Annual Report
2019-2020

T

F

R

I

TROPICAL FOREST RESEARCH INSTITUTE
(*Indian Council of Forestry Research and Education*)
P.O. RFRC, Mandla Road
Jabalpur – 482021 (M.P.)

Overview

Overview: Please indicate most important achievements/new initiatives (not more than 200 words) during the period under report.

- Research work has been initiated to develop Value Chain on Industrial Agroforestry in collaboration with Orient Paper Mill, Amlai (MP) to promote Subabul and Bamboo based Agroforestry System for Economic Upliftment and Livelihood Security of Farmers in Madhya Pradesh under MPSFD, Bhopal and NABARD, Bhopal funded projects**.** Mp bamboo Mission subsidy was also entrusted to the farmers.
- Under a NBM funded project, value chain for bamboos is being developed in a tripartite model between research institute (TFRI), farmers and wood based industry (Orient Paper Mill, Amlai, MP) with the purpose of doubling the farmer's income with buy–back guarantee.
- In *Diospyros melanoxylon*, the sites having pruned bushes depicted higher regeneration more number of regenerated individuals and less disease infestation through root suckers as compared to unpruned tendu poles in Gondia and Gadchiroli forest divisions of Maharashtra.
- Mean velocity of sap flow in *Tectona grandis* was found high during day in comparison to night. Moreover, stems with 10-30 cm girth class had high sap flow compared to 30-60 cm girth class.
- 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 plantations of teak and in agricultural crops. The preliminary study indicated that egg cards and adults are most effective in forestry plantations and nymphs and adults are most effective against agricultural pests.
- 55 insect species and three edible fungi species viz., *Plurotus sp., Lantinus sp,* and *Volverriella volvacea* were recorded and documented from Satpura plateau which are used by traditional healers for the treatment of various diseases. It was also observed that there is a wide difference among collector, trader and retailer price.
- The study on organic fertilizers led to the finding that application of 10% Jivamrut resulted in maximum increase in the height and girth of seedlings of all the 10 selected timber and fruit yielding plant species
- Candidate Plus Trees (02) of *Haldina cordifolia* were selected.
- Experiments were conducted to standardize seed technology for RET species like *Litsea glutinosa, Oroxylum indicum, Lannea coromandelica, Ougeinia oojeinensis,*

Anogeissus acuminate.

- Processing techniques of *Helicteris isora* (Marorphali) and *Mucuna pruriens* (Kewanch) fruits were standardized.
- Tubers of *Curculigo orchioides* Gaertn. (Kali Musli) were collected from 11 Medicinal Plants Conservation Areas of Madhya Pradesh for physiochemical evaluation study.
- Gum samples of *Anogeissus latifolia* (Dhawda) collected from different locations were graded. Fruits of *Terminalia chebula* (Harra) were processed to prepare product Kachariya.
- Different species like *Basella alba, Aloe vera, Crataegus laevigata, Dalbergia latifolia, Boswellia serrata* were explored for adhesive materials for incense sticks. Jiggat was prepared in 14 combinations. Incense sticks were prepared using jiggat and burning time was determined.
- Superior trees based on growth traits were identified in *Gmelina arborea* (48 trees), and 139 trees based on crown spread in *Buchanania cochinchinensis*. Initial growth assessment and regeneration status of Sandalwood population in Chhattisgarh was carried out.
- A progeny trial of Teak consisting of progenies from CPTs/PTs of 04 states; a seedling seed orchard (SSO) consisting 33 families from Madhya Pradesh, Chhattisgarh and Maharashtra was established.
- A total of 260 teak genotypes from exclusive 13 teak dominating agroclimatic zones across the four states i.e. Madhya Pradesh, Maharashtra, Chhattisgarh and Odisha have been sampled and assessed using twenty eight simple sequence repeats (SSR) markers.
- At FRC-SD, 2542 number of soil samples were analysed and revenue of approximately Rs. 2.42 lakhs was generated.
- TFRI and FRC-SD organised 47 programmes including two GSDP training during 2019-2020. Wherein training had been provided to 2958 persons including unemployed youth, students, teachers, farmers, frontline staff of forest departments and other stakeholders.
- TFRI and FRC-SD is regularly organizing, demonstration and environmental awareness programmes like biological diversity day, environment day etc., implementing “PRAKRITI” programme for generating awareness among school

students and participating in Kisan melas and national and international trade fairs organised by different organizations.

Summary of projects

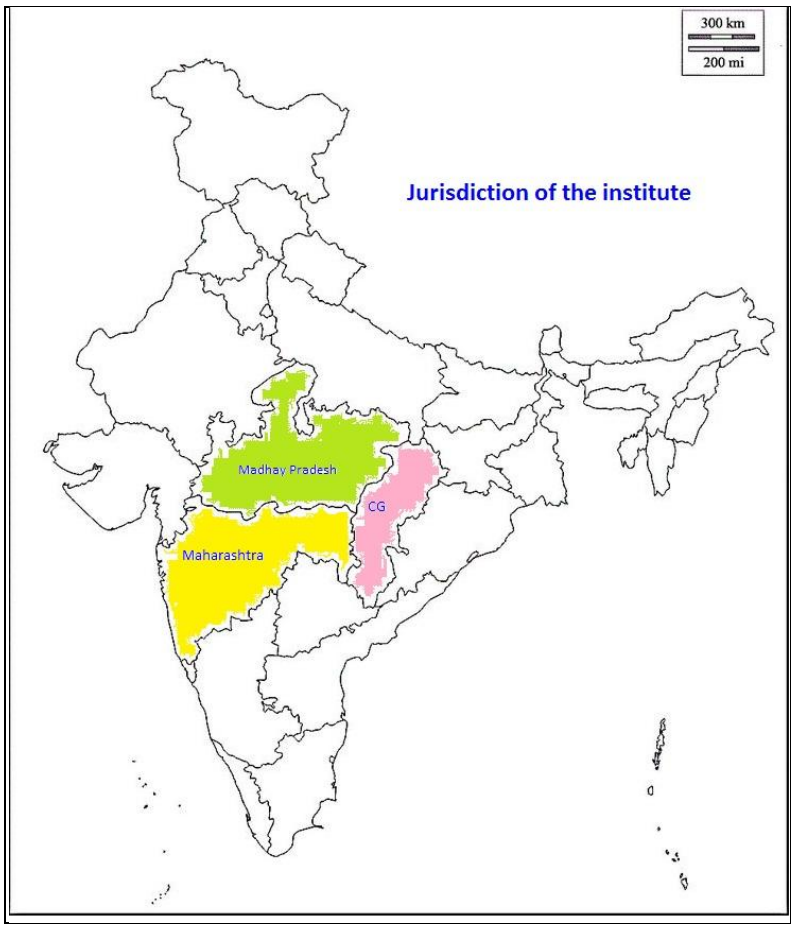
Projects	Completed projects	Ongoing projects	New projects initiated during the year
Plan	07	12	02
Externally Aided	05	20	05
Total	**12**	**32**	**07**

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, NBM and MPCST. It has been undertaking consultancy projects from SECL, NTPC, Adani, SAIL etc.

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:

1. MoU signed between TFRI, Jabalpur and NABARD, Bhopal under project entitled 'Promotion of Bamboo based Agroforestry System for economic upliftment & livelihood security of farmers in Madhya Pradesh'.

2. MoU signed between TFRI, Jabalpur and Orient Paper Mill, Amlai under the project entitled ' Popularization of improved var. of *Leucaena leucocephala* (Lam.) de Wit. based Agroforestry System'.

Visit of dignitaries:

- Sh. Rajesh Bahuguna, IAS Divisional Commissioner, Jabalpur, visited TFRI as Chief Guest of Consultative meeting on Narmada DPR preparation under River Rejuvenation programme.
- Dr. P.D. Juyal, Vice Chancellor, Nana Ji Deshmukh Veterinary University, Jabalpur attended Consultative meeting on Narmada DPR preparation under River Rejuvenation programme.
- Dr. P.D. Juyal, Vice Chancellor, Nana Ji Deshmukh Veterinary University, Jabalpur attended World Environment 2019 as Chief Guest on 5th June 2019.
- Shri B.B.Singh, Addl. PCCF & Former CEO, State Bamboo Mission, Bhopal visited as Chief Guest of MoEF sponsored Two days training programme on 'Agroforestry' for IFS officers held from 3-4 October, 2019 at TFRI, Jabalpur (M.P.)

- Shri Purshottam Dhiman, Additional P.C.C.F. and CEO, SMPB, MP State Minor Forest Produce (T& D) Coop. Federation Ltd., Bhopal (M.P.) visited as Chief Guest of 20 days MoEF sponsored GSDP training programme on 'Value addition and processing of NTFPs (Plant Origin) held from 26th February,2019 to 17th March, 2020 at TFRI, Jabalpur (M.P.)
- Dr. Sanjay Shukla, IFS, Mission Director, MP State Bamboo Mission, Bhopal visited as Chief Guest of Closing Ceremony for BTSG-ICFRE sponsored 6 days Training programme "Value Addition- Bamboo Technologies".
- Smt. Kalpana Tiwari, District Programme Officer, Women & Child Development Department, Chhindwara visited the FRCSD, Chhindwada as on 10 July 2019.
- Shri B.H. Naik, Assistant Director, FSI, Nagpur visited FRCSD, Chhindwada as on 13 September 2019
- Shri. Gajendra Singh Nagesh, CEO, Zilla Panchayat, Chhindwara visited the FRCSD, Chhindwada as on 19 October 2019.
- Shri. Ratnakar Johari, IFS, APCCF, Institute of Forest Biodiversity, Hyderabad visited the FRCSD, Chhindwada as on 7 December 2019

New initiatives:

- Regional Research Conference was organized by TFRI on 23/8/2019.
- Established demo plantation of Bamboo in Satna KVK of Madhya Pradesh under BTSG- NBM Programme.
- Demonstration plots of industrially important eight different bamboo species were established in farmer's fields.

Recruitment and promotions during the year: 2019-20

Recruitment made during 2019-20

- 10 MTS and 01 Forest Guard were selected and Joined Services. Exam of LDC cancelled.
- Advertisement was floated for recruitment of 34 posts, the process is under progress. Number of post LDC- 10, Technical Assistant- 04, Technician-03, Steno-02, MTS-13, Driver-02.

Promotions during the year: 2019-20

- Dr. S. Saravanan, TFRI, Jabalpur was granted *in situ* promotion in the grade of Scientist-F
- Dr. S.C. Biswas, TFRI, Jabalpur was granted *in situ* promotion in the grade of Scientist-D
- Shri A.J.K. Asaiya, TFRI, Jabalpur was granted *in situ* promotion in the grade of Scientist-C

Transfer during the year: 2019-20

- Smt. Shalini Bhowate, Scientist-B FRC-SD, Chhindwara to TFRI, Jabalpur
- Dr. S. Chakrabarty, Scientist-SG, TFRI to FRC-CE,Vishakapatnam.

All India Coordinated Research Projects

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

Survey of various sites resulted into collection of 401 insect specimens of family Tettigoniidae belonging to 21 species from more than 196 sites in five different habitats (agriculture land, barren land, grasslands, forest and plantations in nine agro climatic zones: plains (Balaghat), Northern Hill zone (Mandla, Nivas), Kymore plateau and Satpura Hills (Jabalpur, Katni, Seoni, Kundam), Vindhyan Plateau (Sagar, Damoh), Central Narmada Valley (Narsinghpur, Hoshangabad), Satpura Plateau (Chhindwara, Betul), Nimar Valley (Khandwa, Khargone, Barwani) from Madhya Pradesh, Chhattisgarh Plains (Bilaspur, Durg, Raipur) from Chhattisgarh and Moderate Rainfall Zone (Nagpur & Gondia) from Maharashtra were collected. Insect specimens were collected, pinned and preserved for identification.

(* Included in Table 2.1.1.1 Ongoing EAP project)

At TFRI, Jabalpur total 26 AICRP's, funded by CAMPA, New Delhi are being executed. Three AICRP's projects with NPCs at TFRI are being carried out. They are as follows:

1. **Genetic Improvement and value addition of *Madhuca longifolia (*AICRP- 23)**

   NPC: Dr. Fatima Shirin, Scientist- F

   Tours were conducted to different locations in Chhattisgarh. Forest areas in Dhamtri and Mahasamund were surveyed for selection of phenotypically superior trees of Mahua on the basis of criteria of gbh, crown diameter and stem straightness,30-35 trees were selected in each location and flowers have been collected from selected trees.

2. **Conservation and sustainable management of wild edible fruiting species (AICRP-27)**

   NPC: Dr.M.Kundu, Scientist 'F'

   Started survey for *Semecarpus anacardium* population in Jabalpur and Mandla districts of Madhya Pradesh. Fruits and seeds were collected from 15 trees and morphological data was recorded.

3. **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'

   Probable areas of distribution of *G. arborea* are being identified through literature and survey for collection of germplasm of the species. Interacted with farmers and SFDs for providing field for the establishment of clonal/progeny trials and agroforestry field trials of the species.

Research work has also been initiated in the following AICRPs:

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)

Research Highlights

2.1 Ecosystem Conservation and Management

2.1.1 Overview

2.1.1.1Projects under the Theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	**02**	**02**	**01**
Externally Aided	**02**	**02**	**02**

2.1.2 Climate Change

Carbon sequestration through afforestation at Rourkela Steel Plant (RSP), Odisha

Assessment of carbon stock and annual sequestration was carried out in 42.12 lakh trees of different species planted during 1958 to 2014 covering 1013 ha area at Rourkela Steel Plant (RSP), Odisha. Result indicated an increase in carbon stock from 144.28 t/ha to 166.11 t/ha during four years period, with an annual increase of 5.46 t / ha. During this period the number of trees in the plantations decreased with an annual mortality rate of 0.84%, average GBH of trees increased to 8.37 cm and carbon content per tree increased to 11.84 kg. Carbon content in the total survived trees at RSP in 2019 was calculated to be 1,68,271 tonnes, with maximum carbon in *Tectona grandis*, followed by *Alstonia scholaris* and *Cassia siamea* trees. Carbon in shrubs and herbs was calculated to be 0.22 t/ha and in litter and deadwood it was 2.85 t/ha in the plantation sites and natural forest. A 4.05 ha plantation comprising 12 tree species was raised by TFRI at RSP, which sequestered 56.61 t carbon from the atmosphere during 4 years period, with maximum by *Anthocephalus cadamba*, followed by *Peltophorum pterocarpum* and *Terminalia arjuna*. Diurnal, seasonal and locational variation in atmospheric CO_2 concentration was observed in and around RSP and morning and post-monsoon CO_2 concentration was found higher.

Fig. 1: Measuring Atmospheric Carbon dioxide concentration plantation raised in and around RSP

Fig 2: Carbon sequestration by TFRI at RSP

Understanding plant - water relations to annual weather fluctuations in *Tectona grandis*

Sap flow pattern was assessed in two girth classes viz. 10-30 cm and 30-60 cm of *Tectona grandis*. The aim of the study was to characterize the plant-water use in *T. grandis* and to examine the effects of annual weather fluctuations on tree physiology. Sap flow meter with Heat Ratio Method (HRM)

principle was used to record the diurnal sap velocity rates at the interval of 20 min within 24 hours for 30 days in summer (April to mid June), rainy (July to mid-September) and post-monsoon (October to mid-December) seasons. The average relative humidity (RH) during the observation was 61.82% with temperature of 31°C. Diurnal sap flow pattern shows that mean velocity was high during day in comparison to night. Stem with 10-30 cm girth class had high sap flow compared to that of 30-60 cm. The average sap flow found in the stem with 10-30 cm girth was 0.791 kg h^{-1} while only 0.054 kg h^{-1} in the stem with higher girth. The rate of flow (flux) was observed to be higher in the heartwood and lesser in the sap wood for lower girth class, while it was the reverse for stem with higher girth class. Variations in sap flow was highly influenced by environmental factors especially rainfall.

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

Impact of canopy opening on population structure and community composition under selection cum improvement (SCI) felling system was studied to assess how it influences floral diversity and regeneration. Three compartments each in different forest types (*Shorea robusta* – Sal; *Tectona grandis* – Teak; Mixed Deciduous) were selected and 90 permanent quadrats of 0.1 ha laid out. Data on species diversity and regeneration were collected pre-felling and post felling in these plots. Besides, a control plot of 0.1 ha in each forest type was also laid out. At present, the relation between population structure of plant communities in mixed forest only was analysed in a SCI site and compared with a control site. Observations from 895 stems ha^{-1} in mixed deciduous forest type reveal *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}). Forty one tree species in the understory were recorded to be regenerating in SCI site of which 20 were representatives of species which formed the canopy of the forest. Regeneration of single species ie., *Anogeissus latifolia*, a characteristic deciduous tree was found to be dominant in SCI site. A total of 27 tree species in the understory were recorded to be regenerating in control site and control sites did not have dominance of single species. Combination of three species of *Diospyros melanoxylon* (42%), *Tectona grandis* (27%) and *Lagerstroemia parviflora* (31%) were found in the ground storey.

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

A new project was initiated to assess the current status of land degradation in forest areas of Madhya Pradesh the project aims to measure carbon stock in soil and vegetation in relation to land degradation in the forests of three western districts of Madhya Pradesh. Carbon stock in soil and

vegetation in relation to land degradation in the forests of three western districts of Dhar, Mandsaur and Jhabua in Madhya Pradesh will be measured. Further, based on the severity of degradation in forests, mapping will be done by adopting a landscape approach to suggest mitigation measures.

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

Seeds of *Lannea coromandelica* (Gunja), *Ougeinia oojeinensis* (Tinsa), *Adina cordifolia*(Haldu) and *Mitragyna parviflora*(Mundi) were collected and germination studies were conducted. Seeds of *Lannea coromandelica* have physiological dormancy and this can be avoided by premature collection at a particular stage. Seeds of *Anogeissus accuminata* (Phasi) had very low germination (2-5%) and no given treatment was successful to increase the germination. The effect of light, temperature and soil types and depth on germination of *Ougeinia oojeinensis, Lannea coromandelica, Adina cordifolia* and *Mitragyna parviflora* has been studied. Maturation study on *Lannea coromandelica, Ougeinia oojeinensis, Adina cordifolia* and *Mitragyna parviflora* was completed and maturation indicator/s was identified. Through desiccation and freezing sensitivity test seeds of all the five species are categorised as orthodox species. Seeds were stored and sampled to assess the viability at different conditions. The viability of seeds of *Adina cordifolia and Mitragyna parviflora* can be maintained up to one year at ambient temperature if stored at 3-5% moisture content. The seed are viable for 2 years at 15 to -20 °C if stored at 3-5% moisture content. Viability of *Ougeinia oojeinensis* can be maintained for two years if stored at low temperatures (15°C to -20°C) and 3-5% moisture content and in ambient condition the seeds can be viable for two years, if moisture content is maintained at 4-5%.Viability of *Lannea coromandelica* can be maintained for one year at ambient condition provided they at stored at 3-4% moisture content.

Ecological Monitoring and GIS mapping of Microlepidoptera diversity of Deodar (Cedrus *deodara*) Forest of Himachal Pradesh

Survey for collection of microlepidoptera moths samples was carried out in the Deodar forest of Chaupal, Jogindernagar, Theog and Gohar Forest Division. Total of 26 specimens were collected from selected sites. GPS coordinates of the surveyed sites was recorded along with data on environment parameters. Six species of microlepidoptera were identified and characterized. Work on identification and other parameters is in progress.

Digitization and Development of Web Portal of Herbarium, Insectary and Fungarium of TFRI, Jabalpur

Work is under progress.

2.1.5 Forest Botany

2.1.6 Tribal's and Traditional Knowledge System

Biodiversity of Satpura Agro climatic region with special reference to dependencies of tribals.

- Survey was conducted seasonally in selected sites viz., Batkakhapa, Delakhari, Khutama, Bhoura, Chunahajuri and Mahupani of Satpura plateau for insect collection.
- During the period 55 insect species were recorded from these sites. Five species of insects viz., *Pachliopta aristolochiae* (common rose), *Bombax mori* (kosa kida), *Sceliphron* spp. (Mud Wasp), *Mylabris pustulata* (kuddu kida), and *Cantharcius molossus* (Gober kida) which are used by traditional healers of Satpura plateau for the treatment of various diseases were documented.
- Three edible fungi species viz. *Plurotus sp., Lantinus sp,* and *Volverriella volvacea* were collected from the study area.
- Data has been collected for different NTFP species from Satpura plateau. It was observed that there is a wide difference among collector, trader and retailer price.

Study of sal regeneration status in borer affected areas.

- Mandla and Dindori Forest Division in unprotected areas were selected for laying out experiments.
- Quadrats were laid out in sal forest areas in 3 seasons (winter, summer and rainy).
- Sal seedlings were tagged to check their survival.
- Regeneration was recorded into three categories-(a) saplings (established regeneration) plants below 22 cm girth at breast height with a height of 2 m and above (b) seedlings (un-established regeneration) plants below 2 m of height excluding the recruits. (c) recruits - plants having two leaves stage.
- Observations were calculation of density, and recorded for diversity for sal regeneration status in a numbers of localities.

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

- Surveys were conducted in different seasons in moist, semi-moist and dry forest areas in agro-climatic zones of Madhya Pradesh to collect the following ten beneficial insects viz.,

1. Parasite Wasp, *Trichogramma raoi*
2. Parasite Wasp, *Apanteles machaeralis*
3. Parasite Wasp, *Xanthopimpla cera*
4. Predator Bug, *Canthecona furcellata*
5. Predator Seven-spot Ladybird Beetle, *Coccinella septempunctata,*
6. Predator Dragonfly, *Crocothemis servilia*
7. Pollinator, Honey bee, *Apis dorsata*
8. Productive insect, wild silk worm, *Antheraea paphia*
9. Productive insect, Lac insect, *Kerria lacca*
10. Human food/medicine insect, Red Ants, *Oecophylla smaragdina*

Sampling analysis of the data revealed that:

- Density of Honey bee (*Apis* spp.) was found to be maximum followed by Red Ants (*Oecophylla smaragdina)* and Ruddy Marsh Skimmer dragonfly *Crocothemis servilia* whereas, predatory bug *Canthecona furcellata,* Egg parasitoid *Trichogramma raoi* was found to be minimum.
- Honey bee comb and Red ant nests were counted to calculate the density of beneficial insects.
- Photographs were taken for documentation and creation of electronic data base.

2.2 Forest Productivity

2.2.1 Overview

2.2.1.1 Projects under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	00	01	00
Externally Aided	00	02	00

2.2.2 Silviculture

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

2000 Seedlings of *Dalbergia latifolia* (Kala shisham, Indian rosewood) *and Pterocarpus marsupium* (Bijasal) were grown in polythene bags and root-trainers in nursery. Plantation area was selected, cleaned and fenced. Pits were prepared for plantation.

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* (Kala Shisham) and *Litsea glutinosa* (Maida Chhal) were collected from different trees of Mandla and Chhindwara district's respectively. 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. *Dalbergia latifolia* seeds can germinate from 20-35°C. At 15°C the germination speed was slow. Germination of both species was not affected by light, i.e., seeds can germinate in white light, red light, far-red light and dark conditions. Therefore seed germination 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. Seeds of *Dalbergia latifolia* and *Litsea glutinosa* were adjusted to 3 different moisture contents and stored at 3 different temperatures.

Studies are continued on combined effect of weed, shade and moisture on seed germination and seedling growth. Survival and seedling growth were recorded after one and half years of sowing. Viability of *Litsea glutinosa* was lost if stored at more than 10% seed moisture content at ambient temperature. Seeds of *Dalbergia latifolia* didn't lose viability, if stored with 3-8% moisture content at any temperature after 18 months of storage, but only the seeds stored at 3-4% moisture content were viable at ambient temperature after 2 years of storage. Seeds of *Dalbergia latifolia* and Litsea *glutinosa* do not produce any soil seed bank after 5 months and one and half years of seed dispersal, respectively.

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

Eight Sal forest compartments in three forest ranges in Dhamtari forest division, Chhattisgarh were selected. Collection of data on growth parameters, regeneration status, etc.was completed in three sites. Collected data was entered and analysed. Yield and productivity of Sal was worked out with reference to different silvicultural systems. Required data was collected through laying out various sub plots and recording information on regeneration status, dominant, co-dominant trees, etc.

Fig. 3: Quadrate sampling for regeneration survey and yield assessment in Sal forest, Dhamtari forest division, Chhattisgarh

Fig. 4: Quadrate sampling for growth parameters and biodiversity indices in Sal forest, Dhamtari forest division, Chhattisgarh

2.2.3 Social Forestry, Agro-forestry/Farm Forestry

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	01	01	00
Externally Aided	00	02	01

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

Studies were conducted to standardize *Gmelina arborea* based agroforestry systems by growing traditional medicinal plants viz., *Asparagus racemosus, Curcuma longa, Zingiber officinale,* and *Piper betle* as intercrops. All the intercrops performed better as compared to sole crop during the 2nd year of its experiment. Betel vine was successful introduced under Gmelina based Agroforestry model. Shade of Gmelina favours Betel vine growth and yield. Observations were recorded on above ground parameters height, canopy and girth of tree crop and data revealed increase in growth in intercrop (5.70 to 8.30 m) as compared to sole crop (5.18-5.96m), Canopy (1.72 to 4.21m)as compare to sole(1.92 to 2.24m) and girth (21.45 to 47.88) than sole (22.63 to 29.5m) .Similarly recorded growth and yield of intercrops and data indicates positive effect on its growth as compared to sole crop.

Major nutrients (N, P, K, and Ca & Mg) of soil were estimated and found increased quantity of Nitrogen (30 kg ha^{-1}) in intercrop as compared to sole (35 kg ha^{-1}) which has decreased from initial stage of system to 2nd year of the experiment. Estimated active ingredients curcumin oil, betel oil, satawarin of

the intercrops by following biochemical methods and results showed no significant difference when intercropped.

Fig. 5: A view of Agroforestry system established at TFRI

Impact Assessment of Agroforestry systems existing in farmer's fields of Madhya Pradesh

Seoni and Hoshangabad districts of Madhya Pradesh were selected as study sites. Multi-staged sampling procedure was adopted for the study which included selection of districts, blocks, villages and farmers.100 farmers from 10 villages of each district were selected. Surveys and interaction with farmers (who adopted agroforestry land use system) were carried out data was collected on basis of questionnaire**.** In the seven blocks of Seoni district, only 10 % farmers (mainly large and marginal) of four blocks have adopted Palash based agroforestry system followed by Mango and Orange based Horti-agri system (8%), Eucalyptus and Babul based Silvi-agri system (6%) in their fields. While in Hoshangabad district, 15% farmers (mainly large farmers having more than 5 ha landholding) adopted teak based Silvi-agri system, 8% Mango based system, 4% Aonla based, 3% Bamboo based and 1 % Anar based system. Farmers were trained to adopt of promising agroforestry systems for doubling farm income based on farmer's field conditions and choice**.**

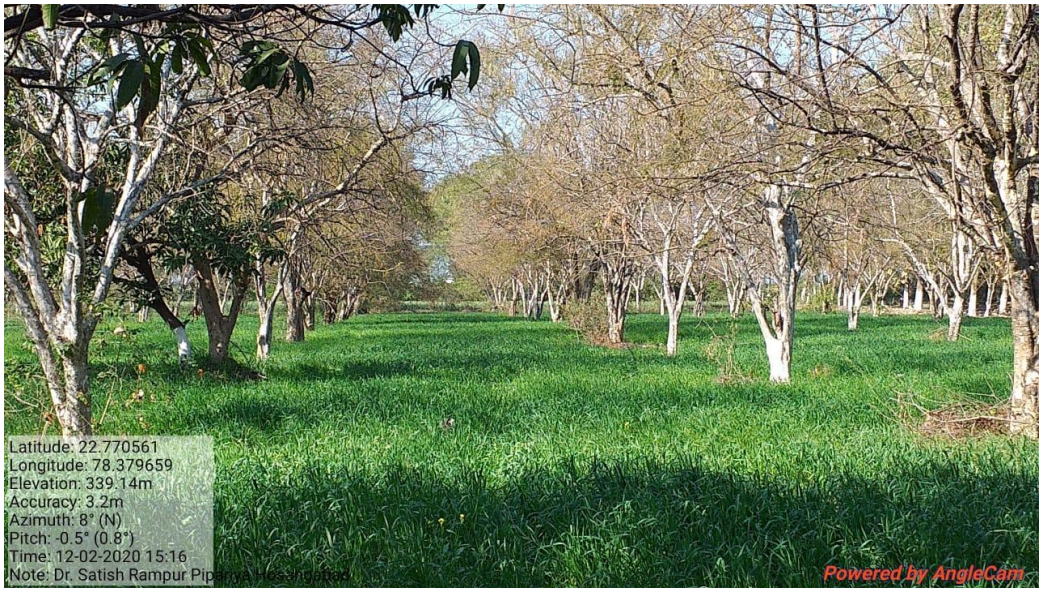


Fig. 6: Aonla based Agroforestry system existing in farmer's field at Seoni (M.P.)

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

Farmers were Identified and finalized, through extensive surveys in Chandiya, Umariya district and Amlai, Shahdol district of Madhya Pradesh near to wood based industry Orient Paper Mill.

Discussions about implementation of the project were held at OPM, Amlai and between officials of OPM, AGM of NABARD and Director, TFRI.

OPM is ready to purcahse leucaena wood from the farmers for pulpwood. Seeds of improved variety i.e. K 636 cv. of *L.leucocephala* were procured from CRIDA, Hyderabad (Telangana).Seedlings were transplanted in poly bags for further plantation. Results indicate better performance under irrigated condition as compared to sole. Planting material of improved variety (K636 cr) of *L.leucocephala* was distributed to identified farmers to establish agroforestry system in farmer's field at Chandiya, Umaria. The subabul based agroforesry system was maintained and above and below ground parameters were recorded.

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

MOU was signed between TFRI and NABARD, Bhopal to undertake first forestry project funded by NABARD in M.P. Identified and selected 15 farmers (8 small and 7 big farmers) for establishment of bamboo based agro-forestry system. Procured Quality Planting Material(QPM) of Bamboo and distributed to them for block and bund planting. PIMC (Project Implementation & monitoring Committee) meeting was conducted by involving beneficiary, DDM, NABARD, Local District Manager , Director, and Principal Investigator, at monthly interval and progress was submitted to CGM, NABARD, Bhopal. Established bamboo based agroforestry system in the selected farmer's field of Jabalpur districts and intercrops were taken as per farmers choice. The plantations are being monitored and maintained by providing technical inputs to farmers.

Fig. 7: Dr.Nanita Berry presenting progress during Project Implementing Monitoring Committee with the DDM, NABARD, Bank Manager and Beneficiary under the chairmanship of Director- Dr. G. Rajeshwar Rao, ARS, TFRI

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

A meeting was conducted with the Addittional PCCF, CAMPA and discussed about the training programme and its objectives. Course manual on seed, nursery and plantation techniques of commercially important tree species was prepared for distribution to the stakeholders/field staff during training programme. Training will be conducted in six circles of the Chhattisgarh.

2.2.4 Forest Soils & Land Reclamation: Nil

2.2.5 Watershed Management: Nil

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	01	05	01
Externally Aided	00	06	01

2.3.2 Conservation of Forest Genetic Resources

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

Surveys were conducted and planting material of *Plumbago zeylanica* (chitrak)and *Celastrus paniculatus* (malkaganii) was collected from Chhattisgarh *(*Dhamtari, Khairagarh, Kondagaon and Baster). Cuttings of *Plumbago zeylanica* and *Celastrus paniculatus* were planted in mist chamber after treatment of 200 ppm IBA. *In vitro* shoot cultures of both the species were established through nodal segments on MS medium containing 1mgl^{-1} BA, after surface sterilization. Sprouting was obtained after 15 days and 2-3 shoots were formed in both. Shoot cultures of *Celastrus paniculatus* were maintained on MS medium supplemented with 1mgl^{-1} BA and cultures of *Plumbago zeylanica* were maintained on MS medium supplemented with 1mgl^{-1} BA, 0.5mgl^{-1} IBA and 2 mgl^{-1} Adenine sulphate.

Fig. 8: Planting material of *Plumbago zeylanica* and *Celastrus paniculatus* in GTI nursery, TFRI, Jabalpur

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

In this project, the aim is to develop a value change for bamboos. Linkages are being formed have between Research Institute, (TFRI), formers and wood based industries (Orient Paper Mill) in a tripartite model. Propagation and multiplication of selected improved clumps of various bamboo species through macropropagation and micropropagation was achieved. Planting material was collected from superior clumps located in Germplasm bank of TFRI. Cuttings of different bamboo species were planted in mist chamber after treatment of different auxins (200 ppm NAA for *B. tulda* and *D. asper*, 200 ppm IBA for *B. nutans, D. strictus* and *B. vulgaris* var. green and *B. vulgaris* var. yellow). *In vitro* shoot cultures were maintained on MS medium with additives (50 mgl^{-1} Ascorbic acid, 22.68 mgl^{-1} Citric acid and 12.6 mgl^{-1} L-Cysteine) and different cytokinins 3mgl^{-1} BA for *B. vulgaris, B.bambos* and *D. strictus*, 7mgl^{-1} BA and 0.5 mgl^{-1}IAA for *B. nutans*, 2.5mgl^{-1} BA and 100 µM Glutamine for *B. tulda. In vitro* rooting was obtained on MS medium supplemented with 5.8 mg l^{-1} Coumarin in *B. tulda* and 5mg l^{-1} IBA in *B. nutans.* 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*) was established at Chingrola district of Umaria, Madhya Pradesh.

Fig. 9: ***In vitro*** **cultures of bamboo species**

Fig. 10: Planting material of Bamboo being produced for plantation

Fig. 11: Discussion and selection of farmers for bamboo plantation

Fig. 12: Preparation of field and plantation of Bamboo in farmer's field at Naugaja, Umaria, MP

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

Under this project on genetic improvement and conservation of *Buchanania lanzan* (Chironji), the potential areas in East Chhindwara, West Chhindwara, Marvahi, Betul, Katni and institutional plantation of FRC-SD was surveyed. Total 139 promising trees were marked in three phenotypic categories i.e. Up right, Semi – spreading and Spreading. Morphometric data along with GPS coordinates was recorded for all the marked trees. Evaluation of marked trees for flowering- fruiting (panicle length, fruits per panicle, average diameter of fruit, 100 fruit weight, 100 kernel weight, etc.) and phytochemical (oil%) traits is under progress. Experimentation on vegetative propagation through branch cuttings using different hormones and concentration levels was conducted.

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

Under the project, we are investigating genetic diversity, status of natural regeneration and factors affecting regeneration and establishment of vulnerable *P. Marsupium* in the forests of Madhya Pradesh. Sample plots (0.1 ha of each) for regeneration studies were laid out at seven sites i.e. 1. Barha [forest division/range- Jabalpur/Kundam, Number of sample plots-05]; 2. Bahoriband [forest division/range- Katni/Bahoriband, No of sample plots-05]; 3. Sara [forest division/range- Mandla/Jagmandal, No of

sample plots-10]; 4. Lamta [forest division/range- Balaghat/Lamta, No of sample plots-06]; 5. Birsa [forest division/range-Balaghat/Birsa, No of sample plots-06]; 6. Semariya [forest division/range-Rewa/Semariya, No of sample plots-06] and 7. Chada [forest Division/range- Dindori/Bajag, No of sample plots-08]. Data recording on regeneration and survival is underway regularly. Inter simple sequence repeats (ISSR) markers are deployed for diversity study. Data on biotic/abiotic pressures on each site (No of Villages in the periphery of 10 Km, human and livestock population, no of fire incidences on sites, compartment history) was collected. Phytochemical variation in heartwood using marker compound 'Pterostilbene' is under progress.

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

In this project, assessment of the status of *Sterculia urens* populations in Madhya Pradesh w.r.t. genetic variation and regeneration is aimed. Information about the potential pockets of S. urens in the forest of Madhya Pradesh was collected from working plans. Potential areas were surveyed in Khandwa (Mundi and Narmada Nagar forest range), South Seoni (Barghat and Rukhad forest range), North Seoni (Chapara and Lakhnadon forest range), Jabalpur (Patan range) and Rewa (Semariya range) forest Divisions and morphometric data along with GPS coordinates was recorded. Experiment for screening of suitable potting medium for seed germination of *S. urens* was conducted. Based on final germination percentage and other associated parameters i.e. energy period, germination rate index (GRI), germination index (GI), time spread of germination (TSG), peak value of mean germination and final germination percentage (FGP), sand medium was found better compared to soil and mixture of Soil: Sand: FYM.

Fig. 13: Data recording in the field (Mundi Range; Khandwa, Barghat Range; South Seoni, 3 Mundi Range; Khandwa)

Fig. 14: Selected site for laying of sample plots for natural regeneration study (Patan Range)

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

Growth and regeneration status of the Sandalwood trees was assessed. Core samples were collected for estimating heartwood and oil content.

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

48 phenotypically superior candidate plus trees of *Terminalia bellirica* (Baheda) were selected from natural population of Maharashtra and Madhya Pradesh out of which 30 candidate plus trees were selected from Amravati, Gondia and Bhandara forest divisions of Maharashtra and 18 trees were selected from West Betul , South Balaghat and West Chhindwara forest divisions.

GPS location of all selected trees was recorded. Important traits viz. height, girth, spreading pattern of the tree and length and breadth of leaves was recorded.

Total fourteen seed samples were collected from the West Chhindwara, South Betul, south Balaghat, Bhandara Gondia and Amravati forest divisions.

Seed weight (gm), seed diameter (mm) and morphological characters was recorded of the seeds collected from selected trees.

2.3.3 Tree Improvement

Selection of plus trees, raising their progeny trials and establishing germplasm bank

A total of 114 CPTs of teak have been selected from four states. M.P-58, Chhattisgarh-30, Odisha-11, Maharashtra-15. A progeny trial of Teak was established representing seedlings from CPTs/PTs of 04 states.

Fig. 15: Establishment of progeny trial of Teak at TFRI, Jabalpur

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

Surveys of SPA, CSO and SSO were conducted in different forest areas of MP, CG and Maharshtra. Existing management practices and flowering and fruiting status was recorded. A Seedling Seed Orchard (SSO) was established representing 33 families from M.P., Chhattisgarh and Maharashtra states.

Fig 16: Establishment of seedling seed orchard of Teak at TFRI, Jabalpur

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

A total of 260 genotypes from exclusive 13 teak dominating agroclimatic zones across the four states i.e. Madhya Pradesh, Maharashtra, Chhattisgarh and Odisha have been sampled and genotyped using twenty eight simple sequence repeats (ssr) markers. Data on tree height (m), clear bole height (m), girth at breast height (cm), wood density (kg/m^3), fire length (µm) and width (µm) has been recorded. Climatic data of last 30 years from these zones was collected. Soil analysis data from these zones also generated. Data generation phase of this project is completed. Statistical analysis and interpretation of the analysed data is under progress. Analysis will provide insight into the genetic diversity and structure of teak in central India which is one of the recognized centre of diversity for teak. Level of disequilibrium for association mapping will also be estimated.

Evaluation of progeny trials of *Tectona grandis* and production of improved planting stock tolerant to defoliator and leaf skeletonizer

In vitro cultures of selected families were established and shoot multiplication was obtained on MS medium supplemented with 2.22µM BA and 1.16µM kinetin in teach*es vitro* rooting and hardening of plantlets was carried out. Cuttings were collected, treated with different auxins (IBA, IAA and NAA) in different concentrations (200, 400 and 800ppm) and planted for multiplication of plants. Rooting was obtained in cuttings treated with 800 ppm IBA.

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

Survey was carried out in 11 sites of Madhya Pradesh for identifying CPTs of *Gmelina arborea* (Khaimer) and 48 trees have been selected. Experiments were carried out on vegetative propagation studies using semi-hardwood cuttings. Maximum rooting of cuttings was obtained in treatment of 500 ppm IBA. Tanin content was estimated in the bark samples of selected trees. Soil samples were also collected from different locations. NPK, pH, EC and organic carbon of soil samples was estimated.

Fig. 17: Rooting in semi hardwood cuttings of selected trees in *Gmelina arborea*

- A progeny trial of Teak consisting of progenies from CPTs/PTs of 04 states; a seedling seed orchard (SSO) consisting 33 families from M.P., Chhattisgarh and Maharashtra was established.
- Demonstration plots of industrially important eight different bamboo species were established in farmer's fields.

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, Two trees of *Haldina* were selected as CPT for seed and vegetative part collection for establishment of field trials.

Fig. 18: CPT of *Haldina cordifolia* in Dindori forest, MP

Fig. 19: Survey and selection of CPTs of *Haldina* cordifolia in Dindori forest division, MP

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

PSPs, CSOs and SSOs were surveyed in Raipur and Bilaspur circle of Chhattisgarh. Survey was conducted based on the information from the Forest Department (R&D Raipur and Bilaspur circle,CG). Data was recorded on growth parameters like height and diameter (GBH), flowering and fruiting pattern of different species and other information like spacing, existing management practices, seed productivity

etc, alongwith their GPS location. All these information were recorded in proforma developed for the purpose of documentation.

The different PSPs, CSOs and SSOs surveyed in Raipur and Bilaspur circle are as follows:

CSO/SSO in Raipur Circle –

CSO Khuteri (*Eucalyptus* hybrid)

CSO Baktara (*Tectona grandis, Gmelina arborea*)

CSO Godhi (*Tectona grandis, Gmelina arborea*)

CSO Baronda (*Tectona grandis*)

CSO Pacheda, Beejapur (*Eucalyptus, Tectona grandis, Gmelina arborea, Eucalyptus sp.*)

CSO Mura (*Tectona grandis*).

SSO Pacheda, Beejapur (*Emblica officinalis, Eucalyptus sp., Tectona grandis, Gmelina arborea,* Chirol, Neem, *Dalbergia latifolia* .

SSO Mura (*Tectona grandis, D. sissoo, Gmelina arborea, Albizia lebbeek*, Mahua, Beeja sal

CSO/SSO in Bilaspur Circle-

CSO Ghasipur, Ratanpur (*Tectona grandis*)

CSO Pondi, Ratanpur (*Tectona grandis*)

CSO Dhelwapur, Kota (*Albizia procera, Gmelina arborea*)

2.3.4 Vegetative Propagation

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

Branch wood cuttings of *Dalbergia latifolia* with basal dip treatment of 5mM IAA + 1mM Boric Acid for a period of 20 hrs planted during the month of April-May resulted in 26% adventitious rooting. Field performance of cuttings raised plants is better than seedlings of *Dalbergia latifolia.*

Fig. 20: Comparative performance of seedlings and cutting raised plants of *D. latifolia*

2.3.5 Biotechnology

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

In vitro shoot multiplication and rooting was carried out in *Madhuca indica* (mahua), *Tamarindus indica* (imli) and *Buchnania lanzan* (chironjii). *In vitro* shoot cultures of mahua were multiplied on MS medium supplemented with 1 mgl^{-1} Kinetin, 0.1mgl^{-1} NAA and 50µM glutamine. Rooting was obtained on ½ strength of MS medium supplemented with 1mgl^{-1} IBA. After the induction of roots, plantlet were transferred on ½ strength of MS medium devoid of any hormone for 2-3 weeks and then hardening of plantlets was carried out. Shoots of imli were rooted on full or ½ strength of MS medium supplemented with 2 mg/l IBA and rooted plantlets were hardened and kept in a mist chamber. *In vitro* shoot cultures of chironjii were maintained on MS medium containing 22.2µM BA and 5.37 µM NAA or MS medium containing 3mgl^{-1} BA and 0.5mgl^{-1} IAA. To control leaf abscission, different additives were tested. Leaf abscission was controlled on two treatments : MS medium supplemented with 1 mgl^{-1} Kinetin, 100 mgl^{-1} casein hydrolysate and 5mgl^{-1} silver nitrate and MS medium supplemented with 3mgl^{-1} BA, 0.5mgl^{-1} IAA, 5mgl^{-1} silver nitrate and 100 mgl^{-1} casein hydrolysate. Rooting was achieved on 3 mg/l IBA.

[Abbreviations : MS – Murashige and Skoog, BA – Benzyl adenine, IBA- Indole-3-Butyric acid NAA- Napthalene-1-Acetic Acid, IAA- Indole-3-Acetic acid].

2.4 Forest Management:

2.4.1 Overview

2.4.1.1 Projects under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	00	00	00
Externally Aided	01	00	00

2.4.2 Sustainable Forest Management (SFM)

2.4.3 Forest Economics

2.4.4 Forest Biometrics

2.4.5 Participatory Forest Management

2.4.6 Policy and Legal Issues

Assessing the impact of pruning of Diospyros *melanoxylon* bushes on its yield, quality and natural regeneration of tree species in Maharashtra

Regeneration pathways in *Diospyros melanoxylon* (Tendu) through root suckers and seeds were studied in Gondia and Gadchiroli forest divisions of Maharashtra. The studies were conducted in quadrats having regularly pruned tendu bushes and unpruned tendu poles. The plots having pruned bushes depicted

higher regeneration and more number of regenerated individuals through root suckers as compared to unpruned tendu poles. The number of individuals in tendu plots increased 1.39 times in a year and maximum increase occurred during post-monsoon period. Under nursery conditions, 37% germination was recorded in tendu seeds, which started on 25th day and continued till 37th day. The germinated seedlings resulted in 94.12% survival on nursery beds.

Fig. 21: Regeneration of tendu through root sucker

Fig. 22: Studying regeneration status of tendu in Maharashtra

2.4.7 Information and Communication Technology (ICT)

2.5 Wood Products: Nil

2.5.1 Overview

2.5.1.1 Projects under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	00	00	00
Externally Aided	00	00	00

2.5.2 Wood and other Ligno cellulosic 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

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	00	02	00
Externally Aided	01	05	01

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

- 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.
- Experiment on effect of growth regulator (Indole butyric acid (IBA) and Gibberellic acid) on germination has been laid out on targeted species. Nursery has been maintained. Data on germination and growth parameters were recorded. Experiment on rooting of branch cutting was laid out in *T. chebula*, *T. bellirica* and *S. anacardium* by applying different concentrations of IBA. 21.5, 33.5 and 25 percent sprouting was observed in the 3 species respectively.
- Periodic surveys were 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.
- Surveys, identification and management of insect pest was also carried out in Chhindwara and Betul state forest department nurseries.
- 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 was conducted

- Herbal gel was formulated from *S. anacardium* leaves and testing of physio-chemical properties, antibacterial and antifungal activities are under progress.

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

Moringa oleifera (drumstick/sahajan) leaves were collected from available sources, processed and stored for further biochemical analysis and product development work. In continuation to the previous years work, products were displayed during the 11th Agrovision Exhibition held from 22nd to 25th November 2019 at Nagpur (MS) for exploring market linkages. SHGs were explored for disseminating results to the various stakeholders. For commercialization of technologies developed under the project, bakery owner was contacted. Clinical studies are under progress for the developed food products which will help in commercialization of the products developed, for developing market linkages and dissemination of results to various stakeholders. Biscuits, papads, vermicelli were developed by incorporating *M. oleifera* leaves powder. The research findings of the study will help in improving the nutritional status of tribal /rural women and children by incorporating these developed food products in their day-to-day diet and thereby overcoming from nutrient deficiencies.

2.6.2 Resource Development of NWFPs: Nil

2.6.3 Sustainable Harvesting and Management

2.6.4 Chemistry of NWFPs, Value Addition and Utilization

2.6.5 Biofuels and Bioenergy:

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

Populations of rare dashmool species *Stereopermum suaveolens* (Patala, Padhal) were demarcated in 10 different districts of Madhya Pradesh. GPS locations were recorded and mapping was done. Root bark samples were analyzed for active chemical ingredient, triacontanol using HPTLC technique to find out chemical variations. Morphological characters (tree height, GBH, CBH, crown diameter, no. of primary branches, leaf area, pod length, pod width, number of seeds per pod and weight of 100 seeds) were recorded for studying the variations. Germination protocols were standardized using different treatments and potting media. Seedlings were raised in the nursery for establishment of germplasm bank and ex-situ conservation. Besides, information on locations of *Stereospermum suaveolens* in Madhya Pradesh was communicated to forest department for seeds collection and its conservation.

Fig. 23: Seedlings of *S. suaveolens raised* in the nursery

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

Tubers of *Curculigo orchioides* Gaertn. (Kali Musli) were collected from 11 MPCAs (Medicinal Plants Conservation Areas) of Madhya Pradesh. Sprouting behavior of tubers were investigated by sowing the apical, distal and end parts. Absolute tubers were also sown in nursery beds to observe the sprouting behavior. Phytochemical evaluation of tubers is being carried out to find out superior germplasm for mass multiplication and domestication.

Fig. 24: *Curculigo orchioides* (Kali musli)

Fig. 25: Germination of *Curculigo orchioides* through apical bud

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

Processing techniques of *Helicteris isora* (Marorphali) and *Mucuna pruriens* (Kewanch) fruits were standardized. Harvesting time of *Helicteris isora* (Marorphali) and *Mucuna pruriens* (Kewanch) fruits were optimized in terms of their active chemical ingredients. The months, January and February were found the best harvesting time of Marorphali and Kewanch fruits, respectively.

Fig. 26: *Mucuna pruriens* (Kewanch) seeds

Fig. 27: *Helicteres isora* (Marorphali) fruits

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) and gum samples of *Anogeissus latifolia* (Dhawda) were collected from 03 forest divisions. Gum samples were graded on physical appearance as Grade I, Grade II and Grade III. Morphological data (length, width, weight of 100 seeds) of Harra were recorded. Harra fruits were processed to make "*Kachariya*" and powdered. The powdered fruit samples are being analyzed for the tannin and gallic acid contents. Besides, as per BIS procedure IS 7437: 1974, Dhawda gum samples are being analyzed for its quality in terms of pH value, viscosity, ash %, volatile (moisture %) and foreign matter.

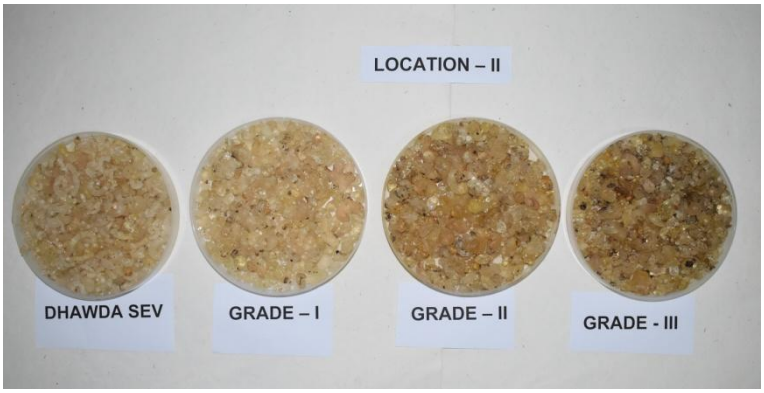


Fig. 28: Grading of *Anogeissus latifolia* (Dhawda) gum

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

Areas with dence populations of *Stercularia urens* were identified in 03 different agroclimatic regions of Chhattisgarh:

i. **Bastar Plateau Zone:**Bastar, Keshkal, South Kondagaon, Dantewada, Sukma and Baloda Bazar forest divisions
ii. **Chhattisgarh Plains Zone:**Janjgir – Champa forest division
iii. **Northern Hills Zone:**Manendragarh and Korea forest divisions

Morphological characters viz., tree height, GBH, clear bole height, crown radius and number of primary branches were recorded. Trees of *S. urens* are being tapped mechanically and chemically (with ethephon) for standardization of harvesting technique for gum karaya.

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

Project was initiated in February, 2020.

Exploration of adhesive materials for incense sticks from the plant species

Different plant parts were collected from of *Basella alba* (Poi), *Aloe vera* (Gwar patha, Ghirt kumari), *Crategu laevigata* (Nag Phani), *Dalbergia latifolia* (Kala shisham), *Cassia tora* (Charota), *Hyptis sauvolenses* (Ban tulsi) and *Bombax ceiba* (semul). Mucilage was isolated from these plant parts and jiggat (adhesive) was prepared in 14 different combinations. Incense sticks were prepared using jigat. Burning time of prepared agarbatti was determined.

Fig. 29: Collection of plants parts for jiggat preparation

Fig. 30: Isolation of mucilage for preparation of Jiggat

Fig. 31: Prepared incense sticks from Jiggat

2.7 Forest Protection

2.7.1 Overview

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

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	03	01	00
Externally Aided	01	03	00

2.7.2. Insects pests, diseases and control

Determining biocontrol efficacy of spiders against insect pests of rice agroforestry system

Mature colony of Spiders were collected from different places of Jabalpur and reared in the rearing unit of TFRI Arachnarium. Experimental work on biocontrol efficacy of spiders against insect pests of rice was done. This project was executed in collaboration with JNKVV, Jabalpur.

Fig. 32: Social spider nests releases in field

Development of integrated insect pest and disease control system for *Albizia* and *Dalbergia* in plantations of Madhya Pradesh and Maharashtra

Survey was conducted in 47 localities of Madhya Pradesh and Maharashtra and recorded the impact of damage caused by insect pests / diseases of *Albizia lebbeck, A. procera* and *Dalbergia* sissoo in plantations.Insect pests - bark eating caterpillar *Indarbela quadrinotata*, termites, *Odontotermes* spp ., defoliator, *Plecoptera reflexa*, leaf folder, *Dichomeris eridantis* on *D. sissoo* and Defoliator/ semilooper, *Ascotis* spp. on *A. procera* ; defoliators *Diradex theclata*, *Rhesala imparata*, on *A. lebbeck* were recorded.

Pathogens – *Alternaeria* spp., *Cladosporium* spp.; *Bipolaris Choletotrichum* spp. on *D. sissoo*; *Alternaeria* spp., *Ganoderma sp*., *Spongipellis spumeus, Schizophyllum commune* on *A. lebbeck* and *A. procera* were recorded. Foliar rust diseases were noticed in *Albizia lebbek* whereas in *Dalbergia sissoo* powdery mildew were recorded.

Field experiments on integrated pest management (IPM) of insect pests/diseases of *D. sissoo* and *A. lebbeck* were laid out in TFRI campus Jabalpur. Observations were recorded on the per cent defoliation, dying / semi-dying shoots / branches, canker diseases of *D. sissoo, A. lebbeck* and *A. procera*. Observations were also recorded damaged and healthy seeds of *A. lebbeck.*

Treatment chloropyrifos 0.05% + ridomil 0.2% + mulching + chaubatia paste was found to be most effective against insect pests/diseases in *D. sissoo A. lebbeck* and *A. procera* plantations. Treatment of trizophos 0.06% was found to be most effective against pod/seed borer *Bruchus bilineatopygus* in *A. lebbeck* plantation, and percentage of damaged seed was less.

Fig. 33: Canker on *Albizia procera*

Fig. 34: Top dying of Sissoo

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

All the five nymph stages and adult stage has been analysed for its efficacy on the targeted pests both in the lab as well as in the field.

Experiment laid out for field release of predator against teak defoliator *Hyblaea puerea*, teak skeletonizer *Eutectona machaeralis* and Sisham defoliator *Plecoptera reflexa* has been laid out.

Observations on predator are being recorded in release site. The egg cards have been prepared and have been released in selected sites along with other life stages.

The technology developed will be transferred to the end-users through different extension activities. Various stages of the predatory insect were explored and collected from the forest and reared in the lab for multiplication and further release in the field.

Based on biology and behaviour of the predator and targeted hosts, mode/ method of field release were standardized through experiments in limited area. The experiments on the field activity were continued by releasing more predatory bugs in the infested sites.

The experiments were repeated in the selected sites and observations and data was collected to analyse the impact of predators. Observations were recorded on the reduction of larvae population and photographs, GPS were taken in the Teak, Sissoo plantations and chick pea crop fields at Niwas, Mandla, Maharajpur and Gauraiya(Gaur). Different stages of predator *Canthecona furecellata* against teak defoliator *Hyblaea puera*, Skeletonizer *Eutectona machaeralis*, sissoo defoliator *Plecoptera reflexa* and *Heleothis armigera* were released.

Chick pea crop field at Gauraiya ghat (Gaur) was selected for releasing of different stages of *Canthecona furecellata* against the *Heleothis armigera* for experimental purposes. After releasing the *Canthecona furcellata* in Chick pea agro crop field and observation were recorded and photographs, GPS were taken. Based on biology and behaviour of the predator and targeted hosts, mode/ method of field release were standardized through experiments in limited area.

The feeding behaviour of the predator was monitored to assess the efficacy to control Lepidoptera insect pests. During the field study larval population on each leaf of the host plant was calculated periodically so as to evaluate the feeding impact of predator on different targeted pests.

The data has been collected for all the nymph stages and adult of the predator and the same is being analyzed for knowing the effectiveness in the lab as well as in the field. The data analysis will reveal the exact need of predator release in the particular area.

2.7.3 Mycorrhizae, rhizobia and other useful microbes

Production of organic fertilizers/organic pesticides and their application in forest nurseries

Four nurseries were selected at Seoni, Ujjain,Ratlam and Indore. Total 10 tree species were selected. 05 fruit yielding trees (Aaonla Jamun, Amrud, Sitaphal , Mango) and 05 timber yielding trees (Khamaer,Teak, Neem, Eucalyptus and *Albizia* sp.). Jivamrut organic fertilizer was applied quarterly on seedlings in 5%,10% and 20% concentrations. Application of 10% Jivamrut has led to maximum increase in the height and girth of seedlings of all the 10 selected fruit and timer yielding tree species. This study has thus helped in protecting environment by reducing application of chemical fertilizers and chemical insecticides.

Fig. 35: Measurement of Height and Girth

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

Further discussion is being carried out with CCF, Raipur and other Forest Division for conducting training for capacity building. A training programme was conducted at Ambikapur VVK, Chhatisgarh.

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

Teak plantations of Forest Divisions of different Kawardha, Jagadalpur, East Bhanupratappur, Raipur and Korba of Chhatisgarh State were visited, along with the forest staff to assess the damage of defoliator and skeletonizers.The sympomology of the insect attack was demonstrated to the accompanying filed staff of the SFD.

The trichocard technique developed by TFRI, Jabalpur along with future plans for dissemination of technology through training and demonstrations was discussed with DFOs and other officials.

Three training programmes were conducted on "Biological Control of Teak Skeletonizer / Defoliator insects" for the frontline staff of three Forest Circles (Durg, Raipur and Bilaspur), Chhattisgarh on 21, 23 and 25 November, 2019.

Fig. 36: Training at Chilphi C.G.

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

The sal forest areas of Kawardha, Jagadalpur, East Bhanupratappur, Kanker, Raipur and Korba Forest Division of Chhatisgarh were surveyed and sites for sal heart wood borer attack and incidence studies were selected.

Tree traps were laid in the selected sites and the accompanying forest staff was instructed to take stock of any occurrence of borer adults in the tree traps. It was reported that few adults were found in the tree trap installed in the Antagarh Forest of Forest division, Kanker.

Trees were also marked in the older plots selected by TFRI Jabalpur during previous studies in the sal forest of Chhattisgarh.

The forest officials were sensitized about the possible symptoms of the borer attack and use of tree trap in identifying the intensity of the attack.

The details of field studies and conducting further trainings was discusse, with CEO, CAMPA (Chhattisgarh) and DFOs.

Three training Programmes were conducted on "Biological Control of Sal Borer insect" for the frontline staff of three Forest Circles (Durg, Raipur and Bilaspur), Chhattisgarh on 21, 23 and 25 November, 2019.

Fig. 37: Survey and layout

Fig. 38: Training at Bilaspur, C.G.

2.7.4 Weeds and Invasive species: Nil

2.7.5 Forest Fire and Grazing

Developing a predictive fire model on forests of Maharashtra with relation to various factors and to delineate suitable strategies

Historical data reveals that most of the forest fire incidences are confined to the eastern part of Maharashtra, which is vulnerable to fire because it is hot and dry region as compared to the Konkan region, which is hot and humid region. The causative factors of forest fire are various androgenic activities such as collection of mahua flowers, tendu leaves, grazing, annoying behaviour of local people for forest department, hunting and spreading of fire from nearby agricultural fields. The pilot study carried out in the forests of Maharashtra showed that the annual accumulation rate of litter was found to be 17.86 t/ha, which was higher in hot and dry areas (19.17 t/ha) than hot and humid areas (15.26 t/ha).

Fig. 39: Collecting litter from the experimental pit in the field

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.

SNo.	No. of Trainings	Duration (in days)	No. of participants
01	47	158 working days	2958

Topics of training programmes organized by Tropical Forest Research Institute, Jabalpur and Forest Research Centre and Skill Development, Chhindwara

SNo.	Topic of Training programme
1	Paid training on Agroforestry Systems
2	'Capacity building on collection, sustainable harvesting and processing of Harra for NTFP gatherer in M.P.'
3	'Capacity building on collection, sustainable harvesting and processing of Harra for NTFP gatherer in M.P.'
4	'Capacity building on collection, sustainable harvesting and processing of Harra for NTFP gatherer in M.P.'
5	'Capacity building on collection, sustainable harvesting and processing of Harra for NTFP gatherer in M.P.'
6	'Capacity building on collection, sustainable harvesting and processing of Harra for NTFP gatherer in M.P.'
7	'Capacity building on collection, sustainable harvesting and processing of Harra for NTFP gatherer in M.P.'
8	'Capacity building on collection, sustainable harvesting and processing of Harra for NTFP gatherer in M.P.'
9	'Capacity building on collection, sustainable harvesting and processing of Harra for NTFP gatherer in M.P.'
10	ग्रामीण ऑगनों मे जडी–बुटी उद्यान की स्थापना पर एकदिवसीय कौ ाल विकास प्रि ाक्षण कार्यकम
11	Forestry Sector in Disaster Risk Reduction and Climate Resilience
12	Carbon sequestration by Industrial Plantation.
13	Training programme on 'Agroforestry'
14	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
15	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
16	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
17	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
18	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
19	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
20	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry

	interventions programme
21	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
22	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
23	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
24	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
25	Training programmes for SFD officials for Collection of data along Narmada river and its tributaries to prepare DPR for Narmada River under River Rejuvenation through forestry interventions programme
26	Training programmes on Lac Cultivation" under ESIP
27	Training programmes on Lac Cultivation" under ESIP
28	Training programmes on Lac Cultivation" under ESIP
29	Training programmes on Lac Cultivation" under ESIP
30	“Biological Control of Sal Borer and Teak Skeletonizer/Defoliator insects”
31	सतपुड़ा पठार की जैवविविधता एवं ग्रामीण जनजातियों की निर्भरता
32	सतपुड़ा पठार की जैवविविधता एवं ग्रामीण जनजातियों की निर्भरता
33	“Biological Control of Sal Borer and Teak Skeletonizer/Defoliator insects”
34	“Biological Control of Sal Borer and Teak Skeletonizer/Defoliator insects”
35	"Bamboo Nursery and Management", organized by GTI division under BTSG-ICFRE programme
36	"Value Addition- Bamboo Technologies", organized by GTI division under BTSG-ICFRE programme
37	Training programmes on Sustainable harvesting/collection and processing of *Aegle marmelos* (Bael) fruits under MFP-MSP training programme for Farmers and NGOs, Forest officials at Singrampur range under Damoh forest division
38	Carbon sequestration through Afforestation.
39-42	Training Programme For B.Sc. IIIrd Year (Biotechnology) Students of Government Model Science College, Jabalpur on Plant Biotechnology.
43	Training programme organized at Ambikapur, Sarguja under VVK Chhattisgarh on: **उन्नत नर्सरी तकनिक, वृक्षसुधार, कृषिवानिकी** **वनरोपणियों / वृक्षारोपणों के कीटों तथा रोगों का समन्वित प्रबंधन**
44	A demonstration cum training programme organized for trainees of GSDP training programme on Bamboo Propagation and Management from FRCER- Prayagraj
45	Training programme organized at Ambikapur, Sarguja under VVK Chhattisgarh on: **उन्नत नर्सरी तकनिक, वृक्षसुधार, कृषिवानिकी** **वनरोपणियों /वृक्षारोपणों के कीटों तथा रोगों का समन्वित प्रबंधन**
46	GSDP- NTFP (Plant Origin): Medicinal Plants
47	GSDP-NTFP (Plant Origin): Bamboo Crafts

Fig. 40 **Training on Bamboo Nursery and Management under BTSG-Increate TFRI, Jabalpur December 2019**

Fig. 41: Training on NTFP (Plant Origin): Medicinal Plants Value Addition and Marketing under GSDP –ENVIS at TFRI, Jabalpur February 2020

Fig. 42: Training on NTFP (Plant Origin): Bamboo Crafts under GSDP at FRCSD, Chhindwara

Fig. 43: Training on "E-procurement and Purchase Management in Government, Storekeeping and Record Maintenance at TFRI, Jabalpur

3.3 Visit Abroad: NIL

3.4 Participation in Seminars/Symposia/Workshops/Training

Sl. No.	No. of Seminars/Symposia/ Workshops/ Trainings attended	Duration (in days)	No. of participants in Seminars/Symposia/ Workshops/ Trainings
1.	06/--/01/22	114	06/--/01/30

4 Extension Panorama/Activities

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

4.1 Report on Van Vegan Kendra's (VVKs) and Demo Village (DV), Tree Growers Mela(TGM), Prakriti and Green Skill Development (GSDP)

- A two day training programme was organized by TFRI, Jabalpur under VVK Chhattisgarh at Ambikapur, Sarguja during 17-18 January, 2020 to disseminate technical knowhow related to research and development of commercially important tree species to staff of Chhattisgarh Forest Department as well as farmers, NGOs and general public. More than 150 stakeholders attended the training programme.

- A two day training programme was organized by TFRI, Jabalpur under VVK Madhya Pradesh at Lakhnadaun, Seoni during 12-13 March 2020 to disseminate technical knowhow related to research and developments of commercially important tree species to staff of MP Forest Department as well as farmers, NGOs and general public. More than 150 stakeholders attended the training programme.
- Maintenance activities were carried out at Demo village at Moiya Nallah.
- Two GSDP trainings, 'Value addition and marketing of NTFP(Plant origin): Medicinal Plants was organized from 26th February, 2020 to 17th March, 2020 at TFRI, Jabalpur and 'Value addition and marketing of NTFP (Plant origin): Bamboo crafts was organised from 7 February 2020 to 23rd March 2020, at FRC-SD, Chhindwara.

Fig. 44: **Training at VVK Ambikapur (C.G.) 16-17 January 2020**

Fig. 45: **Visit of trainees to KVK Ambikapur(C.G.) 16-17 January 2020**

Fig. 46: **Training at VVK Ambikapur (C.G.) 16-17 January 2020**

Fig. 47: **Visit to demo village MoiyaNala, September 2019**

4.2 Technologies transferred : NIL

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

Research articles published by the Institute

Books	Booklets/Brochures/Bulletins/Pamphlets	Articles in Seminar/ Conference workshops etc		Popular articles	Research paper in Journals		Chapters in Books/ Proceedings
		Article	Abstract		Foreign	Indian	
04	23	17	07	05	07	35	07

SNo.	**List of books and booklet, brochures/pamphlets published**	
	Books	**Booklets/Brochures/Bulletins/Pamphlets**
1	Verma, R. K. Asaiya, A.J.K. and Rao, G. R. 2019. *Records of Indian Fungi*, Part I and Part II. Tropical Forest Research Institute, Jabalpur Madhya Pradesh. 750+320 p.	**Booklets :** 1. Berry, Nanita**;** Saravanan, S. & Rao, G. Rajeshwar (2019). Coursebook on **'Agroforestry' published under Compulsory** IFS training program sponsored by the MoEF & CC, Government of India, New Delhi. 2. Saxena HO, Berry N, Choubey SK and Pawar G (2020). Course booklet on **"Value addition and marketing of NTFPs (Plant origin): NTFP Products/ Medicinal Plants"** published under Green Skill Development Programme (GSDP) - ENVIS sponsored by the MoEF & CC, Government of India, New Delhi.
2	Thakur, S. Mattu, V. K. and Kumar, P. 2019. *Biosystematic Studies on some Noctuid Moths through RAPD-PCR technique*. LAP LAMBERT Academic Publishing, 17 Meldrum Street, Beau Bassin 71504, Mauritius. ISBN: 978-620-	**Brochures :**

	0-08314-2, pp 1-501.	
3	Operation manual on "Increasing green cover and carbon sequestration" published by ICFRE.	
4		**Bulletins :** Simple guide cultivation to Oyster mushroom.
5		**Pamphlets :** 1.Tectona grandis –Hindi 2. Tectona grandis –English 3. Maida Chhal (Lour)-Hindi 4. Maida Chhal (Lour)-English 5. Gamari (*Gmelina arborea*)- Hindi 6. Gamari (*Gmelina arborea*)- English 7. Tinsopora cordifolia – Hindi 8. Biofertilizer – Hindi 9. *Asparagus recemosus* – Hindi 10. AGRI-LAC culture System – English 11. *Albizia procera* – Hindi 12. BACH-PADDY (Agroforestry system) English 13. Babul – Paddy (Agroforestry System)- English 14. Arachnarium at TFRI- English 15. Agroforestry systems 16. Bel 17. Bahera 18. Honey 19. *Shorea robusta* 20.*Pongamia pinnata*

4.4 Seminar/Symposia/Workshops Organized

Sl. No	No. of Seminars/Symposia/ Workshops/ meetings organized	No. of days	No. of participants
1.	Regional Research Conference 23 August 2019	1	75
2.	10 Institute level monthly seminars organized by TFRI	1	500

Director TFRI attended one international conference, one National conference, 1 Symposium, 2 Workshops and 1 Training Programme during 2019-2020.

4.5 Consultancies :

S. No	Title of Consultancy	User agency
1	Monitoring of NTPC Ltd. Accelerated Afforestation Programme of Plantation of 10 Million Trees – In Seven States (M.P. and Maharashtra)	NTPC
2	Implementable forestry research for ash utilization promotion and development of research park at APML, Gondia	Adani Maharashtra Power Ltd, Gondia
3	Controlling fugitive dust emission through biological reclamation of flyash lagoons in Shri Singaji Thermal Power Project (SSTPP), Khandwa (M.P.)	M.P. Power Generating Co. Ltd.
4	Wildlife Conservation Plan for Damini and Rajendra Underground coal mines, SECL, Sohagpur Area (MP)	South Eastern Coalfields Limited, Sohagpur Area (MP)

4.6 Technical Services

- Total 1358 soil and forest floor samples received from FSI, Nagpur were analyzed for organic carbon content and revenue was generated for ICFRE.
- Total 1184 samples received under ESIP project, ICFRE, Dehradun was analyzed for organic carbon and dry weight determination and generated revenue for ICFRE.

4.7 Activities of Rajbhasha

उष्णकटिबंधीय वन अनुसंधान संस्थान में, भारत सरकार, गृह मंत्रालय, राजभाषा विभाग की मार्गदर्शी रूपरेखा के अनुसार, 16 सितम्बर, 2019 को **संस्थान के निदेशक, डॉ. जी. राजेश्वर राव, कृ.अ.से. की अध्यक्षता में** हिन्दी दिवस का आयोजन किया गया। इस अवसर पर,निदेशक की उपस्थिति में, संस्थान के प्रशासनिक भवन के प्रांगण में गृह मंत्रालय, राजभाषा विभाग द्वारा जारी **माननीय गृह मंत्री भारत का 'हिन्दी दिवस' पर जारी संदेश का वाचन समारोह आयोजित किया गया**।

Fig. 48: **टी.एफ.आर.आई. में निदेशक की अध्यक्षता में हिन्दी दिवस समारोह का आयोजन।**

गृह मंत्रीजी के संदेश वाचन समारोह में, समस्त वैज्ञानिक, अधिकारी एवं पदाधिकारी साथ-ही-साथ अनुसंधान अध्येयताओं ने उत्साहपूर्वक भाग लिया। वर्ष 2019-20 के दौरान राजभाषा कार्यान्वयन समिति की तिमाही बैठकें प्रत्येक तिमाही में आयोजित की गई एवं बैठक के कार्यवृत्त भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद्, (भा.वा.अ.शि.प.) मुख्यालय, देहरादून के समक्ष प्रेषित की गई। संस्थान की राजभाषा हिन्दी के प्रगामी प्रयोग की तिमाही हिन्दी के त्रैमासिक प्रतिवेदन भा.वा.अ.शि.प. एवं राजभाषा विभाग के संबंधित कार्यालयों को प्रेषित की गई।

वर्ष 2019-20 के दौरान, संस्थान के राजभाषा अधिनियम 1963 की धारा 3(3) के तहत जारी किये जाने वाले दस्तावेज संस्थान में पदस्थ हस्ताक्षरकर्ता अधिकारियों ने हिन्दी-अंग्रेजी में एक साथ जारी किया एवं संघ की राजभाषा नीति का इस संस्थान के हित में अनुपालन सुनिश्चित किया।

Fig. 49: उष्णकटिबंधीय वन अनुसंधान संस्थान में संस्थान के निदेशक, डॉ. जी. राजेश्वर राव, कृ.अ.से. की अध्यक्षता में राजभाषा कार्यान्वयन समिति की बैठक

Hindi Divas was celebrated on 16th September, 2019 under the chairmanship of Dr. G. Rajeshwar Rao, ARS, Director**,** Tropical Forest Research Institute as per the standard guidelines of the Department of Official Language, Ministry of Home Affairs, Government of India. On the occasion, a special get together programme of all the employees of the institute was organized and the message of the Honourable Union Home Minister of India issued by Department of Official Language, Ministry of Home Affairs was read out in front of the administrative building of the Institute in the presence of the Director.

During this celebration, all Scientists, Officers and staff as well as Research scholars participated enthusiastically. During 2019-2020 the meeting of the Official Language Implementation Committee (OLIC) was convened in each quarter regularly and the minutes of the same were sent to ICFRE, Headquarters. Quarterly progress reports in respect of Official Language viz., *Hindi ka tramasik prativedan* were also sent to the ICFRE, Headquarters and other respective offices of the Department of Official Language.

During 2019-2020 the documents which comes under section 3(3) of The Official Language Act, 1963 were issued in Hindi as well as in English simultaneously by the concerned signing authorities of the institute and the prescribed target of Hindi correspondence were also achieved to ensure compliance of The Official Language Policy of the Union in the interest of this Institute.

4.8 Awards and Honours:

1. **Shree Deepak Yadav**, Technical Officer was posthumously conferred, the Life Time Meritorious Award, by ICFRE, Dheradun.

2. **Dr. Hari Om Saxena**, Scientist-D of TFRI, Jabalpur was awarded with **"Fellow Award** "by Action for Sustainable Efficacious Development and Awareness (ASEA), Rishikesh, Uttarakhand, India.

3. Best poster award was awarded for the poster **"Standardization of post harvesting practices of** Vaividang **(*Embelia tsjeriam–cottam*) fruits in terms of embelin content"** during The Indian Science Congress Association – Sagar Chapter (National Seminar on "Science & Technology: Rural Development" at Dr. Hari Singh Gour University, Sagar (M.P.) held on 15-16 November, 2019.

4. Consolation award was given for the poster **"Effect of seed treatments and potting medium on seed germination parameters in threatened *Stereospermum suaveolens* (Roxb.) DC. – a dashmool species"** during 8th International Conference on **"Technology, Innovation and Management for Sustainable Development (TIMS-2020)"** at ITM University, Gwalior (M.P.) held on 19-20 February, 2020.

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

- Dr. G.R. Rao, Director TFRI delivered an interactive talk about various research and extension activities being carried out by TFRI on AIR Jabalpur broadcasted on 13/1/2020.
- 6 programmes under Networking with KVK were conducted by TFRI **Photographs No. 9 & 10**

Fig. 50: **Interaction of trainees with officials of KVK Surajpur17 January 2020**

Fig. 51: **Presentation on doubling of income using Agrforestry at Regional Meeting of KVKs at Khajuraho.28 July 2019**

- 24 Demonstration/awareness programmes were organized for 1200 persons belonging to various groups including students, farmers and trainees.

Fig. 52: **Demonstration of lab technique for preparation of Trichocard to students22 October 2019**

Fig. 53: **Visit of student to TFRI museum**

- "World Earth Day" was celebrated by TFRI Jabalpur at KV TFRI on 23/4/2019. During the programme events were organized for students.

Fig. 54: **Earth Day celebration at KV, TFRI, Jabalpur23 April 2019**

- "International Biological Diversity Day" was celebrated by TFRI Jabalpur and FRC-SD, Chhindwara on 22/5/2019. During the programme awareness generating events like green trail, painting, film show and lectures were organized for students.

Fig. 55: **Celebration of International Biodiversity Day at TFRI, Jabalpur 22 May 2019**

- Honey Bee Day was celebrated by FRC-SD, Chhindwara on 20.05.2019.
- World Environment Day-2019 was celebrated on 5-6 June 2019 with Divisional Commissioner, Jabalpur as Chief Guest.

Fig. 56: **Celebration of World Environment Day at TFRI, Jabalpur 5 June 2019**

- International Yoga Day was celebrated at TFRI Jabalpur and FRC-SD Chhindwara on 21 June, 2019
- Van Mahotsava was celebrates at KV TFRI on 23 July 2019 and on 5th July 2019 at FRC-SD, Chhindwara.

Fig. 57: **Van Mahotsav at TFRI, Jabalpur25 July 2019**

Fig. 58: **Van Mahotsav at KV, TFRI, Jabalpur on 23 July 19**

- To generate awareness about problems caused by Gajar Ghans (*Parthenium*sp) cleanliness programme organized in TFRI on 28/8/2019 on the occasion of Gajar Ghans awareness week.
- Hindi Pakhwada was celebrated from 14.09.2019 to 30.09.2019.
- Oath Ceremony was held to mark celebration of Constitution Day 26th Nov. 2019.
- Republic Day was celebrated on 26th Jan. 2020.

Fig. 59: **Republic Day celebration at TFRI, Jabalpur 26 January 2020**

- 11th Agrovision at Nagpur during 22nd to 25th Nov. 2019,
- 7th International Herbal Mela at Bhopal during 18-22 Dec. 2019.
- 12 programmes under PRAKRITI programme were orgainzed by TFRI & FRCSD, Chhindwara

Fig. 60: **Interaction with students of KV, Ambikapur 18th Jan. 2020**

Fig. 61: **Interaction with students of KV Narsinghpur 14 October 2019**

- **Wildlife Conservation Week**" was celebrated by FRC-SD, Chhindwara from 2 October to 4 October 2019. During the period "Bird Watching Campaign" was organized at the centre for students visiting from various schools of Chhindwara District.

5. Administration and Information Technology

Introduction

5.1 Information Technology

Introduction

5.1 Information Technology Cell

- 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.

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.

5.2.1.1 Action taken to formulate the Charter for the Department and its subordinate formation:

Provision for Annual Review of the Charter after approval is as:

5.2.1.2 Action taken to implement the Charter

Action will be taken for implementing the Charter, after its finalization.

5.2.1.3 Details of Training Programmes, Workshops, etc. held for proper implementation of Charter

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

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 will be initiated, after finalization.

1.3 Welfare measures for the SC/ST/Backward/minority communities:

- The interest of the above section is being safeguarded and as per the guidelines of Government of India a Liaison Officer is in position that monitors the promotion / recruitment as per the roster.
- Recruitment made during the 2019-2020.
  MTS- 10 posts, Forester-01
- Promotion made during 2019-20 under Group "C" posts:- 07 nos.

6. Annexures

1. RTI

वर्ष 2019-2020 के दौरान टी.एफ.आर.आई., जबलपुर में आरटीआई के 47 मामले अभिप्राप्त हुए थे जिनमें 45 मामलो का अनुबंधित समयावधि के भीतर निपटान किया गया।

In TFRI, Jabalpur, 47 cases with regard to RTI were received during the year 2019-2020 and 45 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-chage Scientist, CFRHRD, Chhindwara	In-charge Scientist, CFRHRD, Chhindwara	As per provision and guidelines provided under RTI Act, 2005

2. Information on vigilance cases - Nil

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. Intellectual Property

5.1 Patents Granted - NIL

5.2 Others- NIL

6. 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

DFO – Divisional Forest Officer

DDM- Deupty Development Manager

DNA- Deoxyribonucleic acid

DPR- Detailed project report

ESIP- Earth Science Information Partners

FGP- Final Germination Percentage

FRCSD- Forestry Research Centre for Skill Development

FRI- Forest Research Institute

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

MP- Madhya Pradesh

MOU – Memorandum of Understanding

MOEF&CC- Ministry of Environment, Forests and Climate Change

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- Maharashtra

MS – Murashige and Skoog

NAA – Napthyl Acetic Acid

NABARD - National Bank for Agriculture and Rural Development

NGO - Non Government Organisation

NTFP- Non-Timber Forest Produce

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

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

SPA- Seed Production Area

SSO - Seedling Seed Orchard

ST – Schedule Tribe

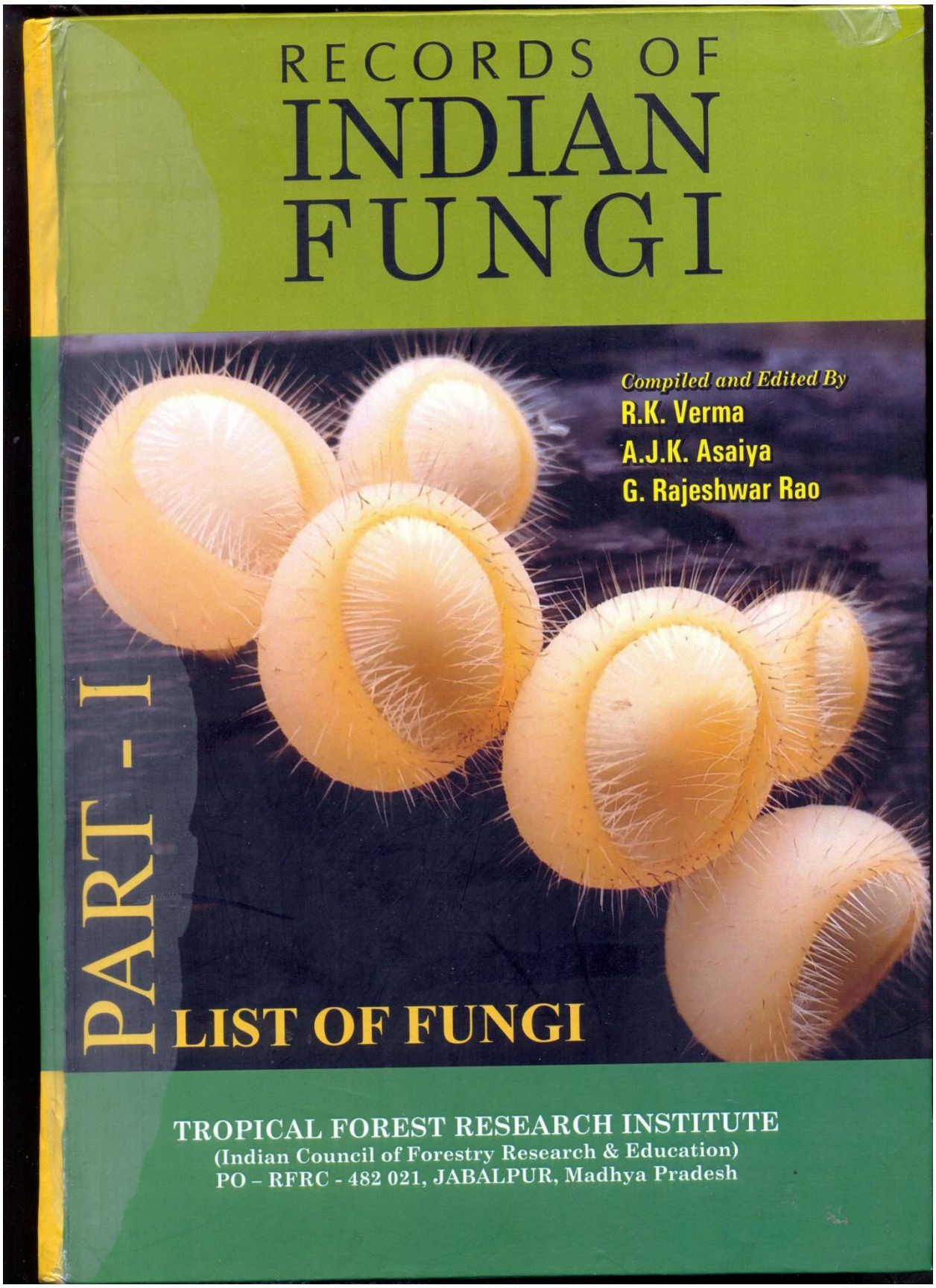
TFRI- Tropical Forest Research Institute

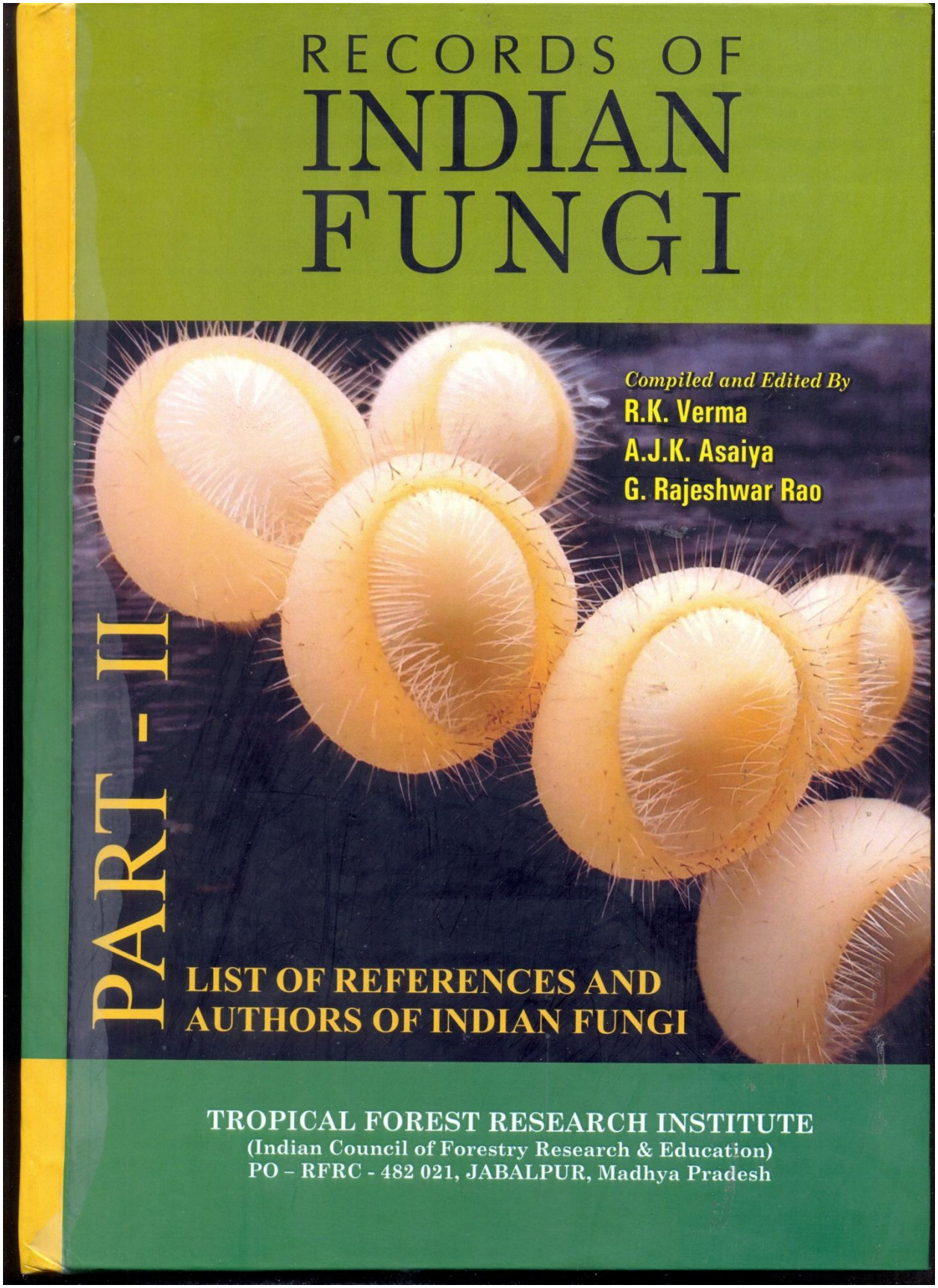
TSG- Time Spread of Germination

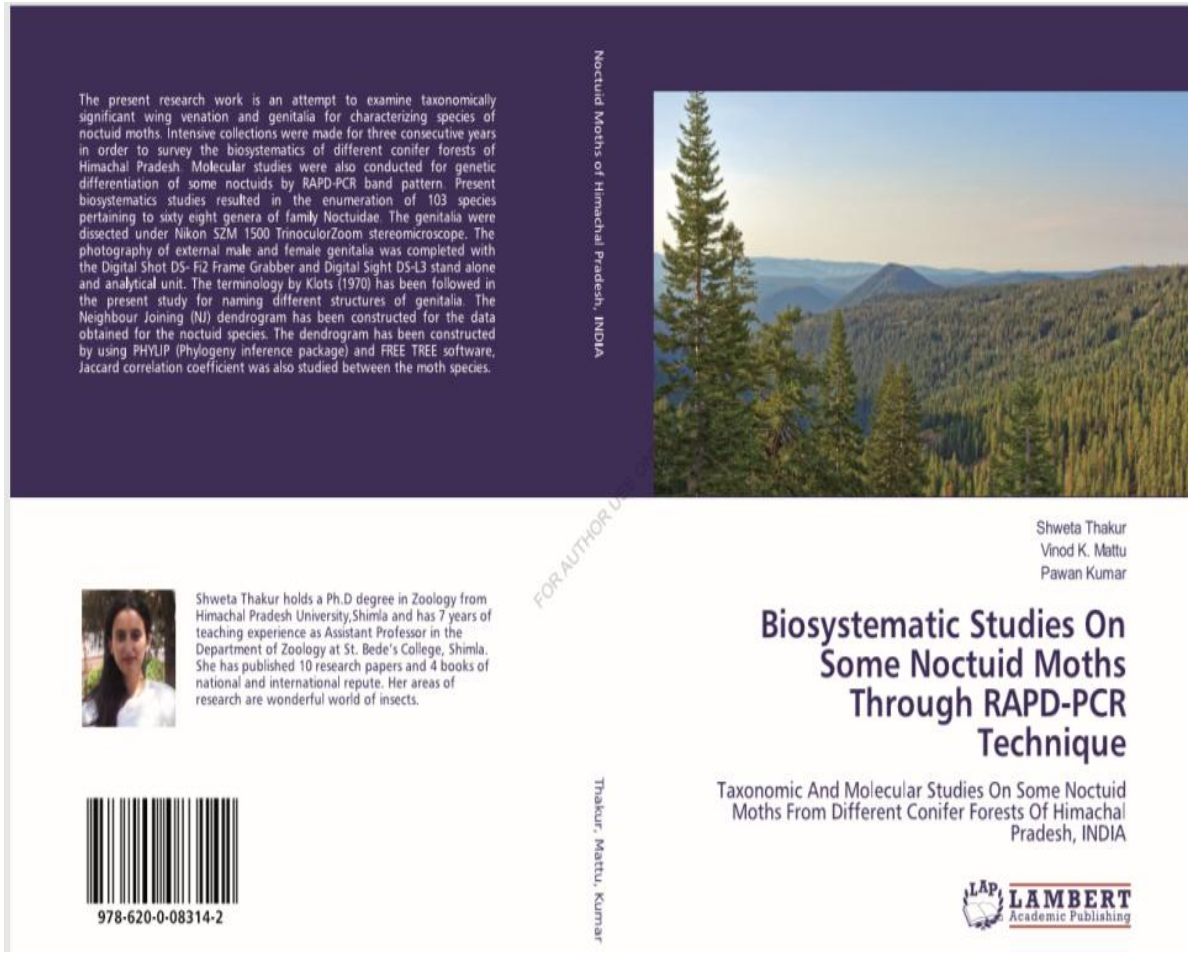
TSO - Teak Seed Orchards

UNDP-GEF - United Nations Development programme –Global environment facility

VVK- Van Vigyan Kendra


RECORDS OF
INDIAN
FUNGI
Compiled and Edited By
R.K. Verma
A.J.K. Asaiya
G. Rajeshwar Rao
PART - I
LIST OF FUNGI
TROPICAL FOREST RESEARCH INSTITUTE
(Indian Council of Forestry Research & Education)
PO – RFRC - 482 021, JABALPUR, Madhya Pradesh


RECORDS OF
INDIAN
FUNGI
Compiled and Edited By
R.K. Verma
A.J.K. Asaiya
G. Rajeshwar Rao
PART - III
LIST OF REFERENCES AND
AUTHORS OF INDIAN FUNGI
TROPICAL FOREST RESEARCH INSTITUTE
(Indian Council of Forestry Research & Education)
PO – RFRC - 482 021, JABALPUR, Madhya Pradesh


The present research work is an attempt to examine taxonomically significant wing venation and genitalia for characterizing species of noctuid moths. Intensive collections were made for three consecutive years in order to survey the biosystematics of different conifer forests of Himachal Pradesh. Molecular studies were also conducted for genetic differentiation of some noctuids by RAPD-PCR band pattern. Present biosystematics studies resulted in the enumeration of 103 species pertaining to sixty eight genera of family Noctuidae. The genitalia were dissected under Nikon SZM 1500 TrinoculorZoom stereomicroscope. The photography of external male and female genitalia was completed with the Digital Shot DS- Fi2 Frame Grabber and Digital Sight DS-L3 stand alone and analytical unit. The terminology by Klots (1970) has been followed in the present study for naming different structures of genitalia. The Neighbour Joining (NJ) dendrogram has been constructed for the data obtained for the noctuid species. The dendrogram has been constructed by using PHYLIP (Phylogeny inference package) and FREE TREE software, Jaccard correlation coefficient was also studied between the moth species.
Noctuid Moths of Himachal Pradesh, INDIA
Shweta Thakur holds a Ph.D degree in Zoology from Himachal Pradesh University,Shimla and has 7 years of teaching experience as Assistant Professor in the Department of Zoology at St. Bede's College, Shimla. She has published 10 research papers and 4 books of national and international repute. Her areas of research are wonderful world of insects.
978-620-0-08314-2
Thakur, Mattu, Kumar
Shweta Thakur
Vinod K. Mattu
Pawan Kumar
Biosystematic Studies On Some Noctuid Moths Through RAPD-PCR Technique
Taxonomic And Molecular Studies On Some Noctuid Moths From Different Conifer Forests Of Himachal Pradesh, INDIA
LAMBERT Academic Publishing