‘Living fossil’ plants

February 2026

LIVING FOSSILS DEFINED

Charles Darwin coined the term ‘living fossil’ in his *Origin of Species*, published in 1859. He was referring to present-day plants and animals that had also been found as fossils millions of years old and seemed remarkably unchanged. He wrote:

> These anomalous forms may almost be called living fossils; they have endured to the present day, from having inhabited a confined area, and from having thus been exposed to less severe competition.

In other words, Darwin concluded that these organisms had not been subjected to the usual processes of natural selection.

FAMILIAR EXAMPLES

Probably the best-known living fossils in the animal world are the coelocanths. In the plant kingdom a familiar example is the gingko, *Gingko biloba*, but there are many others, some of which can be seen at Peacehaven Botanic Park and are the focus of this fact sheet.

EVOLUTION OF PLANTS

For a better understanding of living fossils, we need to go back to some basics about plant evolution. All the plants we know today evolved over immense periods of time from simple algae. The earliest land plants evolved about 450 million years ago, and the first seed-bearing plants about 80 million years later.

There are two main types of seed-bearing plants: gymnosperms and angiosperms. The gymnosperms bear their seeds externally in cones (the name means ‘naked seed’) and are thought to have evolved more than 380 million years ago. Angiosperms evolved at least 200 million years later. These are flowering plants, producing seeds that are enclosed within fruits.

Gymnosperms evolved before the advent of insects and birds, and therefore relied on wind, rainfall and water flows for pollination. In contrast, the angiosperms evolved at much the same time as insects and birds, and these other organisms adapted to meet the plants’ pollination needs.

By 85 million years ago the angiosperms outnumbered the gymnosperms. They continued to increase, and now number more than 250,000 species, whereas only about 1000 species of gymnosperms remain.

ARE ALL GYMNOSPERMS LIVING FOSSILS?

The simple answer to this question is Yes, though some may not be exactly the same as their ancient ancestors. These plants are survivors of much larger global populations, whose existence has been established by the discovery and identification of fossils.

Are all living fossils gymnosperms? No, there are others, such as clubmosses, horsetails and ferns, but Peacehaven’s living fossils are almost all gymnosperms.

QUEENSLAND’S GYMNOSPERMS

The predominant groups among gymnosperms are cycads and conifers such as pines.

Eastern Australia has about 50 cycad species, commonly called zamia palms, of which Queensland has a significant share.

Among the pines, Queensland has *Araucaria* (bunya and hoop pines), *Agathis* (kauri), *Callitris* (cypress) *Podocarpus* (brown pine and plum pine) and *Prumnopitys* (black pine) species. At Peacehaven we have examples of all five genera, most of them in the dedicated area called Prehistoric Corner, where you can also see living fossils from other parts of the world.

The area at Peacehaven Botanic Park known as ‘Prehistoric Corner’

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HOW HAVE THEY SURVIVED?

The 'living fossils' have endured, relatively unchanged, for some hundreds of millions of years. There have been catastrophic environmental changes and some mass extinctions, yet these species have survived. How?

Darwin appears to have been on the right track when he proposed that these enduring species benefited by inhabiting confined areas or being protected from severe conditions in other ways.

More recently, scientists using genetic sequencing technology have found that the gymnosperms have enormous, complex genomes, which may be another clue to their ability to survive and thrive.

Genomes are sequenced in terms of base pairs in the DNA structure. One gigabase (GB) is equal to 1000 million pairs. Humans have about 3.4 GB. Flowering plants on average have about the same number, while gymnosperms often have two to five times as many.

EXAMPLES AT PEACEHAVEN

Among the cycads, Peacehaven has ***Lepidozamia peroffskyana*** (pineapple cycad), a native zamia that grows in small patches in wet forests along the Great Dividing Range, ***Zamia furfuracea*** (cardboard palm, native to Mexico) and ***Cycas revoluta*** (sago palm, native to Japan).

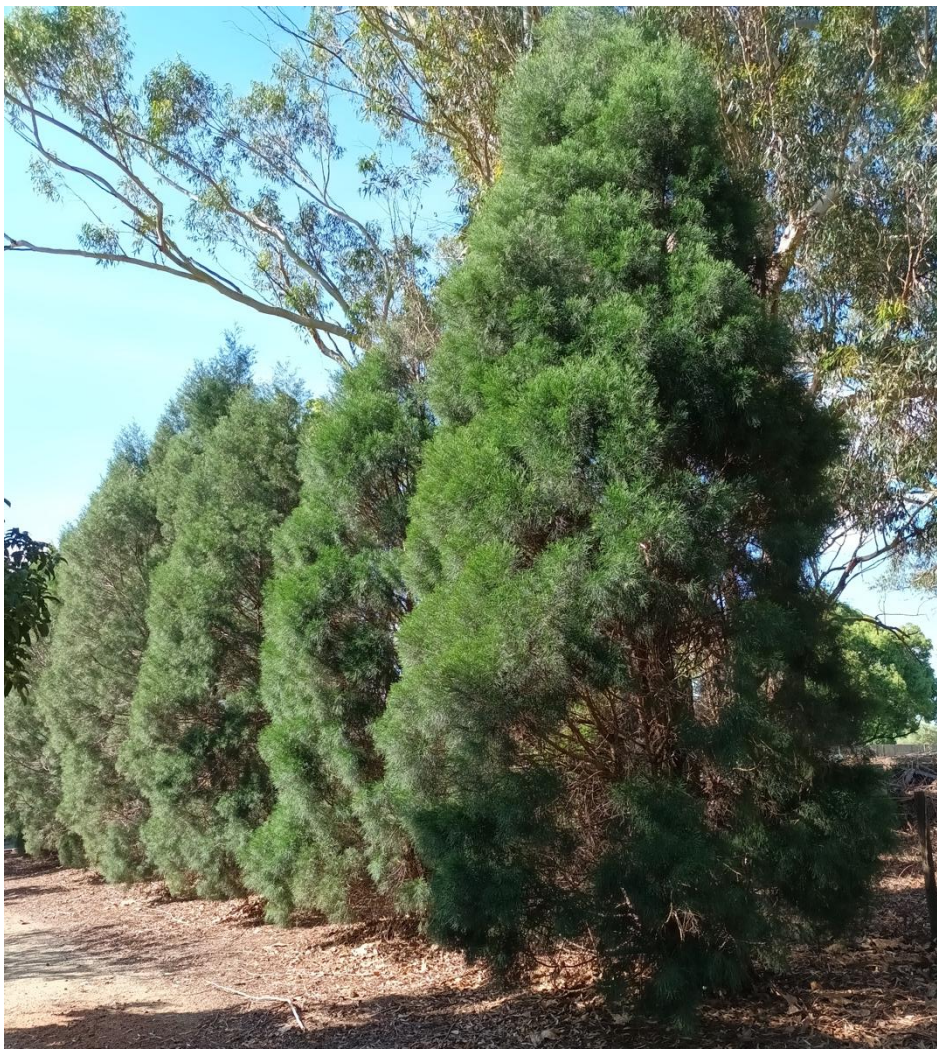
Araucaria species are well represented. ***Araucaria bidwillii*** (bunya pine) and ***A. cunninghamii*** (hoop pine) are familiar local natives. There are two species from Pacific Ocean islands, ***Araucaria heterophylla*** (Norfolk Island pine) and ***A. columellaris*** (Cook Island pine); and two from South America, ***A. angustifolia*** (Paraná pine) and ***A. araucana*** (monkey puzzle). Paraná pine has become critically endangered in its native Brazil through forestry harvesting, to the extent that only about 3% of the original population survives,

The genus *Araucaria* inhabited the great southern landmass of Gondwana, which started to break up about 180 million years ago, carrying more than 30 species to the parts that became South America, New Guinea, the Philippines, Indonesia, Malaysia and the Pacific Islands.

Peacehaven has three species of cypress pine native to our region: ***Callitris baileyi***, ***C. columellaris*** and ***C. glaucophylla***. While the common name for *Callitris baileyi*, Bailey's cypress, is clear-cut, the other two species have common names that vary according to location, and both are often known as white cypress. This potential confusion demonstrates the value of a scientific naming system.

Callitris baileyi is a rare local plant with Near Threatened conservation status. We have 43 specimens of the tree at Peacehaven.

The timber of *Callitris glaucophylla* is valued for its resistance to termite attack and decay. Its current and traditional uses include housing, fence posts and bee boxes, and it has recently found favour internationally as a decorative internal feature material.



Callitris baileyi (Bailey's cypress)

We also have a species of cypress native to the coastal regions of north-western North America, ***Callitropsis nootkatensis*** (Nootka cypress). It was planted by the Kuhl family and features in the iconic picture of Stan Kuhl at his gate on the Kuhls Road boundary of the original farm.

Among ***Podocarpus*** species we have ***P. elatus*** (plum pine), which grows in remnant rainforests along the coastal plain and ranges from central Queensland to south of Sydney, and ***P. dispermus*** (broad-leaved brown pine), a native of the Atherton Tableland.

Another genus closely related to *Podocarpus* is ***Prumnopitys***. At Peacehaven we have ***P. ladei*** (brown pine or Mount Sturgeon black pine). This species is native to the Atherton Tableland and is classified Vulnerable because of its restricted distribution.

Agathis robusta (kauri pine) is native to the coastal plain east of Toowoomba and grows at Peacehaven. Impressive mature specimens can also be seen in the Queens Park Botanic Gardens and outside the Cobb & Co Museum in Toowoomba.

Wollemia nobilis (Wollemi pine) thrilled the botanical world in 1994 when it was discovered growing in a narrow gorge in the Wollemi National Park, not far out of Sydney. A specimen collected by New South Wales National Parks ranger Dave Noble was sent to herbaria for identification and was compared successfully with fossil specimens dating from 91 million to 2 million years ago. As postulated by Darwin, the locality was a confined area, sheltered from extremes of heat, drought, hail and bushfires in a narrow sandstone water-seeping gorge.

Wollemia nobilis (centre) in the Prehistoric Corner at Peacehaven

As part of the campaign to protect this significant species, which is classified Critically Endangered, rooted cuttings were made available to botanic gardens and later to commercial growers, and the cultivated tree is now readily available, though expensive to buy.

The Wollemi pine pictured below was donated in 2007 by the owners of a tree farm in Ravensbourne.

Ginkgo, ***Ginkgo biloba***, is widely known around the world but grows in the wild only in southern China. Fossils of the species 150 million years old have been found, and the oldest living specimens are estimated to be more than 3500 years old.

The species is resistant to disease and can grow in disturbed, polluted environments: some even survived a close encounter with the atomic bomb at Hiroshima. They are now widely planted, as they flourish even when exposed to diesel fumes and other city pollution.

Gingko exemplifies the extraordinary tenacity of living fossils in the plant world.

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