

Defying Drought: Desert Flora

A flower blooming in the desert proves to the world that adversity,
no matter how great, can be overcome.

Matshona Dhliwayo

The wilderness and the wasteland shall be glad for them,
And the desert shall rejoice and blossom as the rose.

Isaiah 35:1

The wide variations in climate, temperature, topography and soils within Australia's arid zone have led to the evolution of a range of unique plants found nowhere else in the world. All plants need water, so the greatest threat to survival comes from the hot, dry conditions that characterise desert areas for much of the year. In addition, because of the great age of the Australian continent, its desert soils have been heavily leached and are deficient in nitrogen, phosphorus and trace elements, rendering them poor and unproductive. Summer temperatures of 46°C are not unusual in the central and western deserts, while the dry air and cloudless skies can cause nighttime temperatures to plunge by more than 20°C (Trewin 2006). Nevertheless, despite such unfavourable conditions, these regions have allowed a variety of ancient plants, elsewhere extinct, to survive in cool, moist refugia, as well as hundreds of species that have evolved fascinating adaptations enabling them to survive extreme temperatures, evaporative winds, high salinity and erratic rainfall.

Ancient Survivors

A few precious remnant species from a distant, wetter past, persist in moist valleys deep within the ranges. Ancient cycads (*Macrozamia macdonnellii*) and red cabbage palms (*Livistona mariae*), some several hundred years old, continue to flourish in Palm Valley, in the Western MacDonnell Ranges, while the Garden of Eden area at the bottom of Kings Canyon in Watarrka National Park is a living plant museum, providing habitat for some sixty rare or relict species including cycads and the umbrella wattle (*Acacia ligulata*) called by the local Luritja people *watarrka*, after which the national park is named.



MacDonnell Ranges cycad (*Macrozamia macdonnellii*) in Cycad Gorge, Finke Gorge National Park, Northern Territory.



Central Australian cabbage palm (*Livistona mariae*), Palm Valley.



Garden of Eden, Kings Canyon with cycads and *watarrka*

Adaptations

Most desert flora are xerophytic (that is, they need very little water) and many are also halophytic (salt-tolerant), enabling them to use water from evaporating pools that become progressively more saline as they shrink. Xerophytes survive in times of drought through structural modifications that enable them to save, store or capture water by reducing the number, size, shape or orientation of their leaves.

Normally plants lose water through stomata, tiny openings in the leaves. As protection against water loss, high light intensity and heat, the leaves of many Australian desert plants are small in surface area, often long and slender, with stomata that can be closed like air vents to minimise water loss. Some plants have leaves covered in fine hairs, resin or wax to trap a layer of humid air and further reduce evaporation; others have developed shiny or powdery surfaces which reflect light and thus cool the plant. Another water conservation feature involves continually positioning leaves edge-on to the sun. Some plants take this further, being nearly leafless and relying largely on their green, moisture-retaining stems to photosynthesise food. Other plants shed their leaves completely in times of drought, remaining dormant until it rains again. Alternative moisture-conserving adaptations include leaves that curl tightly in dry conditions, leaving minimal surface area for evaporation.

To gather moisture over a greater area, root systems may also be specially adapted, either penetrating deeply to a level where water has collected or spreading widely. These modifications allow such plants to survive long periods without rain.

Desert plants also play a crucial role in land conservation. Sandy soils are particularly prone to wind erosion, as evidenced by the dunes aligned with the prevailing winds. As low maintenance protection against such erosion, drought-tolerant plants can be grown to stabilise fragile soils, while salt-tolerant desert plants are used to revegetate land affected by the increasing problem of salinity.

The Water Conservers

Water-conservation may involve water-storage or a variety of mechanisms to avoid water loss. In Australian deserts, where drought may last for a decade or more, the most conspicuous water storers are the Boab trees (*Adansonia gregorii*), related to the Madagascan and African *Adansonia digitata* species, known as Baobabs. In Chapter 3 we see that genetic relationship may have a particular significance for Bradshaw (Gwion) art. Boabs, which can live up to 1,500 years, store water in their trunks, giving them a distinctive bottle shape with a girth up to 20 metres. They thus fill the niche occupied in American deserts by cacti. In dry seasons Boabs drop their leaves to conserve water but, by some as-yet unknown mechanism, the new leaves sprout just before the wet season approaches.



Boab Tree Timber Creek, NT

Leaf modifications provide another means of conserving water. Thick hairs on the small, succulent leaves of saltbush (*Atriplex* sp.), the main scrubby species in arid Australia, slow wind evaporation, and their grey-green or blue-green colour reflects sunlight, cooling the plant and further decreasing water loss through evaporation, while shallow, wide-spreading roots soak up any moisture over a large area. Saltbush is also

remarkably halophytic. It tolerates high salt levels by secreting salt onto the leaf surface to balance osmotic pressure, retain water and reflect sunlight to cool it.



Saltbush (*Atriplex undulata*)

Some emu bushes (*Eremophila* species) found in desert areas also have greyish, hairy foliage to reflect the sun's rays, while others have a shiny, sticky coating as protection against drying winds.

The most characteristic grasses of Australian deserts are the sixty-four endemic species of spinifex (*Triodia* sp.), which grow on the slopes of dunes and the swales or valleys between them, providing half the ground cover and approximately ninety-six per cent of the biomass in desert areas. *Triodia* grows as an expanding dome. The young green leaves on the outer edge of the dome are flat and relatively soft but as they age their edges roll inwards to produce stiff, pointed, spear-like leaves. The centre of the clump, which may be up to 1.2 metres wide and 60 centimetres high, becomes a mass of matted stems and dead leaves and eventually collapses leaving a ring of new leaves. This closely packed mound of vegetation generates its own micro-climate, minimising diurnal temperature fluctuations, providing internal shade and reducing evaporation in the heat of the day, while holding warm air on cold nights. The silvery surface of the leaves also reflects sunlight, further reducing water loss. As we shall see in the next chapter, spinifex provides a much sought-after refuge and larder by attracting numerous insects, which in turn support reptiles, mammals and birds in the food chain. Additionally, its roots compact the sand, allowing small animals to burrow around the clumps without being buried by collapsing sand.



Spinifex clump

Phreatophytes, plants with deep and extensive root systems, access a constant water supply by reaching the zone of saturation in the water table beneath the surface. The

star of Australian phreatophytes is mulga (*Acacia aneura*), which covers about one-third of the entire arid zone and includes some 800 species. Mulga wattles have a 3-metre-deep taproot while the leaves and branches of the horse mulga (*Acacia ramulosa*) act like a catchment area, directing water towards the trunk, where it trickles down to the dense root system and is absorbed before it can drain into the desert soil. This process is so efficient that a five-metre shrub can collect 100 litres of water from a 12-millimetre rain-shower. The roots also contain nitrogen-fixing bacteria that supplement the nutrient-poor soil in which mulgas characteristically grow. During drought, mulga wattles drop most of their leaves, providing a circle of mulch from which nutrients can be reabsorbed.



Mulga wattle (Acacia aneura)

The Brilliant Ephemerals

The desert is not always dry and some plants, the ephemerals, complete their entire life-cycle during brief, unpredictable periods of rain. The seeds of some plants can remain dormant for years, even decades, of drought, because they are covered in a chemical coating, usually an aromatic glycoside, which prevents germination; but after

heavy rain this is washed away and they germinate and bloom within a few hours, producing brilliantly coloured flowers to attract insects for rapid pollination as the whole reproductive cycle has to be completed before the moisture dries up. The blazing red flowers of Sturt's desert pea (*Swainsona formosa*), bright pink parakeelya (*Calandrinia polyandra*), brilliant yellow billy buttons (*Craspedia globosa*) and cassia (*Senna glutinosa*) appear within days after rain, and paper daisies (*Helichrysum*) carpet the ground. Poached egg daisy (*Polycalymma stuartii*), pink everlastings (*Schoenia cassiniana*), Sturt's desert rose (*Gossypium sturtianum*) and Charles daisy (*Rhodanthe charsleyae*) transform the desert into a brilliant garden. On first seeing the desert after rain, artist-naturalist Charles McCubbin, wrote, 'Nothing prepared us for the vast exuberant flower garden that filled the middle desert. Mile after mile of blooms – a great incredible sea of flowers that flowed between the dunes and splashed their slopes in yellow, white, pink and gold' (McCubbin 1973).



Sturt's desert pea, *Swainsona formosa*.



Parakeelya (*Calandrinia balonnensis*)

Ephemerals ensure rapid dispersal of their seeds in a variety of ways. Some rely on birds and other animals to carry them. Emus are attracted to the fleshy fruit of some forms of the shrub *Eremophila*, commonly known as the emu bush. Having ingested the fruit, they may travel many kilometres before passing the undigested seeds in their droppings (Moore 2005). Fire and heavy rain are required to break the hard seed cases, ensuring that germination does not occur before conditions are favourable. Some ephemeral seeds have miniature parachutes to facilitate wind dispersal; others again have explosive devices to spray out seeds across a considerable radius as the seedpod dries. The seeds lie dormant until the next heavy rainfall triggers a new reproductive cycle. As protection against temporary environmental changes, some seeds have built-in sensors, responsive to specific levels of water, temperature and light, to prevent premature germination after a mere passing shower.

A striking ecological feature of the Australian arid zone is the importance of fire in regulating the diversity and abundance of species present at certain stages of their lifecycle. Desert fuchsias (e.g. *Eremophila latrobei* and *Eremophila christopheri*) produce hard seed cases that may lie dormant for years, germinating only after a combination of fire and rain (van Oosterzee 2000, 80). From their long experience of the desert Aboriginal people knew that fire was essential to regulate the diversity and abundance of species in particular areas at specific stages of their lifecycle.



Desert fuchsia (Eremophila latrobei)

Desert plants have been of central importance in the life of local Aboriginal peoples. Collection of 'bush tucker' by groups of women is an important communal and cultural activity, reinforcing traditional links with country and customs. Such plants are a source not only of food and water, but medicine, fuel and materials for making implements, baskets, weapons and ornaments. At a deeper, spiritual level, certain plants are also associated with Ancestral Beings and their Dreamtime journeys.

People outside desert areas are now recognising the value of these plants. Some are being studied for their nutritional and medicinal value, and traditional bush foods are appearing more frequently in city restaurants and supermarkets. 'Bush tucker' excursions led by Aboriginal women feature large on the tourist program, generating tourist dollars and respect for Indigenous knowledge.

Invasives

Australian deserts are particularly vulnerable to environmental disturbance, owing to their fragile ecosystems, the small numbers of the resident species, and their refined adaptations to specific micro-environments. As detailed in chapter 8 they continue to be threatened by the introduction of sheep and cattle, exotic plant species, pollution, extensive clearing of vegetation, modifications to the structure of plant communities, altered fire regimes, and feral animals that disturb their habitat. All these factors put

this fragile ecosystem at high risk (Environmental Protection and Biodiversity Conservation Act 1999).

Buffel grass (*Cenchrus ciliaris*) was introduced from northern Africa and the Middle East across to India and Indonesia in the 1930s as a tough, drought-tolerant species that would control dust storms and provide pasture for cattle in areas where other grasses did not flourish. In this it proved highly successful and in the 1950s scientists began advocating its use in Central Australia (Beudel 2012). Today, many graziers consider this fast-growing perennial 'the king of grasses', supporting much of the beef industry in northern Australia. From an ecological viewpoint, however, the story is very different. It is a major threat to biodiversity, displacing native vegetation, including traditional bush foods and threatening animals in arid and semi-arid areas like the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands in South Australia, where it has now been declared a weed. When buffel grass burns, it destroys the shrubs and trees which it grows around. Ecologist John Read estimates that 'We've spent a lot of time and effort and money working on issues like camels and foxes and rabbits and cats and they were all really big problems. But this Buffel grass, it seems to be almost an order of magnitude bigger than that again. It's really changing whole communities.' Anangu women have even written a song about the 'bad grass'. 'This grass destroys our food', said Timpulya Mervin, a Western Desert man from Watarru (Staight 2015).



Buffel grass (*Cenchrus ciliaris*)

Affirming the importance of the Australian desert and its native vegetation and seeing beyond productivity and profit to the beauty and treasure at the heart of continent are integral to encouraging the desire for its preservation.

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