



Intsia bijuga (vesi)

Fabaceae (legume family)

choyo, show, kebuk (Pohnpei); *cobu, faux teck* (French); *dort, thort, zort, zolt, show, wantal* (Yap); *dort, wantal* (Palau); *fesi* (Tonga); *fesi* (Rotuma); *kwila, iban, mboan, bon, menau* (Papua New Guinea); *ifilele* (Samoa); *ifit, ifet, ipil* (Guam and Mariana Islands); *ipil*, Moluccan ironwood, Borneo teak (English); *kobu* (New Caledonia); *kubok, kubuk* (Marshall Islands); *kuren, nityanmis, tuamis* (Chuuk); *natora* (Bislama, pidgin), *tora, tor, atora, nator, n'tor* (Vanuatu); *u'ula* (Kwara'ae), *nyia nwola, vei, nkengia, kivili, hubula, rurula, gugura* (Solomon Islands); *vesi, vebi, vesiwai, vesi dina* (Fiji)

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IN BRIEF

Distribution Primarily in Southeast Asia and found on many islands of Melanesia, Micronesia, and Polynesia.

Size Typically reaches 7–25 m (23–82 ft) at maturity, usually with a single trunk.

Habitat Favors coastal and lowland forest, on well drained or swampy sites, especially on limestone, 0–450 m (0–1480 ft) with rainfall of 1500–2300 mm (60–90 in).

Vegetation Associated with mangroves, limestone forests, riverine forests, some atoll forests on wetter atolls, and lowland coastal forests.

Soils Grows in light, medium, and heavy soils; tolerates soils with impeded drainage and seasonally waterlogged, shallow, saline, sodic, and limestone (calcareous) soils, often growing on bare limestone on upraised limestone islands.

Growth rate Moderate growth rate, <1.5 m per yr (5 ft/yr).

Main agroforestry uses Coastal protection, windbreak, coastal soil stabilization, ornamental, living fence.

Main products Timber, medicinal, fuelwood, and craftwood for high-quality carving.

Yields Timber production data unavailable.

Intercropping Rarely used in farm cultivation.

Invasive potential Not considered to be invasive.



Vesi has a spreading form especially when grown in the open, as seen here in this young tree.

INTRODUCTION

A spreading tree up to 40 m (130 ft) tall, *vesi* (*Intsia bijuga*) is undoubtedly one of the most highly valued trees in the Pacific islands, both in terms of its traditional cultural importance and its value for commercial timber. Its durable, easy-to-work, attractive dark red-brown wood is especially favored for use in house building, furniture, and woodcarving. It is in very high demand and decreasing in abundance in most locations due to overexploitation for house posts, canoe making, and for woodcarving of valuable cultural artifacts such as kava bowls and weapons, and due to indiscriminate modern commercial logging.

In addition to the wide cultural use of its timber throughout its range, it also has potential as a boundary marker or living fence post, for the production of fuelwood (from its branches when harvested for timber or woodcarving), as well as for its considerable medicinal value.

Vesi tolerates a very wide range of environmental conditions. It grows in rough limestone terrain, in sandy and muddy coastal soils, and on the inner margins of mangroves in very dry climates as well as in seasonally wet coastal windward habitats and along freshwater streams at considerable distances inland, sometimes along ridges.

It is a tree that should be considered under threat. Human population pressure, extensive traditional use, and increasing logging and commercial production of kava bowls and other artifacts for sale to the expanding tourist market, coupled with the lack of a tradition of replanting, have rendered exploitation of current populations unsustainable. There is a critical need for systematic propagation and replanting programs to address the situation.

It is a tree that should be replanted in forestry and agroforestry schemes, even though it is relatively slow growing. It could also be considered for coastal reforestation programs because of its adaptability to coastal habitats, and it is an excellent tree for roadside plantings, urban areas, and tourist resorts. It also has considerable potential as an ornamental, given its attractive glossy green leaves and beautiful orchid-like flowers. It could also be tested on the larger wetter islands of Kiribati and Tuvalu, as it seems to grow well on some of the wetter atolls of the Marshall Islands to the north and Kapingamarangi Atoll to the west in Pohnpei state of the Federated States of Micronesia.

DISTRIBUTION

Native range

Vesi is native to the western Pacific and Indo-Malaysian region, from New Guinea and Palau in the west to Fiji,

Tonga and Samoa in the southeast, and to the Mariana, Caroline and Marshall Islands in the north and northeast in the Pacific. It is found in Madagascar, the Seychelles, Indonesia, Malaysia, Thailand, Philippines, Papua New Guinea, and Australia. The typical habitat is lowland areas, riparian zones, or strand and inner margins of mangroves; it is also found on limestone soils and rocky coastal outcrops. *Vesi* is the dominant species in some areas of limestone forest on the Isle of Pines in New Caledonia and on the limestone islands of Kabara and Fulaga in Fiji.

Current distribution

It is found in its native range of Madagascar, the Seychelles, Indonesia, Malaysia, Thailand, Philippines, Papua New Guinea, Guam, Australia, New Caledonia, Solomon Islands, Vanuatu, Fiji, Samoa, and Tonga, and in Micronesia to Palau, Yap, Chuuk, Pohnpei, and the Marshall Islands. In some islands, particularly in the easternmost extent of its range, it could be an aboriginal or early post-European-contact introduction; e.g., in the Marshall Islands and Tonga. For example, the only reported presence of it in Tonga was by Yuncker on the uninhabited volcanic island of Kao on the margin of forest near an abandoned plantation, as well as in cultivation on other islands in more recent times.

BOTANICAL DESCRIPTION

Preferred scientific name

Intsia bijuga (Colebr.) O. Kuntze

The botanical name stems from the word *intsia*, an Indian plant name; the species name *bijuga* comes from the Latin *bi*, meaning two, and *juga*, meaning yoked, referring to the pairs of joined or yoked pinnae.

Family

Fabaceae (legume family), subfamily Caesalpinoideae

Non-preferred scientific names

Afzelia bijuga (Colebr.) A. Gray

Afzelia cambodiensis Hance

Afzelia retusa Kurz

Albizia bijuga (Colebr.) A. Gray

Eperua decandra Blanco.

Intsia cambodiensis (Hance) Pierre

Intsia amboilensis DC.

Intsia madagascariensis Thouars ex DC.

Intsia retusa (Kurz.) O. Kuntze

Macrolobium bijugum Colebr.

Common names

Pacific islands

choyo, show, kebuk (Pohnpei)

cobu, faux teck (French)

dort, thort, zort, zolt, show, wantal (Yap)

dort (Palau)

fehi (Tonga)

fesi (Rotuma)

kwiila, iban, mboan, bon, menau, arir, ariri, babili, babrie, bat, bauw, bendoro, bon, duhum, epna, ferraai, ganam, gommagome, baboe, haero, jep, kaboei, amele, mep, milimbu, paseh, patoem, pian, pota, rang, raung, rong, seka, tangibe, wohne, yambwan (Papua New Guinea)

ifilele (Samoa)

ifit, ifet, ipil (Guam and Mariana Islands)

ipil, Moluccan ironwood, Borneo teak (English)

koku (New Caledonia)

kubok, kubuk (Marshall Islands)

kuren, nityanmis, tuamis (Chuuk)

natora (Bislama, pidgin), *tora, tor, atora, nator, n'tor, nitortat, nato, tou, nip, niv, ni-iv, we-iv, nipf, kimau, hmau, umau, nakumau, purkam, botpamau, vumalatora, noghuma, leav, hive, ntarauvi, liv, vutora, nator, aivornarat, ekmau, nokomo, nokmo miel* (Vanuatu)

u'ula (Kwara'ae), *nyia nwola, vei, nkengia, kivili, hubula, rurula, gugura* (Solomon Islands)

vesi, vehi, vesiwai, vesi dina ("true vesi") (Fiji)

Other regions

ipil, ipeh, ipil tandok, malapari, merbau ayer, merbau changkat, merbau laut (Malay Peninsula)

ipil, ipil laut (Philippines: Tagalog)

merbae, merbau, merbo, taritish (Java)

merbau (trade name)

merkau, merkau ajer (Sumatra)

praduu thale, lumpho-thale (Thailand)

Form

Normally 7–25 m (23–82 ft) at maturity, and in exceptional cases reaching 40 m (130 ft), with a spreading canopy; the bright green foliage often grows in subcrowns. The tree grows upright in full sun (100–75% sun) and spreading in shade (50–25% sun). The trunk can attain 0.5–1 m (1.6–3.3 ft) or more in diameter, with small buttresses. The bole is usually straight and long, although it is often crooked and leaning in coastal situations. Its bark is a distinctive light pinkish to reddish brown, weathering to light gray, smooth overall, slightly dappled, peeling in irregularly sized scales (exposing fresh color underneath), sometimes flaky. The inner bark is light pinkish brown grading to light yellow brown on the wood; sapwood is white; heartwood is red-

brown.

Flowers

Vesi trees each have both male and female flower parts (bisexual). Individual flowers are moderately large with four greenish sepals, corolla reduced to one large petal, three stamens with seven staminodes. The petal is white (with red center) or pink to purple or red. Flowers occur in axillary or terminal corymbose panicles. In PNG, flowers have been observed year-round, with a peak in August around Madang. Flowers are reported in May–June in Vanuatu and October–May in Fiji, and April–November in Samoa. Insects (such as bees), birds, and wind are considered to be the major pollinators.



Top: Pinkish-purple flowers. PHOTO: R. DEMEO **Bottom: White to rose-purple flowers.** PHOTO: L. THOMSON

Leaves

Vesi's bright, shiny, light-green foliage distinguishes the tree from others in the forest. The leaves are pinnately compound, usually with four leaflets each 8–15 cm (3.1–4.6



Left: Vesi's paired (even-pinnate) terminal leaflets. PHOTO: R. THAMAN **Right: Immature pod and mature seed.** PHOTO: C. ELEVITCH

in) long, broadly elliptic, asymmetrical and medium to dark green. Two terminal leaflets are very distinctive and hanging. Although vesi trees are evergreen, they tend to lose their leaves periodically due to infestation of the species-specific psyllid *Innesia glabrascuta*, where present.

Fruit

Fruits are thick, rigid, oblong, or pear-shaped pods up to 10 cm (4 in) wide and up to 30 cm (12 in) long. Each pod contains two to eight dull-brown, rounded, flattened seeds about 2–4 cm (0.8–1.6 in) wide, with hard seed coats. In PNG, fruiting has been reported in all months, with a peak in February. Fruiting is reported to be around December–January in Vanuatu and between April and October in Fiji. In Samoa fruiting has been observed in October–February and June–July and probably occurs in all months of the year.

Rooting habit

Mature trees of the species have wide buttresses which, when fully developed, may exceed 4 m (13 ft) wide. Some

may also demonstrate a slight root swelling, which depends upon site conditions. As the tree becomes larger it requires sufficient minerals and support to sustain growth. A fibrous system would not work, so the woody roots expand vertically, forming radial walls (buttresses) extending out from the sides of the trunk. This root system enables the tree to cover the large and often thin layer of soil typical of tropical environments or rock/limestone islands. This feature is considered a competitive advantage that prevents the establishment of competing individuals in the space occupied by the buttresses and provides additional tensile force to resist uprooting during cyclones.

Similar species

In the forests of Palau, vesi is easily distinguished by the leaf shape and color, which stand out from the rest of the forest canopy. The asymmetrical leaflet pattern, with the two terminal leaflets, is a very strong field identification characteristic for this species in its native forests.

Another legume closely related to vesi and similar in appearance is *Kingiodendron platycarpum*, which is endemic

to Fiji. Vesi can be distinguished from *Kingiodendron* by the slightly more rounded, almost opposite leaflets and terminal, attractive, white and pink to purple flowers, compared to the alternate leaflets and axillary green to dull cream-colored flowers of *Kingiodendron*.

The genus *Intsia* is closely related to *Afzelia*, and it is difficult to assign botanical specimens lacking flowers or fruits to either genus. *Intsia* differs from *Afzelia* by *Intsia*'s three fertile stamens, its flat seeds lacking an aril, and its leathery pods.

GENETICS

Distribution of the genus

The genus *Intsia* comprises two species, *I. bijuga* and *I. palembanica*. *Intsia bijuga* is the more widely distributed species and the only species of this genus that occurs in the Pacific islands to the east of Papua New Guinea. *Intsia palembanica* is widespread in Southeast Asia, extending eastwards as far as the island of New Guinea. Several species formerly included under *Intsia* have been transferred to the genus *Afzelia*.

Variability

The species *Intsia bijuga* has two described forms, *glabra* and *hirsuta*, which are considered to be local modifications of little significance (Smith 1985). In Samoa, where it is used as a favored house post and for furniture and kava bowls, several varieties are recognized based on wood properties (color, hardness, and grain straightness), including *ifilele ulu*,

ifilele o'a, *ifilele ala'a*, *ifi toa*, *ifi'ulu*, *iffifatu*, and *ifisoga*. The most common are *ifi toa*, which has a hard, dark grain, and *ifi 'ulu*, which has a smooth light colored grain. In Kabara, in Fiji's Lau Islands, where carving of vesi into kava bowls is the main source of income, there is a similar discrimination of *int vesi*, which has a darker and harder grain, and *vesi uto*, which has a lighter color and softer grain and is easier to carve. Vesi is considered to be one of the priority species for conservation and genetic improvement in Samoa due to its local importance for woodcarving and its threatened status in the wild. In Fiji (Kabara Island), the conservation management of vesi requires monitoring the rate of consumption by local people through keeping records of handcraft production and educating people about the need for conservation.

ASSOCIATED PLANT SPECIES

Vesi is associated with mangroves, coastal forests, limestone forests, riverine forests, and lowland coastal and ridge forests on volcanic islands. It is also found in some atoll forests on wetter atolls and in areas of degraded forest and in tree groves in shifting agricultural areas, such as in New Caledonia and Vanuatu, where the tree is still quite common.

Associated native species commonly found

Commonly associated species in limestone forests include, depending on the location, *Pisonia grandis*, *Manilkara dissecta*, *Diospyros elliptica*, *Excoecaria agallocha*, *Cynometra*, *Maniltoa* spp., *Vavaea amicorum*, *Planchonella grayana*, *Elatostachys falcata*, *Polyalthia amicorum*, *Santalum* spp., and *Ficus* spp. In coastal atoll forests, where it might be an introduction, it can be found with *Neisosperma oppositifolia*, *Pandanus tectorius*, and other inland species. In mangrove associations, it can be found with *Barringtonia asiatica*, *Milletia (Pongamia) pinnata*, *Inocarpus fagifer*, *Hibiscus tiliaceus*, *Thespesia populnea*, *Xylocarpus granatum*, *X. moluccensis*, and *Heritiera littoralis*.

Associated introduced species

In some areas, either where vesi has been deliberately planted or protected in fallow vegetation or secondary forest, such as in New Caledonia, it can be found with other aboriginally introduced trees, such as candlenut (*Aleurites moluccana*) and ylang ylang (*Cananga odorata*). In some places, such as New Caledonia, Vanuatu, and Vava'u, Tonga, vesi is sometimes found



Vesi in the forest of Palau, it's bright green foliage clearly standing out.

PHOTO: R. DEMEO



Vesi growing in a secondary forest on Isle of Pines, southern New Caledonia. PHOTO: R. THAMAN

planted in villages in houseyard gardens or protected in tree groves along with a range of other useful cultivated species.

ENVIRONMENTAL PREFERENCES AND TOLERANCES

Climate

Vesi has a wide range of environmental and climatic tolerances. It prefers wet, hot climates but can tolerate annual dry seasons. The tree occurs most frequently in coastal and lowland forest on well drained or swampy sites. It is also found in tropical rainforest, in primary or old secondary forests, and in open forests. The species also occurs in wet ground on the inner edge of coastal mangrove swamps. The tree grows particularly well on dry leeward sides of main islands or in seasonally dry areas in dry forest, often up to elevations of 450 m (1480 ft), but is also found in coastal and riparian forest and occasionally in inland forest on the drier, leeward sides of both large and small islands. It is

particularly dominant on well drained limestone soils and rocky outcrops in coastal areas that suffer from drought.

Elevation range

0–450 m (0–1480 ft)

Mean annual rainfall

1500–2300 mm (60–90 in)

Rainfall pattern

It grows best in climates with bimodal and uniform rainfall patterns.

Dry season duration (consecutive months with <40 mm [1.6 in] rainfall)

0–4 months, very drought resistant.

Mean annual temperature

26–27°C (79–81°F)

Mean maximum temperature of hottest month

23–33°C (73–91°F)

Mean minimum temperature of coldest month

20–31°C (68–88°F)

Minimum temperature tolerated

17°C (63°F)

Soils

Grows particularly well on well drained, high-pH (alkaline) soils, particularly limestone and recent basaltic soils (e.g., on the limestone islands of eastern Fiji, the Isle of Pines in New Caledonia, and in the young basalt soils of north-central Savai'i, Samoa). It also does well as a riparian species and in poorly drained soils on the inner margins of mangroves. The species is said to prefer saline soils (i.e., near coastal regions), although there are populations of vesi that grow well inland in Papua New Guinea and Fiji.

Soil texture

The tree grows in light, medium, and heavy soils.

Soil drainage

Vesi can grow in soils with free drainage as well as soils with impeded drainage and seasonally waterlogged soils.

Soil acidity

It tolerates soils with neutral and alkaline acidity (pH 6.1–7.4+).

Special soil tolerances

Vesi tolerates shallow, saline, sodic, and limestone (calcareous) soils and is commonly found growing on almost soil-less limestone outcrops

Tolerances

Drought

It seems to be particularly tolerant of drought, especially the physiological drought characteristic of well drained, rocky limestone habitats.

Full sun

It grows well in full sun in exposed situations.

Shade

The tree tolerates 0–75% shade.

Frost

Vesi does not tolerate freezing temperatures.

Waterlogging

It seems to withstand a high degree of waterlogging, as it is

a common component on the inner margins of mangroves and in riparian vegetation.

Salt spray

It has a high tolerance of salt spray, although it is rarely found in the outermost zone of coastal vegetation.

Wind

Vesi is very resistant to wind damage and well adapted to strong gusts in coastal locations and on rock outcrops.

Other

The tree withstands termite attack.

Abilities

Fix nitrogen

The tree has been recorded nodulating with rhizobia of the cowpea type (Allen and Allen 1981).

Regenerate rapidly

Vesi is relatively slow growing and does not regenerate quickly.

Self-prune

The trees typically have a main trunk free of lower side branches, indicating good self-pruning characteristics.

GROWTH AND DEVELOPMENT

Growth rate varies according to the environmental conditions where the species is located. Growth ring boundaries for the species are often indistinct, making growth rate calculations difficult.

Growth rate

The species is in general slow growing, even after an initial phase of rapid growth, and it may take up to 75–80 years to mature. Trial plots in the Solomon Islands using germinated seeds or collected wildings recorded 2 m (6.6 ft) per year in height for the fastest growing individuals. In Bogor, Indonesia, 8-year-old seedlings attained an average height of 10.7 m (35 ft) and diameter of 15 cm (6 in). The average height growth increment in Samoa during the first 3 years was 77 cm (30 in) per year, but thereafter height growth decreased. Studies by Whistler in Samoa in 1994 showed that vesi had a growth rate of 14–18 mm (0.55–0.62 in) in diameter per year (over 14 to 22 years).

Yields

Apart from early growth data, yields over the life cycle of



Trunks of two vesi trees in well drained portion of a mangrove swamp, Valolo Island, Rewa Delta, southeastern Viti Levu, Fiji Islands. PHOTO: R. THAMAN

vesi are not known. Currently harvests are primarily from native stands, which have led to depletion of natural populations to the point of disappearance of the species in many areas.

Reaction to competition

The tree is slow growing compared with many pioneer species, and requires good early maintenance to keep weeds at bay.

PROPAGATION

Vesi is easily propagated by seeds or transplanted seedlings/wildlings. Cuttings from mature trees have been successfully propagated, although this method is rarely used.

Propagation by seed

Propagule collection

Because healthy, mature vesi seeds have a hard seed coat that is resistant to germination under normal circumstances, viable seeds can usually be found in their pods or loose on the ground under trees. Mature seeds are medium brown in color and hard when pressed with the thumbnail. Collect seeds from under trees that have good health and form. Healthy-looking seeds less than a year old usually have high germination.

Propagule processing

The seeds are large (about 160–225 seeds/kg [73–102 seeds/lb]) and are easy to clean in water or a sieve to remove soil or decaying organic matter.

Seed storage

The seeds are orthodox, i.e., they retain viability after drying. Before storing, the seeds should be well dried to less than 10% moisture. At this moisture level, the seeds will remain viable for up to 3 years, which can likely be extended by storing with a desiccant in an airtight container in a refrigerator or freezer. Cleaned and dried seeds require no special treatment for long-term storage.

Pre-planting seed treatments

Without pretreatment, most vesi seeds will not germinate in a timely fashion, even under ideal germination conditions, due to their hard seed coat that keeps water from entering the seed. Without special pretreatment to break the impervious seed coat, only a small percentage of seeds will germinate spontaneously within a reasonable time. The most practical method of treating the seed coat (scarification) is to file or nick through the outer seed coat on the edge of the seed opposite the hilum (the small mark on the edge of the seed where it was once attached to the seed pod). A small triangular file works well; even more efficient is a large nail clippers. A shallow nick just through the outer surface suffices. After nicking, soak the seeds in cool water for 24 hours to ensure the seeds swell with water.

Growing area

Seeds germinate best in full sunlight, although partial shade will work fine. Seedlings adapt to various light and shade levels. Studies of the growth rate (measured in increase in dry weight) at light levels of 100%, 76%, 47%, and 24% showed that 76% gave the best growth of seedlings.

As with most seeds, protection from driving rains is recommended, which is why a shade house with a translucent plastic cover is often used.

Germination

Planting the seeds on edge with the hilum down helps ensure that the seed coat is shed as the growing shoot emerges. Dipping or dusting the seeds with a fungicide just before sowing may help prevent fungal infections. Fresh seeds generally have a germination rate over 90% and will emerge 7–11 days after sowing.

Media/containers

Because of the rapid germination and early growth of vesii seedlings, a rather large container works best. A minimum container volume of 250 ml (about 1 cup) is recommended. To avoid root spiraling, a root-training container is best. The potting medium should be well drained to help prevent fungal diseases. Inoculation with a select rhizobia strain should take place within 2 weeks of germination. If a select strain is not available, a cowpea type inoculant may serve as an adequate substitute, but nitrogen fixation is not guaranteed. Low available nitrogen is important to encourage the symbiotic relationship with N-fixing bacteria. Ample P and micronutrients also support nitrogen fixation and the development of a sturdy stem.

Time to outplanting

Seedlings grow quickly and are ready for outplanting in about 12 weeks.

Approximate size at time of outplanting

An average height of 25–40 cm (10–16 in) is recommended for outplanting. If low available N and high P are used, the stem should have become woody at the base and have a diameter of 10–15 mm (0.4–0.6 in). A strong, short stem is better for outplanting than a tall, weak stem.

Other comments on propagation

The tree is rarely deliberately planted at the community level in the Pacific islands, although replanting should be promoted in order to increase populations in overexploited areas.

DISADVANTAGES

Vesii is relatively slow growing and requires good maintenance during the first few years to reduce competition from weeds. For timber production, the tree is considered to reach a harvestable age at 50–60 years, which is a very long rotation length for a tropical timber tree.

Potential for invasiveness

Vesii is not considered to be invasive.

Pests and diseases

Innesia glabrascuta, a species-specific psyllid, is problematic in Guam but not in Palau. *Phellinus noxius*, a fungal disease that induces root and crown rot of woody plants throughout the tropics, is considered a major threat to native trees including vesii in Samoa. As a coastal tree, vesii is exposed to periodic cyclones. Damage to branches can facilitate disease. Ants or other insects easily attack the pods. Crabs can also do some damage to harvested logs that are allowed to lie on the ground for long periods. The species has been shown to be susceptible to the following parasitic nematodes: *Rotylenchulus*, *Helicotylenchus*, *Meloidogyne*, *Criconemoides*, and *Hemicriconemoides* at Laguna, Philippines. Vesii was also proved repellent to termite (*Cryptotermes cynocephalus*).

Other disadvantages

Because of its long rotation time, it is questionable whether vesii is an economically viable timber tree.

AGROFORESTRY/ENVIRONMENTAL PRACTICES

Soil stabilization

Vesii is suitable for erosion control, especially along creeks and waterways on the inland side of mangroves.

Crop shade/overstory

The tree has some potential to be used for crop shade.

Homegardens

It makes a good shade tree in homegardens, although its large size may make it unsuitable for urban areas.

Improved fallows

Vesii can be used to regenerate land, especially land degraded by gully erosion. In addition to being a nitrogen fixer, the tree is known to have high uptake of subsoil calcium and to enrich calcium levels in the surface soil, resulting in higher soil pH (ICRAF 2004).

Living fences

The species is not currently used for planting living fences and is unsuitable due to its spreading form and slow growth in the open.

Boundary markers

Vesii is very easily distinguished from other forest trees and surrounding vegetation by the showy leaf arrangement and color. The species is very long lived, and coupled with its

sacred significance and high visibility, it is very suitable for boundary marking.

Windbreaks

Vesi is very wind-sturdy and makes an excellent component in a multi-layered windbreak, especially in coastal areas.

Silvopasture

The tree is not normally planted in grazing areas, although some remnant or volunteer trees are sometimes found in grazing areas in Vanuatu and New Caledonia.

Woodlot

Vesi's superb timber makes it a candidate for a long-term (50–60 year) timber planting, even though the economic viability of vesi as a commercial timber tree is uncertain.

Native animal/bird food

Little has been written about relationships between vesi

and vertebrate and invertebrate animal life, although in Oro Province of Papua New Guinea vesi is closely linked to the life cycle of the world's largest butterfly, the Alexandra birdwing butterfly (*Ornithoptera alexandrae*), which is listed as endangered on the IUCN Red List.

Wildlife habitat

Vesi provides good shelter and nesting sites for birds.

Bee forage

Many pollinators, including honey bees, frequent the flowers.

Coastal protection

Vesi grows well in swampy coastal areas and on coastal limestone and tolerates wind and salt spray, making it a very good tree for coastal protection.

FIJIAN LORE

The cultural significance of vesi is diverse and is embedded in many Fijian cultural expressions and beliefs. The tree itself was sacred among ancient Fijians, and its hardness and seemingly indestructible nature embodied admired human qualities. The tree was used as the main pole to hold up traditional temples and chiefly bures (traditional houses), to build the drua or waqa tabu (sacred canoe) reserved only for those of noble birth, and to make the traditional gong (lali) used to announce important events. Many native expressions still in use today incorporate the word vesi to indicate a person of noble birth or one of strong character. For instance “sa ciri na vesi” (the vesi is afloat) is used when bidding farewell to a paramount chief and “kaukauwa vaka na vuni vesi” (strong as the vesi tree) refers to one of firm character. Many of the artifacts derived from vesi have also made their way into native proverbs, such as the kali (traditional head rest) used as a taunt in quarrels—na kali oqo, na kali oqori (the headrest here, the headrest there) meaning “If you have power so do I.” Likewise when kava is mixed

in the tānoa (kava bowl derived from vesi) and presented during ceremonial occasions the mixer will call out “e saqa ena kuro vesi” (it is cooked in the vesi pot).

Kabara Island, Lau

The island of Kabara is one of the few areas in Fiji where vesi stands grow abundantly. Due to the abundance of this wood, the island has become renowned as the historic center of woodcarvers.

Local legend states when the first Kabaran settlers arrived on the island, they found it to be inhospitable, a limestone landscape lacking in sufficient soil for agriculture. Their ancestor god, Berewalaki, seeing their plight, set off for Oloi, an area not far from Suva, to beg for soil to take back to Kabara. The inhabitants of Oloi agreed, and he began the tedious task of transferring soil to Kabara. He made one journey and returned to Oloi for more, but on returning to Kabara for the second time he found his people baking the soil he had previously brought. Furious with them, he angrily hurled the baskets of soil

and the sticks he was using to carry them at the island, and it all heaped up in one place. The sticks from the vesi tree immediately sprouted and flourished throughout the island. The heap of soil became a hill (locally called Delai Oloi or Mount of Oloi) and remains the only planting ground on the island. Similarly, to this day, the islanders consider the vesi an ancestral gift incapable of ever being depleted.

An alternative version on how vesi came to be on the island is that another ancestor, Daunisau, who is renowned on the island as a trickster, brought it from Verata. The first Kabara settlers set off from Verata and as they left Daunisau grabbed soil from a headland, which he transferred to Kabara. This soil had vesi trees on it, and this was how they made their way to Kabara. Some village elders claim that if one goes back to Verata, one will find a few vesi trees, which they consider the ones Daunisau left behind.

(Matavura et al. 2004, Thompson 1940)



Vesia growing in a disturbed limestone forest, Isle of Pines, southern New Caledonia. PHOTO: R. THAMAN

Ornamental

The tree is a highly ornamental, with its attractive bright, shiny, light-green foliage and beautiful orchid-like flower. It is quite suitable for landscaping, streets, and parks. Top pruning may be required in urban environments.

USES AND PRODUCTS

Nut/seed

The seeds can be made edible through careful preparation that includes soaking in salt water for 3–4 days and then boiling them.

Medicinal

In Fiji, people often use the juice extracted from the bark of the species for internal injuries. A decoction of the bark is used to treat rheumatism, chills, diarrhea, and muscular rigidity and rheumatoid arthritis in adults and, with the extracts of other plants, to treat broken bones. The juice of the stems is reputed to be used to treat asthma and the juice of the inner bark to treat pains in the bones, colds, and influenza. A decoction of the leaves is drunk to treat the body when it is possessed by a spirit, and with other plant extracts to treat toothache and sore tongue. It is also used along with other plant extracts to treat relapse from any sickness, scabies, and headaches (Cambie and Ash 1994).

Medicinal use is reported from the Reef Islands (Solomon Islands), where it is used to treat a mysterious urinary condition (very dark urine), believed to be produced by sorcery

carried out using vesia. It has also been reportedly used to treat rheumatism, dysentery, and diarrhea.

Beautiful/fragrant flowers

The flowers are very attractive, especially close up, but are not known to be used for decoration or as cut flowers.

Timber

Vesia is an excellent tropical hardwood traded as merbau. The heartwood timber is extremely dense (641–961 kg/m³ [40–60 lb/ft³]), has limited shrinkage over time, and good insect repellent properties. The wood has reasonable resistance to saltwater and is easily cut and worked for carving. It is one of Samoa's most important timber species, with large stands of it having been cut in northern Savai'i in the early 1990s. Considered one of the finest timber trees in Tonga, it is very rare, except on the Niua group in far northern Tonga. The wood is highly prized throughout the Solomon Islands, where it is used for heavy construction, boatbuilding, house posts and beams, other timber, fencing, and furniture. Because of its high durability, it was selected as one of only four trees permitted for use as fence posts within the Livestock Development Grant Scheme of the mid-1970s in the Solomon Islands. In Vanuatu, the wood is used for ground posts, heavy aerial timbers in house construction, boat building, and furniture. Because of its combination of wood properties (strength, heavy weight, and low shrinkage), the wood is very suitable for carving. It is also used for furniture, ground posts, and heavy construction because it is hard and strong. The wood is traditionally



Clockwise from left: One of many vesi trees scattered throughout the limestone island of Kabara, Fiji, showing clear bole; newly felled vesi tree showing the creamy sapwood and toffee-brown heartwood; a 127 cm (50 in) *tānoa*, the largest known carved on Kabara Island. PHOTOS: F. AREKI

used for canoes in the South Pacific.

Although vesi is seriously threatened due to its overexploitation, its inclusion in international law to protect threatened species (Appendix II of CITES) in 1992 was thwarted by Malaysia's objection.

Fuelwood

It makes a good fuelwood but is normally considered too valuable for this use. Discards from felled trees are used as a source of good quality fuel.

Craft wood/tools

The wood is highly valued for making handicrafts, house parts, slit gongs (a type of drum), and war clubs. The wood is considered the most valuable one in Samoa, and kava bowls made for ceremonial occasions and for sale to tourists are typically made of this wood. It is used to make house posts, canoe keels, a range of tools, weapons, and other artifacts,

such as mallets for beating bark cloth in the production of tapa cloth. Items made from it in the Solomon Islands include walking sticks, food bowls, and carvings.

Canoe/boat/raft making

Historically, vesi has been used for canoe building and construction of houses, buildings, and furnishings in the Pacific. In pre-European times Tongans voyaged to Fiji to obtain double-hulled canoes made of this hard, durable wood.

Tannin/dye

A brown and yellow dye can be made from an oily substance present in the wood and bark.

Toxin/insecticide/fish poison

An insect repellent comparable to that made from the neem tree (*Azadirachta indica*) can be made from the seeds.

Ceremonial/religious importance

The tree was sacred among ancient Fijians (see text box, “Fijian lore”).

COMMERCIAL CULTIVATION

In the Pacific, the valuable timber is used for export, wood-carving of bowls, clubs, and other artifacts for sale, especially for the tourist and handicraft market, for boatbuilding, and for furniture manufacture.

Spacing for commercial production

Spacings of 3 x 4 m and 5 x 5 m (10 x 13 ft and 16 x 16 ft) have been used in plantations (Soerianegara et al. 1994).

Management objectives

If phosphorus is a limiting macronutrient, fertilization with super-phosphate or rock phosphate is often necessary for optimum yields. In more acid soils (e.g., less than pH 5), calcium deficiency may be a major limiting factor,

which can be remedied by additions of dolomite or calcium sulfate.

Weed control is extremely important, because the seedlings cannot tolerate intense competition and require open access to high light intensity for optimal growth. The tree tends to be self pruning when grown close together.

Design considerations

A 50–60 year rotation is recommended for natural stands. Longer rotations have been suggested for Malaysia (120 years).

The species is best grown in polyculture, planted several years after other fast-growing tree species have been established to provide side shade and encourage better stem form. This species is well adapted to low-fertility sites such as the limestone islands of Palau, in part due to its ability to fix atmospheric nitrogen. There may be secondary benefits to associated species from the nitrogen fixation of the roots.

Estimated yields

Although vesi is among native hardwood timbers commonly exported annually from Fiji, Samoa, and other Pacific island countries, data specific to the species in terms of volume and earnings are unavailable.

On-farm processing

In Kabara, Lau, Fiji Islands “blanks” hewn in the general shape of kava bowls are transported from the field on foot, and sometimes by boat, to the villages, where the actual carving and finishing of the kava bowls (tānoa) takes place.

Markets

The primary market for vesi in the Pacific islands is traditional handicrafts such as carvings, especially high-value kava bowls in Samoa and Fiji. In other areas where there is still an abundant supply, it is an important timber for furniture manufacture and heavy structural uses, such as sawn construction timber, heavy decking, piles, poles, and posts. There is a large market for its use as a decking timber in Australia.

INTERPLANTING/FARM APPLICATIONS

Some interplanting systems may include windbreak, field border, riparian buffer tree, and possible interplanting among crops that are shade tolerant. Vesi may also be used for reforestation on poor sites or in limestone areas.



Woodcarver carving a kava bowl (tānoa) from vesi in Uafato, Samoa, the main Samoan source of kava bowls and other carvings for the tourist market. PHOTO: R. THAMAN



Kava bowl “blank” fashioned from solid log in the field, Uafato, Samoa. PHOTO: C. ELEVITCH

PUBLIC ASSISTANCE AND AGROFORESTRY EXTENSION

Extension offices for agroforestry and forestry in the Pacific: <http://www.traditionaltree.org/extension.html>

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Species Profiles for Pacific Island Agroforestry (www.traditionaltree.org)

Intsia bijuga (vesi)

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