Azim Premji University

# The trees in our lives:

Trees around the Azim Premji University campus, Sarjapura, Bengaluru

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Authors:

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We thank Enakshi Bhar for helping with creating the map and Vipul Kumar for design and layout.

All photographs included here were taken by the students. Drawings were done by students as well, and names are mentioned against the specific drawing. However, to improve clarity, pencil drawings were traced with pen by those involved in booklet design.

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# What we did

The carbon mapping exercise is a ritual done by the batches who take the course "Sustainability in Urban Social-Ecological Systems" (earlier "Urban Sustainability in India: A Social Ecological Perspective"). Knowing and documenting the trees around our campus's local area has now become a custom. Our campus is in the rapidly expanding peri-urban interface of Bengaluru city at Sarjapura. Sarjapura's peri-urban area can seem dystopian with tiled roof homes next to multi-story apartments, cows ambling on mud paths and cars zipping on tarred roads, and agricultural activities amidst businesses.

We, the students from the School of Arts and Sciences (SAS), participated in this task to map the trees around our university campus in this peri-urban environment. Each group of two students chose three trees of different species for this assignment. We were to identify the species while providing the scientific, common, and Kannada names. Additionally, we used our phones to record the GPS coordinates of the trees, indicating their exact locations. Using a clinometer, we determined the tree's height and measured its girth using a measuring tape. This information was utilised to determine both the above- and below-ground biomass, as well as the carbon these trees retain. We also measured the ambient temperature using a high accurate hygro thermometer and the road surface temperature using an infrared thermometer. We also gathered secondary data on the social and cultural significance of the species, recording the numerous daily benefits that trees provide for all of us. We photographed the different parts of the tree—bark, flower, fruit, seed pods, seed, leaves—and we tried our hand at sketching different parts of the tree as well.

This booklet is a final product of our class, based on our observations, the data we gathered in the field, and secondary data primarily from the internet. It is in no way a comprehensive guide of the species recorded. But this is a small beginning of our attempt to start recording the trees in and around our own campus in Sarjapura. All errors in this effort are entirely our own!

# What we found

As a class we mapped a total of 21 trees of 11 species around our campus. Except for one tree, all other trees were situated on the road connecting the campus to the Sarjapura-Attibele Road. Out of these trees, nine were native to India, and two introduced. Among the native species the common trees we mapped were jamun, banyan, peepul, mango, neem, and Indian beech. In addition, we also mapped the cluster fig, orchid tree and pride of India among the native species. The introduced species mapped were copperpod and West Indian mahogany. Most species could be easily identified observing their flowers, fruits and most importantly their leaf structure. There was some confusion while identifying a jamun tree—this was initially identified as a weeping fig that has similar features. But this error was corrected.

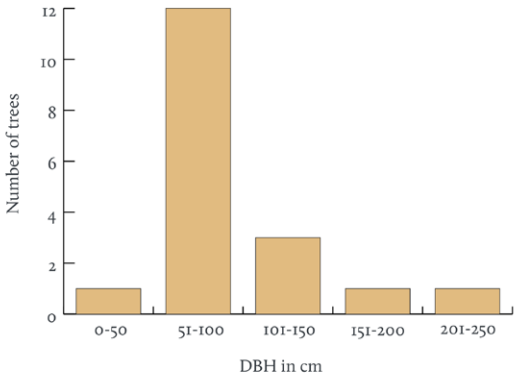
***Table 1: Mapped species***

| No | Scientific name | Common name | Number of trees | Native/Introduced |
|---|---|---|---|---|
| 1 | *Azadirachta indica* | Neem | 1 | Native |
| 2 | *Bauhinia variegata* | Orchid tree | 1 | Native |
| 3 | *Ficus benghalensis* | Banyan | 3 | Native |
| 4 | *Ficus racemosa* | Cluster fig | 1 | Native |
| 5 | *Ficus religiosa* | Peepul | 1 | Native |
| 6 | *Lagerstroemia speciosa* | Pride of India | 1 | Native |
| 7 | *Mangifera indica* | Mango | 1 | Native |
| 8 | *Millettia pinnata* | Indian beech | 2 | Native |
| 9 | *Peltophorum pterocarpum* | Copperpod | 4 | Introduced |
| 10 | *Swietenia mahagoni* | West Indian mahogany | 3 | Introduced |
| 11 | *Syzygium cumini* | Jamun | 3 | Native |

For the calculation of tree height, girth or DBH (diameter at breast height), and carbon we used the values for only 18 of the 21 trees as there was an error in recording the height and DBH for three trees. The tree with the highest DBH was also the tallest—a peepul with a girth of 245 cm, followed by the banyan with 172.7 cm and a jamun at 130 cm. Majority of trees were in the DBH range of 51-100 cm (Figure 1). Of the 18 trees

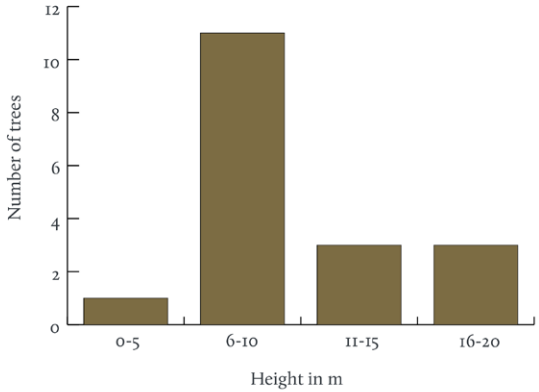
the tallest tree measured was a peepul at a height of 17.7 m followed by banyan at 17.6 m, and copperpod at 16.8 m. The tallest trees were in the range of 6-10 m (Figure 2). The measurements of height and DBH were used to calculate the carbon sequestered by the tree. Trees need carbon to grow. Through a process known as carbon sequestration, they obtain this carbon by extracting carbon dioxide from the atmosphere and storing it. Carbon sequestration reduces atmospheric carbon dioxide, a major cause of increasing temperatures, which is crucial for the growth of the tree but also for mitigating global warming and climate change. The girth of the tree was measured in the field using a measuring tape, and the height using a clinometer. From these measurements and taking the wood density from online databases the above ground biomass (AGB), below ground biomass (BGB), and carbon sequestered by a tree were calculated. The tree that had the most carbon sequestered, 1,641 kg, was the peepul that also had the widest girth and was the tallest. The total carbon sequestered by the 18 trees was 4,656 kg or 4.6 tonnes. On the other hand, one estimate gives that a car or a two wheeler in India emits around 300 gm of carbon dioxide per kilometre[1]. As the area around the university campus develops and road traffic increases in the future the role of these trees in absorbing carbon and contributing to the mitigation of climate change will become even more critical.

***Figure 1: Distribution of trees by DBH (18 trees) (Figures have been rounded off)***




1 Moran, G. 2018. Emissions 101: A two-wheeler takedown. Auto.com The Economic Times, 17th January 2018. URL: https://auto.economictimes.indiatimes.com/autologue/emissions-101-a-two-wheeler-takedown/2826 (last accessed 18th August 2022).

*Figure 2: Distribution of trees by height (18 trees)*
*(Figures have been rounded off)*

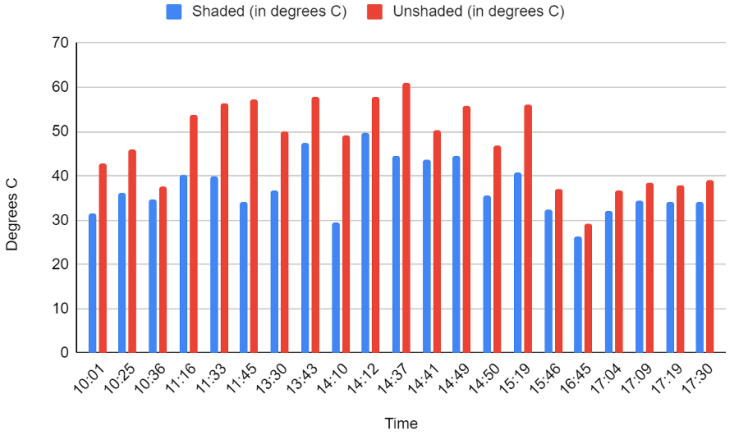



Cities are increasingly facing the urban heat island phenomenon, and one of the important ways of mitigating this is to maintain urban green cover. Our campus is in a peri-urban area and has considerable open spaces but limited green cover around. To demonstrate the importance of green cover in maintaining the microclimate we measured the ambient and surface temperatures under the shade of a tree and in the unshaded portion. The road surface temperature was measured using an infrared thermometer while the ambient temperature was measured using a high accurate hygro thermometer.

The measurements were taken by different groups on different days and times. But comparing within groups when measurements were taken at the same time and on similar road surfaces itself gives us an idea of the importance of green cover, especially when it came to road surface temperature. The maximum difference in road surface temperature, of 23.1 degrees C, was in the case of a copperpod. The road surface temperature taken on 21st April 2022 at 11.45 am was 57.3 degrees C in the unshaded part and 34.2 degrees C under the shaded part of the tree. Copperpods are trees with a wide canopy that provides considerable shade. The copperpod in this case had a DBH of 108.8 cm and a height of 12.52 m—a considerably large tree. The considerable difference in temperature between the shaded and unshaded portions indicates the importance of shade in the absence of which walking on the road would be extremely uncomfortable. Ambient

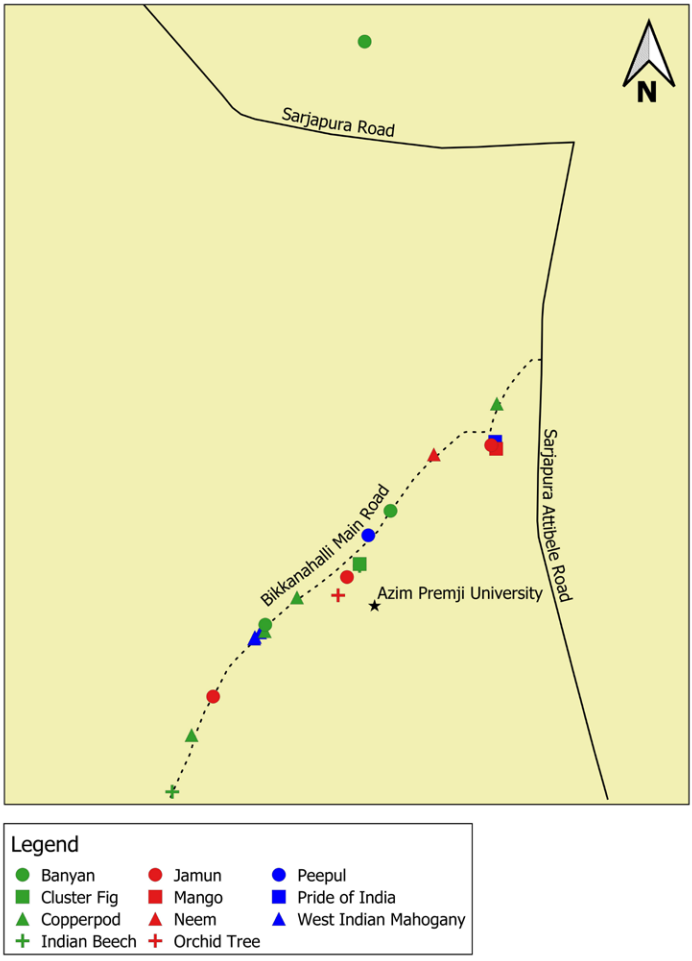
temperature, or the temperature of the air around, was also measured. The maximum difference was of 6.43 degrees C and this was in the case of another copperpod. The temperature was measured at 13.30 pm on 17th April 2022.

*Figure 3: Road surface temperature under shade of tree and unshaded (for 21 trees)*




Thus, a relatively clear distinction can be drawn between the shaded portion under a tree, and the unshaded part nearby (Figure 3). The recordings show a high difference between the road surface temperature and a minor yet important difference between the temperature of the air in the surrounding. This points to the importance of urban greenery such as trees in lowering temperature especially during peak summers.

*Location of trees around Azim Premji University campus, Sarjapura*



# *Azadirachta indica*

**Common name:** Neem **Kannada name:** Kira bevu

Neem trees are evergreen trees with small but somewhat broad leaves with serrated edges. The trees can grow to 30 m in height and the arrangement of their branches are widespread. The trunk is straight and furrowed. The tree bears small, white, flowers in axillary clusters. The flowers have a honey-like scent that attracts many bees. The fruit is smooth, and is described as "ellipsoidal drupe", and can grow up to almost 2 cm long. When the fruit is ripe, it is yellow/greenish-yellow and encloses a sweet pulp containing a seed. The seed is composed of a shell as well as a kernel or two.

Illustrated by Ria

Since ancient times, people have used the neem tree to cure a variety of illnesses. For example, bile diseases may be prevented and treated with neem flowers, ulcers can be treated with neem leaves, and disorders of the central nervous system, paralysis, and other conditions are believed to be treatable with neem bark. The thin branches of the tree are used to brush teeth as neem also has antifungal and antibacterial properties. On occasion, the leaves are even placed underneath beds to get rid of insects, and the composted leaves can even be used as a natural plant insecticide.

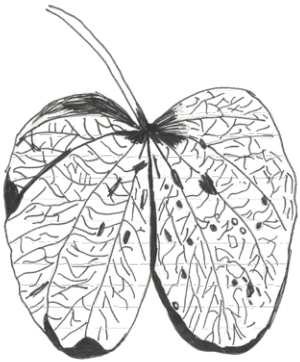
Because of its hardiness, the neem tree is a particularly important species, especially in urban forestry. It can resist heat as well as air and water pollution. Neem also aids in preserving the integrity of the soil, which increases soil fertility. It serves as a helpful windbreak and keeps the environment healthy by absorbing toxins. Additionally, the tree's canopy cools the surroundings.

The neem tree has long been respected and used in numerous religious and cultural rites because of the wide range of advantages it offers. It is seen as a manifestation of the Hindu goddess Durga in several cultures. Many communities believe that the tree is the home of “Sitala,” the legendary goddess who has the power to both cause and treat sickness such as smallpox and chicken pox. Bevu bella, crushed neem leaves and jaggery, is a preparation made for Ugadi, the Kannadiga new year.

# *Bauhinia variegata*

**Common name:** Orchid tree **Kannada name:** Kanchanara

The orchid tree's trunk usually has a very small girth. The leaves are broad, rounded, and bilobed. The blooms have five petals apiece and are a vivid pink and white. The seeds are round and are found in long, thin seed pods, which form the fruit. The fruits split apart when they are dry, releasing and dispersing the seeds.



Illustrated by Harshada

This tree is mostly prized for its ornamental flowers; however, the edible buds are eaten as a vegetable in parts of the Indian subcontinent. They have been shown to have antioxidant and anti-cancer properties. The tree acts as a wind breaker and helps with mitigating pollution. The cultural significance of the tree is that it symbolises purity and is believed to be a representation of chastity in some cultures.

# *Ficus benghalensis*

**Common name:** Banyan **Kannada name:** Aalada mara

The banyan is a semi-evergreen strangler fig. These trees range in height from 10 m to 20 m. The leaves are broad and large, about the size of an adult's palm, and the lateral veins are very noticeable. Despite being glossy and leathery, the leaves feel fluffy and soft to the touch. The tree's durable, primarily smooth, but slightly rough, bark is furrowed.

The banyans large, rather straight, and short trunk feature multiple dangling branches. The branches with leaves on them are not particularly widely spaced, but rather dense or near to one another. The figs that are produced have a diameter of between 1 cm and 2 cm, with no stalks, and are found in pairs in the leaf axils. Bright red is the colour of the ripe fruit.

Illustrated by Mahathi

The milky sap from the banyan has medicinal properties and is used to cure problems like bruises and skin disorders as well as toothaches and cough. Additionally, the bark's fibre may be used to manufacture rope or paper, and the tree itself is occasionally harvested for its wood.

Sometimes the leaves are sewn together to create biodegradable leaf plates. The leaves are also utilised as cow and goat fodder. The tree is very useful to grow in urban areas, as it is resistant to drought, and it provides ample and useful shade in hot climates. It is also a commonly planted species when afforestation is required and helps in revegetation.

The tree is usually planted near temples since it is revered by both Hindus and Buddhists in India. Although this is more typical around the peepul, *ashwath kattes* (raised sacred platforms) are occasionally constructed around banyan as well. Women in certain cultures worship this tree praying for the long life of their husbands.

# *Ficus racemosa*

**Common name:** Cluster fig **Kannada name:** Atti mara

The cluster fig is an evergreen tree revered for its healing abilities and sacred significance. The tree that we recorded was of a relatively small size with a smooth, white-grey bark and one or two above-ground roots that gave away the presence of an aerial or fibrous root system.

Illustrated by Sharda and Gouri

The bark had a flaky feel and was covered in what seemed like powder, which peeled off when the trunk was touched. The tree's canopy has the appearance of being packed or dense, and its branches or stems are slightly thick and grow vertically upward. The simple, oval-shaped, dark green leaves are arranged alternately. Small fruit-like nodules were found on several leaves; these were later determined to be parasites. The term "cluster fig" refers to the clustered nature of its fruits. The tree we saw has yet to produce any fruit because the fruiting season was later in the year.

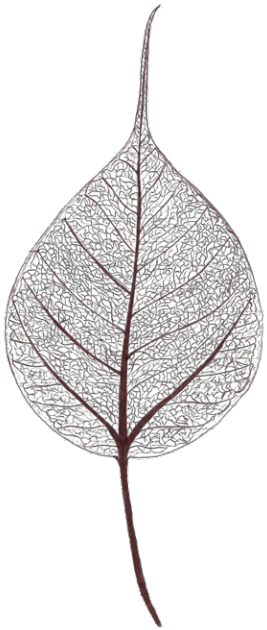
Typically, the fig has a syconium, which is the fleshy, hollow numerous fruit of a fig. Inside the fig, the flowers are concealed and in bloom. The fig develops black stripes and a vivid orange colour as it ripens. The cluster fig is widely found in India and other South Asian countries, and is a fast-growing tree. The tree is also drought tolerant, used as fodder, fuelwood, pest management, among other things. The treatment of acne, mouth ulcers, sinuses, stomach-ache, chicken pox, bronchitis, and bronchial asthma, among other conditions, are only a few of the health advantages of the cluster fig. It has a long history of usage in traditional medicine.

The tree, which grows extensively and wildly, is significant for ecological preservation and important for many religions. Both Hinduism and Buddhism hold the cluster fig in high regard. The Hindu belief that Lord Indra created trees also makes the tree a symbol of protection from evil. It also features in the legend surrounding Lord Dattatreya, a revered Hindu deity. It seems vital in Buddhism and other cultures to value the tree' s blossom.

# *Ficus religiosa*

**Common name:** Peepul **Kannada name:** Arali mara

The trunk of this tree can grow to a considerable girth. The peepul's bark has a light grey colour. The specific tree we recorded details of had an anthill at its base, which gave the bark at the base of the tree a reddish hue. The dark green leaves of this tree have a distinctive drop form with a long, narrow tip. These trees produce little fig fruits.



Illustrated by Harshada

Peepul has several health advantages. Asthma, cough, sexual dysfunction, diarrhoea, ear and toothaches, migraine, eye difficulties, and stomach issues all find a cure with one or other part of the tree. Traditional medicine uses the bark for its analgesic and anti-inflammatory qualities. This tree's fruits are delicious, and traditional medicine uses several parts of the tree to cure a variety of ailments.

The peepul tree is cherished by believers of Buddhism, Jainism, and Hinduism. Due to its historical significance as the tree beneath which Gautama Buddha received enlightenment, the peepul tree holds a special place in Buddhism. Hindus also worship this tree often by circumambulation around it while praying.

# *Lagerstroemia speciosa*

**Common name:** Pride of India **Kannada name:** Holematti

Illustrated by Sharda and Gouri

A blooming tree with the common name "crape myrtle," the pride of India is native to the Indian subcontinent and some other parts of the world . This is a small-sized tree or ornamental shrub with stunning (and sometimes described as "showy") flowers that bloom primarily in the summer. Because of the small size of the tree, even fully grown ones are sometimes mistaken for juvenile trees. The tree has a single trunk and small branches and twigs. The bark and trunk of the tree are often brown, reddish brown, or light brown, and smooth in texture. In the tree we recorded there were patches and spots where the bark was flaking. The leaves are oval-shaped and placed opposite to each other. Since the tree typically produces blooms and fruits in the spring, summer, and winter, respectively, the tree was devoid of either fruit or flowers at the time we viewed it (April).

In addition to its wood's use as timber and as a beautiful shrub owing to its alluring blooms and leaves, the tree has long been valued for its many health advantages. Its health benefits include treating inflammation, constipation, diabetes, diarrhoea, and other ailments as well as aiding in the prevention of the formation of cancer cells (since it contains the antioxidant saponin). There are said to be several health advantages of the tree to treat diseases of the skin, kidneys, heart, blood, etc. People have traditionally employed the tree's bark, leaves, flowers, fruit, and roots to treat a variety of health problems.

# *Mangifera indica*

**Common name:** Mango **Kannada name:** Maavina mara

The mango tree is a tree with a rounded canopy, with thin long slightly leathery leaves that are dark green and shiny. It is an evergreen tree. The leaves of the mango tree are believed to have medicinal properties—it is believed that the leaves have an anti-inflammatory property and can also be used to treat stomach ulcers. The wood is also used for furniture as it is hard, quite durable and has an attractive look to it.

The tree of course provides us with mangoes during the mango season of May, June, and July. In India mangoes are significant as the fruits are seen as symbols of good luck and prosperity and in many parts of the country the leaves are strung over the front doors of homes as *toranas*. The *toranas* demarcate the outside polluted area and the pure interior of the home, which is why it is placed above the main entrance of a house.

Illustrated by Siddarth

# *Millettia pinnata*

**Common name:** Indian beech **Kannada name:** Honge

The trunk of the Indian beech is thick with many branches. The leaves are arranged in an alternate fashion and are oval-shaped with smooth edges. The bark is grey in colour and very smooth in terms of texture. Flowers are small, and have vibrant colours such as purple, pink, or white that grow in an inflorescence. The fruit is a dark brown pod with red-brown seeds encased inside it. The tree can grow upto 50-80 feet in height.

Illustrated by Aarya

This is used as an ornamental tree but the wood also as fuelwood. The wood, though being well-grained and textured, is not hardy and is vulnerable to insect attacks. Thus, it is not suitable as timber. The wood is used for making cabinets, posts, agricultural implements, and tool handles. The oil from this tree is used as fuel for lamps. Other uses of the oil extracted include as a lubricant, water paint binder, pesticide, soap-making and in tanning. In traditional medicine, it has been used to treat rheumatism, and to treat human and animal skin infections. Leaves of this tree are known to improve soil fertility. Seed oil cakes are also known to be an effective pesticide and fertiliser. They are also used as an insect repellent when dried. The bark fibre can be made into string and rope.

Due to its pollen and nectar-rich blossoms, this tree serves as a habitat for a variety of biodiversity—insects (pollinators) such as honey and carpenter bees, common tiger butterflies, and birds such as flycatchers, and bulbuls. Trees that are mature can survive cold temperatures, excessive salinity, and flooding. It can withstand drought and is heat- and sunlight-resistant. Its root structure allows it to endure immersion in water for extended periods of time. It serves as a windbreaker as well. The tree is also significant across cultures for its ornamental beauty and is used as a decoration.

# *Peltophorum pterocarpum*

**Common name:** Copperpod

The copperpod is a deciduous tree that typically reaches heights of 15 m to 25 m. It features leaflets that are grouped in pairs and split into smaller leaflets to give the appearance of feathers. After the trees have grown for around four years, they start to bloom. This tree has spherical, brownish, or copper-coloured buds and vivid yellow blooms with a coppery centre. The fruits are tiny pods that are between 5 cm and 10 cm long. They have one to four seeds and are initially crimson before turning darker as they grow.

Illustrated by Aarya

This evergreen tree is used as an astringent to cure intestinal disorders, sprains, bruises, muscular pain, sores and swelling in traditional medicine. It contains anti-fungal substances in leaflets and buds, which can be used to fend off fungal growth. It has anti-inflammatory and anti-bacterial properties and can be used in ophthalmic settings.

This tree has a wide canopy that is generally used for providing shade, both along roads and as a shade tree in coffee plantations.

The bark is also a key component of the black "soga" dye in Java, which is used to make batik products. The dye is also used for preserving fishing nets. The wood from this tree is used for light construction work, owing to it being moderately hard and heavy. It is also used in boat building, cabinet making, wood carving and marquetry, other than as a fuel. The copperpod is a heritage tree in Singapore.

This tree is a quick-growing nitrogen fixer that may be cultivated alongside plants that require nitrogen as well as utilised for reforestation. It is cultivated in a system of intercropping with mahogany. Additionally, it provides green manure. Due to its deep root structure, this tree is also wind-resistant and storm-resistant.

# *Swietenia mahagoni*

**Common name:** West Indian mahogany

Illustrated by Mahathi

The West Indian mahogany, which have reddish-brown hardwood and smooth bark, were brought from the West Indies to India around the late 1700s. They are semi-evergreen and monoecious (having male and female flowers in the same plant). The leaves of the West Indian mahogany have 4–8 leaflets per pinnate (compound leaf with leaves arranged on either side of a stem typically opposite to each other). The huge, five-part, greenish-brown capsulated fruit (seed pod) separates to release the flat, light-brown, airborne seeds.

Mahogany fruit and seed extracts are utilised as dietary supplements, antioxidants, blood sugar regulators, and even as insect repellents. Bark extracts are used as an astringent for wounds. In India and most of Africa, it has historically been used to treat depuration, anaemia, diarrhoea, fever, dysentery, and malaria. Numerous limonoids found in the leaves help lower blood sugar and cancer risk. This tree's timber and wood have a great market value since they may be used to make furniture, boats, baskets, musical instruments, fixtures, and many other things. It is renowned for its strength, longevity, water resistance, and appealing texture and colour.

Being a strong tree, it can act as a windbreaker. A variety of pollinators including bees and moths such as *Gonodontis clelia* are closely related to this tree for pollination. These trees are quite resilient and help regeneration of soil and biodiversity of flood affected areas. These are important trees for silviculture and forest management.

# *Syzygium cumini*

**Common name:** Jamun **Kannada name:** Nerale mara

The trunk of the tree has a medium girth, compared to the other trees. The bark of the tree is uneven and rough and is beige and light grey in colour. The leaves are bright green and have a thin oval shape that tapers into a sharp point. The flowers are a pale yellow, and form dandelion and sundew-like tufts when in bloom. The jamun is a little fruit with a deep purple colour that almost borders on black with a sweet and sour flavour.

Illustrated by Siddarth

The fruits of the tree are edible, and often used for medicinal purposes. Along with the fruits, the leaves and even the bark of the tree have been shown to possess medicinal properties and have been used mainly to treat diabetes and diarrhoea. In ayurvedic medicine the fruit is recommended to be taken for various conditions such as heart ailments, arthritis, and asthma.

The leaves of the jamun tree are used as fodder for livestock and for silkworms. Since jamun wood is both durable and robust, it is ideal for creating bullock cart wheels as well as inexpensive furniture in rural regions. However, outside of these locations, it is not frequently used for its timber. In India, jamun is a highly attractive tree that grows readily. This, together with its lush foliage and capacity to yield tasty fruits, make it the ideal decorative tree.

The jamun tree is considered sacred to Lord Krishna; he is said to have four symbols of the jamun fruit on his right foot. In India, the jamun fruit is referred to as the “fruit of the gods” and has special importance in Hindu mythology since it is thought that Lord Rama consumed jamun throughout his 14-year exile from Ayodhya.

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