

ABOUT ICFRE - IFGTB

ICFRE - Institute of Forest Genetics and Tree Breeding (ICFRE - IFGTB), Coimbatore is a National Research Institute under the Indian Council of Forestry Research and Education. ICFRE - IFGTB envisions a wood secure society. The Institute primarily aims to carry out research to improve productivity of forest tree species through conventional breeding programmes and biotechnological interventions. The major areas of research include tree improvement, breeding, planting stock improvement, marker assisted selection, genomics, clonal propagation, agroforestry systems, climate change research, integrated disease and pest management, seed handling and testing, eco restoration and conservation.

ABOUT EIACP

EIACP (erstwhile ENVIS) established by the Government of India, in 1982 has been providing environmental information to decision makers, policy planners, scientists and engineers, research workers, etc. all over the country. It is a comprehensive decentralized information system on environment involving effective participation of institutions / organisations in the country actively engaged in work relating to different subject areas of environment. A large number of nodes, known as EIACP PC RP (erstwhile ENVIS Centres), have been established in the network to cover the broad subject areas of environment with a Focal Point in the Ministry of Environment, Forest and Climate Change.

INSTRUCTIONS TO CONTRIBUTORS

Dear Author/Subscriber/Contributor,

We invite contributions to the EIACP Newsletter issues! The EIACP Resource Partner at ICFRE-IFGTB focuses on Forest Genetic Resources and Tree Improvement. It aims to act as a window for quality scientific publications and a forum for presenting your thinking on the challenges in the fields of FGRs and tree improvement. The EIACP Newsletter, Van Vigyan, a quarterly publication, publishes original research articles, reviews, reports, research highlights, news-scan etc., related to the thematic area of the EIACP Resource Partner. Original research and review articles, notes, research and meeting reports are invited for the newsletter. Details of forthcoming conferences / seminars / symposia / trainings / workshops also will be considered for publication in the newsletter. Articles may be sent in Times New Roman (with font size 12) in double spacing with a maximum of 5-6 typed pages. Photographs/line drawings and graphs need to be of good quality with clarity for reproduction in the newsletter. Only electronic submission will be accepted.

Details may be sent to: ifgtb@envis.nic.in.

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EIACP Newsletter Forest Genetic Resources & Tree Improvement

VAN VIGYAN

ICFRE - INSTITUTE OF FOREST GENETICS AND TREE BREEDING
(Indian Council of Forestry Research and Education)

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From the
Director's Desk

The Van Vigyan newsletter serves as a conduit for disseminating research findings to stakeholders. This edition provides thorough insights into *Garcinia gummi-gutta*, along with details on diverse activities conducted over the past three months. It aims to be a valuable resource for researchers, educators, students, and others interested in the field. Feedback and suggestions are welcome to further enhance its utility and effectiveness.

Dr C. Kunhikannan
Director, ICFRE - IFGTB

In this issue

1. Know Your Trees - *Garcinia gummi-gutta* (L.) N. Robson.
2. EIACP Activities
3. ICFRE - IFGTB Products

Know your trees - *Garcinia gummi-gutta* (L.) N. Robson

Introduction

Garcinia gummi-gutta (L.) N. Robson also known as *G. cambogia* Desr., is a member of Clusiaceae family. This genus *Garcinia* encompasses a diverse range of evergreen fruit tree species primarily found in tropical and subtropical regions (Baas, 2017). The significance of *Garcinia* within the flora of the south Western Ghats is notable, with the genus being named in honor of the Dutch army doctor and naturalist Laurentius Garcin (Angami *et al.*, 2021). The cultivation of *Garcinia* species is widespread, with approximately 30 species under cultivation out of the 200 known worldwide (Abraham *et al.*, 2006). In India alone, around 36 species have been reported, with 11 of them being endemic to the south Western Ghats. One notable species, *Garcinia indica*, is categorized as Vulnerable A2cd according to the IUCN, and is restricted to India and Sri Lanka (Patil *et al.*, 2005). The genus *Garcinia* holds immense socio-economic value due to the presence of numerous valuable species, leading to its



recognition as 'A Gold Mine of Future Therapeutics' (Angami *et al.*, 2021). These species are not only vital for their ecological roles but also for their potential in various fields including pharmaceuticals, nutraceuticals, and traditional medicine. Further exploration and research into the diverse properties and applications of *Garcinia* species are crucial for unlocking their full potential for human well-being and environmental conservation.

Distribution and habitat

G. gummi-gutta, commonly known as Brindle berry or Malabar tamarind, is a medium-sized to large fruit tree highly prized for its fruits. It is believed to have originated from Southeast Asia, with the south Western Ghats of India identified as one of its secondary centers of origin (Parthasarathy *et al.*, 2013; Parthasarathy and Nandakishore, 2014). This species has been introduced to various other tropical and subtropical regions in Asia, including China, Malaysia, and the Philippines (Orwa *et al.*, 2009). Additionally, it is endemic to the Western Ghats and Sri Lanka (Ramesh and Pascal, 1997).

G. gummi-gutta thrives prolifically in Peninsular India and western Sri Lanka, particularly along streams at lower altitudes ranging from 300 to 750 meters above the sea level. It is extensively cultivated in the coastal regions of Gujarat, the Konkan region of Maharashtra, Goa, Karnataka, as well as in both wild and domestic habitats of Kerala and Tamil Nadu. In Kerala, this fruit tree is particularly valued and is commonly maintained in homesteads primarily for its fruits (Abraham *et al.*, 2006). The geographical distribution and cultivation of *Garcinia gummi-gutta* highlight its

importance both as a cultural and economic asset in various regions, contributing to local economies and diets. Additionally, its adaptability to diverse environments underscores its potential for further exploration and utilization in different parts of the world.

Botanical description

G. gummi-gutta is an evergreen tree, 5-20m tall, about 70cm dbh, with dark smooth, lactiferous bark and horizontal or drooping branches. Leaves are simple, entire, opposite, petiolate (1.2-2.2 cm long), coriaceous, glossy dark green, elliptic-ovate to obovate, 1-13 long, 2-8 cm wide, shortly acuminate tip, tapered based, sub-acute and glabrous. Flowers are either androecious or bisexual, thus it is an andromonoecious species. Male flowers occur in axillary clusters of 4-8, with long membranous sepals and concave, oblong petals which are twice as long as sepals, with monadelphous cluster of 16-18 stamens attached to a pistillode with a non-functional stigma. Hermaphrodite flowers occur solitary or in 2-3 flowered axillary or terminal clusters, with 4 greenish white, 4-6 mm long persistent sepals and 4 greenish-white, pink, or reddish, fleshy, 5-10 mm long petals, stamens 8-12 free or in 2-3 bundles, ovary globose and superior crowned by a sessile, circular papillate stigma with 8-10 tuberculate stigmatic rays. The fruit is a fleshy, globose, sub-globose to ovoid berry, 7-10 cm in diameter, green turning yellow, orangey or reddish when ripe, fluted with 5-13 longitudinal grooves, not grooved to the tip. The fruit is capped by the persistent calyx at the terminal end and a rosette of 4-5 triangular remnants of the stigma at protruding nipple-shaped mamilla. Seeds 6-8, smooth, pale brown, oval, 12 mm long, surrounded by a succulent reddish or whitish succulent aril.

Reproductive biology and breeding system

The studies by Richards (1990), Joshi *et al.* (2006), Abraham *et al.* (2006), and Joseph *et al.* (2014) have erroneously classified it as a true dioecious species. In Kerala, the flowering season typically spans from January to April, although in high-altitude areas of the Western Ghats with colder temperatures and increased precipitation, flowering may be delayed by about a month. Male trees of *G. gummi-gutta* generally initiate flowering earlier than hermaphrodite trees, regardless of altitude. Flower morphology in *G. gummi-gutta* reveals distinct characteristics between male and hermaphrodite specimens. Male flowers are typically arranged in clusters, whereas hermaphrodite flowers are solitary or occur in clusters of 1-4. Male flowers are smaller, elongated, and pale yellow or flesh-colored, while hermaphrodite flowers are larger, less

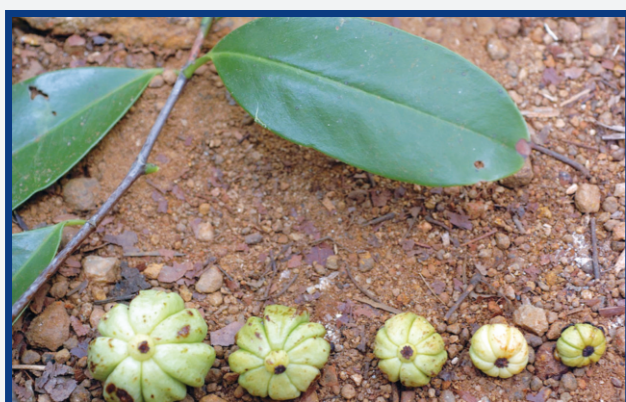


elongated, and exhibit yellow or pink hues (Raven *et al.*, 1986). Stamens vary in number from 1 to 26 in hermaphrodite flowers, with a reduction in size and pollen grain count compared to male flowers. Gynoecium structure comprises a superior ovary with 5-11 ovaries, lacking a style and featuring a lobed stigma with a central pit.

Pollen germination studies conducted by George *et al.* (1992) demonstrate lower germination rates in male flowers (25%) compared to hermaphrodite flowers (0%) in artificial germination mediums. Hermaphrodite flowers exhibit an inability of pollen grains to germinate on the stigmatic surface, suggesting facultative apomictic seed setting and fruit formation. Fruit setting percentages vary, with hermaphrodite trees showing approximately 6.07% fruit set, contrasting with George *et al.* (1992) finding of 20% fruit set in hermaphrodite trees. These insights into the reproductive biology of *G. gummi-gutta* provide valuable information for understanding its breeding mechanisms and fruit production dynamics, essential for its effective cultivation and management.

Fruit collection and processing

Harvesting mature yellow ripe fruits of *G. gummi-gutta* requires careful techniques to



ensure optimal quality. Fruits should be carefully picked from the tree either by climbing or using pole pruners (George *et al.*, 1992). Once collected, the fruits are spread on the ground under the sun for one day to facilitate uniform ripening (Abraham *et al.*, 2006). Fully ripe yellow fruits can then be de-pulped using a knife to extract the seeds, which are subsequently washed in water to remove any pulp adhering to the seed coat (Raven *et al.*, 1986). The seeds are manually extracted by hand, with the fleshy outer rinds of the fruits removed to access the seeds by removing the fleshy juicy aril (Joseph *et al.*, 2014). After extraction, the seeds are washed again in water and spread on the ground to prevent excess moisture accumulation. For optimal preservation, shade drying the seeds for two weeks is preferable to sun drying (George *et al.*, 1992). Freshly extracted seeds and those surface dried exhibit initial moisture content and germination rates of 35.84% and 5%,

respectively (George *et al.*, 1992). Germination is a slow process, typically initiating only after two months of sowing (Joseph *et al.*, 2014).

Germination

Primates play a crucial role in the dispersal of *G. gummi-gutta* fruits, aiding in the distribution of seeds away from parent trees and thereby enhancing the likelihood of seed and seedling survival (Rai, 2003). However, the species face challenges with poor initial germination rates, necessitating pre-sowing treatments for improvement. The presence of gummy seed pulp and coats inhibits germination, but effective pre-treatments such as sand abrasion, kerosene wash, seed coat removal, or soaking in 0.9% sodium chloride for one hour have been identified, significantly enhancing germination from a meager 5% to a substantial 45% (Rai, 2003).

Furthermore, studies have revealed that *G. gummi-gutta* seeds exhibit desiccation tolerance but are sensitive to temperature fluctuations. Despite possessing approximately 35% initial moisture content, their shelf life under ambient conditions is limited to less than a year. Interestingly, desiccation does not adversely affect seed viability, leading to its classification as an intermediate seed with a tendency towards recalcitrance. When subjected to desiccation, seeds show a gradual decrease in germination, yet they display desiccation tolerance, as evidenced by the lack of significant variation in germination rates among different treatments. Additionally, after-ripening processes occur during storage, with seeds demonstrating good germination rates (53%) after six months when stored at various temperatures, indicating their tropical dormant recalcitrant nature (Joshi *et al.*, 2017).

The intensive harvesting of *G. gummi-gutta* fruits from forests, with 90 to 95% of fruits being removed in high harvest areas, poses a threat to natural regeneration (Joshi *et al.*, 2006). However, it has been observed that sections of the seeds can develop into complete seedlings, contributing to the species' regeneration despite high fruit removal rates. *G. gummi-gutta* seeds are a significant food source for frugivores such as primates, civets, and arboreal squirrels, who are also the main seed dispersers. Each fruit contains six to seven seeds, with the probability of seed damage during frugivory. Surprisingly, seeds with damaged seed coats exhibit higher germination rates compared to intact ones, although defecated seeds display poor germination due to inhibition by undamaged seed coats (Lieberman and Lieberman, 1986).

In response to the pressures of high fruit removal rates and potential pest infestation, the species relies on its ability to establish from any seed fragment containing vasculature. However, as food reserves deplete over time, the seeds gradually lose their ability to regenerate (Joshi *et al.*, 2006). These findings underscore the intricate balance between ecological interactions, seed characteristics, and species survival strategies in *Garcinia gummi-gutta*.

Vegetative propagation

Vegetative propagation methods, such as utilizing juvenile stem cuttings treated with the plant hormone indole-3-butyric acid (IBA), have proven highly effective for the rapid multiplication of *Garcinia gummi-gutta* (Nair *et al.*, 2002).

Insect pests and diseases

G. gummi-gutta, faces various challenges posed by pests and diseases, which can significantly

impact its cultivation and productivity. Fruit borers, including larvae of beetles and moths, pose a significant threat by boring into the fruits, causing damage and reducing yield (Smith, *et al.*, 2020). Leaf miners, another common pest, create winding tunnels within the leaves, leading to discoloration and reduced photosynthetic efficiency (Jones and Brown, 2019). Fruit flies infest the fruits, feeding on the pulp and causes premature fruit drop (Garcia, *et al.*, 2018). Additionally, fungal diseases such as anthracnose and powdery mildew affect various plant parts, including fruits and leaves, leading to rotting, defoliation, and reduced fruit quality (Lee, 2016; White and Patel, 2017). Phytophthora root rot, a soil-borne fungal disease, causes root rot and stunted growth, ultimately resulting in plant death (Anderson and Jackson, 2018). To mitigate these challenges, integrated pest management (IPM) strategies and disease control measures should be employed, including regular monitoring, cultural practices, biological control, and judicious use of chemical interventions (Smith and Johnson, 2021). Selecting disease-resistant cultivars and maintaining optimal growing conditions can further enhance resilience against pests and diseases (Taylor, 2022).

Agroforestry practices

Agroforestry practices involving *G. gummi-gutta* are recognized for their potential to enhance agricultural productivity, biodiversity conservation, and economic sustainability. Research has shown that integrating *G. gummi-gutta* into agroforestry systems can offer numerous benefits. For instance, studies have demonstrated the viability of intercropping *G. gummi-gutta* with shade-tolerant crops such as coffee (*Coffea* spp.) and cocoa (*Theobroma*

cacao) (Girinath *et al.*, 2018). This practice optimizes land use efficiency and diversifies income sources for farmers. Alley cropping systems with *G. gummi-gutta* have been found to improve soil fertility, prevent erosion, and increase overall land productivity (Santoso *et al.*, 2020). By alternating rows of *G. gummi-gutta* with annual or perennial crops, farmers can maximize yields while maintaining soil health. Additionally, integrating livestock into *Garcinia gummi-gutta* agroforestry systems has been shown to enhance nutrient cycling and soil fertility (Jose *et al.*, 2019). Grazing animals contribute to vegetation management and provide natural fertilization, improving tree growth and productivity. By adopting these agroforestry practices, farmers can promote sustainable land management, enhance ecosystem services, and improve livelihoods in *G. gummi-gutta* cultivation areas.

Tree improvement

Recognizing the imperative for conservation, ongoing endeavors aim to identify, document, and conserve 24 diverse accessions collected from various districts across Karnataka, Kerala, and Goa. These accessions represent critical genetic diversity within the *Garcinia gummi-gutta* species. Notably, distinct sexual forms of flowers have been observed, including male flowers with and without pistillode, female flowers with staminodes, and bisexual flowers, each contributing to the species' reproductive diversity. In recent years, two particularly promising germplasms have been identified for their exceptional yield and other desirable traits. IC244100-2 (INGR No. 04061) and IC244111-1 (INGR No. 04062) exhibit early bearing, high fruit yield, substantial fruit weight, and other favorable characteristics, making them valuable

genetic resources for further breeding and cultivation efforts. Moreover, advancements in molecular biology have facilitated the development of markers to assess genetic diversity within *G. gummi-gutta* populations. Various marker systems, including random amplified polymorphic DNA (RAPD), inter-simple sequence repeat (ISSR), and microsatellites, have been utilized for genetic analysis and characterization (Mohan *et al.*, 2012; Parthasarathy *et al.*, 2013; Ravishankar *et al.*, 2017). These molecular tools enable precise evaluation of genetic variation and aid in formulating effective conservation strategies for this species. The escalation of endemism levels from 50% to 65% underscores the pressing need for proactive conservation initiatives to mitigate the decline in population size. Urgent measures are required to manage the genetic resources of *Garcinia*, both *in situ* and *ex situ*, to safeguard its genetic diversity and ensure the species' long-term survival in the face of mounting environmental challenges.

Utilization

G. gummi-gutta has been used traditionally in India for the treatment of ulcers, edema, constipation, delayed menstruation, haemorrhoids, fever, diarrhoea, dysentery, intestinal parasites, and open sores (Duke *et al.*, 2002). It is also used as anti-microbial, anti-fungal and anti-cancerous agent (Philip, 2014). It is well known for its natural antiobesity properties and used traditionally for reducing body weight and as a potential cholesterol lowering agent (Pittler and Ernst 2004; Thomas *et al.*, 2008). Fruit extract is used for the treatment of various diseases such as rheumatism, peptic ulcers and bowel complaints. Bark and leaf extract contain alkaloids and found



to have anti-inflammatory activity used for the treatment of bowel complaints (Dos Ries *et al.*, 2009). Dried rind is used for various culinary purposes which help to promote digestion; and a decoction is used against uterine diseases and Arthritis. The root of the plant is used against swelling of the whole body due to viper bite. The plant is shown to possess anticatarrhal, anthelmintic, antimicrobial, antioxidant and anti-cancer activities (Madappa and Bopaiah 2012). The plant has been used traditionally to cure respiratory infections such as sore throat and cough (Oluyemi *et al.* 2007). The resin obtained from the trees is used as a purgative. The dried rind is used for polishing gold and silver and as a substitute for acetic or formic acid in coagulating rubber latex (Lim, 2013). Being a medicinal as well as commercially important tree, dried rinds of the ripe fruit are used as a body weight reducer and condiment. The fruit juice or syrup having coolant properties (Orwa *et al.*, 2009). The fruits are sour in taste due to the presence of various organic acids of which the hydroxy citric acid is the staple ingredient which is used as an anti-obesity drug (Jena *et al.*, 2002). The fat yielded from seeds is used as vegetable butter in south India (Singh 1993). Its wood is hard and used in construction and furniture-making (Orwa *et al.*, 2009).

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EIACP ACTIVITIES

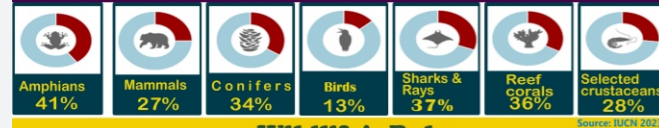
Wildlife Week 2023



WILDLIFE WEEK OCTOBER 2-8, 2023

Wildlife is of paramount importance for the health of our planet, the sustainability of ecosystems, and the well-being of human societies. Wildlife's contributions to human well-being are multifaceted and include economic, ecological, cultural, and educational aspects. Protecting and conserving wildlife is not only essential for their own survival but also for the overall health and well-being of human societies. Protecting and conserving wildlife is not only an ethical responsibility but also crucial for the long-term survival and prosperity of our planet and future generations.

More than 42,100 species are threatened with extinction. That is still 28% of all assessed species



Wildlife's Role

- Protects natural stability
- Promotes tourism
- Promotes pollination
- Helps in investigatory research
- Improves biodiversity
- Enhances food security
- Safeguards indigenous communities
- Preserves cultural heritage

What can be done to protect wildlife?



As part of this commemoration, an Elocution Competition on the theme "Significance of Wildlife" was conducted in which people from different walks participated. E Certificates were awarded to all the participants. An awareness poster highlighting the importance of wildlife conservation was released during the occasion and its copies were shared with students and all the stakeholders. Various school and college students took selfie in the LiFE Mission selfie points.

As part of Mission LiFE and Wildlife Week 2023, EIACP (Environmental Information, Awareness, Capacity Building and Livelihood Programme) Programme Centre (erstwhile IFGTB ENVIS) RP at the ICFRE - Institute of Forest Genetics and Tree Breeding, Coimbatore organized an awareness campaign. In addition, 02 Life Mission Selfie Points were installed in Gass Forest Museum and ICFRE-IFGTB Office respectively. The primary goal of these LiFE Selfie points is to raise awareness about the LiFE Mission among students and the general public, encouraging them to incorporate LiFE Mission activities into their daily lives by taking the LiFE Pledge.

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Regional Evaluation Workshop

ICFRE-IFGTB EIACP PC RP participated in the Regional Evaluation Workshop of EIACP Centres for South Zone on 09th and 10th October 2023 at Hotel Apollo Dimora, Thampanoor, Thiruvananthapuram. Year wise activities from 2019 to 2023 were presented. Officials from Southern EIACP hubs, RPS and Ministry were participated in the workshop.



Green Diwali 2023

IFGTB EIACP PC on Forest Genetic Resources and Tree Improvement at the Institute of Forest Genetics and Tree Breeding, Coimbatore organized an awareness campaign to spread the message on the importance of the celebration of Green Deepavali. Green Greetings on Green Deepavali Celebrations containing information on its need and the tips for celebrating the festival in a green way was released and disseminated to students, the general public, and various stakeholders.



CELEBRATE ECO FRIENDLY DIWALI



ICFRE-IFGTB EIACP
wishes happy & green diwali to you

Tips to celebrate green diwali

- Use traditional & green lightings
- Wisely dispose wastes after celebration
- Encourage eco-friendly gifts and decorating items
- Plant more trees
- Burst green crackers if inevitable

Let's join together to celebrate eco friendly diwali

World Soil Day 2023

As part of Mission LiFE and in connection with World Soil Day 2023 EIACP (Environmental Information, Awareness, Capacity Building and Livelihood Programme) Programme Centre (erstwhile IFGTB ENVIS) Resource Partner on Forest Genetic Resources and Tree Improvement at the ICFRE-Institute of Forest Genetics and Tree Breeding, Coimbatore organized an awareness campaign on 05.12.2023 at Corporation Higher Secondary School, Coimbatore.

A drawing competition on the theme “Soil and Water: A source of life” was conducted to the students of Corporation Higher Secondary School, North Coimbatore on 04.12.2023. Among the participants Shri M. Saran, Shri A. Azarudeen and Shri. Francis John Fredric Won the first, second and third prizes respectively. Shri J. Gowtham and Shri A. Arivarasan won consolation prizes. An Awareness Quiz on soil was also organized for students and the general public from 10.11.2023 to 05.12.2023.

People from all walks of life have participated and E Certificates were awarded to all. Copies of the awareness poster were disseminated to various schools & the general public in and around the district and its digital copies were shared with all the stakeholders. All the events were registered in the worldwide events organized by the FAO of the United Nations.

WORLD SOIL DAY - 2023
Theme: Soil & Water : A Source of Life

Our planet's survival depends on the precious link between soil and water. Over 95% of our food originates from these two fundamental resources. Soil water, vital for nutrient absorption by plants, binds our ecosystems together. By prioritizing the health of our soils and water systems, we can work towards securing a more resilient and sustainable future for both ecosystems and the human population. This involves a holistic approach that integrates ecological principles, technological innovations, and community engagement to promote environmental sustainability.

Did you Know ?

- 95% of our food comes from soils
- 33% of soils are degraded
- It can take up to 1000 years to produce just 2-3 cm of soil
- Soils supply 15 of the 18 naturally occurring chemical elements essential to plants
- There are more living organisms in a tablespoon of soil than people on Earth
- Over the last 70 years, the level of vitamins and nutrients in food has drastically decreased
- 2 billion people worldwide suffer from lack of micronutrients, known as hidden hunger
- Agricultural production will have to increase by 60% to meet the global food demand in 2050
- Up to 58% more food could be produced through sustainable soil management
- Up to half of our household waste could be composted to nurture our soil

Benefits of Healthy Soil

- Healthy soil purify, drain and store water, making it an indispensable foundation for life on Earth.
- Green water sustains crop growth and business production, facilitating nutrient uptake.
- 80% of our food comes from soils thanks to the power of water.
- Healthy soil plays a crucial role as a natural filter, purifying and storing water as it infiltrates into the ground.
- Each 1% increase in soil organic matter holds 100,000 litres of water per hectare.



International Mountain Day 2023

As part of Mission LiFE and in connection with International Mountain Day 2023 EIACP (Environmental Information, Awareness, Capacity Building and Livelihood Programme) Programme Centre (erstwhile IFGTB ENVIS) Resource Partner on Forest Genetic Resources and Tree Improvement at the ICFRE-Institute of Forest Genetics and Tree Breeding, Coimbatore organized an awareness campaign to the NSS volunteers of Government Arts College, Coimbatore. The campaign sought to shed light on the unique characteristics, significance, and challenges faced by mountain ecosystems, aiming to inspire individuals and communities to actively contribute to their conservation and sustainable management.

An eco-tour to Nilgiri Biosphere Natural Park (NBNP), Anaikatti was organized for the students to provide real time exposure to the significance and conservation of forest genetic resources and their role in preserving the mountain ecosystems.

INTERNATIONAL MOUNTAIN DAY - 2023
Theme : "Restoring Mountain Ecosystems"

International Mountain Day 2023, under the theme "Restoring mountain ecosystems" offers an opportunity to enhance understanding of the significance of mountain ecosystems. It encourages the promotion of nature-based solutions, adoption of best practices, and investments aimed at fostering resilience, diminishing vulnerability, and enhancing the adaptability of mountains to both daily challenges and extreme climatic events.

Benefits of Mountains

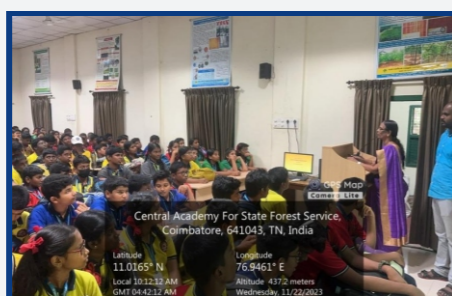
- Provides home for 1.1 billion people
- Host about half of the world's biodiversity hotspots
- Origin of 6 of the 20 most important food crops
- Forests cover around 40% of the global mountain area
- Provide upto 60-80% of the world's fresh water



Mission LiFE Activities

As part of Mission LiFE, the ICFRE-IFGTB EIACP organized comprehensive awareness campaigns targeting diverse groups including school and college students, industries, government sectors, petrol pumps, and other stakeholders. A total of 40 activities were meticulously conducted, engaging 7545 participants from varied backgrounds. During these initiatives, awareness materials were distributed, and practical tips promoting the adoption of a LiFE style were shared.

Moreover, as an extension of these efforts, the MoEFCC PRAKRITI program was implemented in Government Higher Secondary School, Sundapalayam, and Kendriya Vidyalaya, Puliyakulam. This program featured a series of informative lectures delivered to students, further reinforcing the importance of environmental awareness and sustainable practices within educational settings.



ICFRE - IFGTB PRODUCTS



ICFRE - INSTITUTE OF FOREST GENETICS AND TREE BREEDING

(Indian Council of Forestry Research and Education)

(An autonomous body of Ministry of Environment Forest & Climate Change, Govt. of India)
P.B. No. 1061, R.S. Puram, Coimbatore - 641 002. Tamil Nadu, India



The following Services are provided at ICFRE - IFGTB for various stakeholders. Please contact us for details as below.

Services		Cost per unit	Contact Number with Email ID
Clonal Seedling: For Sale & Booking			
1.	Clones of Casuarina Hybrids (CH-1, CH-2 & CH-5)	Rs. 4.50 per plant	Smt. K. Shanthi, CTO, Division of Plant Biotechnology, Phone : 0422 2484122 E-mail : shanthik@icfre.org
	Eucalyptus clones (EC-4, EC-6, EC-9 & EC-11)	Rs. 4.00 per plant	
2.	Tissue Culture Teak Plants Bamboos Plants	Rs. 55.00 per plant Rs. 25.00 per plant	Dr Rekha R. Warriar, Scientist - F & Head, Division of Chemistry & Bioprospecting Phone : 0422 2484167
3.	Windbreak Clones (WBC-1, WBC-2, WBC-3 & WBC-4)	Rs. 4 per plant	Dr. C. Buvaneshwaran, Scientist - G, Sliviculture & Forest Management Division, Phone : 0422 2484198, 94422 45047 E-mail : buvanesc@icfre.org
4.	ArborEasy® DNA Isolation Kit	Price Rs.	Dr. Modhumita Dasgupta, Scientist - G, Division of Plant Biotechnology Phone : 0422 2484115 E-mail : ghoshm@icfre.org gmodhumita@gmail.com
	10 Reactions	950.00	
	20 Reactions	1900.00	
	50 Reactions	4750.00	300.00
5.	Soil Testing (pH, EC, OC, Micro and Macro Nutrients)	Rs. 4750.00	Dr. A.C. Surya Prabha, Scientist - D, Sliviculture & Forest Management Division, Phone : 0422 2484150 E-mail : acsuryaprabha@icfre.org
6.	Phytosanitary Certificate	Rs. 100.00 + Tax per application	Dr. John Prasanth Jacob, Scientist - G, Forest Protection Division, Phone : 0422 2484157 E-mail : jacob@icfre.org

Products of IFGTB: For Sale & Booking			
7.	Hy-Act (Natural and Seed Oil Based Biopesticide)	Rs. 80.00 per bottle	Dr. N. Senthilkumar, Scientist - F Phone : 0422 2484193 Mobile : 9629160703 E-mail : senthink@icfre.org
	Tree PALH (Natural and Seed Oil Based Biopesticide)	Rs. 80.00 per bottle	
	Crawl clean (Plant Based Green Insecticide)	Rs. 25.00 per packet	(or)
	Tree Rich Biobooster (Instant Organic potting mixture for home garden, terrace and kitchen garden)	Rs. 50.00 per packet	Smt. R. Sumathi, CTO Division of Chemistry & Bioprospecting, Phone : 0422 2484144 Mobile : 9942245542 E-mail : sumathir@icfre.org
	Tara Red Jam (with natural fruit colorant)	Rs. 60.00 per bottle	