

Surviving Zone Denial

Chapter 6

Prehistoric Landscapes with Hardy Ancient Gymnosperms

Over 70 million years ago, the earth was a much different place. Vast tropical jungles were filled with large spiky evergreen conifers that thrived in the steamy heat or warm moist temperate climates. Armed to ward off herbivores larger than the suburban home and with appetites to match, these plants elicit the same excitement in some plant lovers that dinosaurs do in children. Stone shadows of their leaves and fronds litter shale, coal, and sandstone with the same dramatic flourish that dinosaur footprints in petrified river beds do for their lost megafaunal compatriots. Yet, while many artists strive to capture the general form and scale of these lost plants in posters and movies, few of us realize that representatives of most of these types of plants still linger today in remote jungles and on untouched mountainsides, still armed to ward off creatures that haven't crossed their path in many millions of years. Time truly has stood still for these living fossils. They've endured through years of darkness and falling ash and brimstone that wiped out many plants and animals, suffered withering heat from erupting volcanoes, road atop continent-side landmasses as they slipped to or from the equatorial regions, and retreated from vast ice sheets that reshaped mountains and carved valleys. Yet they are not celebrated in plastic replicas, or on cereal boxes. If a living dinosaur were discovered in remote Africa or on a mountain top in South America, the news would likely rocket 'round the earth on TV and the Web in hours, while the discovery of a plant they might have eaten arouses barely a blip among scientists in a few specialty fields. How many people realize that botanical Jurassic Parks already exist in a few locations in the world today? People can walk among trees and shrubs that endured unwelcome attention from extinct reptiles without fear of being ambushed by velociraptors or the like. Chances are you can even coax one of these botanical dinosaurs to grow in your own yard.

So, what did the dinosaurs eat? Well, if you live in a warm subtropical region you may find that there's at least one plant in your back yard they'd recognize and quickly turn into a stump. For example, the sago palm, or King Sago, is extremely popular in landscaping, wherever the winters are mild enough to allow it to survive. But even more common pines, cedars, magnolias, and maples appeared in forms similar to if not identical to forest and landscape plants we know today. Some researchers speculate that one of the most famous living fossils, the ginkgo tree, maintains a uniquely anachronistic fruit especially designed to encourage long-dead dinosaurs to consume the foul-smelling fruit, and later disperse the seed. Extinct dispersers, climate change, and mass extinctions brought about by natural calamities may all play a role in reducing a formerly widespread plant to a small, isolated, lowland and sometimes subtropical range. Perhaps the last ice age forced some species towards the equator. Or maybe birds or mammals assumed the role of a missing seed dispersal agent in cooler regions, where harsh weather or over hunting lead to the extinction of a companion farther north. One or more of these factors may explain a species ability to survive and even thrive in colder climates than its current "natural" location.

If you are looking to approximate a Mesozoic forest in your backyard, there are some conifers that hang on in remote corners of the world that fit the bill. Although it is hard

to believe, there are remote corners of the world that have remained relatively stable for tens of millions of years. In other cases, the slow pace of continental drift ensured that plants had a migration path that would enable them to survive even as their original habitat became wetter, drier, hotter or colder. From the short, stout, palm-like cycads that can sometimes be mistaken for ferns, until they produce giant pine cones and scatter bright orange seeds, to the architectural, minimalist and spiky branches of *Auracaria*, there are attention grabby prehistoric greenery that can be teased into growing and even thriving in cooler climates. Most of the plants in this chapter can manage with little or no extra care in zone 8, and many can be easily wintered over in zone 7 with extra care. A few sturdy oddities, such as the Monkey Puzzle tree and *Cedrus* species, can survive in zone 6. So there's something for everyone.

Before we move on to the prehistoric giants, let's take a look at some more diminutive companion plants that are equally exotic and with similarly ancient lineage. Rushes or horsetails (*Equisetum* species) are an ancient family of plants. Millions of years before the dinosaurs ruled the earth, they took the form of giant trees in steamy amphibian and insect-infested primeval forests. Today, most forms rarely exceed three feet in height. They consist of little more than branched or unbranched, hollow, photosynthetic stems. The plants often grow in mats or dense stands as they spread underground. Larger forms can resemble bamboo. Others are more difficult to describe as they sprout flushes of horizontal stems from each joint so that they look like a stack of wheel spokes. Like their giant ancestors, most forms prefer to stay constantly moist or even wet, and flourish in high humidity and dappled shade. Forms range from narrow hollow cylinders capped with small cones that, when unopened, cause the plant to resemble wild onions with flower stalks, to delicate and almost skeletal pale green tufts that grow in drainage ditches, at the edges of ponds, and alongside streams.

Another rather large and interesting family of plants includes plants commonly referred to as spike mosses, and occasionally, resurrection plant, or hanging moss? (*selaginella* species). Often labeled generically as fern allies, they are actually a diverse group of plants related to both ferns and horsetails. Like mosses and ferns, they reproduce through spores. While horsetails are usually restricted to outdoor water gardens, *selaginella* are often grown as house plants or in shady landscape plantings as ground cover or specimen plants. Its ancestors were the giant club mosses, which are now extinct. *Lycopodium*, the clubmoss, is often called ground-pine or running cedar and bears a strong resemblance to and kinship with the spike mosses. Both groups contain many low growing, evergreen plants with unusual leaf, stem, and reproductive structures. The leaves tend to resemble scales more than what we would recognize as a true leaf. In many cases, the growth is very much like that of some cedars or other landscape evergreens.

Table 1 – “Para-tropical” Ferns and fern allies

Then of course there are the ferns themselves. Many larger ferns lend a tropical appearance to any garden. One of the best is the ostrich fern. Established plants can often exceed 4-5 feet in height. Their numerous upright fronds arranged in a circle around the crown is similar to the growth habit of palms and cycads. Ostrich ferns can grow in partial sun and tolerate drier conditions, so they are more adaptable than some of the smaller ferns. The cinnamon and lady fern are also good choices. Like the ostrich

fern, the cinnamon fern tends to produce large fronds from a central crown, with the added bonus of producing a brown cluster of fertile, spore bearing leaves in the spring. The lady fern tends to spread via underground rhizomes, so it can quickly spread to fill an area that suits its needs. Its fronds are similar to but typically smaller than ostrich and cinnamon ferns. The sensitive fern is a moisture and sun loving resident of wetlands. It has undivided leathery leaflets on each frond and this gives it a tropical appearance. Other unusual fern specimens include the heart's tongue fern, which has undivided strap shaped leaves that give it a tropical appearance. These tend to be smaller plants that prefer shade. A couple of species of maidenhair fern are also quite hardy. Their delicate fan-shaped leaflets can appear to float in mid-air as the stems are thin, wiry black and virtually invisible in shade. These ferns tend to be more sensitive to heat and drying out than to harsh winters.

There are also a couple of species of tree ferns from Tasmania and New Zealand that are fairly hardy. The Tasmanian tree fern, *Dicksonia antartica*, is often grown in British gardens and depending on where the plant or its parents originally grew; they can be hardy to at least 15 degrees Fahrenheit with no protection. It is sometimes imported as sawed-off trunks from areas where the forest where it grows has been cleared, because trunk itself is actually made up of fibrous roots. These ferns can grow to be quite large over time. Growers report that using leaf litter as insulation for the trunk and crown in winter can enhance its ability to withstand cold winters. These tree ferns don't mind sun, but may not tolerate hot, dry summers without some assistance.

Cycads

Cycads are related to both ferns and conifers, and have characteristics of each. There are over 250 species of cycads living today. Cycads are a truly ancient group of plants. They are actually older than the dinosaurs. While they were not the first plants to produce seeds, they are the oldest living plants that did so. Some living plants are also known from fossils, and some living families are also represented by extinct species. The plants are primarily tropical, but many have a peculiar ability to go dormant and withstand poor growing conditions for extended periods of time. I have often wondered if the cycads that are alive today survived because of that ability. It must have come in handy during the months (or perhaps years) that the sky was obscured by dust from the apocalyptic end that the dinosaurs met. Of course, seeds with hard coatings would probably also aid a species in surviving a temporary environmental catastrophe (which is another characteristic of living cycads). Whether some or all of the living species of cycads were alive during the age of dinosaurs is debatable, but given the fossil evidence, it is safe to assume that many of the characteristics exhibited by modern cycads evolved to allow them to survive environmental factors that shaped their large reptilian co (word meaning lived at same time).

Cycads have long leaves that are divided into leaflets, so these leaves are usually referred to as fronds. In most types, the leaflets are either needle like, or resemble those of ferns. Cycads do not flower, but produce cones, like conifers. Cycads are male or female, so male plants tend to produce tall thin cones suitable for releasing spores into the air. Female cones are large and compact, because the heavily modified leaves that make up the cone are designed to protect seeds while they form. In the *Dioon* and *Cycas*

family, it is sometimes very obvious that the cones are simply modified leaves, while other families bear cones that are difficult to distinguish from pines, except for their size. But there are exceptions, for example, cycads in the *Zamia* family produce hexagonal cones that appear to resemble beehives. Cycads can assume two forms. Many types have stout trunks that are visible above ground, and are often covered with scars from crowns of fronds from years past. Cycads with above ground trunks often resemble palms. The other type grows from a subterranean stem, and tends to more strongly resemble ferns. In fact, one African species was first described as a fern before it was observed to produce a cone, which made the mistake obvious. Cycads with subterranean stems often have an advantage in terms of winter hardiness, particularly since this root-like stem can reach lengths of six feet in some species!

One of the hardiest cycads is the sago palm or king sago (*Cycas revoluta*), which is native to temperate and tropical regions of the Pacific coast of Asia and Japan. It is a very common landscape plant in the southeastern United States. The sago palm produces a circle of long narrow fronds atop a thick brown trunk. It grows slowly, producing one crop of fronds with their characteristic dark green needles per year. A close relative, *Cycas taitungensis*, from Taiwan, is also very hardy and looks very similar to the sago palm. This less-often grown species grows much faster, typically producing two or more crops of fronds a year. *Cycas circinalis*, sometimes called the queen palm, is somewhat less hardy than the sago palm, but is also frequently grown where the winters are mild. It has a thinner trunk and longer, more palm-like leaflets. All three varieties produce striking golden cones as they mature, which adds to their exotic appearance.

Africa has two endemic families of cycads, the *Stangeria* and *Encephalartos*. *Stangeria*, which is represented by one living species, can survive mild frost but is not well suited for cooler climates. *Encephalartos* consists of dozens of species scattered across central and southern Africa. Some species of *Encephalartos* from South Africa grow in mountainous regions that are subject to occasional snows. The South African varieties may have developed a tolerance for cold as the African continent slid southward over the millennia. These plants are not widely grown outside their native environment but some would likely be as hardy (if not more so) than the sago palm. Most have no common name, so you might have to keep this book handy as you scan catalogs or search engines for nurseries that sell them. The hardier varieties have short fronds with spiny bluish leaflets, and thick short trunks. These types tend to be slow growers because in part because they have adapted themselves to seasonal variations in growing conditions. Many species of *Encephalartos* produce large, spiny cones with brightly colored seeds.

Dioon and *Zamia* are two families of cycads from the western hemisphere that contain a few hardy species. *Dioon* occurs from Mexico through central and into South America. *Dioon* are considered by many to be the most primitive of the living cycads, because like many *Cycas* species, they form very crude cones which one can plainly see the leaf-origin of the cone (particularly the female, seed-bearing cones). Some Mexican species grow in highland environments and have evolved to be fairly resistant to cold temperatures. The hardier species tend to have smaller leaflets and grow in sunnier conditions, such as *Dioon edule*. The less hardy *Dioon* varieties grow in lowland rainforest settings and have broad leaflets on gracefully arching fronds.

Zamia species occur in the Americas and throughout the Caribbean. One *Zamia* (*Z. floridana*) is native to Florida and southern Georgia. It is a trunkless plant that resembles

a small palm, with bright green leaflets that curl along the edges, and strangely geometric brown cones held just above the soil level. Like *Dioon*, the less hardy versions tend to be more palm, or fern-like. Another hardy *Zamia* that is widely used in landscaping is *Z. furfuracea*. It has thick oval leaflets that are remarkably tough. It sometimes forms short trunks but usually the fronds originate from a crown that just breaks the soil's surface.

Did *Dioon*, *Ceratozamia*, and *Zamia* cling to cold tolerance following a glacial migration southward? The distribution of some *Dioon* and *Zamia* species might provide evidence to support this. Some *Dioon* species grow in mountainous regions in Mexico just a few hundred miles south of the US border. Could some common ancestor of the *D. edule* faction of the *Dioon* family with their narrow compact leaflets have once lived in the American west? *Zamia* hangs on in subtropical southeastern US, primarily in Florida, where so many variations are common that experts debate whether there are multiple species or a highly variable single species. Are there new species on the brink of emerging in this area? Or is this merely a function of golf courses and suburbs cutting off former interbreeding populations from one another? In any case, America's *Zamia* is not struggling to cope with the climate of its current surroundings.

Finally, a few species of cycads from Australia are also moderately hardy. The predominant cycads in Australia are *Cycas*, and the endemic *Lepidozamia*, *Bowenia*, and *Macrozamia*. The Australian *Cycas* species tend to live in the northern tropical or desert parts of the continent. Likewise, *Bowenia*, which is a group of small fern-like cycads, prefer the warmer parts of Australia. Some *Macrozamia* species occur in the southern part of the country or in mountainous or desert settings and have evolved a modest resistance to cold. There are two major types of *Macrozamia*. There are a number of species that have subterranean stems. A few of these reach surprising sizes, despite their trunkless growth habit. The other type of *Macrozamia* have a more palm like habit, because they form trunks. This type is less cold hardy. In the case of Australian species, cold-hardiness is probably as much a function of the protective nature of the soil as it is an evolved trait in response to environmental pressures. It may be the case that most cold tolerant Australian cycads are merely incidentally so, a side effect of their retreat into the soil to avoid seasonal fires or dry periods.

Table 2 Hardy and semi-hardy cycads

<i>Ceratozamia hildae</i>	Mexico	mid teens
<i>Cycas revoluta</i>	Japan	mid teens, with leaf damage
<i>Cycas taitungensis</i>	Taiwan	mid teens, with leaf damage
<i>Dioon edule</i>	Mexico	mid teens, with slight leaf damage
<i>Encephalartos ferox</i>	South Africa	slightly below freezing
<i>Encephalartos lehmanii</i>	South Africa	mid 20's
<i>Encephalartos natalensis</i>	Natal	mid 20's
<i>Macrozamia communis</i>	Australia	mid 20's
<i>Zamia furfuracea</i>	Mexico	slightly below freezing, lower with leaf damage

In fact, a general rule with cycads is that trunkless forms are better candidates for experimentation in cooler climates. *Ceratozamia hildae* for example can form a subterranean trunk that exceeds six feet in length. In areas where there is heavy frost or even snow, this plant may freeze back to the ground, but return quickly when spring arrives. The Australian *Bowenia* genus, species of *Ceratozamia* and *Zamia*, and some *Macrozamia* species are all good candidates for cooler climates if you can synchronize their dormancy period with the local seasonal variations. The key is selecting a relatively fast growing plant that can produce enough fronds to ensure that it is able to continue to build its root/trunk system, and planting in a location where the ground does not freeze. Mulch and a microclimate such as near a foundation will all help to provide the necessary conditions. And while starting young is often a good idea, both because smaller plants are less expensive and easier to come by, you are likely to have more success with larger subterranean specimens in marginal areas. Just make sure you plant as early as you can in the first growing season, and provide ample protection the first year (and every year if winters are unpredictable) to make sure the plant has time to establish itself.

Tropical Conifers

The Norfolk Island pine (*Araucaria heterophylla*) is a popular indoor houseplant and is sometimes used as a living Christmas tree. While it may resemble a pine, and serve as a suitable substitute for decorative purposes, it is actually a member of a tropical conifer genus called *Araucaria*. The Norfolk Island pine is not hardy, and in the United States it is only used in landscaping in subtropical and tropical areas such as southern Florida and the Florida keys (sailors planted the tree in Key West so that its straight trunks could be harvested for ship masts). The family is also home to one of the tallest trees in the world, the Klinki pine (*A. hunsteinii*) from New Guinea. This genus spans the southern Pacific from South America to the south Pacific and Australia, and several species tolerate temperate climates. These are moderately hardy and even more interesting species than their more common cousin. The most famous is the Monkey Puzzle tree.

The Monkey Puzzle tree (*A. araucana*) comes from mountainous regions in Chile and Argentina. Western scientists discovered the tree in the late 1700's. Explorers from the Royal Kew botanical gardens found that peoples native to the area in which it grew consumed the large pinyon-like seeds from the massive cones. They wondered how one could possibly reach the cones, remarking that the task would even puzzle a monkey, hence the name. Monkey Puzzle trees are slow growing, but ultimately achieve large sizes (in excess of 100 feet) and advanced age (may exceed 1000 years). With the right conditions, the trees can easily survive zone 6 winters. They prefer high humidity and to have their roots stay cool and moist during hot summers. In their native habitat, there are frequent winter snows, so they have no problem tolerating snow and ice, and the extended periods of cold temperatures that accompany winter precipitation.

Like the Norfolk Island pine, Monkey Puzzle tends to grow straight and tall, with new sets of branches emerging together on a horizontal plane each year. But the leaves are quite un-pine like. They tend to completely wrap and conceal the branches and are short, broad at the base, but quickly narrow to a sharp point. Since *Araucaria* is an ancient genus that were common in forests of the Cretaceous period, it leads one to speculate that the spiny, inedible leaves evolved to thwart large reptilian grazers of that era. Monkey Puzzle is extremely unusual in its growth habit, even within its own genus. The branches

tend to arch toward the ground as the tree grows, and the tree forms a pyramid. As it gets older, it sheds its lower branches and the top flattens a bit so that it has a truly unique and primitive shape unlike many other living trees. The trees are either male or female, and the female trees produce large egg-shaped cones with edible seeds. Everything about it seems designed for a different era.

The common name Monkey Puzzle is sometimes used to refer to other species of *Araucaria* as well. *A. bidwillii*, which is more commonly referred to as the bunya bunya tree, comes from north eastern Australia, and had a growth habit that is intermediate between the Chilean Monkey Puzzle and the Norfolk Island pine. Its somewhat tangled branches bear long narrow leaflets that arch and have pointed tips. The tree is quite a bit less hardy than its South American cousin, and can often die back to the ground if the temperatures drop below the mid teens for an extended period of time. It becomes hardier with age, so it might be possible to establish it if planted near a foundation in zone 7. Given the fact that it grows in tropical regions of Australia, it is remarkable that it is as hardy as it is. Like the Norfolk Island pine, it adapts well to houseplant conditions, including low light. As a landscape tree, it eventually comes to resemble the bare trunk, domed crown growth habit of the Monkey Puzzle. Also like its cousin, it is valued both for its wood and its edible seeds.

A tree that bears a striking resemblance to the bunya bunya tree is the China fir (*Cunninghamia lanceolata*). This beautiful and exotic looking evergreen is native to Southeast Asia. As seedlings, it can be difficult to tell the two trees apart, despite the fact that the China fir is a close relative of the redwood. Its needle-like leaves are longer and tend to arc gracefully but grow in a spiral pattern along the branches just like *A. bidwillii*. As adults, the trees are more easily to distinguish from one another, since the China Fir is smaller and retains its pyramidal shape. Some varieties also produce striking blue foliage and the tree suckers freely from the base and along its trunk. It is grown in Taiwan, Mainland China, and Korea as a source of timber for construction, flooring, and for building furniture. The China fir is hardy to at least zone 6, where its foliage turns a golden bronze in winter.

The China fir is long lived, like its close relatives, the redwoods. It can grow to over 150 feet, and some say it can live for thousands of years. In the Deep South, it was widely used for landscaping, probably because it roots so readily from cuttings. The 'glauca' or blue variety of the tree, sometimes referred to as *Cunninghamia konishi*, is the hardier and more beautiful of the two varieties. The tree tends to hold onto dead leaves and branches, which can sometimes give it a ragged appearance. It tends to grow quickly when young, and slow with age.

Podocarpus is another large family of tropical conifers. Some South American varieties produce very fine wood. Many varieties grow as trees while others assume a shrub form. *Podocarpus* species tend to have long broad leaflets that add to their tropical appearance. A few varieties are hardy. Common names for African species include African yellow wood and African fern pine. Recent taxonomic reviews have led to the establishment of a separate genus for African species, called *Afrocarpus*. Within the *Podocarpaceae* family, there are nearly 100 distinct species that range from the near tropics, growing primarily in the subtropical zone of tropical mountains to temperate regions, usually to be found in the warmer temperate zones of the southern hemisphere. It is from

the temperate southern extent of the podocarps that a few good candidates for cooler climates originate.

One hardy species is the Japanese Yew-Pine, *P. macrophyllus*. It is found in southern Japan, as well as southwestern China and Taiwan. This medium sized drought-resistant and shade-tolerant evergreen tree can also be pruned into a hedge. Several forms are available that range from a small short leaved shrub (var. *appressus*) to a columnar tree (var. *maki*). This slow growing species also produces small edible purple fruits. It is hardy to zone 7, if provided with protection from winter wind.

P. nagi is somewhat less hardy than *macrophyllus*, but may be worth a try if you have a suitable microclimate. It bears much broader evergreen leaves on a small-to-medium sized pyramidal tree. It is typically grown in Florida and coastal California, but may be suitable for dry coastal regions as well. It might be worth a try against a southern facing wall in cooler climates.

Finally, several subtropical cedars with striking foliage are becoming increasingly common in landscaping in cooler climates. Species of the *Cedrus* genus are referred to as “true cedars” since many other conifers are referred to as cedars. The blue atlas cedar (*C. atlantica*), which is native to the Atlas Mountains in northwestern Africa, has proven to be quite hardy. Many resources list its hardiness as zone 7, but it can in fact be grown in zone 6 with no special effort. The stark gray trunk is barely visible among the sparse branches that are covered in vivid silvery blue foliage. Like other cedars, it loses many of its needles as the new growth emerges in the spring. Deodar and Lebanese cedars are other good choices for cooler climates. Deodar cedar, which grows in India and Pakistan, is drought and heat tolerant, and grows faster than its African cousin. It bears dense branches covered in long needle-like foliage. *C. libani* is native to the Asia minor region, primarily Lebanon and Syria. It is a large picturesque but slow growing tree. The distribution of the Mediterranean species suggests that they may be relics of forests that once stood in the area that is now the Mediterranean Sea. Given their hardiness, the tree could have retreated southward during the last ice age. Perhaps the true cedars were once quite common in Europe as well.

Conifers, cycads, ferns, and fern-allies represent an incomplete continuum of evolutionary types that lead to the flowering plants with which we all tend to be more familiar. Populations of these tropical and subtropical types are perhaps our closest link to the plants that shared the earth with the dinosaurs. Evidence that ranges from peculiar fruits and armaments to unexplained hardiness found in plants and trees that only occur in tropical regions hints at ancient lineages that grappled with untold challenges that the plants encountered over the eons. While seed ferns, the cycad-like benitoles, and tree-sized horse tails and clubmosses are familiar to most of us today only as lumps of coal, there are those rare cycads, ferns, and tree-sized conifers that bridge the gap between the steamy jungles of the Mesozoic era and the suburban landscapes of modern America. Perhaps others retain hidden abilities to unexpectedly withstand temperature extremes – abilities that may have enabled them to survive mass extinctions caused by catastrophic volcanism or asteroid or comet strikes. Only their unusual, ancient, and sometimes anachronistic forms hint at their longevity.