

Climate Resilient Landscapes

A Planting Guide for
The **Northern Rivers Region**



Brunswick Valley
Landcare

Acknowledgements

Brunswick Valley Landcare acknowledges and pays respect to the original custodians of this land, the people of the Bundjalung nation and their Elders past, present and future.

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Introduction

Welcome to *Climate Resilient Landscapes*, a planting guide to adapt to climate variability in the Northern Rivers Region.

This publication aims to inspire residents and new arrivals to strengthen their connections to the local environment. They may learn how to make adaptations in their home gardens or on land they manage. They may also learn how to give our unique flora and fauna the best possible opportunity to survive and flourish under our changing climate.

Changes in the frequency and intensity of extreme climate events affect our natural vegetation and therefore our native wildlife. Extended droughts, extended fire seasons, storm events with more intense rainfall, increasing runoff and soil erosion are all increasing in frequency in our region. The seasonal timing of rainfall is also predicted to change. These extreme events, especially hotter days and longer periods of drought conditions are documented as major climatic factors impacting on flora and fauna.

We hope this guide will strengthen community knowledge to know what to expect, better understand the effects of climate change and learn actions they can take to be prepared and resilient.

We provide lists of local endemic native plants that are drought resistant, fire retardant, flood tolerant, sequester carbon and provide habitat and food for a wide range of native mammals, birds, reptiles, and insects.

Native plants are the trees, shrubs and wildflowers that have grown in the region for thousands of years. Over that time, they have developed a symbiotic relationship with soil organisms, fungi, local insects, frogs, birds, and other wildlife. When this ecosystem is established in your garden, all the benefits of generations of coexistence are available.

Bring natural habitat into the garden by setting aside areas for forest, grassland,

shrubland or wetland. If you have only a small garden plot, include native groundcovers as a lawn and native herbs as borders, or intersperse native shrubs amongst your crops. The native plants and wildlife will interact with the garden to enhance soil fertility, increase pollination, and provide natural pest management. They also protect against the spread of invasive plants (which are favoured by the changing climate).

As the global climate warms, the world faces an urgent need for increased food security, sustainability, and environmental stewardship. By teaching children skills that support ecological balance, school gardens can be used as a tool to meet this challenge. Children want to do something about climate change. When young people work together to grow food and learn sustainable practices, they become part of the climate change solution.

The Northern Rivers region of New South Wales is recognised as a biodiversity ‘hotspot’ – one of the richest and most diverse regions for flora, fungi, and fauna in Australia. The Big Scrub was once the largest representative sub-tropical lowland rainforest on the planet. There is currently less than 0.6% of the original biodiversity of the Big Scrub remaining in remnants, often disconnected patches (Lott and Duggin 1993). The caldera that defines the region’s topography, with majestic Wollumbin, the ‘Cloud Catcher’ (Mt Warning) at its heart, is the dormant remains of a 2-million-year-old shield volcano. Basalt lava flows atop older rhyolite that has eroded over time to provide rich, red, volcanic soils alongside older sedimentary rock in the hinterland and floodplains.

For those wishing to explore further they can visit the ‘Climate Resilient Landscape’ demonstration site, which is in Maslen Arboretum, Heritage Park, Mullumbimby. The demonstration site features plants for local gardens and revegetation projects that will be resilient to the effects of climate change. They are set out in the sections later in this book.

TIP Google will give you the location of Maslen Arboretum



2. Climate Snapshot for the NSW North Coast

2.1. Historical and Current Climate

The climate of the Northern Rivers is typically experienced as mild winter temperatures (Figure 1) and summer maximum temperatures buffered by seasonally high rainfall (Figure 2).



Figure 1: Seasonal average temperatures (Murwillumbah station 058158)

Rainfall in the Northern Rivers region is on average highest across the months of January, February, and March with the rains more intermittent through winter and early spring (figure 2).

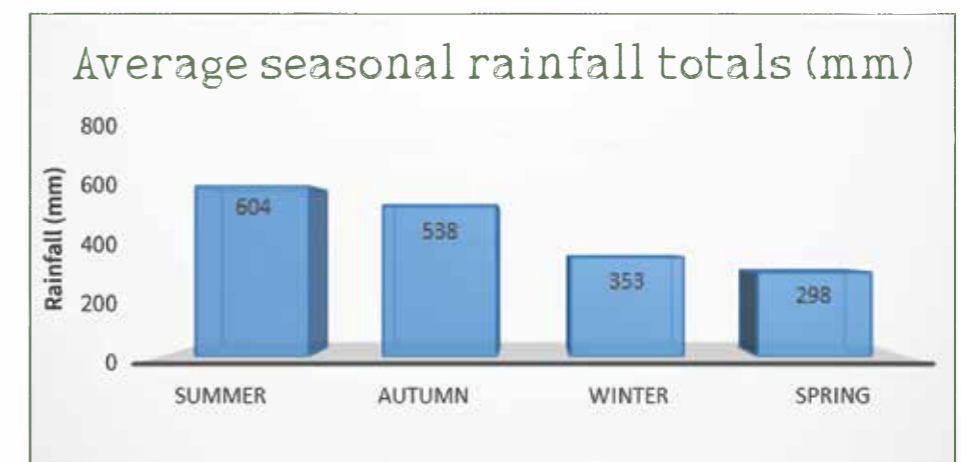


Figure 2: The average seasonal rainfall in Mullumbimby based on 15-year data (Mullumbimby station 058040).

2.2. Future Climate Projections for NSW North Coast

The North Coast Region is projected to continue to warm in the near future (2020–2039) and far future (2060–2079), compared to recent years (1990–2009). The warming is projected to be on average about 0.7°C in the near future, increasing to about 2°C in the far future.

The number of high temperature days is projected to increase. Summer will see the greatest changes in maximum temperatures, increasing by 2.1°C in the far future. Increased maximum temperatures are known to impact human health through heat stress and increasing the number of heatwave events.

If world average warming is kept to 1.5°C this century, Australia will warm by 1.4°C to 1.8°C.

If the world average temperature rises by 4°C this century, Australia will warm to between 3.9°C and 4.8°C. Sea surface temperatures off the coast of Australia have currently increased at four times the rate of the global averages (IPCC).

The North Coast currently experiences considerable rainfall variability across seasons and from year-to-year and this variability is also reflected in the projections. Rainfall is projected to decrease in winter and to increase in autumn and spring. Increased intensity of extreme rainfall events is projected.

The potential frost risk is expected to decrease.



Mean sea level will continue to rise and the height of extreme sea-level events will also increase.

Severe and average Forest Fire Danger Index is projected to increase. Severe fire weather is projected to decrease in autumn in the near future.

Detailed information on the projected climate changes for the North Coast can be found in the North Coast Climate change snapshot or explored further through the interactive climate projections map.

<https://www.climatechange.environment.nsw.gov.au/sites/default/files/2021-06/North%20Coast%20climate%20change%20snapshot.pdf>

<https://www.climatechange.environment.nsw.gov.au/projections-map>

TIP Digging deeper on climate

Read chapter 13 for a detailed review of our climate

Expected Impacts of Climate Change

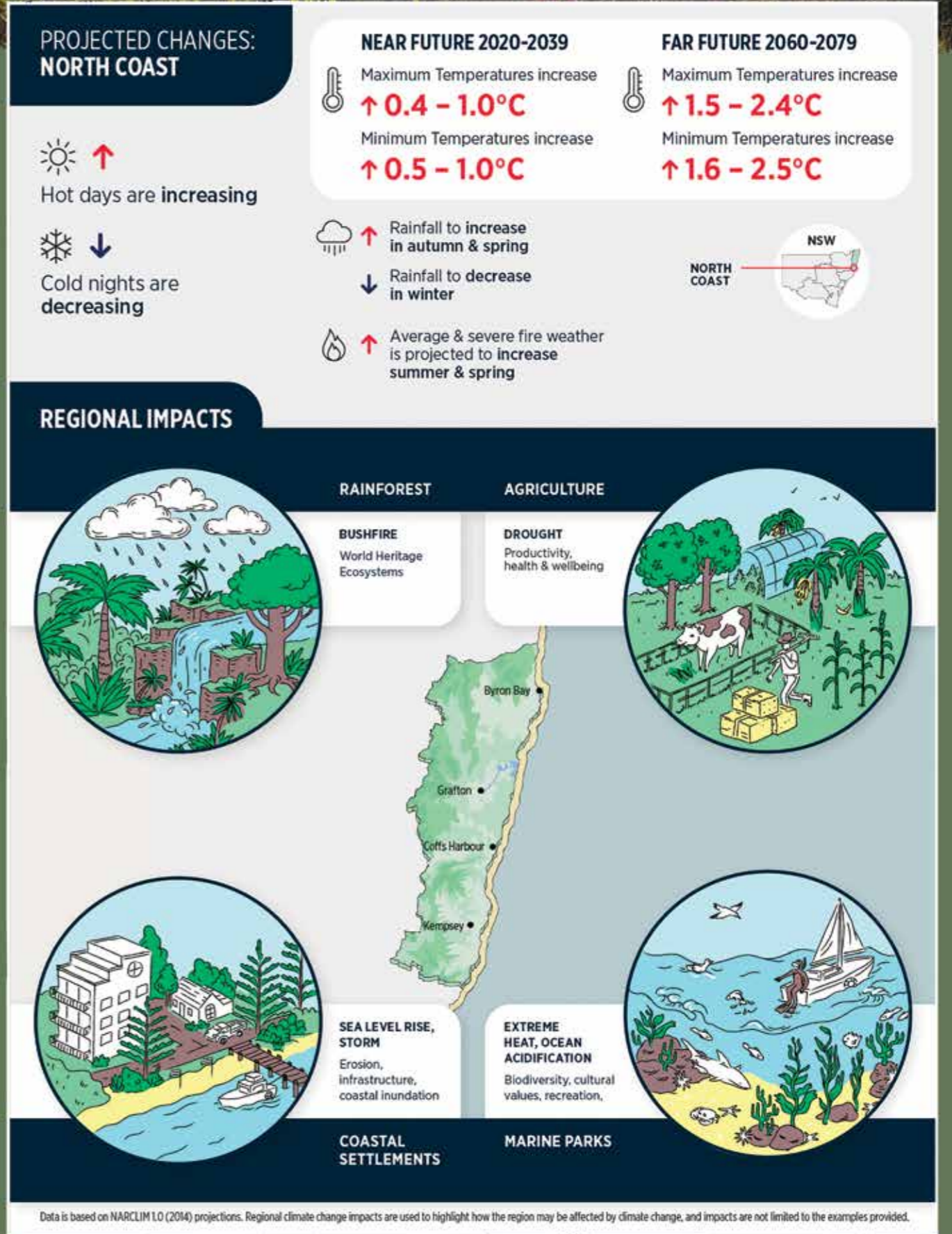
As many land managers, gardeners and backyard wildlife enthusiasts have noticed, climate change is having a significant impact on our plants and animals.



Changes in growing, flowering and fruiting seasons - higher average temperatures and shifting rainfall patterns are causing plants to bloom earlier, creating unpredictable growing seasons.

- **More pest animals, insects, and plants** - invasive, non-native plants and animals' ranges are expanding, making them more adept in taking advantage of weakened ecosystems and outcompeting native species. Some of the most problematic species, including vine weeds and Lantana, thrive under these new conditions and take hold.
- **More diseases** - there is likely to be a shift in geographic distribution of diseases of both plants and animals.
- **Changes in native species' ranges** - climatic shifts also mean that many native and iconic plants may no longer be able to survive in portions of their historic range.

- **Decrease in pollinators** - with seasonal habitat changes for pollinators, important connections between them and the plants they depend on are disrupted. Pollinators such as Flying Foxes may arrive either too early or too late to feed on the flowers on which they normally rely.
- **Extreme weather events** - especially intense rainfall can lead to more landslips and topsoil loss.
- **Sea Level Rises** - can lead to drowning of coastal wetlands, such as saltmarshes and mangroves. With much of our coastline developed, this affects the ability of these wetlands to move to higher areas. This in turn affects the coast's capacity for resilience in the face of severe storms.
- **Saltwater intrusion** - sea level rises mean that salt water moves into freshwater wetlands and even aquifers leading to drinking water contamination.



3. My Climate Resilient Landscape Sections

As there are many factors that affect and influence native vegetation, it is difficult to decide which type of vegetation community will thrive at your place. To help you identify which native plant community best suits your land we have divided vegetation types into 4 sections. For detailed information on each of the landscape sections see the companion guide My Local Native Garden for your area (there are versions for Tweed Shire, Byron Shire and Lismore Shire).



<p>Coastal & Estuarine</p> <p>From the beach to 5km from the coastline</p> <p>PLANT COMMUNITIES Littoral Rainforest, Melaleuca Wetland, fire dependant Coastal Heath, Coastal Dry Forest.</p> <p>SOILS sandy, sandy clay, sandy loam, peaty sand.</p>	<p>Riverine & Alluvial</p> <p>Within 5km from a river or creek</p> <p>PLANT COMMUNITIES Riparian (Gallery) Rainforest, Swamp Sclerophyll (Eucalypt) Forest, Paperbark Forest, Swamp Oak Forest, Sedgeland and Tidal Saltmarsh and Mangroves</p> <p>SOILS gravel, fine clay, silts and alluvial.</p>	<p>Foothills & Hinterlands</p> <p>40m to 300m elevation</p> <p>PLANT COMMUNITIES Big Scrub / Subtropical Rainforest, Wet Sclerophyll (Eucalypt) Forest</p> <p>SOILS red/brown kraznozems, volcanic.</p>	<p>Ridges & Ranges</p> <p>50m to >300m elevation</p> <p>Tall open forest with grassy or fern understorey</p> <p>PLANT COMMUNITIES Wet Sclerophyll (Eucalypt) Forest, Dry Sclerophyll Forest, Rainforest in gullies</p> <p>SOILS red/brown, well drained, often gravelly, rhyolite derived</p>
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3.1. How to use this book

1. Learn

Read the information in chapters 4-5 to learn more about the different factors that can influence what will grow in your garden and how you can make it more resilient to climate change.

2. Look

Look at the landscape graphic and sections opposite

- Coastal & Estuarine
- Riverine & Alluvial
- Foothills & Hinterland
- Ridges and Ranges

Which best describes your property?

Do the descriptions and soil types fit your place? If not look at some of the other sections – your garden may draw inspiration from two or more sections*.

3. Check

- a:** Check what existing vegetation is on or near your property. Look at vegetation community maps for your area available online.
- b:** Check what soil types you have on your property and what the underlying soil landscape is through online mapping tools.
- c:** Check out My Local Native Garden booklet for Tweed Shire, Byron Shire and Lismore Shire for further information on garden design, site analysis and correct planting techniques.

4. Choose

Go to Chapter 6 and look at the section that is relevant to you and choose from the list of striking native plants in your section. Then phone or visit your local native nursery and ask them if they have your selection in stock. For a list of local native nurseries please contact your local Landcare group.

* Remember – finding a vegetation and soil type that resembles your property is “best fit” – this is a general guide, and your garden may include sections and plants from one, two or even three zones. If you’re unsure, try visiting your local nursery or get in touch with your local Landcare group or council.

TIP

You can find out what vegetation types and soil landscape you have on your property through your local councils online mapping tools.

The NSW Government also has mapping tools

- for soils info visit www.environment.nsw.gov.au/eSpade2WebApp
- for plant community types PCT’s <https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet/about-bionet-vegetation-classification/vegetation-maps/state-vegetation-type-map>
(at the time of writing the North Coast PCT map is in development)

4. Resilient Gardens

Nature is a breathtakingly complex, interrelated, and dynamic living system in which nothing operates in isolation. Ecosystems are built upon a multitude of relationships developed between organisms, plants, and animals.

Gardeners and land managers are both stewards and guardians of this complex system and can make a difference in the fight against climate change.

Many of us are creatures of habit, working with the land and the seasons as we have always done, sometimes over-using conventional solutions such as chemical fertilizers, pesticides and herbicides that

artificially boost our success, but can work at the expense of the environment.

It's time to recalibrate. In our hectic modern world, there are benefits to slowing down to delve a little deeper and observe the systems at work around you. Which plants, animals and insects are already on your site? Are there certain species that should be present but are missing? By identifying the plants that cope better in extreme weather or drought, you will have vital information to guide your planning. Think through the entire process of gardening and landscape management from start to finish, adapt to what you observe, to accentuate positive effects and minimise negative ones.



There are four essential ingredients in designing a resilient garden:

Diversity

Soil

Water

Shelter

4.1 Diversity

A greater variety of plants, animals, microorganisms, and fungi make a healthy resilient ecosystem, which will mean less pests and diseases in your garden.

Local native plants (that is, plants that occur naturally in your local area) are more suited to local climate conditions. They also provide food and shelter for native animals. Many exotic plants can be useful in the garden but be careful to avoid plants that

have the potential to become weeds in surrounding bushland (see resources section for links to find out what plants to avoid in your area). Invasive species are expanding and can have major impacts on the health, function and diversity of native forests.

A wide range of plant families will increase your garden's resilience to pests and diseases. For example many Australian plants are from the family Myrtaceae - Eucalyptus,

Leptospermum (Ti Tree), Melaleuca (Paperbark), Callistemon (bottlebrush), and Syzygium (Lillypilly). So if a disease such as Myrtle Rust arrives in your garden you may lose a large percentage of your plants.

When it comes to food plants, instead of planting the popular dozen or so "usual suspects," mix it up. Try heirloom varieties of herbs, vegetables, and flowers. Diversification helps ensure that you'll have both variety and resilience in your bounty.

A variety of planting layers (trees, shrubs, and understorey plants) provides different opportunities for insects, birds and animals to shelter or hunt. There are some fantastic wildlife habitat ideas to follow in Chapter 8.

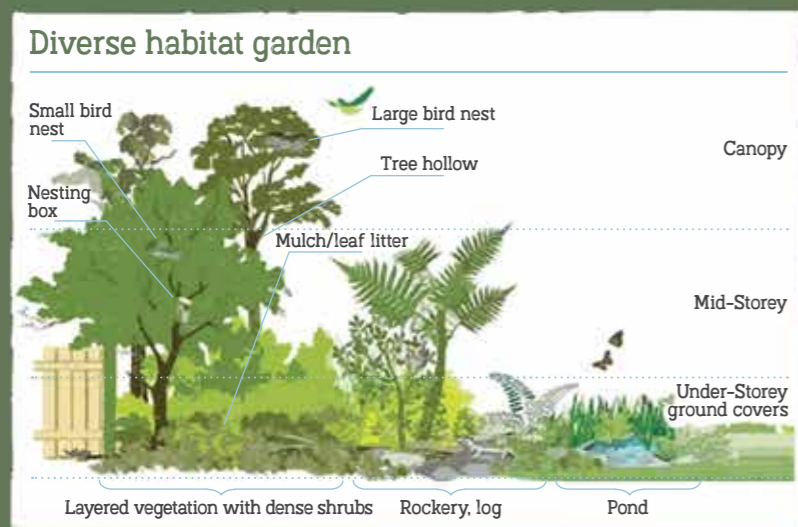


Illustration courtesy of City of Ryde Habitat Friendly Gardens (2012)

4.2. Soil

Soil is a living ecosystem and essential in creating a resilient garden. It plays a key role in promoting the health of your plants.

Healthy soils = great gardens

Soil is alive and teeming with life. It hosts a quarter of our planet's biodiversity. This biological diversity or biota is made up of familiar animals such as worms, termites, ants, mites, millipedes, springtails, pseudoscorpions, amphipods, and cicadas as well as a vast diversity of mostly unknown species of fungi, bacteria, and other microorganisms.

A healthy population of soil microbes can help reduce pathogens that cause plant diseases. Atmospheric carbon dioxide can be stored 'sequestered' in healthy soil. Fungi are very successful inhabitants of soil and have the capacity to adopt various life forms in response to adverse conditions. Building good soil begins with fungal activity and many diseases are both caused and solved by fungi. Some plants are so dependent on fungi, they cannot survive without them.

Resilient soils are 'spongy' and can store more water. Organic matter and humus promote good structure with more air pockets - allowing faster absorption of moisture, making the soil better able to cope with intense



rainfall. Organic matter also helps hold nutrients within the soil, maintaining fertility and stopping excess nutrients flowing into our waterways. Open, well-structured soils also allow roots to explore and form deep and wide root systems. This makes plants healthier, stronger, and able to form more symbiotic relationships with fungi and bacteria, which in turn leads to a better fed and less stressed plant.

Continuous soil coverage with plants or mulch (no bare ground) keeps the soil structure in good condition or even improves it. With the forecast of drier winters followed by more rainfall in spring, (bigger volumes over shorter

periods), bare soils are vulnerable to erosion and the loss of topsoil.

Did you know that it can take 200 – 400 years to form 1cm of topsoil?

Ways to build and preserve soil organic matter include:

- Recycling the organic matter from your garden and house by digging-in, mulching and composting.
- Using green manures, cover crops, companion planting and polyculture (different plants grown together) to maintain soil cover for as long as possible.
- Minimise digging, only dig to incorporate organic matter or landscape gardens. When soils are repetitively tilled, the carbon they store is released into the atmosphere and contributes significantly to greenhouse gas emissions.
- Avoid invasive species to prevent the resultant largescale clearing.

Each of these measures reduces run-off and erosion and helps to preserve precious topsoil.

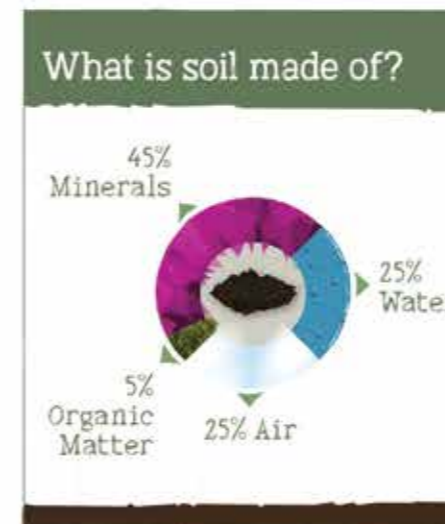


Illustration courtesy of FAO (Food and Agriculture Organisation of the United Nations)

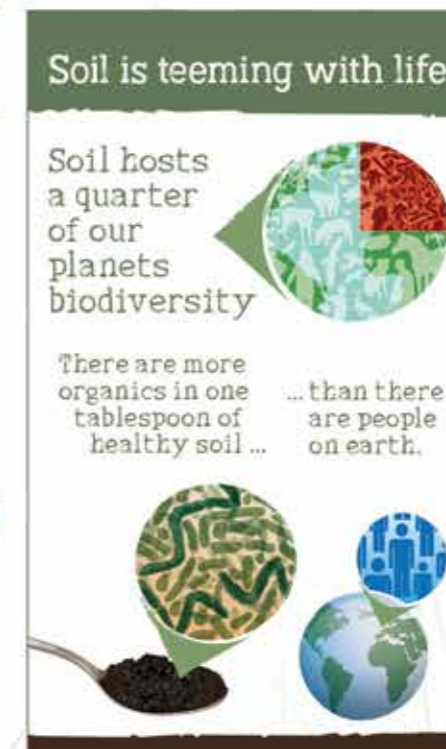


Illustration courtesy of FAO (Food and Agriculture Organisation of the United Nations)



4.3. Water Slow, spread and sink

A resilient garden allows rainfall to move through it as slowly as possible, giving water time to be absorbed and stored in the soil, available to plants and replenishing ground-water supplies. Factor the increased likelihood of extreme heavy rainfall events into your garden design, by considering how to divert and capture excess water in rainwater tanks, ponds, swales or wicking beds.

Watch where the water flows when it does rain and use structures such as dry creek beds, mounds and walls to direct the flow away from infrastructure.

Slow down the water falling on your garden, allowing more time for it to be absorbed by the soil and plants. You can do this by:

- Replacing hard surfaces with porous surfaces e.g. Lomandra hystrix borders and sedges in wet places, and native grasses under trees, with gravel or wood chip pathways instead of concrete.
- Use a diversity of leaf shapes - large leaves cool the ground and slow the passage of rainfall.
- Different shaped and textured leaves create different shapes and sizes of raindrops.



Longer dry spells result in reduced water availability. Consider reducing your water consumption. This can be done by:

- Changing the methods and timing of watering, for example, water less frequently but deeper.
- Watering first thing in the morning or last thing in the evening will reduce water loss through evaporation, enabling plants to make more efficient use of the water.
- The use of smart irrigation systems such as drip irrigation and wicking beds.
- Group plants according to their water needs e.g. wetland plants together, to make specialised watering easier and mulch gardens to reduce evaporation.

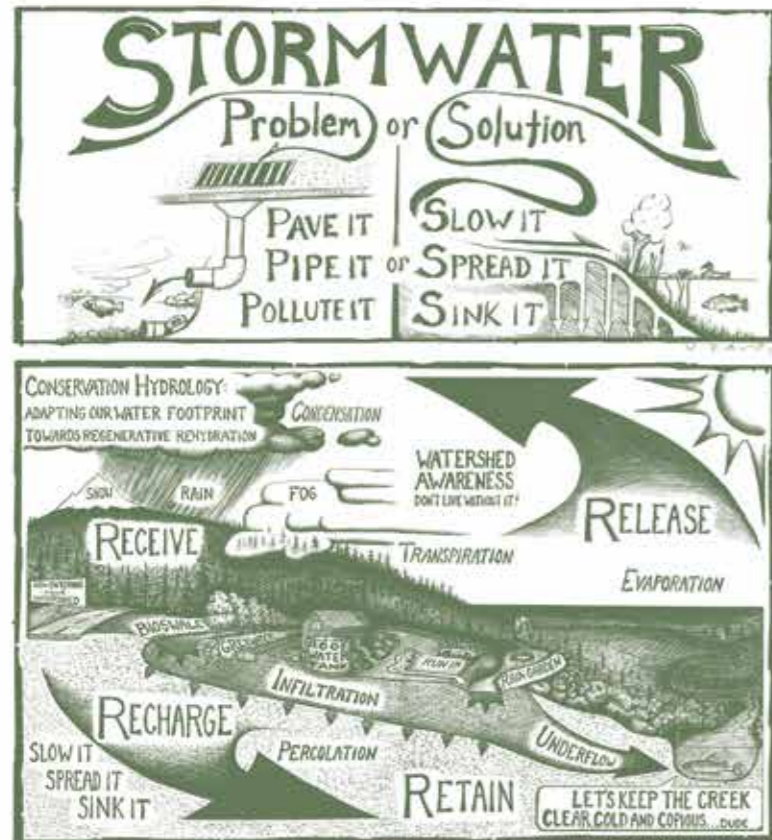


Illustration courtesy of Occidental Arts & Ecology Centre WATER Institute: Brock Dolman, Kate Lundquist and Jim Coleman



4.4. Shelter

Cool plants use less water. During hot periods, plants should be kept as cool as possible. When plants get hot, they 'transpire' to keep cool. This internal air-conditioning system uses the plants' roots to pump water up from the soil to the leaves. Water emerges from pores on the leaf and evaporates to cool the plant.

If plants can't keep up with the transpiration required to stay cool, their leaves will wilt. Some plants can handle significant wilting and recover in the cool of the afternoon or evening, but some species do not recover well.

Shelter from wind reduces transpiration because in still air the atmosphere immediately around the leaf becomes

saturated with the water vapour droplets emerging from the pores on the underside of the leaf. In contrast, moving air blows the moisture away, causing the plant to continue to transpire and use more water.

Help plants keep cool during hot spells, by positioning them so they receive shade and wind shelter from taller plants or construct artificial structures. Physical barriers consisting of 50 per cent white shade-cloth will protect valuable garden plants and vegetables by reducing sunburn to the leaves and fruit and lowering the temperature. Physical screens can be permanent or temporary.

A well-designed regenerative landscape can complement your property, reduce your



water and maintenance costs, improve air quality, and create seamless yet visually pleasing harmony with surrounding natural open spaces. The impacts of shade and wind protection that come from a carefully planted backyard means that your backyard can create a micro-climate that becomes your very own 'refuge'.

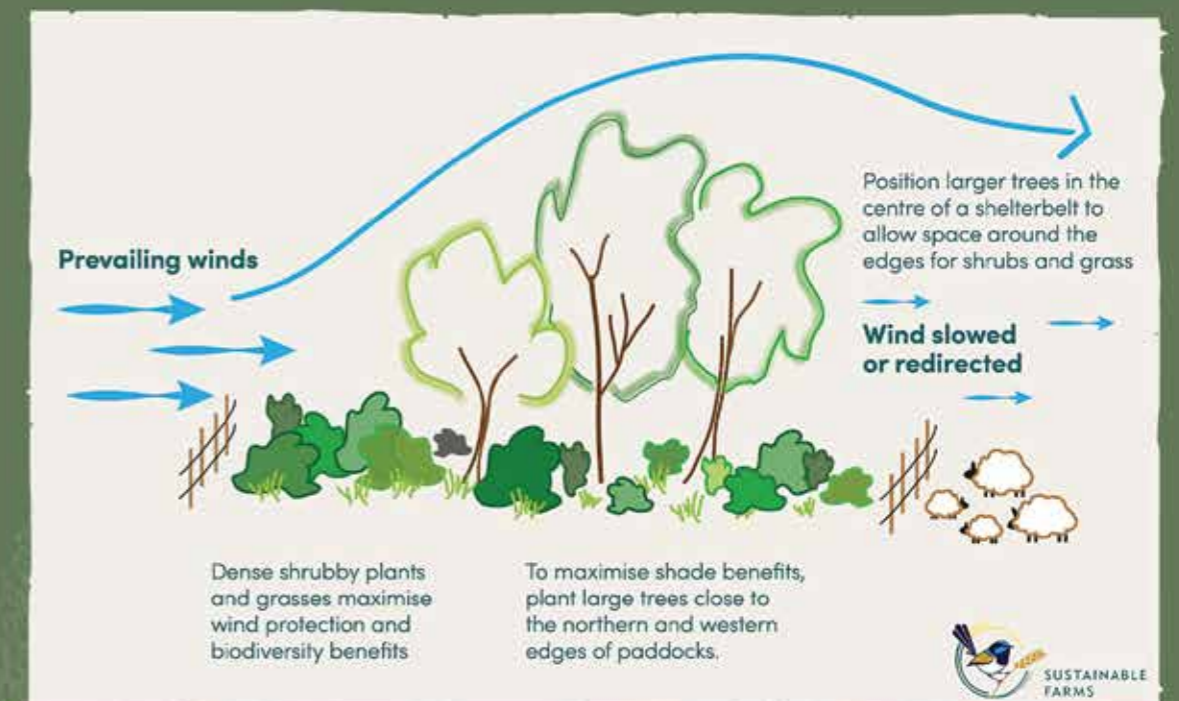


Illustration courtesy of Sustainable Farms, The Australian National University

5. Adapting your Garden to weather extremes

When considering how weather extremes may affect your garden and property there are number of factors to think about.

Location, location, location!

Where is your property? What kind of conditions occur on your property?

- **Water:** What access to water do you have? Will you be able to water your plantings? If not, plant species that are drought tolerant.
- **Flood:** Is your property in a flood zone? If so, plant species that can withstand or bounce back from flooding and inundation. (see Chapter 9 for more details)

- **Frost:** Do you get frosts? Frost can burn and kill some plant species – plant frost hardy species.
- **Wind:** Is your property exposed to prevailing winds? If so, consider planting a windbreak with suitable trees and shrubs.
- **Soil:** What is your soil like? Choose plants that occur naturally in your type of soil.
- **Elevation:** How high or low are you? Wind, exposure, or sheltered valley?
- **Fire:** Are you in a bushfire zone? If so, plant species that are fire resilient or act as a buffer (see Chapter 10 for more details).

Timing

Generally, the best time of year for planting in the Northern Rivers is the Autumn wet season (March - May).

However, planting can also take place throughout the year if there is adequate rainfall. Keep an eye on the long-range weather forecast and time your plantings to minimise the amount of watering you will need to do.

What are the windiest months – will your tender new plants need wind protection?

Is the planting on a river flat? You may get frosts over winter so plant frost tolerant species first then a few years later plant more species once they have shelter.

TIP → Deep watering once a week is better than watering daily as it helps to establish deep root systems and enhances adaptability.

The 3 Ms

To ensure success remember the 3Ms:

- **Monitor** species which cope during extreme weather events (wet and dry). Don't persevere with species which do not survive – plant more of the ones that do well at your place! Observe local, successful native plantings – check out nearby bushland, council landscapes and neighbouring gardens to discover what will work best in your garden. Talk to your local nursery or Landcare network.
- **Maintain** your plants by removing excessive dead material from vegetation to reduce flammability and encourage new growth, flowers, and fruiting; this will in turn benefit native wildlife. Also discouraging grass around the base of your trees will ensure healthy happy trees – grass will compete with the trees for water and nutrients.
- **Mulch** to maximise the soil's water-holding capacity and reduce evaporation. Mulch suppresses weeds and encourages beneficial fungi. Fungi cause mulch to decompose, improving soil fertility by making nutrients available to plants and increasing soil water retention. Ensure mulch is clear of dry leaf litter and debris which could increase the flammability of your garden.



And a further note on Diversity

Diversity should also include the genetic diversity of the native plants that you put in your garden. Research and genetic testing have shown that many plants purchased from nurseries have very similar if not the same genetics. This is because all the seeds may have come from a single tree. To minimise this, buy your plants from several different nurseries or grow your own from local seed, collected from several plants of the same species.

The Royal Botanic Gardens Restore and Renew project is creating tools to enable genetically informed species restoration www.restore-and-renew.org.au/

Big Scrub Landcare are working on a project to create a living seed bank with optimal genetic diversity. www.bigscrubrainforest.org/wp-content/uploads/2020/04/SCIENCE-SAVING-RAINFORESTS-BOOKLET-March-2020.pdf

Valuing Trees

After the Black Summer bushfires many people are fearful of trees around their properties. But trees are so important to include in our landscapes, both urban and rural. They help to build our wider relationship with nature, establish a beautiful landscape and provide habitat for wildlife. Trees lock up carbon to ameliorate the effects of climate change.

Trees also cool the environment, capturing or absorbing radiant heat from hard surfaces like roads, footpaths, and buildings. Trees planted in the north and or southwestern corners of your property can help block cold, destructive winter winds and harsh, western summer sun. This will help to cool your home. Trees that are deciduous or have sparse leaves like the native Red Cedar *Toona ciliata* and White Cedar *Melia azedarach*, allow winter sun to come through. From a health and wellbeing perspective, trees and plants release Phytoncides, chemicals that may help to boost our immune system. They have also been shown to extend life spans,

reduce violence and vandalism, and lower blood pressure.

Urban vegetation can drop temperatures by up to 8 °C, reduce air conditioner use by 12-15%, reduce wind speeds by 10%, hold and absorb water during intense rainfall events reducing localised flooding and reduce atmospheric pollutants! (SGA)

So how can we live with trees and fire? There are many things that you can do but it all starts with planning.

Plants can act as radiant heat screens and absorb more of the heat of an approaching fire without burning – but you need to choose the correct types of plants and plant them in a thoughtful way. (See chapter 10 and 11 for more details.)



6. My Resilient Garden Species Lists

6.1. Coastal & Estuarine



1 Sea Celery
Bush food tastes like Celery and Flat-leaf Parsley. Sun or shade, moist. Clusters of tiny white bee-attracting flowers.

2 Bacopa
Flat and dense white flowering ground cover.

3 Pigface
Fleshy leaves and bright pink flowers, edible parts after flowering.

4 Blue Flax-lily
Grass like with deep blue flowers, clumping.

5 Berry Saltbush
Tiny green flowers, red fruit year long. Very salt tolerant. Food for caterpillar of Saltbush Blue Butterfly.

6 Knobby Club-rush
Attractive grass like clumping plant with brown seed heads.

7 Seaberry Saltbush
Groundcover or low background shrub, windbreak coast or soil control. Food source and habitat for birds, lizards small mammals, fire retardant.

8 Sea Purslane
Grows in saltmarsh, sandy areas, attract tiny pollinator insects (and possibly even lizards).

9 Coastal Wattle
Low growing bright yellow flowers, sand binding and extremely hardy for banks and steep sites.

10 Weeping Baeckea
Soft weeping foliage with white flowers in abundance bee-attracting flowers.

		Common Name	Scientific Name	Flower Colour
Groundcovers/ Grasses	1	Sea Celery	<i>Apium prostratum</i>	White
	2	Bacopa	<i>Bacopa monnieri</i>	White
	3	Pigface	<i>Carpobrotus glaucescens</i>	Pink
	4	Blue Flax-lily	<i>Dianella congesta</i>	Blue
	5	Berry Saltbush	<i>Einadia hastata</i>	White
	6	Knobby Club-rush	<i>Ficinia nodosa</i>	Brown
	7	Seaberry Saltbush	<i>Rhagodia candolleana ssp. candolleana</i>	Green
	8	Sea Purslane	<i>Sesuvium portulacastrum</i>	Pink
Shrubs/ Grass-like plants	9	Coastal Wattle	<i>Acacia longifolia subsp. sophorae</i>	Yellow
	10	Weeping Baeckea	<i>Baeckea linifolia</i>	White
	11	Fern-leaved Banksia	<i>Banksia oblongifolia</i>	Yellow
	12	Large-leaf Hop-bush	<i>Dodonaea triquetra</i>	Yellow
	13	Needlebush	<i>Hakea sericea</i>	White
	14	Spiny-headed Mat-rush	<i>Lomandra longifolia</i>	Yellow
	15	Rough Fruit Pittosporum	<i>Pittosporum revolutum</i>	Yellow
	16	Tree Shaggy Pea	<i>Oxylobium robustum</i>	Yellow
Trees	17	Coastal Banksia	<i>Banksia integrifolia</i>	Yellow
	18	Corkwood	<i>Duboisia myoporoides</i>	White
	19	Ti Tree	<i>Leptospermum polygalifolium</i>	White
	20	Muttonwood	<i>Myrsine variabilis</i>	White
	21	Boobialla	<i>Myoporum acuminatum</i>	White
	22	Lilly Pilly	<i>Syzygium smithii</i>	White
Vines	23	Climbing Guinea Flower	<i>Hibbertia scandens</i>	Yellow
	24	Dusky Coral Pea	<i>Kennedia rubicunda</i>	Red



11 Fern-leaved Banksia
Hardy small growing Banksia with orange flowers in winter spring.



Needlebush
Feature plant that provides a great food source and habitat opportunity for beautiful small to medium birds.



12 Large-leaf Hop-bush
Open branched habit, attractive glossy foliage, tiny yellow-green flowers & purplish fruit can be used to relieve toothache & fever. Seeds attract birds.



Spiny-headed Mat-rush
Fire resistant, great for bank stabilisation. Larval food plant for skipper butterflies including the rare White Spot Skipperbee-attracting flowers.

Family Name	Growth Rate	Height (typical mature garden height)	Properties
Apiaceae	Slow	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Scrophulariaceae	Medium	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Aizoaceae	Fast	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Hemerocallidaceae	Medium	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Chenopodiaceae	Medium	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Cyperaceae	Medium	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Chenopodiaceae	Medium	< 0.5m - 2m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Aizoaceae	Medium	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Fabaceae	Medium	1-2m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Myrtaceae	Medium	1-2m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Proteaceae	Medium	0.5m - 1.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Sapindaceae	Medium	1-2m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Proteaceae	Slow	0.5m - 1.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Lomandraceae	Fast	0.5m - 1.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Pittosporaceae	Medium	1-2m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Fabaceae (Faboideae)	Fast	1-2m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Proteaceae	Medium	5.0m - 8.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Solanaceae	Fast	2.0m - 5.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Myrtaceae	Fast	2.0m - 5.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Myrsinaceae	Medium	2.0m - 5.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Myoporaceae	Medium	2.0m - 5.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Myrtaceae	Medium	8.0m - 10m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Dilleniaceae	Fast		[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Fabaceae (Faboideae)	Fast		[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]

- Drought resilient
- Fire resilient
- Flood resilient
- Carbon sequestration
- Habitat and food
- Salt tolerant
- Frost tolerant
- Wind tolerant

15 Rough Fruit Pittosporum
Attractive yellow fruits, compact growth suitable for small gardens bee-attracting flowers.



Tree Shaggy Pea
Yellow pea flowers in spring, especially effective when planted with *Hovea acutifolia* Purple Pea Bush which flowers around the same time.



Coastal Banksia
Large lemon yellow flowers autumn winter to spring, nectar rich and attract birds.



Corkwood
Grows from rainforest to coast on sandy soils behind sand dunes. White flowers in spring and summer. Fruit eaten by birds.



Ti Tree
Fast growing with abundant white flowers, good screen plant, important for bees.



Muttonwood
Hardy small tree with white flowers through out the year. Grows in mangroves.



Boobialla
Dense, dark foliage and attractive blue fruit eaten by rainforest birds including Rose Crowned Fruit dove.



Lilly Pilly
Great screen plant, attractive new growth, clusters of white flowers and fruit for many birds.



Climbing Guinea Flower
Scrambling non invasive vine with large yellow flowers bee-attracting flowers.



Dusky Coral Pea
Fire tolerant red flowering pea. Edible flowers in spring.



6. My Resilient Garden Species Lists



1 Tall Sedge
Grows well in boggy positions, in swamps, beside streams and in shallow ponds in full sun. Host plant for butterflies.

2 Swamp Lily
Attractive landscaping plant, tolerates poor drainage, clay soils, and can grow under established eucalypts.

3 Mat-rush
Fire resistant, great for bank stabilisation. Larval food plant for skipper butterflies, including the rare White Spot Skipper.

4 Harsh Ground Fern
Hardy fast growing ground covering fern providing shelter for small mammals and birds.

5 Ottochloa
Excellent native grass ground cover, responds well to mowing.

6 Rose Myrtle
Adaptable shrub with weeping habit, pink flowers, edible red berries, bird attracting.

7 Palm Lilly
Tough understory palm like plant with pale mauve sprays of flowers and red fruit.

8 Long-leaved Tuckeroo
Slender tree to 6m with very showy red new flushes of serrated leaves, Looks great when planted in a group of 3 or more.

9 Blue Tongue
Large pale mauve flowers will grow in wet or boggy soil.

10 Brush Sauropus
Hardy tolerant of flooding and cattle, attractive tiny flowers and fruits.

		Common Name	Scientific Name	Flower Colour
Groundcovers/ Grasses	1	Tall Sedge	<i>Carex appressa</i>	Yellow/brown
	2	Swamp Lily	<i>Crinum pedunculatum</i>	White
	3	Mat-rush	<i>Lomandra hystrix</i>	Cream
	4	Harsh Ground Fern	<i>Hypolepis muelleri</i>	Fern
	5	Ottochloa	<i>Ottochloa gracillima</i>	Grass
Shrubs/ Grass-like plants	6	Rose Myrtle	<i>Archirhodomyrtus beckleri</i>	Pink
	7	Palm Lilly	<i>Cordyline rubra</i>	Pink
	8	Long-leaved Tuckeroo	<i>Cupaniopsis newmanii</i>	Pink
	9	Blue Tongue	<i>Melastoma affine</i>	Mauve
	10	Brush Sauropus	<i>Phyllanthus microcladus</i>	Green
Trees	11	Twin-leaved Coogera	<i>Arytera distylis</i>	White
	12	Willow Bottle Brush	<i>Callistemon salignus</i>	Cream
	13	River Oak	<i>Casuarina cunninghamiana</i>	Brown
	14	Brown Kurrajong	<i>Commersonia bartramia</i>	White
	15	Creek Sandpaper Fig	<i>Ficus coronata</i>	White
	16	Cheese Tree	<i>Glochidion ferdinandi</i>	White
	17	Silky Oak	<i>Grevillea robusta</i>	Golden
	18	Native Frangipani	<i>Hymenosporum flavum</i>	Yellow
	19	Swamp Box	<i>Lophostemon suaveolens</i>	White
	20	Yellow Pear-fruit	<i>Mischocarpus pyriformis</i> subsp. <i>pyriformis</i>	White
	21	Firewheel Tree	<i>Stenocarpus sinuatus</i>	Red
	22	Giant Water Gum	<i>Syzygium francisii</i>	White
Vines	23	Carronia	<i>Carronia multisepealea</i>	White
	24	Native Wisteria	<i>Callerya megasperma</i>	Purple/mauve



11 Twin-leaved Coogera
Attractive pink new growth and yellow fruits.



12 Willow Bottle Brush
Attractive pink new growth, versatile plant used by many animals including Koalas.



13 River Oak
Useful for stabilising riverbanks, prevention of soil erosion, tolerant of wet and dry soils. The foliage is a stock food. Can be planted as effective screening plant or for windy sites.



14 Brown Kurrajong
White flowers in abundance at Christmas.

6.2. Riverine & Alluvial

Family Name	Growth Rate	Height (typical mature garden height)	Properties
Cyperaceae	Fast	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Amaryllidaceae	Fast	0.5-1m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Lomandraceae	Fast	0.5-1m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Dennstaedtiaceae	Fast	<0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Poaceae	Fast	<0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Myrtaceae	Medium	3-5	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Asparagaceae	Medium	1-2m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Sapindaceae	Medium	2-5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Melastomataceae	Fast	1-2m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Phyllanthaceae	Medium	1-2m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Sapindaceae	Slow	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Myrtaceae	Medium	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Casuarinaceae	Fast	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Sterculiaceae	Fast	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Moraceae	Fast	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Phyllanthaceae	Fast	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Proteaceae	Fast	10m -15m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Pittosporaceae	Fast	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Myrtaceae	Medium	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Sapindaceae	Slow	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Proteaceae	Medium	6.0 - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Myrtaceae	Slow	10m -15m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Menispermaceae	Medium	10m -15m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]
Fabaceae (Faboideae)	Fast		[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant] [Wind tolerant]

Drought resilient
Fire resilient
Flood resilient
Carbon sequestration
Habitat and food
Salt tolerant
Frost tolerant
Wind tolerant

15 Creek Sandpaper Fig
Drought food for birds and pademelons.



16 Cheese Tree
Great stabilising roots for banks.



17 Silky Oak
Flowers are nectar for birds and bats.



18 Native Frangipani
Nectar for Richmond Birdwing Butterfly.



19 Swamp Box
Habitat tree for Koala, tolerant of waterlogging.



20 Yellow Pear-fruit
Attractive bunches of yellow fruits.



21 Firewheel Tree
Very attractive red flowers.



22 Giant Water Gum
Purple fruits, attractive habitat for many birds.



23 Carronia
Host plant for endangered Pink Underwing Moth.



24 Native Wisteria
Butterfly host, Wisteria like flowers.





1 Rough Maidenhair
Hardy Maiden Hair Fern with attractive new growth, grows on banks and under trees. Bee-attracting flowers.

2 Native Ginger
Small growing pink flowered native ginger.

3 Rainbow Fern
Hardy spreading fern for under trees.

4 Indian Pennywort
Low growing flat ground cover with round green leaves. Edible.

5 Binung
Clumping fern for under trees and wet places.

6 Prickly Alyxia
Hardy & adaptable, slow growing. Fragrant white flowers, bright orange/red fruit. Good bird nesting plant.

7 Coffee Bush
Medium shrub with graceful arching branches, greenish flowers and bright red bird attracting fruit.

8 Palm-Lily
Tough understorey palm like plant with pale mauve sprays of flowers and red fruit.

9 Long-leaved Tuckeroo
Slender tree to 6m with very showy red new flushes of serrated leaves. Looks great when planted in a group of 3 or more.

10 Orange Thorn
Important understorey plant with orange fruits, prickly foliage provides bird habitat.

6. My Resilient Garden Species Lists

		Common Name	Scientific Name	Flower Colour
Groundcovers/ Grasses	1	Rough Maidenhair	<i>Adiantum hispidulum</i>	-
	2	Native Ginger	<i>Alpinia arundelliana</i>	Pink/White
	3	Rainbow Fern	<i>Calochlaena dubia</i>	-
	4	Indian Pennywort	<i>Centella asiatica</i>	Pink/White
	5	Binung	<i>Christella dentata</i>	-
Shrubs/ Grass-like plants	6	Prickly Alyxia	<i>Alyxia ruscifolia</i>	White
	7	Coffee Bush	<i>Breynia oblongifolia</i>	Green
	8	Palm-Lily	<i>Cordyline rubra</i>	Blue/Purple
	9	Long-leaved Tuckeroo	<i>Cupaniopsis newmanii</i>	Pink
	10	Orange Thorn	<i>Pittosporum multiflorum</i>	White
	11	Rough Fruit Pittosporum	<i>Pittosporum revolutum</i>	Yellow
	12	Banana Bush	<i>Tabernaemontana pandacaqui</i>	White
	13	Tiebush	<i>Wikstroemia indica</i>	Green/Yellow
Trees	14	Pink Laceflower	<i>Archidendron grandiflorum</i>	Pink
	15	Twin-leaved Coogera	<i>Arytera distylis</i>	Yellow/White
	16	Diamond-leaf Pittosporum	<i>Auranticarpa rhombifolia</i>	White
	17	Illawarra Flame tree	<i>Brachychiton acerfolius</i>	Red
	18	Lacebark Tree	<i>Brachychiton discolor</i>	Red/Pink
	19	Three-veined Cryptocarya	<i>Cryptocarya triplinervis</i>	Yellow
	20	Creek Sandpaper Fig	<i>Ficus coronata</i>	-
	21	Blue Lilly Pilly	<i>Syzygium oleosum</i>	White
	22	Veiny Wilkiea	<i>Wilkiea huegeliana</i>	Yellow
Vines	23	Snake Vine	<i>Stephania japonica var. discolor</i>	Green
	24	Large-leaved Wonga Vine	<i>Pandorea baileyana</i>	White



11 Rough Fruit Pittosporum
Attractive yellow fruits, compact growth suitable for small gardens.



12 Banana Bush
Small shrub with white scented flowers and mini banana like yellow fruit.



13 Tiebush
Pale green/cream flower heads spring and autumn. Fruit a succulent bright red berry. (Fruit and leaves possibly toxic if eaten): Hardy in all well drained soil types. Eaten by Brush Turkeys.



14 Pink Laceflower
Very attractive clusters of pink flowers, suitable specimen tree.

6.3. Foot hills & Hinterland

Family Name	Growth Rate	Height (typical mature garden height)	Properties
Adiantaceae	Medium	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration]
Zingiberaceae	Medium	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration]
Dicksoniaceae	Fast	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration]
Apiaceae	Medium	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Salt tolerant] [Frost tolerant]
Thelypteridaceae	Fast	< 0.5m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration]
Apocynaceae	Slow	1.0m - 2.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Phyllanthaceae	Medium	1.0m - 2.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Asteliaceae	Medium	1.0m - 2.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Sapindaceae	Medium	1.0m - 2.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Pittosporaceae	Slow	1.0m - 2.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Pittosporaceae	Medium	1.0m - 2.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Apocynaceae	Slow	1.0m - 2.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Thymelaeaceae	Medium	0.5m - 1.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Fabaceae (Mimosoideae)	Medium	8.0m - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Sapindaceae	Slow	5.0m - 8.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Pittosporaceae	Medium	8.0m - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Sterculiaceae	Medium	8.0m - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Sterculiaceae	Medium	8.0m - 10.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Lauraceae	Slow	5.0m - 8.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Moraceae	Medium	5.0m - 8.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Myrtaceae	Medium	5.0m - 8.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Monimiaceae	Slow	2.0m - 5.0m	[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Menispermaceae	Fast		[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]
Bignoniaceae	Fast		[Drought resilient] [Fire resilient] [Flood resilient] [Carbon sequestration] [Habitat and food] [Salt tolerant] [Frost tolerant]

Drought resilient
Fire resilient
Flood resilient
Carbon sequestration
Habitat and food
Salt tolerant
Frost tolerant
Wind tolerant

15 Twin-leaved Coogera
Very attractive pink new growth flushes several times a year, yellow fruits at Christmas. Grows well on riverbanks.



16 Diamond-leaf Pittosporum
Shiny foliage with clusters of orange fruits, suitable specimen tree, which flowers around the same time.

17 Illawarra Flame Tree
Showy red flowers cover this specimen tree in late spring.

18 Lacebark Tree
Pink bell flowers and pods, suitable specimen tree.

19 Three-veined Cryptocarya
Hardy salt and wind tolerant rainforest tree. Important food source for native fruit eating pigeons.

20 Creek Sandpaper Fig
Drought food for birds and pademelons.

21 Blue Lilly Pilly
Shiny foliage and blue fruits. Food for rainforest pigeons.

22 Veiny Wilkiea
Upright small tree. Food plant for Regent Skipper Butterfly.

23 Snake Vine
Non invasive climber. Greenish small flowers in clusters, oval shaped, orange or red fruit. A feature of this plant is the heart shaped leaves.

24 Large-leaved Wonga Vine
Climber with cream and pink bell flowers in clusters. The type specimen for this vine was collected from Mullumbimby Creek in 1895.



1 Creeping Saltbush
Hardy shrub for the most difficult soils exposed sites. Edible red berries used in jam. The foliage can be grazed by stock, a useful plant for drought fodder and soil stabilisation, bee-attracting flowers.

2 Star Goodenia
Prostrate form, yellow ground cover. Attracts butterflies, and is frost tolerant. Very hardy. Full sun to filtered sun.

3 Forest Lobelia
Spreading groundcover with blue flowers from summer to autumn. Flowers visited by native forest flies, bees and butterflies.

4 Spiny-headed Mat-rush
Hardy grass like bank stabilising attracts butterflies.

5 Weeping Grass
Low growing grass, can be planted as a lawn.

6 Basket Grass
Hardy native grass for shade or sun. Provide shelter for lizard and insects. Grows in sandy or clay soils.

7 Radiator Plant
Hardy succulent leaved ground cover for rocks or garden. Sun or shade, widespread.

8 Bush Basil
Grows in exposed ledges cliffs and outcrops or shade. Bush Basil. Good for Blue Banded Bees.

9 Kangaroo Grass
Grows on exposed cliffs and open forest. Attracts 13 species of butterflies including orange and browns.

10 Prickly Moses
Hardy prickly shrub, good shelter for small birds.

6. My Resilient Garden Species Lists

		Common Name	Scientific Name	Flower Colour
Groundcovers/ Grasses	1	Creeping Saltbush	<i>Atriplex semibaccata</i>	Yellow/White
	2	Star Goodenia	<i>Goodenia ovata</i>	Yellow
	3	Forest Lobelia	<i>Lobelia trigonocaulis</i>	Purple/Blue
	4	Spiny-headed Mat-rush	<i>Lomandra longifolia</i>	Yellow/White
	5	Weeping Grass	<i>Microlaena stipoides</i>	Yellow/Green
	6	Basket Grass	<i>Oplismenus imbecillis</i>	Pink
	7	Radiator Plant	<i>Peperomia leptostachya</i>	Green
	8	Bush Basil	<i>Plectranthus graveolens</i>	Purple/Blue
	9	Kangaroo Grass	<i>Themeda australis</i>	Pink/Yellow
Shrubs/ Grass-like plants	10	Prickly Moses	<i>Acacia ulicifolia</i>	Yellow/White
	11	Mountain Bottlebrush	<i>Callistemon montanus</i>	Red
	12	Lemon-scented Teatree	<i>Leptospermum petersonii</i>	White
	13	Soft Dogwood	<i>Ozothamnus rufescens</i>	White
	14	Geebung	<i>Persoonia media</i>	Yellow
	15	Tree Heath	<i>Trochocarpa laurina</i>	Yellow
	16	Sandfly Zieria	<i>Zieria smithii</i>	White/Pink
Trees	17	Forest Oak	<i>Allocasuarina torulosa</i>	Red/Pink
	18	Pigeonberry Ash	<i>Cryptocarya erythroxylon</i>	White/Green
	19	Yellow Tree Pea	<i>Davesia arborea</i>	Yellow
	20	Bolwarra	<i>Eupomatia laurina</i>	White
	21	Brown Possumwood	<i>Quintinia sieberi</i>	White
	22	Native Elderberry	<i>Sambucus australasica</i>	White
Vines	23	Hairy Apple Berry	<i>Billaderia scandens</i>	Yellow
	24	Native Yam	<i>Dioscorea transversa</i>	Pink/Brown



11 Mountain Bottlebrush
Red flowers grows in sun or shade good for shallow soils on cliff tops and edges.



12 Lemon-scented Teatree
Fast growing with lemon scented leaves. Attracts birds and bees to the garden.



13 Soft Dogwood
Dense heads of small white "flowers" can be used in floral arrangements.



14 Geebung
Geebung was derived from the Aboriginal word Jibbong referring to the edible fruits of some of the species. Good screen plant.

6.4. Ridges & Ranges

Family Name	Growth Rate	Height (typical mature garden height)	Properties
Chenopodiaceae	Fast	<0.5	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Goodeniaceae	Medium	<0.5	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Campanulaceae	Medium	<0.5	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Lomandraceae	Fast	<0.5	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Poaceae	Fast	<0.5	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Poaceae	Fast	<0.5	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Peperomiaceae	Medium	<0.5	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Lamiaceae	Fast	<0.5	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Poaceae	Fast	<0.5	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Fabaceae (Mimosoideae)	Medium	1-2m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Myrtaceae	Fast	0.5m - 1.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Myrtaceae	Fast	0.5m - 1.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Asteraceae	Fast	0.5m - 1.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Proteaceae	Medium	3.0m - 5.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Ericaceae	Slow	2.0m - 5.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Rutaceae	Medium	< 0.5m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Casuarinaceae	Fast	5.0m - 8.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Lauraceae	Slow	8.0m - 10.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Fabaceae	Medium	2.0m - 5.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Eupomatiaceae	Medium	2.0m - 5.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Quintiniaceae	Slow	5.0m - 8.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Adoxaceae	Fast	1.0m - 4.0m	[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Pittosporaceae	Medium		[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]
Dioscoreaceae	Medium		[Fire] [Drought] [Flood] [Carbon] [Habitat] [Salt] [Frost] [Wind]

- Drought resilient
- Fire resilient
- Flood resilient
- Carbon sequestration
- Habitat and food
- Salt tolerant
- Frost tolerant
- Wind tolerant

Tree Heath
Small tubular white flowers in summer and dark blue fruits. Reliable food tree for the Bower-bird & Lewin's Honeyeater.



Sandfly Zieria
Aromatic foliage, possible insect repellent leaves when crushed and rubbed on, host plant for Orchard Swallowtail Butterfly.



Forest Oak
Food for Glossy Black Cockatoo, used by Koalas.



Pigeonberry Ash
Slender rainforest tree with slightly buttressed trunk. Important food source for native fruit eating pigeons.



Yellow Tree Pea
Very showy yellow pea flowers, attractive to insects



Bolwarra
Edible fruit which attracts seed eating birds, butterflies, mammals, shiny foliage, good playground plant.



Brown Possumwood
Attractive white flowering tree from rainforest.



Native Elderberry
White flowers followed by small golden yellow or orange fruits. Both flowers and fruit are edible, though the fruit are very astringent unless fully ripe.



Hairy Apple Berry
Pale yellow flowers attract honeyeaters, non invasive climber.



Native Yam
Attractive non vigorous vine, with pink to brown papery seeds, edible tuberous roots, male and female plants. Larval food plant.





7. Unwelcome Plants (Weeds)

When a climate changes, some plants will benefit, and others will suffer; this is the case with exotic species as well as native species. Weeds are likely to increase and with the increase in frequent extreme weather events, ecosystems are under greater pressure. Weeds are in a favourable position to take over bare areas that are created by fires, floods, landslips or droughts. Additionally, many pasture and garden plant varieties are being bred to be hardier and this may result in Australia becoming more weedy. Many vine weeds respond positively to higher CO2 levels. The changes in birds and insect behaviour may result in more weeds being pollinated (Invasive Species Council).

Weeds are already one of the most serious threats to biodiversity. On some properties sadly, without some intervention, invasive plant species will be the winners.

Did you know that Australia has over 2700 invasive plant species with 20 new species registered every year? (Invasive Species Council)

Weeds have been identified as a threat to endangered animal species including the Golden-Tipped Bat, the Long-Nosed Potoroo and the Black-Breasted Button Quail.

It is easy to get overwhelmed when you learn about all the environmental weeds we have in the Northern Rivers. Knowing where to start is important. Choose a small area at a time and focus on those weeds that are changing the ecosystem – plants that strangle, smother, or spread.

- **Strangle:** some vine species, such as Cat's Claw Creeper *Dolichandra unguis-cati*, Morning Glory *Ipomoea cairica* and Madeira Vine *Anredera cordifolia* and Arrowhead *Syngonium sp* can kill mature trees.
- **Smother:** some ground covers stop any other seed germination effectively creating monocultures, such as Wandering Dew *Tradescantia sp*, Singapore Daisy *Sphagneticola trilobata* and Ground Asparagus *Asparagus aethiopicus*.
- **Spread:** some weeds have very attractive berries that mean they are spread far and wide, grow in shade and can form dense thickets under established canopy, such as Night-blooming jasmine *Cestrum nocturnum*, Mickey Mouse Plant *Ochna serrulata* and Privet *Ligustrum sp*.

See Resources section for links to local weeds information and control methods.

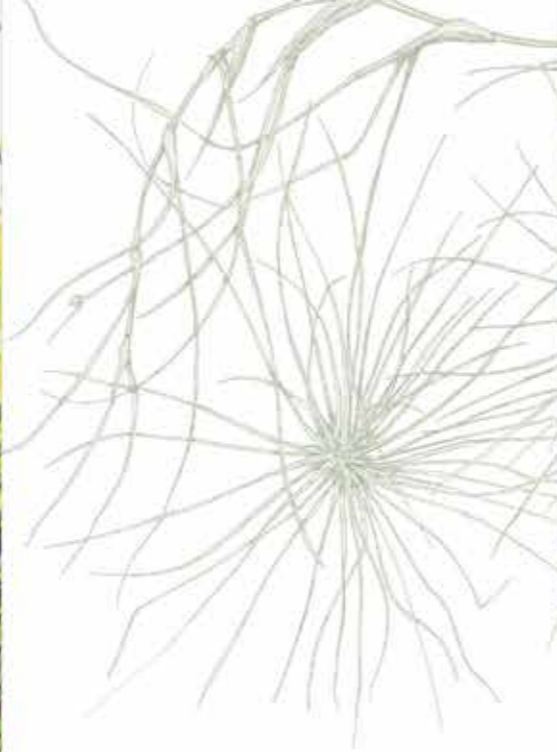


Photo: Shaz McGrigor



Photo: Deborah Pearce

8. Wildlife Habitat



Photo: Deborah Pearce

The 2019-20 bushfires burnt 5.5 million hectares with over 3 billion animals either killed or displaced. Some of our threatened animal, plant and insect species are believed to have become extinct (AIDR).

No matter how big or small your patio, garden, or acreage, by making the right choices, you can help our native wildlife's resilience in surviving the impacts of climate change.

Native wildlife species need shelter and food and the opportunity to move across the landscape when conditions such as temperature and rainfall drastically change. Providing connected native vegetation patches and steppingstones across the landscape to link areas of native bush, National Parks and Nature Reserves are essential for our wildlife's survival in the years ahead.

Where to start?

Plants are the key and by selecting and planting local native species indigenous to your area, you will reduce maintenance on your property and attract local wildlife which have adapted over thousands of years to live within your local ecosystem. Structure is important. If space permits, include an upper storey of tall trees, mid storey of shrubs and native ground covers to suppress weeds.

Practical tips for creating wildlife habitat in your garden

- Fruit and nuts attract possums, bats, and birds (pigeons, figbirds, parrots).
- Nectar attracts bees, butterflies, and birds (honeyeaters). Note: If planted excessively, nectar plants (eg. Grevilleas) attract Noisy Miners and larger birds which frighten off smaller birds.
- Seeds attract small birds such as finches.
- Native grasses are an important seed source for finches.
- Flowers and foliage attract insects, which in turn provide an important food source for other native species.
- Dense thickets of thorny native shrubs and vines provide homes, nesting sites and protection for small birds. eg. Orange Thorn *Pittosporum multiflorum*, Prickly Pine *Bursaria incana*.
- Logs provide food for fungi, shelter for lizards, bandicoots, echidnas and ground birds (noisy pitta, whip birds and bower birds).
- Rocks provide protection for lizards, snakes, bandicoots, echidnas, and insects.
- Keep wooden debris around the garden and mulch beds to provide habitat for insects to spend the winter.
- Make native bee hotels to provide homes for native bees and beneficial insects.
- Water attracts a variety of wildlife. Shallow containers of water on the ground are used by lizards, snakes and ground birds. Elevated bird baths attract many bird species and work best when situated in a shady location near or under trees or shrubs to provide protection.
- Nest Boxes provide homes for hollow-dependant species. Natural tree hollows can take up to 200 years to form. Choose nest boxes carefully to suit the species you wish to attract - different species have different hollow size requirements.



Photo: Rainer Hartlieb

8.1. Wildlife working for you in the garden!

Native fauna species have an important role to play in a biodiverse ecosystem. Welcoming them into your garden also brings a host of other amazing benefits.



Photo: Bela Allen

Small birds

There are so many benefits in having small birds visit your garden. They consume pest species, pollinate plants as well as disperse seed. They are also pretty, fun to watch and often have beautiful songs, a total joy to have around.



Photo: James Mayson

Pollinators

Bees, birds, butterflies, moths, wasps, ants, bats, possums and even flies are all essential pollinators. Over 80% of the world's flowering plants rely on pollinators for successful reproduction. Impacts of climate change and pesticide use are driving the extinction of pollinators. Supporting them by providing suitable habitat and food sources in your garden will not only help them survive but will have flow-on benefits such as increased crop yields.



Photo: Bemi Heiner

Predatory and beneficial insects

Predatory species such as ladybugs, lacewings, hover flies, parasitic wasps and praying mantis often attack different life stages of the pest, and even different pest species providing the best natural pest control! Many predators are also able to supplement their diet by feeding on alternative food sources, such as nectar, pollen, and fungi.



Photo: Rainer Hartlieb

Lizards and skinks

Not only fun to watch on a warm sunny day - also great for reducing garden pests like slugs and snails!



Photo: Deborah Pearce

Nocturnal predators

Forest owls, pythons, and insectivorous microbats are very effective and safe pest controllers. A resident python or owl are an effective way of controlling unwanted rats and mice. Microbats can eat around 40% of their body weight in insects in a single night, especially mosquitos.



Photo: Karin Black

Habitat for hollow dwelling species

If your property lacks hollow bearing trees, consider installing nest boxes for gliders, rosellas, forest owls, micro bats - this will enhance pest control and pollination as well as enhancing survival of native wildlife.

8.2. Vulnerable Wildlife (NSW Northern Rivers)

Here are some specific things you can do to provide food and habitat for some of our rare and endangered native species. It follows that many other native species of wildlife will also benefit from the habitat you provide.



Photo: John Stanicic

Mitchells Rainforest Snail

Thersites mitchellae

Leave dead palm fronds cut up on the ground in damp areas for snail habitat. Snails also use fallen logs for shelter and foraging.



Photo: Frank McGrath

Southern Pink Underwing Moth

Phyllodes imperialis subsp. Smithersi

Plant the native rainforest vine *Carronia multisepelea* which is the caterpillar's only food plant. The moth feeds on the juice of rotting or over-ripe fruit that has not fallen to the ground.



Photo: David Milledge

Long-nosed Potoroo *Potorous tridactylus*

Encourage fungi by leaving logs and understorey. Potoroos like dense understorey and feed mainly on underground fruiting bodies of fungi. Through digging for food, they aerate the topsoil, breakdown leaf litter and improve the overall health of the ecosystem. This also reduces fire risk by keeping leaf litter to a minimum.



Photo: David Milledge

Common Planigale

Planigale maculata

Maintain adequate ground cover, especially near water, for this tiny marsupial. Leave logs and bark for protection.



Photo: Georgia Beyer

Squirrel Glider *Petaurus norfolcensis*

Squirrel gliders nest in bowl-shaped, leaf lined nests in tree hollows in dry eucalypt forest and woodland. They feed on insects, the sap of Eucalypts and Wattles, as well as nectar, pollen, and seeds. Plant winter flowering plants such as Banksia to give them a year-round food supply. If tree hollows are scarce, install nest boxes.



Photo: Michael Bingham

Koala *Phascolarctos cinereus*

Koalas feed mainly on Eucalypt foliage, but they are fussy and most of their diet comes from just a few species. Plant the koala food trees indigenous to your area ie: Swamp Mahogany *Eucalyptus robusta*, Forest Red Gum *E. tereticornis*, Tallowwood *E. microcorys*, and Grey Gum *E. propinqua*.

Koalas will also rest and shelter in other trees, particularly in hot weather - if you are thinking of removing a tree, check that it is not being regularly used by koalas first.



Photo: Shaz McGrigor

Richmond Birdwing Butterfly

Ornithoptera richmondia

Plant the native rainforest vine *Pararistolochia praevenosa* which is the caterpillar's only food plant.



Photo: Byron Shire Council

Glossy Black-Cockatoo

Calyptorhynchus lathami

This vulnerable bird feeds on she-oaks, breaking the seed cone open with its large beak, and requires tree hollows for nesting. Plant she-oaks, *Allocasuarina littoralis* and *Allocasuarina torulosa* and retain hollow-bearing trees in your garden as well as large mature trees which will provide hollows for the future. Young trees are important for cone production. Glossy black cockatoos also need good access to clean water, so can benefit from a pond or bird bath.

How to care for wildlife in extreme weather conditions TIP

Floods and storms
www.acf.org.au/wildlife-care-guide-floods-storms

Extreme heat
www.wires.org.au/seasonal-animal-advice/heat-stressed-wildlife

Bush Fires
www.environment.nsw.gov.au/topics/animals-and-plants/native-animals/helping-wildlife-in-emergencies

9. Designing for intense rainfall



The Northern Rivers is likely to receive more extreme rainfall events which can lead to flooding and land slips. There is nothing that can hold back water, but by watching and learning you can work with the flow of water.

The right slope - the ground should slope away from buildings, in all directions.

Drainage - direct water away from infrastructure with diversion drains combined with

plantings of moisture loving plants to create stability and increase water absorption.

Increase permeability – by reducing impenetrable surfaces such as concrete areas. Replace with gravel or pavers.

Deal with low areas - by creating mounds so that plants are not sitting in pooled water.

Create a rain garden - filled with water-loving plants to collect rainwater and let it slowly absorb into the ground (see My Local Native Garden page 34 for more details).

Choose the right plants – The lists in Chapter 6 will help, but also include plants that have:

- Deep extensive roots or dense shallow roots. When rain falls it follows the roots path, dispersing it into the ground. A deeper root system allows the water to travel further and deeper. Deep roots also

anchor the soil to the bedrock below. The shallow meshing roots of plants like Lomandra sp and Cheese Tree *Glochidion ferdinandii* help to bind the topsoil in place. Together the variety of root structures connect underground interlocking and anchoring. Microorganisms that live around the plant roots produce tiny threads that ramify through the soil, coiling around particles of sand and clay. They also exude sticky glomalin that holds soil particles together.

- A mix of groundcovers, shrubs, trees, and perennials not only provide a variety of root structures but is FAR more effective than a monoculture on a slope as the layers of vegetation and dense canopy disperse the energy of rain hitting the ground. Cover the areas between plants with mulch and/or rocks.

Flooded land

Many plants that sit in waterlogged soil will begin to decline because the soil doesn't have enough oxygen. Flooding also leaches out nutrients. To help your soil bounce back:

- First let the soil drain naturally - this will take longer for clay soils.
- Add coarse organic material to the soil. Compost is best, or low nitrogen mulch.
- Check the pH of your soil. If waterlogged soils become acidic, add lime.
- Note what plants naturally bounce back and plant more!
- Floods also bring weed seeds so monitor for new plants.

Slip prone soils

The key factors that lead to slips are slope angle, soil cohesion and soil water content. Excess water in the soil profile is the prime cause of landslips. Knowing your geology and soil types can help to identify slip prone land. Where different soil types meet can be prone so manage water in these areas. Also look for old slips in the landscape and cracks and fissures. Retain old trees as these have the deepest and most extensive roots.

Soil Water Content

To manage a landslip site, control the water in and around the affected area. Working on slips is dangerous so it is best to consult a professional. On any slips monitor movement, avoid heavy loads, and protect any cracks.

Physical works

- Use surface or subsurface drains or small diversion banks to redirect water flow. Divert first to a small pool with a wide level spill area to spread the energy of the water over a larger area. The divert the flow to a stable, well-vegetated area away from the slip.
- If possible, grade the land to include benches to reduce infiltration, assist surface drainage, prevent ponding and allow for revegetation works.
- Reinforcing by battering back head escarpments and steep faces that are prone to further slipping. Excess material available from the 'head' after grading could be added to the toe of the slope to provide added support.
- If streams undercut the toe of the slip and remove supporting material, it might be necessary to divert or pipe the stream at this point or reinforce the bank with rock or logs.



Vegetation

After earthworks the most important thing to stabilise banks and slopes with a suitable gradient is to establish a matrix of grasses, shrubs and trees. The roots mesh together and support each other.

- Establish deep rooted trees, shrubs and grasses on the active slip area. Lomandra seeds can be direct seeded as can Black-beans, Native Figs, Cheesetrees and Lilly Pillies. Plant fast and slow growing species together.
- Exclude all stock.
- Planting in the catchment above the slip will maximise water use before it reaches the slip. Plants transpire out water so will reduce the amount of water flowing through the soil.
- On slopes greater than 60% vegetation has a negative impact as it adds mass.

Possible species for consolidating slopes (for other species see local lists)

Botanical name	Common Name	Features
TREES		
<i>Allocasuarina littoralis</i>	Black Oak	Habitat tree
<i>Allocasuarina toruosa</i>	Forest Oak	Slow long lived
<i>Alphitonia petriei</i>	Pink Ash	Fast deep rooted
<i>Araucaria cunninghamii</i>	Hoop Pine	Tall slow long lived
<i>Callistemon salignus</i>	Bottle Brush	Hardy in many situations, matting roots
<i>Castanospermum australe</i>	Black Bean	Deep tap root
<i>Casuarina cunninghamiana</i>	River She Oak	Fast good for riverbanks mid slope
<i>Elaeocarpus grandis</i>	Blue Quandong	Fast very tall lower bank
<i>Eucalyptus grandis</i>	Flooded Gum	Wet Gullies
<i>Eucalyptus species</i>	Gums	Tall fast growing for top of slopes, deep rooted, chose local species
<i>Ficus coronata</i>	Creek Sandpaper Fig	Seeds direct sow, lower height
<i>Ficus obliqua</i>	Small-leaved Fig and others	All tall trees
<i>Glochidion ferdinandii</i>	Cheese Tree	One of the best bank stabilising trees
<i>Lophostemon confertus</i>	Brush Box	Major species deep rooted
<i>Podocarpus elatus</i>	Plum Pine	Slow, deep rooted
<i>Rapanea variabilis</i>	Muttonwood Tree	Fast hardy lower growing
<i>Tristaniopsis laurina</i>	Watergum	Extremely strong in high flows.
Shrubs		
<i>Acacia species</i>	Wattles	Fast growing. Choose local shrubs
<i>Callistemon montanus</i>	Mountain Bottle Brush	Choose local Callistemons
<i>Leptospermum petersonii</i>	Lemon Ti-Tree	Hardy on slopes
GRASS Like Plants and ground covers		
<i>Lomandra hystrix</i>	Mat Rush	Best species along creeks
<i>Oplismenus species</i>	Basket Grass	Good soil binder
<i>Themeda australis</i>	Kangaroo grass	

This does not replace site specific professional advice and should not be relied upon to prevent landslips or flood damage.

10. Designing a garden in a fire prone environment

It is important to note that all plants will burn in the hottest fires. Having water available and keeping plants well-watered is essential.

The fires of 2019/2020 were unprecedented with extreme conditions. However, in less severe fire circumstances, various plants and strategic planting design have proven to help slow the spread of fire and help to protect buildings. There are some fire-retardant plants and trees, backed by scientific evidence, that are less likely to ignite or may take longer to ignite.

A few studies have measured flammability, i.e. the time it takes to ignite green leaves and dry leaves (Gill & Moore 1996). Moisture content of leaves and the leaf litter on the ground have been shown to be very important for slowing fires. The level of decay of fuel loads in rainforest and eucalypt forests was also important in creating the flammability of the fuel layer. More decayed fuel (leaf litter and twigs) is less likely to burn (Peacock 2017).

You cannot rely on plant selection alone to stop bushfires, but it makes sense to use plants that have a delayed ignition. These plants can act as screens and absorb heat from an approaching fire. They can also reduce wind speed near a house and trap embers and sparks carried by the wind.

Fire retardant plants tend to have characteristics such as:

- high salt content
- fleshy or watery leaves
- low levels of volatile oil in leaves
- thick well-defined, insulating bark
- dense crowns
- rarely shed large quantities of leaves and twigs
- seeds usually enclosed in woody capsules.



Many rainforest type, or 'mesic' species have these characteristics, but these need to remain well watered if they are to retain their fire suppressant characteristics, so installing a grey water drip irrigation system is a good idea. You will find helpful information on plant species and their fire resilience in Chapter 6 and the References section has more links for designing in fire prone landscapes.

Highly Flammable Plants and Trees TO AVOID

Plants which are more likely to burn include those with:

- Fibrous, loose bark, such as Stringybark Eucalypts
- Volatile oils in their leaves, such as most Eucalypts, Callistemons, Melaleucas
- Volatile, resinous foliage, such as many Conifers
- Dry foliage
- Tendency to retain or accumulate dead leaves, twigs, and bark



For more information about Bushfire planning see:

<https://www.rfs.nsw.gov.au/plan-and-prepare/building-in-a-bush-fire-area/planning-for-bush-fire-protection>



Planting design tips

Maintenance: Remove loose bark, dead branches, and dry leaf litter on the ground in accordance with fire authority requirements for bushfire prevention. Break up the potential fuel load – keep plants separate especially in the canopy and avoid flammable mulch. Consider having a dedicated water supply for gardens with a design that maximises permeability.

Plant your gardens to create a defensible space around your house.

Vertical separation

- Space trees from shrubs when planting to provide vertical separation. Under-plant trees with ground covers instead.
- Crown-lift lower branching species to separate the foliage from the ground layer

Horizontal separation

- Plant shrubs in small groups, maintain a gap or informal pathway between the groups, so that you can comfortably walk around and between them.
- Groups of trees can be retained (rather than individual trees). Ensure additional space is left between any two groups of trees.
- If retaining trees which carry a high load of foliage, maintain these as individual trees.

Shelter Belts

A shelter belt is a barrier of trees, shrubs and ground cover plants located strategically to reduce fire risk by reducing prevailing wind, radiant heat, and the chance of ember attack on a house. Fire retardant ground covers can catch embers without catching fire themselves and slow the travel of a fire.

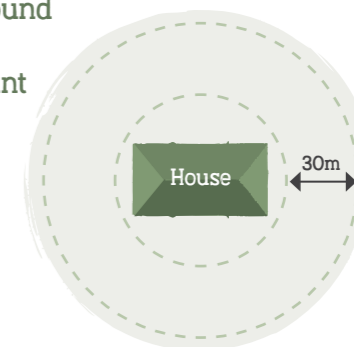
It's important to note that no plant is fireproof, and any plant can burn given enough heat and the right conditions, but many plants and trees are either fire retardant, in that they don't tend to burn, depriving the fire of fuel, or at least fire resistant, being difficult to ignite.

Plant your shelter belt along the boundary of your house site, on the side where incoming fires threaten, such as the direction of the

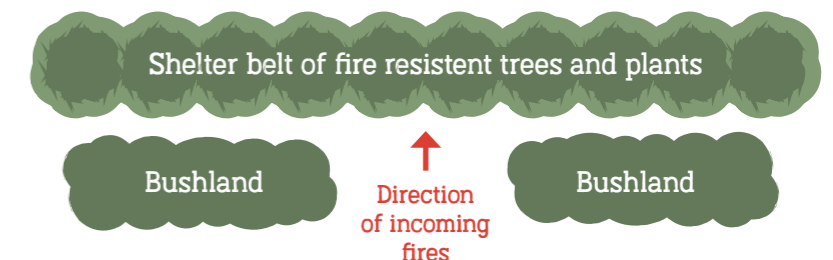


side of a hill or of prevailing winds. There should be a minimum of 30m space around the house where all flammable materials have been removed.

Firebreak area around house and shelter belt of fire retardant plants and trees



Minimum of 30 meter space cleared of all flammable materials around the house



11. Plants That Are Suitable for Fire Prone Areas

In her book Safer Gardens Leslie Corbett (2021) has analysed many studies and anecdotal information to produce a list of plants that may have low flammability. The information in Safer Gardens is very comprehensive and is highly recommended for further reading for this section.

Plants suited to the changing climate of the Northern Rivers region are listed here. Studies have shown that in general rainforest plants are slower to ignite, release less heat and burn slower and less completely. High moisture levels in leaf litter are critical (Peacock 2017).

Maintenance: Remove loose bark, dead branches, and dry leaf litter on the ground in accordance with fire authority requirements for bushfire prevention. Break up the potential fuel load – keep plants separate especially in the canopy and avoid flammable mulch.

Botanical Name	Common Name	Flammability*	Features	
TREES and SHRUBS				
<i>Acacia melanoxylon, A. decurrens</i>	Blackwood	Low to very low - high under summer conditions	Evergreen shade tree, tolerant of coastal conditions, bird attracting.	
<i>Acacia ulicifolia</i>	Prickly Acacia	Low flammability moisture content 58%	Small hardy shrub to 2m. Attractive cream prickly flowers.	
<i>Alyogyne huegelli</i>	Native Hibiscus	Low flammability	Attractive shrub to 2.5 m. Fast growing with purple flowers.	
<i>Cupaniopsis anarcardioides</i>	Tuckeroo	Low flammability	Evergreen shade tree 5-8m, tolerant of coastal conditions, tolerates light frost, drought resistant once established, all soil types, including clay.	
<i>Elaeocarpus reticulatus</i>	Blueberry Ash	Higher flammability if leaves present, keep pruned	Fast growing specimen tree, tolerant of coastal conditions, tolerates light frost, prefers moist, well drained, fairly fertile soil.	
<i>Ficus macrophylla</i>	Moreton Bay Fig	Low flammability	Large spreading tree for parks and large gardens 15-35m x 15-25m fast growing when young with adequate moisture, attracts flying foxes.	
<i>Grevillea aquifolium</i>	Prickly Grevillia	Medium flammability	Full sun to part shade in well-draining soils, sensitive to phosphorus fertilizers, does not tolerate coastal conditions or high humidity.	
<i>Melicope elleryana</i>	Pink Euodia	Low flammability	Hardy fast-growing tree. Pink flowers along branches.	
<i>Melia azedarach</i>	White Cedar	Low flammability	Deciduous, feature tree to 10m, light shade tree, timber tree, tolerant of most soil types.	
<i>Myoporum insulare</i>	Coastal Boobialla	Low to very low flammability	Variable shrub 3-5m, drought tolerant once established, tolerates salinity, damaged by moderate to heavy frosts, tolerates coastal conditions, produces edible fruit for birds.	
<i>Philotheca species</i>	Wax Flower	Low to very low flammability	Small to large shrubs, size varies depending on species height 0.3-1.5m x 0.3-1.5m wide full sun to light shade in well-draining soils.	
<i>Prostanthera ovalifolia</i>	Oval Leaved Mint Bush	Low to very low flammability	Fast growing shrub to 2m with fragrant foliage, feature plant, screening plant, windbreak, full sun to light shade in well-draining soil.	
<i>Scaevola crassifolia</i>	Thick-leaved Fan Flower	Low flammability	Small shrub, height 1-1.5m x 2m wide. Pale blue/purple flowers.	
<i>Syzygium australe</i>	Brush Cherry	Medium flammability	Bushy tree, good hedge, or screen, keep moist under dry conditions.	
<i>Syzygium smithii</i>	Lilly Pilly	Medium flammability	Bushy tree, good hedge, or screen, keep moist under dry conditions.	
<i>Lophostemon confertus</i>	Brush Box	Low flammability	Hardy fast-growing tree, smooth bark near top of tree, white flowers, habitat tree.	
<i>Tristaniopsis laurina</i>	Water Gum	Low flammability	Attractive compact shade tree to 10m. Glossy leaves, attractive bark and clusters of cream/yellow flowers attract native bees. Frost tolerant, light shade to full sun, tolerates a variety of soils.	
<i>Viminaria juncea</i>	Native Broom	Low flammability	Fast growing shrub 2m high, ideal for wet areas, prefers poorly drained soils in swamps and depressions, adaptable to drier conditions if watered in summer, grows in full sun to part shade.	

* (see Safer Gardens, Plant flammability and Planning for Fire, Lesley Corbett)



Botanical Name	Common Name	Flammability*	Features	
STRAPPY LEAF PLANTS				
<i>Anigozanthos species</i>	Kangaroo Paw	Low flammability (prune dead foliage in dry weather)	A good garden cultivated plant in fire prone areas. Grows around 1m with colourful flowers in spring - summer.	
<i>Arthropodium strictum</i>	Chocolate Lily	Low to very low flammability	Feature plant low growing for under trees <1m.	
<i>Bulbine bulbosa</i>	Bulbine Lily	Low to very low flammability	Feature plant yellow flowers low growing for under trees <1m, bush food.	
<i>Bulbine semibarbata</i>	Leek Lily	Low to very low flammability	Feature plant yellow flowers low growing for under trees <1m, bush food.	
<i>Dianella caerulea</i>	Blue Flax Lily	Low to very low flammability	Blue flowers and fruit < 1m spreading plant for banks and slopes.	
<i>Dianella longifolia</i>	Smooth Flax Lily	Low to very low flammability	Blue flowers and fruit < 1m spreading plant for banks and slopes.	
<i>Doryanthes excelsa</i>	Gynea Lily	Low flammability	Feature plant to 1m high with tall red flowers to 2 or 3m high.	
<i>Doryanthes palmeri</i>	Giant Spear Lily	Low flammability	Superb feature plant, grows to over 2m high with red flower spikes to 3m high.	
<i>Lomandra hystrix</i>	Mat Rush	Low flammability	Clumping grass like plant to 1m with shiny leaves. Great on riverbanks.	
<i>Patersonia species</i>	Purple Flag	Low flammability	Attractive purple flowered Lily type for feature or under trees, <1m high.	
GROUND COVERS				
<i>Ajuga australis</i>	Austral Bugle	Low to very low flammability	Groundcover, hardy for all gardens, blue flowers.	
<i>Carpobrotus glaucescens</i>	Native Pig Face	Very low flammability	Low-growing ground cover and bush food with bright pink flowers suitable for coastal and exposed sites, drought hardy.	
<i>Dichondra repens</i>	Kidney Weed	Very low flammability	Low-growing light green ground cover/lawn for shade or some sun.	
<i>Myoporum parvifolium</i>	Creeping Boobialla	Low flammability	Green leafy carpeting ground cover for banks and feature gardens. White flowers.	
<i>Scaevola aemula</i>	Fan Flower	Low flammability	Blue flowered ground cover for banks, shade, or semi shade suitable.	
<i>Scaevola albida</i>	White Fan Flower	Low flammability	White flowered ground cover for banks, shade, or semi shade suitable.	
<i>Viola hederacea and Viola banksii</i>	Native Violet	Low flammability	Excellent long flowering ground covers for all gardens, shade, or filtered sunlight best.	
CLIMBING PLANTS				
Don't grow them against the house or any other buildings in fire-prone areas as they may catch and retain burning embers!				
<i>Hibbertia scandens</i>	Guinea Flower	Low flammability	Hardy non-invasive climber for sun, in any area. Large yellow flowers.	
<i>Kennedia coccinea / prostrata</i>	Coral Vine Plant	Low flammability	Spectacular ground covers/climbers with red flowers in spring.	
<i>Pandorea pandorana and Pandorea jasminoides</i>	Wonga Wonga Vine Bower of Beauty	Low flammability	Hardy spectacular flowering climbers for any garden, cream or mauve/white flowers. Suitable for pot.	

* (see Safer Gardens, Plant flammability and Planning for Fire, Lesley Corbett)

12. Supporting Cultural Resilience

Native plant names from the Northern Rivers & South East Queensland

The plant names presented below follow the *DICTIONARY OF YUGAMBEH INCLUDING NEIGHBOURING DIALECTS* compiled by Margaret Sharpe 1998, and published by Pacific Linguistics, Research School of Pacific and Asian Studies The Australian National University PO Box 1428 Canberra ACT. The table below is a guide and will be updated as knowledge is confirmed.

A version of the Three Brothers Legend, recorded by Rev Livingstone in 1892,

addresses the story of formation of the dialects or languages of the northern rivers area: Ngandowel in the Tweed, Minyunbal on the Brunswick River and Byron and Nygunbal at Ballina. This is not the only story and names vary across the region. Some common words are not actually from a native language e.g. Coolamon is an anglicised NSW Aboriginal word used to describe an Australian Aboriginal carrying vessel.



Aboriginal Names	Pronounced	Common Name	Botanical name
jayi	dhai	Green Wattle	<i>Acacia spp.</i>
karnir-karnir, durubi	durovy	Wattles	<i>Acacia spp.</i>
jumaw	chuma, tyu'mau	Black Wattle	<i>Acacia meanoxylon, Acacia spp. Callicoma serratifolia</i>
janggir	jungeegerie	Mangroves	<i>Aegericerus corniculatum, Avicennia marina</i>
nguyagal	Ngoyagal	Forest Oak	<i>Allocasuarina torulosa</i>
budheh, kanjibuy	kanjiboy	Cunjevoi (lily)	<i>Alocasia macrorrhiza</i>
buyi buyi, buy buy, bulbil	boy boy	Apple Gum	<i>Angophora</i>
buhnyi boonyil	buani	Bunya Pine	<i>Araucaria bidwillii</i>
bimbul	bim bul	Hoop Pine	<i>Araucaria cunninghamiana</i>
bigabihn	bigabeen	Bangalow Palm, Piccabeen Palm	<i>Archontophoenix cunninghamiana</i>
midyim		Midgem	<i>Austromyrtus dulcis</i>
bambar	binabar	Honeysuckle tree	<i>Banksia sp.</i>
jimbiger	dyinbigeri	Bottle tree	<i>Brachychiton</i>
kaluhl	kallohl	Kurrajong, red flower	<i>Brachychiton acerfolius</i>
mandang	mundung	Kurrajong, pink flower	<i>Brachychiton discolor</i>
mahram	mahram	Bottlebrush	<i>Callistemon viminalis</i>
bugam(bil)	boggumbil	Blackbean	<i>Castanospermum australe</i>
amburih, kulanybil, kulambil,	kulaynbil	Lime tree, wild	<i>Citrus australasica</i>
murehr, yurahr, bibuy	murehr, yur 'a	Spotted Gum,	<i>Crymbia maculata</i>
kudhin	cudgin	Plum tree, Native	<i>Davidsonia spp.</i>
jihbiny t, kulburu	jeebin	Stinging Tree,	<i>Dendrocnide excelsa</i>
bagah	bug-gah	tree: bat or cork,	<i>Duboisia</i>
kulun	cooloon	Fig tree, blue,	<i>Elaeocarpus grandis</i>
kalahwun	kalahoon	Quandong (tree),	<i>Elaeocarpus grandis</i>

Aboriginal Names	Pronounced	Common Name	Botanical name
baga-bagah	bukkabukka	Coral Tree	<i>Erythrina vespertilio</i>
buwayil, bulbu, bunaw t, burgin	borrogin	Bloodwood	<i>Eucalyptus intermedia</i>
wanggay(gah)	wongigar	Tallowwood	<i>Eucalyptus microcorys</i>
bigar t, biyar, janehn	big 'er, judnen	Narrow-leafed Ironbark	<i>Eucalyptus siderophloia</i>
jumabil	tyumabil	Ironbark tree, Silver-leaf	<i>Eucalyptus sideroxylon</i>
man.garl	mangar	Forest Red Gum (blue gum)	<i>Eucalyptus tereticornis</i>
man.gargin	mungurrigin	Flooded Gum	<i>Eucalyptus grandis</i>
bulbarl, yagir	bulbura, yagrey	Teak	<i>Flindersia australis</i>
kadhir	cudgeraa	Cudgerie	<i>Flindersia scottiana</i>
karbin karbin	karbin	Red Carabeen	<i>Geissois benthami</i>
binabar	benabarah	White Beech	<i>Gmelina leighardtii</i>
jabililam, kambalam	tablilum, kambullum	Silky Oak	<i>Grevillea robusta</i>
wudhur(u), balbul, bulaml	wud'huru, balbul	Tea-tree	<i>Leptospermum</i>
nyamin, nyumin, midhin	midjim, nummin, yummin	Walking stick palm	<i>Linospadix monostachya</i>
bangam, nyungargur	bangam, yangarguur	Cabbage Tree Palm	<i>Livistona australis</i>
kurayir	gurair	Brush box (box tree)	<i>Lophostemon confertus</i>
gumbur	gumbaar	Macadamia Nut (tree)	<i>Macadamia tetraphylla</i>
barawang, danin	burrawang	Palm, cycad	<i>Macrozamia sp, Lepidozamia perroskyana</i>
daygil	tygalgar	White Cedar	<i>Melia azederach</i>
bilihnyah waybar	bileenyah	Mistletoe	<i>Mistletoe various</i>
jambinbin	jumpinpin	Pandanus root sucker	<i>Pandanus tectorius</i>
kumuru-kumuru	kum'uru-kum'uru	Native Mulberry	<i>Pipturus argenteus</i>
junbil	joombeel	Fern, elk staghorn,	<i>Platynerium</i>
jumbil, junbil, dumbin	joombeel	Staghorn	<i>Platynerium superbum</i>
kungun	koongoon	Brown Pine	<i>Podocarpus elatus</i>
jumbay	choombi	Black Apple	<i>Pouteria australe</i>
karamgal(gah)	kurrumgull (gah)	Satinwood	<i>Dissiliaria baloghoides(SEQ)</i>
malgam	malgum	Raspberry, wild,	<i>Rubus spp.</i>
duroby	durobee	Coolamon	<i>Syzygium moorei</i>
wudhe(h) t	wujeh	Red Cedar	<i>Toona australis</i>
bumbinbihn-baral,	boombenbeen burreal, kurragurrannumban	Grass tree	<i>Xanthorrhoea</i>
magirbal	muggerabull	Prickly Yellowwood	<i>Zanthoxylum brachyacanthum</i>

13. Digging deeper on climate

Recent Trends in Climate

13.1. Extreme Heat

According to the 6th Intergovernmental Panel on Climate Change (IPCC, 2021), global warming is causing an increase in the intensity and frequency of extremely hot temperatures in Australia, as well as a decrease in cold extremes. The IPCC said unequivocally that recent extreme heat episodes in Australia were made more probable, or more severe, by human activities. These events include:

- the Australian summer of 2012–13, also known as the Angry Summer, when more than 70% of Australia experienced extreme temperatures
- the Brisbane heatwave in 2014
- extreme heat preceding the 2018 Queensland fires
- the heat and drought leading into the Black Summer bushfires of 2019-20.

The IPCC report expresses high confidence in future warming and heat extremes in the twenty-first century, the intensity of which is dependent on global efforts to decrease greenhouse gas emissions.

The Australian climate on average has warmed by 1.44°C since 1910, when official temperature records began (BoM, 2020). While this may not sound like a large increase, the additional energy (heating) is leading to increases in extreme weather events (BoM, 2020). This is increasing both the frequency and duration of extreme heat events such as heatwaves (Figure 3) creating greater heat stress for plants, animals, and people. Average regional temperatures are further projected to rise by 0.7°C by 2030 (AdaptNSW, 2021).

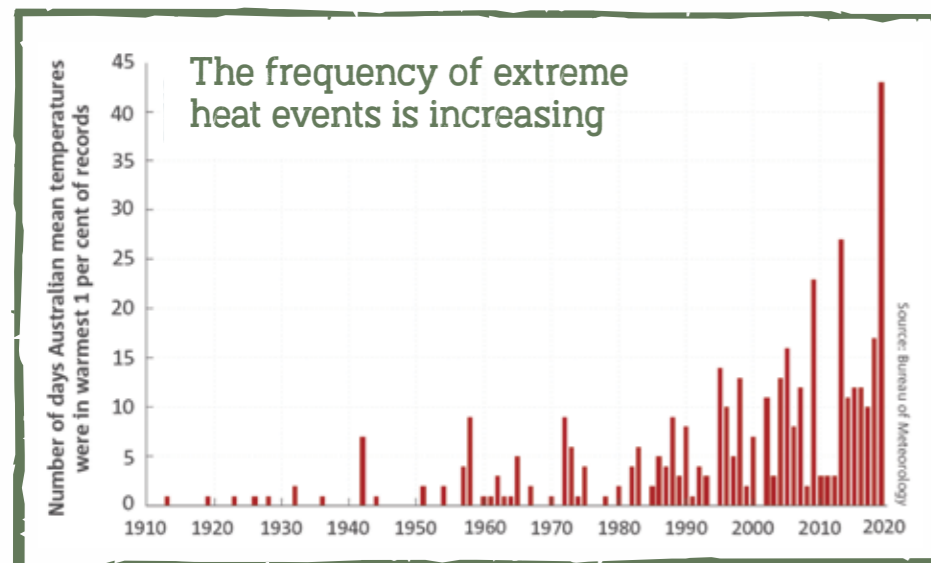
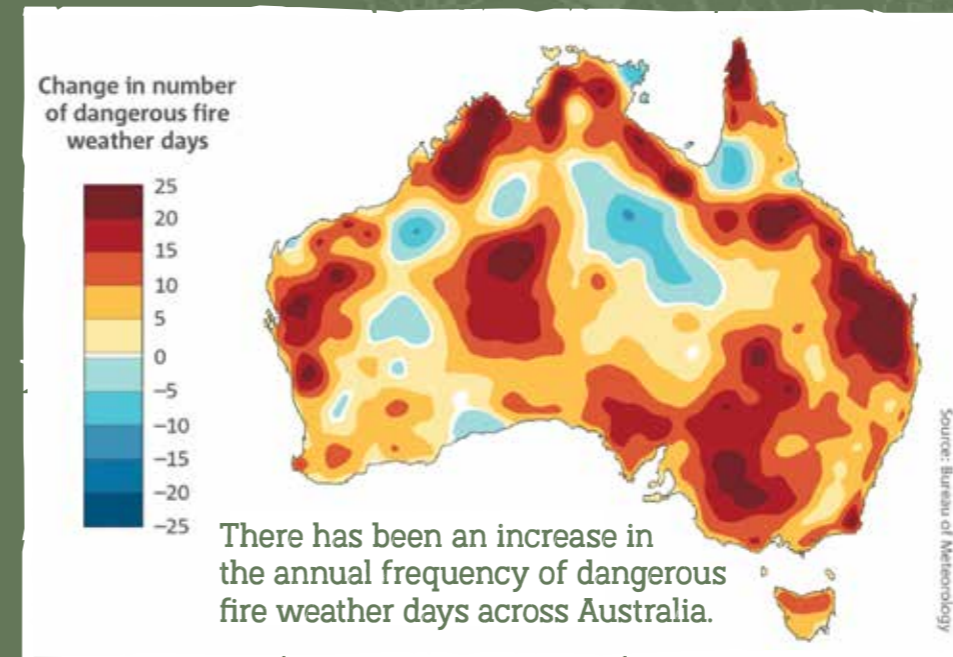


Figure 3: The number of days each year where the Australian area-averaged daily mean temperature for each month is extreme (the hottest 1% of days in a month) Based on data from 1910 to 2019 (source: BoM State of the Climate, 2020).

13.2. Fire Risk

More frequent and intense periods of extreme heat are heightening the risk of extreme fire weather events. Climate change is impacting the dryness and availability of fuel loads. Changes in rainfall, air temperature and atmospheric moisture exacerbate landscape drying (Figure 4). More CO2 in the atmosphere can increase the rate and amount of plant growth, also affecting fuel loads.



There has been an increase in the annual frequency of dangerous fire weather days across Australia.

Figure 4: The change in annual fire weather days from the 1950 -1985 period compared with 1985 - 2020 (source: BoM State of the Climate, 2020).

13.3. Significant rainfall

Extreme weather also includes significant rainfall events. The Northern Rivers bioregion experiences these intermittently as East Coast rainfall troughs (depressions), which may then develop into East Coast Lows, bringing strong winds and heavy rainfall. Other potentially damaging rainfall events come in the wake of ex-tropical cyclones. Warming coastal waters (Figure 5) are increasing the likelihood of extreme weather events. A warmer atmosphere can store more water vapour than a cooler environment. Together these can enhance the chance of significant rainfall occurrences (BoM State of the Climate, 2020).

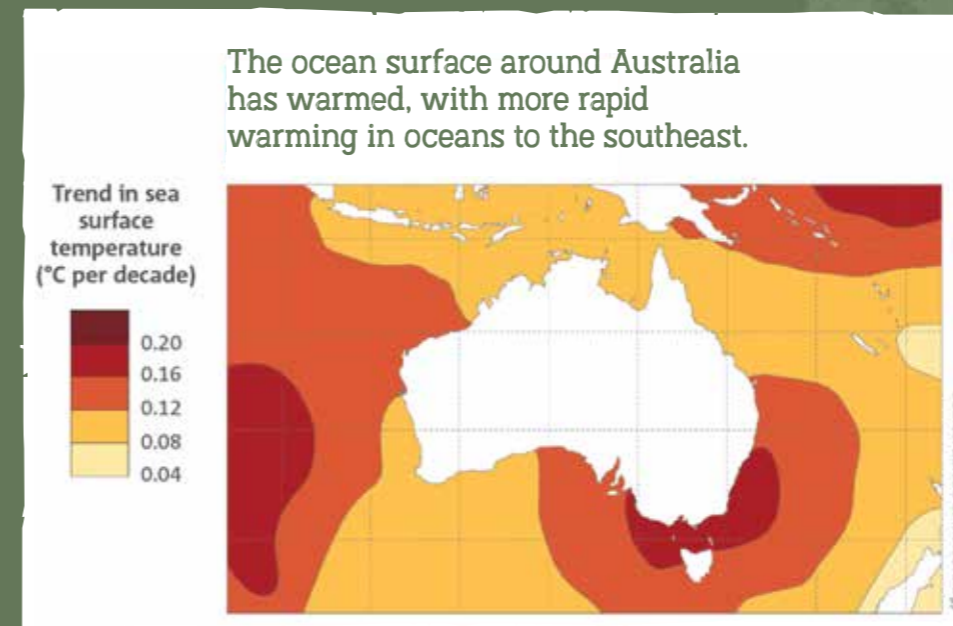


Figure 5: Sea surface temperature trends (1950 to 2019) in Australian waters (source: BoM State of the Climate, 2020).





13.4. Sea level rises

The rate of global mean sea level rise is increasing. Observations from tide gauges and satellite altimetry suggest that the rate of global mean sea level rise has increased from 1.5 ± 0.2 cm per decade (1901–2000) to 3.5 ± 0.4 cm per decade (1993–2019). These rates are not uniform across the planet (Figure 6). There is significant sea level rise occurring on the Northern Rivers coastline. This will exacerbate coastal erosion, flooding and saltwater infiltration (BoM State of the Climate, 2020).

Due to elevated risks of storm inundation and flooding, those living in the coastal zones may find it necessary to select plant species able to cope with periodic saltwater inundation.

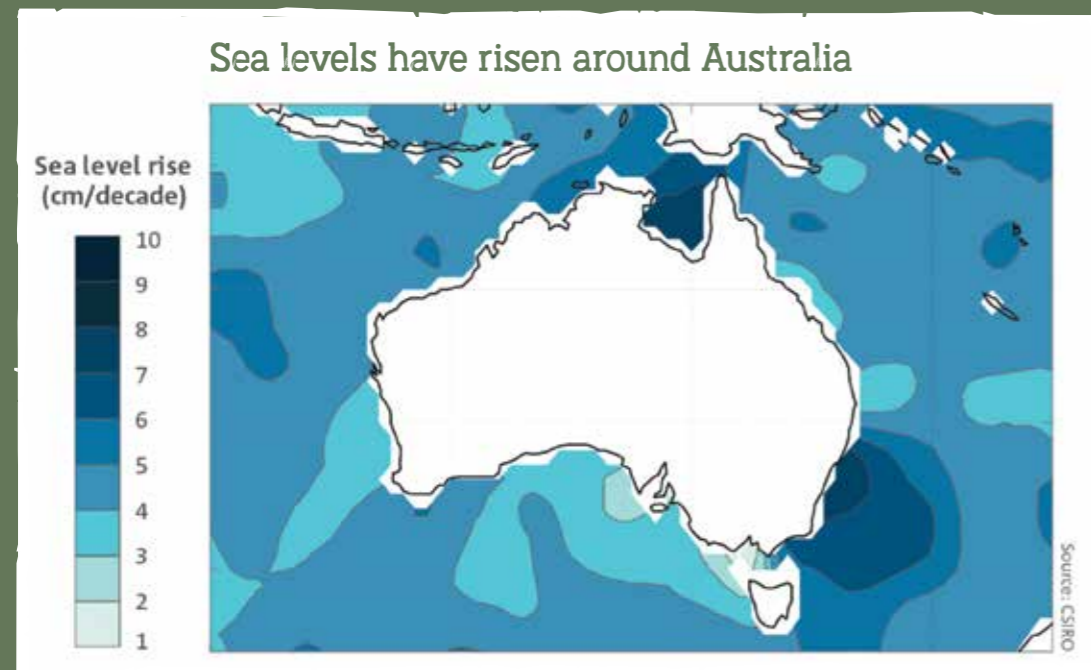


Figure 6: Sea level rise from 1993 to 2019 as measured by satellite altimetry (source: BoM State of the Climate, 2020).

TIP Want to know what the Australian coastline may look like in 2100? Coastal Risk Australia (CRA) has developed an interactive map to show you just that. <https://coastalrisk.com.au/>



13.5. Changes in rainfall

The average yearly rainfall as recorded across 122 years at Mullumbimby display an increasing trend (Figure 7).

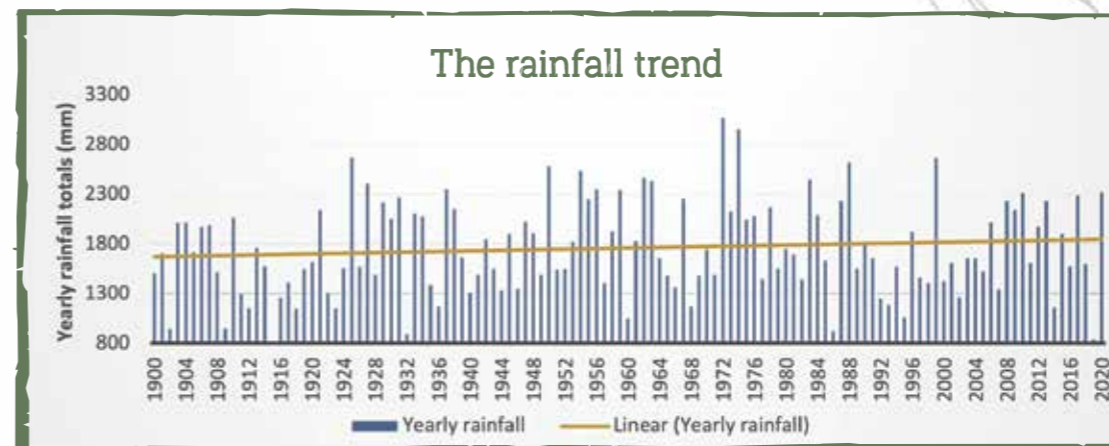


Figure 7: Increasing trend (yellow line) of yearly rainfall averages across 122 years of data (Mullumbimby station 058040).

Breaking this down to monthly percentage changes in average rainfall reveals a drying trend in July, August and September across recent decades (Figure 8).

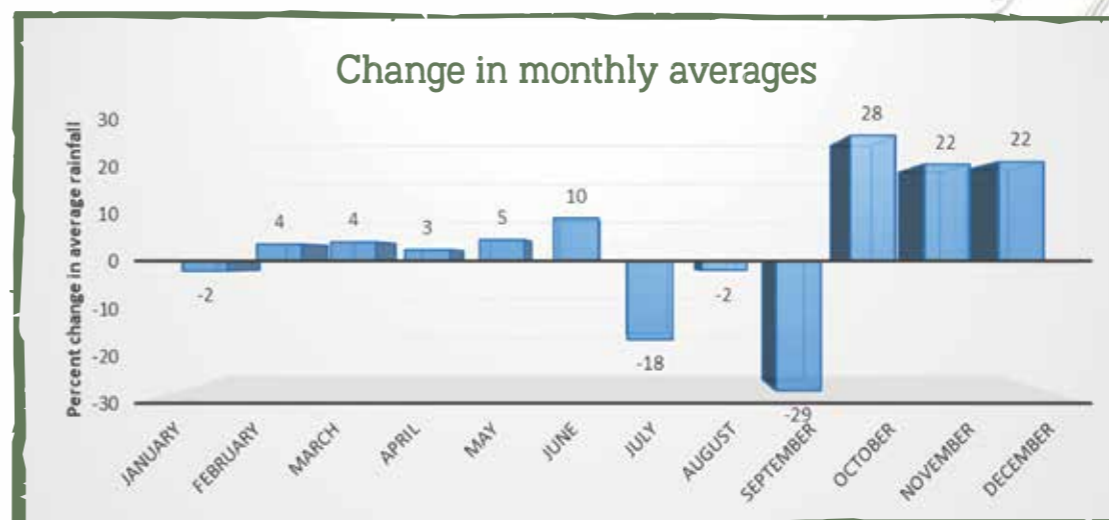


Figure 8: Shifting seasonal rainfall averages when comparing 60 year periods, 1900 – 1960 compared to the years 1960 – 2020 (Mullumbimby station 058040).

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