T.F.R.I.

ANNUAL REPORT

2020-2021

TROPICAL FOREST RESEARCH INSTITUTE, JABALPUR

Overview

- The impact of canopy openings created due to selection cum improvement (SCI) felling on the sub-canopy regeneration in Mixed Deciduous forests of Dindori Forest Division, Madhya Pradesh revealed that, the proportion of new individuals that regenerated from gaps was higher in canopy openings occurring due to felling (R^2 = 0.15, P = 0.0002), while lower in natural gaps (R^2< 0.01, P = 0.57), indicating that artificial canopy gaps trigger a set of new forest structure and composition.
- Collected data on felled trees of the selected species for revising form factors in Chhattisgarh state.
- Monitored plantations for their survival, health and growth raised in M.P. and Maharashtra under NTPC Ltd. Accelerated Afforestation Programme.
- Collected data on vegetation sampling for tree, shrub and understory flora; and carbon stock assessment in 5C pools (aboveground, belowground, dead wood, litter and soil) using quadrate nested method of 33 sites out of 49 sites in Madhya Pradesh.
- The level of forest land degradation in three western districts (Dhar, Jhabua and Mandsaur) of Madhya Pradesh, which are highly vulnerable to climate change are being studied by measuring important indicators such as carbon stock in soil and vegetation.
- Bamboo plants of four superior clumps of *Bambusa tulda* (one clump), *B. bambos* (two clumps) and *B. vulgaris* var. green (one clump) were supplied to Gujarat Forest Department.
- A Bambusetum was established with assemblage of 25 species.
- Two superior clumps of *Bambusa balcooa* and one superior clump each of *Bambusa tulda, Bambusa nutans* and *Bambusa balcooa* were selected from Raipur and Bilaspur respectively
- *In vitro* stock cultures of 05 identified superior clones of teak were multiplied for shoots.
- Phenotypically superior trees of *Azadirachta indica* were selected in agroclimatic zone 8.
- Phenotypically superior trees of *Dalbergia latifolia* were selected in M.P. and Maharashtra and root cuttings were planted for regeneration.
- Phenotypically superior trees of *Madhuca longifolja* were selected in M.P. and Chhattisgarh following criteria of flower yield.
- Total 121 trees of *P. marsupium* sampled from different forest divisions of Madhya Pradesh were genotyped using 20 ISSR markers for diversity assessment. Samples from the seven study sites were also analysed for marker compound i.e., Pterostilbene using HPLC technique.
- Promising trees of *Buchnania cochinchinensis* were selected from various locations of Madhya Pradesh, morphometric data along with GPS coordinates recorded.
- Planting material of *Celastrus paniculatus* and *Plumbago zeylanica* was produced through stem cuttings, tissue culture.
- 09 Phenotypically superior trees of *Tectona grandis* were selected from M.P. for assessing their genetic worth. Morphometic data alongwith GPS coordinate recorded.
- A germplasm bank of 24 accessions of teak representing M.P., Chhattisgarh, Maharashtra and Odisha was established.
- Flowering and fruiting status of Seed production areas (SPA), Clonal seed orchards (CSO) and Seedling seed orchards (SSO) located in Madhya Pradesh and Chhattisgarh were recorded.
- Silvicultural operations like sub-soiling associated root pruning in CSO increases seed production.

- Significant differences recorded among sampled teak populations for wood density, fibre length and fibre width. Coefficient of variation for wood density (12.56%) was higher than for fibre width (11.30%) and fibre length (7.30%).
- Comparative field performance of cutting's raised plants and seedlings of *Dalbergia latifolia* was assessed. Cutting's raised plants are better in terms of height (14%), collar diameter (21%), number of primary branches (43%) and crown diameter (15%) than the seedlings.
- Extension material in hindi and english has been published for distribution among stakeholders. To showcase various research activities of the institute a documentary is being prepared.
- Two trainings conducted on Biocontrol of Teak defoliator & Teak skeletonizer for the front line staff of Chhattisgarh Forest Department.
- All life stages i.e. egg (egg cards); nymphs and adult of predatory bug *Canthecona furcelata* were examined to control different insect pests in field plantation of teak and in agricultural crops. The preliminary study exhibit that egg cards and adults are most effective in forestry plantation and nymphs and adults are most effective against agricultural pests.
- Total 17 trainings for Nursery staff were organized on preparation of organic fertilizers and its application at various Forest divisions of Chhattisgarh Forest Department.
- Antagonistic tests on efficacy of Trichoderma against Fusarium species isolated from soil collected from various *Dalbergia sissoo* plantations were done.
- Established bamboo based Agroforestry system in farmers fields covering 10 ha area of Madhya Pradesh to develop value chain of the system by involving multipartied agreement like wood based industry, farmers, financial institution and TFRI.
- Standardized Gmelina based Agroforestry system for MP.
- Developed seed handling techniques of important tree species including RET species.
- Initiated work on NTFP species collected from different sources for the estimation of active ingredients for medicinal purpose.
- Selected eight Sal forest compartments in three forest ranges in Dhamtari forest division, Chhattisgarh to assess the impact of Silviculture systems on the natural forests of Chhattisgarh with special reference to Sal and Bamboo.
- Exploration of adhesive materials from plant species was carried out and incense sticks were prepared.
- Investigation was initiated for sustainable harvesting of kewanch and marod phalli.
- Conducted various training cum demonstration programme for the stakeholders like farmer, Women SHGs, forest officials and students on Lac cultivation, Agroforestry and seed handling techniques as well as NTFPs sustainable harvesting, processing, essential oil extraction and its value addition.
- FRC-SD, Chhindwara submitted a proposal and Terms of Reference for Preparation of Conservation Plan for endangered species found in and around the Dhelwadih UG, Bagdeva UG and Singhali UG mines of DSB sub area of SECL, Korba (Chhattisgarh) to TFRI, Jabalpur.
- Total 1272 soil and forest floor samples received from FSI, Nagpur were analyzed for organic carbon content and revenue was generated for the centre and ICFRE out of the analysis work during the year.
- Centre contributed in the preparation of recovery plan for rare, endangered and threatened (RET) plant species.

Summary of projects

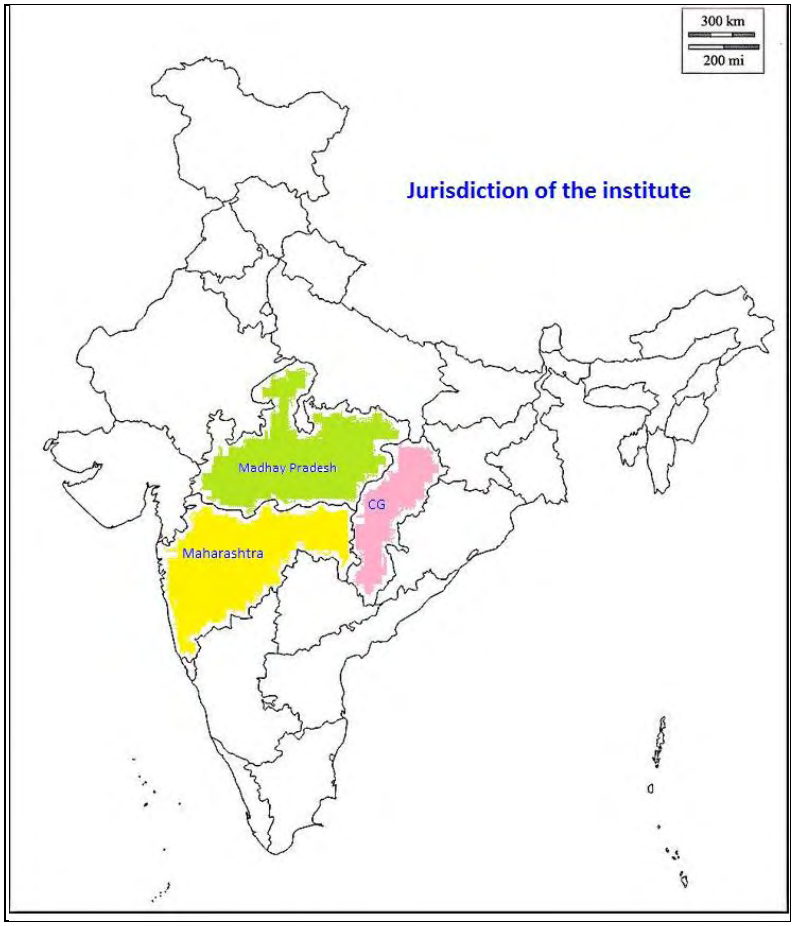
Projects	Completed projects	Ongoing projects	New projects initiated during the year
Plan	06	07	02
Externally Aided	04	22	02
Total	**10**	**29**	**04**

C o n t e n t s

1. Introduction

Tropical Forest Research Institute (TFRI), Jabalpur (M.P.) provides research support to State Forest Departments and other stakeholders in central India covering the states of Madhya Pradesh, Chhattisgarh and Maharashtra. The Institute came into existence in April 1988, although its origin goes back to 1973 when a Regional Centre of FRI, Dehradun was established at Jabalpur to provide research support to the problems of forest management in central India. It has an area of 109 ha and maintains a constant liaison with state forest departments, NGOs working in the field of forestry and allied areas, universities imparting education in forestry and forest based industries, SAU's, funding agencies like NABARD and MPCST.

The institute has a satellite research centre, namely Forest Research Centre for Skill Development at Chhindwara (M.P.) Earlier it was known as Centre for Forestry Research and Human Resource Development (CFRHRD) which came into existence on 30th March 1995. After restructuring of the ICFRE institutes/ Centres vide ICFRE notification dated 16 April 2018, the centre was renamed as Forest Research Centre for Skill Development (FRC-SD), Chhindwara with effect from 01 May 2018.



MoUs signed:

MoU signed between TFRI, Jabalpur and Orient Paper Mill, Amlai, MP under the project titled 'Development of value chain for bamboos for mass multiplication, popularization in farmers' field and industrial linkages in central India' funded by NBM, New Delhi.

Visit of dignitaries:

1. Shri Apoorva Gupta, DDM NABARD, Jabalpur visited for the review meeting held on 25th June, 2020 and to attend training cum demonstration programme on Bamboo based Agroforestry system on 12th March, 2021.
2. Shri Atul Shukla, APCCF, Chhattisgarh visited and interacted on various issues of forestry research with Director, TFRI.
3. Dr. Akhilesh Pandey, Vice Chancellor, Vikramaditya University, Ujjain (MP) interacted with the Head of Divisions on 12th March, 2021.

New initiatives:

1. Bamboo plants of four superior clumps of *Bambusa tulda* (one clump), *B. bambos* (two clumps) and *B. vulgaris* var. green (one clump) were supplied to Gujarat Forest Department.
2. National Seminar on "Propagation, management and development of value chain in Bamboos" was organized through virtual mode on 10th February 2021.
3. Established Bamboo demonstration plots in the farmers field of Jabalpur, Katni and Damoh districts of Madhya Pradesh under BTSG-ICFRE programme.
4. Developed linkages with the State agricultural University (Rajmata Vijay Raje Sindhia Agricultural University, Gwalior and Central Institute of Soil Science, Bhopal) by delivering invited lectures in their various training programme through virtual mode.
5. Developed linkages with KVKs by initiating work in their fields on Bamboo.

Recruitment and promotions during the year: 2020-21 –

New scientists joined at TFRI –

1. Sh. Ajin Sekhar, Scientist-B
2. Sh. Kaushal Triapthi, Scientist-B
3. Sh. Digvijay Ummed Sinh Rathod, Scientist-B
4. Sh. Nikhil Verma, Scientist-B
5. Sh. Neeraj Prajapati, Scientist-B
6. Dr. C. Mohan, Scientist-B
7. Ms. D. Jangam, Scientist-B
8. Sh. Darshan K., Scientist-B

(A) Promotions during the year: 2020-21

1. Scientists :
    1. Dr. S.N. Mishra, Scientist – B to Scientist – C
    2. Sh. Shalini Bhowate, Scientist – B to Scientist – C
2. Technical services :
    1. Dr. Mamta Purohit ACTO to CTO
    2. Ms. Sushma Maravi, STO to ACTO
    3. Sh. Y. Pardhi, STO to ACTO
    4. Sh. D.P. Jharia,TO to STO
    5. Sh. S.K. Choubey,TO to STO
    6. Sh. A. Francis, TO to STO
    7. Sh. P.S. Rajput, TO to STO
3. Ministerial staff :
    1. Sh. Anil Vishwakarma, LDC to UDC
    2. Sh. R.K. Vishwakarma, LDC to UDC
    3. Sh. Arun Kumar Dagore, LDC to UDC
    4. Sh. Chintu Kumar, MTS to LDC

(C) Transferred during the year: 2020-21

1. Sh. Neelesh Yadav, Scientist-E, TFRI to HFRI, Shimla.
2. Dr. Arun Kumar AN, Scientist-F, TFRI to IWST,Bengaluru.
3. Dr. Geeta Joshi, Scientist-F, TFRI to ICFRE, Dehradun.
4. Sh. C. Behera, IFS, TFRI to FSI, Nagpur.
5. Dr. Pawan Kumar, Scientist-E, TFRI to HFRI, Shimla.

2.	**Research Highlights :**
A	**CAMPA Activities: 1. AICRPs 2. NFGRs 3. CAMPA Extension –** Material for this section will be compiled and edited by the NPCs of concerned AICRPs/NGFRs and Head Extension for incorporating in the material to be sent by their respective institute.
1.	**All India Coordinated Research Projects :** **At TFRI, Jabalpur total (23+3)= 26 AICRP's, funded by CAMPA, New Delhi are being executed.** 1. Testing and deployment of clones and seed sources of *Casuarina* for different planting environments and end-use applications(AICRP-1) 2. All India coordinated research project on bamboo (AICRP-2) 3. Conservation, improvement, management and promotion of Sandalwood (*Santalum album* Linn.) cultivation in India (AICRP-3) 4. Eucalyptus improvement (AICRP-4) 5. Assessment and monitoring of Invasive Alien Plant species in India and formulation of strategies for management of key invasive alien plant species in different regions of the country (AICRP-7) 6. Quality teak production: Capitalizing on cloning (AICRP-9) 7. Developing seed testing, seed storage protocols and nursery techniques of selected forestry species from diverse forest types (AICRP-10) 8. All India coordinated research project on *Dalbergia sissoo* (shisham) (AICRP-11) 9. Assessment of demand and supply of timber, fuel-wood and fodder in India(AICRP-12) 10. Valuation of forests for GDP, Green GDP and payment of eco-system good and services. (AICRP-13) 11. Forest fire research and knowledge management (AICRP-14) 12. Bio-prospecting for industrial utilization of lesser known forest plants (AICRP-16) 13. Enhancement of fodder availability and quality to reduce unsustainable grazing in the forest (AICRP-17) 14. Silvicultural interventions for productivity and qualitative improvement in plantations of important tree species under different agro-climatic zone (AICRP-18) 15. Assessment of water requirement of different forest tree species and its impact on sub soil moisture (AICRP-19)

16. Development of Biopesticide products/formulations from extracts of tree borne oil seeds and different tissues of wild plants for management of insect pests (AICRP-20)
17. Development of Superior Bio-fertilizer Products for Enhanced Plant Productivity (AICRP-21)
18. Preparation of forest soil health cards under different forest vegetations in all the forest division of India(AICRP-22)
19. Combating desertification by enhancing vegetation cover and people livelihoods in degraded drylands and deserts of India(AICRP-24)
20. Genetic Improvement of *Azadirachta indica* A. Juss. (Neem) (AICRP-26)
21. Population status, collection, conservation, characterization and evaluation of genetic resources of Indian Rosewood, *Dalbergia latifolia* (AICRP-28)
22. Sustainable management of NTFPs through conservation and value addition(AICRP-29)
23. Study of climate driven effects on Indian forests through long term monitoring(AICRP-31)

(i) Three (03) AICRP's projects with NPCs at TFRI are being carried out. They are as follows:

(a) Genetic Improvement and value addition of *Madhuca longifolia* (AICRPs-23).

NPC : Dr. Fatima Shirin, Scientist F, TFRI, Jabalpur.

PIs :

IFP, Ranchi

Dr. Animesh Sinha, Scientist E

IFGTB, Coimbatore

Mrs. D. Thangamani, Scientist C

IFB, Hyderabad

Dr. G. R. S. Reddy, Scientist G (Till his retirement on 30th November 2020)

FRC-ER, Prayagraj

Dr. Kumud Dubey, Scientist

FRC-SD, Chhindwara

Dr. Visakha Kumbhare , Scientist E

TFRI, Jabalpur

Dr. Pramod Kumar

Working plans of Forest Divisions in Madhya Pradesh, Chhattisgarh and Maharashtra were consulted for finding out the location of mahua populations. Surveys were carried out and tours were conducted to different locations in Chhattisgarh and Madhya Pradesh. Phenotypically superior trees of *Madhuca longifolia* based on flower yield were selected from both the states. In

Chhattisgarh, 20-30 trees were selected from Kondagaon, Kanker, Dhamtari, Mahasamund, Surajpur, Marvahi, Baloda Bazaar, Dhamtri, Mahasamund and Korba forest areas. In Madhya Pradesh, 20-30 trees were selected from Hoshanagabad, Narsinghpur, and Betul. Morphometric data of trees viz., Total tree height, Clear bole height, GBH, crown diameter and number of branches was recorded for each tree. The geographical location of each tree was also recorded using GPS. Flowering and fruiting status of the trees was recorded. Flowers and fruits were collected from selected trees. Morphological characterization of flowers was carried out. Fresh flower weight (g), fresh flower length (cm) and fresh flower width (cm) was recorded. Drying and processing of flowers was carried out and biochemical estimation of sugar, phenol and protein was done. Morphological characterization of fruits and seeds was carried out and the parameters recorded were fruit length, width, weight and seed length, width and weight. Branches were also collected from trees in each location. Seeds of 35 selected trees were collected and sown in nursery. Later on these seedlings will be used as root stock for grafting. Soil samples were collected from each location. Secondary data related to ITKs was documented.

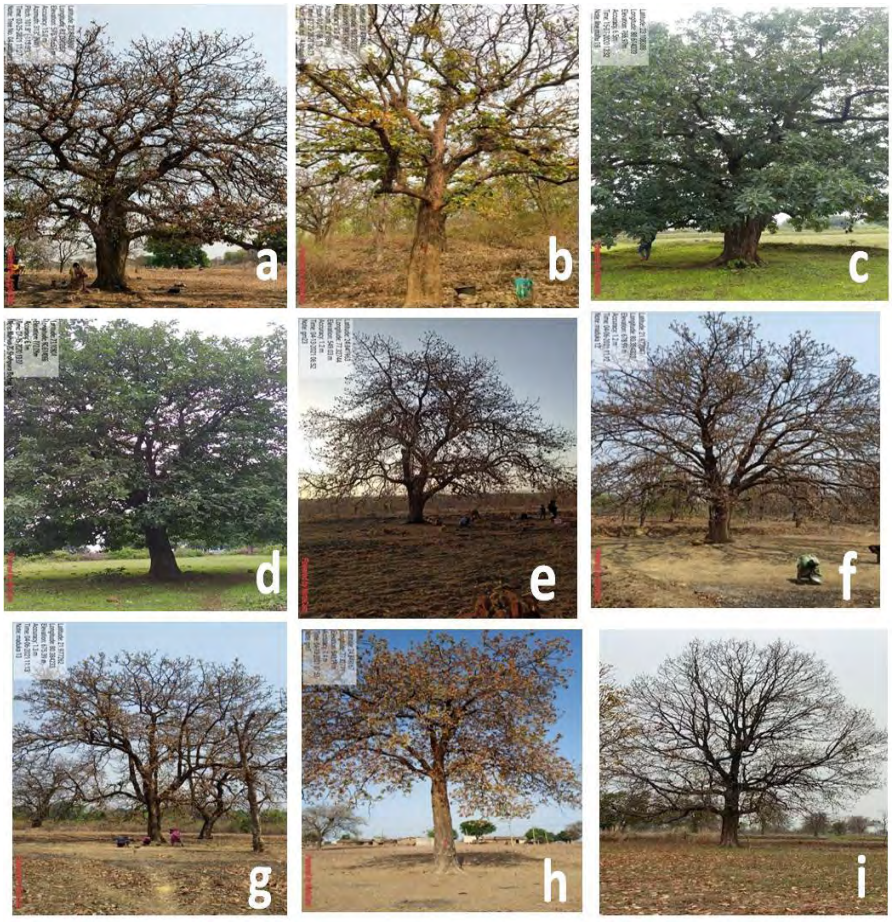


Fig. 1: Selected phenotypically superior trees of *Madhuca longifolia* in a).Narsinghpur, b) Hosangabad, Madhya Pradesh, c) Dhamtari, d) Mahasamund, e)Balodabazar, f) Kondagaon, g) and h) Marwahi, i) Kanker, Chhattisgarh.

Fig. 2: Selected Superior trees of mahua in a). Measurement of GBH, b). & c). Flowers of mahua, d). – g). Collection and measurement of Flowers, h). & i). Fresh and dried flowers- j). & k). Collection and planting of branch cuttings of mahua, l) & m). Fruits and raised seedlings from selected tree.

IFP, Ranchi

Surveys were carried out in three agroclimatic zones of Jharkhand and one zone each of Bihar and West Bengal states. Survey was carried out in total 11 districts for selection of superior trees of Mahua (*Madhuca logifolia*). Survey was carried out in Ranchi, Khunti and Ramgarh districts of Jharkhand for selection of phenotypically superior trees. Eighteen phenotypically superior trees were selected from Bero, Palkot, Jonha, Dasm, Saraikela, Kharsowa and Mahua Dar in Jharkand. So far 42 phenotypically superior trees were selected from three states. Data on tree height, GBH, crown diameter, number of branches etc were recorded for each selected trees. GPS data of each location was also recorded. Flowers were collected from 13 selected trees and data on different parameters were recorded. Seeds of two selected trees were collected and sown in nursery. Later on these seedlings will be used as root stock for grafting.

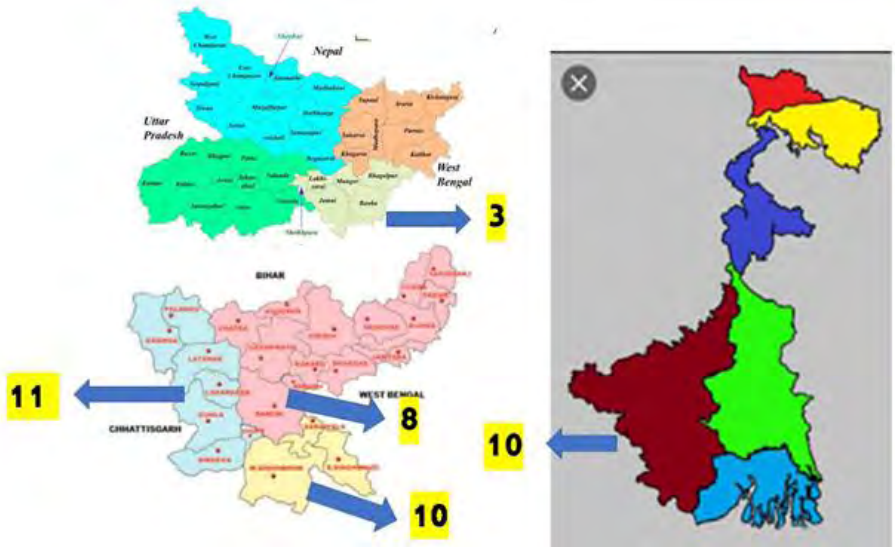


Fig. 3: Selection of phenotypically superior trees of Mahua in different agro-climatic regions in Bihar, Jharkhand and West Bengal.

Fig. 4: Selected trees of mahua in Jharkhand and Bihar.

Fig. 5: Collection of flowers of mahua selected tree (Bero – 3).

Fig. 6: Raising of seedlings of mahua at IFP, Ranchi.

IFGTB, Coimbatore

Survey has been carried out in local areas of Coimbatore, Madurai, Thiruvannamalai and Dharmapuri. Totally 22 phenotypically superior trees were selected from different locations of Coimbatore, Madurai, Thiruvannamalai and Dharmapuri. The stem cuttings, flowers, fruits, and seeds were collected. The geographical locations were noted using GPS. The soil samples were also collected and physico-chemical parameters are being analyzed. Leaves were collected and air dried to analyze the phytochemicals and some of the leaves were stored in 4ºC for DNA analysis. Fruits collected were tested for its phytochemical constituents. Phytochemical analysis of leaf was carried out in 17 selected trees. Phytochemical analysis of seeds was carried out in 4 locations. Seeds collected from the different locations were sown in nursery for germination studies. Seedlings were raised from seeds and seedlings were also directly collected from field to produce

quality planting material through grafting. Flowers were also collected from 10 different locations and air dried for further phytyochemical analysis. Flower weight has been measured; single flower weight and 100 flowers weights were measured to find out the total flower yield of trees. Morphological variation in leaves, fruits and seeds has been carried out using image analyzer. Cuttings were collected from the all 22 selected trees and kept for propagation in the nursery. Initially the stem cuttings were treated with various concentrations of IBA such as 500ppm, 1000ppm, 2000ppm, and 4000ppm. Shoot and root initiations were observed in cuttings, after root initiation plants were transferred into polybags and hardening process is ongoing. Regeneration studies has been carried out in Tiruvannamalai area and Coimbatore area and the data has been recorded.

Fig. 7: Collection of flowers and flower weight measurement and dry flowers at IFGTB, Coimbatore.

Fig.8: GBH measurement.

Fig.9: Collection and planting of stem cuttings.

Fig. 10: Natural Regeneration in *Madhuca longifolia* in a) Tiruvannamalai b)Coimbatore.

IFB, Hyderabad

Permission was sought from Telangana, Odisha and Andhra Pradesh Forest Departments for field survey under progress. Permission was received from Telangana and Andhra Pradesh State Forest Departments to conduct the study for next five years. Secondary data was collected from working plans of Telanagana-14 divisions and Andhra Pradesh- 07 divisions for location of *Madhuca longifolia*. Tours were conducted in different forest areas of Telangana in Yellandu, Amrabad, Siddipet and Mahabubabad for selection of phenotypically superior trees of mahua. 20-30 trees were selected in each location. Tours were conducted in Kamareddy forest division, Telangana and 35 phenotypicallysuperior trees were selected.The geographical locations were noted using GPS. Flowers were collected from selected trees. Preliminary processing of flowers is being carried out. Seed collection was initiated from selected trees and nursery work was started. Literature review was conducted and articles related to the project were collected. Letter was submitted to GCC regarding mahua seed and flower information. Letter was submitted to Telangana State Excise Department regarding mahua flower and seeds transportation and Energy Bar blending. But permission was not granted to carryout the work. Field Vehicle selection was finalized and letter was initiated for DG approval. Seeds have been procured for value addition. JPF recruitment was completed and joined in the month of February-2021. ITKs secondary details were documented.

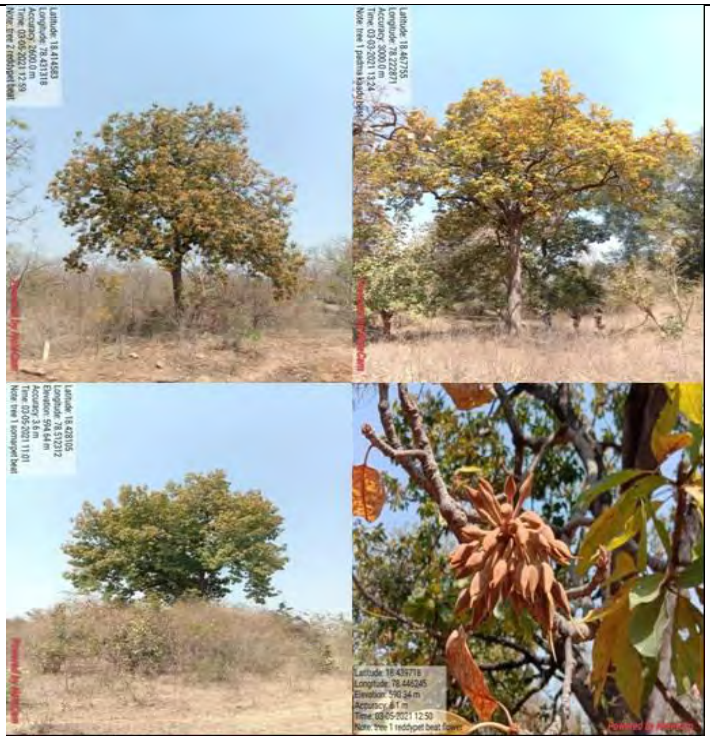


Fig. 11: Selected phenotypically superior trees of *Madhuca longifolia*.

Fig. 12: Morphological data observation from selected trees of *Madhuca longifolia*.

Fig. 13: Seedlings of *Madhuca longifolia* at IFB, Hyderabad.

FRC-ER, Prayagraj

Discussions were held with the PCCF (Project) State UP Forest Department for the natural availability of *Madhuca longifolia*. Survey of natural and planted sites of *Madhuca longifolia* in Prayagraj Forest Division was carried out as representative of gangetic plain. The natural Mahua was found only in Meja range of Prayagraj forest division. Twenty five phenotypically superior trees were selected for further research as per guidelines issued by the National Coordinator of Project from Prayagraj, Kaushambi and Jaunpur. Surveys were carried out in forest areas of Vindhyan region and 25 phenotypically superior trees were selected from Mirzapur. From Chitrakoot district of Bundelkhand region 15 trees were selected. Morphometric data viz., Height, Girth, Crown etc. of selected trees was collected at four survey sites. Seeds were collected from 20 selected trees and seed data was recorded. The parameters recorded were fruit length, width, weight and seed length, width and weight. A nursery as also been raised from seeds of mahua collected from marked trees.

Fig. 14: Survey and selection of phenotypically superior trees of *Madhuca longifolia* in, Prayagraj, Uttar Pradesh.

FRC-SD, Chhindwara

Survey was conducted in FRCSD Chhindwara for availability of *Madhuca longifolia* species. Fresh flowers, leaves and bark samples were collected from available trees of FRCSD campus. Samples were further dried, processed and stored for chemical analysis and product development work. Mahua bark and leaves are reported to possess antimicrobial and antifungal activities. Hence bark and leaves extract will be utilized for development of handwash and flowers will be utilized for development of energy bar. Preparation of sample extracts of bark and leaves was carried out for utilizing the same in product development works. Moisture content in leaves and bark was determined. Phytochemical evaluation of dried *Madhuca longifolia* (mahua) flowers was done for total ash, moisture, total fat, protein, total sugar, energy value, carbohydrates, ascorbic acid (vitamin –C), iron, calcium, potassium, sodium, and dietary fibre content. Experiments were conducted for development of herbal handwash. Survey through internet sources was conducted for documentation of ITKs related to post harvest techniques. Survey was also conducted to tribal areas viz., Amarwada, Talpiparia, Surlakhapa, Bichhua, West Forest Division, Betul and documented traditional knowledge on processing of mahua oil for removal of bitterness and unpleasant odour removal from mahua flowers. Method for preparation of traditional dishes viz., sattu, latto, thetra, laddus, bhondi, koya, domri made from mahua flowers was documented. Mahua flowers are also used for medicinal purposes by the tribals. Information was documented on use of mahua flowers /seed cake for swelling removal and reptile repellent purposes.

Fig. 15 : Mahua oil extracted by tribals of Bichua

Fig. 16: Survey at Majhiapaar and Talpipariya village for traditional tribal mahua knowledge by FRC-SD, Chhindwara

(b) Conservation and sustainable management of wild edible fruiting species (AICRP-27)

NPC : Dr.M. Kundu, Scientist F , TFRI, Jabalpur.

The Project is being implemented by 7 Institutes: FRI, Dehradun (on *Pyrus pashia, Ficus palmate and Myrica esculenta)*, TFRI, Jabalpur (on *Semecarpus anacardium, Flacourtia indica and Carissa carandas*) IFGTG, Coimbatore (on *Pithecellobium dulce and Limonia acidissima)*, HFRI, Shimla (on *Myrica esculenta and Prunus cornuta)*, RFRI, Jorhat (on *Prunus jenkinsii and Spondias pinnata) a*nd IFP, Ranchi (distribution of wild edible fruiting species in Jharkhand). Field visits were conducted to survey the probable habitats of these wild fruiting species to record their distribution pattern, population structure and regeneration status. Number of promising trees was identified were: *Semecarpus anacardium:* 18; *Flacourtia indica:* 7; *Pyrus pashia*: 10; *Ficus palmate*:10; *Limonia acidissima*: 24. Experiments on standardization of propagation protocol from seed and vegetative parts are going on. Development of methodology of growing of seedling in nursery is under process. 2 value added products "energy drink" and "karonda chips" have been prepared from *Carissa carandas* fruit. Propagation of *Myrica esculenta* by tissue culture method is being standardized. Survey in the villages and village markets of Hazaribagh, Deoghar, Dumka and Khunti districts in Jharkhand had been carried out for identification of wild edible fruit species.

Flacourtia indica

Flacourtia indica

Fruit of Myrica esculenta sp.

***Seeds of Prunus cornuta* sp.**

Fig. 17: Vegetative propagation of *Flacourtia indica* , fruit collection of *M. esculenta* and seed collection of *P. cornuta* sp.

(c) Development of Package of practices on *Gmelina arborea* Roxb. (Khamer or Gamhar) in selected agroclimatic regions of India(AICRP-30)

NPC : Dr. Nanita Berry, Scientist E, TFRI, Jabalpur.

- Fields have been identified for the establishment of field trials in Jharkhand, Uttarakhand, Madhya Pradesh, Chhattisgarh, and Tamilnadu states. 69 CPTs were identified in Jharkhand 20 in Bihar, 50 in Naharoni,Golghat,Assam, 50 from Tamilnadu, few from northern region and 5 in Chhattisgarh and 5 in MP. Morphometric data of trees viz., GBH, total height, clear bole height and crown diameter was recorded. Also registered GPS data of the respective CPTs. Fruits/seeds from 50 clones, scion cuttings of 26 clones and 300 stocks from Titabar Biodiversity park,Lohpohiaforest nursery, Ruma nursery, Hojai(Nagoan) Assam, Jharkhand, MP, Chhattisgarh.

- The Gmelina seeds were soaked in cold water for 24 hours and sown in the raised sand bed. Quality planting stocks were produced from 20 open pollinated families of Gmelina. Assessed variation in the seedling growth attributes. 35 number of clones were responded good germination and seeds were sown for the seedlings. germinated.
- Evaluated clonal trials of Gmelina for growth superiority and tolerance to pest and disease. Maintained the multi-location clonal trials for better growth and development. Shortlisted high productive clones based on early growth superiority
- The seeds of 11 plus trees has been received from the Institute of Forest Genetics and Tree Breeding, Coimbatore, Tamil Nadu and sown in the nursery of the Division of Genetics and Tree Improvement of FRI. Seed data like stone length, width and 100 stone weight were recorded.
- Genomic DNA was extracted from thirty individuals of *Gmelina arborea*. Twenty sets of new genome wide microsatellite primers were designed for synthesis. These twenty primers were optimized. Leaves samples were collected from progeny trial established by IFGTB at Salem. DNA was isolated from twenty nine families of *Gmelina arborea* for SSR profiling. Protocol for the isolation of genomic DNA is being standardized to isolate genomic DNA at Jharkhand area.
- Selected sites in Central region, Semiarid Tropical Region of T.S and southern region for the establishment of Agroforestry models at TFRI & IFB & IFGTB) and fields are ready for demonstration plots. Established Gmelina based agro forestry models - Gmelina + Banana at Vadakadu, Pudhukottai, Gmelina + Papaya at Kangeyam, Thiruppur and Gmelina + Casuarina + Ground nut at Soolakal, Pollachi. Evaluated clonal trials of Gmelina for growth superiorly and tolerance to pest and disease. Vegetative multiplication of high productive of Gmelina clones through mini cutting. Established mulit-tree agroforestry models- Gmelina + Casuarina + Ground nut at Soolakal, Pollachi.
- Survey was conducted in plantations, nurseries and forest areas of ikamgarh, Chattarpur, Niwari, Budhani and Sehore district of Madhya Pradesh against the insect pests of *Gmelina arborea* in nurseries, plantations. The assessments of losses of key pests were recorded. Collected insects were preserved and their identification is in progress.

Fig. 18: (a) Fruits of *Gmelina arborea*, (b and c) Seedlings of *Gmelina arborea at TFRI*

Fig. 19: (a) Seed collection from CPTs, Assam (b) Collection of Cuttings (scion) from existing *G. arborea* CSO

Fig. 20 : Scion from the CSO of Gmelina for clonal trial at RFRI

Fig. 21: A view of grafted seedlings of g.arborea at different stage at RFRI

Fig.22: (a) Layout of the field for establishment of agroforestry trial at TFRI (b) Pitting for the transplantation of seedlings of *G.arborea*

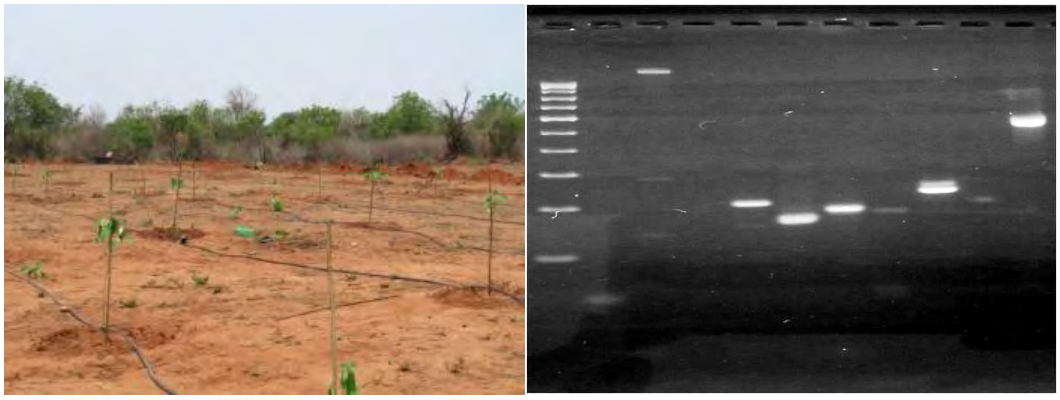


Fig. 23: . Established block plantation of *Gmelina arborea* at IFB, Hyderabad and SSR primer optimization

Fig. 24: CPTs of *G. arborea*Identified in Madhubani, Bihar

Fig. 25 : Identified CPTs of *G. arborea* in Bihar

Fig. 26 : Identified CPTs of *G. arborea* in Bihar

(ii) All India Coordinated Research Projects (23) They are as follows:

Testing and deployment of clones and seed sources of *Casuarina* for different planting environments and end-use applications (AICRP-1).

For establishment of clonal trials, three sites have been selected (2 sites in Madhya Pradesh and one site in Chhattisgarh). For establishment of clonal trials, different clones will be transported from IFGTB. Clonal trials will be established after onset of monsoon and after establishment, periodical growth parameters will be recorded for comparison to assess the site suitability of clones in central India.

All India Co-ordinated Project on Bamboo (AICRP-2).

Survey was carried out in TFRI campus and new bamboo clumps of *Bambusa nutans* and *Bambusa balcooa* were selected. The rhizomes of selected clumps were assembled in the rhizome bank/germplasm bank, for establishment of clumps. Two new superior clumps of *Bambusa balcooa* were selected from Raipur, Chhattisgarh, one clump each of *Bambusa tulda*, *Bambusa nutans* and *Bambusa balcooa* was selected from Bilaspur, Chhattisgarh.

Cuttings of *Bambusa balcooa* and *Bambusa tulda* were collected from Bargi, Madhya Pradesh, Bilaspur and Marwahi, Chhattisgarh and *Bambusa tulda* from Balaghat, Madhya Pradesh. Cuttings were planted in mist chamber after treatment with IBA 800 PPM for *Bambusa balcooa* and IBA 200 PPM for *Bambusa tulda*.

Survey and identification of existing bamboo plantation in Jabalpur to conduct experiment for standardization of silvicultural and management techniques was carried out. Correspondence was made to concerned authorities for land requirement for establishment of Demo bamboo plantations. Surveyed and interacted with farmers of Jabalpur to establish bamboo plantation in their fields.

Survey was conducted at Seoni, Gwalior, Mandla, Sehore, Katni, Jabalpur district in Madhya Pradesh and Raipur district in Chhattisgarh against the insect pests of Bamboo in nurseries, plantations and Bamboo growing areas. The assessment of losses due to key pests in bamboo species was recorded. Collected insects were preserved and their identification is in progress.

Five samples each of *B. tulda* and *B. vulgaris* var. green were collected from the

Germplasm Bank of TFRI. Genomic DNA of the same extracted, purified and quantified. 28 SSR primers specific to the target species was compiled from the published literature and procured. Screening of procured primers completed. 17 primers found to be amplifying the genomic DNA of target species. One population of *B. tulda* collected from Assam (Jorhat and Sivsagar) is under process of genomic DNA extraction.

Land was cleared and prepared for establishment of Bambusetum at TFRI, Jabalpur. Bambusetum was established with 25 species of bamboos at TFRI, Jabalpur. The various bamboo species in the Bambusetum were maintained by regular irrigation, fertilization and weeding. Literature consultation and collection is going on to get the publication of Training Material (manuals, brochures, pamphlets, extension material etc) in vernacular languages.

Component 1

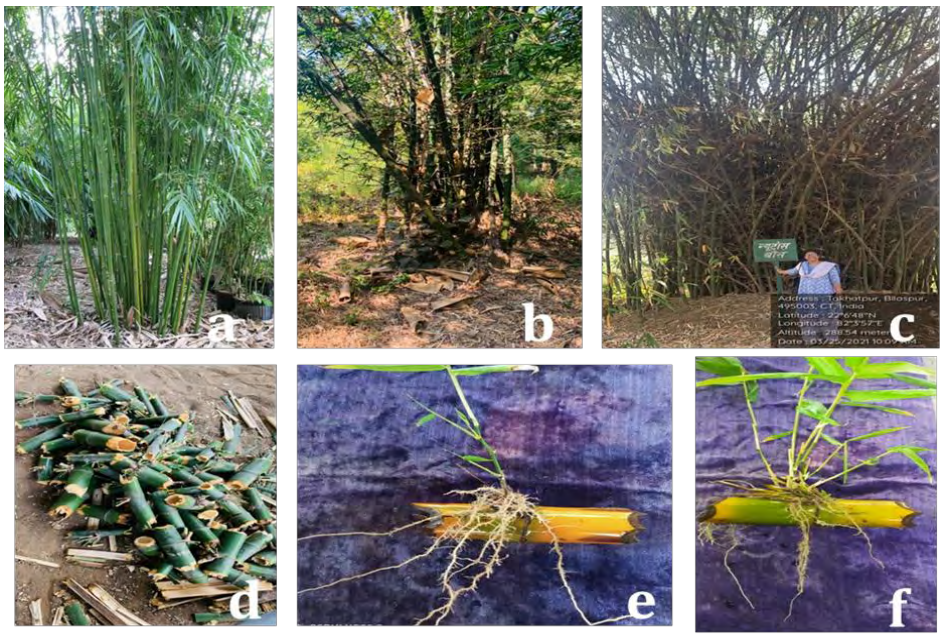


Fig. 27: Selected superior clump of a) *Bambusa nutans,* b) *Bambusa balcooa,* c) *Bambusa tulda,* d) Prepared cuttings, e-f) Rooted cuttings of *B. balcooa* and *B. nutans*.

Component 4(b)

Fig. 28:Bamboo culms infested by borer *Estigmena chinensis* in plantation at Jabalpur

Fig. 29: Damaged seedlings of Bamboo by leaf roller Crypsipta *coclesalis* Bamboo

Component 8

Fig. 30 : (a) Field preparation for establishment of Bambusetum, (b and c) planting of bamboo plants, (d) bamboo after 2 months of planting

Fig. 31: Application of fertilizer in Bamboo clump, b) & c) Bamboo plants after six months of plantation in Bambusetum located at TFRI, Jabalpur.

Conservation, Improvement, Management and Promotion of Sandalwood (*Santalum album* Linn.) cultivation in India (**AICRP- 3**)

Collected seeds from the natural forest of Seoni (MP.). Study was conducted on Germination and recorded the data on survival. Procured seeds from the KFRI for planting stock production. Procured equipments as listed under the project. Prepared guideline for the initiating Agroforestry system in all the partner institutes uniformly. Identified land for the establishment of Agroforestry system.

Eucalyptus Improvement(MLT of eucalyptus clones) (**AICRP- 4**)

During the period of report, requests were placed to Madhya Pradesh, Maharashtra and Chhattisgarh Forest Department for allotment of land parcels for establishment of clonal evaluation trial of eucalyptus. Sites allotted by MP and CG forest department were visited. One evaluation trial consisting of 151 clones was planted in randomized block design with six replications. Need based plant protection measures were executed.

Assessment and monitoring of Invasive Alien Plant Species in India and formulation of strategies for management of key Invasive Alien Plant Species in different regions of the country (AICRP-7)

Selected forests sites in Jabalpur and Mandla forest divisions. Collected baseline data on tree species composition and regeneration status is in progress. Collected soil samples (3 depths – 0-15, 15-30 and 30-45 cm) to study the soil various physical and chemical properties in Lantana invaded area and that will be compared with soil samples taken from nearby agricultural field.

Quality Teak production : capitalizing on cloning (AICRP-9)

In vitro stock cultures of teak (*Tectona grandis*) of five clones (10 bottles each) were obtained from NPC at IFGTB, Coimbatore. The stock cultures were multiplied and maintained on standardized culture medium supplemented with BA and Kinetin. Around 286 bottles of shoot cultures of different clones have been established. Each bottle contains 5-6 shoots. The highest shoot multiplication was obtained in Teak clone 5, followed by Teak clone 2. Clonal Seed Orchard of Teak located at TFRI Jabalpur was surveyed and 3 clones (PT-41, TNT and CSC-9) were selected and 4 clones (PT-46, BHC-19, CSC-9, C4) were selected from Progeny trial located at Moiyanala, Mandla. Branches were collected from these clones and semi-hard wood cuttings were prepared. The cuttings of all clones were given an overnight treatment of 500 ppm of IBA solution. After 30 -40 days, nodal segments of clone PT-46, CSC-9 and C4 were collected from cuttings and established under aseptic *in vitro* conditions.

Fig. 32: Shoot cultures of *Tectona grandis*

Fig. 33: Inoculation of Nodal segments of *Tectona grandis*

Developing seed testing and seed storage protocols of selected forestry species from diverse forest types. (AICRP-10)

Seeds of *Putranjiva roxburghii, Mallotus philippensis Semecarpus anacardium* and *Buchanania lanjan* were collected from Jabalpur, and Mandla District. Seed maturation work has been initiated on *Semacarpus anacardium, Sterculia villosa, Putranjiva roxburghii, and Mallotus philippensis.* Work is initiated on seed extraction procedure on *Putranjiva roxburghii, and Mallotus philippensis.* Different pre-sowing treatments were applied to seeds of *Mallotus philippensis, Putranjiva roxburghii, Semecarpus anacardium* and *Buchanania lanzan* to evaluate their germination. Maximum germination percentage was observed in the seeds treated with Gibberellic Acid at the dose of 250 ppm in *Putranjiva roxburghii* and IAA 250 in *Semecarpus anacardium,* gibberellic Acid at the dose of 750 ppm for *Mallotus philippensis* and combined treatment of sulfuric acid for 5 minutes and gibberelic acid at the dose of 250 ppm in case of *Buchanania lanzan.* Seeds of *Putranjiva roxburghii* and *Semecarpus anacardium* were desiccated to different moisture content and viability was assessed. Seeds were viable till 4-5% moisture content. Seeds of both species may be categorised as orthodox seeds. *Putranjiva roxburghii, Semecarpus anacardium* and *Buchanania lanzan* seeds were stored at different moisture contents at three different temperatures. *Putranjiva roxburghii and Semecarpus anacardium* were sampled for viability assessment after 3 months of storage.

A**ll India Coordinated Research Project on *Dalbergia sissoo* (AICRP-11)**

- Soil samples were collected from different location of *Dalbergia sissoo* planataions
- Cultures of *Trichoderma* sp and *Fusarium solani* were screened for antagonistic activity.
- Multiplication of Trichoderma on various substrate initiated.
- Necessary purchase of consumables has been done.
-

Fig. 34 : Seed Germination test of *D. sissoo* before seed sowing.

Assessment of demand and supply of timber, fuel-wood and fodder in India. (AICRP-12)

Conducted tour to collect data of timber supply, timber demand, wood wastage, wood received in different wood based Industries at Budhani, Gotegaon, Pipariya, Bhopal, Sagar and Jabalpur district from the mention period.

Fig. 35: Surveyed Forest department depots, Wood based industries and farmers for collecting data of demand and supply of timber, fuel wood in Madhya Pradesh

Valuation of Forest for GDP, Green GDP and payment of ecosystem Goods and Services(AICRP-13)

The project is in initial stage. The PI attended inception meeting of the project at Van Vigyan Bhawan, New Delhi. The project staff under the project has been appointed. According to the format provided by NPC, the data on households from 20 families belonging to 2 villages of Jabalpur district has been collected for quantification of forest resources by the households. A manual on "Valuation of Nutrient Cycling in Ecosystem Services" has been developed and submitted to NPC for further comments. The manual includes glimpse of nutrient cycling in forest, provides glance of important nutrient cycles (NPK), and format for Valuation of Nutrient Cycling in Ecosystem Services. A case study of Changbaishan Mountain Biosphere Reserve (CMBR) in Northeast China is also mentioned in the manual as an example to measure total nutrient accumulation.

Forest Fire Research and Knowledge Management(AICRP-14)

Equipment (all in one PC, UPS, printer and Hard disk) and a GPS have been purchased. Baseline Data collection of various parameters viz., loss of timber, fuelwood, NWFP, biodiversity (including invasion by alien species) and carbon storage, discussing the overall ecological losses in burnt and adjoining un-burnt control sites for Tropical Moist Deciduous Forest of Odisha (Similipal national park) has been done for burnt and non-burnt forest fire scars. The team also collected soil samples for physico-chemical characteristic which is now being processed in TFRI laboratory Jabalpur. Also, in interim report has been submitted. Forest fire points from Maharashtra was received but due to outbreak of Covid-19 situation it was not possible to go there due to prolonged lock down situations. Letter have also been sent of nodal office of Madhya Pradesh and Chhattisgarh and being pursued time to time.

Fig. 36 Burnt site at Nigirdha beat in Similipal National park, Odisha and Laying out quadrat

Bioprospecting for industrial utilization of lesser known forest plants (AICRP-16)

Surveyed *Cyprus rotandas* and collected rhizomes of 7 districts for estimation of essential oil. Surveyed *woodfordia fruticosa* and collected flower for isolation of dyes. Collected flowers of from 18 places of 11 districts of MP. Drying and grinding process of rhizomes is in progress and few samples had been processed for estimation of essential oil and estimation of dyes.

Collection of targeted speices

Processing of C. Rotundus

Fig. 37: Processing of *Woodfordia fruticosa* for estimation of dye

Enhancement of fodder availability and quality to reduce unsustainable grazing in the forest (AICRP-17)

Sites were identified in two districts i.e. Dindori and Jabalpur of M.P. with consultation of CCF, Jabalpur for the implementation of the project. Finalised the fodder trees and grasses for sustainable supply of fodder in the selected sites. Production of planting stock of Fodder tree was started in the nursery. Seeds of grasses were procured from the IGFRI, Jhansi(UP). Equipments were procured.

Silvicultural interventions for productivity enhancement and carbon sequestration in plantations of important tree species (AICRP-18)

Identified three locations of Chhattisgarh, Mandla and Jabalpur districts for collection of seeds of *Haldina cordifolia*. Identified block and boundary plantations of Gmelina and teak existing in farmer's field of Jabalpur district to assess the growth performance under different silviculture practices. Procured the seeds of selected tree species from IFGTB, Coimbatore (Tamilnadu) and started production of planting material in nursery. The work is under progress. Identified land in the farmer's field in Khamria, Medhar and Purva villages of M.P.

Assessment of water requirement of different forest tree species and its impact on subsoil moisture (AICRP-19)

Research staff has been appointed. Protocol for instrumentation and data recording has been finalized. An area of 10 ha is identified and permission granted in Kanha National Park under AICRP-31 which will be used of experiment set up for the tentatively selected species i.e., 1. Shorea robusta, 2. Tectona grandis, 3. Pterocarpus marsupium, 4. Terminalia arjuna. Two AWS have been purchased and one has been installed at Moiya Nala, west Mandla forest division and the other one in the TFRI campus itself. Besides them, one all in PC (1 no.) and Leaf water potential system (Psychrometer) (1 no.) have also been delivered. Purchasing of Mini-disc infiltrometer and Soil moisture sensors are in process. Purchasing of Sap flow meter and its accessories are being done centrally under the leadership of FRI, Dehradun.

Fig. 38: Installation of AWS at Moiya Nala, West Mandla forest division

Development of Biopesticide products /formulations from extracts of tree borne oil seeds and different tissues of wild plants for management of insect pests (AICRP-20)

During the period Pre-formulated Bio-pesticide products i.e. TREE PAL and CRAWL CLEAN received from IFGTB, Coimbatore and different concentrations has been prepared in the laboratory as per standard protocol and its testing work is initiated in the laboratory. Seeds of *Madhuca indica* and *Jatropa* were collected from different locations under the jurisdiction of Tropical Forest Research Institute (TFRI), Jabalpur, for isolation of pesticidal properties.

Observation of Larval infestation on seed and fruit of *Madhuca indica* had been analysed in laboratory at Forest Protection Division. Arrangements were made for rearing and mass multiplication of major insect pest of teak i.e. teak defoliator (*Hybleae purea*) and skeletonizer (*Eutectona machaeralis*) under laboratory conditions. Drying and grinding process of seed is in progress and few samples had been processed for oil extraction.

Benefits of Research:

An extensive efficacy and safety database will be completed and documented on Biopesticides products. Innovative formulations with suitable formulation inerts will be developed and tested for it values. The technology/techniques used in developing biopesticide formulations (using locally available resources can easily be learnt and adopted) will be disseminated to the local people including the tribal community which would help in creation of job opportunities and poverty alleviation. Dissemination of techniques, technologies and products to stake holders through training programmes.

Fig. 39 : Pre-formulated Tree Pal and Crawl clean Bio-pesticides and extracted oil

Fig. 40: Extraction of seed oil using Soxhlet Apparatus.

Development of Superior Bio-fertilizer products for enhanced plant Productivity (AICRP-21)

- Procured commercially available bio-fertilizers (AM fungi, *Azospirillum*, *Azotobacter*, Phosphobacteria and Potash Mobilizer (Tricho-K) from Department of Agricultural Microbiology, Jawaharlal Nehru Krishi Vishva Vidhyalay (JNKVV)University.
- Experiments were laid out at Bamandehi nursery Seoni as per project document.

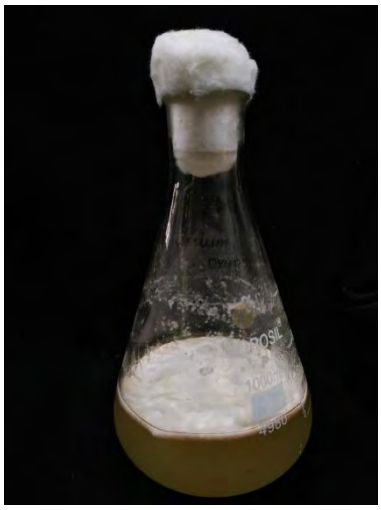


Fig. 41: Culture of *Fusarium oxysporum* in broth.

Preparation of Forest Soil Health Cards under different Forest Vegetations in all the Forest Divisions of India (AICRP-22)

The project is in the second year of implementation. All the instruments under the AICRP have been procured. Project fellows have been recruited under the project, except 2 PAs who did not join after lay-off period.

Soil and litter samples from 10 forest divisions of Madhya Pradesh have been collected processed and analysis for the selected parameters is going on in TFRI laboratories.

Fig. 42: (a) Measuring bulk density of soil in Seoni forest division of M.P.
(b)Collecting litter sample from Jabalpur forest division of M.P.

Combating desertification by enhancing vegetation cover and people livelihoods in degraded drylands and deserts of India (AICRP-24)

The project is in the second year of its implementation. Procurement of instruments is under process. Recruitment of project fellows has been completed. One 15-ha plot has been selected in Morena district of M.P. for raising plantation of suitable tree species in consultation with SFD officers. Vegetation survey has been conducted near the selected site to get a broad understanding of indigenous species of grass, herbs, shrubs and trees.

Fig. 43: (a) Discussing with DFO Morena regarding project and selection of site (b) Selecting site at Morena forest division for raising plantation

Genetic Improvement of the *Azadirachta indica* A. Juss (Neem) (AICPR-26)

Surveys were carried out and tours were conducted in different locations of Madhya Pradesh in Agroclimatic zone 8. In Sohagpur, Narsinghpur, 30 phenologically superior trees were marked. The geographical locations were noted using GPS. Morphometric data viz., Girth, Height and Crown Diameter was recorded for the selected trees. Soil Type, Humidity, Temperature of the site was noted. Soil samples were collected from each location and Soil analysis was performed to evaluate soil properties, viz., pH, EC, SOC and Total Nitrogen. For Phenological studies, observations (Number of branches, leaf fall, leaf initiation, and Flowering initiation) and morphological data was recorded from 20 trees of Katni and 10 trees from Jabalpur.

Fig. 44: Selected CPTS of *Azadirachta indica* located in (a) Katni, (b) Shahpura, (c) Jabalpur, (d) Sohagpur, Madhya Pradesh, (e) collection and processing of fruits from selected trees, (f) de-pulped seeds of *Azadirachta indica,* (g) Flowering initiation in *Azadirachta indica*, and (h) Leaf fall & New Leaf initiation in *Azadirachta indica* A. Juss (Neem).

Population status, collection, conservation, characterization and evaluation of genetic resources of Indian Rosewood, *Dalbergia latifolia* (AICRP -28)

Populations of *Dalbergia latifolia* were located through working plans in central India. Tours were conducted to Tamia, Silewani, Betul in M.P. and 28 phenotypically superior trees were marked. In Allapalli Chandrapur, Maharashtra, 12 phenotypically superior trees were marked. Five trees were also selected from Jabalpur, M.P. Root cuttings were collected from the selected trees and planted in polytunnels. From all the selected trees leaves and bark were collected. Seeds were also collected from some trees. Morphometric data of seed pods and seeds was recorded. For seed pods and seeds, length, width and weight was noted down. Tannins, phenols and alkaloids were estimated in bark and leaf samples of all the trees. Indents for glassware and chemicals were placed and procured.

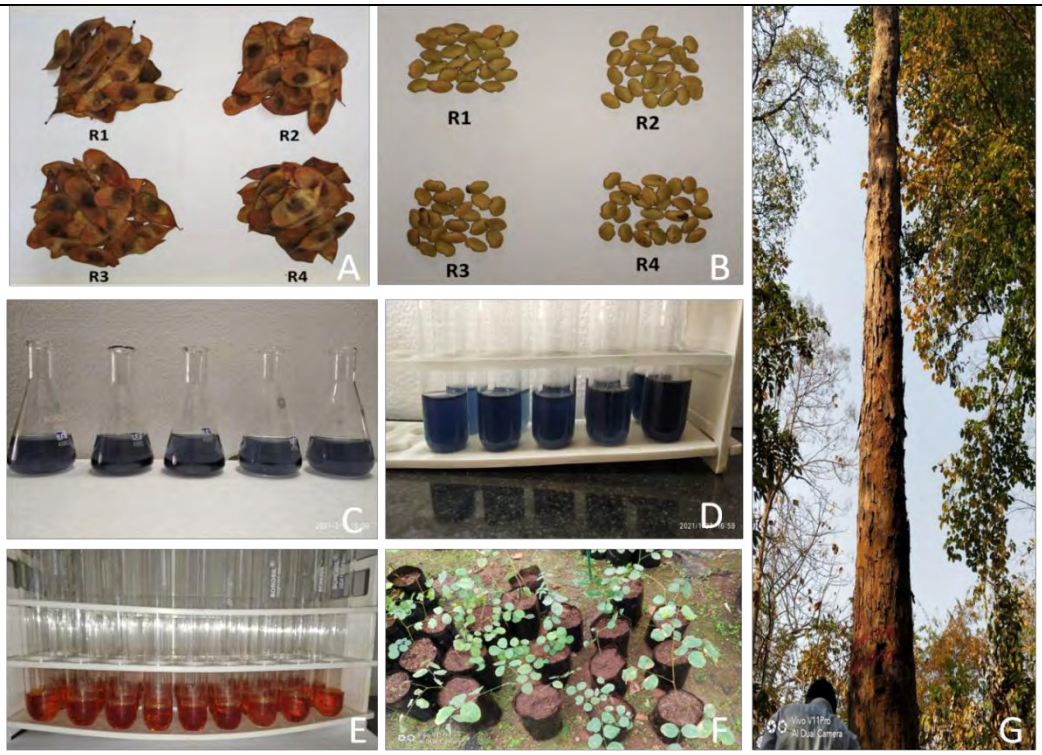


Fig. 45: A-B) Measurement of seed pods and seeds of *Dalbergia latifolia*, C) Estimation of Tannins, D) Estimation of phenolic content, E) Estimation of alkaloid, F) Transfer of plants from vermiculite media to polybags after rooting, G) Selected phenotypically superior tree Allapalli, Chandrapur, Maharashtra.

Sustainable management of NTFPs through conservation and value addition(AICRP-29)

Working plans of different divisions of Madhya Pradesh were explored and five localities/ sites have been identified in MP for collection of germplasm of *O. indicum* and *U. Picta*. Seeds of *O. indicum* arranged and experiments for germination of seeds in different potting media were laid out. Potting mixture (Soil: Sand: FYM , ratio 1: 1: 1) showed approx. 90% germination. More than 200 seedlings of *O. indicum* were prepared. Literature surveyed regarding harvesting practices of Arjun (*Terminalia arjuna*) and Kutaj (*Holarrhena antidysenterica*) in central India. Moreover, survey was conducted in Amarkantak range under Anuppur forest division and Karanjia range of Dindori forest division and traditional knowledge of medicinal plants to cure diseases were documented.

Study of Climate Driven Effects on Indian Forests through Long term monitoring (AICRP-31)

The project is in the second year of implementation. Procurement of equipments has almost been done. Recruitment of project fellows has been completed, except those who left their jobs in between. We have selected a 10-ha plot at Kanha National Park for installing AWS and other

equipments and conduct a series of experiments. The request for installing equipments and lay out plot through demarcation by stone pillars has been sent to PCCF (WL), Bhopal.

Fig. 46: Selecting site for 10-ha permanent plot at Kanha Tiger Reserve

2. NFGRs:

National Programme for conservation and development of Forest Genetic Resources
Nodal Officer: Dr. M. Kundu, Scientist 'F'

65 species was selected out of 181 species for documentation and distribution map 10 species for in situ conservation, 45 species for seed gene bank, 4 species for molecular characterisation and 10 species for field gene bank and development of nursery techniques after discussion with forest officials, University professors, researchers and NGOs of Madhya Pradesh, Chhattisgarh and Maharashtra through Online interactions and included their priority species preferably indigenous and economically important too. Prepared distribution map species wise as per its habitat by consulting Working plan of particular areas. Surveyed in the forest of Chhindwara, Betul, Mandla of Madhya Pradesh and Dhamtari and Rajnandgaon of Chhattisgarh states to verify natural population of 10 species . Started collection of Economic importance of prioritised species in order to strategies germplasm collection.

3. CAMPA Extension :

This year, out of funds received under CAMPA-Extension project to create awareness among various stakeholders about environmental issues institute has undertaken various activities.To

strengthen and improve infrastructural facilities in VVKs and institute to conduct training programmes, virtual meetings and other extension programmes. Under this, IT equipment, Extension equipment and office equipment were procured and existing conference halls were upgraded.Extension material in hindi and english has been published for distribution among stakeholders. To showcase various research activities of the institute a documentary is being prepared.

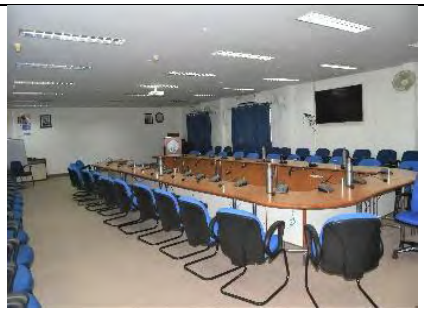
	
Installed new Desktop and Video Conf Sys in VC room 1	Carpeting in Conf Hall, GTI Building TFRI 2
	
Publication 1	Extension equipments Desktop and Multimedia Projector handed over to VVK-MP

Fig. 47 : CAMPA Extension work at TFRI

B	**Plan and External Projects**

2.1 Ecosystem Conservation and Management

2.1.1 Overview

2.1.1.1 Projects under the Theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	2	0	0
Externally Aided	2	1	0

2.1.2 Climate Change

2.1.3 Ecology & Environment

2.1.4 Biodiversity

Biodiversity, Regeneration and life history feedback of forest communities in response to canopy openings under selection cum improvement felling system

The impact of canopy openings created due to SCI operations in Mixed Deciduous Forests of Dindori Forest Division in Madhya Pradesh was studied using permanent quadrats and compared with its control sites. The impact was assessed along (i) different gap sizes (small - 0.01-0.1 ha; large gaps > 0.1 ha) and (ii) two time periods i.e. pre-felling and post-felling, and their combined influence on population density, structure and regeneration. Observations from 895 stems ha^{-1} show that *Diospyros melanoxylon* stems has the highest tree density (32%), followed by Tectona grandis (27%) of the community. Whereas highest basal cover was recorded for *Tectona grandis* (7.65 sqm ha^{-1}) followed by *Diospyros melanoxylon* (1.43 sqm ha^{-1}) and *Lagerstroemia parviflora* (1.10 sqm ha^{-1}).

Whereas, the regeneration of species in control plot and SCI plot differed substantially. There were proportionally much less regenerating individuals originating from the natural gaps in control plot compared to SCI. Of the 41 tree species regenerating under gaps in SCI, they were classified as shade-intolerant and shade-tolerant species. *Tectona grandis* and *Lagerstroemia parviflora* were found to be shade in-tolerant group and species such as *Diospyros melanoxylon* were found to be shade-tolerant species. Species such as *Anogeissus latifolia* occurred both in felling-gaps as well as natural-gaps. The proportion of new individuals that originated from gaps was higher in canopy openings occurred due to felling (R^2 = 0.15, P = 0.0002), while lower in natural gaps (R^2< 0.01, P = 0.57).

Fig. 48: A view of regeneration data in Mixed forests of Dindori, Madhya Pradesh during January, 2021

Quantitative assessment of land degradation in forests of three western districts of Madhya Pradesh and suggest mitigation measures

Status of forest land degradation in three western districts (Dhar, Jhabua and Mandsaur) of Madhya Pradesh, which are highly vulnerable to climate change are being studied. Carbon stock in soil and vegetation are being measured as indicators to assess the level of degradation. Vegetation studies in ten 0.1 ha quadrats in each of the Beat/Compartment is laid and soil, litter, herbaceous samples have been collected from two districts. Soil analysis for assessing the carbon content is in progress. Based on the severity of degradation in forests, mapping will be done by adopting a landscape approach to suggest mitigation measures.

Fig. 49: Laying quadrats for vegetation and collecting soil samples in Jhabua Forest Division

Studies on maturation and viability of seeds of five important tropical species: *Adina cordifolia, Mitragyna parviflora, Lannea coromandelica, Ougeinia oojeinensis* and *Anogeissus acuminate* for effective collection and seed storage

The conditions (temperature, light, soil, pretreatment, if needed) for germination of seeds of *Adina cordifolia, Mitragyna parviflora, Lannea coromandelica, Ougeinia oojeinensis* and *Anogeissus acuminata* were investigated. The best time for collection of seeds of these five species was identified and maturation indicators were determined. Best storage conditions for storing seeds of these species were evaluated and storability of them was determined.

2.1.5 Forest Botany

2.1.6 Tribals and Traditional Knowledge System

Studies on the diversity of some beneficial insects in forest ecosystem in Madhya Pradesh.

Survey was conducted to study the diversity of beneficial insects in different agro climatic zones of Madhya Pradesh. 1907 individuals of ten different species of beneficial insects were surveyed from the area. Diversity indices were calculated by using Shannon- Weiner index, Margalef's index and Evenness index. The result shows that the diversity of beneficial insects in forest ecosystem in Madhya Pradesh is rich and diverse.

Benefits of research: Data and status report generated from this project will be helpful for conservation of beneficial insects

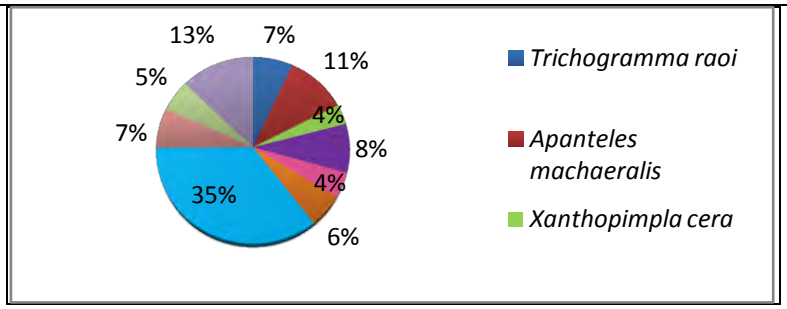


Fig. 50: Showing Percentage composition of each beneficial insect in forest ecosystem in Madhya Pradesh

Taxonomic study of Tettigoniidae (Orthoptera) of India (Under All India Co-ordinated project on Taxonomy) (AICOPTAX)

Surveys were conducted to explore diversity status of long-horned grasshoppers of Madhya Pradesh. 16 species of long-horned grasshoppers were recorded, out of which ten species are known and six species viz. *Himertula* sp., *Isopsera pedunculata*, *Mecopoda elongate*, *Phaneroptera nana*,*Phaneroptera falcate*, *Sathrophyllia fuliginosa* are new locality records from Madhya Pradesh.

Fig.51: *Holochlora* sp.

2.2 Forest Productivity

2.3

2.2.1 Overview

2.2.1.1 Projects under the Theme (in table as given at 2.1.1.1)

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	0	1	0
Externally Aided	1	5	1

2.2.2 Silviculture

Impact of Silviculture systems on the natural forests of Chhattisgarh with special reference to Sal and Bamboo.

Selected eight Sal forest compartment in three forest ranges in Dhamtari forest division, Chhattisgarh. Collection of data on growth parameters, regeneration status, etc. has been completed in three sites. Collected data are entered and analyzed. Yield and productivity of Sal has been worked out with reference to different silvicultural systems. Collected required data through laying out various sub plots and recorded information on regeneration status, dominant, co-dominant trees, etc.

Studies on quality of nursery seedlings and their relation to outplanting performance of *Dalbergia latifolia and Pterocarpus marsupium*

2000 seedlings of *Dalbergia latifolia* and *Pterocarpus marsupium* were grown in polythene bags and root-trainers in nursery. Plantation area was selected, cleaned and fenced. Pits are prepared for plantation. Seedling were graded according their shoot height and are planted in RBD design. Other data on seedling characteristics were also recorded before planting. After 6 months of planting morphological data of planted seedlings were recorded. Plantation area is regularly maintained.

2.2.3 Social Forestry, Agro-forestry/ Farm Forestry

Development of *Gmelina arborea* based agroforestry system in M.P.

Standardized *Gmelina arborea* based agroforestry system for M.P. by utilizing shade for shade loving crops like *Asparagus racemosus, Curcuma longa,* and *Zingiber officinale* and *Piper betle* as intercrops. Initially betel vine did not performe well but in subsequent years performed well under proper management including drip irrigation system and insect pest management. Bio control management was conducted to successfully control attacke on betel leaves. Ginger oil was extracted and found maximum (1.9ml/100g) under sole crop than that of intercropped (1ml/100g) while yield of ginger was maximum (6.37 t ha^{-1}) under intercrop and minimum (4.25 t ha^{-1}) in sole crop.

In case of Saponin content in satawar, it was found maximum in intercop as compared to (1.5%) than sole crop (0.9%) and similarly satawar yield was found maximum in tercrop (321.66g/plant) and sole (216.45g/plant). respectively growth and yield data of the tree as well as intercrops was compiled. Data revealed increase in height of Gmelina upto 3.40 m in intercrops as compared to sole (2.30m) and girth 44.80 cm while in sole 28.67cm (6 – 8 year old trees) .Organic carbon content increased from 0.64% to 1.13% while macro nutrients like nitrogen also reported maximum increase (27.5 kg ha^{-1}) under betel vine intercropped with *Gmelina*. Agroforestry models were extended through Online training programmes to the various stakeholders.

Popularization of Improved var. of *Leucaena leucocephala* (Lam.) de Wit. based

Established *L. leucocephala* based Agroforestry system in farmer's field of Chandiya and Umariya. Interacted with the Senior Officials of OPM to discuss the various issues of the projects. Maintained the agro

forestry system with periodic intercultural activities including intercropping of seasonal crops. Collected and analysed soil samples for the estimation of nutrients. Observations were recorded to assess the growth performance of new improved cv. of *L. leucocephala* species under Agroforestry system.

Promotion of Bamboo based Agroforestry System for economic upliftment and livelihood security of farmers in Madhya Pradesh.

Established bamboo based agro-forestry in 15 farmers (8 small and 7 big farmers) fields of Jabalpur district. Monitoring the agroforestry system by conducting management activities like use of irrigation, casualty replacement and insect management under the system. Annual progress report was presented during Annual review meeting held on 30th September,2020 under the chairmanship of Chief General Manager, NABARD, Bhopal and including DDM of various districts of Madhya Pradesh. Conducted PIMC (Project Implementation and Monitoring Committee) meeting by involving beneficiary, DDM, NABARD, Local District Manager , Director, and Principal Investigator, at monthly interval and submitted progress to CGM, NABARD, Bhopal. Observations on growth and yield parameters were also recorded to evaluate the performance of bamboo as well as intercrops established in the farmers field. Conducted hands on training on 'Bamboo based agroforestry system: harvesting and management' on 12th March,2021 at farmers field specially for the beneficiaries of the project. Prepared and printed brochures on 'Baans adharit krishivaniki padhatti evam iska prabandhan' for the distribution among the farmers.

Fig.52: (a) Release of information leaflet for the beneficiary during the programme (b) Hands on training on bamboo management at farm field

Capacity building on seed and nursery technology and plantation techniques for prioritized species of Chhattisgarh state.

Organized One day Online training programme on 'Capacity building on Seed, plantation and management techniques of commercially important tree species' for the forest officials of five circles of Chhattisgarh including Raipur, Bilaspur, Durg, Jagdalpur and Ambikapur with CCF, Chhattisgarh. Delivered four lectures on Seed handling techniques of commercially important timber species, Plantation and management of *Melia dubia*, Plantation and management of *Gmelina arborea* and Bamboo and on NTFPs: management issues. Extension material on seed, nursery and plantation techniques of commercially important tree species was also prepared for the distribution to the stakeholders/field staff during training programme.

Empowering tribal communities through Lac cultivation in M.P.

Revived lac cultivation in ten villages of Jabalpur and Mandla districts of Madhya Pradesh. Prepared and printed course material on Lac cultivation: its management for the distribution to the beneficiaries. Organized two days training cum demonstration programme on 'Lac cultivation: its management, processing and value addition to 12 women Self Help Groups (more than 100 beneficiaries) of Mandla and Jabalpur districts. Demonstration of lac bangles making was carried out. They prepared various articles like bangles, saree pins and crown of God. The articles were distributed to the beneficiaries.

(a) Leaflet on Lac cultivation released by Director, TFRI

(b) Demonstration of making raw lac into Bangles to Women SHGs

(c) Beneficiaries preparing articles from raw lac

(d) Value added articles prepared by the Women SHGs during the programme

Fig. 53: Organized two days training cum demonstration programme on 'Lac cultivation: its management, processing and value addition to women Self Help Groups at TFRI.

Development of form-factors for important forest tree species of Chhattisgarh.

Conducted an inception meeting with senior officers of Chhattisgarh SFD at PCCF Office, Raipur and discussed in detail, the prospects and methodology of form factor estimation of important forest tree species of Chhattisgarh. Secondary information such as Chhattisgarh state forest manual and other baseline information about the existing form factors were collected. The need for revising the form factors of major forest tree species was also discussed. Designed a format for developing form factor and collected data of the felled trees on girth at different heights and other parameters of different tree species from Jagdalpur and Raipur forest divisions.


Fig.54: Inception meeting and collecting information on felled trees from Jagdalpur and Raipur forest divisions

2.2.4 Forest Soils & Land Reclamation

2.2.5 Watershed Management

2.3 Genetic Improvement

2.3.1 Overview

2.3.1.1 Projects under the Theme (in table as given at 2.1.1.1)

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	2	4	2
Externally Aided	1	6	1

2.3.2 Conservation of Forest Genetic Resources

Population dynamics, structure and genetic diversity of *P. marsupium* in the tropical forests of Madhya Pradesh.

This project is initiated to develop the conservation strategy for vulnerable Bija saal (*P. marsupium*). During period of report, work on diversity assessment using DNA markers was completed. Total 121 trees of *P. marsupium* sampled from different forest divisions of Madhya Pradesh were genotyped using 20 ISSR

markers. Samples from the seven study sites were also analysed for marker compound i.e., Pterostilbene using HPLC technique. Field visits were made to each study site and recorded growth and survival data in sample plots laid out for regeneration study. All morphological, phytochemical and molecular data was compiled, checked and analysed. Writing of project completion report is under progress.

Fig. 55: Recording of regeneration data of *Pterocarpus marsupium* from Balaghat forest division

Genetic improvement and conservation of Chironji (*B. cochinchinensis* Lour.) in Central and Eastern India.

Field visits were made to East Chhindwara, West Chhindwara, FRC-SD Plantation, Katni and Marvahi forest divisions of Madhya Pradesh and Chhattisgarh. Recorded data on panicles and leaf morphology. Seeds were collected from marked trees from Betul and Marvahi Progenies of marked trees were maintained in nursery.

Assessment of diversity and natural regeneration status of *S. urens* Roxb. for development of conservation strategy in Madhya Pradesh.

In this project, we are assessing the status of *S. urens* populations with respect to genetic variation and regeneration. During the period of report, surveyed potential areas in South Seoni, Tikamgarh, Rewa, Chattarpur, Jabalpur Forest Divisions. Recorded morphometric data along with GPS coordinates. Sample plots were laid out for regeneration studies in Jabalpur, Seoni and Chattarpur forest divisions.

Fig. 56: Recording of morphometric data on *S. urens* from Chattarpur and Tikamgarh Forest Divisions

Conservation of *Litsea glutinosa* Lour. through population establishment in Madhya Pradesh.

This project is initiated with the financial support of the NBM, New Delhi in August, 2020. During the period of report, field visits were made to Mandla, Chhindwara and Dhamtari forest divisions and fruits were collected from available trees. Fruits were de-pulped, shade dried and stored for raising planting stock in coming season. Production and maintenance of planting stock (raised in earlier year in anticipation of project) is under progress.

Fig. 57: Fruiting in *Litsea glutinosa* tree and Maintenance of planting stock of *L. glutinosa*

Conservation of RET species of Chhattisgarh – *Plumbago zeylanica* and *Celastrus paniculatus* and production of quality planting material.

In different forest areas of Chhattisgarh, surveys were conducted and planting material of *Plumbago zeylanica* and *Celastrus paniculatus* was collected from Surajpur-Ghatpandari, Pratappur, Devri areas and Jashpur- Patiya, Manora areas. In *Celastrus paniculatus*, Nitrate Reductase Activity (NRA), flavanoid, carbohydrate, phenols and sugar was estimated during organogenesis through leaves. Tannins were estimated in leaves of malkangini. In *Plumbago zeylanica*, protein, tanins and carbohydrates were estimated in leaves. Planting material of *Celastrus paniculatus* and *Plumbago zeylanica* was produced through stem cuttings. Shoot multiplication and rooting experiments were carried out in both species.

Fig.58: Collection of planting material of *Plumbago zeylanica and Celastrus paniculatus* from Surajpur, Ghatpandari, Manora, Patiya , Jashpur, Chhattisgarh.

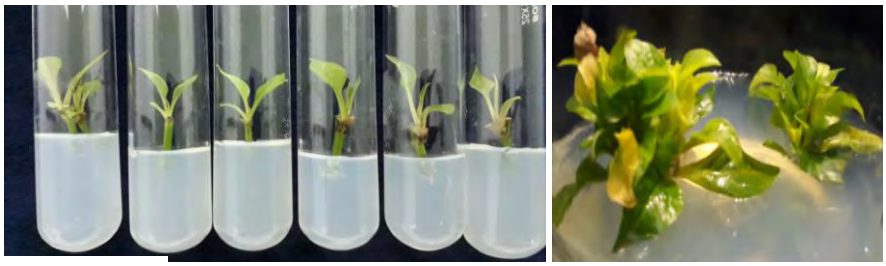


Fig.59: Shoot cultures of *Plumbago zeylanica*

Fig.60: Shoot cultures of *Celeastrus paniculatus*

Development of value chain for bamboos for mass multiplication, popularization in farmers field and industrial linkages in central India

Observations were recorded in the bamboo plantations carried out in various farmers fields located at different villages (Naugaja, Chingrola, Bharhut) of Umaria, M.P. The field trial of eight different bamboo species (*Bambusa tulda, B. bambos, B. nutans, B. vulgaris* var. green, *B. vulgaris* var. yellow, *B. balcooa, D. strictus,* and *D. asper*) established at village Chingrola, Umaria was maintained through irrigation and fertilization. Another field trial was established at TFRI, Jabalpur with the objective of comparing the performance of two superior clumps (genotypes) of six different bamboo species (*B. bambos, B. balcooa, B. tulda, B. nutans, B. vulgaris var. green* and *D. strictus*). The parameters for assessing the comparative performance will be in terms of culm number, culm height and clump diameter. *In vitro* shoot cultures of

Pseudooxytenanthera stocksii were established and maintained on MS medium supplemented with 4.5 mg l^{-1} kinetin. *In vitro* rooting was obtained on MS medium supplemented with 1mgl^{-1} IBA. Discussions were held with officials of Orient Paper Mill, Amlai for selection of more farmers for bamboo plantations. Different fields were surveyed in Umaria and Katni districts, Madhya Pradesh for suitability of bamboo plantations.

Fig. 61: a)Visit at Farmers's field at Umaria, b) Disscusion at Orient paper Mill, Amlai, c) and d) Bamboo plantations at Bharhut, Umaria and Naugaja, Umaria.

Preliminary assessment of Indian Sandalwood population in Chhattisgarh for growth, heartwood, oil and regeneration status.

- Growth data of the trees in Hosdev nursery and adjoining areas has been recorded
- Regeneration status has been assessed after laying out sample plots
- Growth data of ten year old plantation raised by the Department has been recorded
- Collection of core sample of Sandalwood trees.
- Recorded thickness of bark , sapwood and heartwood and estimated oil percentage.

Fig. 62: Collection of core sample, and growth data of Sandalwood plantation, from Hasdev, Manendragarh CG

Selection and evaluation of natural population of *Terminalia bellirica* (Gaertner) Roxb. for its active ingredient content

32 phenotypically superior candidate plus trees of *Terminalia bellirica* (Baheda) has been selected from natural population of Maharashtra and Chhattisgarh out of which 14 candidate plus trees selected from Bhandara forest divisions of Maharashtra and 18 trees selected from Dhamteri forest division of Chhattisgarh .

- GPS location of all selected trees has been recorded. Important traits viz. height, girth, spreading pattern of the tree and length and breadth of leaves and morphology has been recorded.
- Total Fifteen (15) seed samples were collected from the Bhandara forest divisions of Maharashtra and 18 trees selected from Dhamtari forest division of Chhattisgarh .
- Seed weight (gm), seed diameter (mm) and morphological characters has been recorded of all the seed collected from selected trees.
- Seedlings of collected samples has been raised in the FRCSD, nursery

Variability for Growth, wood traits and natural regeneration status of *Hardwickia binata* a multipurpose tree species in Madhya Pradesh"

- Extensive survey has been carried out in Khandwa , Barwah and Buranpur forest divisions of Madhya Pradesh and selected suitable populations of *H. binata*.
- Under Chandgarh forest range of Khandwa forest division, compartment No. 280, 281,282,283,284 285, 286, 303 and 304 has been selected as a suitable populations.
- In Barwah forest division under Barwah range compartment No. 219 and under Katkut range compartment no. 209 populations has been selected.
- Under Buranpur forest division of Dhulkot range comparment no. 95 and under Asir range compartment no. 130 has been selected.
- Seeds / Samara of has been collected from 11 suitable populations and recorded physical parameters of the fruits/seeds i.e. fruit weight (gm), seed weight (gm), fruit:seed ratio, fruit/seed length (cm) and fruit/seed thickness (cm).
- Quadrates of 10 x 10 m have been laid out in all selected populations for natural regeneration studies. It has been observed that regeneration of the *H. binata* is poor.

2.3.3 Tree Improvement

Improvement of Teak for Higher Productivity in Central/Peninsular India: A Multi-institutional All India Coordinated Project.

Established progeny trial was maintained regularly. Surveyed forest areas of Kurai and Bahrai range of South Seoni forest division and Hathini forest area of Damoh forest division and selected 09 plus trees of Teak. Recorded morphometric data along with the GPS coordinates. Established a germplasm bank with 24 accessions of teak representing 04 states viz. M.P., Chhattisgarh, Maharashtra, Odisha and is being maintained regularly.

Fig. 63: Establishment of Germplasm bank of *Tectona grandis*

Development of Management Practices of Teak Seed Production Areas, Seedling seed orchards and Clonal seed orchards.

Surveyed Seed Production Areas in Jagdalpur and Raipur circles of Chhattisgarh and recorded seed status and management practices. CSOs and SSOs were surveyed in Jagdalpur and Raipur circles for seed productivity status and management practices. SPA, CSO and SSO in Ratlam and Jhabua forest divisions of M.P. were surveyed and recorded seed status and management practices. Experiment executed using treatment of Paclobutrazole, girdling and KNO_3 in selected clones of CSO, TFRI for enhancing seed productivity. Established Seedling Seed Orchard was maintained regularly.

Fig. 64: Seedling Seed Orchard in Institute campus

Studies on population structure, linkage disequilibrium and marker-trait association mapping of Indian teak.

Morphological and wood trait data generated in the project was compiled, checked and analysed. Analysis revealed significant differences among sampled teak populations for wood density, fibre length and fibre width. Coefficient of variation for wood density (12.56%) was higher than for fibre width (11.30%) and fibre length (7.30%). Sambalpur population recorded highest wood density followed by Khariar. Longest fibre length and width was observed in Dhamtari and Amravati populations, respectively. Mean value of 582.99 kg/m^3 for wood density, 987.026 µm for fibre length and 24.806 µm for fibre width was recorded. Analysis of molecular data is under progress.

Documentation and assessment of the status of Permanent Preservation Plots (PSP), Seedling Seed orchards (SSO) and Clonal Seed Orchards (CSO) in Chhattisgarh.

Surveyed various CSOs, SSOs and SPAs of different species in Raipur, Bilaspur and Jagdalpur R&E circle of Chhattisgarh. Data recorded on growth parameters like height and diameter (GBH), flowering and fruiting status and other information like spacing, existing management practices, seed productivity etc, along with their GPS location for documentation.

Fig. 65: Clonal Seed Orchard at Erikpal, Jagdalpur and Godhi at Raipur in Chhattisgarh

Evaluating the impact of tree improvement activities on seed quality of *Tectona grandis* in Madhya Prad and Chhattisgarh.

Survey was carried out in Seed Production Areas at Hathni (Damoh), Moiya Nala, Kalpi and Tikaria in West Mandla and Bahrai (South Seoni) in M.P. Survey was carried out in SPA at Devpur and CSO in Ghasipur and Mura in Chhattisgarh. Morphological parameters of seeds of improved and unimproved populations are being studied.

Fig. 66: Clonal Seed Orchard at Mura, Raipur in Chhattisgarh and Seed Production Area at Bahrai (South Seoni) in M.P.

Selection of pest and disease free CPTs of *Gmelina arborea* and production of clonal planting material

Branches were collected from selected trees of *Gmelina arborea* at different locations. Semi hardwood cuttings were prepared from them. Cuttings were planted after treatment with various concentrations of IBA (200, 500 and 1000 ppm) and planted for multiplication of plants. Highest average rooting was obtained in cuttings treated with 200 ppm IBA. The sprouts from the cuttings were further utilized for production of planting material. A vegetative multiplication garden of selected trees was established.

Fig. 67: Vegetative propagation of *Gmelina arborea* (a-b) Rooting in cutting treated with 200 ppm IBA after 30 days of planting and (c-d) Rooted plants shifted to polybags

Fig. 68: Vegetative Multiplication Garden of selected trees of *Gmelina arborea* at TFRI, Jabalpur Selection and evaluation of *Haldina cordifolia* for higher wood productivity.

For identification of CPTs and collection of seed and plant materials official permission has been received from Madhya Pradesh to conduct survey and seed collection in Dindori forest division. Format designed for selection of CPTs includes growth, stem form, edaphic and climatic factors, pest and disease presence, etc. Visited 4 ranges in Dindori forest division of M.P and in the survey found 47 Haldina trees and based on the scoring sheet, 2 Haldina selected as CPT for seed and vegetative part collection for establishment of field trials.

2.3.4 Vegetative Propagation

Studies on improving adventitious rooting in *Dalbergia latifolia* Roxb. and field performance of its rooted plantlets.

Branch cutting from 9-10 year old progenies of selected trees of *Dalbergia latifolia* exhibited variation in adventitious rooting from 10% - 56% with an average 27% adventitious rooting in cuttings planted during the month of April with basal dip treatment of 5mM IAA + 1mM Boric Acid for a period of 20 hrs. Seasonal variation noted in adventitious rooting, endogenous IAA and total soluble sugars. Growth data recorded for planted seedlings and cutting raised plants. Growth performance of cutting's raised plants is better than the seedlings i.e. better height (14%) and collar diameter (21%). Number of primary branches and crown diameter are 43% and 15% respectively more than the seedlings. Increased productivity of cutting's raised plants is expected due to more foliar area. Survival is 100%.

Fig.69: Plantation of Seedlings and cuttings raised plants of *Dalbergia latifolia*

2.3.5 Biotechnology

Development of tissue culture protocols for important forestry species, viz., *Buchanania lanzan*, *Madhuca indica* and *Tamarindus indica*.

Shoot cultures of *Buchanania lanzan* were maintained on MS medium containing 22.2µM BA and 5.37 µM NAA. In vitro shoot cultures of *Madhuca indica* were maintained on MS medium containing 3mgl^{-1} BA. In vitro cultures of *Tamarindus indica* were maintained on MS medium containing 1 mgl^{-1} Kinetin. In vitro rooting was achieved and plantlets were hardened and acclimatized to outside environmental conditions. Genetic fidelity testing was carried out. Writing of project completion report was initiated. The project aims to develop tissue culture protocols for the three important NTFP species.

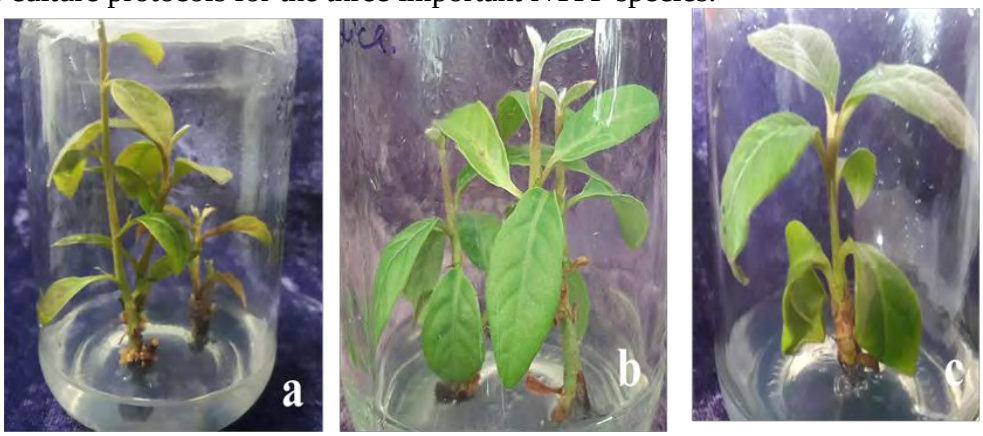


Fig. 70: *In vitro* shoot multiplication in *Madhuca longifolia* on MS medium supplemented with (a) 3 mg l^{-1} BA, (b) 3 mgl^{-1} Kinetin, (c) 3 mg l^{-1} Zeatin after 40 days of inoculation

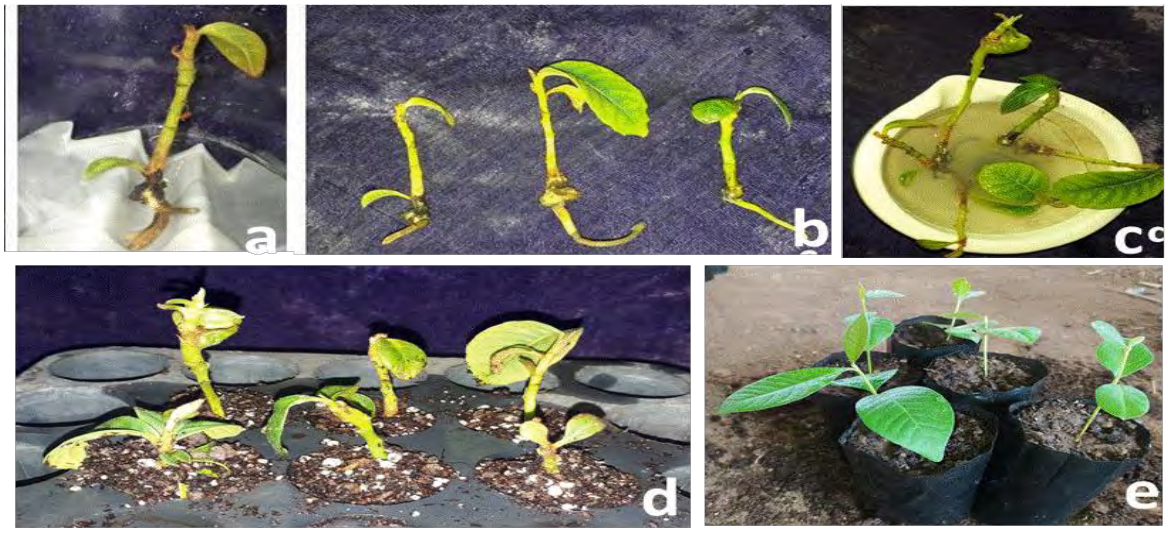


Fig. 71: *In vitro* rooting and hardening of *Madhuca longifolia* (a) rooting on MS medium supplemented with 2 mg l^{-1} IBA, (b) rooted plantlets, (c) treatment of plantlets with 0.2 % bavistin, (d) hardening of plantlets in soilrite in root trainers, (e) transfer of plants to in shade house.

2.4 Forest Management

2.4.1 Overview

2.4.1.1 Projects under the Theme (in table as given at 2.1.1.1)

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	0	1	0
Externally Aided	0	0	0

2.4.2 **Sustainable Forest Management (SFM)**

Study on ecophysiology of seed germination and seedling survival for restoration of natural regeneration of two threatened species of Central India

Seeds of *Dalbergia latifolia* and *Litsea glutinosa* were collected from three different locations. Viability of seeds of *Dalbergia latifolia* and *Litsea glutinosa* varies from 55%-100% and 90-100% respectively. Effect of temperature and light and soil type and depth on germination of seed was assessed. Effect of light on seed germination indicated that it is not affected by open or dense forest. *Litsea glutinosa* seeds are physiologically dormant. During rain dormancy is naturally broken and 60-90% seeds germinated in field condition. Observation on germination phenology indicates that intermittent rain at suitable temperature resulted germination and subsequent death of seedlings during dry season. Investigation on storability of seeds of *Dalbergia latifolia* and *Litsea glutinosa* at combination different temperature and moisture contents is continued. Studies are continued on combined effect of weed, shade and moisture on seed germination and seedling growth. Seeds of *Dalbergia latifolia* and *Litsea glutinosa* did not produce any soil seed bank after 5 months and one and half years of seed dispersal respectively. The loss of seeds of *Litsea glutinosa* and *Dalbergia latifolia* was estimated due to predation.

2.4.3 Forest Economics
2.4.4 Forest Biometrics
2.4.5 Participatory Forest Management
2.4.6 Policy and Legal Issues
2.4.7 Information and Communication Technology (ICT)

2.5 Wood Products

2.5.1 Overview

2.5.1.1 Projects under the Theme (in table as given at 2.1.1.1)

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	0	0	0
Externally Aided	0	0	0

2.5.2 Wood and other Lignocellulosic Composites
2.5.3 Wood Processing
2.5.4 Value Addition and Utilization
2.5.5 Wood Chemistry
2.5.6 Pulp and paper

2.6 Non-wood and Forest Products (NWFPs)

2.6.1 Overview

2.6.1.1 Projects under the Theme (in table as given at 2.1.1.1)

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	2	0	0
Externally Aided	0	7	0

Integrated approach for development of standard nursery techniques and value added products of some socio-economically important species of Madhya Pradesh

- Extensive survey was conducted for collection of seeds of selected species viz. *Terminalia chebula* (Harra), *Madhuca indica* (Mahua), *Terminalia bellirica* (Baheda) and *Semecarpus anacardium* (Bhilwa). Morphological observations on fruit/ seeds were recorded on various parameters after collection i.e. fruit size, fruit colour, fruit weight.
- Periodic survey was carried out in the nursery for diseases of targeted species. Collection/Isolation, Identification and management of Insect pest/micro organism associated with seeds/seedlings was carried out in nursery of Chhindwara.
- Periodical survey was conducted in Chhindwara and Betul state forest department nursery of the targeted species. identification and management of Insect pest/micro organism associated with seeds/seedlings
- Soil samples were collected from nursery and forest. Soil texture, bulk density and organic carbon content were analyzed.
- Experiment on effect of organic and inorganic fertilizer on growth of *Terminalia chebula, Semecarpus anacardium* were carried out. Data on growth parameters was recorded. Powder has been prepared of one year old seedlings of *Madhuca indica* and *Terminalia bellirica* for analysis of N, P, K.
- Experiments were conducted for formulation of value added product viz., Biscuits by incorporation *Semecarpus anacardium* (Bhilwa) fruit powder. Consumer acceptability test for developed biscuit were conducted. Chemical parameters viz. total ash (%), moisture (%), total protein (%), fat (%), sugar (%), carbohydrate (%), energy kcal/100gm, sodium and potassium mg/kg were analyzed for herbal biscuit and herbal powder.
- Herbal gel was formulated from S. anacardium leaves and testing of physio-chemical properties, antibacterial and antifungal activities were carried out.

Development of fast food products enriched with *Moringa oleifera* (Drumstick) leaves and skill upgradation training to rural women

Clinical studies on Developed food products of *Moringa oleifera* viz. biscuits and papads were conducted to assess the efficacy of *Moringa oleifera* leaves enriched food products among females with iron deficiency anaemia and promising results were obtained.

2.6.2 Resource Development of NWFPs

Conservation of *Stereospermum suaveolens* (Roxb.) DC. – A rare species in Madhya Pradesh

Germplasm bank of *Stereospermum suaveolens* was established in NWFP nursery of TFRI.

Fig. 72: Germplasm bank of *S. suaveolens*

Investigation on variations and domestication of *Curculigo orchioides* Gaertn. (Kali Musli) in Madhya Pradesh.

Tubers of *Curculigo orchioides* Gaertn. (Kali Musli) with higher cuculigoside content were sowed in beds to observe the germination behavior and standardization of cultivation technique.

Fig.73: Standardization of cultivation technique of *C. orchioides*

Identification of prominent locations and best populations of *Terminalia chebula* (Harra) and *Anogeissus latifolia* (Dhawda) in Madhya Pradesh in terms of their active chemical ingredients

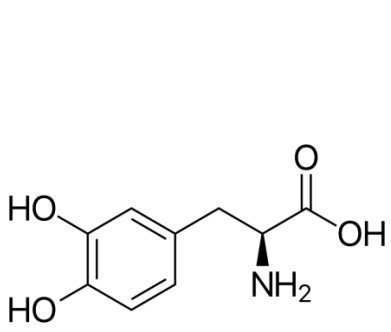
Fruits of *Terminalia chebula* (Harra) were collected from 05 forest divisions of Madhya Pradesh. Morphological data (length, width and weight) of Harra fruits were recorded. Harra fruits were processed to make "Kachariya" and powdered. Powdered fruit samples were analyzed for tannin and gallic acid contents.

Fig. 74: Fruits of *Terminalia chebula* (Harra)

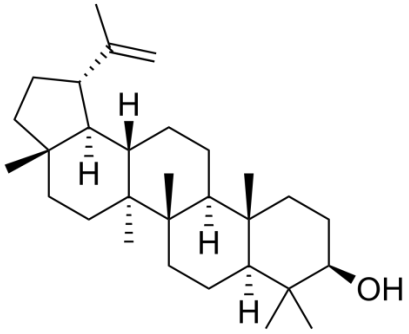
2.6.3 Sustainable Harvesting and Management

Standardization of harvesting time and post harvesting techniques of *Helicteris isora* (Marorphali) and *Mucuna pruriens* (Kaunch)

Fruits of *Helicteris isora* (Marorphali) and seeds of *Mucuna pruriens* (Kewanch) were stored in different containers i.e.polythene bags, woven sacks, gunny bags, tin, air tight plastic, air tight glass and steel containers to see the effect of storage containers on active ingredient for 14 months. Unpacked samples kept in open environment were taken as control.The stored samples were examined at bimonthly intervals for lupeol content in fruits of H. isora and L-Dopa content in seeds of *M. pruriens.* Microbial infestation in stored samples of both the species was also evaluated for observing the shelf life of the materials. Data is being analyzed to come out for holistic conclusion.



Chemical structure of L- Dopa



Chemical structure of Lupeol

Fig. 75: *Mucuna pruriens* (Kewanch) seeds

Fig.76: *Helicteres isora* (Marorphali) fruits

Selection of CPTs, standardization of collection practices and quality evaluation of Gum karaya (*Stercularia urens*) in Chhattisgarh state

Study sites in Janjgir-Champa forest divisions (Village – Barra, Beat – Dahkoni, Range – Janjgir) and Manendragarh(Village – Bodidand, Beat – Sunhari, Range – Manendragarh) belonging to Chhattisgarh Plains Zone and Northern Hills Zone respectively were selected for standardization of harvesting practices of gum karaya. Morphological characters viz. tree height, GBH, clear bole height, crown radius and number of primary branches were recorded. For standardization of harvesting technique for extraction of karayagum, experiments were laid out on *S. urens* trees of different girth classes (90 – 140, 141 – 190 and > 190 cm). Trees were tapped mechanically with different techniques (traditional T0 as well as improved techniques, T1 for one semi-arc blaze and T2 for two semi-arc blazes on opposite sides) with five replications in each girth class. Observations are being recorded for yield of gum per tree in each girth class in March, April, May and June months.

Fig.77: Length of initial blaze on *S. urens* tree

Fig.78: Width of initial blaze on *S. urens* tree

2.6.4 Chemistry of NWFPs, Value Addition and Utilization

Exploration of adhesive materials for incense sticks from the plant species

- Collection of *Hiptis suaveolens* (leaf, tender twig and seed), *Cassia tora* (seed), *Lantana camarra* (Leaf) and *Bombax ceiba* (Leaf).
- Processed sample and prepared 7 types of Jigat combination.
- Prepared agarbatti using the Jigats.
- Standardization of techniques for preparation and application of new Jigat was done.
-

Fig.79: Processed plant parts for preparation of Jigat

Investigations on active chemical ingredients and propagation of critically endangered species *Dillenia pentagyna* Roxb. for its conservation in Madhya Pradesh

Populations of critically endangered *Dillenia pentagyna* Roxb. were identified in four places of 03 forest divisions of Madhya Pradesh. Morphological data were recorded. Plant samples viz. leaves, stem and root bark were collected from each population and are being investigated for chemical ingredients using High Performance Thin Layer Chromatographic (HPTLC) technique. Experiments have laid out to standardize propagation technique of this critically endangered species.

Fig. 80: *Dillenia pentagyna* tree and recording morphological data of *D.pentagyna*

2.6.5 Bio-fuels and Bio-energy

2.7 Forest Protection

2.7.1 Overview

2.7.1.1 Projects under the Theme (in table as given at 2.1.1.1)

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	0	1	0
Externally Aided	0	3	0

2.7.2 Insects pests, diseases and control

Development of delivery system for field application of *Canthecona furecellata* as biological control agent against major insect pests.

Nyphal and adult stages of predatory bug, *C. furcellata* were tested against teak defoliator *Hyblaea puera*, Skeletonizer *Eutectona machaeralis* in the laboratory as well as in the natural field conditions as a effective biocontrol agent. The observations revealed that all the life stages of the predatory bug feeds extensibly on both the pests and can be used as effective bio control agent against these pests

Benefits of research: Data generated from the project will be helpful in developing techniques for bio control of the targeted pests in the laboratory as well as in the field.

Fig. 81: Feeding behaviour of Predator *Canthecona furcellata* on different host

Capacity building of nursery staff on preparation of organic fertilizer and its application.

Trainings to field staff were conducted at circle level all six circles were covered. Total 250 official attended training. Training imparted through power point presentation as well as hands on practical demonstration.

Fig. 82: Practical Demonstration During traning program.

Extension of biological control of teak defoliator and skeletonizer through egg parasitoid, *Trichogramma raoi* (TFRI-Trichocards) in plantations.

Six trainings were conducted on Biological Control of Teak Skeletonizer / Defoliator insects for frontline Staff of Forest Circles Bilaspur, Durg, Raipur, Ambikapur and Korba, Chhattisgarh.

Benefits of research: This extension project will help to popularize the biological control method for the ecofriendly and biorational management of teak defoliator and skeletonizer in teak plantations, thereby saving losses in terms of incremental growth in teak due to reoccurring incidences, without using chemicals. This will also facilitate introduction of the parasitoids in the areas of release by the stakeholders and might help their further establishment and help in maintaining natural balance in the pest and natural enemies.

Fig.83: Training on biological control of Teak skeletonizer & defoliator at Bilaspur (C.G.)

Monitoring and dissemination of knowledge to manage sal heartwood borer, *Hoplocerambyx spinicornis* in Chhattisgarh.

During the period six trainings on "Management of Sal Borer" were conducted for the Frontline Staff of four Forest Circles (Ambikapur, Durg, Raipur and Bilaspur, Korba), State Forest Department Chhattisgarh. Monitored the Sal forest areas of forest divisions and assessment of damage by the borer at selected sites was recorded.

Benefits of research: This study will help for effective dissemination of management strategies through field demonstration to the frontline staff of State Forest Department. Theoretical and practical knowledge will also be helpful to user groups and to the local people as source of livelihood.

Fig.84: Training conducted for management of Sal Borer.

2.7.3 Mycorrhizae, rhizobia and other useful microbes
2.7.4 Weeds and Invasive species
2.7.5 Forest Fire and Grazing

3.	**Education Vistas/Activities**

3.1 FRI University (Applicable for FRI, Dehradun only)

3.2 Trainings Organized : Topics must be indicated in text while providing information in the table given below:

Note: Please indicate in numerals i.e. 1, 2, 3…n only. Please do not write one week, six months etc.

Sl. No.	No. of Trainings	Duration (in days)	No. of participants
	24	35	629

3.3 Visits Abroad – NIL

3.4 Participation in Seminars/Symposia/Workshops/Trainings

Sl. No.	No of Seminars/Symposia/ Workshops	Duration (in days)	No. of participants
1	30/00/02	00/01/14	45/00/02

4.	**Extension Panorama/Activities**

- National Forest Library and Information Centre (NFLIC) (Applicable for FRI, Dehradun only)
- Environmental Information System (ENVIS) (Applicable for FRI, Dehradun & IFGTB, Coimbatore only)

4.1 Report on Van Vigyan Kendras (VVKs) and Demo Village (DV),Tree Groweres Mela(TGM), Prakriti and Green Skill Development Programme (GSDP)

Networking of KVK and VVK for demonstration:

Under VVK-KVK networking programme, consent received from ICAR-ATARI, Jabalpur for establishment of demonstration plots, displaying of posters and to conduct training programme in following 10 KVKs in the state of Madhya Pradesh and Chhattisgarh and the list of KVKs follows:

1. KVK, Umaria (JNKVV, Jabalpur), M. P
2. KVK, singrauli (JNKVV, Jabalpur), M. P

3. KVK, Dhar (RVSKVV, Dhar), M. P
4. KVK Govindnagar (NGO, Hoshangabad), M. P
5. KVK Satna (DRI, Chitrakoot), M. P
6. KVK, Balrampur (IGKV, Raipur), C. G
7. KVK Mainpat (IGKV, Raipur), C.G
8. KVK Bemetra (IGKV, Raipur), C.G
9. KVK Sukma (IGKV, Raipur), C.G
10. KVK Kondagaon (IGKV, Raipur), C.G

Strengthening of VVK:

For strengthening of VVK, procured and handed over one desktop and one digital multimedia projector to Nodal Officer, VVK, Madhya Pradesh for organizing trainings/seminar/workshop etc. Extension team visited the nursery at VVK, Jabalpur, M.P and assessed the facilities for production and distribution of free QPM of various seedlings to farmers.

New VVK and Demo village:

- Team from extension division visited Metaguda nursery, Social Forestry Division, Jagdalpur Forest Circle, Chhattisgarh on 8-10, March, 2021 for establishment of new VVK for demonstration of various extension activities.
- Team from extension division visited Banjari, Seoni forest division on 03/03/2021 for selection of new Demo Village to demonstrate the forestry technologies for different stakeholders.

4.2 **Technologies transferred--** NIL

4.3 **Intellectual Property - Patents Granted/Applied (during the year), any other information regarding IP --** NIL

4.4 Research Publications: Please provide information in the tables given below:

Books	Booklets/ Brochure/ Bulletins/ Phamplets	Article in Seminars/ Conferences/Workshops etc.		Popular articles	Research Papers in Journals		Chapters in Books/ Proceedings
		Articles	Abstracts		Foreign	Indian	
03	00/08/13/00	06	14	22	10	29	00

Note: List of books along with photographs of cover page are to be submitted separately.

4.5 Seminars/Symposia/Workshops Organized

Sl. No	No. of Seminars/Symposia/ Workshops/ meetings organized	No. of days	No. of participants
1	Organized 08 Institute level monthly seminars by Extension division, TFRI	08	526

4.6 Consultancies

Received consultancy worth of Rs. 120 lakhs from CAMPA, Chhattisgarh State Forest Department for 'Monitoring and Evaluation of plantations' established under CAMPA funding for the year 2021-22.

Sl. No	**Consultancy**	**User agency**
1.	Preparation of Wildlife Conservation Plan for Endangered Species found in and around Dhelwadih UG, Bagdeva UG and Singhali UG mines of DSB Sub Area of SECL Korba Area	South Eastern Coalfields Limited (SECL)
2.	Monitoring of NTPC Ltd. Accelerated Afforestation Programme of Plantation of 10 Million Trees – In Seven States (M.P. and Maharashtra)	NTPC
3.	Implementable forestry research for ash utilization promotion and development of research park at APML, Gondia	Adani Power Maharashtra Limited

4.7 Technical Services

- FRCSD - Total 1272 soil and forest floor samples received from FSI, Nagpur was analyzed for organic carbon content and dry weight of plant samples. Revenue was generated for the centre and ICFRE out of the analysis work during the year.

4.8 Activities of Rajbhasha :

उष्णकटिबंधीय वन अनुसंधान संस्थान, जबलपुर में वर्ष 2020-21 के दौरान संचालित राजभाषा गतिविधियों की सचित्र सूचना

उष्णकटिबंधीय वन अनुसंधान संस्थान, जबलपुर में संघ की राजभाषा नीति का अनुपालन सुनिश्चित करने की दिशा में वर्ष 2020-21 के दौरान निम्नलिखित राजभाषा गतिविधियां संचालित की गई । संस्थान में निदेशक महोदय की अध्यक्षता में गठित राजभाषा कार्यान्वयन समिति की तिमाही बैठकें अनुबद्ध समय पर आयोजित की गई और

राजभाषा कार्यान्वयन के कार्य संबंध में भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद् मुख्यालय द्वारा दिये गये दिशा-निर्देशों का समुचित पालन सुनिश्चित करने हेतु निर्णय लिये गये और आयोजित बैठकों की कार्यवाही का विवरण भा.वा.अ.शि.प. तथा अन्य संबंधित कार्यालयों को सूचना एवं अपेक्षित कार्रवाई हेतु तय समय पर प्रेषित की गई।

संस्थान द्वारा राजभाषा अधिनियम 1963 की धारा 3(3) का शतप्रतिशत अनुपालन सुनिश्चित किया गया तथा निर्धारित किये हिन्दी पत्राचार के लक्ष्य को प्रति तिमाही के दौरान संस्थान द्वारा हासिल किया गया।

संस्थान की राजभाषा हिन्दी के प्रगामी प्रयोग से संबंधित अवधिक रिपोर्टें जैसा कि हिन्दी के प्रगामी प्रयोग की तिमाही रिपोर्टें संबंधित कार्यालयों को सूचना एवं अपेक्षित कार्रवाई हेतु प्रेषित की गई। भारत सरकार के मार्गदर्शी रूपरेखा के अनुरुप संस्थान द्वारा सितंबर माह 2020 के दौरान हिन्दी दिवस एवं हिन्दी पखवाड़ा को भी आयोजित किया गया।

वर्ष 2020-21 के दौरान आयोजित राजभाषा कार्यान्वयन समिति की बैठक, हिन्दी कार्यशालाओं के आलोकचित्र

Following Rajbhasha activities were conducted at the Tropical Forest Research Institute, Jabalpur during the year of 2020-21 in order to ensure the compliance of the Official Language Policy of the Union. The Meeting of the official language implementation committee which already existed in this institute under the chairmanship of the Director were held regularly in each quarter and decisions were taken on the directives issued from time to time by the Indian Council of Forestry Research and Education head quarter with regard to official language implementation work and decisions were to complied with the same and proceedings of the meetings were sent to ICFRE head quarter and other relevant offices within the stipulated time for their information and for required action.

The documents which comes under section 3(3) of the official language 1963 were issued in bilingual viz Hindi and English simultaneously and achieved the prescribed target of Hindi correspondence in each quarter by this institute.

The periodical reports such as Hindi QPR etc, were sent to the respective offices for information and requisite action. The Hindi Day and Hindi Fortnight Celebration was celebrated by this institute during the month of September, 2020 by following COVID 19 guidelines issued by the Govt. of India. Photographs of the Hindi functions such as Hindi workshop etc. organized by this institute during 2020-21.

Fig. 85: Rajbhasha activities were conducted at the TFRI, Jabalpur during year 2020-21

4.9 Awards and Honours:

The employees were awarded the "**ICFRE Outstanding Employee Award"** in technical and ministerial categories as follows -

i. Sh. R.B.Manjhi, CTO and Dr. P. K. Rana, ACTO
ii. Sh. Manoj Sharma, Assistant and Sh. Sanjay Mishra,LDC

4.10 Special Activities (Such as Van Mahotsava, Forestry Day and Other occasions)

Fig. 86: Observed International Day of Forests – 2021 on 19/03/2021 and organized tree planting programme at Botanical Garden, TFRI.

Fig. 87: TFRI observed'Bharat Ka Amrut Mahotsava' and conducted one-day training programme on 'Lac based agroforestry value chain model' to women SHGs. In the training programme, hands-on training provided to the SHGs on making of various ornaments by using Lac.

Fig. 88: National Seminar on "Propagation, management and development of value chain in Bamboos" was organized through virtual mode on 10th February 2021.

Other occasions:

1. "**International Biodiversity Day** 2020" was celebrated by FRC-SD, Chhindwara on 22 May 2020.
2. "**World Environment Day**" was celebrated by FRC-SD, Chhindwara on 5 June 2020.
3. "**Van Mahotsav**" was celebrated at FRC-SD, Chhindwara on 7 July 2020.
4. **"Vigilance Awareness Week"** was celebrated at TFRI from 27th October 2020 to 2nd November, 2020

Fig. 89: Vigilance Awareness Week celebrate in TFRI

4.11 **Extension Activities performed under CAMPA Extension** (this information is different from the information provided in the Chapter as above)

5.	**Administration and Information Technology**

Introduction

5.1 Information Technology

- The institute has 100 MBPS NKN link provided under the National Knowledge Network (NKN) scheme of NIC project. The NKN comprises an ultra-high speed CORE (multiples of 10 Gbps), complimented with a distribution layer at appropriate speeds to support Overlay, Dedicated and Virtual Networks.
- The institute has a 100 MBPS fast Ethernet fiber optic backbone LAN, which is used for Internet access and other online activity. Video Conferencing facility also been used throughout the year.
- Under IFRIS project, Personal Information Management System (PIMS) has been in operation successfully.
- The web pages of institute's website (http://tfri.icfre.org) have been updated and also for the institute's online open access e-magazine 'Van Sangyan' (ISSN 2395 - 468X), institute's journal "Indian Journal of Tropical Biodiversity" linked with institute's web site on regular basis and

issues have been uploaded on monthly basis over it for easy access to the users.

- Reports have been generated for all the activities undertaken at the institutes level - conferences/seminars/workshops/trainings/visits of dignitaries/visits etc. are uploaded on institute's web site and also sent to the headquarter for uploading over ICFRE website.
- Various networking facilities extended within the institute. All the circulars, notifications, office orders, proceedings of monthly seminars and other documents have been regularly uploaded over the Online Office Records (Order /MoM / Agenda etc.) System for wider circulation.
- FRCSD - LAN is presently non functional.

5.2 Administration: A brief note on general administration activities along with information on the following:

5.2.1 Sevottam: Activities relating to the Citizens/Clients Charter as detailed below has to be included in the Annual Report. : **Activities related to the citizen /client charter are mentioned as under -**

5.2.1.1 Action taken to formulate the Charter for the Department and its subordinate formation; **Citizen's charter is being drafted by TFRI, Jabalpur and the centre is under the administrative control of TFRI, Jabalpur.**

5.2.1.2 Action taken to implement the Charter; **Action will be taken for implementing the Charter as per the directives received from TFRI Jabalpur.**

5.2.1.3 Details of Training Programmes, Workshops, etc. held for proper implementation of Charter; **These programs will be organized after approval of the citizen charter.**

5.2.1.4 Details of publicity efforts made and awareness campaigns organized on Charter for the Citizen/Clients; **NIL**

5.2.1.5 Details if internal and external evaluation of implementation of Charter in the Organization and assessment of the level of satisfaction among Citizen/Clients. : **Evaluation of implementation of charter is to be initiated.**

5.3 **Welfare measures for the SC / ST/ backward / minority communities**

- The interest of the above section are being safeguarded and as per the guidelines of Government of India a Liaison Officer is in position who monitors the promotion / recruitment as per the roster.

6.	**Annexure** **1. RTI** वर्ष 2020-2021 के दौरान टी.एफ.आर.आई., जबलपुर में आरटीआई के 40 मामले अभिप्राप्त हुए थे जिनमें 39 मामलो का अनुबंधित समयावधि के भीतर निपटान किया गया।

In TFRI, Jabalpur 40 cases with regard to RTI were received during the year 2020-2021 and 39 cases were disposed within stipulated time period.

Names and Addresses of Public Information Officers and Appellate Authorities under the Right to Information Act 2005 in the Institute

Headquarter / Institute	Appellate Authority	Public Information Officer	Subject matter(s) allocated
Tropical Forest Research Institute, Jabalpur	Director, TFRI, Jabalpur	Shri AJK Asaiya, Scientist-C, TFRI, Jabalpur	As per provision and guidelines provided under RTI Act, 2005.
Centre for Forestry Research & Human Resource Development, Chhindwara	In-charge Scientist, CFRHRD, Chhindwara	In-charge Scientist, CFRHRD, Chhindwara	As per provision and guidelines provided under RTI Act, 2005

2. Information on vigilance cases – 02 cases.
3. Information on audit objections – NIL
4. Email and Postal addresses

Director
TROPICAL FOREST RESEARCH INSTITUTE
(*Indian Council of Forestry Research & Education*)
P.O. – R.F.R.C, Mandla Road, Jabalpur – 482021 (M.P), India
Phones: 0761 – 4044002, 2840483(O) , Fax: 0761 – 4044002, 2840484
***E-mail* – dir_tfri@icfre.org**

Scientist In-charge,
Centre for Forestry Research & Human Resource Development
(Indian Council of Forestry Research & Education)
Poama, P.O- Kundalikala, Parasia Road, CHHINDWARA - 480 001 (M.P)
Phones: 07162 – 292061 (O)
e-mail: head_cfrhrd@icfre.org/dir_cfrhrd@rediffmail.com

5. LIST OF ABBREVIATIONS

AICRP – All India Coordinated Research Project

AM – Arbuscular Mycorrhiza

APML – Adani Power Maharashtra Limited

ARS – Agriculture Research Services

BA – Benzyl Adenine

BIS – Bureau of Indian Standards

CAMPA – Compensatory Afforestation Fund Management and Planning Authority

CCF – Chief Conservator of Forests

CEO- Chief Executive Officer

CG – Chhattisgarh

CGM- Chief General Manager

CPT- Candidate Plus Tree

CRIDA – Central Research Institute for Dry Land Agriculture

CSO – Clonal Seed Orchard

DDM – Deputy Development Manager

DFO – Divisional Forest Officer

DNA – Deoxyribonucleic acid

DPR – Detailed project report

DPR- Detailed project report

ESIP – Earth Science Information Partners

ESIP – Ecosystem services improvement project

FGP – Final Germination Percentage

FRCSD – Forest Research Centre for Skill Development

FRI – Forest Research Institute

FSI – Forest Survey of India

GBH – Girth at Breast Height

GIS – Geographical Information System

GPS – Global Positioning System

	GRI – Germination Rate Index GSDP – Green Skill Development Programme HoFF – Head of Forest Force HPLC – High Performance Liquid Chrometography HPTLC – High Performance Thin Layer Chrometography HRM – Heat Ratio Method IAA – Indole Acetic Acid IBA – Indole Butyric Acid ICAR – Indian Council of Agricultural Research ICFRE – Indian Council of Forestry Research and Education IFRIS – Integrated Forest Resource Information System IFS – Indian Forest Service IPM – Integrated Pest Management JNKVV – Jawaharlal Nehru Krishi Vishwavidyalaya JNV – Jawahar Navodaya Vidyalaya KVK – Krishi Vigyan Kendra MoEF&CC – Ministry of Environment, Forests and Climate Change MoU – Memorandum of Understanding MP – Madhya Pradesh MPCA – Medicinal Plant Conservation Area MPCST – Madhya Pradesh Council of Science and Technology MPFDC – Madhya Pradesh Forest Development Corporation MPSFD – Madhya Pradesh Forest Department MS – Murashige and Skoog MS – Maharashtra NAA – Napthyl Acetic Acid NABARD – National Bank for Agriculture and Rural Development NGO – Non Government Organisation NTFP – Non-Timber Forest Produce NTFPs – Non Timber Forest Products

	NTPC – National Thermal Power Corporation NWFP – Non Wood Forest Produce PCCF – Principal Chief Conservator of Forests PIMC – Project Implementation and Monitoring Committee PMS – Payroll Management system PSB – Phosphate Solubilizing Bacteria PSP – Permanent Preservation Plots QPM – Quality Plantig Material RAG – Research Advisory Group RFRC – Regional Forest Research Centre RIMS – Research Information System RSP – Rourkela Steel Plant RTI – Right to Information SC – Schedule Caste SECL – South Eastern Coalfields Limited SHGs – Self Help Groups SPA – Seed Production Area SSO – Seedling Seed Orchard ST – Schedule Tribe TFRI – Tropical Forest Research Institute TSG – Time Spread of Germination TSO – Teak Seed Orchards UNDP-GEF – United Nations Development programme –Global environment facility VVK – Van Vigyan Kendra


TFRI/Book-1/2020
COMPENDIUM OF
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TECHNOLOGIES
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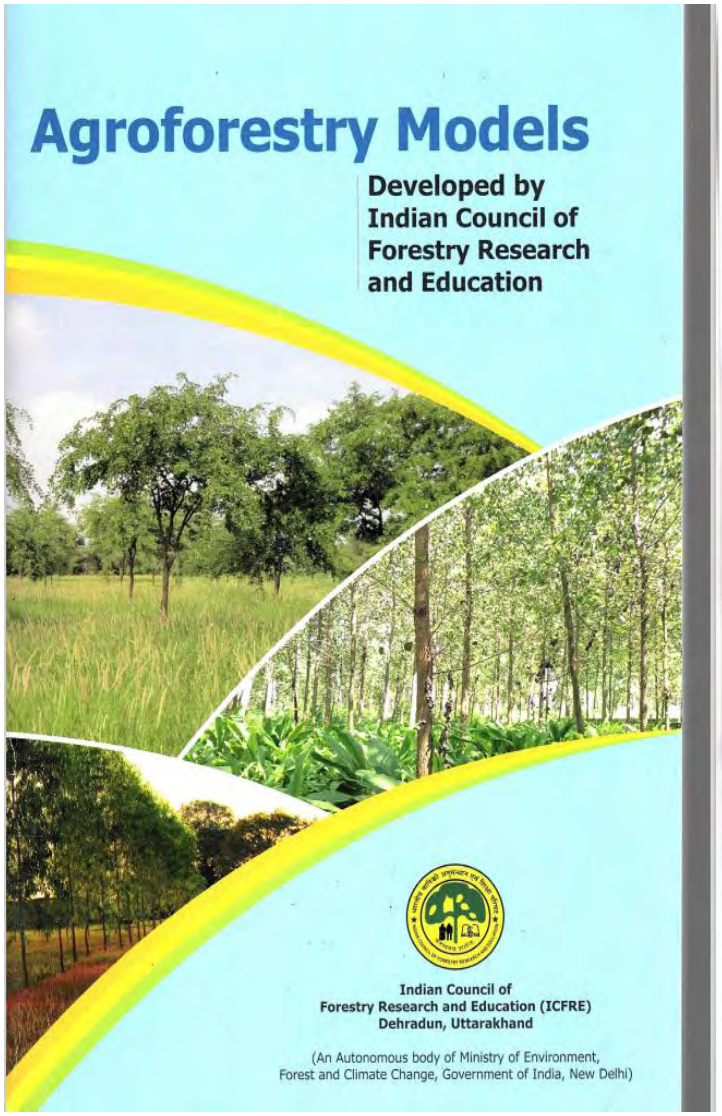

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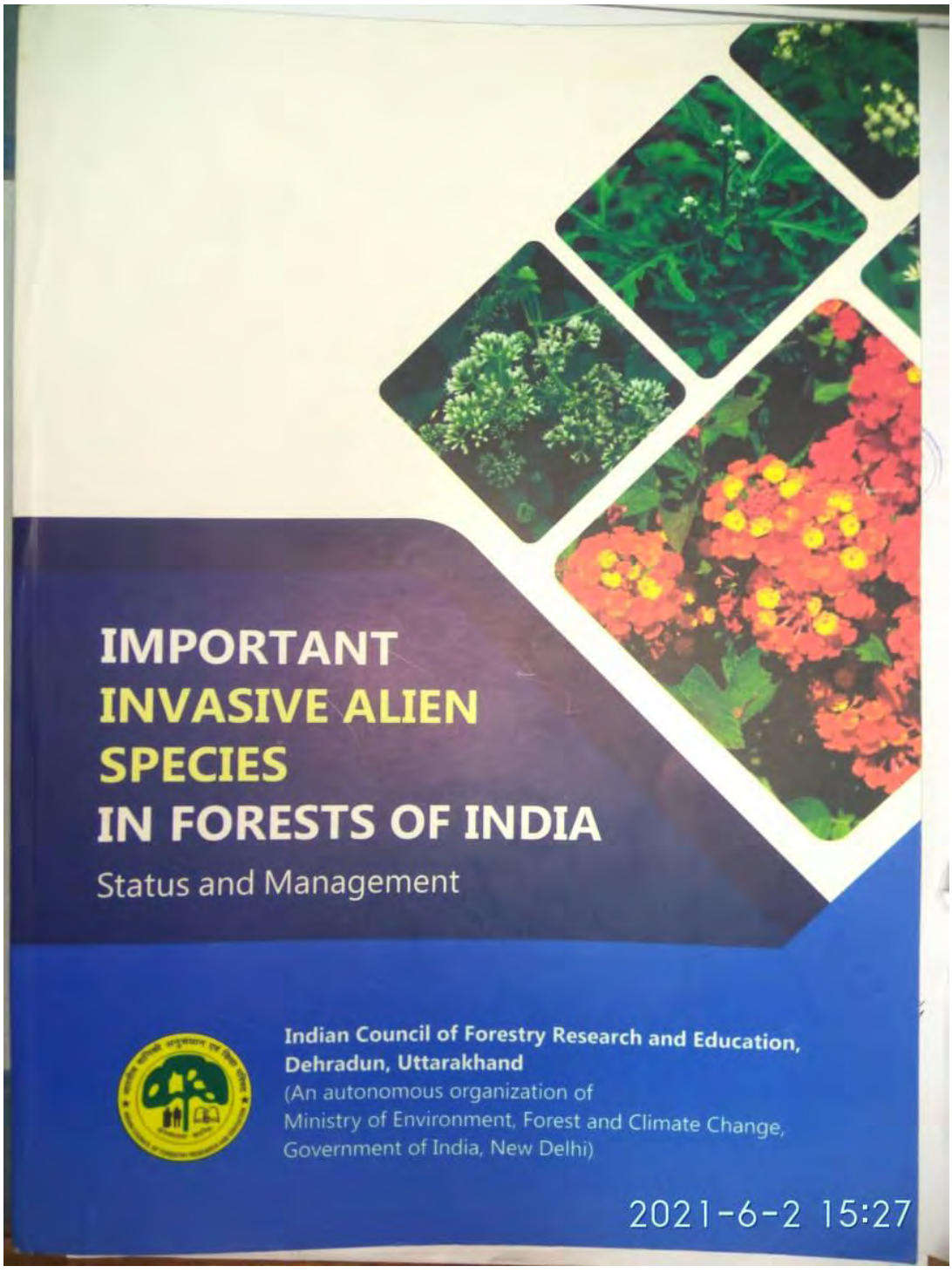
IMPORTANT
INVASIVE ALIEN
SPECIES
IN FORESTS OF INDIA
Status and Management
Indian Council of Forestry Research and Education,
Dehradun, Uttarakhand
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