canary Islands.

FLOWERING SEQUENCE

j f m a m j j **A S O** n d

Prolific flowering of tagasaste Photo: Rob Manning

Conditions

Climate	Temperate, hot/arid, warm/humid, frost tender
Rainfall	350 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained deep sands, pH 4.0–7.5

Uses

An attractive specimen tree if allowed to grow, with profuse flowers. Widely planted fodder species for cattle and sheep in semi-arid Australia; at least 100 000 ha planted in Western Australia (www.agric.wa.gov.au 2011). With appropriate management it can provide much needed fodder in drought. It is widely used to improve the productivity of infertile sands and has been able to significantly increase carrying capacity. Its foliage has a crude protein content varying seasonally between 15 and 25%, equivalent to pasture grasses (www.agric.wa.gov.au 2011). It is often called a green haystack. It provides improved environmental outcomes by using soil water, mitigating dryland salinity and preventing erosion. It can also provide on-farm shade and shelter. It may offer carbon sequestration benefits.

Apiculture

Walsh (1978) noted that tagasaste is a prolific producer of pollen and nectar that can cause out-of-season hive increases that may create management problems in the North Island of New Zealand. It produces abundant dull creamy-yellow pollen and a white, mild-flavoured honey.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
		White	Good		Annual
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Cream yellow	High	High	Annual

SHRUB

White mallee

Eucalyptus dumosa

FLOWERING SEQUENCE

J F m a m j j a s o n d

Features

Large shrub to mallee tree

H 1.5–6.0 m

E. dumosa Photo: Dean Nicolle

A fast-growing hardy, adaptable mallee. A 'sock' of fibrous bark persists on the base; above is smooth gum bark, white to yellowish–white. Leaves are lanceolate dull grey to green to 10 x 2 cm. Infloresence is axillary, with 7 creamy-yellow flowers.

Origin: South Australia Victoria, New South Wales.

Conditions

Climate	Hot/arid
Rainfall	300 mm
Aspect	Full sun
Soil	Very adaptable. Well-drained sandy to heavy clay, pH <6.5 to >8, salt-tolerant

White mallee buds Photo: Dean Nicolle

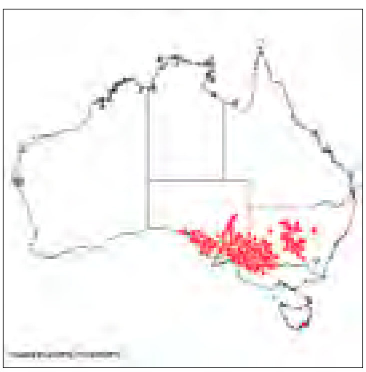
Uses

Can be used as a low component in shelterbelts and provides good firewood. It is salt-tolerant and has been used for its high oil (cineole) content.

Apiculture

E. dumosa yields high volumes of nectar after good rains just before and during flowering. It produces a good-quality light to medium amber honey of good density and characteristic flavour. It produces abundant creamy-white pollen that supports brood rearing (Clemson 1985).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	>50 kg/hive	Light to medium amber	Good body		3 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Creamy white	Good brood rearing	Major	3 years



SHRUB

Yorrell

Eucalyptus gracilis
Mallee gum, red mallee, white mallee

FLOWERING SEQUENCE
j f m a m j **J A S O** n d

Features

Mallee to small tree

H 5–10 m

Moderately fast growth rate. Yorrell has the mallee 'sock', persistent fibrous bark near the base and smooth upper bark; it sheds in short ribbons, revealing a glossy, grey–white patchiness. The leaves are glossy dark green, thick and very narrow, 8 cm x 1.5 cm. Inflorescence is axillary, 3–11 flowered. It is bird-attracting and a useful garden specimen.

Origin: Western Australia, South Australia, Victoria New South Wales.

E. gracilis, a profuse honey producer
Photo: Dean Nicolle

Conditions

Climate	Hot/arid, frost tolerant
Rainfall	250 mm drought tolerant
Aspect	Full sun
Soil	Sandy soils over limestone, salt-tolerant

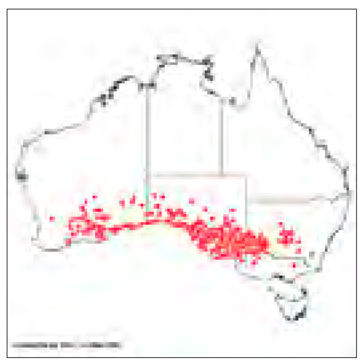
Uses

E. gracilis makes a useful addition to shelterbelts and produces firewood. Its burls are sought after for their intense grain. It is smog tolerant and used as a street tree. Being sand binding, it is used for erosion control. A suitable specimen tree for domestic gardens.

Apiculture

A producer of abundant honey in favourable seasons. Pollen production is unreliable, although abundant yields occur with favourable conditions. Beekeepers need to be aware of the risk of low pollen yield and to either supplement or move the bees on to a good pollen source (Clemson 1985).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	>70 kg/hive	Light amber	Good		2–3 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Cream white	Good	High to low	2–3 years, fickle



SHRUB

Christmas mallee

Eucalyptus socialis
Red mallee

FLOWERING SEQUENCE
J f m a m j j a s o **N D**

E. socialis buds Photo: Dean Nicolle

Features

Mallee to small tree

H 3–6 m

Moderate to fast growth rate. A hardy mallee or occasionally a small single-stemmed tree. The smooth bark is shed in long, narrow ribbons, leaving a white to grey patchiness. Narrow grey–green leaves to 15 x 1 cm. It has yellow to creamy flowers and dark grey bark, fibrous at the base then typically gum smooth. The flowers grow on the end of a long stalk.

Origin: Western Australia, South Australia, Victoria, New South Wales, Northern Territory.

Christmas mallee tree Photo: Dean Nicolle

Conditions

Climate	Temperate, hot/arid, frost hardy
Rainfall	300 mm, drought tolerant
Aspect	Full sun
Soil	Well-drained shallow sands, sandy loam, adaptable

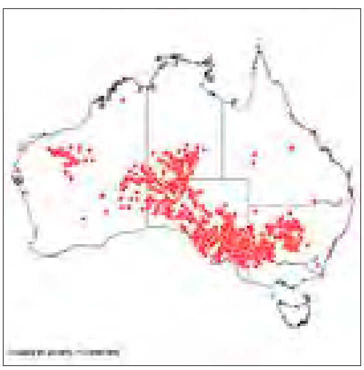
Uses

E. socialis provides low shelter as a component of shelterbelts and aids in soil conservation. Wood in small dimensions is dark, dense and durable. It is used as firewood. Its burl wood is prized, deep red and 'gummy'.

Apiculture

An outstanding bee tree allowing for large quantities of honey following favourable rain. The pollen is of good quality with a crude protein content of 26.6% (Somerville 2001).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	54 kg/hive	Medium amber	Good density	Rapid	2–5 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Cream	Good 26.6%	Major	2–5 years



SHRUB

Desert banksia

Banksia ornata

Features

Shrub

H 3 m W 1.5 m

Slow growth rate. A rounded shrub to 3 m with obovate leaves up to 10 x 2 cm with serrated margins. The yellow to yellowish–green cylindrical flower spikes are up to 14 x 12 cm. This species does not develop a lignotuber and is killed by fire; it regenerates from seed. It can be grown in a pot.

Origin: South Australia.

Conditions

Climate	Temperate, hot/arid, frost hardy
Rainfall	350 mm drought tolerant
Aspect	Full sun
Soil	Well-drained sandy

Uses

B. ornata is useful for low shelter and as a garden specimen in hot/arid climates. It is suited to cut flowers and is used in floral art. Could form low shelter in farm shelterbelts.

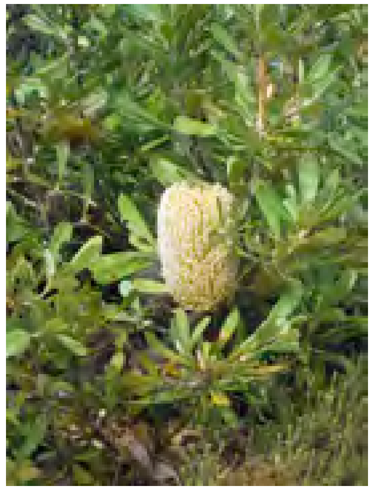
Apiculture

This is an important species producing medium amounts of pollen and low yields of nectar most years provided there is reasonable rainfall. It remains an important honey species in South Australia, often producing in excess of 20 and up to 120 tonnes of honey in a year.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	13–54 kg/ hive	Dark		Rapid	Annual to 5 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Good, 36.9%	Average	Annual

FLOWERING SEQUENCE

j f m **A M J J A S O** n d



Desert banksia Photo: malleefutures

TREE

Mulga

Acacia aneura

FLOWERING SEQUENCE
j f m a m j j **A S** o n d

Features

Large shrub to small tree

H 5–15 m

Pollen-rich mulga flowers Photo: Wikimedia Commons

Very slow growth rate. Mulga has erect branches, widespread, typifying arid Australia. It has an open flowering season, responding to favourable rains, and can flower up to 4 times. The phyllodes are greyish–green, narrow to broadly linear, very variable, 3–25 cm x 1–10 mm. Bright yellow flower spikes 1.5–3 cm long. Can live more than 50 years. It grows faster under cultivation.

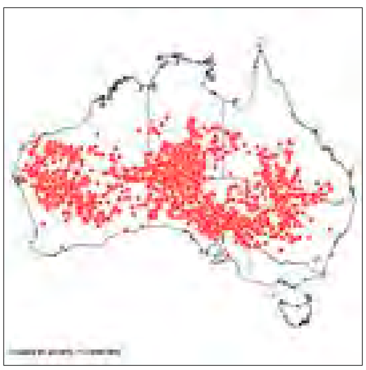
Origin: Western Australia, South Australia, New South Wales, Queensland, Northern Territory.

Conditions

Climate	Hot/arid
Rainfall	>50 mm, very drought tolerant
Aspect	Full sun
Soil	Well-drained sands to heavy clay, prefers acid to neutral

Uses

Mulga is suited to smaller gardens and is used as a street tree in arid parts of the United States. It can be used on farms as low shelter and shade and is a very important drought fodder tree in arid land grazing. The seeds have been used to make a traditional flour; the wood is a very good fuel and makes good charcoal. The wood is very hard, (ADD 1100 kg/m^3); an attractive contrast between the golden–yellow sapwood and dark reddish–brown heartwood has made it a traditional and popular wood for souvenir production (Bootle 2001). Aboriginal traditional use includes boomerangs, spear shafts and ends, and food.



Apiculture

A. aneura is an important pollen-producing species for arid land beekeeping. Pollen is abundant when there is adequate moisture (Clemson 1985).

Honey	Yield	Colour	Density	Crystal	Frequency
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	High	Yellow	Poor to good	High	Annual

A typical mulga Photo: FPC WA

TREE

Hill gum

Eucalyptus dealbata

Tumbledown gum, ridge gum, sand gum

FLOWERING SEQUENCE

j f m a m j j a **S O N D**

Features

Small to medium tree

H 10–15 m

Hill gum flowering is profuse and very attractive to bees Photo: Mark Leech

Can have a single stem or a multi-stemmed mallee form on poorer sites. Its feature bark and silvery leaves make it an attractive garden specimen. The bark comes off in large plates, revealing white mottled grey, smooth trunk. The leaves are up to 12 x 3.5 cm and from lanceolate to obovate and can be greyish–green to glaucous.

Origin: Victoria, New South Wales, Queensland.

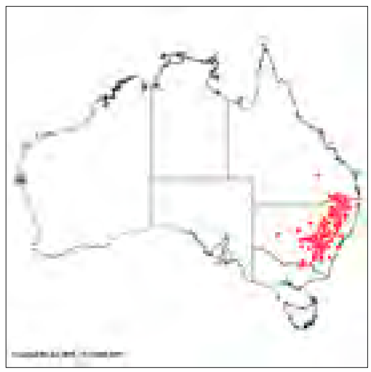
Conditions

Climate	Temperate, hot/arid
Rainfall	Very drought tolerant
Aspect	Full sun to partial shade
Soil	Very tolerant, acid to very alkaline

E. dealbata at the Australian National Botanical Gardens, Canberra Photo: Mark Leech

Uses

E. dealbata is an excellent revegetation and rehabilitation species and provides reasonable firewood. It could be used on farm in windbreaks and woodlots and as stock shelter.



Apiculture

An abundant pollen and nectar producer. It is also very reliable in its flowering and in some regions can be an annual flowerer. It provides both excellent spring build and a generous take of both nectar and pollen. It has been noted that it is so good that it can cause problems with swarming.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	27 kg/hive				2–3 years
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
			Highly valued, 21–24% cp	High	2–3 years

TREE

Coolibah
Eucalyptus microtheca

Features

Small to medium tree

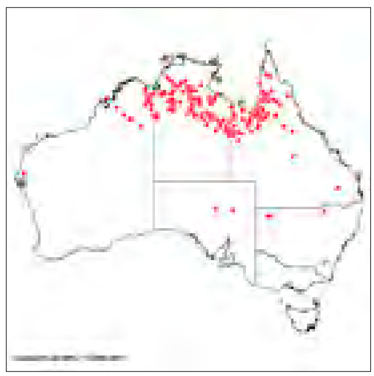
H 10–22 m

FLOWERING SEQUENCE
J f m a m j j a s o n **D**

E. coolibah fruit Photo: Dean Nicolle

Rarely more than 10 m and often forming a mallee habit. A rough, whitish–grey, often deeply fissured bark, but very variable and can be smooth. Branches are pendulous and leaves drooping greyish–green often curved to 20 x 3 cm. Populations of the different coolibah species often intermix and cause confusion. *E. microtheca* is the most widespread species and the species/species group most used by beekeepers. The plant is commonly called coolibah or coolabah.

Origin: Western Australia, South Australia, New South Wales, Queensland, Northern Territory.



E. microtheca

Conditions

Climate	Hot/arid
Rainfall	250 mm, drought tolerant
Aspect	Full sun
Soil	Various, from coarse-textured sands to heavy clays, alkaline; seasonal inundation tolerant

E. microtheca Photo: Dean Nicolle

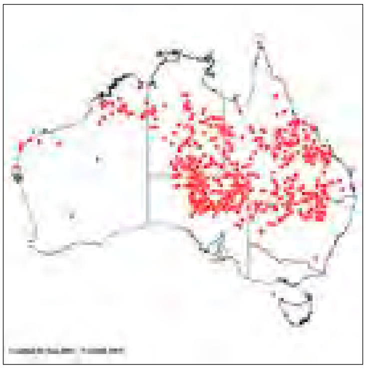
Uses

In a hot/arid climate coolibah provides essential shade and shelter. The wood is extremely hard and durable, used for firewood and round posts. The decorative burls are highly sought after for fine wood turning and cabinet detail.

Apiculture

Coolibah can provide very heavy flows in a short time, up to 30 kg recovered in 4–5 days. The honey is light in colour with excellent density and flavour. Abundant creamy pollen is produced. Given extreme heat and dry conditions, adequate water must be provided, and shade can help control hive overheating (Clemson 1985). When there have been sufficient spring rains, buds appear in November and persist for about 6 weeks. Flowering begins in December and lasts into January.

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	> 50 kg/hive	Pale straw	Very good	Slow	2–3
Pollen	**Yield**	**Colour**	**Quality**	**Quantity**	**Frequency**
	Heavy	Cream	Good	Heavy	2–3



E. coolibah

TREE

River red gum

Eucalyptus camaldulensis

FLOWERING SEQUENCE

J F m a m j j a s o **N D**

Features

Medium to large tree

H 30 m

This iconic Aussie, depicted in many famous landscape paintings, is fast growing. It has smooth white bark, cream and pale grey with yellow, pink or brown patches, fibrous at the base. Leaves are green to grey–green, 5–30 x .7–3.5 cm. It is widely planted internationally.

Origin: mainlaind Australia.

River red gum, buds and fruit Photo: Dean Nicolle

Conditions

Climate	Temperate, warm/humid, hot/arid
Rainfall	200 mm with annual flooding, 500 mm without flooding
Aspect	Full sun
Soil	Well-drained, seasonally waterlogged. Moderate to deep sandy loam to heavy clay, pH <6.5 to >7.5

Uses

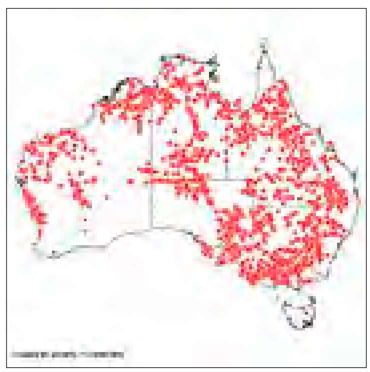
River red gum is a versatile farm forestry species, a good windbreak tree and withstands coastal spray. Often seen in large parks, it is an attractive spreading specimen providing good shade.

It has very durable dense red to reddish–brown heartwood (900 kg/m^3). The interlocked grain produces very attractive wood, which is highly sought after for furniture and turning. It also produces massive burls that are extremely decorative and prized. Traditional uses include heavy construction, fence posts, firewood and charcoal (Bootle 2001).

Apiculture

River red gum honey is golden coloured with an easily recognisable aroma. It can be pleasantly woody or grassy with a balanced citrus or barley sugar finish and excellent density. This is a very important tree for the honey industry: it provides large surpluses of excellent nectar and high volumes of good-quality pollen. It often grows in association with yellow box (*E. melliodora*) and effectively supports the harvesting of yellow box honey (Clemson 1985; Blake & Roff 1996).

Honey	**Yield**	**Colour**	**Density**	**Crystal**	**Frequency**
	60 kg/hive	Light gold	Dense	Rapid	2 year
Pollen		**Colour**	**Quality**	**Quantity**	**Frequency**
		Yellow	High	Heavy	2 year




A grand old river red gum Photo: Dean Nicolle

The bee farm

Non-migratory beekeeping

Central Valley, California, almond pollination, the world's most extreme example of mass monoculture pollination—more than 1.5 million hives Photo: Richard Thornton/Shutterstock.com

In most industrialised countries modern commercial beekeeping relies on migratory beekeeping—that is, moving hives to make use of pollen abundance and peak nectar flows from the available floral resources. This requires periodic movement of hives, often large numbers of them, to the location of the flowering resource, be it an artificial planting, environmental weeds or natural vegetation. The movement of large numbers of hives is also associated with crop pollination in agriculture and horticulture. The type of operation or combination of operations will determine hive numbers and when and where the hives are transported. Migratory beekeeping for peak honey flows and pollination management typifies the Australian honeybee industry.

Before the advent of modern forms of transport, most beekeeping was non-migratory and, as a consequence, the industry was much smaller. Typically 'yards' of up to 50 hives would service a large area with a radius of about 8 km (Raymont 1920). Agricultural practices differed greatly, and there was significant diversity in the form of environmental weed species and remnant native forests. The current industry relies on efficient modern transport to move large numbers of hives, sometimes tens of thousands of kilometres a year. An extreme example of this occurs in the United States, where 50–60% of the nation's hives (approximately 1.3–1.5 million hives) are moved, in most cases long distances, to the Central Valley of California for mass pollination; the area to be pollinated covers 740 000 acres (approximately 300 000 ha) of almond groves (Flottum 2010b).

The Australian honeybee industry uses three distinct flora types: native flora, introduced flora (often in the form of environmental weeds) and annual and perennial crops (Paton 2008). The majority of Australian honey is produced from native flora and predominantly from eucalypts and associated forest species. Tasmania has the benefit of a reasonably reliable annual flow of honey from one main species, leatherwood (*Eucryphia lucida*), a cool-temperate rainforest species. The Australian flora, and particularly the eucalypts, are variable in terms of flowering and nectar production within species, between species, and between sites and regions (Florence 1996; Paton 2008; Birtchnell & Gibson 2008).

Beekeepers have in-depth knowledge of the species and forest communities they exploit and are aware of forest conditions across vast areas of land, often more than 1000 km apart. This is essential to maintain their production since many eucalypts do not flower annually and the same area may not produce on a reliable cycle. Somerville (2010) concludes that for individual species many variables must be met for flowering to be initiated—the correct set of climatic conditions for bud set, followed by flowering and often a rest period of varying length.

All species, native or exotic, depend on the climate for nectar production. Consistent cold, wet, windy weather in Tasmania significantly reduced the 2011 leatherwood crop. This could also have been due to lack of suitable flying conditions, lower nectar secretion and flower drop, although it might be the rainfall or lack of it in the previous season that affects bud development, flowering and nectar production in many eucalypts. The length of daylight, soil fertility, day-time and night-time temperatures, genetics, altitude, aspect, tree size, age and crown space are other factors that affect bud development, flowering and nectar secretion, all of which makes for a complex equation (Somerville 2010).

> Most flora, other than ironbark and boxes, produce best when good rains occur during bud development and then just before flowering. (Goodacre 1938)

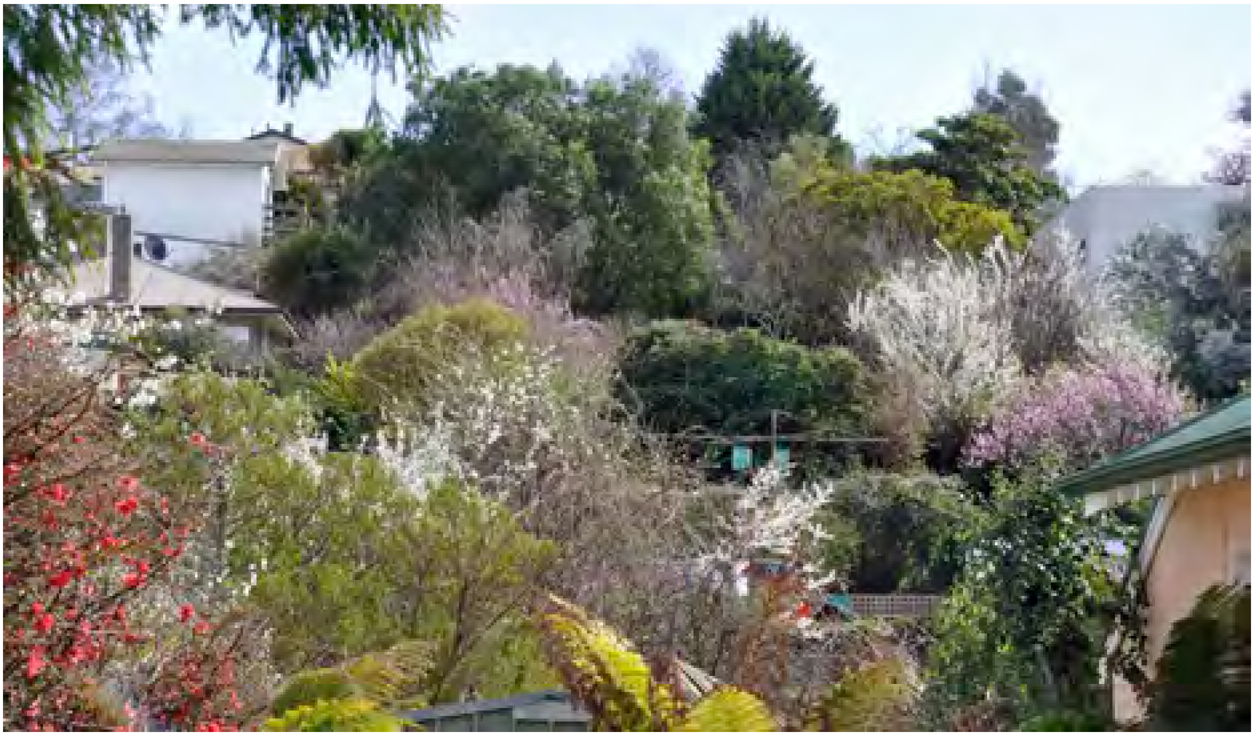
Some species do flower and produce nectar regularly and on an annual basis. Some of these are represented in streetscape plantings across the nation, chosen for their reliable flower show. Western Australian red flowering gum (*Corymbia ficifolia*) stands out. Recognised as a remarkable nectar and pollen producer in the United States in the early 1900s by Pellett, the famous American 'bee plant' author, its status has not altered. The bold, colourful flower display is a feature of many Australian street scenes and on closer observation it will be found to be covered with bee activity.

Can't get enough! *Corymbia ficifolia* and visitors Photo: Mark Leech

Paton (2008) introduces the further complication of climate change, explaining that the floral resource available to honeybees is likely to change as a result of the frequency and intensity of drought, frost and wildfire and with possible changes in the timing of rainfall.

It is also noted that eucalypts and other Australian flora can produce very large nectar surpluses, requiring commercial beekeepers to maintain a level of flexibility and a deep understanding of the resources they rely on.

Non-migratory beekeeping is mostly practised by non-commercial and hobbyist beekeepers. There are



A cool-climate spring feast Photo: Mark Leech

some examples of modern larger commercial operations, but they are usually associated with atypical geography and vegetation. Urban beekeeping, where several hives are kept in a backyard or other available space, characterises modern non-migratory beekeeping. In Les Aix d'Angillon, in central France, a large commercial beekeeper with 400 to 500 hives used to be mainly stationary until the early 2000s. The location enabled marvellous spring build on willow, hazelnut, wild prune and hawthorn. Significant honey crops were produced from canola, wheat, sunflower, wildflower and *Robinia pseudoacacia*. When systemic insecticides started to be used to coat the sunflower seeds, however, the sunflowers became toxic to bees. Consequently, when the sunflowers came into bloom the beekeeper had to move his hives out of the district (Y Ginat 2011, pers. comm.).

The Australian newspaper weighted the average production from all commercial hives in the nation in 2002 at 80 kg per hive. The productivity of urban hives depends on the skill of the beekeeper and the available resources. It has been reported that up to 80 kgs of honey was produced in the United States, and some Australian urban beekeepers report similar productivity (Schwarz 2011; L Fenlon 2011, pers. comm.). Bees in urban colonies have the benefit of gardens, with year-round flowering from many different species, different foraging habitats, and a variety of pollens and nectar. Placement of apiaries is often unregulated, while allowable hive numbers tend to relate to block size. At this stage, urban hives are often well spaced, reducing competition for floral resources.

Reducing bee movements and mixing bee populations may improve biosecurity, with less chance of disease transfer. It may also reduce energy consumption and the carbon footprint from lower emissions, capital investment and less hive handling and possibly reduce beekeeper fatigue.

A changing resource

The Australian honey yield comes predominantly from native flora, with an overwhelming emphasis on eucalypt species, from the coasts to the drier inland regions. Agricultural and other environmental weeds such as European gorse (*Ulex europea*) and willow (*Salix* spp.) contribute much to the health of the honeybee population, particularly with pollen for spring build-up. Some species, such as Paterson's curse (*Echium plantagineum*) provide for significant honey flows. However, the traditional resource base is continually changing—and arguably diminishing in area as state forests are turned into conservation reserves. With changed management come changed agricultural practices, and weed management improves, further reducing beneficial bee forage (Benecke 2003).

Commercial beekeeping in Australia began as stationary beekeeping, making the most of the abundant natural resources. A letter describes Berry's operation on the south coast of New South Wales in the 1800s:

> David Berry did not kill his bees when harvesting honey, nor did he just simply like them. David has hundreds of hives in front of his house in a bee garden … in this mild climate they work all the year round …

Berry's hives appear to have been very productive and an important stationary apiary. Records support this:

> Until recently it seemed sufficient for a beekeeper to make a study of his own locality, since beekeeping was then conducted on permanent sites. (Goodacre 1938)

And in South Australia:

> South Australia's then largest apiary, Coleman's Fairfield Apiary near Mylor, began with twenty-seven Langstroth-principle hives … and nearly two years later, in May 1885, operated 109 of these hives—for the time, a large operation. (Jolly 2011)

The case for planting bee forage

Many beekeepers have explained that planting for commercial honey crops is not viable because beekeepers own little land and the land area required to produce commercially viable regular crops is large and there is no guarantee of success. This notion is supported by authorities in the field:

> It is not generally an economic proposition to cultivate plants solely as forage for bees. Nevertheless some species can yield unusually high amounts of honey per hectare of land. (Crane 1999)

> The beekeeper cannot provide his bees with enough flowers to keep them busy. He needs to rely on the growers in the vicinity. To be supported by his bees, the beekeeper would have to sow large fields. (Warré 1948)

While this established logic is supported by the irregularity of native flora flowering and honey yields, the large distances bees are known to be capable of flying and the need to chase honey flows suggest that there may be room to reconsider. Ayers and Hoopingarner (1986) noted that in the United States fixed-land honey production may be economically feasible given the significant changes in agriculture since 1900. Global bee populations have been under immense pressure, with large annual losses. Population decline can be attributed to the very publicly reported colony collapse disorder in the United States and Europe and the threat in Australia from insect incursions, including the Asian honeybee (*Apis cerana*) and the dreaded mite *Varroa destructor*. There has been increasing public and government concern in relation to global reliance on commercially managed honeybees to provide pollination services for the majority of our food crops. This concern, combined with the rising cost of fuel, labour and capital, provides a further incentive to explore different approaches to commercial beekeeping.

Multipurpose plantings are considered a more viable option for planting larger areas with bee forage. Partners for Sustainable Pollination, an initiative in the United States, has stated that the common factor in hives lost to colony collapse disorder is nutritional stress due to lack of access to natural forage. This is exemplified in the Central Valley almond groves of California, where there is little natural forage in a vast area of what is effectively a monoculture:

> As beekeeper Randy Oliver says, it is 'monoculture at its absolute worst—they don't allow one species of weed to grow': mile after mile of bare soil and almond trees. No native pollinators can survive on this wasted landscape to ease the honeybees' burden, and nothing lives to sustain bees before or after the almond bloom. (Covina 2007)

Providing high-quality natural forage is a proven strategy to improve honeybee health. In the past there have been adequate forage resources for bee colonies once they have completed crop pollination, but changes to agricultural practices and improved environmental weed management have significantly reduced this resource.

Beekeepers do not usually own enough land to plant and rely on neighbours or farmers for access to suitable bee forage. In the United States, Partners for Sustainable Pollination is demonstrating alternative methods for establishing significant areas of bee forage through its Bee Friendly Farmer™ initiative. This collaborative approach to increasing bee forage between crops and on unused land, either spatially or seasonally, has the potential to provide large areas of useful continuously flowering forage. Researchers and program managers recognise the need for increased plantings of bee forage to add to their food base and to provide diversity in bee nutrition. Researchers in the United States have pointed to the lack of bee forage as a factor contributing to colony collapse disorder (Mussen 2009; Heintz 2009).

Bee Friendly Farmer™ Mark Griffin, Estate Manager, Napa Valley Reserve, St Helena, California, points to buckwheat bee pasture in a vineyard Photo: Serge Labesque

History records early evidence of efforts to enhance bee forage in Tasmania, with a recommendation in 1826 to scatter thyme seeds over the colony's idle, deserted and barren spots of land (Jolly 2011). This gives an indication of an awareness about the need to create favourable bee forage, even if the motive was a particular honey flavour, rather than nutrition.

There are mounting reasons for reconsidering fixed-land, or non-migratory, honey production. Changes in agricultural practices that affect honey production include vast areas of monoculture; altered grazing management, with pastures grazed or harvested before flowering; greater use of selective herbicides that reduce pasture weeds and their beneficial pollen; increased costs of labour; and a preference for transporting large numbers of hives long distances to chase honey flows. With wholesale bulk honey prices in most states remaining low, one of the simplest ways of improving financial returns is to reduce operating costs.

In Australia broad-acre opportunities to enhance bee forage exist across the landscape, but programs and incentives with a specific focus on enhancing and promoting bee forage do not exist. The Enrich™ grazing program in the semi-arid zone provides some hope as a model. While the focus is on improving grazing outcomes through introducing perennial shrubs and appropriate grazing management, the goal is to produce functional systems, both biological and managerial, that increase profit and enhance natural resources (Revell et al. 2008). If plant species could be identified that provide both improved grazing feed supply and bee forage, significant gains could be made across sectors, for both graziers and beekeepers. While there is evidence that honeybees are using some of the species being planted, there is concern that increased bee activity may adversely affect some plant species (J Emms 2011, pers. comm.).

The Enrich™ project identifies an opportunity for broad-acre productive revegetation, increasing the bio-richness of degraded grazing lands. Where bee forage is introduced into new grazing systems, it may provide a significant opportunity for beekeepers and possibly assist in establishing non-migratory apiaries in these landscapes.

evegetation is another broad-acre planting option that might provide multiple benefits. Planting salt-affected lands and biofuel and carbon plantings have the potential to provide significant long-term bee forage. Species such as *Eucalyptus loxophleba (*York gum) provide a number of opportunities, as well as being excellent bee forage. The York gum is a versatile, dryland mallee tree from the Wheat Belt region of Western Australia that is fast-growing and coppices well (McMahon et al. 2010). It is being used in oil mallee production, carbon sequestration and revegetation projects. Other excellent honey-producing mallee species such as *E. porosa* (black mallee box) and *E. viridis* (green mallee) are also being considered (Turnbull 2010; Kapambwe & Keenan 2009).

Diverse species planting, Bandingarra, Western Australia Photo: Dean Revell

The Israeli experience

Turning deserts into places of great productivity is an Israeli phenomenon that is not lost on honeybees. The area near Beersheba, in the Negev desert, is no exception. Once barren and desolate, no place for honeybees, it now has a forest of over 1000 ha of *Eucalyptus torquata* (coral gum), supporting hundreds of hives (A Dag 2011, pers. comm.). A number of eucalypt species were chosen using the following selection criteria:

- high sugar rate
- long floral blooming
- flowering preferably in the 'dearth' period
- ability to survive without irrigation
- nutritional resource, nectar or pollen, or both
- other uses of the plant—shade, ornamental or energy source
- proximity to crop plants and competition at crucial pollination time (Eisikovitch 1986).

Coral gum producing abundant nectar and pollen in a former desert Photo: Dan Eiskovich

Among the species chosen were *E.torquata, E. landsdowneana, E. erythrocorys, E. leucoxylon* var. *macrocarpa, E. calycogona, E. woodwardi* and *E. occidentalis*. At the time these were highly recommended and are now considered 'mega-producers'. Israel's forest department, the KKL-JNF, has a program of providing seedlings for beekeepers. David Brand, Chief Forester, pointed out that the selection criteria included other values and believes that program will result in an increase in Israel's honey production. Within this program 100 000 plants are provided to beekeepers each year and this has resulted in 1.5 million plants, all highly productive bee forage. The program continues (D Brand 2011, pers. comm.; A Dag 2011, pers. comm.).

A simple economic comparison between planting *E. erythrocorys* and grazing returns on the same country showed that at even very modest returns of $2/kg for honey, it was 5 times more valuable than grazing returns—($1000/ha or 500 kg honey/ha compared to $230/ha for grazing) (A Dag 2011, pers. comm.). It should also be noted that some of these eucalypts flower within 2 years of planting. The program has been a great success, with continuous planning and with many beekeepers maintaining stationary operations instead of chasing wildflower flows. It demonstrates that appropriate planting can contribute significantly to reduced hive movement.

Bees and fidelity

Honeybees show exceptional flower fidelity. Provided there are enough flowers from a single species, they will keep collecting from that species until its resources are exhausted. This enables unifloral or varietal honeys to be produced and is one of the main reasons honeybees are such good commercial crop pollinators: they are not often distracted. Pollen load analysis shows that only 6 per cent of honeybees are inconsistent and cases of this happening may be attributed to accidental wind-blown pollen (Hill 1998; Burlew 2011). This suggests a key

E. erythrocorys provides regular abundant blooms that are 'mega-producers' Photo: Dan Eisikovich

design element for fixed-land apiary establishment—larger area plantings of single species.

Foraging distance

Typically, when discussing foraging distance in relation to hive locations, beekeepers and land managers have considered a 3 km radius a minimum for avoiding competition for floral resources. However, it has been reported that in the absence of close resources, honeybees will fly up to 13.5 km from a desert location to an irrigated area with flowers (Ratnieks 2000). Where there is an abundance of flowers, such as in cities, it is reported that bees fly much shorter distances, up to 1.1 km from the hive (Waddington et al. 1994). The diversity of the landscape, the complexity of the floral patches and the abundance of flowers significantly affect foraging distance flown. A lack of pollen causes bees to fly longer distances (Schneider & McNally 1993; Beekman & Ratnieks 2000, cited in Steffan-Dewenter & Kuhn 2003).

Evidence that honeybees make shorter foraging flights during periods of floral abundance is supported by work in the pollination sector. Funk et al. (2009) reported that bees foraging on manuka in New Zealand do not forage effectively beyond 1 km of the hive. Paton (1996) observed that most bees from commercial apiaries, when foraging on *Banksia ornata* in winter, flew within 1 km of their hives. This is consistent with observations of suburban foraging (Waddington et al. 1994). With sufficient areas of continually flowering bee forage, it may be possible to maintain highly productive colonies on stationary sites. Hive productivity will be dependent on the beekeeper's ability to manage the hive, prevent swarming, and ensure the queen is actively laying and hive numbers are maintained.

Species composition

The species composition of planted areas will vary across the country and depends on desired outcomes, such as the production of unifloral honey, the ability to maintain a floral sequence through differing climate conditions, and on-farm requirements such as stock or crop shelter, drought fodder and other non-wood and wood products. The use of exotic pasture, perennial herbs, shrubs and trees should be given careful consideration since some of them are robust and consistent flowerers. Similarly, non-endemic natives often provide some safety in terms of climate change and atypical seasons. Planning for climate change has been suggested by Paton (2008) to help maintain the floral resource. The climate change threat to honeybee forage is significant due to the increase in catastrophic climatic events such as fire, frost and drought.

It is very important that abundant and varied pollen sources are available during the desired peak nectar flows. Many important honey-producing eucalyptus species are pollen deficient, and the absence of alternative pollen sources causes severe population decline. Pollen sources can came from trees known for pollen, planted understorey species known for high-quality pollen, crops and ornamental flowers. Many understorey plants, particularly 'pea flowers' from the Leguminosae (such as species from the genera *Daviesia, Dylwinia, Pultanaea* and *Oxylobium*), provide excellent pollen.

Planting design

It appears we are moving into relatively uncharted waters, with little information published about planting bee forage specifically for stationary, or fixed-land, beekeeping. Flottum, in his latest book, *Better Beekeeping* (2011), devotes a chapter to rethinking the merits of stationary beekeeping in the current context: 'Where land is available and beekeepers are willing to pursue the adventure, the opportunities and possibilities are awesome', he concludes.

Examples of improving bee forage in the landscape are the work of Partners for Sustainable Pollination in the United States and a small manuka plantation on Tregothnan Estate in the United Kingdom. However, there is a lack of information relating to planting design to establish a commercial stationary apiary. The following concepts are based on published research and discussions with beekeepers.

A French model provides some indication that a successful forage planting design is achievable (Janssens et al. 2006). The model enables researchers to identify more precisely what contributes to valuable honeybee forage within a limited landscape. A number of researchers have concluded that increased diversity in more complex landscapes with greater natural and semi-natural habitats and small mean patch size may contribute to a greater supply of honey and nectar (Beekman & Ratnieks 2000; Steffan-Dewenter et al. 2002; Steffan-Dewenter & Kuhn 2003; Janssens et al. 2006). However, the planting layout for species or species mixes needs to be researched: species mix, area, shape and distribution of planting patches are specific to each individual site.

Spacing, configuration and layout

Revegetation, farm forestry projects and larger plantations are usually planted closely spaced, often commencing with more than 1000 plants/ha and, if direct seeding is used, many times more germinants/ha. However, it has been previously noted that dense plantings do not provide the best bee forage outcomes, since crown development and flowering capacity are limited. Neil Barr, a New Zealand farm forestry pioneer, was well known for his low-density plantation regimes for growing large-diameter sawlogs. This concept had little following in Australia outside farm forestry circles. Volker (2010) reported on a concept called the Lonely Happy Tree Silviculture in Uruguay, which includes early thinning for wide spacing and is being successfully implemented in significant areas. This management system of growing 'fatter' trees faster with more open crowns has been introduced in Australia by Rowan Reid in the Otways and Frank Hirst in Gippsland, in smaller farm forestry plantings.

Early thinning, using crown spacing, will provide greatly improved flowering abundance in sawlog-focused plantations, where the aim is to optimise diameter growth by keeping crown competition to a minimum. Where favourable bee forage species (such as Tasmanian blue gum) are grown the gains will be significant and also allow for a diverse and healthy understorey. Paton (2008) demonstrated the difference in floral abundance between more open grown trees at less than 50 stems/ha and free crowns; these trees have up to 10 times more flowers than densely germinated river red gum (*Eucalyptus camaldulensis*). It is considered that a spacing of between 100 and 200 stems/ha will provide an adequate floral outcome for trees while maintaining the wood quality and growth targets. With species such as manuka (*Leptospermum scoparium*) the planting spacing may be reduced to 3 m and still provide full light to this scrub species (NZBR 2010). Such species may provide inter- or under-planting opportunities.

Where to plant

According to Raymont (1920), the 'Best sites are hill sides with a slight eastern slope to get the full benefits of the morning sun'.

With that in mind, there are many other criteria that need to be considered when selecting and designing an optimal planting site. Again, this is in the absence of research focused on planting for stationary beekeeping, and the following are perhaps obvious elements of a good 'bee yard' and bee forage planting: the site, both the planted area and the location of the hives, should be sheltered from prevailing winds, especially wind extremes; it should also be accessible year round and protected from stock grazing at least during establishment and the flowering times of herbs and shrubs. Tew (2010) points out 10 characteristics of a good bee yard, including constant clean water availability, clear long-term commitment from the landowner, minimal pesticide exposure, protection from summer heat and winter cold, protection from wildfire, good air drainage, and no competition from major bee yards. Raymont (1920) emphasised that the limits to the apiary size should take into account the number of colonies that may be supported in a drought; this criterion can be applied to drought planning with consideration for species choice, mix and planting configuration.

What to plant

The question of what to plant for a stationary beekeeping enterprise is what is on everyone's lips. Given the previous discussion about the extreme variability of the Australian flora, the design process will need to happen at the local or subregional level. There will be a general need to maintain hive health, with a particular emphasis on spring build and winter flora so that there are sufficient numbers of healthy bees going into winter, with high-quality and adequate stores of both pollen and nectar and a good 'building' spring flora. Because it is likely to take a number of years for flowering trees to first flower and then reach capacity, a number of perennial herbs and shrubs could be introduced as intermediate crops or components of the future floral estate. Annual crops can also be used to provide a step-up approach or may well become a component of the operation. Buckwheat (*Fagopyrum esculentum*) is a fast-growing annual that produces a unifloral honey; it can be used as a green manure and helps improve soil quality.

Paton (2008) noted that productive woodlands in South Australia contain at least 6 eucalypt species, and revegetation for honey production should contain a number of species with complementary flowering times. The presence of pollen-producing understorey plants, both native and exotic, is fundamental to success. *Bursaria spinosa* (called variously blackthorn in New South Wales, sweet bursaria in Victoria and Christmas bush or prickly box in Tasmania) is both a quality pollen producer and at times an extremely high nectar yielder, with a very attractive aromatic honey. This species produces prolific seed and is a primary coloniser of poorer sites, ideally suited to difficult conditions. There are many species that can be grown that will produce healthy hives of good foraging numbers to capture the honey flows of the main honey plants. While some of these plants are environmental weeds, such as gorse and willow species, there are many natives and non-natives that flower in spring, producing high-quality pollen and nectar.

Unifloral crops may be considered for stationary beekeeping, especially the high-value, medically active *Leptospermum scoparium* (manuka) and *L. polygalifolium* (jelly bush) in appropriate climates. These would need to fit within the floral sequence of the planting and have supporting pollen to maintain hive numbers to optimise nectar yield. Massey University is undertaking a significant research program to improve manuka plantation outcomes. While a number of long-flowering species such as *Eucalyptus leucoxylon* produce abundant honey, unless sufficient pollen-producing plants can be planted to support honey production, it may be more prudent to plant a eucalypt that produces good honey and abundant pollen—for example, spotted gum (*Corymbia maculata*), red gum (*E. camaldulensis*) or yellow mallee (*E. incrassata*).

Specific per-hectare production information for Australian species is lacking in the literature. Birtchnell and Gibson (2008) provide some useful information as an indication of production per hive, based on a 27 kg tin as the unit of measure, with further indication of the frequency of production. The difficulty with this is that it does not relate to the potential area-based production for purpose plantings. Paton (2008), in analysing the nectar production of flowers, tree shape and floral abundance, provides an indication of potential production from *E. leucoxylon*. With a 20% tree cover, it is estimated that 3.8 kg/ha/day could be produced. With increased cover, it may be possible to produce in excess of 20 kg/ha/day. With long flowering periods and good supporting pollens, very productive outcomes may become a reality. Analysis of New Zealand research indicates that manuka could produce up to 55kg/ha over the flowering period, reported as 2 to 3 months in south-east Australia (Clemson 1985; Birtchnell & Gibson 2008; Leech 2009). Can we learn some fast lessons from our New Zealand neighbours?

Location of hives

Year-round access is a key to managing the hives and maintaining hygiene and productivity. Ready access to water is fundamental for bee health. Security from vandalism and theft, protection from prevailing winds, scorching sun, wildfire, floods and adverse agricultural practices (including stock exclusion from the hives) are also considerations. In colder climates, aspect and morning sun become important for early foraging flights linked to flowering ecology. Perfect sites, if they exist, will be few, and some compromise is inevitable.

The layout of the planting warrants further research, but there are many options—linear, clumps, broad biodiverse shelterbelts or the forest gardening approach. Bio-ecology, streamside reserves, laneway verges, steep banks and rocky ground all provide opportunities for establishment. There is no template for providing sustainable year-round food for a commercial honeybee operation.

Ownership and funding: new partnerships

A new skill set is needed. Establishment of vegetation and management with a focus on producing sustainable bee forage are essential. Finance, equipment and land are also required. There are currently no direct incentives for planting bee forage, and a robust discussion must be had about this important investment in our future.

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Glossary

The following definitions are adapted from www.florabase.dec.wa.gov.au. Several Western Australian Herbarium publications were also consulted: *Flora of the Perth Region*, Parts I and II (1987); *Flora of the Kimberley* (1992); *The Western Australian Flora—a descriptive catalogue* (2000).

acuminate	tapering gradually to a protracted point
annual (plant)	completing the full cycle of germination to fruiting within a single year and then dying
anther	that part of the stamen in which the pollen is produced
axil	the angle between one part of a plant and another part (e.g. a branch and a leaf). *adj*. axillary
biennial (plant)	completing the full cycle of germination to fruiting in more than one year, but not more than two, and then dying
bipinnate	2-pinnate; twice pinnately divided
bract	a leaf-like structure, usually different in form from the foliage leaves, associated with an inflorescence or flower. *adj*. bracteate
burr	a type of seed or fruit with short, stiff bristles or hooks
calyx	the outermost floral whorl usually consisting of sepals or a calyx tube and calyx lobes. *adj*. calycine
catkin	a slim, cylindrical flower cluster, with inconspicuous or no petals, usually wind pollinated but sometimes insect pollinated
carpel	a leaf-like seed-bearing structure, part of the innermost whorl of a flower
concolourous	uniformly coloured, on upper and lower surfaces. *cf.* discolourous
coppice	shoots or suckers from cut stumps or branches
corolla	the floral whorl inside the calyx, usually consisting of petals or a corolla tube and corolla lobes. *adj*. coralline
corymb	an inflorescence, usually a raceme, in which the flowers, through unequal pedicels, are in one horizontal plane. *adj*. corymbose
denticulate	finely dentate—with sharp, spreading, rather coarse teeth standing out from the margin
dioecious	having male and female reproductive organs on separate plants. *cf* monoecious
discolourous	having two colours, e.g. the lower leaf surface distinctly different in colour from the upper. *cf* concolourous
elliptical	a 2-dimensional shape; oval in outline and with a length–breadth ratio between 3:2 and 2:1 broadly
floret	one of the small individual flowers of the Asteraceae
glaucous	blue–green in colour with a whitish bloom
inflorescence	the arrangement of flowers in relation to the axis and to each other
lanceolate	lance-shaped, much longer than wide, the widest point being below the middle
leaflet	one of the ultimate segments of a compound leaf
lobe	a rounded or pointed projecting part, usually one of two or more, each separated by a fissure or sinus
lignotuber	a woody, usually underground, rootstock often giving rise to numerous aerial stems
monoccious	having male and female reproductive organs on a single plant
nectary	a secretory organ producing nectar; commonly in a flower, sometimes on leaves, fronds or stems
obovate	a 2-dimensional shape, similar to ovate but attached at the narrower end and with a length–breadth ratio between 3:2 and 2:1
orbicular	of circular outline
palmate	describing a leaf that is divided into several leaflets that arise from the same point
panicle	a compound raceme; an indeterminate inflorescence in which the flowers are borne on branches of the main axis or on further branches of these. *adj*. paniculate
perennial (plant)	with a life span extending over more than two growing seasons

pericarp	the wall of a fruit, developed from the ovary wall
petiole	the stalk of a leaf. *adj*. petiolate
Pfund	a scale used to describe honey colour
pH	a measure of acidity to basicity, with a range of 0 to 14; 0 is most acid, 14 most base, and 7 neutral
phyllode	a leaf whose blade is much reduced or absent and whose petiole has assumed the functions of the whole leaf
propagate	breed specimens; in the case of a plant, by natural processes from the parent stock
pseudo-stem	a false stem composed of concentric rolled or folded blades and sheaths that surround the growing point
pungent	sharp-pointed
raceme	an indeterminate inflorescence with a simple, elongated axis and pedicellate flowers
rhizome	a creeping stem, usually below ground, consisting of a series of nodes and internodes with adventitious roots
sepal	free segment of the calyx
sessile	without a stalk
silage	fodder prepared by storing and fermenting green forage plants
spike	an unbranched inflorescence of sessile flowers or spikelets
spray	a small branch bearing buds, flowers or berries
stamen	one of the male reproductive organs of a flower, consisting typically of a stalk (filament) and a pollen-bearing portion (anther)
stipule	one of a pair of leaf-like, scale-like or bristle-like structures inserted at the base or on the petiole of a leaf or phyllode
stolon	the creeping stem of a rosetted or tufted plant, giving rise to another plant at its tip
style	the usually narrowed, elongated part of a carpel or group of fused carpels, between the ovary and stigma
tendril	a slender organ formed from a modified stem, leaf or leaflet which, by coiling around objects, supports a climbing plant
terete	circular in cross-section
terminal	at the apex or distal end
thixotropic	describing honey that is gel-like and becomes liquid when stirred
trifoliate	a leaf having three leaflets
tuft	a densely packed cluster arising from an axis
umbel	an inflorescence in which the pedicels originate from one point on top of the peduncle and are usually of equal length. *adj*. umbellate
unifloral	referring to honey from one floral source or a known majority of pollen
verticillaster	a cymose inflorescence resembling a whorl but actually arising in the axils of opposite bracts, as in most mints

Abbreviations

ADD	air dry density
CBD	central business district
CCBY	Creative Commons Licence
CCD	colony collapse disorder
CERES	Centre for Education and Research in Environmental Strategies, Melbourne
CFA	Country Fire Authority
CIE	Centre for International Economics
cm	centimetre
cp	crude protein
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEE	Department of Climate Change and Energy Efficiency
DPI	Department of Primary Industries
dS/m	deciSiemens per metre
EC	electrical conductivity
ESD	ecologically sustainable development
ICRAF	World Agroforestry Centre
GNU	Free Documentation Licence
ha	hectare
IBRA	International Bee Research Association
kg/m^3	kilograms per cubic metre
KKL-JNF	Keren-Kayemeth LeIsrael—Jewish National Fund
LGA	local government association
MGO	methylglyoxal
MRSA	methicillin-resistant *Staphylococcus aureus*
mS/m	milliSeimens per metre
OGTR	Office of the Gene Technology Regulator
pers. comm.	personal communications
PFSP	Partners for Sustainable Pollination
PFSQ	Private Forestry Service Queensland
PFT	Private Forests Tasmania
pH	a measure of acidity
OSU	Oregon State University
RFA	Regional Forest Agreement
RIRDC	Rural Industries Research and Development Corporation
RSBG	Royal Sydney Botanic Gardens
SGEG	Scottish Environment Golf Group
UC	University of California

Celosia

Species lists

By common name

Common name	Botanical name	Page
Acorn banksia	*Bansksia prionotes*	107
Alyssum	*Lobularia maritima*	89
Albo tedera	*Bituminaria bituminosa* var. *albomarginata*	271
Anise hyssop	*Agastache foeniculum*	225
Banana	*Musa* spp.	62
Apple	*Malus* spp.	37
Apple box	*Eucalyptus bridgesiana*	236
Avocado	*Persea americana*	65
Bee balm	*Monarda didyma*	167
Bee bee tree	*Tetradium daniellii*	66
Bimble box	*Eucalyptus populnea*	190
Bird's foot trefoil	*Lotus corniculatus*	239
Blakely's red gum	*Eucalyptus blakelyi*	247
Blueberry	*Vaccinium corymbosum*	34
Borage	*Borago officinalis*	42
Broad-leaved tea tree	*Melaleuca quinquenervia*	111
Brush box	*Lophostemon confertus*	126
Buckwheat	*Fagopyrum esculentum*	222
Budda	*Eremophila mitchellii*	136
Bull banksia	*Banksia grandis*	168
California lilac	*Ceanothus* spp.	93
Candy tuft	*Iberis sempervirens*	196
Carambola	*Averrhoa carambola*	61
Catmint	*Nepeta cataria*	150
Celosia	*Celosia* spp.	54
Cherry plum	*Prunus cerasifera*	100
Chicory	*Cichorium intybus*	254
Christmas mallee	*Eucalytpus socialis*	276
Coast banksia	*Banksia integrifolia*	175
Common clematis	*Clematis pubescens*	166
Coolibah	*Eucalyptus microtheca*	281
Cootamundra wattle	*Acacia baileyana*	162
Coral gum	*Eucalyptus torquata*	78
Coreopsis	*Coreopsis grandiflora*	134
Coriander	*Coriandrum sativum*	55
Cornflower	*Centaurea cyanus*	152
Crab apple	*Malus ioensis*	97
Creeping boobialla	*Myoporum parvifolium*	135
Crimson mallee	*Eucalyptus lansdowneana*	139
Cup gum	*Eucalyptus cosmophylla*	170
Currawong	*Acacia doratoxylon*	115
Desert banksia	*Banksia ornata*	277

Common name	Botanical name	Page
Desert lime	*Citrus glauca*	79
Dogwood	*Jacksonia scoparia*	263
Dryland tea tree	*Melaleuca lanceolata*	80
Dwarf bottlebrush	*Callistemon subulatus*	103
Elegant wattle	*Acacia victoriae*	73
Ellangowan	*Eremophila deserti*	199
Emu bush	*Eremophila duttonii*	76
Escallonia	*Escallonia* spp.	95
Fairy fan-flower	*Scaevola aemula*	102
Fern leaf grevillea	*Grevillea asplenifolia*	92
Firewood banksia	*Banksia menziesii*	198
Flat-topped yate	*Eucalyptus occidentalis*	142
Flax-leaved paperbark	*Melaleuca linariifolia*	125
Flowering currants	*Ribes* spp.	31
Forest boronia	*Boronia rosmarinifolia*	262
Forget-me-not	*Myosotis*	153
Gazania	*Gazania* spp.	91
Giant angelica	*Angelica gigas*	183
Glossy abelia	*Abelia grandiflora*	108
Golden grevillea	*Grevillea pteridifolia (prostrate form)*	181
Golden penda	*Xanthostemon chrysanthus*	186
Gorse bitter pea	*Daviesia ulicifolia*	232
Green mallee	*Eucalyptus viridis*	74
Grevillea bronze rambler	*Grevillea 'Bronze Rambler'*	105
Grevillea insignis	*Grevillea insignis*	138
Grevillea 'Mason's Hybrid'	*Grevillea 'Mason's Hybrid'*	118
Grevillea 'montis-cole'	*Grevillea montis-cole*	30
Grevillea 'Poorinda Royal Mantle'	*Grevillea 'Poorinda Royal Mantle'*	132
Grevillea gaudichaudii	*Gaudi chaudi*	90
Grey box	*Eucalyptus microcarpa*	192
Grey honey myrtle	*Melaleuca incarna*	133
Guava	*Psidium guajava*	58
Guioa	*Guioa semiglauca*	128
Gum-barked coolibah	*Eucalyptus intertexta*	206
Gungurru	*Eucalyptus caesia*	44
Hairpin banksia	*Banksia spinulosa*	45
Hairy-leaved pea	*Pultenaea villosa*	243
Happy wanderer	*Hardenbergia violacea*	180
'Harkness' bottlebrush	*Callistemon 'Harkness'*	106
Heath-leaved banksia	*Banksia ericifolia*	242

By botanical name

Bee Friendly

A planting guide for European honeybees and Australian native pollinators

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