BFRI

at a Glance

Government of the People's Republic of Bangladesh

Bangladesh Forest Research Institute

Chattogram, Bangladesh

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BFRI
at a Glance

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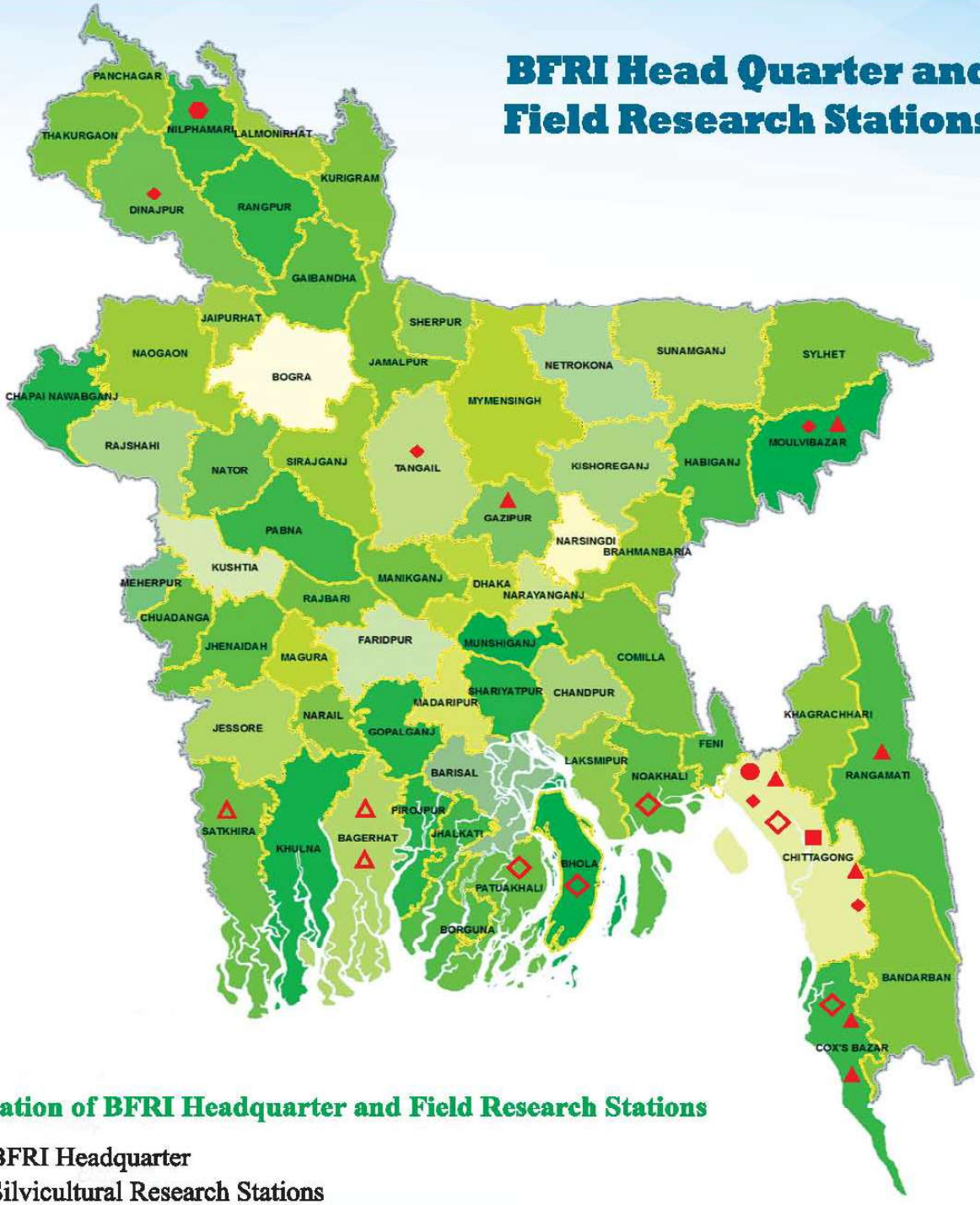
Bangladesh Map

BFRI Head Quarter and Field Research Stations



Location of BFRI Headquarter and Field Research Stations

- ■ BFRI Headquarter
- ◆ Silvicultural Research Stations
- ▲ Seed Orchard Research Stations
- ● Minor Forest Research Stations
- △ Mangrove Research Stations
- ◇ Plantation Trial Unit Research Stations
- ⬢ Regional Bamboo Research & Training Centre (RBRTC)

Message

It is my pleasure to see the BFRI ***at a Glance*** has taken a praise-worthy step to compile its strength, role and contributions in the forestry sector both to the readers at home and abroad. It has now been more than half century since the establishment of Bangladesh Forest Research Institute (BFRI) that it has become the center of excellence spearheading forestry research for increasing the productivity of forest land through improved management of forest resources, forest protection, tree improvement, efficient utilization of forest produces, improving livelihoods of forest dependent people, economic growth and natural resource conservation. The mandate of BFRI is to undertake research in all aspects of forestry aiming sustainable productivity of forest land and forest industries, reduce the demand-supply gap on forest, increasing the benefits derived from trees and forest resources through conservation and sustainable management practices innovation. Our research is focused on the conservation of natural forest ecosystem; identification the sustainable management of plantation forests; species site suitability and managing trees on farms; developing and promoting the quality of forest products and services; providing integrated pest and disease management; tree improvement and germplasm conservation; plant tissue culture, bio-technology and molecular biology. We also address the emerging issues such as climate change and any other field identified by the stakeholders. We strive to share the information and developed technologies among the stakeholders, communities, foresters, scientists and others. We also provide technical advice and technology transfer in partnership, collaboration and cooperation with various government agencies, NGOs and private sectors. The knowledge gained from research conducted at BFRI will continue to enhance socio-economic benefits for forest management practices around the country and aid in forest policy decision-making. BFRI is dedicated to address current forestry issues, while providing the opportunity, under secure conditions, to investigate anticipated forestry issues that have yet to arise.

It's my great privilege to be the Director of BFRI just before the start of centenary celebrations of birth anniversary of the founding Father of Bangladesh. I envision our institute as part of a vital strategy to invest in emerging research field and more devoted to conduct, support and encourage extensive research on forest related application and services. I encourage your presence in our institute which is a mesmerizing gift of nature and inspired by the innovation, ambition and creativity. Hopefully this brochure will be helpful for the readers to get an insight about BFRI in brief.

Dr. Md. Masudur Rahman
Director
Bangladesh Forest Research Institute

Seed Orchard Division

Seed Orchard Division is one of the largest field research division of Forest Management Wing of Bangladesh Forest Research Institute (BFRI). In 1975, as a scheme "Tree Improvement and Establishment of Seed Orchards" was taken up for the supply of required quantities of quality seeds to the Forest Department and other planters. According to Norman Jones (1977), in July 1975 fund was allotted for the scheme which led to the formation of Seed Orchard Division at BFRI, Chattogram. Six seed orchard centers were established within the first two financial years (1975-76 and 1976-77) these were Ukhia, Dulahazara, Hyankho seed orchard centers in Chattogram, Kaptai seed orchard center, in CHTs, Barshijura seed orchard center in Moulavibazar and Salna seed orchard center in Dhaka.

Plant propagation unit

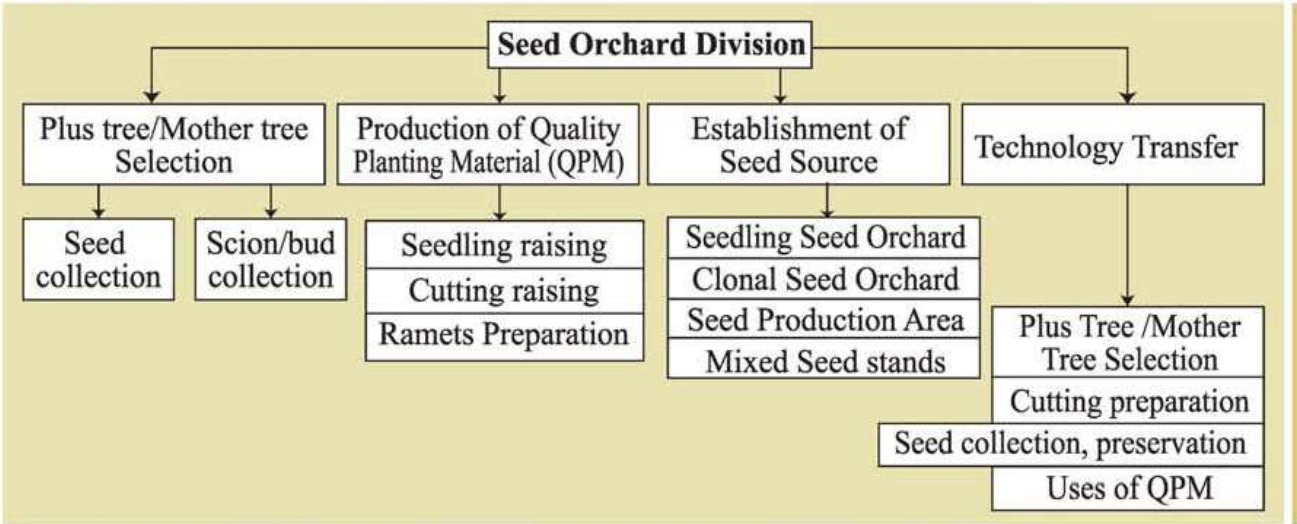
Cold room

Laboratory, SOD

Later on, three more centers one at Ichamoti in Chattogram, Baghaihat in CHTs and other one at Dhangmari, Sundarban, Khulna were initiated and partial facilities were developed. At present Baghaihat and Dhangmari are not remaining to Seed Orchard Division. All the field areas have been selected with due consideration of the plantation

programme, so that each seed orchard center could render services to a number of forest ranges. Since then it has been conducting research on different programme areas such as plant breeding and tree improvement, biodiversity and conservation of forest tree species. Under these areas several research studies have been executing through developing quality planting materials by selection of Plus tree/Mother tree, collection of quality seeds, raising quality seedlings, establishment of quality seed sources like Seedling Seed Orchard (SSO) and Clonal Seed Orchard (CSO), development of Seed Production Area (SPA) of major and threatened forest tree species.

Major Research Areas and Activities



Tree Improvement through Plus Tree Selection and Producing Quality Planting Materials

Development of quality seed sources of major forest tree species were started from the beginning of the establishment of Seed Orchard Division through Tree Improvement Program. Fifty-nine (59) plus tree/mother trees of major and threatened forest tree species have been selected at the different natural and plantation sites of forest areas, home garden and road sites of Bangladesh. Several propagation methods have been tried

Selected Plus Tree, Quality planting materials (seeds/seedlings/ramets/cuttings) at the nursery

on twenty two (22) major and threatened forest species to produce quality planting materials with varying rate of success. Among them vegetative propagation techniques of 15 important forest tree species have been developed and continued till date to produce quality planting materials for establishment of Seed Orchard.

Establishment of Quality Seed Source

Genetic base most of the plantation forest tree species of Bangladesh is going to be narrow, but it is necessary to enrich or broaden the genetic base of breeding populations for the major forest tree species. Quality planting materials are prerequisites to overcome such condition through creation of productive quality seed sources. It can be classified into three types (1) Plus Trees/Mother Trees (2) Seed Orchards and (3) Seed Production Areas. Seed Orchard Division established sixty seven (67) hectares seed orchard at the different forest areas of seven Seed Orchard Centers to meet the demand of quality seeds or Quality Planting Materials (QPM). Along with seed source development this Division also distributed QPM to Forest Department, Government and NGOs.

Established new and old quality seed sources or seed stands

Conservation of Plant Genetic Resources

The main challenges of forest gene conservation and management are related to ongoing forest degradation and encroachment. This is a national scale problem that requires multi-sectorial solutions towards land use planning and improved livelihoods.

Considering the above points, Seed Orchard Division have been conserved major and threatened forest tree species under ex-situ condition. Vulnerable, endangered and critically endangered species have been conserved at seven seed orchard centers and adjacent areas as a genetic resource.


Conservation plots of Garjan and Teak species

Technology Developed and Dissemination

PlusTree/MotherTree Selection, Seed collection, preservation & uses of QPM and cutting preparation are two significant technologies of Seed Orchard Division. However, all these technologies have been disseminating among the different stakeholders through training, sharing knowledge publishing leaflet, booklets and posters. Every year lots of quality seeds and seedlings are distributed among the different stakeholders.


Technology dissemination


Training and distribution of quality planting materials

Current Research Focus

1. Seed Orchard Division have been started rubber research since 2012-13 financial year through Centralization of high yielding Rubber clone and established 4 hectares rubber seed orchard at Datmara Rubber Estate Fatikchari, Chattogram.
2. Recalcitrant seeds lose viability within short time and nursery men face a great loss to raise seedling. So to find out a suitable storage method which can prolong its viability for a few days or weeks to raise seedlings in large scale in the nurseries. At present seed storage behavior of chapalish (*Artocarpus chama*), gutgutya (*Protiums erratum*), neem (*Azadirachta indica*), horitaki (*Terminalia chebula*) and bohera (*Terminalia bellirica*) are observing in different storage conditions.
3. A development project namely "Quality seed source development and its popularization" has been running now (2017-18 - 2020-21) under this division.

Future Plan

Expansion of large scale quality seed sources of threatened and endegenous forest tree species for sustainable resource development through advance technology as well as improved the forest productivity.

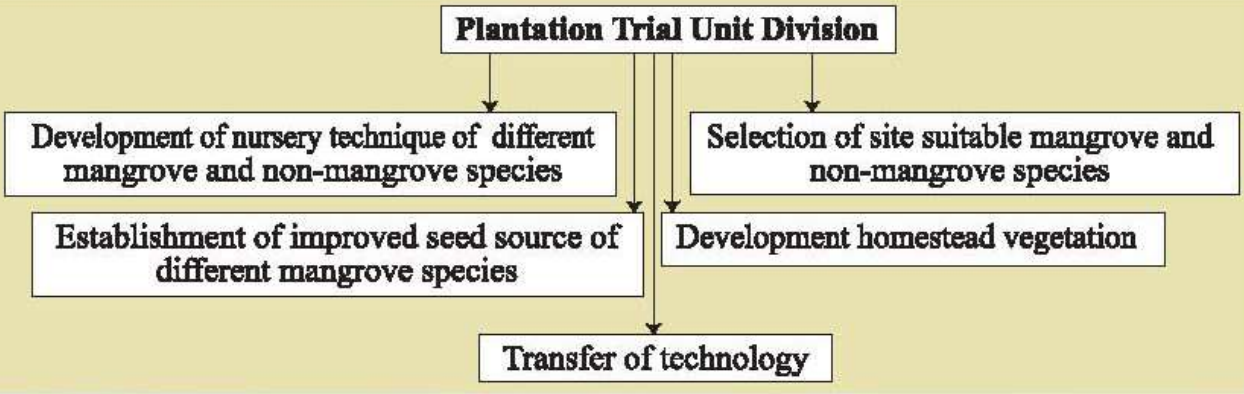
Plantation Trial Unit Division

Plantation Trial Unit (PTU)Division is one of the research divisions of the Forest Management Wing of Bangladesh Forest Research Institute. Its headquarter is at Rupatali in Barishal district. Since 1985, this division has started research activities. PTU Division has been conducting research activities in the coastal areas of Chattogram, Noakhali, Bhola, Barishal, Patuakhali and Cox's Bazar through four research centers and one sub-research center. This division conducts research on nursery development and planting technique as well as site suitability of different mangrove and non-mangrove species in the coastal areas of Bangladesh.

Head office of PTUD

The division is playing an important role for conserving coastal ecosystems through mangrove research and protecting coastal settlements and infrastructure from natural disasters. In the meantime, continuous research on mangroves and various non-mangrove species has led to the development of a number of technologies and information that are essential for the creation of sustainable coastal forest management in Bangladesh.

Major Research Areas and Activities



Development of Nursery Technique of Different Mangrove and Non-Mangrove Species

Plantation Trial Unit Division has developed nursery technique of 17 important mangrove species in coastal areas. The species are keora (*Sonneratia apetala*), soila (*S. caseolaris*), baen (*Avicennia officinalis*), sadabaen (*A. alba*), morichabaen (*A. marina*), gewa (*Excoecaria agallocha*), sundari (*Heritiera fomes*), passur (*Xylocarpus moluccensis*), dhundul (*X. granatum*), singra (*Cynometra ramiflora*), khalsi (*Aegiceras corniculatum*), kirpa (*Lumnitzera racemosa*), golpata (*Nypa fruticans*), hental (*Phoenix paludosa*), kankra (*Bruguiera sexangula*), goran (*Ceriops decandra*) and garjan (*Rhizophora mucronata*). This division also developed nursery technique of Palmyra palm (*Borassus flabellifer*) from detached germ tube.

Mangrove nursery at Char Kukri-Mukri

Palmyra palm nursery at Barishal

Selection of Site Suitable Mangrove and Non-Mangrove Species in the Coastal Belt of Bangladesh

In order to minimize the adverse effects of monoculture with keora and sustainable forest cover, 11 mangrove species were trialed inside the keora plantation

Underplanting trail with Singra species at Char Kukri- Mukri

Underplanting trail with Passur species at Char Kashem in Rangabali

which were flooded with tidal water for 3, 6, 9 and 12 months. The performance of passur and khalsi species as under planting was observed as potential in all types of flooded areas. On the other hand, sundari, gewa, dhundul, kirpa and kankra are found suitable in inundation prone areas for 3, 6, 9 months. Goran and hantal were found suitable in inundation prone areas for 3 and 6 months. The plantation techniques and site suitability of 11 mangrove species have been developed. Experimental plantation with 11 commercially important non-mangrove species trialed to verify their suitability in the raised coastal land and found seven species such as jhao (*Casuarina equisetifolia*), babla (*Acacia nilotica*), rain tree (*Samanea saman*), pyra (*Pithecellobium dulce*), sada korai (*Albizia procera*), kalo korai (*Albizia lebbeck*) and karanja (*Pongamia pinnata*) suitable. In addition, experimental plantation of 14 medicinal tree species

Experimental keora plot with seeds collected from keora seed production area

Experimental plantations of pitraz at Horidrakhali embankment at Rangabali

namely, kalojam (*Syzygium cumini*), gora neem (*Melia azedarach*), neem (*Azadirachta indica*) arjun (*Terminalia arjuna*), bohera (*Terminalia belerica*), katbadam (*Terminalia catappa*), shimul (*Bombax ceiba*), khayer (*Acacia catechu*), kadam (*Neolamarckia cadamba*), sonalu (*Cassia fistula*), horitoki (*Terminalia chebula*), pitraj (*Aphanamixis polystachya*), chatiyan (*Alstonia scholaris*) and punial (*Calophyllum inophyllum*) were established. Considering the survivality and growth of khayer, arjun, gora neem, neem, chatiyan, shimul, punial, pitraj, horitaki, sonalu, katbadam, kadam and kalojam were found promising and suitable for planting in the raised lands of the coastal belt of Bangladesh. Experimental plantation of four native palm species such as coconut (*Cocos nucifera*), date palm (*Phoenix sylvestris*), betel nut (*Areca catechu*) and palmyra palm (*Borassus flabellifer*) has been raised. Among these coconut, date palm, and palmyra palm showed good growth performance in the foreshore area.

Establishment of Improved Seed Source of Different Mangrove Species

The growth and yield of planted mangrove species in our country vary from site to site and lower as compared to those in other South Asian countries. To overcome this problem,

seed production areas of keora and baen species have been established. Moreover, plustrees of several other important mangrove species sundari, passur, khalshi, gewa, kankra, baen and keora have been selected for getting good quality seed sources. Preliminary results of the study showed that the yield of keora plantation raised from the seeds of selected tree is about 4 times and more than that of the mass collection.

Experimental keora plot with seeds collected from keora seed production area

Selected plus tree of gewa at Char Kasem in Rangabali

Development of Homestead Vegetation

To improve the quality of life of the coastal people and increased vegetation through agro-forestry practices in the coastal homestead. Some wood tree, fruit tree and vegetables were planted experimental basis. The wood tree species were raintree, mahogany, akashmoni, neem and kalokarai and fruit trees were coconut, betel nut, mango, jackfruit, guava and tamarind were found suitable. Besides, about 8-10 types of seasonal vegetables were cultivated in the homestead, among which bottle gourd, green gourd, pumpkin, amaranth, red leafy, spinach, bean, radish, brinjal and tomatoes were notable. Two species of bamboo name baijja bans (*Bambusa vulgaris*) and borak bas (*B. balcooa*) and two species of cane name jali bet (*Calamus tenuis*) and kerak bet (*C. viminalis*) were planted in the coastal districts of Patuakhali, Bhola, Noakhali, Chattogram and Cox's Bazar.

Coconut trees planted on the mound in coastal settlements at Char Nazir

Four year old baijja bamboo groves at Rangabali of Patuakhali district

Transfer of Technology

Plantation Trial Unit Division has been implemented more than 80 training/workshop programs with the coastal people, people's representatives, farmer's representatives and teacher's representatives. Moreover, the technologies have been published in national and international journals as scientific articles and in the form of booklets and leaflets. The mentioned research technologies have also been published and disseminated in national daily newspaper.


Training on nursery raising of palmyra palm and golpata

Current Research Focus

Currently, the coastal forest research program focuses on the development of man-made mangrove forests, site suitable species selection and introduction of new species and assessment of soil, water salinity in the coastal areas. On the other hand, work is underway to assess the feasibility of cultivating bamboo and cane inside the vacant keora plantation to increase the production of coastal forest resources.


Experimental plantation of bamboo and rattan at Char Nazir in Rangabali

Future Plan

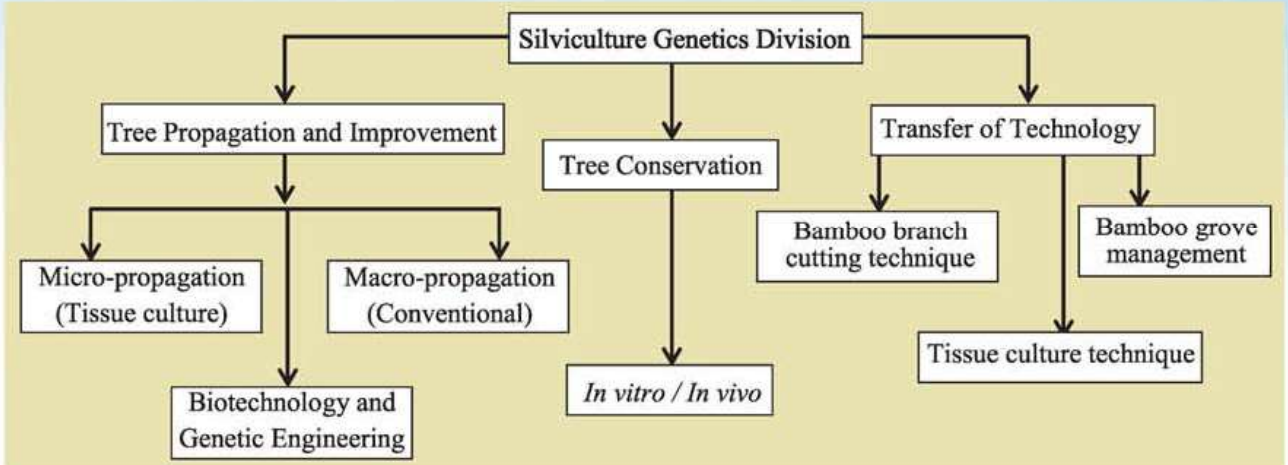
The future plan of this division is to increase the productivity of the coastal forests, improve/develop plantation techniques of environmentally important species to reduce the adverse effect of climate change. Research planning will be carried out for proper use of coastal raised vacant lands, assessing grazing effects and developing alternative methods of grazing. Research on the effect of sedimentation, inundation, salinity and other climatic factors on vegetation will be carried out.

Silviculture Genetics Division

Silviculture Genetics Division is one of the research division of Forest Management Wing of Bangladesh Forest Research Institute. It started its journey since 1973. This division was established with a view to the genetic improvement of tree crops through producing quality plant materials for increasing the forest productivity. Since then it has been conducting research on different programme areas such as plant breeding and tree improvement, propagation of bamboos and non-timber economic crops, biodiversity and conservation of forest genetic resources. Under these areas several research studies have been implementing on micro-propagation and biotechnology, macro propagation of trees, propagation of bamboos and non timber species and conservation of threatened forest species. Different plant propagation systems, including conventional and modern have been practicing to produce the quality planting propagules for large scale plantation and to increase the forest productivity. Technologies have been developed for propagation of important tree species through conventional methods as well modern systems such as tissue culture and biotechnology and disseminating them among the stakeholders.

Plant biotechnology and Tissue culture laboratory

Major Research Areas and Activities



Macro Propagation and Tree Improvement

Vegetative propagation and improvement of forest tree species was started at Silviculture Genetics Division of Bangladesh Forest Research Institute in 1977. Since then several conventional methods have been tried on various forest species with varying rate of success. It is stated that propagation techniques have been developed around 20 important forest tree species and published as in bulletins. Research on macro propagation of different forest tree species has been continued till date under this division to produce quality planting materials for plantation programme.

Macro-propagation of bamboos and other plant species at SGD nursery

Micro-propagation and Tree Improvement

With the advent of plant tissue culture, the prospects for the general use of the vegetative propagation in the genetic improvement of a wide spectrum of plant species became a reality. From this point of view a tissue culture laboratory was established at Silviculture Genetics Division on 1989 and it went under operation in 1991. Since then research on micro-propagation for bamboos, forest trees, fruits, ornamental and medicinal plants have been continued. Successful micro-propagation protocols were developed for 14 bamboo

species out of 33 available species of Bangladesh, 6 tree species and 5 medicinal plants as well. Demonstration plots of bamboos and other tissue culture produced plants were raised at different locations in our country, including Bangladesh Forest Research Institute campus, Chattogram, Sugarcrop Research Institute, Isshardi; Chattogram University campus; Jahangirnagar University campus; Rajshahi University campus and farmers' field of different districts. Developed protocols were also disseminated through training programmes among different university students, government and NGOs. Findings of this research were published in national and international journals and produced

Macro-propagation and plant production at tissue culture laboratory and green house

Bamboo Research

Bangladesh Forest Research Institute is the pioneer of bamboo research in Bangladesh. Silviculture Genetics Division was started this research since 1973 through germplasm conservation. Consequently, it established the only bambusetum of Bangladesh at BFRI campus in Chattogram and conserved 36 bamboo species collected from home and abroad. Later on research started on bamboo propagation and its management. Popular technologies were developed for bamboo propagation and grove management. Research on this field has been continued for the enrichment of bamboo species and the expansion of bamboo cultivation in Bangladesh.

Bambusetum of BFRI

Conservation of Biodiversity and Forest Genetic Resources

Bangladesh's forests have decreased significantly in terms of both area and health status over the last few decades. The annual deforestation rate is estimated to be around 3.3%. A great number of plants are already extinct from Bangladesh. It is anticipated that already 10% of country's plant species have gone extinct. The main challenges of forest gene conservation and management are related to ongoing forest degradation and encroachment. This is a national scale problem that requires multi-sectorial solutions towards land use planning and improved livelihoods. Considering the above points, Silviculture Genetics Division had attempted to make a plan for research on conservation of threatened forest species under *ex-situ* condition. Four thousand plants of forty eight threatened forest tree species at different degree of threat (vulnerable, endangered and critically endangered) were conserved at three protected area namely Institute of Forestry and Environmental Sciences, Chittagong University; Radar Unit of Bangladesh Air Force, Cox's Bazar and the Keochia research station, Satkania, Chattogram of Bangladesh Forest Research Institute. The findings of this study already published in Journal of Biodiversity Conservation and Bio Resources Management in 2018.

Conservation of threatened plant species at Chittagong University Campus and Rudder unit of Air force, Cox's bazar

Technology Developed and Dissemination

Some popular technologies have been developed by Silviculture Genetics Division. These are bamboo propagation through branch cutting technique, bamboo grove management, and tissue culture protocols for bamboos, timber and medicinal plants. However, all these technologies have been disseminating among the different stakeholders through training, sharing knowledge in national and international conferences and published as journal articles in national and international journals.

Technology dissemination in national and international level

Current Research Focus

Current research programmes are focused on molecular and biotechnology areas. Molecular characterization of endangered forest tree species through DNA barcoding to identify the discrimination or gaining a new barcodes for the forest species. Genetic analysis of micro propagated plants for new genotypes or a new variety. Rapid multiplication of elite plant for large scale plantation programme through tissue culture technology.

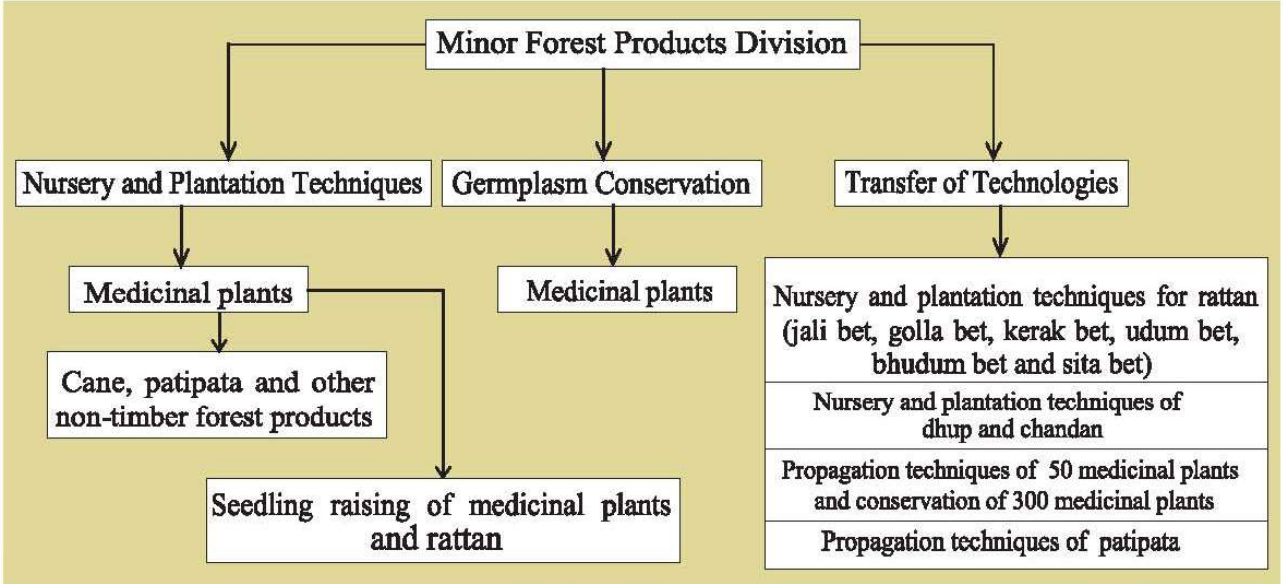
Future Plan

Bangladesh has a rich heritage of biological diversity in natural forests. Some of the opportunity areas in forestry include forest resource management, cash crop development, agroforestry, *in situ* and *ex situ* conservation of forest resources and improvement of economic forest plants by the application of modern biotechnology. In this regard, a plan will be designed to develop improved protocols for plant regeneration and genetic transformation of commercially important forest species. Production of quality planting materials of timber and non-timber forest species for sustainable resource development through advance technology for large scale plantations as well as increase the forest productivity.

Minor Forest Products Division

Minor Forest Products Division (MFPD) is one of the important research division under Forest Management Wing and started its research activities at early seventies with the mandate of exploration and documentation of non-timber forest products of the country. Subsequently its research activities expanded to development of propagation and cultivation techniques of non-timber forest products focusing on rattans and pati-pata. In early eighties MFPD includes medicinal plants in its research prospect and doing research on propagation and cultivation of commercially important medicinal plants along with other non-timber forest products. In late nineties MFPD's research horizon is expanded to conservation of endangered medicinal plants along with other non-timber forest resources. At present MFPD is working for popularization of propagation and cultivation of rattans and important medicinal plants, exploration and documentation of ethno-medicinal plant uses in CHT's, development of propagation technique for economic crop and germplasm conservation of endangered medicinal plants along with other non-timber forests products.

Major Research Areas and Activities



Since the inception of MFPD, it has generated considerable amount of technologies /information within its mandated area. Some of the notable technologies/information are as follows: Nursery and plantation techniques of rattan, propagation and cultivation of pati-pata (*Schumunianthus dichotoma*), growth performance of common rattan species (jali, kerak and golla), propagation techniques of 40 medicinal plants, information on distribution and uses of 160 medicinal plants, nursery and plantation techniques of khair (*Acacia catechu*), dhup (*Canarium resiniferum*), chandan (*Santalum album*), ritha (*Sapindus mukrosii*), box-badam (*Sterculia foetida*), kusum (*Schleichera oleosa*), mahua (*Madhuca indica*) and germplasm conservation of 300 medicinal plants.

Golla bet (*Daemonorps genkinsiana*) seedlings in nursery bed

Golla bet seedlings in polybag

Kerak (*Calamus viminalis*) bet seedlings in nursery bed

Pati-pata (*Schumunianthus dichotoma*) plot

Rattan plantation at BFRI

Rattan plantation at Hinguli research station

Chandan (*Santalum album*) seedlings

Chandan plantation at BFRI

Khair (*Acacia catechu*) seedlings

Khair plantation at Hinguli research station

Dhup (*Canarium resiniferum*) seedlings

Dhup plantation at BFRI

Mahua (*Madhuca indica*) seedlings

Kusum *(Schleichera oleosa)* seedlings

Ritha (*Sapindus mukorossi*) seedlings

Box-badam (*Sterculia foetida*) seedlings

Germplasm conservation plot of medicinal plant at BFRI

Medicinal plants conservation plot at Hinguli research station

Outstanding Achievement

Minor Forest Products Division achieved Prime Minister's Award 2017 under the category of Research and Conservation for Germplasm Conservation of 221 medicinal plants at Bangladesh Forest Research Institute.

Received Prime Minister's Award 2017 under the category of Research and Conservation

Providing Training and Advisory Services

Minor Forest Products Division is providing training and advisory services to the clients based on their demand including researchers, academicians and students of different universities, colleges, herbal practitioners and nursery owners.

Visitors from Dinajpur Government College

Trainee from LGED visited MFPD nursery

Forestry student of ShahJalal University visited medicinal plants nursery

Forestry student of Chittagong University visited medicinal plants nursery

Medicinal plants training programme at Natore

Motivation programme of Ratan plantation at Rajbari

Curent Research Focus

Research is a dynamic process and research paradigm may be shifted with time and demand of stakeholders. However, recent research activities of MFPD focused on (i) Exploration and documentation of ethno-medicinal plant uses in Chittagong Hill Tract's (ii) Development of nursery techniques of akorkanta (*Alangium salvifolium*), kau (*Garcinia cowa*) and sindur (*Mallotus philippensis*) (iii) Screening of nurse or host crops for chandan (*Santalum album*) plantation (iv) Development of vegetative propagation techniques of cashew nut (*Anacardium occidentale*) and (v) Germplasm conservation of endangered medicinal plants.

Ethno-medicinal data collection from Kaptai

Searching for ethnomedicinal plant

Ethno-medicinal plant conservation plot at BFRI

Conserved ethno-medicinal plant in the nursery

Future Plan

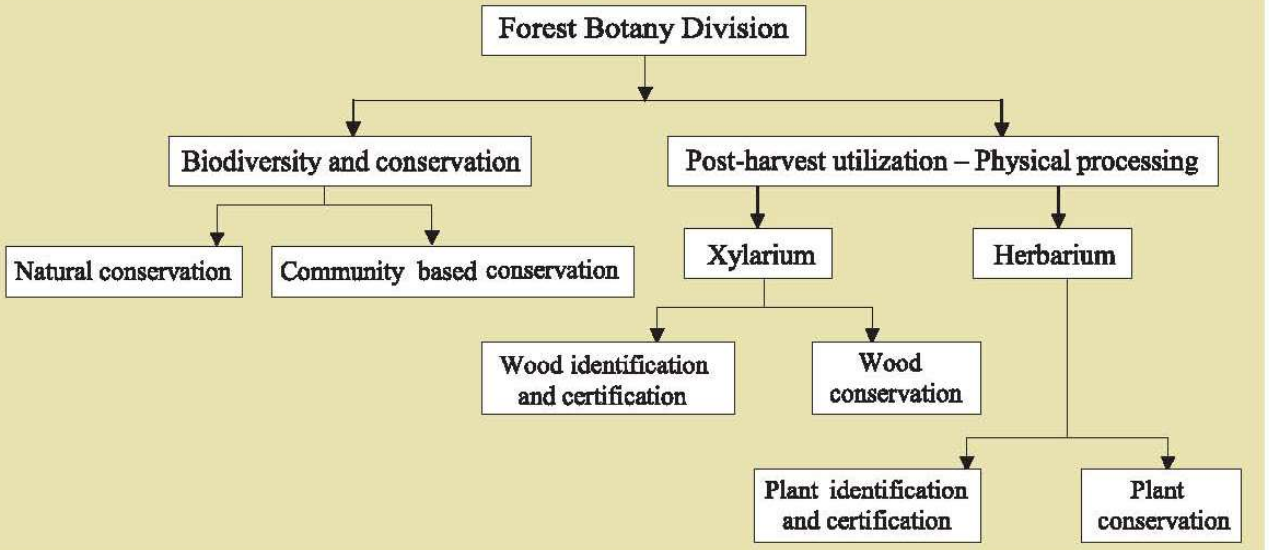
MFPD is being mandated for doing research on propagation, cultivation and conservation of non-timber forest products including medicinal plants, it will continue its research activities within its command area based on the demand of clienteles and time. However, in continuation of present research program MFPD will incorporate the study (i) Establishment of Orchadium in BFRI campus and (ii) Germplasm conservation of wild edible fruits of Bangladesh along with other NTFP's.

Forest Botany Division

Forest Botany Division is one of the research divisions under the Forest Management Wing of BFRI. There are two sections (a) Xylarium and (b) Herbarium. The anatomical research of wood is completed with the identification of wood specimens in the xylarium and the taxonomical research of plants is completed with the identification of plant specimens in the herbarium. Later on it extended its research activities on biodiversity conservation, Assistant Natural Regeneration (ANR), regeneration of protected forests and planting of native endangered species in the community reserves of the Chittagong Hill Tracts (CHTs).

Major Research Areas and Activites

The research activities of the division are basically done under two branches (a) Xylarium and (b) Herbarium.



Xylarium

The xylarium of Bangladesh Forest Research Institute was established by Mr. Dilip Kumar Das (Ex Divitional Officer) in 1965. From its foundation to till date, 650 wood specimens of natural and rural forests of Bangladesh have been preserved in this xylarium. Total 2,000 wood samples of 21 species bring from 20 countries of the world through bilateral exchange activities and about 2,200 permanent slides of native woods are stored in this xylarium. The xylarium is the only wood samples laboratory and wood collection center in the country and a major center for wood anatomical research.

Tree

Wooden logs

Planks

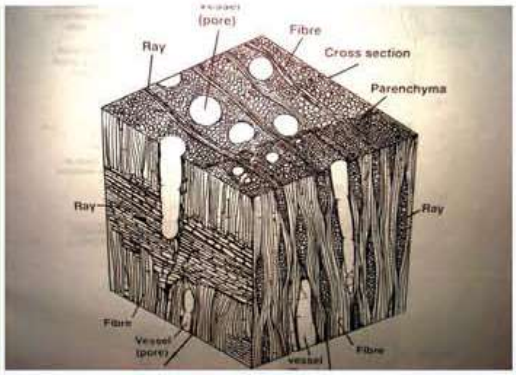
Samples in xylarium

Xylarium

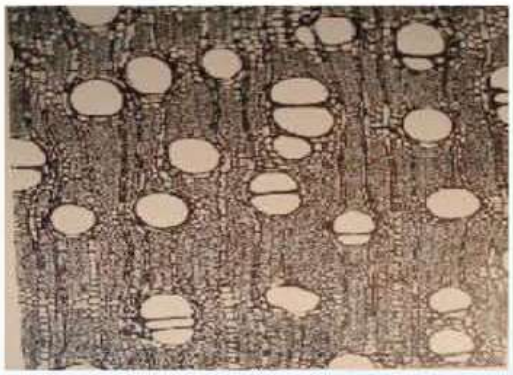
Wood identification instruments

Microtome machine

Microscopic analysis



Three dimensional structure



Internal structure of wood

Herbarium

Herbarium is a plant collection center. This is a plant archive arranged in a scientific way containing detailed information. It can also be called a museum of dead plant specimens.The herbarium of BFRI was established in 1959 by Mr. Dilip Kumar Das. Since its establishment, it has made significant contributions to the study of taxonomical research, the practice of botany, the research and development of the country's medicinal and economically significant tree resources, the development of the environment and the conservation of the country's biodiversity. It is the second largest herbarium in the country. In this herbarium, about 30,700 plant specimens of 1,600 species under 750 genera of 180 families have been preserved. In addition, 1,500 plant specimens of 450 species used by anthropological groups are also preserved here.

Plant specimens preserved in the Herbarium

Plant Survey and Regeneration Status Observation in Protected Forests

Plants survey have been conducted in protected forest areas such as Kaptai National Park, Hazarikhil Wildlife Sanctuary and Ratargul Swamp Forest and observed the current regeneration status. Research activities are currently underway at the Rema-Kalenga Wildlife Sanctuary and Lawachara National Park to observe the current status of plant and regeneration.

Data collection through quadrat method in Ratargul swamp forest


Data collection through quadrat method in Kaptai National Park

Research on Assisted Natural Regeneration (ANR)

Research on Assisted Natural Regeneration (ANR) was started at Sitapahar Nutunpara and Baganpara adjacent two community reserves of Bandarban district of CHTs. The ANR method of afforestation is much more cost effective and readily available than the conventional method. No nursery is required for raising the seedlings and there is no cost for transporting the seedlings. ANR is a sustainable method for conserving biodiversity. ANR method has been successfully implemented in Bandarban district for conservation of biodiversity.


ANR and NR data collection from Sitapahar nutunpara and Bagan para

Research on Ethno-medicinal Plants

Ethno-medicinal knowledge needs to be recorded and preserved on an urgent basis. Research activities have been conducted on the survey, use and preservation of various medicines used in the medical work of different tribal people living in the CHTs district.


Ethno-medicinal data collection from Rangamati and Khagrachari

Current Research Focus

Research activities are ongoing on the regeneration status of protected forests areas of Bangladesh and to find out the anatomical properties of mahogany and lambu trees based on the agro-ecological region.

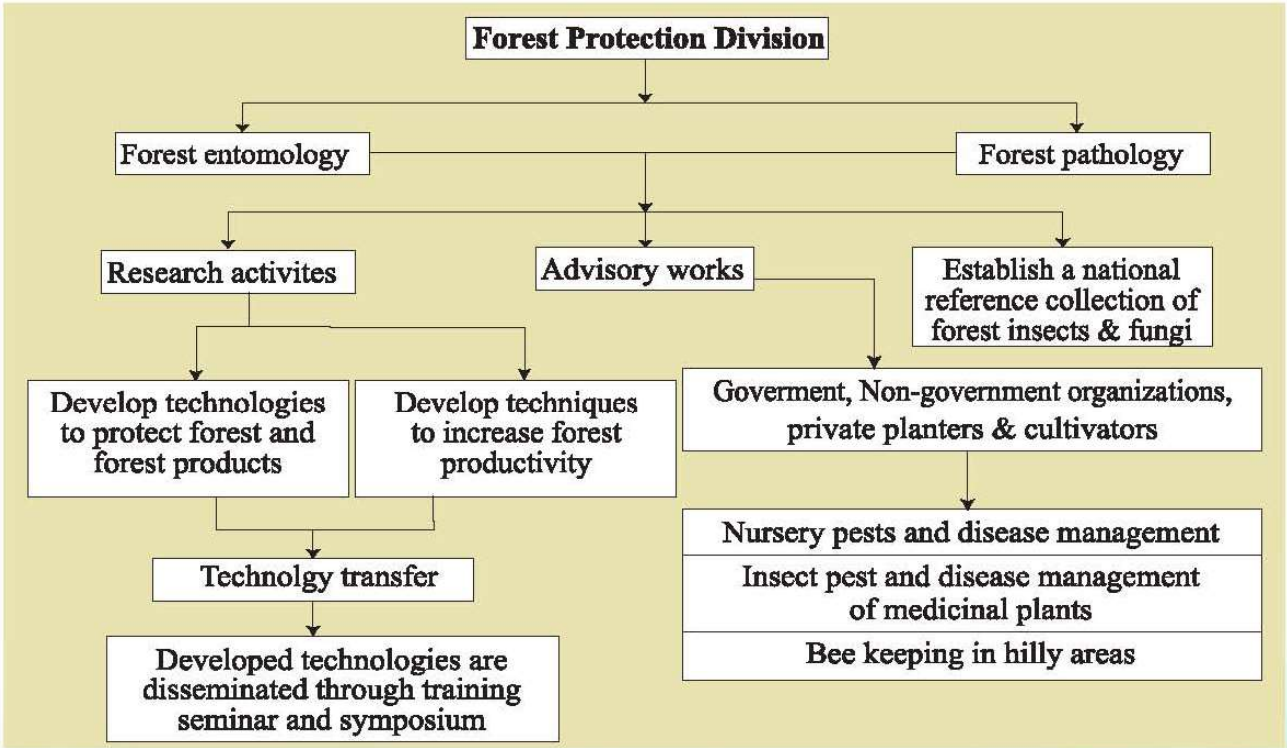
Future Plan

The future research plan is to digitize the herbarium and xylarium. Also research will be conducted to increase the forest production and forest resources, ensuring biodiversity conservation and tackling the effects of climate change.

Forest Protection Division

Forest Protection Division (FPD) is one of the most important research divisions of the Forest management wing of Bangladesh Forest Research Institute (BFRI), Chattogram. Though the division was created in 1969 but its actual research work was started after the liberation war of Bangladesh. The research activities of this division are conducted under two sections. One is forest entomology and the other is forest pathology. The major activities of this division are-(a) to develop management techniques to protect forest and forest products from the infestation of insect pests and diseases; (b) to develop suitable techniques to increase forest productivity through utilization of beneficial insects, fungi and bacteria; (c) to collect reference on forest insects and fungi. For this purpose, samples of about 6,000 insects and 2000 fungi (mostly wood rotting) have been collected by this division from different forest areas of Bangladesh. These are preserved and maintained in the Insect Museum and Fungal Herbarium respectively. Out of them around 300 insects and 200 fungal specimens have been identified up to genus/species level. To date, more than a hundred research papers, 18 bulletins and folders/leaflets have been published under this division.

Major Research Areas and Activites



Notable Research Activities

Control Insects, Pests and Diseases of Forest Tree Species

Forest Protection Division has identified insect pests and diseases of major forest tree species of Bangladesh and has developed their control measures. Notable of them are Teak defoliator, Gammar defoliator, Mahogany shoot and collar borer, Teak Cancer grab, village forest and fruit tree insects, Cane top shoot borer, Keora defoliator, Malakanakoroi defoliator, Amra defoliator, Hijol stem borer, Sisso mortality, Bamboo blight, diseases of Rubber plants and Collar rot of Keora with their management technique.

Some insect pests and disease symptoms of forest tree species

Development of Nursery Pest and Disease Management Technique

Seedlings in nurseries are infested by different insect pests and diseases and damaged extensively. The division has developed suitable management techniques of major pests and diseases of forest nursery and plantation. Notable of them are gall insect of Arjun, Koroi defoliator, sap sucking bug of Neem, mite of Acacia, Sisso defoliator, wilting disease, root rot disease, powdery mildew disease, die back and leaf spot disease with their management.

Some insect pest and disease symptoms of forest nursery

Development of Insect Pests and Diseases Management Techniques of Important Medicinal Plants

Forest Protection Division has generated suitable management techniques of major pest and diseases of some commercially cultivated medicinal plants such as basok, tulsi, ashwagandha, kalomegh, chuijhal, aloevera and asparagus.

Some insect pests and diseases symptomps of medicinal plants

Advisory Works

The division also provides advisory services to stakeholders such as Forest Departments, NGOs, nursery owners and private planters on pests and diseases related problems. Notable of them are (a) Insect pests and disease management of forest nurseries (b) Insect pest and disease management of medicinal plants and (c) Bee keeping in hilly areas.



Advisory works

Technology Dissemination

Developed technologies of the FPD are disseminated by the help of Technology Transfer Unit (TTU) of BFRI among different government and non government organizations, NGOs, university students, nursery owners, private planters and farmers through training, seminar, symposium, scientific papers, bulletins, leaflets and folders.

Current Research Focus

At present the division is working on (i) biological control of bacterial and fungal diseases of commercially cultivated medicinal plants in Bangladesh (ii) microbial control of lepidopteran pests of some important forest tree species through entomopathogenic fungi (iii) investigation of Neem (*Azadirecta indica*) and Rain tree (*Samanea saman*) mortality of Bangladesh due to pest and pathogens and their management. Beside these, a research project on honey bees of the Sundarbans is also running under this division funded by Bangladesh Climate Change Trust Fund.

Future Plan

In future the division has plan to work on

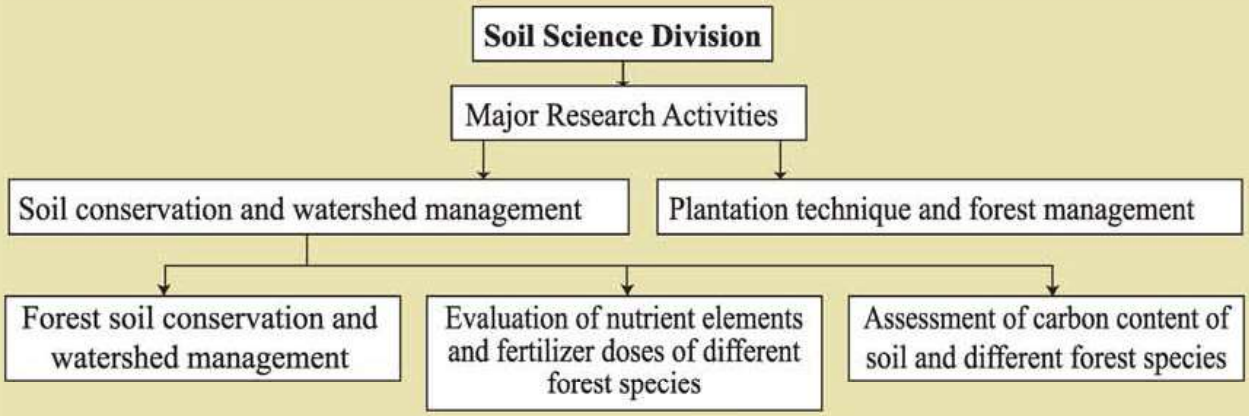
- Identification and management of invasive pest and disease of exotic forest tree species of Bangladesh.
- Climate change impact on forest insects and pathogens and their mitigation.
- Development of nanopesticides to control forest pest and disease.
- Development of pest and disease resistant varieties of important forest plant species.
- Establishment of gene bank of forest pest and diseases through genome sequencing.
- Bioremediation of pesticide polluted soil by microorganism.
- Development of biopesticides to control forest pest and disease.

Soil Science Division

Soil Science Division started its journey as a section, named Soil Chemistry under the Forest Management Branch during seventies (1969) and took its present status Soil Science Division at mid-seventies (1975). From then the division that has been functioning and involved to research on forest soil. Gradually with the increased demands of the clients its working area has widen. It covers the research on forest soil classification, plant nutrition, land use planning, agro-forestry, farming systems research and development, watershed management, etc.

Laboratory of Soil Science Division

Major Research Areas and Activities



Important Technologies

- Site-specific species selection manual based on land suitability and soil properties.
- Sustainable hill farming technologies-
- Contour Trast Line (CTL)
- Natural Vegetative Buffer Strip (NVBS)
- Differentiated Sloping Agriculture (DSA)
- Sloping Agriculture Land Technology (SALT)
- Auger Hole Method

Selection of High Yielding Rubber Tree and Recommendation of Fertilizer doses of Rubber Tree

There were total number of 1000 high yielding rubber trees were selected from Dantmara Rubber Estate, Fatikchari, Chattogram and Pirgacha Rubber Estate, Modhupur, Tangail respectively. The list of the selected trees given to the Seed Orchard Division of BFRI for growing high yielding seedling through collection of scion materials. Recommended NPK fertilizer doses were provided for increasing latex yield of rubber trees.

Soil collection through augar

Activities of soil conservation and watershed management

Excavated soil profile

Service and Advisory Activities

This division has close relation with other research institutes, universities and departments of the country. Providing different services and advisory activities such as soil samples collection and analysis, forest plantation, fertilizer recommendation etc. to different government and non-government stakeholders such as Bangladesh Forest Department (BFD), Bangladesh Forest Industries Development Corporation (BFIDC), Bangladesh Rubber Board (BRB), Bangladesh Economic Zone, Institute of Forestry and Environmental Sciences, Chittagong University (IFESCU), Khulna University and Shahjalal University of Science and Technology, Sylhet as well as Non Government Organizations (NGOs) and private planters.

Current Research Focus

Current research programmes are focused on development of degraded hill for soil conservation and watershed management; soil organic carbon content of bamboo plantations in the northern regions of Bangladesh; effect of bamboo plantation on soil erosion minimization in the coastal areas of Chattogram and assessment of soil quality for sustainable forest ecosystem of hill forest areas.

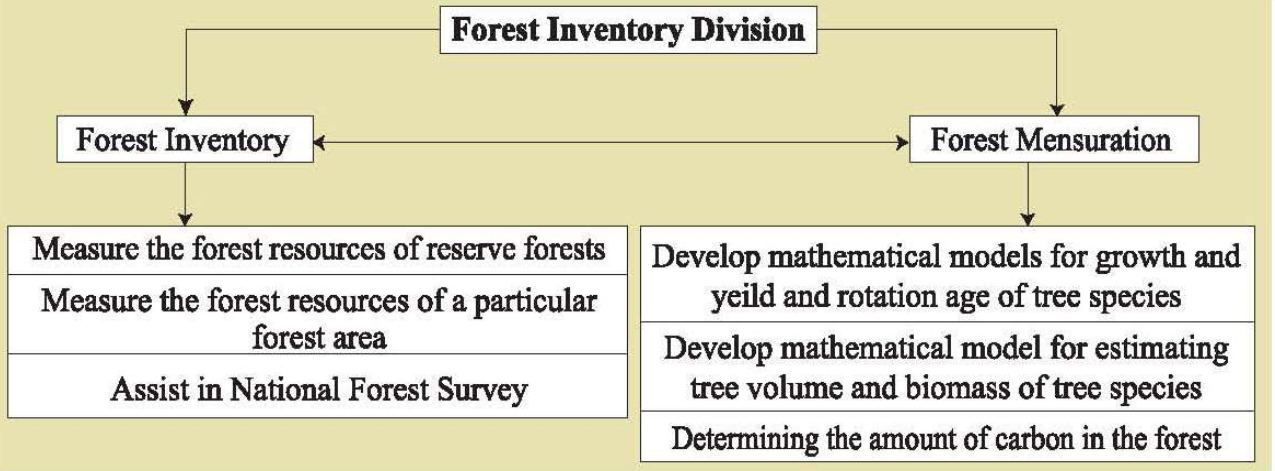
Future Plan

Hill and coastal forest degradation is a major concern in our country. To cope the degradation, the research activities on development of proper land use plan and evaluation of soil quality for sustainable forest management and forest ecosystems as well as minimization of soil erosion through plantation in the erosion prone coastal areas of Bangladesh.

Forest Inventory Division

Forest Inventory Division was formed in 1977 for proper and sustainable management of forests and forest resources. This Division conducts research on the subject of inventory and mensuration of forests and forest resources. Since its inception, it has been conducting short and long term research programs to accurately assess and quantify the forest and forest resources of the country such as: forest inventory, growth and yield of main tree species grown in different locations (hills, plains, coastal areas, sundarban, roads and highways, homesteads) of the country, developed mathematical model for estimate the volume and biomass of important trees. If only the diameter at breast height or girth at breast height and total height of the tree is known, the total volume of each tree or the amount of total production and carbon storage per acre can be determine by using derived volume models. Growth and yield models are used to determine growth rate and yield if age is known. Currently the Forest Department, NGOs and privately owned planters in the country market determining the total production of trees using the derived models by this division.

Major Research Areas and Activities



Forest Inventory and Forest Resources Assessment

Forest inventory is the systematic collection of data and forest information for assessment or analysis which given an information on forest resources in a specific areas regularly. It allows assessment of the current status and lays the ground for analysis and planning, constituting the basis for sustainable forest management. From beginning, Forest Inventory Division has taken part in the inventory of natural and plantation forest resources of Chattogram, Cox's Bazar, Ksassalong, Sylhet, Kaptai pulpwood plantation, Costal afforestation, Sal forest, borer attack of Keora in the costal afforestation and partial inventory of the gewa working circles in the Sundarban. Assisted in all forest and tree surveys implemented by FAO and Bangladesh Forest Department.

Forest Mensuration and Mathematical Models

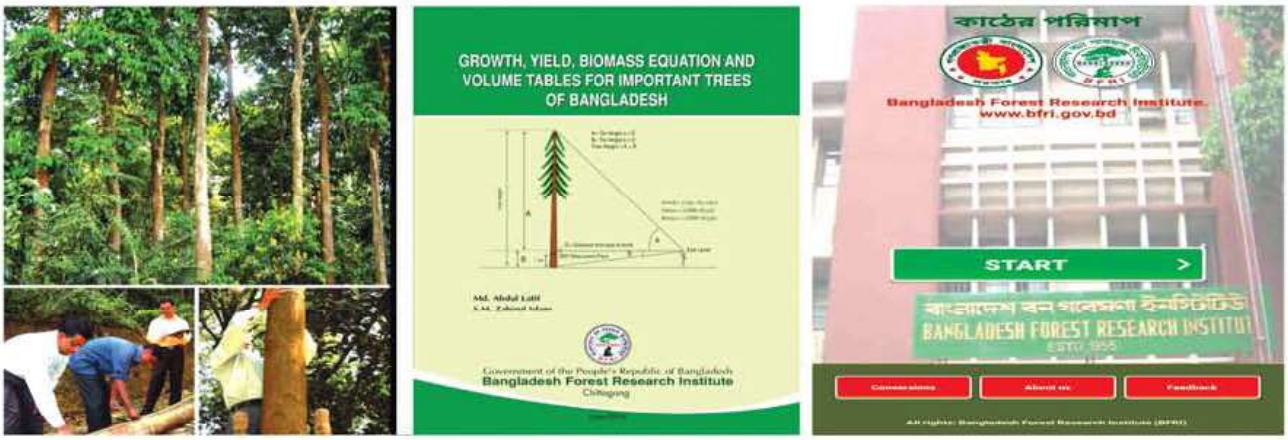
Forest mensuration is that branch of forestry which deals with the determination of dimensions (e.g. diameter, height, volume etc.), form, age, and increment of single trees, stands or whole woods, either standing or after felling. In a word, inventory data is determined using forest mensuration formulas. Since the inception of Forest Inventory Division, it has been conducting research activities on the subject through various projects. Researchers from the Forest Inventory Division have so far developed 726 allometric models for determining the tree volume of 42 species at different locations, 141 growth and yield models for 16 species and 40 biomass allometric models for 4 species through short and long term projects.

Data collection from permanent sample plots to determine growth and yield of mahogany

Collection of data from standing trees to determine the stand volume of keora plantation in coastal forests

Innovation and Extension of Information Technology

Forest Inventory Division have been developed 726 allometric models for determining volume of 42 tree species grown in naturally and plantation forest with 11 headings, 4 tree species for biomass calculation with one heading and 141 allometric equations for growth and yield of 16 important tree species with 11 headings. A mobile app has been developed to determine the stem volume of 40 important tree grown in naturally and plantation forest using allometric equations. The invented information technologies have been presented at national and international conferences and published as articles in national and international journals.



A bulletin enriched by the allometric models and a mobile app to determine the stem volume of 40 species of standing trees

Current Research Focus

At present, the research program of the division has determined the growth & yield and volume table of new trees species. At the same time, in order to implement the SDG target, research programs are underway in the northern part of the country to determine the tree resources and carbon sequestration of homestead.

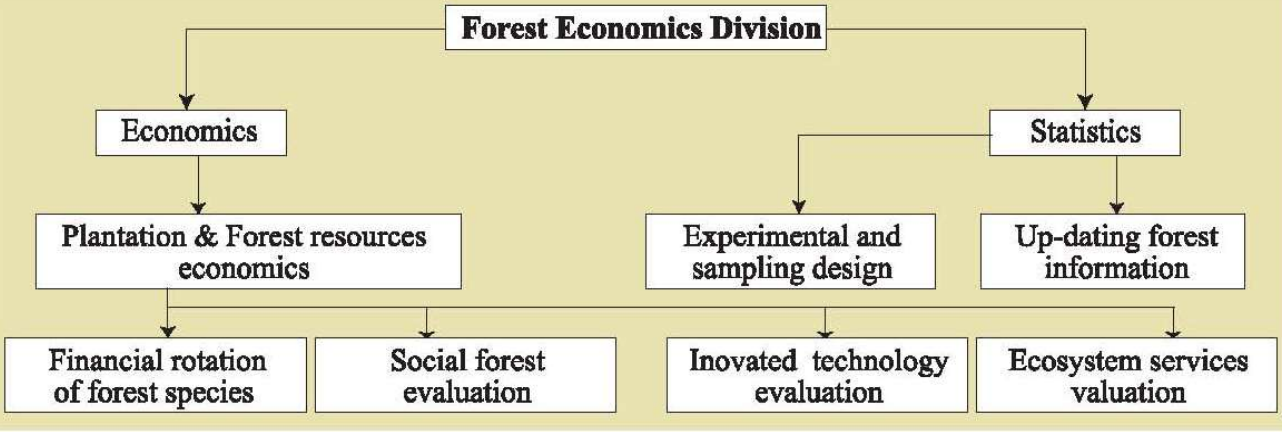
Future Plan

Natural and plantation forests of Bangladesh are rich in forests and forest resources. There are plans to set up GIS labs for proper management of these rich forests and forest resources and to measure forest and forest resources easily and accurately by inventory with the help of aerial photography. The allometric equation will be developed for estimate biomass and carbon for important tree species with semi-destructive (small branch pruning) method. The growth and yield prediction model will be developed for important trees due to the impact of climate change. Moreover, there are plans to create one more mobile app to determine the growth and yield of important trees using the previously determined growth model.

Forest Economics Division

Forest Economics Division is one of the research divisions of Forest Management Wing. The inception of this division was in 1973 with a view to conduct research on forest plantations and forest resource sectors applying statistics and economics discipline. It has been making statistical design analysis and investment analysis in forestry sectors as well. This division plays an important role to evaluate inevitable impact of forest and forest resources on environment and socioeconomic condition of human life.

Major Research Areas and Activities



Determination of Optimal Financial Rotation of Forest Species

Plantations forests are established mainly for optimum timber production in a certain age. The profit of individual tree species at the ending duration of that certain age is found maximum. This duration age of tree species is called financial rotation age. If that financial rotation age is determined, then the unnecessary waste period in the length of rotation age of tree will be reduced in forest land and that is why wood productivity will be increased more in due time plantation for the next rotation. Up to this period, optimal financial rotation age of 12 forest species are determined by this division.

As routine work of Forest Economics Division, it is imperative to determine financially profitable rotation of other forest species for reducing gap between demand and supply of forest resources and making sound plan of forest management.


Data collection from Rajkoroi plantation

Social Forestry Evaluation

Social forestry plantations with the active patronization of Forest Department have been initiated from the decade of 80. The economic evaluation of planted social forestry in approach road, highway and in embankment of Coastal and Northern districts are done in the last decade. The results of economic analysis showed that the quality of life in relation to socioeconomic condition of landless families have become improved due to participation with the social forestry programme, and in another side, it plays an important role to make productive fallow and uncultivated land comparatively have resulted in mitigation of national employment problem, poverty, food crisis and timber and fuel wood crisis of the country.


Data collection from social forestry plantation

Evaluation of BFRI Developed Technologies at Field Level

Bangladesh Forest Research Institute have innovated notable number of technologies for the stakeholder of forest and forest resources production and marketing that is to utilize in their respective working field. Economics division is played a vital role to evaluate in economic point of view in real condition of utilizing technology in working field of stakeholder. The economic impact assessment for one (Using preservative bamboo materials in Betel farm) of the using technologies in field level in the meantime are already done.The results of economic impact is observed that the reduction of investment cost and using materials were 15% and 64% respectively and that has resulted incremental net benefit is increased three times higher than that of traditional one.

Data collection from rubber garden and nursery management

The research activities regarding economic impact assessment for another two technologies that "Treated Rubber Wood" and "Nursery Pest and Diseases Management" are ongoing in field level.

Ecosystem Service Valuation

In Bangladesh, declaration and management of PAs is one of the efforts from the Government side to tackle the degradation of forest resources. To find out whether this approach working or not, knowing the economic value of ecosystem services provided by

Data collection from Baraiyadhala National Park

the PAs is important. This division has already estimated the value of 11 ecosystem services in Baraiyadhala National Park which is 561.36 million BDT/yr (USD 6.60 million/yr). At present, valuation of ecosystem services in Sitakunda Botanical Garden and Eco-park, Chattogram is on going.

Layout of Experimental and Sampling Design

This research division collaborates to make the layout of species trial, spacing trial, fertilizer trial etc. for forest plantation and laboratory trial for bamboo and wood based commercial products through basic and factorial design for experimentation and helps to make layout of appropriate sampling method on various landscape of forest plantations and also perform its' statistical analysis as per requirement of respective research division of this institute.

Updating Forest Information

Forest statistics is essential to compose maintaining and continuity of data-based statistics on the production and utilization of different aspects of forest and forest resources. Updating databases of forest information periodically are composed in Forest Economics Division.

Current Research Focus

In the light of the realities on forest cover around the world, leaving aside the conventional method of estimating the economic value of plantation forest and natural forest, the assessment process is started in modern way for estimating economic value of ecosystem services. In this way the value of the Bariayadhala National Park's ecosystem services has already been estimated. Data collection of Sitakunda Botanical Garden and Eco-park is ongoing.

Future Plan

The planning is to carry out an economic impact assessment of the real condition of each of the technologies used at the field level. After performing an economic assessment of the real condition of all the technologies in use, it will be possible determine the actual contribution of this institute to the national economy. Over the past two decades, new versions for estimating forest valuation have been developed. In this way, gradually there is a plan to perform the estimation of the economic value of the protected and plantation forest in different part of the country. In addition, this division has plans to provide statistical support to the relevant research work of different research divisions and to perform economic assessment according to the needs of other organizations.