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Endangered trees

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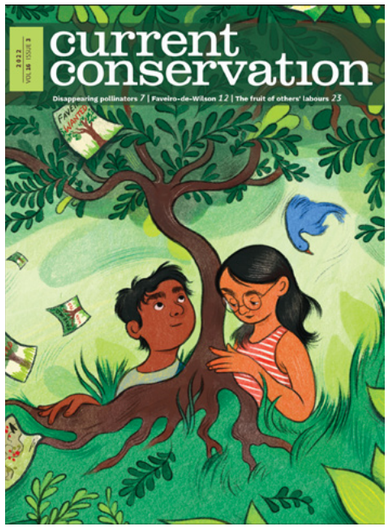

Cover art **Maithili Joshi**

'Plant blindness' was a term coined in 1999 by J. H. Wandersee and E. E. Schussler to describe a widespread phenomenon—people's inability to notice plants in their environment. While it sounds benign enough, plant blindness has serious ramifications. Plant biology courses across the world are shutting down, research support for plant ecology is dwindling, and there is considerably less funding for plant conservation as compared to initiatives focussed on animals.

It is hardly surprising then that the IUCN Red List of Threatened Species only includes five percent of the plant species listed in the Global Biodiversity Information Facility. What this means is that despite the fundamental role that plants play in the ecosystem, the conservation status of most plant species is currently unknown.

As an ecologist involved in bird-related research and conservation for most of my career, I must also admit to being oblivious to trees. I have spent countless hours squinting at forest birds through binoculars, but the vegetation always faded into the background. I'm pretty sure this is true of most animal ecologists. It wasn't until I got roped into a long-term tree phenology project—which involved studying the timing of life cycle events, such as leaf flushing, flowering, fruiting, etc.—that I started to notice, appreciate, and identify different tree species. Suddenly, I was seeing the whole landscape through new eyes.

Without further ado, I'm thrilled to present our first ever issue focussed entirely on trees: endemic, endangered, often rare but sometimes locally abundant. To those who haven't yet had a chance to pay attention to plants, I hope this is the invitation you need.

—Devathi Parashuram

Endangered means not yet extinct

Author **Anita Varghese** | *Illustrator* **Norzin Norbhu**

Trees have always felt like the upward raised hands of the Earth seeking rain, wind, and sunlight from the skies, while keeping myriad living and non-living things safe under their protective canopy. They never cease to fill me with awe and inspiration—their architecture, their defiance of gravity, their ability to soar above even as their roots dig deep into the soil. As an ecologist who has spent considerable time studying trees, I have had the joyful experience of hugging at least a thousand of them in the course of taking valuable diameter measurements!

Conservation of Nature usually finds its way into the hearts and minds of people through furry and huggable or majestic and awe-inspiring animals. This leaves tiny but spectacular orchids, serpen-

tine climbers, creepy crawly insects, scaly snakes and frogs and a whole host of life forms unnoticed. Animals are given priority, while plants seem like they are everywhere and not particularly under threat of any loss. Up until we spend more time exploring and improving our understanding about the ecology or interdependencies that form the web of life.

Then we realise that a tree in the forest is more than just the flowers, fruits, and the leaves it produces. The bark has a host of mosses, ferns, frogs, crabs, insects, and orchids living on it. The canopy is home to a diversity of pollinators, primates, and other mammals. What happens in the deep roots and their capillaries that weave through the forest forming a vast network below ground is even less understood. A tree therefore becomes an entire habitat and even an ecosystem in the forest. In conserving a tree, one is protecting a web of relationships and interdependencies that are also threatened when that tree species is driven to extinction.

In the introduction to his book *Against Extinction*, Prof. Bill Adams writes about three timescales that conservation practitioners are engaged with—geological time which extends across millennia, a lifetime where one aspires to see change within a few decades, and the present, where every problem has to be addressed now or it will mean certain doom. Keeping these timescales in perspective is very important when one sets out to protect endangered species and to prevent their extinction.

The International Union for the Conservation of Nature (IUCN) maintains a Red List which is a comprehensive list of all living things and their conservation status. The information on populations, distributions, and the threats they face becomes invaluable when decisions on protection and preservation have to be taken. The Red Listing process assesses every species' risk of extinction and places them under one of the nine stipulated categories: Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild, Extinct, and Not Evaluated. The assessments are based on information available about a species' population and its range or distribution. These criteria are now globally accepted and widely used for conservation planning.

Through the articles in this special edition which are focussed on Endangered Trees, we want to draw attention to a world of plant conservation, which is replete with discovery, piracy, isolation, destruction, and lost relationships—all the makings of a conservation saga with trees as the protagonists.

As detailed in this series, once thought to be extinct in the wild, one species of the Faveiro trees of Brazil was rediscovered a hundred years ago and conservation plans are being implemented to ensure their long-term protection in the state of Minas Gerais. Another chance discovery of a cluster of *Dipterocarpus bourdillonii* trees in the Western Ghats of India spurred a large-scale survey for 11 endangered tree species in the Anamalai Hills, set against a backdrop of evolution, land use change, and global climate change. Moving on to the southern Western Ghats, where a single species from the genus *Gluta* is found (the only one in the Indian subcontinent), and although locally abundant in the forest, it faces a serious bottleneck in its life history, posing a threat to its long-term survival. But bottlenecks are many, when it comes to species in the wild, as in the case of the cycads from South Africa, where absence of beetle pollinators or their declines can have serious implications on populations in the wild. Human use poses a threat to the species as observed in the case of the *Caryota* palms, where the recreational or cultural use necessitates the removal of the flower—the reproductive part of the plant—even before it matures or has produced seed. Illegal wildlife trade is of concern to all wildlife, even plants, as seen in the article about the theft from the Gurukula Botanical Sanctuary in India and larger online trends. Finally, the fascinating history of the pivotal botanical text *Hortus Malabaricus*—with its detailed descriptions and meticulous illustrations of 780 plants of the Malabar region—is revealed.

Several species have been driven to extinction and are endangered owing to one or many of the reasons listed above. Will a species become extinct if we don't act today or in our lifetime? Saving the Earth and protecting the planet by not letting anything die or go extinct has been the mainstay of conservation, which incidentally is only about 100 or so years old. From an evolutionary point of view extinctions give rise to newly adapted forms of life and keep the process of life moving ahead. Nothing stops in Nature. While saving species from dying seems like a short-

term goal of conservation, there is a larger goal which I am afraid we are missing out on—literally losing sight of the woods for the trees. In the last few years in the mountains of South India, we have seen unprecedented weather patterns and a disruption of the rhythm of life. When a section of the grasslands and Shola forests of the Nilgiris collapsed in a landslide a few years ago, one started to wonder if our ecological footprint has now begun to challenge the very resilience of ancient landforms like the Western Ghats. What can we do now to rebuild the resilience of the Earth so it does not lose the capacity to bounce back after environmental disasters; this for me will be the long-term goal of conservation. We have to keep trying tree by tree, species by species, habitat by habitat to rebuild and restore that which is not completely lost.

Dr Anita Varghese *is a director at Keystone Foundation. Her work looks at the factors that mediate the relationship between people and nature, specifically how the goals of conservation and development can be harmonised. Additionally she is Chair of the Western Ghats Plant Specialist Group of the IUCN SSC.*

Norzin Norbhu *is an illustrator and small shop owner based in Bangalore. Her work is inspired by nature and the hills of Darjeeling she grew up in.*

Disappearing pollinators and extinction of the world's oldest seed plants

Author **John Donaldson** | *Illustrator* **Shivani Shenoy**

In the early 1900s, an astute naturalist noticed beetles crawling all over cycad cones in South Africa, an observation that seemed to suggest these ancient plants were insect pollinated. The implications were so surprising that **Alice Pegler's observations** were included in a presentation by Professor Harold Pearson to the Royal Society of South Africa in 1906. The circumstantial evidence was, however, not enough to challenge the prevailing paradigm of the time, that all cycads and related plants that do not produce flowers (Gymnosperms) were wind pollinated. It seemed inconceivable that a cycad—one of earliest plant groups to evolve from fern-like ancestors and develop seeds roughly 280 million years ago—could be insect pollinated. Insect pollination was generally believed to be one of the defining features of the flowering plants which evolved and diversified more than 100 million years later.

It was only in 1986 that researchers working in a botanic garden in the USA proved beyond doubt that some cycads were indeed pollinated by beetles. Even more surprising was evidence that cycad pollination systems include highly specialized interactions where the insect larvae develop in the cycad cones. This form of mutualism compares to the better-known interactions between figs and fig wasps, rather than the clumsy and opportunistic beetle interactions associated with primitive flowering plants. Since then, insect pollination has been confirmed in all ten genera of living cycads, across all five continents where cycads occur, and it is likely that it occurs in most of the approximately **350 known species of cycads.**

Insect pollination of cycads is far more than just a fascinating evolutionary and ecological riddle, it is also critical to the survival of this unique group of seed plants. They represent one of the most threatened groups of plants yet assessed for the IUCN's Red List of Threatened Species, with roughly 70 percent of all cycads now at risk of extinction. Over the past two decades, as studies of cycad pollination have gained momentum, there has been an increasing incidence of cases where pollinators seem to have disappeared. In some cases, pollinators were recorded in earlier surveys but have not been found in subsequent studies, while, in others, attempts to find pollinators have failed and these cycad populations do not produce viable seeds.

The collapse of pollinator populations is not unique to cycads. There is a global concern about their decline and disappearance. So much so that it was one of the first thematic assessments for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). In the case of cycads, the loss

of pollinators threatens the very existence of species that are already struggling to survive due to loss of habitat and the removal of plants from the wild for the ornamental plant trade. These pressures have left small populations surviving in remnants of intact habitat or isolated plants that have escaped the attention of plant collectors. Together, these pressures increase the likelihood of pollinator extinctions. Cycads are dioecious, which means they have both male and female plants and there need to be enough male and female plants for them to be able to breed. Theoretically, it only takes one male and one female to reproduce, but that does not work for cycads. Many cycad species do not cone every year, so the population needs to be at least big enough that a male and female will cone in the same year. More importantly, there need to be enough cones in the population to support their insect pollinators, most of which develop in the male cones. How many plants is enough remains an unanswered question. Pollinators have been found in populations with only 50 plants, but they are also absent from populations with more than 500 mature

plants. The overall context may make all the difference, depending on how far the population is from neighboring populations as a possible source of pollinators, whether the habitat is sufficiently intact to cater for other requirements of pollinators, such as shelter between coning seasons, and possible impacts of land use practices, particularly fire intensity and frequency or use of pesticides.

The absence of pollinators could be a major barrier for any attempts to recover or re-establish cycad populations. If we can't get the pollinators back, is there any hope of reversing the trend towards extinction? This is still an open question and studies are currently underway to determine what is possible. There are some hopeful signs.

Many cycads have more than one pollinator species—a form of insurance if one pollinator is absent. For example, one recurring pattern amongst the known pollination systems is for pollination by weevils (beetles in the family Curculionoidea) as well as one or two other beetles (often Cucujoidea beetles). Where this combination exists, one pollinator may be quite specialized and will pollinate only one or a few species, whereas the more generalist pollinator will visit a wider range of cycad species. This opens up the possibility of reintroducing more generalist pollinators from populations of other cycads even if the more specialized pollinator is extinct.

Another promising avenue is to determine whether cycad pollinators have survived in botanic gardens and private collections. Plants in gardens tend to cone more frequently than in the wild and pollinator populations can become naturalized in gardens. The first experimental study of insect pollination is a great example. The study was carried out at Fairchild Tropical Garden in the USA on naturalized populations of pollinators that usually occur only in Mexico. Surveys of cycads in gardens may reveal insect pollinators that no longer exist in the wild or, just as important, show whether pollinators in gardens shift hosts and can develop in a wider range of cycad hosts than previously thought. If so, it could be possible to even re-introduce specialist pollinators into wild cycad populations.

The IUCN/SSC Cycad Specialist Group is leading a global initiative to reverse the extinction trend for cycads. It is becoming increasingly clear that this requires a greater understanding of risk and resilience associated with cycad pollination systems, and finding ways to recover and restore pollination systems wherever possible.

Further Reading

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John Donaldson *is a conservation biologist with an enduring interest in cycad conservation. He is exploring ways to reverse population declines and restore pollinator mutualisms.*

Shivani Shenoy *is an illustrator and visual designer. She loves exploring colourful visual storytelling, especially about wildlife and culture, bird watching, and music.*

On forest remnants and scarce jewels

Reflections from surveys for endangered trees in the Anamalai Hills of the Western Ghats

Author and Illustrator **A. P. Madhavan**

The air hung heavy with the scent of nectar, and the pools in the streams glittered green and pink with fallen *Dipterocarpus bourdillonii* flowers. The emergent trees from which the flowers had fallen rose in regal elegance above the canopy. The previous year, in late January 2021, a team of researchers from the Nature Conservation Foundation and the Wildlife Institute of India had found a small cluster of these trees here, along the bend of the Parayankadavu River in the Anamalai Tiger Reserve. It was an exciting find because this critically endangered tree species, endemic to the Western Ghats mountains in India, had not been recorded in this area.

Now, we were back in the valley of riverine lowland montane rainforests to survey the area for more individuals and to document their altitudinal range, abundance, and other trees associated with the species.

Staring into the domed crown dancing with peppered sunlight and rustling against the clouds, I pictured the land—located in the southern Western Ghats, within the Anamalai hill range—from up above, looking out from the 52 m crest of the giant. All around was a landscape with an astonishing diversity of more than 7,400 flowering plant species, distributed over a vast range of altitudinal and geographic zones. Looking to the horizon, the forests become an intricate symphony, carpeting and moulding the valleys and crests, which stood silhouetted against the expansive blue of the sky.

The reverie was broken by a swirling, pirouetting flower drifting down from the canopy, which served as a reminder of the several unexplored kilometres that lay ahead.

The systematic survey for endangered trees had been underway over the past two years to understand the distribution and conservation status of ten endangered tree species within the Anamalais landscape. After the discovery of the *Dipterocarpus bourdillonii* cluster, the survey expanded to focus on 11 species. The surveys along 63 forest trails, each several kilometres long, were distributed across rainforest remnants on the Valparai Plateau and the adjoining Anamalai Tiger Reserve. A survey of this scale and resolution had not been undertaken since C. E. C. Fischers's 'Flora of the Anaimalai Hills', followed by his work with J. S. Gamble in the 'Flora of the Madras Presidency', both published more than a century earlier.

More than a century of human intervention, the limited geographic scope of prior surveys, and climate change have made the data from our survey crucial to the current context. By systematically measuring the girth, height, and geolocation of every individual of our 11 endangered tree species, and laying plots to record associated trees and regeneration, we were able to gather more information on the conservation status of these species.

Ecological information that we collected suggested that patterns of endangerment varied across species. For instance, the endemic and critically endangered tree *Phyllanthus anamalayanus* was previously thought to be restricted to a small cluster of less than a hundred individuals spread over a couple of hectares of forest near the Iyerpadi region of the Valparai Plateau. In our surveys, we found the trees in high abundance along river systems in the mid to lower elevation of the landscape. Another species, *Palaquium ravii* (whose seeds germinate well in nurseries) was found as a cluster of 30-odd individuals in the forests of the Manamboli region, but was extremely scarce or absent elsewhere.

What makes certain trees extremely rare both in distribution and in abundance, while other endangered trees are locally expansive in range and numbers? Why do some endangered trees occur in high densities in specific valleys but are absent elsewhere? In every new range we explored and documented, in every cluster that we found, was a distinct reminder that there was much to learn about endangered species in the landscape.

A major hindrance to understanding the ecology of endangered trees within forests today is the significant historical influence of anthropogenic destruction and pressures. Extensive logging for timber, fuel or biochemical properties (sap) may have removed huge tracts of forests and large numbers of key dominant species of each forest type (e.g., *Myristica dactyloides*, *Diospyros paniculata*, *Vateria indica*).

Confounding these factors are the broad ecological parameters that seem to affect tree abundance and distribution in the Western Ghats, such as variations in rainfall, elevation, prevailing soil type, and latitude. These patterns relate to the high rates of endemism within the landscape and are, at times, significant enough to cause dramatic changes in tree composition between two adjoining valleys or neighbouring ranges. For example, the understorey tree *Cryptocarya anamalayana*, is only found below 1000 m elevation on the western slopes of the Anamalai plateau in select locations of high annual precipitation.

Our present-day understanding is thus situated at the crossroads where the knotted threads of history and land use change meet the ecological relationships and adaptations that have evolved over vast timescales, all set in a time of global climate change.

In a landscape that is threatened by fragmentation, deforestation, and extinction, the questions surrounding endangered trees, their distribution, association, abundance, and specific roles become that much more critical. What we gain from such knowledge can help in shaping future conservation and restoration efforts, built on an understanding of the composition, structure, diversity, and resilience of existing forests and their historic baselines.

A. P. Madhavan *pursues the field of ecological research, creating useful indices to inform biodiversity conservation. He works with the Nature Conservation Foundation (Valparai).*

Faveiro-de-Wilson: The hidden treasure of Minas Gerais, Brazil

Authors **Fernando Moreira Fernandes, Marcio Verdi et al.** | *Illustrator* **Maithili Joshi**

DISCOVERY OF THE FAVEIRO

In Minas Gerais, a southeast Brazilian state known for its mineral wealth, there is another kind of natural treasure, which is still hidden: the faveiro-de-wilson tree (*Dimorphandra wilsonii*) from the legume family. Its story probably started a long time ago, but the species was known to science only in 1968, when a woodsman, Wilson Nascimento, came across a few individuals of the species in the Paraopeba municipality. The following year, this tree was described by Dr. Carlos Rizzini of the Rio de Janeiro Botanical Garden Research Institute, who had employed the woodsman as a research assistant. The scientific as well as common name of the species honour Mr. Wilson, who passed away shortly after the discovery.

It is curious how such a large tree species found in the vicinity of a metropolis was discovered so late. It was assumed that the species was never very abundant in nature. 15 years later, in 1984, Dr. Rizzini returned to that region and counted only 18 individuals of the species, both in Paraopeba as well as in the neighbouring municipality, Caetanópolis. Since he had encountered so few individuals, he believed that this species could be at risk of extinction.

Following this, the faveiro-de-wilson was forgotten about until 2003, when it was 'rediscovered' by researchers from the Parks and Zoo-Botanical Foundation of Belo Horizonte's Botanic Garden. They visited the Paraopeba and Caetanópolis municipalities, where, in the midst of extended pastures of the invasive alien grass *Urochloa decumbens* (also known by its synonym *Brachiaria* or "braquiária" in Portuguese), they spotted a dozen old and peculiar faveiro-de-wilson trees.

This encounter led to several questions: Is the species rare? Does it only occur here? Is it facing extinction? What do we know about its biology and ecology? To answer these questions, the researchers began seed collection, nursery reproduction, and studies on phenology and population genetics. On realising that it was a rare and poorly documented species, finding more individuals and protecting this mysterious species became their priority. Committed to finding more faveiro-de-wilson individuals, the researchers ignored all the discouragement aimed at their attempts to protect a species considered a "lost cause". They decided to carry out direct searches throughout the state of Minas Gerais. To help with this difficult task, they had an idea: creating and distributing "wanted" posters and leaflets with information about and photos of the species, as well as the team's contact details. And thus, the long search for the faveiro-de-wilson began.

THE TREASURE HUNT

The search resembled a treasure hunt, except without a map for guidance. Outreach materials in hand, the group of researchers went to "hunt" for the faveiro-de-wilson, putting up posters everywhere and approaching local people, mostly in the countryside. They handed out leaflets with images and passed around samples of faveiro's leaves, fruits, and seeds, which could be touched and smelled. The team asked if people knew the species and could help them locate individuals. Those who had the closest contact with nature and were interested in collaborating became special partners, who were later referred to as "faveiro hunters".

The absence of a general mechanism to protect the species in its natural habitat led to the creation of a state decree in 2004, which declared a ban on the logging and exploitation of the faveiro-de-wilson in Minas Gerais. In 2006, the conservation status of the species was assessed and subsequently published in the IUCN Global Red List's "Critically Endangered" category. Another couple of years later, the faveiro-de-wilson was also included in the Minas Gerais and Brazilian Official Red Lists.

In the following years, with logistical support from the State Forest Institute (IEF, acronym in Portuguese) and sponsorship from a cement company and a non-governmental organisation, the tree searches were reinforced and the research was extended to include physiology and reproductive biology. Other activities were also initiated at the same time, including the reintroduction of the species in suitable habitats and spreading environmental awareness through meetings, chats, and presentations in schools, at public squares, and other places. Thus, a simple project became the Faveiro-de-Wilson Conservation Programme, whose work was mainly focused in the central region of Minas Gerais, in the transition or ecotone zone between two biodiversity hotspots: the Cerrado (a vast tropical savannah) and the Atlantic Forest.

Although the conservation programme was focussed


FAVEIRO
WANTED
MINAS GERAIS
FAVEIRO

on a single species—the faveiro-de-wilson (*D. wilsonii*)—researchers stumbled upon another morphologically similar species during their surveys in the region. The faveiro-da-mata (*Dimorphandra exaltata*), native to the Atlantic Forest, is likewise rare and little investigated. Until then, it was known only from herbarium records collected in the eastern region of Minas Gerais and in some municipalities in the states of Rio de Janeiro and São Paulo. This was the first time that they observed it in the central region of Minas Gerais and such a discovery would bring more challenges and surprises.

CREATING A CONSERVATION ACTION PLAN

Thanks to community involvement, the treasure hunt for faveiro-de-wilson yielded good results. Up until 2013, **219 adult individuals had been recorded** in 16 municipalities in the central region of Minas Gerais. They were able to show that the species was endemic to this region. With all the data and information gathered during the surveys, there was an impetus to create a Conservation Action Plan (CAP) for the species—Faveiro-de-Wilson CAP. This was done in partnership with the Brazilian National Centre for Plant Conservation of the Rio de Janeiro Botanical Garden Research Institute (CNCFlora/JBRJ, acronym in Portuguese) and involved 30 stakeholders from 10 institutions.

Five years later, in 2020, most of the conservation actions were implemented/executed by the stakeholders involved in the Faveiro-de-Wilson CAP. It was noted that faveiro-de-wilson and faveiro-da-mata are not used for commercial purposes. However, their pods/favas, although dry, are palatable and nutritious for animals, including wild species (e.g. tapir, paca, deer, cotia, and macaw) as well as cattle and horses, who also help disperse the seeds. Moreover, since the pods fall in the period when the pastures are dry, they are beneficial for farmers whose cattle feed on them. This fact has been used to advocate for the conservation of this species. However, although both species produce many fruits and seeds, the recruitment is low, and growth is slow and uneven. Additionally, the young plants have to compete with the aggressive alien grass, braquiária, as well as survive being trampled by cattle and predated on by insects, all of which leads to many losses, including in reintroduction attempts.

TRACING THE ORIGIN OF THE FAVEIRO

From the start, a genetic comparison was sought between the faveiro-de-wilson and the faveiro-do-campo (*Dimorphandra mollis*), a non-threatened and common species in the Cerrado with a wide distribution in Brazil. But after faveiro-da-mata was discovered where the researchers knew that the three species converged, they were all considered in the genetic studies performed by the Federal University of Minas Gerais (UFMG).

This led to a surprising discovery in 2019: the faveiro-de-wilson is a probable natural hybrid of faveiro-da-mata and faveiro-do-campo!

Such a revelation prompted researchers to make several adjustments along the way. For example, the illustrated educational booklet, which was being written for schools, ranchers, faveiro hunters, stakeholders and other partners, was published in 2020 under the title "Preserving the Rare Faveiros", in order to also include faveiro-da-mata and faveiro-do-campo.

A milestone was reached in 2020, with a total of 441 adult faveiro-de-wilson trees being georeferenced and marked in 24 municipalities. However, none of these trees were found inside Protected Areas and the vast majority of them are located in deforested landscapes. This makes the conservation of the species more challenging.

Additionally, 451 individuals of faveiro-da-mata were also found, georeferenced, and marked in the same region. For both species, the researchers observed that the main cause for drastic reduction was not any specific uses of the plants, but simply the destruction of their habitat. Based on this new information and expanding knowledge, CNCFlora/JBRJ has now re-evaluated the faveiro-de-wilson and down-listed the species from Critically Endangered to Endangered, also including the faveiro-da-mata in the same category. Both species assessments have been submitted and the faveiro-da-mata assessment has already been published on the IUCN Global Red List.

LOOKING TO THE FUTURE

CNCFlora/JBRJ recently joined forces with national and international institutions (e.g. IUCN SSC CSE-Brazil and CEPF) to develop the Conservation Action Plan for Threatened Faveiros Species (*Dimorphandra*), which includes faveiro-de-wilson and faveiro-da-mata as targets species, and faveiro-do-campo as beneficiary species. This made it possible to redefine the objectives and priority actions, as well as to expand the efforts undertaken for the conservation and recovery of their populations. This change was very important because the Cerrado and the Atlantic Forest, where these species occur, are under severe pressure from agricultural expansion and livestock rearing. Thus, conservation efforts from multiple angles are needed in order to succeed. Moreover, these efforts to restore and protect the faveiros and their habitat require national and international collaboration among stakeholders to drive investment and conservation outcomes.

Thousands of people have been involved in the conservation programme over the years—from different sectors (public, private, and non-governmental) and from different cities. This includes school students, local communities, faveiro hunters, the fire brigade, and rural landowners, who safeguard the two rare faveiros on their properties with great pride. It is also worth mentioning that in 2015, the Faveiro-de-Wilson Conservation Programme was awarded the National Biodiversity Award for the best Brazilian nature conservation initiative from the Ministry of Environment under the public service category. Through our joint efforts, we hope to continue expanding our work to protect these peculiar faveiros trees in a region which should be remembered not only for its mineral resources, but also its green treasures.

This article has been translated into Portuguese and is available in the online version of the issue (www.currentconservation.org/issues/)

Further Reading

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Fernando Moreira Fernandes *is a Forest Engineer and Environmentalist. Coordinator of Faveiro-de-Wilson Conservation Programme.*

Marcio Verdi, Thaís Andrade Ferreira Dória, Marcela Barbosa, Fernanda Saleme, *are all biologists associated with the Brazilian National Centre for Plant Conservation, Rio de Janeiro Botanical Garden Research Institute, Brazil.*

Maithili Joshi *is an illustrator and junior designer based in New York. Alongside her role as junior designer at Scholastic, she also works as a children's book illustrator with clients as Simon and Schuster BYFR, Little Bee Books, Tulika Books etc.*

Plant pilfering and the pandemic

How online trends and trade may be the next threat to endangered plants

Author **Soham Kacker** | *Illustrator* **Shivangi Pant**

In April of 2021, four plants went missing from outside the gates of the Gurukula Botanical Sanctuary in the Western Ghats of Wayanad, Kerala. The plants were closely related to the ubiquitous money plant and belonged to the genus *Anthurium*, which is prized for its ornamental foliage. Weeks later, amidst occasional smaller disappearances, a large *Anthurium warocqueanum* plant—also known as the 'Queen Anthurium'—went missing from inside the gates. The targeting of exotic species, and the circumstances surrounding the thefts coincided exactly with cases I had heard of while working at the Auroville Botanical Gardens in Tamil Nadu. These cases also reminded me of the thefts of rare species from Kew Gardens in 2014, and more recently, from the Penang botanical gardens in Malaysia. Intrigued, I contacted Suprabha Seshan—a restoration ecologist and the head of the trust that runs Gurukula—and she quickly confirmed my initial impressions. The instances at Gurukula and Auroville are part of a larger trend linking the global horticultural trade, the desire for exotic species, and a worldwide houseplant renaissance sparked by the pandemic.

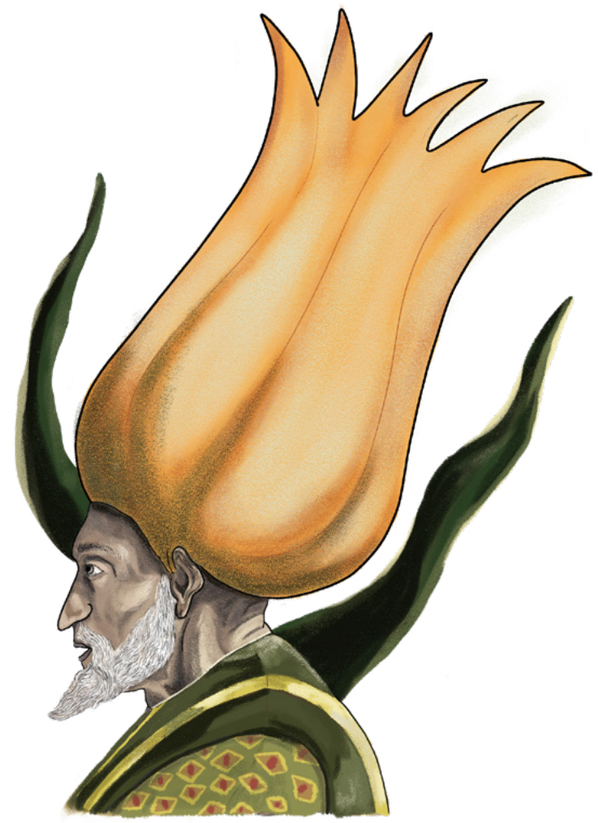
During my time at the Auroville Botanical Gardens (AVBG), many of the horticulturists related stories of orchids, ferns, and cacti going missing from their collections. The carnivorous plants were so tempting that before long, there were none left in the botanical gardens! As a result of these regular thefts, AVBG had little choice but to keep its collection of over 250 cacti species under lock and key in their specially constructed cactus house. Gradually, I began noticing a pattern in the cases—while the species and types of plants targeted seemed random, they had a common denominator. Almost all the plants that were stolen were of ornamental value, and had gone "viral" on the internet at some point. So it was not the priceless orchids native to the Western Ghats that were stolen, but the showy and common *Cattleya*; ray ferns native to the local sandstone hills—and almost impossible to find in cultivation—were left alone in favour of the exotic carnivorous plants; and the *Stapeliads* from South Africa in the cactus house were passed over for the internet-famous *Astrophytum* with its attractive white striations. I noticed the same trend in the Gurukula—while the sanctuary grows hundreds of species of rare plants from the Ghats, the species stolen belonged to the genera *Diffenbachia* and *Anthurium*. The latter, native to South America, has gained cult status in the plant world, with single cuttings being sold for well over $100 on online auction sites.

So, where is the problem? If the species being stolen are not native or endangered, and are easily replaceable, then apart from the inconvenience, aren't the thefts fairly benign? The answer is no, and to understand why, it's important to first understand how global plant trends work. To start with, these trends are not new.

From the Ottoman and later Dutch obsession with tulips in the 17th century, to the Victorian infatuation with tropical ferns and orchids, to the current craze over cacti and succulents in Japan, Singapore, and Southeast Asia, cultivating the unusual and exotic affords a rare thrill to growers. Historically, the possession of plants from across the world has been a powerful status symbol, and a way to show off one's wealth. Today, it is a hobby for millions, but the channels of status and popularity have shifted from ballrooms and glasshouses to the realm of social media.

Characteristically capricious, plant trends change with the fashions and sensibilities of the day. Dutch tulips famously crashed and caused economic ruin, and Victorian orchids became so common that now they bloom on supermarket shelves everywhere. But these unpredictable changes in popularity coupled with the amplifying power of the internet make for a potentially dangerous powder keg. During the global COVID-19 pandemic, lockdown restrictions and online retail spurred a global surge in the number of people buying houseplants. Google searches for the term "gardening" spiked in March 2020, reaching an all-time high by May. Trends around owning ornamental plants sweeping social media can quickly translate into a massive demand for rare and unusual species, and this demand can be fulfilled by online retailers, nurseries and individuals, in an almost undetectable manner. Many plant conservationists fear for the remaining populations of rare species in the wild, should they be the targets of the next social media trend.

Horticultural trends have undeniably had effects on wild plant populations in the past, and in many cases continue to do so today. Foliage plants such as *Peperomia, Hoya, Anthurium, and Begonia*, are routinely smuggled out of South America,



Southeast Asia and tropical forests elsewhere—often, many of these species are new to science. In the coastal cliff habitats of California in North America, wild populations of *Dudleya*, a rare genus of succulents, have been nearly exhausted due to illegal collection for sale in the exotic plant trade. Similarly, many South African succulents, such as *Conophytum*, have also been over-collected for horticultural trade to the point of endangerment. In fact, several online sale/auction websites prevalent among enthusiasts place a premium on rare and 'unclassified' species.

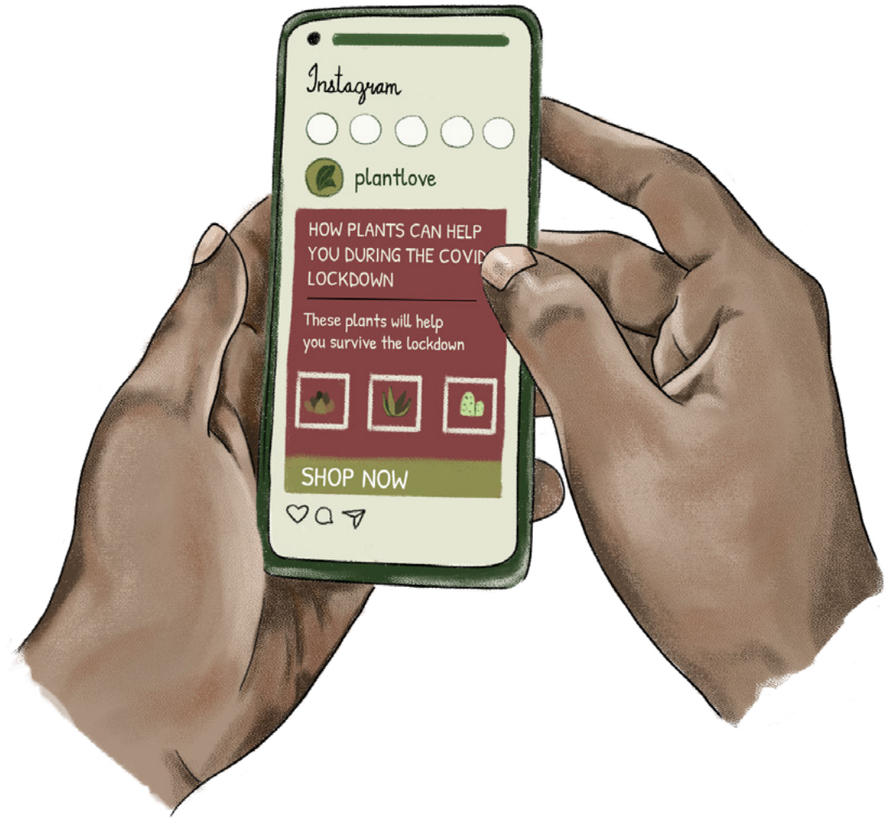
The anthropogenic Allee effect—a term used in wildlife trade to describe a syndrome of increasing prices with increasing rarity—applies robustly to the plant kingdom as well. CITES is a multilateral treaty that aims to protect endangered plants and animals by ensuring that international trade does not threaten their survival in the wild. While wildlife trafficking gets plenty of media attention, few people realise that of the 37,000 species currently protected under CITES regulations, more than 30,000 are plants, and over 90 percent of which belong to just one family: the orchids. Since horticultural demands for rare and unusual plants posing a threat to wild and endangered populations is a relatively new problem, conservation discourse is still divided on what may be the most effective way of addressing it.

Two broad viewpoints emerge on the horticulture of rare species. The first is vehemently against this, maintaining that it is too difficult to regulate and only feeds the dangerous premium on rarity. This viewpoint is supported by policies such as CITES which aim to regulate trade, but in practice make it nearly impossible to move plants and plant material across international borders, often even for accredited scientific institutions. Similarly, Gurukula Botanical Sanctuary maintains an ethos of pure environmental conservation by aiming to remain non-commercial and by not selling any of their plants on the grounds that the commercialisation of any lifeform is intrinsically unethical. Suprabha Seshan believes that to remain devoted to conservation, one must also work towards stalling species extinction, which in the case of plants means keeping them out of large-scale commercial trade. She also points to the politics of resource appropriation: plant trade in India has a colonial legacy, which arguably caused more harm than any other factor to Gurukula's regional Nilgiri ecosystem through the introduction of exotic species—many of which have since become invasive—for large-scale plantations.

The other point of view suggests that by making endangered plants common in horticulture, one could sate the ever-growing demand for exotic plants, preventing their collection from the wild. This could be a distinct possibility due to the ease of large-scale propagation techniques, such as tissue culture, which are commonly employed in commercial horticulture. Eminent botanical institutions seem to back this stance. For instance, at Kew Gardens in London, one can buy a Wollemi pine sapling—one of the most endangered conifers in the world—for a little over $70. Paul Blancheflower, Director of the Auroville Botanical Gardens, insists that this approach is the only feasible way of protecting plants in the wild, as well as in scientific collections, such as those at AVBG and Gurukula. This also provides an additional source of income to these institutions, which helps fund vital conservation work. Conversely, the efficacy of this approach may vary between species and relies heavily on the supply of rare plants, which is tightly controlled by various institutions.

While neither of these solutions is a silver bullet, they both have potential and their application in the real world is dictated by specifics of region, taxa, and demand. However, one must think carefully about the implications of tying conservation goals to something as erratic as the plant trade.

The very real possibility of increasing the premium on rarity looms over the solution—people will always want what they can't have, and in this case it may lead to further exploitation of wild populations. Two thirds of all cycad species, nearly half of all threatened cacti, and other plants prized as rarities and collectibles, are endangered due to over-collection and illegal trade—problems that horticulture has not addressed in the past. As we look to the future, we must ask whether cultivation can aid conservation, and if yes, how to frame and regulate it in a way that can truly be of value to conservation in the connected and clandestine age of the internet.



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Soham Kacker *is passionate about plants. Based in New Delhi, he is currently a research student at Ashoka University, focusing on plant ecology and conservation.*

Shivangi Pant *is a visual communicator working at the intersection of art and environment. She is an Art Editor at Current Conservation.*

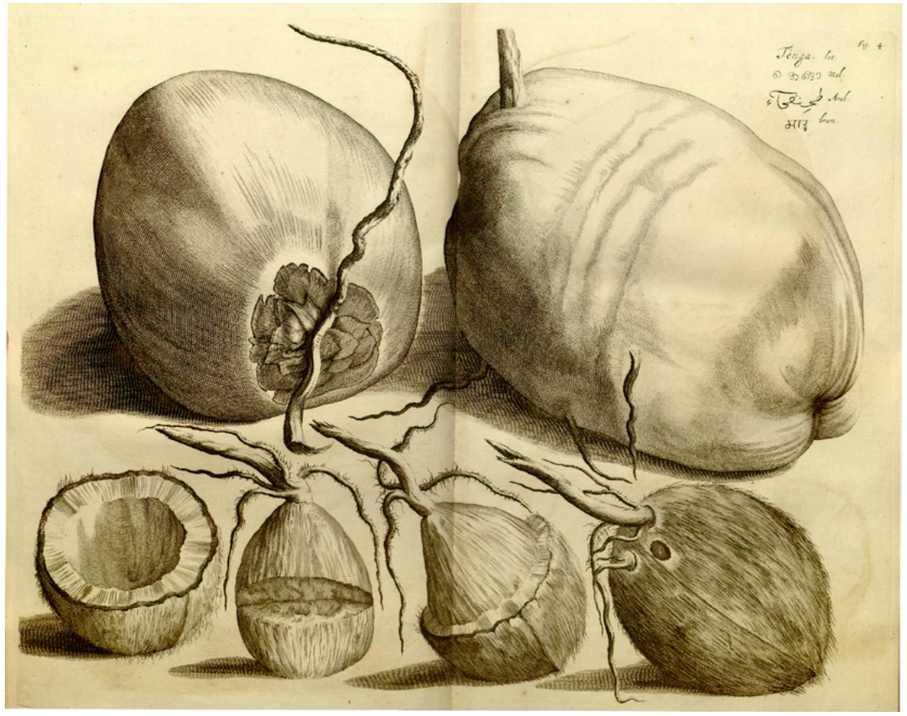
THE FRUIT OF OTHERS' LABOURS

Author **Madhuri Ramesh** | *Illustrator* **Srihari Gnanavelu**

Recently, on one of my aimless virtual rambles, I found myself re-reading commentaries on the significance of a pivotal botanical text—the *Hortus Malabaricus*. It struck me that when I had first read these articles around two decades ago, I had followed the plot only in a superficial way because I had believed that they were making a point about Dutch contributions to botanical classifications and nothing more. However, when I read the commentaries again recently, I had a 'light bulb' moment. I realised that the *Hortus* could be understood as a retelling of an earlier, ecologically embedded knowledge of plants. In other words, the *Hortus* was not a story of how the Dutch discovered various plants of the Malabar region and their uses, but rather, it was a story of how the Dutch discovered the traditional botanical knowledge of the Ezhava community of the Malabar region. In some ways, the most intriguing part of the *Hortus* tale is that its sequel unfolded three centuries later!

But let me begin at the beginning:

The *Hortus Malabaricus* in its original form is a weighty tome of 12 volumes, which were all written in Latin and published between the years 1678—1693. In total, it contained copious multi-sensorial descriptions of 780 plants of the Malabar region, including the localities and habitats in which they were found, the smell and taste of



Top and right: Pages from the *Hortus Malabarius*; Source: https://archive.org/details/HortusMalabaricus

various botanical parts, and the familial resemblances between different species. The text was accompanied by 794 meticulous illustrations that were labelled in Malayalam, Arabic, Roman, and Devanagiri scripts. (Some of the Malayalam names are still in use. That apart, the drawings were so true to life that three centuries later, scholars could identify the genus based on the illustrations alone.) It also documented the medicinal value and use of over 600 of these species.

This landmark volume was compiled by the Dutch governor of the Cochin region at that time, one Hendrik van Rheede dot Drakenstein. Van Rheede in particular, and the Dutch in general, were interested in competing with other European colonists to break the Arab monopoly over trade in medicinal and other economically useful plants of Asia. The Europeans were mostly unsuccessful in deciphering the botany of a region that was completely different from their own terrain, with two notable exceptions: Garcia da Orta who was the Portuguese author of a text on ethnomedicine, the *Colóquios dos simples e drogas da India* (published in 1563), and our protagonist, van Rheede. It appears that the latter was able to move past the cultural barrier to gaining botanical knowledge by developing a deep personal rapport with Indian experts on the Malabar region: an eminent physician from the Ezhava caste named Itty Achuden was the main contributor. He hailed from the Collet vaidya lineage of Carappuram (a place 25 km south of Cochin), and it was his ecologically embedded, practical knowledge that shaped the *Hortus*. Three Brahmin Ayurvedic practitioners Ranga Bhat, Vinayaka Pandit, and Appu Bhat also assisted van Rheede, but their understanding was largely textual and abstract.

Overall, it is estimated that the compilation of the *Hortus* involved the labours of 200-odd people, including Ezhava plant collectors, a select group of Indian physicians who 'peer reviewed' the manuscript, the interpreters of the Dutch East India Company, another select group of European botanists who further validated the species described. The collecting expeditions were supported by the Raja of Cochin and the Zamorin of Calicut and two wealthy Dutch patronesses, who financed the publishing costs but are merely referred to in the *Hortus* as 'the widow of John van Someren, the heir of John van Dyck, Henry, and the widow of Theodore Broom'.

What is striking about this entire process is the deep regard that van Rheede had for his Indian collaborators' knowledge. He acknowledges their role clearly in the frontispiece of the *Hortus*, in a historical period during which racism and Eurocentrism were par for the course. For example, a little-known fact is that Carolus Linnaeus, who is often dubbed 'the father of modern taxonomy', assiduously studied the *Hortus* in 1740 and extended the Ezhava taxonomic principles to describe over 200 new species.

Therefore, my newfound understanding was that if we pay careful attention to how certain texts and historical figures come to be lauded and remembered as authoritative sources of knowledge, in contrast to those who are ignored or rejected, we can also learn about the politics of science in that period, i.e. what counted as 'real' knowledge and who was valorised as its authors.

However, the story does not end here:

In 2003, the *Hortus Malabaricus* became much more accessible to botanists around the world when a rigorous English translation was published by an Indian botanist, Professor K. S. Manilal, who was also from the Malabar region (the modern state of Kerala). He later produced a Malayalam edition too.

Manilal's dedication to the task surpasses even van Rheede's because it took him several decades of gruelling work and it was completed with far less support. He not only faithfully translated over a thousand pages of 17th century Latin into English, but also added his own commentaries on the botanical descriptions in each volume. In an interesting inversion, Manilal's translation includes an appendix of plant names in Dutch. But perhaps his crowning achievement was to collect and reassemble a herbarium of almost all the species mentioned in the *Hortus* with help of one of his students and co-authors, C. R. Suresh (since van Rheede's original collection has disappeared). This mammoth project was supported by the University Grants Commission and the Smithsonian Institution.

By 1988, these efforts enabled Manilal to co-author the book *An interpretation of van Rheede's Hortus Malabaricus*, which is considered a classic by the International Association of Plant Taxonomists, as well as a fascinating Malayalam commentary in 1996, titled *A study on the role of Itty Achuden in the compilation of Hortus Malabaricus*. Understandably, the figure of Itty Achuden seems to have haunted Manilal over the decades that he engaged with the *Hortus*—he took extraordinary pains to gather material on this iconic but mysterious figure. But sadly, he found that there seemed to be neither other texts authored by Itty Achuden himself nor any trace of texts that might have informed the Collet vaidya lineage (since they were literate, hereditary physicians).

Manilal generously transferred the copyright to his path-breaking English translation to the University of Kerala for free in 2003 (followed by the copyright to the Malayalam edition in 2008). However, the institution proceeded to organise a

formal book release without even inviting the author. Fortunately, others were considerably more appreciative: over the span of his career, Manilal was awarded the Vishwambhar Puri medal by the Indian Botanical Society, Y. D. Tyagi gold medal by the Indian Association of Angiosperm Taxonomy, E. K. Janaki Ammal National Award for Taxonomy, the Padma Shri and the (Dutch) Order of the Orange-Nassau. But the most appropriate recognition perhaps is that other botanists have named several species of plants after him, such as *Lindernia manilaliana*. Incidentally, a 'liana' is a woody climber!

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Madhuri Ramesh *teaches in the School of Development, Azim Premji University. Her research focuses on the politics of biodiversity conservation and she is interested in inclusive forms of resource management.*

Srihari Gnanavelu *is an illustrator from Coimbatore, who draws unique characters from everyday life and weaves them into storylines. His goal is to create a brand of multimedia products centred around compositions, conveying the emotions that his stories carry.*

How culture threatens species

A note on Caryota urens in South India

Author **Madhu Ramnath** | *Illustrator* **Karunya Baskar**

Different human cultures have their own ways of conserving plant and animal species—sometimes this is in the form of tiny sacred groves, and other times it could include entire hillsides. In Central India, individual plant species figure in the first fruit ceremonies of the adivasi (indigenous) communities. During certain periods of the year, their fruits, flowers, leaves or seeds are not collected or consumed. This allows those species to rest for a few weeks or months during crucial periods for their growth or regeneration.

The norms around these practices or methods are often embedded within the cultural-religious traditions of communities. As a knowledge system being transferred between generations, seldom are they explained or discussed in terms of ecology or conservation. This may be a reason why, when things go wrong (overharvest, collection of immature seeds), there is no mechanism within the tradition that can set matters straight. This is especially true of species that are not much used within the culture, and hence have not received any particular attention, and whose slipping away from the collective forest or local flora goes unnoticed. A good example of such a species is 'menda' or *Litsea sebifera*, whose bark was harvested in great quantities for making incense sticks. Much of the Central Indian forests are now characterised by an absence of this species. Other such species that are extracted solely for commercial purposes, and outside of traditional norms, include 'baibidang' (*Embelia ribes*), 'sarpagandha' (*Rauwolfia sepentina*), and 'guduchi' (*Tinosporia cordifolia*).

The more common absences (or minimal presence) in forest settings are timber species—rosewood,

ebony, mahogany, red sanders, haldu, cedar—which have over the years been smuggled out for their value in furniture and construction. The only way to keep these species from declining in numbers is to cultivate them in private homesteads as well as in plantations. The official authority in charge of many of these species—and responsible for prohibiting their felling and transport—is the Forest Department.

THE CASE OF *CARYOTA URENS*

The fishtail palm *Caryota urens* ('kundapanai' or 'kunjapanai' in Tamil and 'salopa' in Odia) may soon be added to our list of endangered species in India, especially in Tamil Nadu. *Caryota* is a genus of tall palms with a few broad, bipinnate leaves. There are ten species which are distributed from India to Australia. The name Caryota comes from the Greek *karyota*, 'date-shaped nut', and urens refers to the stinging, needle-like crystals in the outer covering of the fruit. The kundapanai, *C. urens*, can grow more than 15 m tall but is usually between 10–12 m high. The trunk is slightly ringed and the leaves start at a height of 5–7 m.

In Tamil Nadu, especially in the districts of Theni, Madurai, Palani, and Dindigul, the tree is used in decorative 'pandals'—makeshift venues erected for events. The entire flowering stalk, usually with the long string of immature seeds, is lopped off the tree and then hung at the entrance of wedding halls, temples, venues where political speeches are given, house-warming ceremonies, and so on. These decorations, especially for events and ceremonies in temples, is a norm strictly followed. The devotees of a temple may go to great lengths to find and procure the required materials, especially the kundapanai stalks. Once the event is over, these stalks are simply discarded.

For a few months after March, when the temple festivities begin, marauding gangs come to harvest stalks of the fishtail palm, and often the fronds too, going about their business with a righteous air. They enter private lands and estates as well as protected forests, with equal impunity and take what they can. Their announcement that they are taking the flowering stalks to decorate such-and-such a temple is expected to prevent any dissent or disagreement. Most of these gangs come prepared with pickup trucks to load the stalks in, accompanied by about 15–20 men on motorcycles, with ropes and machetes. No checkposts or authorities dare to stop them.

Through the spring and summer months, such gangs come regularly into the hills and forested regions of these districts, leaving mutilated palm trunks in their wake. Many of these people have now become traders in palm stalks with no religious intention to decorate any temple—they cater only to the demand.

With the large number of temples in Tamil Nadu (79,154 according to a recent survey), it is not surprising that there is a constant demand for palm fronds and stalks. Add to this the large number of unsurveyed temples and private events that demand their share of 'pandals', and one gets an idea of how vulnerable the fishtail palm is likely to become.

In the Central Indian context (Chhattisgarh, Madhya Pradesh, Odisha, Jharkhand), the flowering stalk of the palm is tapped for toddy. In some places the toddy is then converted to jaggery (a coarse dark brown sugar), a litre of toddy yielding about 125 mg of jaggery. Here too, the tapping destroys or prevents the formation of new seeds, leading to a dearth of mature seeds that will regenerate and grow into new plants. However, among these communities there is a consciousness that unless there are new palm trees the overall flow of their beloved toddy will come to a stop! This makes people spare a flowering stalk or two just for seed, and there is a desire to nurture palms in their backyards and homesteads. Owning, trading and tapping toddy palms is a matter of pride within the community. Such an attachment to the species ensures that the palm is in safe hands, despite the detrimental usage.

LOOKING AHEAD

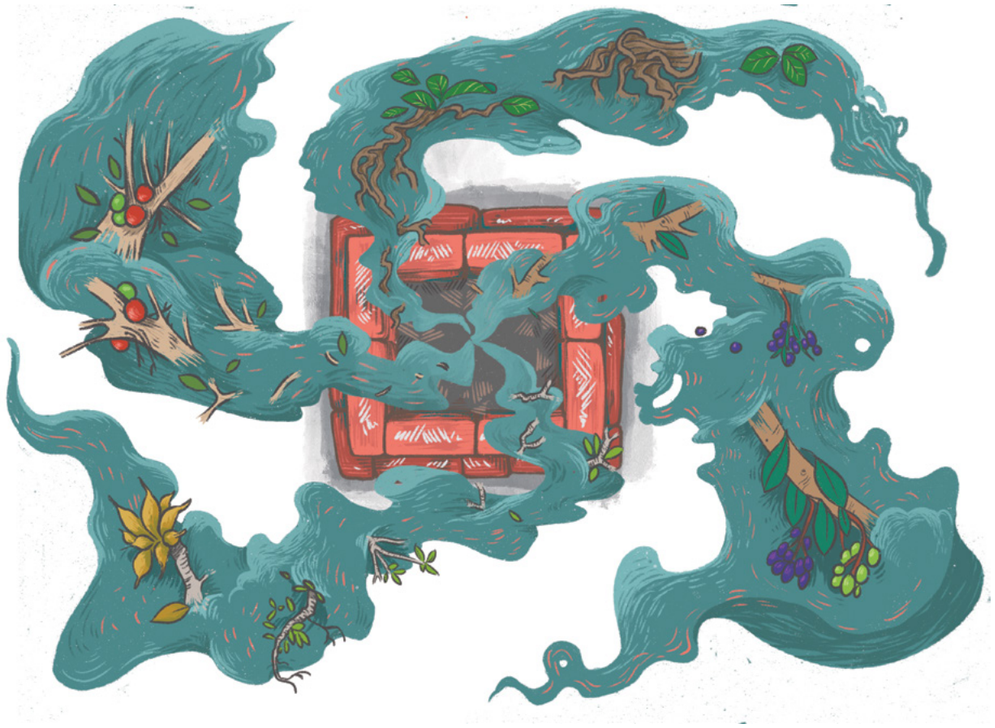
There are no attempts to grow the palm in Tamil Nadu as they do in Central India. Moreover, there is little or no knowledge about seed collection or the time and conditions required for the seeds to germinate. Discussions with the people who come to harvest the flowering stalks reveal that most of them have not even seen the seed or sapling. There are no efforts by the government or private nurseries to cultivate these palms at a large scale: all the flowering stalks harvested necessarily come from the wild. Elephants are also known to relish the leaves of the toddy palm, and occasionally elephant keepers come to the hills looking for this particular fodder.

Caryota seeds have a long viability and can tolerate the vagaries of both soil and weather. Even under controlled conditions they take about six to 12 weeks to germinate, as compared to naturally dispersed seeds, which can take up to six months. The fruits are consumed by monkeys and civets. Seeds found in their droppings germinate well. Though the long seed viability is an excellent strategy for survival in the wild, there is little one can do if flowering stalks are lopped off before the seeds mature, due to cultural-religious reasons.

The decline of the fishtail palm is mainly due to a cultural-religious custom and more difficult to

stop or correct than if it was a blatantly commercial phenomenon. Moreover, a recent conversation with members of SEEDs Trust, an NGO working in Tamil Nadu, revealed that in some villages in the Natham Block of Dindigul district, people are engaged in felling specific trees–'atthi' (*Ficus glomerata*), 'ala' (*Ficus benghalensis*), 'arasu' (*Ficus religiosa*), 'illipe' (*Madhuca indica*), 'naval' (*Syzigium cumini*), and a few others— and then chopping the trees into little bits. These bits are dried, mixed, and packed into bags of specific quantities, before being smuggled out. Such wood is apparently used in the performance of Vedic 'homam' rituals, which involve a ceremony around a fire that uses such wood species.

It is necessary that the concerned authorities deliberate on the new cultural trends that are detrimental to plant species. Biologists can flag these issues, but it requires leaders and officials from other sectors and departments to stem the losses to our natural resources. There is a real danger of more and more species being included in the so-called cultural-religious "traditions" of a people and slipping out of any rational intervention to save them.



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Madhu Ramnath *is a student of adivasi botany and has spent many years in Bastar, Chhattisgarh.*

Karunya Baskar *is a visual designer and artist who loves to travel. Whether it's scuba diving, surfing or trekking through the hills, she's always up for an outdoor adventure.*

THE MIGHTY INDIAN REDWOOD TREE

Authors **Namitha L. H. & Suhara Beevy S.** | *Illustrator* **Jisha Unnikrishnan**

In the tropical evergreen forests of the southern Western Ghats of India—more than 9000 miles away from the land of the largest tree in the world, the California redwood (*Sequoia sempervirens*)—dwells the Tirunelveli redwood tree (*Gluta travancorica*). Clustered populations of this majestic tree grow to a height of 35–45 m and are distributed in discontinuous small as well as large patches at an elevational range of 300–1200 m above sea level. The species belongs to the family Anacardiaceae, commonly known as the cashew family or the sumac family. Gluta comes from the Latin word 'gluten' or 'glutus', referring to the petals which are glued to the stipe (the stalk that supports the flower's ovary, while travancorica refers to the erstwhile kingdom of Travancore, where the tree occurs. Different vernacular names like 'thenmavu', 'thodappei', 'chenkurinji', and 'shenkurinji' have been attributed to the tree, based on its distribution in the South Indian states of Tamil Nadu and Kerala.

According to the IUCN Red List database, the Tirunelveli redwood or chenkurinji is classified as '**near threatened**'. The species was heavily logged for its ornamental hardwood in the past, during the reign of the Travancore kings, and later by the British. This red-coloured heartwood was

cut down for building construction, making cabinets and furniture, decorative interior joinery, turnery articles and carvings, tool handles, and shipbuilding. The bruised surface of the bark of *G. travancorica* and allied species exudes an acrid resinous juice that turns black on air exposure and is used as lacquer. One such species, *Gluta usitata*, is commonly known as Burmese lacquer because of the characteristic bole, which is tapped for its lacquer. Most species in the Anacardiaceae family contain an irritant class of compounds called urushiols. Similarly, the resinous exudate from *G. travancorica* can cause extreme contact allergies in some people. Therefore, caution should be exercised while touching any part of this tree.

In the current scenario, logging of *G. travancorica* is strictly prohibited by the Kerala Preservation of Trees Act 1986. This has curbed the extent of logging. However, chenkurinji is a sensitive, altitude-specific tree, especially at the seedling stage. This has put a massive dent in the afforestation activities focused on the species in the past few years.

There are few places like the Western Ghats, which is considered one of the 'hottest' biodiversity hotspots in the world. It has been estimated that around **5800 species** of flowering plants are located here, of which 56 genera and 2100 species (which includes 650 trees) are categorised as endemic to this region. *G. travancorica* is one such tree which is so uniquely and narrowly endemic that the Shendurney Wildlife Sanctuary in Kerala is named after the vernacular name of the tree—chenkurinji. In 1984, the Shendurney Valley was proclaimed a Wildlife Sanctuary and became the only Sanctuary in the Kollam district to date.

In its native habitat, a few other tree species commonly associated with *G. travancorica* are *Cullenia exarillata, Mesua ferrea*, and *Palaquium ellipticum*. Another notable feature is the tree's association with understorey species from the genera *Pandanus* and *Calamus*. This undergrowth protects the seedlings from being grazed by foraging animals. Eventually, when a forest gap is created, those seedlings with greater survival ability will emerge from the undergrowth.

The extreme pruning of these lower canopy associates is more prominent in areas where there is tourist activity. The sholas (tropical montane grasslands) of Ponmudi, which are home to a few hundred chenkurinji trees, have a substantial tourist presence, which has resulted in the clearing of many spiny plants like *Calamus*. This clearing, in conjunction with trampling by visitors, has left the forest floor devoid of the ideal environment for the seeds to grow. The adjacent area of Brymore is also home to a small population of *Gluta* with nearly 50 individuals. But in this area, fireline burning often destroys fallen mature seeds. These are also common issues faced by most other native trees sharing a similar habitat.

The story of the ancestors of the genus *Gluta* dates back to 200 million years ago when the Gondwana land started splitting. Of the 35 or more *Gluta* species present in the world, most are spread across Southeast Asia, and only three are found in isolated land masses outside the Malayan Peninsula. The three deviants are *G. tourtour* in Madagascar, the highly threatened *G.papuana* in Papua New Guinea, and the near threatened *G. travancorica* in the Western Ghats of India. The common ancestor of *G. tourtour* and *G. travancorica* got separated when Madagascar and India split about 70 million years ago. The Indian subcontinent collided with Asia and has been moving northeast from Africa ever since. Buried within the character traits in their seeds lie untold stories and the long-forgotten origins of the species. *G. tourtour* is a species endemic to the coastal marshlands of Madagascar. After millions of years of geographic isolation and evolution the species has adapted to live in a mangrove ecosystem and also shows vivipary—the ability of seeds to germinate when still attached to the parent tree. Remnants of this unique feature of marshland *Glutas* can be seen in the montane species—*G. travancorica*. Among the thousan ds of seeds produced by chenkurinji trees, a few show vivipary, especially if these seeds are shed during the peak monsoon.

Gluta usitata is a common species of *Gluta* found in many parts of Southeast Asia. It is characterised by pinkish-white petals which are modified to form

wings in mature fruits. This is a very efficient seed dispersal technique that was lost in *G. travancorica* and a few other species after the split of Gondwana land, when they became isolated and started evolving separately. Fossil wood resembling the modern day *G. travancorica*, and dating back to the Early Eocene period nearly 50 million years ago, was unearthed from a lignite mine in the Bharuch district of Gujarat. This shines some light on the present day *Gluta travancorica*, which diverged from a tropical wetland gene pool and must have been present throughout India at some point in history. As the Indian subcontinent moved away from the Equator, the central and northern regions of India, which once were home to dense tropical forests, gradually turned to arid scrub jungles and deserts. This northeast movement of the Indian plate at a rate of 5 cm/year is an ongoing process. Accompanied by the current level of global climate change and rising global temperature, there will be imminent changes in the tropical forests of the Western Ghats. Therefore, from a geological evolutionary point of view, the future of *G. travancorica* is uncertain. Returning to the present, the poor rate at which new seedlings are establishing and growing into adult trees in the forests, coupled with the narrow distribution are issues that can further endanger *G. travanacorica* populations. Since trees take several decades to mature into an adult population from seeds, a lack of regeneration and establishment becomes alarming, despite having a sizable stable adult tree population in-situ.

Other species of *Gluta* have seeds floating across oceans and flying over picturesque mountains only to fall on suitable substrate and eventually germinate. Evolution has left chenkurinji handicapped in both these respects. Yet, there's hope because field studies of the population have revealed strong survival traits, such as regrowth of fire-destroyed tree stumps, new shoot emergence in dried-up seedlings, and seeds germinating after being buried in leaf litter on the forest floor for nearly a year. However, given the imminent threats of tourism, landslides, and the construction of roads, there is an immediate need for implementing action plans to extend its natural habitat. The best conservation plan for habitat-specific trees like *G. travancorica*, is to reintroduce seedlings in forest gaps in the same environment where they grow naturally.

Further Reading

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Namitha L. H. *teaches Botany at Bishop Moore College, India. Her research focus is on the conservation of Gluta travancorica, a tree endemic to the Western Ghats.*

Jisha Unnikrishnan *is an illustrator and print designer based in Ahmedabad. She considers her illustration work as a constant form of study—of nature, people and culture and believes in art as a powerful tool to understand and communicate.*