Aegle marmelos

Common name : Bengal Quince

General information

Flowering and Fruiting: March-May Medium sized deciduous tree Height: 12-15m

Provisioning services

One of the dasamoola roots in Ayurvedic medicine Fruit edible and fruit pulp used to make a cooling and energy drink Timber used for carving and making agricultural implements

Regulating and Supporting services

Acts as a pollution sink of poisonous gases larval food plant for lime butterfly. Common Mormon and several moth species Hedge Plant



Cultural services

Sacred tree associated with Lord Shiva

Aegle marmelos (Bengal Quince)

Aegle marmelos is a slow-growing, medium-sized, deciduous tree and the only species in the genus Aegle. The plant is thorny and bears pale green trifoliate leaves, fragrant flowers and hard fruit. Commonly distributed in South Asia and parts of Southeast Asia, there is a history of use of more than 5000 years by the inhabitants of the Indian Sub-continent.

Common names: Hindi: Bael, Konkani: Bael, Malayalam: Koovalam, Nepali: Bael

Ecosystem Services Provided by Aegle marmelos

1. Provisioning services

Medicinal properties and uses: Bael is one of the 'dasamoola (ten roots)' which are the top traded group of medicinal plants, used by the Ayurvedic industry. The leaves, bark, fruits, seeds and latex are also of extreme utility and used extensively in Ayurveda. Bael is reported to contain biologically important phytochemicals, coumarins, alkaloids, steroids and essential oils. The utility of *bael* finds mention in the texts of ancient Indian systems of medicine.

Commercial uses: *Bael* sherbet is a popular cooling and energy drink made from the fruit pulp. The pulp is also converted into marmalade, *murabba*, or syrups and is consumed with meals. The essential oil is extensively used in the perfume, beverage and food industry. Leaf extracts have insecticidal activity against the brown plant hopper, an important pest of rice plant in Asia. The timber is used for carving and to make agricultural implements.

2. Regulating and supporting services

Plant animal interactions: The caterpillars of the Lime butterfly (*Papilio demoleus*), the Common Mormon (*Papilio polytes*), and moths like Citrus Leafminer (*Phyllocnistis citrella*), Citrus Leaf Roller (*Psorosticha zizyphi*), snout moth (*Metallosticha plumbeifasciella*), and Citrus Pock (*Prays endocarpa*) feed on the leaves of the plant.

Ecological functions: *Bael* is a 'sink' for chemical pollutants as it absorbs poisonous gases from atmosphere, making them inert or neutral. It is a 'Climate Purifier' - emitting greater percentage of oxygen in sunlight as compared to other plants. The spiny branches are effective barriers to animals, finding use in live fencing.

3. Cultural services

It is believed that the bael fruit is the symbol of Lord Shiva and the offering of bael leaves is a compulsory ritual of the worship of Lord Shiva. The tree is considered to be sacred by Hindus and is commonly seen in the sacred groves and temple premises

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Flowering and Fruiting: October-February large sized evergreen tree Height: 30-40m

Provisioning services

Fruit has anthelmintic and antimalarial properties Wood used to make coffins. packing cases and paper latex used in chewing gum

Regulating and Supporting services

Common avenue plant that helps in dust arresting Has SO₂ absorption properties Commonly hosts beehives

Alstonia scholaris

Common name : Devil Tree

Cultural services

Considered to be an abode of the devil in Indian mythology Wood used to make mask worn in Kummatikali during Onam festival in Kerala Alstonia scholaris is an evergreen tree, with a tall, straight, greyish trunk- dotted with small raised lesions called lenticels which help with the exchange of gases and pagoda branching. A distinguishing feature of the tree from which it gets its Sanskrit name 'Saptaparna' which means "seven leaves", is the distinct whorled arrangement of four-seven leaves around the node of each stem. The tree received its scientific name Alstonia from the Scottish botanist, C. Alston and scholaris, from the fact that its wood was used to make slates for children.

Common names: Hindi: Saptaparni, Konkani: Santon, Malayalam: Ezhilam pala, Nepali: Chhatiwan

Ecosystem Services Provided by Alstonia scholaris

1. Provisioning services

Medicinal properties and uses: It is used in traditional medicine systems such as Ayurveda, Unani, Siddha, Homeopathy, traditional Chinese medicine to cure asthma, toothache, heart ailments, fever, malaria and diarrhea. The fruits have anti-helminthic properties. In coastal Karnataka, an annual ritual of preparing a decoction with the bark of the tree known as *kashaaya* is common. The bitter medicine is believed to strengthen the immune system and prevent diseases during the monsoons.

Commercial uses: The wood of the tree is softwood and therefore is used to make coffins, packing cases and pulped to make paper. The latex is used in chewing gum.

2. Regulating and supporting services

Plant animal interactions: The white flowers give off a potent perfume in the months of October-December and are pollinated by insects. It is the host plant of *Parotis marginata* and *Parotis vertumnalis* moth and considered as one of the common nectar plants in a butterfly garden. The large branches of the tree are used by bees to build their hives.

Ecological functions: Alstonia scholaris is a common avenue plant and recommended in greenbelt development for its dust arresting, SO₂ absorption and noise-reducing properties. It is also considered a bio-indicator species for air pollution.

3. Cultural services

The common English name 'Devil's tree' is rooted in Western Indian and South Indian mythology where it was considered to be the abode of the devil or demigoddess. The masks worn in Kerala during Onam are also made from the wood of this tree.

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Artocarpus <u>heterophyllus</u>

Common name : Jackfruit

3

General information

Flowering and Fruiting: November-July Medium-sized evergreen tree Height: 15-25m

Provisioning services

Seed edible and nutritious Fruit edible and processed into value added products Timber used for making furniture

Cultural services

Several Asian cuisines use jackfruit Seat made from the wood. used by Hindu priests in ceremonies

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Regulating and Supporting services

2

Sequesters carbon and helps in soil enrichment Important nesting tree for heronry birds leaves used as fodder for cattle and goats Artocarpus heterophyllus is a large sized tree native to the rain forests of Western Ghats of India. Presently it is cultivated mostly in tropical countries throughout southeast Asia, parts of Africa and Brazil. Jackfruit is the 'jack of all trades' of nutrition. Jackfruit is being hailed as a meat substitute because it has a texture similar to pulled pork. Growing jackfruit trees can attain heights of 25 meters, with a straight trunk branching out from the base. All but the rind and core of the fruit is edible and an average fruit weighs around 6 kg.

Common names: Hindi: Kathal, Konkani: Ponnsaa rukkuu, Malayalam: Plavu, Nepali: Kathal

Ecosystem Services Provided by Artocarpus heterophyllus

1. Provisioning services

Medicinal properties and uses: Jackfruit has diverse medicinal uses especially anti-oxidant, anti-inflammatory, antimicrobial, anti-cancer and anti-fungal properties.

Commercial uses: In some countries, pureed jackfruit is processed into baby food, juice, jam, jelly, base for cordials, candies, fruit-rolls, marmalades, jackfruit leather, and ice cream. The unripe fruit is also used to prepare pickles, when the fruit is tender.

2. Regulating and supporting services

Plant animal interactions: Jackfruit tree is an important nesting tree for heronry birds in the urban areas. Other than heronry birds, crows also use this tree as a nesting site. Jackfruit tree leaves are given as food for the cattle and goats in the villages.

Ecological functions: The tree has a high capacity to sequester carbon and to help in soil enrichment.

3. Cultural services

The tree has been an important part of Indian agriculture since a very long time. The seat made of the tree wood is used by the Hindu priests in ceremonies.

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based on a decision of the German Bundestag	INTERACT-BIO Integrated action on biodiversity	Forest and Climate Change Government of India	Local Governments for Sustainability

Bulea monosperma Common name : Flame of the Forest

General information

Flowering and Fruiting: March-May Medium-sized deciduous tree Height: 5-15m

K Provisioning Services

Bark and seeds have analgesic. vermifuge and astringent properties Bark and root fibers used to make ropes Gum is a good source of tannin

Regulating and Supporting services

Controls soil erosion Conserves water and sequesters carbon Flower nectar is the preferred diet of migratory Rosy Starlings

Cultural services

Considered sacred in Hinduism and Buddhism Colour pigments from flowers used in Holi celebrations

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Butea monosperma (Flame of the Forest)

Butea monosperma is a medium size, deciduous tree which grows in most conditions, except very arid geographies. The characteristic features of the tree include its trifoliate leaves and its bright orange flowers. Out of the two species variants, the dark leafed ones are more common than the light leafed ones. "Dhak ke teen paat" is a common Hindi proverb associated with the tree meaning efforts that lead nowhere'.

Common names: Hindi: Dhak, Palash Konkani: Palas, Malayalam: Plasu, Nepali: Palans

Ecosystem Services Provided by Butea monosperma

1. Provisioning services

Medicinal properties and uses: It have several medicinal properties, due to which it is used in traditional medicinal systems of Ayurveda, Siddha and Unnani. The bark and seed are important for their analgesic, vermifuge, astringent properties.

Commercial uses: The tree is a host for the rangeeni lac insect (Kerria lacca) and the insect produces the most in terms of quantity when reared on this tree. The gum extracted from this plant is a good source of tannins. The bark fibres are used in cordage and the wood pulp to make newspapers. Fibres from the roots are used to make sandals and ropes.

2. Regulating and supporting services

Plant animal interactions: Several animal species are dependent on the plant during the time of its flowering (late February to April), but the flowers are mainly pollinated by birds.

Ecological functions: *Butea* forests have ecological and environmental functions in term of soil erosion control, land rehabilitation, water conservation and soil carbon sequestration. It is also considered to be an ideal species choice in the restoration

of degraded lands in dry tropical regions. Farmers use the tree to stabilize bunds while seedlings and green branches are spread in rice fields as a salt-filtering agent and green manure. The tree is known for its nitrogen fixing capacity.

3. Cultural services

Palash leaves were a popular choice to make plates in India, although the practice is dying out. The flowers produce natural dyes of red and yellow colour, which is used in Holi celebrations, and to dye silk.

In Hinduism the tree is considered sacred because the tri-foliate formation of its leaves, which represents the Holy Trinity of Vishnu, Brahma, and Shiva. This tree is often depicted in Buddhist's Jataka tales. In Manipur's Meitei community, if the body of a family member is missing, the wood of this tree is cremated in its stead.

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Common name : Cluster fig

General information

General information Flowering and Fruiting: February May Medium sized semi deciduous tree Height: 20-30m



Provisioning services

Plant has anti-diabetic and anti-inflammatory properties Fruit eaten raw or processed Tree extracts used in pharmaceutical and cosmetic industry

Regulating and Supporting services

Known for fig fig wasp mutualism Larval food plant of Common Crow Butterfly Conserves soil and water



Considered sacred in Hinduism and Buddhism

Ficus racemosa (Cluster Fig)

Ficus racemosa is a medium sized evergreen tree. It is popularly known as the cluster fig tree or Indian Fig tree. In India, the tree and its fruit are called us gular in the north and *atti* in the south. The fruit is a favorite staple of the Common Indian Macaque.

Common names: Hindi: Gular, Konkani: Rhumbud, Malayalam: Atti, Nepali: Gular

Ecosystem Services Provided by Ficus racemosa

1. Provisioning services

Medicinal properties and uses: Fig tree is a popular medicinal plant in India, which has long been used in Ayurveda, for various diseases/disorders including diabetes, liver disorders, diarrhea, inflammatory conditions, hemorrhoids, respiratory, and urinary diseases. The plant has been pharmacologically studied for various activities including antidiabetic, antipyretic, anti-inflammatory, antitussive, hepatoprotective, and antimicrobial activities. A wide range of phytochemical constituents have been identified and isolated from various parts of fig tree.

Commercial uses: Various extracts from the tree are used in pharmaceutical and cosmetic industries.

2. Regulating and supporting services

Plant animal interactions: The companionship between fig and fig wasp is an interesting one. The tiny flowers of the fig are enclosed in an edifice which looks like a fruit. Only female fig wasps can pass

the small hole on the fig and pollinate the flowers. The wasps lay eggs inside the fig and in return to the pollination service the fig tree provide nourishment and safe place for the young wasps. This relationship between fig and fig wasp is called mutualism. *Ficus racemosa* is larval food plant of common crow butterfly (*Euploea core*).

Ecological functions: *Ficus racemosa* is known for its capacity to conserve soil and water.

3. Cultural services

The tree has significance in Hinduism and Buddhism. The tree is used in many religious offerings in Hinduism.

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<u>Cassia fistula</u>

Common name : Golden Shower Tree

General information

Flowering and Fruiting: February-August Medium-sized deciduous to semi-deciduous tree Height: 10-18m

Cultural services

Flowers are used as symbol of prosperity in Vishu festival in Kerala

Provisioning services

Plant has antidysenteric, antifungal and antibacterial properties Bark used as tanning agent Wood ash used as mordant in dyeing

Regulating and Supporting services

leaves support Greater Short-nosed Fruit Bat and caterpillars of butterflies and moths Ripened pods are summer delicacy for Sloth bears. Monkeys and Jackals Plant used to revegetate overgrazed or degraded lands *Cassia fistula* is a small, deciduous to semi-deciduous forest tree. It can grow in a variety of conditions in different habitats and has gained popularity among urban planners of late. It is easily identifiable by its drooping leaves and flowers. The fruits are pods, which look like long, brown cylinders when they ripen. In Ayurveda it is called *Aragvadha* or disease killer. It is said that flowering indicates the arrival of the monsoons for the year.

Common names: Hindi: Amaltas, Konkani: Baya, Malayalam: Kani Konna, Nepali: Raj Brichhya

Ecosystem Services Provided by Cassia fistula

1. Provisioning services

Medicinal properties and uses: It is used in the Ayurvedic and Unani systems of medicine as well as in modern medicine for its anti-dysenteric, antibacterial and antifungal properties. Its roots are used to treat fever, purify wounds and ulcers, and its bark is used for folklore medicine. The most commonly known medicinal use is its laxative properties which manifests the strongest in its fruit pulp.

Commercial uses: The young leaves and flower buds are cooked as a vegetable, being rich in Vitamin K and Calcium. The bark is used as a tanning agent, while wood ash of the species is used as mordant in dyeing, and the pulp of pods is used to flavour tobacco. The wood is used for construction purposes, to make a variety of tools and wooden articles where strength and toughness are primary considerations.

2. Regulating and supporting services

Plant animal interactions: The leaves support the caterpillars of several butterfly species and the Greater Short-nosed Fruit Bats. Carpenter bees pollinate the flowers through a special mechanism called buzz pollination, by creating vibrations with their wings that cause the pollen grains to break out from the anthers and fall on

the bees' bodies. The flowers also support other insects like weaver ants and oriental fruit flies. The ripened pods are summer delicacy for Sloth Bears, Monkeys, Jackals and Wild Boars helping in seed dispersal.

Ecological functions: The plant can also be used to revegetate overgrazed and degraded lands since it is not palatable to domestic animals.

3. Cultural services

The plant has an important significance in Vedic literature and is mentioned in the Ramayana and the Mahabharata. In Kerala, it is an important component of sacred groves within the State. In fact, it has sacred relevance and is used as a symbol of Vishu festival.

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Saraca asoca

Common name : Ashoka

Flowering and Fruiting: February-August Small-sized evergreen tree Height: 7-10m

Provisioning services

Dried roots used to treat neurological disorders Dried leaf powder useful for removal of hazardous dyes Bark used in making cosmetics

Regulating and Supporting services

Larval food plant for Plains Cupid. Common Ciliate Blue. and Common Cerulean Captures dust and has high tolerance to air pollution

Cultural services

Used in the worship of Hindu God of love

Saraca asoca (Ashoka)

Saraca asoca is a small, beautiful, evergreen tree, greatly valued for its attractive foliage and fragrant flowers. The flowers come in bright yellow, heavy, lush bunches which turn red before wilting. It is distributed in evergreen forests of India, up to an elevation of about 750 meters. Saraca asoca is one of the most ancient trees of India but in recent times is becoming rarer in the wild and has been listed as 'Vulnerable' by the IUCN.

Common names: Hindi: Sita Ashok, Konkani:, Malayalam: Ashokam, Nepali: Ashok

Ecosystem Services Provided by Saraca asoca

1. Provisioning services

Medicinal properties and uses: Ashoka is used for various pharmacological purposes such as an anti-diabetic, anthelmintic, CNS depressant, antihemorrhagic, uterine tonic, analgesic, anti-inflammatory, anti-ulcer, anti-cancer, larvicidal, antioxytocin activity and has extended uses in Ayurveda, Unani and Homeopathy.

Commercial uses: The leaf powder is used as a biomaterial adsorbent for the removal of hazardous dyes such as methylene blue, malachite green, rhodamine B and brilliant green from aqueous solution or effluents. The bark is used in the cosmetics industry.

2. Regulating and supporting services

Plant animal interactions: The tree is a larval food plant for the Plains Cupid (*Chilades pandava*), Ciliate Blue (*Anthene emolus*), and Common Cerulean (Jamides celeno).

Ecological function: Saraca asoca is tolerant to air pollution and has a high dust capture capacity.

3. Cultural services

Ashoka tree is believed to be sacred and is mentioned in the Ramayana, Buddhist and Jain texts. The tree is associated with the

Hindu God of Love, Kamadeva, for whom it is worshipped every year. The Indian philosopher and founder of Buddhism, Siddhartha Gautama is said to have been born under this tree. It is also a recurrent element in Indian art.

Charaka Samhita which is believed to have been composed in 1000 B.C. describes the tree and its medicinal benefits.

In India, married Hindu women eat the flower buds of *Saraca asoca* on "Ashok Shasthi day" to guard their children against grief and sorrow.

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Flowering and Fruiting: December April Medium sized evergreen tree Height: 10-15m

Provisional services

Seed powder used to treat Diabetes mellitus Fruit used as alternative dye for histological staining Timber used in building constructions

Cultural services

Considered to be sacred due to association with Lord Krishna



Regulating and Supporting services

Hedge plant and windbreak Planted as a shade provider Preferred foraging plant by honey bees Anthocyanins

Flavonoids

Syzygium cumini

Common name : Black plum

Syzygium cumini is a large evergreen and densely foliated tree with a greyish brown thick bark. The wood is whitish, close grained and durable. The fruits are berries and are purple or nearly black, fleshy. The tree is widely cultivated in the tropics and subtropics for its edible fruit, shade, ornamental properties and as a windbreak. It is native to the Indian Subcontinent, adjoining regions of Southeast Asia, including Myanmar, Sri Lanka, and the Andaman Islands.

Common names: Hindi: Jamun, Konkani: Zambla, Malayalam: Njaval, Nepali: Jamun

Ecosystem Services Provided by Syzygium cumini

1. Provisioning services

Medicinal properties and uses: *Syzygium cumini* is an ancient medicinal plant with an illustrious medical history. It is a widely used in the treatment of various diseases, particularly diabetes. The fruits have been used for a wide variety of ailments, including cough, dysentery, inflammation and ringworm. Various traditional practitioners in India use different parts of the plant in the treatment of diabetes, blisters in mouth, cancer, colic, diarrhea, digestive complaints, dysentery, piles, pimples and stomachache.

Commercial uses: Besides being consumed, the fruit is used as a natural dye, an alternative to existing synthetic colorants in food and in histological staining and cytotoxicity testing of cosmetics. The antimicrobial property of the seed has been researched on for the development of antimicrobial fabric. The timber used in building construction and to make agricultural implements. The flowers are very attractive to bees, yielding quality honey.

2. Regulating and supporting services

Plant animal interactions: It is also a host plant of the tasar silkworm (*Antheraea mylitta*), and a good source of nectar for honeybees (*Apis dorsata*).

Ecological functions: Used in agroforestry, the plant is amenable to trimming and can be grown as a hedge or to provide shelter from the wind. In perennial plant systems it is often planted as a shade-provider with crops such as banana, coffee and cocoa.

3. Cultural services

The plant is an ancient fruit crop, cultivated for over 2,500 years in India, where it is venerated by Buddhists and Hindus. It is considered to be associated with Lord Krishna and is often planted near temples.

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Serminalia bellirica

Common name : Bedda nut tree





General information

Flowering and Fruiting: December-May Large-sized deciduous tree Height: 25-40m

Provisioning services

One of the components of triphala in Ayurveda Fruit edible and processed into value-added products Wood used in construction and making agricultural implements



Regulating and Supporting services

Plant eaten by wild ungulates and Hanuman langur Preferred by Malabar Grey Hornbill and Black Kite for nesting

Cultural services

Nuts find mention as dice in the Mahabharata and Rigveda





Terminalia bellirica (Bedda Nut Tree)

Terminalia bellirica is a fast-growing deciduous tree found across India, which grows up to 30 meters in height. Various parts of the plant are used in traditional ayurvedic medicine. The tree is cultivated across India for its fruits and tannin-rich bark.

Common names: Hindi: Bahera, Konkani: Goting, Malayalam: Thanni, Nepali: Barro

Ecosystem Services Provided by Terminalia bellirica

1. Provisioning services

Medicinal properties and uses: It is one of the best-known medicinal plants in world. Both unripe and ripe fruits are eaten raw or used as medicine. The fruits are boiled, sliced and sun dried and preserved for medicinal purposes; usually chewed after meal as digestive.

Commercial use: Tannins are obtained from the fruits of *Terminalia bellarica*. Tannins are a heterogeneous group of complex compounds which are of widespread occurrence in plants. Tannins are sometimes present in cell sap and occur frequently in the cell wall and in dead tissues of plants. Tannins are used for dyeing material and also to tan the hides of goats, calf, sheep skins which are used for sole and harness leather. The wood is very hard and used for construction and making agricultural implements.

2. Regulating and supporting services

Plant animal interactions: The tree forms part of diet for wild ungulates like the Gaur and Hanuman Langur. Hanuman Langur eats the unripe fruit. *Terminalia* is one of the trees preferred for nesting by bird species such as Malabar Grey Hornbill and Black Kites.

Ecological functions: The species is a light demander and fairly drought resistant. It coppices well after pollarding, especially if planted on a wide spacing.

3. Cultural services

The nuts of the tree are rounded but with five flatter sides. These nuts find mention as dice in the Mahabharata and the Rigveda.

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Ziziphus mauriliana

Common name : Indian Jujube

Flowering and Fruiting: February-April Small-sized evergreen tree Height: 8-12 m

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Provisioning services

Root, bark, fruits, seeds have medicinal properties leaves used as fodder for sheep and goats Timber used in construction, making agricultural implements and charcoal

Regulating and Supporting services

Preferred nesting tree for Spotted Munia. Purple Sunbird and Baya Weaver Used as hedge tree in agroforestry

Cultural services

Fruit finds mention in Vajurveda



Ziziphus mauritiana is a spiny, small-sized evergreen tree. Fruit of *Ziziphus* has been used in India since antiquity. During ancient period, the plant is mainly cultivated in the Deccan Plateau, which predates Gangetic civilization. Indian Jujube tree is now widely cultivated in dry areas, throughout the tropics. It has multiple uses, including culinary and medicinal.

Common names: Hindi: Bada ber, Malayalam: Badaram

Ecosystem Services Provided by Ziziphus mauritiana

1. Provisioning services

Medicinal properties and uses: The plant is known for its antitumor, anti-fungal, antidiabetic and antidiarrheal properties. It is used in different Ayurvedic medicines to treat a wide variety of diseases including obesity, fever, skin diseases and ulcer.

Commercial uses: The timber is hard, strong and is most often used to make agricultural implements. The branches are used as framework in house construction and the wood makes good charcoal. Apart from this, the species is used as firewood in many areas.

2. Regulating and supporting services

The seed dispersal is carried out by mammals and birds. Many species of birds such as Spotted Munia, Purple Sunbird and Baya Weaver use this tree as their nesting sites.

Ecological functions: The plant tolerates extremely dry habitats and is an extremely valuable tree for people who live in such climates. This thorny tree makes good live fencing and is an excellent agroforestry tree for use as hedges.

3. Cultural services

Fruit of *Ziziphus* finds mention in the Yajurveda. Results from excavations have indicated that farmers of the Indus valley collected fruits from native trees and propagated them to other areas.

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