Araucariaceae in Queensland

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Key words*: hoop pine, bunya pine, kauri pine, Wollemi pine, plantations, native forest.*

Introduction

The first export from the colony of Moreton Bay (now Queensland) was hoop pine (*Araucaria cunninghamii*). It is a major source of high quality softwood, both as natural pine and as a plantation resource. Kauri pine (*Agathis robusta*) was widely used in the timber industry and initially was a promising timber species until insect damage stopped the planting program. William Pettigrew built the first large sawmill specifically for the processing of kauri pine (*Agathis robusta*) in 1863. Bunya pine (*Araucaria bidwillii*), with its characteristic crown shape, is an icon of the natural and cultural heritage of Queensland, it was a secondary source of natural and plantation softwood, and it was a major food supplier in early times for many indigenous groups of south-east Queensland. The newest member of the *Araucariaceae* family, Wollemi pine (*Wollemi nobilis)*, although not a native of Queensland, is being propagated in the state with the royalty from the sale of plants used to conserve the Wollemi and other threatened Australian plant species. This paper discusses the role played by these trees in the history of forestry in Queensland, and briefly mentions Norfolk Island pine (*Araucaria heterophylla*), klinkii pine (*Araucaria hunsteinii)* and Paraná pine (*Araucaria augustifolia*).

Hoop pine: 'the monarch of these woods'

> Hitherto in our examination of this River, we have been only gratified with the distant view of the Pine; immediately we approached one of the magnificent stature, the Monarch of these woods (A. Cunningham, 1824).

Nomenclature, location and properties

Hoop pine (*Araucaria cunninghamii*) lies within the genus *Araucaria*, the name of which is taken from the word Arauco, a province of southern Chile. It is the only major plantation-grown native conifer in Australia. The specific name honours Allan Cunningham, the King's botanist of the day and explorer of eastern Australia. Hoop pine is an impressive tree, growing up to a height of nearly 60 metres with a diameter (at 1.3 metres) of 60 to 190 centimetres.

It occurs primarily in Queensland but is also native to New South Wales, Papua New Guinea and Irian Jaya. In Queensland hoop pine is found as major and minor disjunctions within 150 km of the coast (and on many islands) from the New South Wales boarder to Captain Billy Creek, approximately 11°40'S, on Shelburne Bay. The majority of the great stands of maiden hoop pine were clustered in an area from the New South Wales border north to about Gladstone and west to Monto and the Bunya Mountains. In some districts the pines in the scrubs were so numerous that the panorama of the ridges and ranges from a distance was often described as being 'black with pine', and within the scrub the pines were so close that the vegetation was said to be 'choked with

pine'. It is generally regarded as drought-tolerant and wind-firm but it is susceptible to damage from fire and frost.

It has long been grown in plantations in the Crown estate, as street trees, and in school plots (the first of these was planted in 1928); it has also been planted as windbreaks, and in land rehabilitation and private plantings. The timber is white to pale brown, fine-textured, carrying little figure, and light in weight (air-dried density of 560 kilograms per cubic metre).

Early exploitation of hoop pine

In 1823 the explorer John Oxley sailed up the Brisbane River and found 'timber of great magnitude [including] a magnificent species of pine … in great abundance.' The 'magnificent species' was hoop pine. In the next year botanist and explorer Allan Cunningham travelled with Oxley up the Brisbane River and described the hoop pine as 'monarchs' of the woods. The 'monarchs' were heavily cut and utilised in the 1800s leading to concerns for the future availability of the species. Accordingly, in 1901 a Forestry Branch of the Department of Public Lands was formed to provide government control of cutting.

Timber-getting methods

Initially axes were used in scrub (rainforest) felling and general timber-getting. Some popular brand names were Kelly, Plumb, and the Black Diamond. The Kelly was an Australian-designed axe made in the USA and sold in Australia from about the turn of the last century. Crosscut saws were popular, as two men working in tandem could use them, and were preferred to axes in the pine because they created less waste. After the Second World War, chainsaws became the main mode of tree felling, and productivity in the bush skyrocketed. In very steep areas, felled pine trees were often 'shot' or 'chuted' down the slope to the road or snig track. Shooting involved spearing the logs down the slope along a brushed path or track. The front ends of the logs were pointed to make their travel easier. 'Chuting' involved the sending of logs in a specially made chute constructed out of timber or bark; in some cases a trench was simply dug into the soil. In both methods the logs travelled with great speed. Often the logs would split into many pieces when they hit obstacles while being shot or when they landed at the bottom.

Both horses and bullocks were used to snig logs in the early days of timber-getting. In some places horses were used along narrow tracks to snig logs from the stump to a wider, main snig track where they were then snigged by bullocks to a loading ramp. As horses are surer-footed than bullocks, they were prefered for snigging in steep country. Nevertheless, as bullocks were stronger than horses, they were the favoured beasts for pulling loaded wagons from the loading ramp to the mill or railway yard. Overall, bullocks were favoured over horses because they could live more easily on feed in paddocks, were cheaper to buy and to maintain and were less susceptible to 'spooking' than horses. In 1920 and later years, cable devices and winches were used in conjunction with bullocks to move logs. By 1934 motor lorries were able to haul more cheaply than bullock teams and the days of the teamsters were coming to an end.

Hoop plantations

The harvesting of hoop pine in Queensland was unsustainable and by 1917 the need for plantation hoop pine to supplement the depleted natural stands had long been apparent. Following early growth trials, the first commercial plantations—48 hectares of mostly hoop and bunya pine—were established during the period 1917 to 1920 in southern and northern Queensland. So began the successful hoop pine plantation program in the state. Despite many early establishment problems by the early 1930s the total area of plantation was 1250 hectares.

The native conifer program that began as such a modest endeavour a few decades earlier was by 1940 a healthy and steadily growing enterprise showing promise of contributing to the economy of Queensland. Except for four years (1942–1946) during and just after the Second World War due to lack of labour, plantings have been made every year since 1920. The last of the first-rotation plantations of hoop pine on cleared-forested land was planted in the 1990–91 financial year;

second-rotation plantings were begun in the early 1980s. The size of the hoop pine plantation estate, located mainly in south-east Queensland, is now about 44,100 hectares (approximately 23% of the total Queensland plantation estate). About 50% of the current hoop pine estate was established between 1960 and 1980 and 27% of the plantations are second rotations. These plantations are widely acclaimed not only for their timber productivity but also for their aesthetic value.

Planting 1946.
Photo: Queensland, Department of Primary Industry, Forestry

Due to limitations on clearing native vegetation for first-rotation establishment and restrictions on what can be clearfalled (e.g. in areas prone to land slip), the size of the harvestable hoop pine plantation estate on land currently owned by the state will slightly decrease over time without the purchase of additional land. As hoop pine is very sensitive to fire damage, strips of scrub (dry rainforests) that will only burn during times of extreme fire weather were retained as a necessary safeguard against fire. Generally the dense scrubs provide a shaded forest floor and cooler conditions than the adjacent eucalypt forests. These green scrub firebreaks are supported by strategically placed fire towers and lookouts to aid in fire detection.

From 1920 to about 1988 establishment entailed logging rainforests, then clearfalling the remaining original vegetation (initially by hand, later by machine) and burning the debris. Since then, especially in the second rotation areas, a litter retention system has been used. Seedlings were initially planted at 1500 stems per hectare on a grid pattern of 2.7 × 2.4 metres. From 1980, when seed orchard quality seed became available, a planting spacing of 3.0 × 3.0 metres (1111 stems per hectare) was adopted. Currently planting spacing is 6.0 × 2.4 metres (694 stems per hectare).

A standard nursery production system was implemented in 1924. This involved growing seedlings in nursery beds under shade for about 12–14 months then transferring them to metal tubes, each 20 centimetres long, with a diameter of about 4 centimetres. After tubing, the seedlings were kept in the full sun for up to several months before they were planted. As facilities did not permit the transport of large numbers of tubed seedlings, nurseries were established close to the areas that were set aside for hoop pine plantations. This nursery production method was in place until 1998 when a new fully containerised nursery was built to supply all hoop pine seedlings for Queensland.

For the first plantings, seed was collected from well-formed high-quality trees in the native stands. In the late 1950s seed was collected from plantation-grown trees selected for good form, vigour and branching. In addition, small areas of hoop were heavily thinned to leave groups of well-formed stems as seed production areas. Since 1980 all planting stock has been derived from seed orchard quality seed.

In the early years a range of pest plants and animals were a problem in the young plantations. Wallabies and rats damaged young stock and reduced survival figures. Weeds and grass also invaded the new plantations. Erecting wire netting fences excluded the wallabies, and the weeds and grass were controlled by manual cultivation using hoes and grubbers. The main pests today are rats, turkeys and feral deer. Grass and weeds are now controlled by the use of chemicals and a range of mechanical operations.

In 1941, Australia was at war and forest workers and mill hands enlisted in large numbers. The demand for hoop pine and other timbers for defence and essential uses was heavy. During and immediately after the Second World War, much work was necessary to support a forestry reconstruction program but labour was scarce. The government made available northern European migrants (many were called 'Balts' as they came from the Baltic countries) to assist. By 1949 some 400 of them were working in the forests.

Removing the lower limbs (pruning) by handsaws to ensure knot-free timber for an expected future plywood market began in 1935. Pruning commenced at about age six when 600 stems per hectare were pruned to 2.4 metres. This was followed by three subsequent stages or 'lifts' using ladders when the best 300 stems per hectare were pruned to a final height of 6.8 metres. Today, pruning is undertaken in two to four variable height 'lifts' over a period of 4–5 years, commencing at about age five aiming at a final pruned stocking of about 350–400 stems per hectare and a pruned height of 5.4 metres. Pruning operations are confined to winter to reduce the risk of infestation of freshly cut pruning wounds by the pine bark weevil (*Aesiotes notabilis*).

First thinning in a hoop pine plantation, date unknown
Photo: Queensland Department of Primary Industry, Forestry

The first thinning operations began in the mid-1930s. Thinning has aimed to reduce the competition around the pruned stems and maintain the stand at close to the optimal basal area for growth. To ensure that the basal area was maintained within the prescribed range, thinning was done on a regular basis with some stands receiving up to five thinnings. Today thinning of first-rotation stands is limited to stands less than 35 years old with each stand being thinned at least once between the ages of 25 and 30 years. Thinning is based on a reduction in stocking levels and still aims to reduce the competition around the pruned stems.

In 1963–64 the cut of hoop pine grown in plantations exceeded the cut of natural hoop pine for the first time.

Up until 1965, horses were used to snig plantation thinnings because they caused little damage to the retained trees. In the same year the first crawler tractor with a specially designed winch was used. Horses continued to be used for the extraction of thinnings from steep areas up until the late 1970s. Depending on the terrain, wheeled tractors, crawlers, and cables were common in the mid-1970s; forwarders, skidders and the like are now used. By the 1980s there was a growing awareness of the importance of soil conservation to preserve the productive capacity of the forest sites. One outcome of this was a shift from downhill logging using the natural topography to assist snigging, to uphill extraction which requires more specialised harvesting equipment.

Clearfalling of first rotations commenced in 1982–83. By 1985–86 about 50 per cent of the volume of timber harvested was from clearfalled stands. Currently about one-third of the volume harvested is from thinning material. Second rotation plantations are now established under a stocking regime aimed at maximising clearfall volume and quality and with a single commercial thin on sites that will economically support it based on terrain. The current average clearfall age for the first rotation is around 55 years, whilst the envisaged length of the second rotation is around 40–45 years.

Forestry workers and supervisory staff lived on forest stations that were established on the reserves. By 1930 twelve forest stations were established in hoop pine plantation districts; by the 1960s–1970s the number had risen to about 20. Some stations were small and located in isolated areas. Others were larger, being located close to small sawmill towns with perhaps a community hall and a school. A typical small forestry station comprised one or two houses, a number of married quarters (small three-roomed houses with a detached kitchen) and single-man quarters (usually three-roomed buildings with a kitchen and an open fireplace on one end). The stations also had an office, truck shed and a storeroom. Larger stations often had a ranch or mess hall. Small forest stations employed 8–20 men while larger ones employed up to 80 men. Today, most small forest stations have disappeared or have been converted to other uses, for example as education centres owned by state and private educators.

Uses of hoop pine

As hoop pine has an even texture it has always been favoured for plywood. The plywood industry was established in Queensland during the First World War and was a big success. In 1918 plywood sold for six shillings a sheet. The logs were rotary peeled. Hoop pine has also been used extensively in the construction industry for framing and boards; internal flooring; protected lining; panelling; tongue-and-groove boards for walls and ceilings; protected structural joinery; protected non-structural joining; mouldings; weatherboards (painted); and building railway carriages. Today it is still favoured for plywood, mouldings, furniture componentry, panelling and joinery with a significant volume exported to Asia for reprocessing into products for the United States of Americia and European markets.

As hoop pine is one of only a few timbers in the world that does not have an aroma, it was used in the manufacture of meat cases, butter boxes and pine casts. During the early part of the 20th century the majority of the butter boxes manufactured in Australia were from Queensland hoop pine. The timber's lack of aroma is still an important trait with, for example, a local

Queensland company (only one in Australia) manufacturing approximately 1.5 billion taint-free paddle-pop sticks and coffee stirrers for the domestic and export market.

Research

The story of the development of hoop pine plantations has been not without its problems. It is a story of trial, determination and hard work. The development of techniques that has resulted in the successful establishment of the only native conifer in Australia to have been used as a plantation species has, since the early 1920s, been underpinned by a vigorous research effort. This research has involved technological advances in nursery systems, plantation silviculture and tree breeding. This research effort includes a new nursery system that has resulted in the production of more robust planting stock; the use of herbicides that has boosted the early growth rates; tree spacing trials and work on optimal pre-commercial thinning and pruning levels that have led to increases in the productive capacity of the forests; the use of better seed sources based on genetic research that has improved stock quality and growth rates; and the establishment of environmental assessment methods that ensure that all plantation establishment and harvesting operations adhere to strict codes of operations. This continuing research effort and the input from plantation managers will ensure that hoop pine plantations will continue to be established and managed on a sustainable basis.

Bunya pine: a noble denizen of the scrub

> This noble tree I purpose to dedicate to its discoverer, who is not only a successful cultivator of plants in his garden at Sydney, but who has been the means of making known to us many novel plants of Australia, and more especially of New Zealand (W.J. Hooker, 1843).

Nomenclature and location

Bunya pine (*Araucaria bidwillii*) lies in the genus *Araucaria*. The specific name honours John Bidwill (1815–1853) an early explorer, botanist and the first Land Commissioner for Crown Lands, Wide Bay District of Queensland (then New South Wales). The species is endemic to Queensland with a disjunct distribution in the state, with one large but fragmented area in the south-east and two smaller but adjacent areas in the north. In one small mountainous area in south-eastern Queensland—the Bunya Mountains (approximately 160 kilometres west of Brisbane)—this tree occurs in abundance. It was because of the bunya pine that this area was set aside as Queensland's second national park in 1908; the area occupied by the species in the Bunya Mountains National Park (19,490 hectares) is now less than 100 hectares.

Tree and timber properties

The bunya pine has many features that set it apart from most other Australian trees. It is a towering, majestic tree growing from 30 to 45 metres in height with a diameter (at 1.3 m) of up to 1.5 metres. It has 'a certain nobility of habit', with a single, straight, unbuttressed trunk and a very distinctive symmetrical, dome-shaped (parabolic) upper crown. Its branches often occur in whorls (15–75 centimetres apart) and are horizontal, evenly spaced and generally unbranched. In old trees the branches are 12–15 centimetres in diameter. In addition, the large female cones are unlike those of other aracaurias. There can be 20–50 pineapple- or football-shaped cones on one tree, each being very large (20 × 30 centimetres) and weighing up to 10 kilograms. They are found in the top one-third of the tree and are dark green in colour and often camouflaged by branches and leaves. Each cone can contain 50–100 seeds. These heavy cones can cause serious damage when they fall and indeed in recent times, because of the litigious nature of modern society, a number of bunya pine trees have been removed from parks and gardens for fear of accidents.

Bunya pine is classified as a cabinet wood, its timber being pale yellow and slightly pink with an even texture, faint growth rings, and light weight (air-dried density of 460–530 kilograms per cubic

metre). Bunya pine has historically been used for the same purposes as hoop pine and in the 1920s hoop and bunya timber was collectively known as 'Queensland pine'. Today bunya pine wood is not readily available as the only trees cut are those removed for safety reasons or which are in poor health.

Bunya plantations

Although early timber-getters harvested the bunya pine because of its good wood qualities, it has not been planted extensively in plantations. The reasons for this lie in the persistent, sclerophyllous pointed leaves; the very thick prickly bark, especially in the butt; the presence of large-sized knots at close intervals that significantly affects the strength properties and the ability to take stains etc, and the inherently slow growth rates. During the 1960s a number of low-lying areas in south-east Queensland were planted with bunya pine as it is more frost-tolerant than hoop pine. Also as its thick bark affords some protection from fire, bunya pine has in a few cases been planted as a firebreak around hoop pine plantations. Although there were 510 hectares of bunya pine in plantations on state-owned land in Queensland in 1980, today there are only 368 hectares extant.

Aboriginal use and spiritual values

The indigenous people of southern Queensland (and northern New South Wales) have always had special affinities with the bunya pine. The trees were considered to be sacred and their edible seeds (or nuts) were, and still are, a ceremonial food of great significance. They were the focal point of major seasonal ceremonial gatherings that brought together thousands of people from a wide area, usually at the time of the bumper season every third year. Special envoys carrying message sticks from custodians of the trees travelled through surrounding districts to invite selected groups to attend the ceremonial feasts. Although the bunya pine is found in several areas in south-east Queensland, the bunya feasts were traditionally held in two main areas, the Blackall Ranges (in the Sunshine Coast hinterland 100 kilometres north-west of Brisbane) and in the Bunya Mountains. These feasts were times of great spiritual significance. It was a time when Indigenous people gathered to receive strength from Mother Earth. They were also times for arranging marriages, settling disputes, trading goods and sharing dances and songs. There is evidence, although scant, that they used parts of the tree other than the edible nuts. The headman of the Kaiabara tribe wore an armband made of bunya fibre as a mark of office and the bark of dead trees was used as fuel. Also, the gum and roots were a food source, with the roots being peeled before being roasted.

Bunya cones were collected by climbing the trees and knocking the cones off with a stick or stone tomahawk. There is some debate on how the trees were climbed. One tradition is that toe holes were cut into the bark using stone axes. However, some early observers recorded and present-day elders state that Aborigines would not damage the bunya trees for they were considered sacred and that climbing was done with the aid of vines that encircled the tree and the climber. The nuts were eaten raw, roasted in the ashes or on coals, or ground into flour.

The bunya pine is one of the few trees (perhaps the only tree) to have been protected by government legislation. In 1842, the governor of the day, aware of the importance of the bunya pine to the Aborigines and to lessen conflict between them and the white settlers who saw the bunya pine as a source of timber, proclaimed that Aborigines were to have sole use of bunya trees wherever they occurred.

Bunya pine today is mainly planted for ornamental purposes. Because of its unique branching feature this tree was very popular in the nineteenth century as in garden situations and was planted in cemeteries, around homesteads and churches, in streets, and around city memorials.

Kauri pine: gun-barrelled sentinels of the forest

> Here tower majestic Araucarias,
> Gun-barrelled Kauris in lead armour
> Thunder-browed Satinays from Fraser Island,

With their ladies, the comely Crow's Ash,
And crinolined and carmined Lillipillies,
And ti-trees wrapped in tissue paper (E.H.F. Swain 1966).

Nomenclature, location and properties

Kauri pine (*Agathis robusta*) lies within the genus *Agathis*, from the Greek 'agathis' meaning a ball of thread, referring to the resemblance of the cone to a ball of thread. The specific epithet is Latin for 'strong', an allusion to the vigorous growth of the species.

In Australia this species only occurs in Queensland. It has a disjunct distribution, being found in two locations. In south-east Queensland it is found in the Gympie, Maryborough and Fraser Island regions and in north Queensland it is found in rainforests between Ingham and the Big Tableland near Cooktown. Two closely related *Agathis* species are bull kauri (*Agathis microstachya*) and blue (or black) kauri (*Agathis atropurpurea*). They are both restricted to north Queensland and are not included in the descriptions of kauri below.

Kauri is a very tall tree between 36 and 42 metres in height with the occasional specimen nearing 50 metres. Mature trees can have diameters (at 1.3 metres) of 90–120 centimetres, sometimes up to 300 centimetres. Large kauri trees are quite imposing and majestic. Tree boles are usually straight with little taper and are branch-free in the lower sections (*Agathis* species are self-pruning). Trees grow on a variety of well-drained soils in the 1000–1500 millimetres rainfall belt.

The wood of kauri is creamy-white, of plain appearance, even-textured and fine-grained. It is easy to work and can be stained and glued readily, being relatively light with an air-dried weight of 324 to 450 kilograms per cubic metre. The timber is ideal for cabinetwork, joinery, panelling, framing, sheeting and plywood. Much has been exported to southern Australian states.

Kauri harvesting on Crown lands

William Pettigrew was the first sawmiller who recognised the potential of kauri pine. In 1863 he built the first sawmill specifically for the milling of kauri pine calling it 'Dundathu' after the indigenous word for kauri pine. The mill was on the banks of the Mary River downstream of Maryborough.

The relatively small natural distribution on Crown and private lands in south-eastern Queensland did not sustain the intensive logging of kauri for long and by 1912 southern kauri pine stands were described by the Forestry Branch of the Department of Public Lands as 'almost trees of the past'. Nevertheless, there were still considerable forests of the species on Fraser Island. By 1922, however, the Forestry Branch reported: 'Of kauri pine the southern resource is utterly gone.'

Natural kauri pine had been logged in north Queensland since the 19th century. In the 20th century, the total amount of Crown mill logs of northern natural kauri harvested was well over half a million cubic metres, mostly from state-owned lands. Logging in the north continued until the forests in that area were World Heritage listed in 1987. In regard to plantation pine, thinning of kauri in Queensland began in 1947–48 with a small quantity of 29 cubic metres being harvested.

Kauri plantations

In north Queensland a nursery was established near Atherton at the end of 1912 and sown with kauri seed and other potentially commercial rainforest species. The fledgling Forestry Branch of the Department of Public Lands decided in 1913 to trial kauri for survival rate and growth performance. The potential of future plantations of kauri pine in north Queensland looked promising according to the trial results. It was not until 1935, however, that 13 hectares were established as a plantation. Experiments in the early 1950s revealed that the kauri pine of north Queensland, under favourable conditions, showed growth comparable with the best hoop pine stands in the state. By 1952, 115 hectares of kauri had been planted in the north. No further plantings of note were carried out in this region. Enrichment planting of kauri was beginning to look promising in the 1960s. This practice entailed the planting of kauri seedlings in the more open

sections of natural rainforest in north Queensland, either in naturally sparse areas or in pockets arising as a result of logging. The practice operated until the mid-1970s.

In southern Queensland kauri was first planted on Fraser Island in 1876 in gaps and large strips cleared in the forest. However, these plantings failed presumably from competition from the surrounding vegetation and competition from weeds. Despite these failures, kauri was re-established in plantations during the period 1916–1920. Growth in these was better, with some trees planted in 1918 being 12 metres tall at age four years. Effective plantations on the mainland in south-eastern Queensland were established in the 1930s. Then in 1935, an insect pest, thrip, was noticed on kauri seedlings in the Imbil Nursery. It was an ominous portent! The area of kauri plantation in Queensland in 1958 was 716 hectares and the maximum area established to kauri pine in Queensland by 1964 was 780 hectares. The future of kauri as a plantation species looked assured. But disaster struck in 1959 because of attacks in the Mary Valley of the coccid scale insect *Conifericoccus agathidis*. This native insect caused widespread defoliation of plantation kauri. Then in 1963–64, kauri thrips (*Oxythrips agathidis*) continued to increase the overall level of damage to southern kauri. The coccid also attacked kauri in north Queensland but the problem was not major. By 1967, the coccid attack in south Queensland was still serious and salvage logging of the affected plantation trees was carried out. The kauri plantation program in the south quickly came to a halt. Today there are only 129 hectares of kauri plantations on state-owned land.

Kauri gum

Mention is made in the late 1920s of commercial quantities of *Agathis Palmerstonii* (now *A. robusta*) fossil gum. The Technical Museum of the Forestry Branch reported that the product was 'valuable for the manufacture of spirit varnishes and that the product had a good commercial future provided that regular supplies could be obtained.' In 1946–47, 125 tonnes of kauri gum was harvested from Crown forests. In the following financial year the figure dropped to 45 tonnes and in 1948–49 the amount was only a little over 9 tonnes. As there are no further entries in Forestry Department annual reports it is assumed that the resource was exhausted.

Wollemi pine: the tree that time forgot

Wollemi pine (*Wollemia nobilis*) is one of the world's rarest tree species. It is the only member of the genus *Wollemia* and takes its generic name from the national park in which it was found. Its specific name *nobilis* honours its discoverer, David Noble, a New South Wales National Parks and Wildlife Officer who found it in 1994 in the Wollemi National Park, 150 kilometres west of Sydney. It has been called the 'dinosaur tree', for it has been suggested that the leaves of the tree were a food source for herbivorous dinosaurs, and as a 'living fossil' as its heritage can be traced back through the fossil record of Australia, New Zealand and Antarctica to the early days of the conifers. In 1999 it was known to occur at two sites (about 40 adult trees and 200 juveniles); in 2000 it was found at a third site (less than 100 adult trees). A tree with very distinct knobbly bark, it grows to a height of 40 metres with a diameter of over a metre. Its growth rate in the wild is very slow.

Although Wollemi pine produces viable seed, the species appears to possess little genetic variation. This is to be expected in a geographically isolated relict population. It has been exacerbated by the fact that many trees in the extant population have been reproduced vegetatively. Vegetative reproduction can occur through rudimentary buds in the axils of leading vertical shoots and by buds at the base of and along the trunk. This ability to readily coppice has resulted in trees with multiple trunks of different ages. However, this feature has been used to ensure that this rare and endangered species survives. In 2001 a joint venture company (Wollemi Australia Pty Ltd) was set up between Queensland's Department of Primary Industries and Fisheries and a private nursery to propagate, market, distribute and sell the Wollemi pine to the domestic and international market under licence from the Royal Botanic Gardens (Sydney). Propagation of the species is being undertaken by cuttings and tissue culture. Plants are due for public release in late 2005 and each plant sold will return a royalty to conserve the Wollemi and other threatened Australian plant species.

Other species

Three other species planted in Queensland are klinki pine (*Araucaria hunsteinii*), Norfolk Island pine (*Araucaria heterophylla*) and Paraná pine (*Araucaria angustifolia*). Klinki pine has been planted in trial plots in north Queensland. Although growth rates and tree form have been good, this species does suffer from top breakage caused by wind, and because of this there are no plans to plant this species commercially in Queensland. Norfolk Island pine has been planted extensively as an ornamental, especially at seaside locations in the 1920s and 1930s. Today these trees still survive. It continues to be planted in parks and roadside verges in new residential and industrial areas in coastal Queensland. The planting of the Paraná pine has been limited to several trial plot plantings.

Acknowledgments

Special thanks are due to Mr John Comrie-Greig for his editorial assistance. The helpful criticism of the original manuscript by Drs Mark Hunt and David Lee is appreciated and the useful comments on the historical content by Mr Len Sivyer, Mr Alan Ward and Mr Eric Ward are gratefully acknowledged. Thanks are also due to Mr Brian McCormack (General Manager, Marketing, DPI Forestry) for his general comments and assistance in writing the paragraphs detailing pruning and thinning operations of hoop pine plantations.

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