Annual Report 2015-16

TROPICAL FOREST RESEARCH INSTITUTE
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EXECUTIVE SUMMARY

Executive Summary of the Report

Silvi-agri-medicinal system and agri-medicinal system were studied at the two study sites i.e. at farmer's field in Chandrapur district, Vidharbh region of Maharashtra and on station trial at TFRI, Jabalpur (M.P.) and these two agroforestry systems have been standardised.

Women group and rural youth have been involved and trained on the benefit of adoption of lac cultivation as an income generation activity for their livelihood. They were motivated to cultivate lac on the non-conventional lac host in their courtyards also. Studies in this project revealed that lac yield was maximum from the trees located near waterstreams.

Under Madhya Pradesh Council of Science and Technology (MPCST) funded Project, study was conducted to document folk- medicines prevalent in tribal pockets of Chhatarpur, Panna, Satna, Jabalpur, Seoni, Chhindwara and Hoshangabad districts of Madhya Pradesh. Documented species of herbs, shrubs, climbers and trees distributed in clusters and overexploited due to their uses in pharmacy, herbal uses, and their value in export. Market survey was also conducted to study the fluctuations in prices.

Data was collected from the semi permanent plots established in the identified populations of Uraria picta and Andrographis paniculata, in the buffer region of Tadoba Andheri Tiger Reserve (TATR). Population dynamics of Uraria picta and Andrographis paniculata was studied and population growth rate in response to the environmental factors and disturbance was alsom studied in different populations using Matrix modeling. Projection matrix was used to project the future trend of the population based on current trends. The data is being further analyzed over a period of time.

Preparation of electronic data base and digital Photographs of the flora of Satpura agro-climatic zone is in progress. The user interface and data entry portal is being prepared.

Genetics and Plant Propagation Division of the institute is engaged in genetic improvement of forestry species, encompassing conservation of genetic resources of tree species like *Tectona grandis, Pterocarpus marsupium, Dalbergia latifolia, Litsea glutinosa,* Non Timber Forest Produce (NTFP) species - *Rauvolfia serpentina* and *Madhuca indica* and 6 bamboo species through collection of diverse germplasm across the Central Indian part and their propagation and screening of improved genotypes through biotechnological interventions, including molecular marker assisted evaluation of germplasm for future performance of these species.

Phenotypically superior trees of *Tectona grandis, Pterocarpus marsupium, Litsea glutinosa* and *Dalbergia latifolia* were collected form diverse areas of Chhattisgarh, Maharashtra, Odisha and Madhya Pradesh for assessing their genetic worth for improvement of these species. Field data were collected for girth at breast height, clear bole and bark dry weight. Seeds and pods were collected from different localities for raising seedlings. Growth data of seedlings were also recorded. Genomic DNA (Deoxyribonucleic acid) from 180 trees of *Tectona grandis* was isolated and quantified. Wood fibre slides of all the collected samples were prepared and fibre length & breadth were measured for first six zones.

In *Rauvolfia serpentine*, twenty five cultivars collected from 12 states, two cultivars were found to be maximum in resperine content and proposed for their release as new varieties.

Germplasm evaluation trial of *Litsea glutinosa* was established in the campus of the Institute comprising 3 plants of 10 locations in 3 replications. In *Pterocarpus marsupium*, seed source trial was established in Raipur and Chhindwara. Similarily, progeny trial comprising 21 families in Raipur and 09 families in Chhindwara werer established.

A study has been initiated to evaluate *in-vitro* antioxidant activity of medicinally important parts of *Asparagus racemosus*, *Argyreia speciosa* and *Curculigo orchioides* for the standardization of sustainable harvesting time with respect to antioxidant chemicals. Antioxidant constituents-phenolic acids i.e. syringic acid, vanilic acid, algenic acid, anthranilic acid, cinnamic acid and coumaric acid and flavonoid-querecetin, β-sitosterol and lupeol were identified and quantified by High-Performance Liquid Thin Chromotography (HPTLC).

Experiments were laid out using different types of incisions in different months and quantity and quality of oleogum resin were evaluated to standardize harvesting technique of oleo-gum resin of *Commiphora wightii*. The influence of storage containers and conditions on quality- Guggulsterone Z&E of oleo gum resin was evaluated. Maximum quantity of Guggulsterone Z &E was observed in samples stored in glass bottles in dark conditions.

In a study on *Schleichera oleosa* (Kususm), developed value added products-Kusum Vati, Kusum Jam, Kusum Sauce, Kusum Thandai, Kusum Squash, Kusum Sarbat, Kusum Morabba & Kusum Powder from fruits of Schleichera oleosa. The products showed larger acceptability on 9 – point Hedanoic Scale.

Studies have been conducted to standardize the processing and storage techniques of Malkangni (*Celastrus paniculatis*), Baheda (*Terminalia belerica*) & Baividang (*Embelia tsjeriam* –cottam) fruits/seeds. The fruits/ seeds were dried & processed. Dried seeds of Malkangni, Baividung and rind of Baheda fruits were stored in different containers (jute, polythene, markin cloth, tin, glass and plastic).

The infrastructure development cum research project entitled "Establishment of Arachnarium at Tropical Forest Research Institute (TFRI) Jabalpur" is in progress and Arachnarium of TFRI is going to be the 1st of this kind in India.. Work on local survey, collection, identification, digital imaging and checklist preparation of spiders are done.

Results under the research project titled "Carbon sequestration through afforestation at Rourkela Steel Plant (RSP), Odisha" indicated that an average of 0.88% soil organic carbon (SOC) was present in the 200 soil samples and soil of RSP contains 32.19 t C/ha.

Outcome of the research project 'Standardization of technique to enhance the quality and sustainable production of *Diospyros melanoxylon* leaves in Chhattisgarh' were disseminated to State Forest Departments as result of which Maharashtra State Forest Department amended the guidelines for pruning of tendu bushes and also sanctioned a project entitled "Assessing the impact of pruning of *Diospyros melanoxylon* bushes on its yield, quality and natural regeneration of tree species in Maharashtra". Laid out quadrats in Gondia and Gadchiroli forest divisions of Maharashtra and pruned the tendu bushes. Each bush was marked and tagged by Aluminium foil with unique ID. Collected baseline information on tendu leaves and shoots before pruning.

During the current year, data obtained on sal borer incidence from Kanha National Park, Mandla, Mawai Forest Range of East Mandla Forest Division and Bajag Forest Range of Dindori Forest Division revealed a total of 34,501 sal trees were affected by sal borer. Sal borer predator, *Alaus sordidus* red tree ant, *Oecophylla smaragdina* as a predator and an *Ichneumon* wasp, a larval-pupal parasite of sal borer were recorded from timber depot. Pesticidal experiments using biopesticide (Spinosad) and chemical pesticides (Monocrotophos and Cartap hydrochloride) against borer beetles revealed Spinosad, Cartap Hydrochloride and Monocrotophos to be effective with 100% mortality of beetles, in captivity and tree traps. Fumigation of logs in depots Dichlorvos, Cartap Hydrochloride, Chlorpyriphos, Cypermethrin and Monocrotophos was effective in killing beetles inside the logs with intensity of borer beetles inside the logs varying fom 313-733/cmt. Imparted two trainings on sal heartwood borer and its management to the frontline staff of the State Forest Department.

Under the project Studies on insect biocontrol agent *Chrysoperla carnea ans its potential as insect predator,* sites of occurrence *C. carnea* was recorded in Madhya Pradesh (M.P.), Chhattisgarh and Maharashtra, native populations were collected and culture maintained. Developed mass-multiplication protocol and populations were evaluated for their potentiality as biological control agent against insect pest species, viz. *Hyblaea puera, Eutectona machaeralis, Plecoptera reflexa* and sisham defoliator. Temperature regime of 27^0C ±1 and RH 70 ± 5% was the most suitable for mass-multiplication and the Rice moth *Corcycera cephalonica* was found the best host. The laboratory bioassays with *Hyblaea puera, Eutectona machaer*alis, *Plecoptera reflexa* and sisham defoliator revealed that it could consume 7-8 larvae or 80-90 egg per day and thus a promising biological control agent. Laboratory experiment on life cycle of predator, alternative hosts was also carried out.

Under the project evaluation of introduction of honey bees in seed production in teak, 800 teak trees were marked in 5 ha. in TSO, Ghissi, whereas in Nanditola 500 trees were marked and numbered for recording observations during the flowering/ fruiting season. Initial data on fruit/ seed production at both the sites were recorded. Data on flowering and fruiting status was also recorded pre- and post- introduction of honey bee colony. Work is continued.

Observations on incidence of white grubs were recorded under the project Integrated Pest Management of white grubs in 29 forest nurseries, falling under ACZ of Chhattisgarh plains, GIRD Zone, Jhabua Hills, Kymore Plateau & Satpura Hills, Malwa Plateau Nimar Valley, Northern Hill zone of Chhattisgarh, Satpura Plateau and Vindhyan Plateau, Central forest nurseries Sanpna, Dhapada, Narmadanagar and Oberi. Culture *G. mellonella* larvae and native populations of EPNs were also maintenaned throughout the year. Field experiments were laid out in Darauli Forest Nursery, Research & Extension Circle and Obery Forest Nursery, Rewa-Sidhi Project, Madhya Pradesh Forest Development Corporation (MPFDC), Bhopal and observations recorded, which will be repeated in the second year of the project.

Under the project Causes of *Gmelina arborea* mortality in plantation of MP, CG and its integrated management, disease and insect survey in *Gmelina arborea* plantation was conducted and mortality status was recorded. Eight insects and 8 fungi were identified associated with mortality of khamer. Field experiments in both the states are in progress for management of *Gmelina* mortality.

In project on biofertilizers, strains of bacterial biofertilizers and AM fungi were isolated and inoculants of bacterial biofertilzers and consortium of AM fungi were prepared for selected species. Carrier based packets of different selected bacterial biofertilizers were prepared for distribution to forest department.

In the Project 'Standardization of plantation techniques for major forest plant species in Madhya Pradesh' growth data of all the plants were recorded quarterly. Observations on eight species revealed that during the year 2015-16 the maximum average height was attained by *Dendrocalamus strictus* (294.25 cms) followed by *Dalbergia sissoo* (242.13 cms) and minimum height was achieved by *Terminalia bellerica*(77.50 cms).

In the Project 'Impact of forest cover change on streamflows of the Narmada River Basin using Macroscale Hydrological Model' data on climatic, soil, land use and groundwater observation well were procured and basin boundary, watersheds and channels were derived. GIS software named IGIS was procured and preparation of hydrological model is under process.

In the Project 'Standardization of the techniques for germination, collection and maintenance of maximum viability of four important tropical species: *Bridelia retusa, Sterculia urens, Boswellia serrata* and *Saraca* indica', factors working on germination were evaluated, maturation indices were identified and storage trials were continued on seeds of *Sterculia urens, Boswellia serrata* and *Saraca indica*

Ten training programmes were conducted by Centre for forestry Research & Human Resource Development (CFRHRD), Chhindwara during the year on various topics related to forestry. Target groups were farmers from gram Moadei, Karaboh, Bhaisadand, Patpada, Mordongri Khurd, Tamia and Amla, State Forest Department officials (SFDs) from Chhindi Range, East Forest Division, Chhindwara and students from Jawaharlal Nehru Krishi Vishwavidyalaya (JNKVV) Jabalpur, Govt. Higher Secondary School, Gangiwada.

Total 1336 soil samples received from Forest Survey of India (FSI), Nagpur were analyzed for organic carbon content which includes soil (1047) and forest floor (289) samples.

One externally funded [Madhya Pradesh State Biodiversity Board (MPSBB), Bhopal] project entitled "Comparative field performance of seedling and clonal planting stock of Buchnania lanzan Spreng" was completed during the year.

All the existing plantations viz. Phyllanthus emblica (Aonla), Buchanania lanzan (Chironji), Tectona grandis (Teak) and Gmelina arborea (Khamer) of the centre are being maintained.

During the year, Centre conducted concurrent evaluation work of Forest Development Authority (FDA) where advance work has been carried out in the financial year 2011-12 and plantation was done in the year July 2012 in West Forest Division, Betul District (Madhya Pradesh).

Centre for Forestry Research and Human Resource Development, Chhindwara (MP) has been empanelled as an Implementing agency/Resource Centre of Tribal Co-Operative Marketing Development Federation of India Ltd (TRIFED), Bhopal under the Ministry of Tribal Affairs, Govt. of India for imparting training and skill up-gradation / development programmes

related to Minor Forest Produce vide letter no. TFD/ROB/MFP/Skillupgradation13-14/15/781, dt. 09.03.2016.

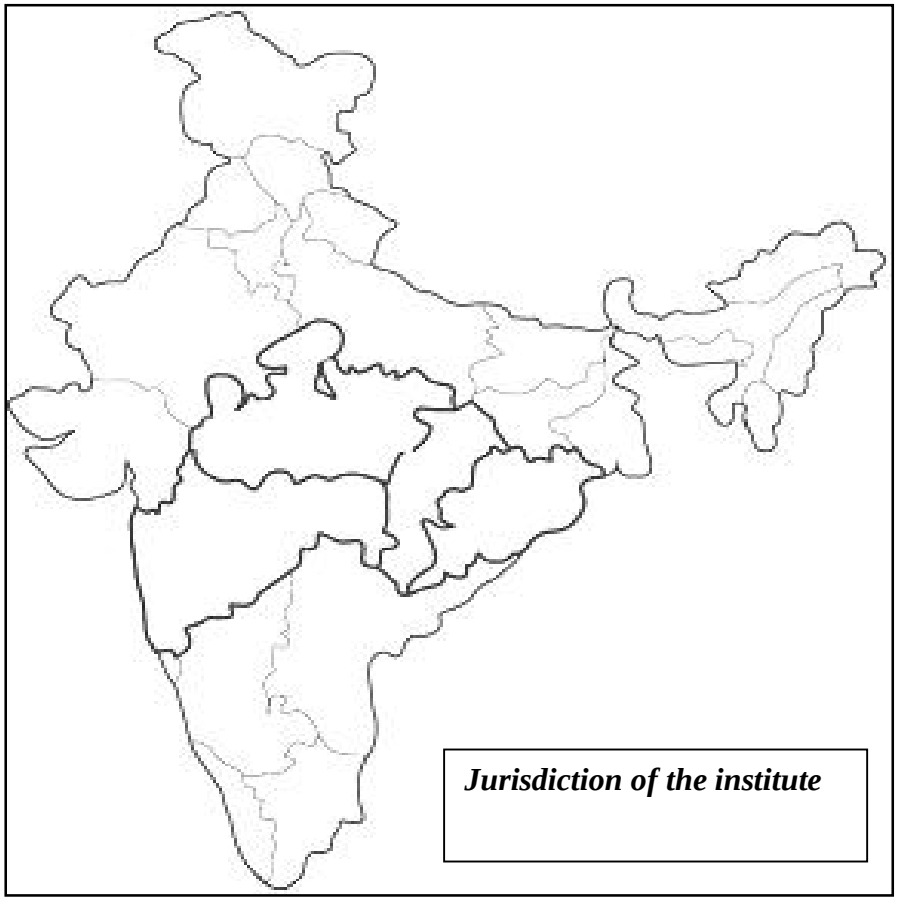
CFRHRD, Chhindwara acted as a resource centre for State Forest Department (SFD), Chhindwara and conducted one day training of trainers (ToT) programme on "NTFPs collection, processing and conservation" under the United Nations Development Programme (UNDP) project at Range office, West Batkakhapa for UNDP beneficiaries. 125 persons participated in the training programme including SFD officials.

Summary of the Projects

Project type	**Completed projects**	**Ongoing projects**	**New projects initiated during the year**
Plan	5	6	-
Externally Aided	4	11	5
Total	**9**	**17**	**5**

1. INTRODUCTION

Tropical Forest Research Institute (TFRI), Jabalpur is a regional institute under the Indian Council of Forestry Research & Education to provide research support to various stake holders in central India covering the states of Madhya Pradesh, Chhattisgarh, Maharashtra and Odisha. Its origin goes back to 1973 when a Regional Forest Research Centre (RFRC) was established which later on was upgraded in to a full-fledged institute in April 1988. The institute has steadily advanced in terms of infrastructure and specialized itself as a major nucleus for research on forestry and environment. In its jurisdiction, TFRI covers 33 agroclimatic zones as well as 5 major forest types rich in biological and ethnic diversity. The institute has a satellite research centre known as Centre for Forestry Research and Human Resource Development (CFRHRD) at Chhindwara, M.P.



Centre for Forestry Research & Human Resource Development (CFRHRD), Chhindwara came into existence on 30 March 1995. The mandate of the centre is to take up forestry research in the specialized areas like biodiversity conservation, non-wood forest products, forest protection, silviculture & tree improvement. In addition to this, the centre has also been assigned to develop human resource in forestry sector by imparting vocational trainings leading to poverty alleviation through self employment in central India.

2. Managing Forest and Forest Products for Livelihood Support and Economic Growth

(i) Development of Silvi-agri-medicinal and agri-medicinal system in vidharbh region of Maharashtra.

Objectives:

1. To develop Silvi-agri- medicinal and Agri-medicinal system.
2. To evaluate the compatibility of intercrops under the system.
3. Transfer of technology to the user groups .

Achievements:

- Silvi-agri-medicinal and agri-medicinal system in both the sites i.e. OSR,TFRI (M.P.) and OFR, Chandrapur (M.S.) was standardized.
- One day meeting was conducted with the farmers of Kothari block of Chandrapur on 19 March 2015 to discuused the problems related to diversification of land through agroforestry. It emerged that the farmers of Vidharbh region are more interested to grow quick return cash crops like cotton, seasonal fruits and oleri crops.
- They felt the need to establish mandi (Bazar) for medicinal plants in the vidharbh region.
- Farmers are keen to grow fast growing and short rotation timber yielding species like *G.arborea* in their farms.
- Attended and presented progress of the project as an invited lecture on 6 January 2016 during one day workshop on "Research priority setting on Forestry in Maharashtra" with the senior forest officials of state at Nagpur (Maharashtra).

Plate:1 A view of Silvi-agri-medicinal system at OSR, TFRI, Jabalpur (M.P.)

Plate: 2 With the farmers of Kotahri block of Chandrapur (M.S.) on 19 March 2015.

(ii) Empowering Tribal Community Through Lac Cultivation in Madhya Pradesh

Objectives:

- To sensitize the tribal community towards Lac cultivation.
- To introduce scientific method of lac cultivation through training and demonstration in the tribals field.
- To develop "Broodlac Farm" in each site for the sustain supply of new lac production areas.

Achievements:

One day traning programme was organised for the rural youth and women group of selected villages on the livelihood generation through lac in the presence of Gram Vikas Co-ordinator and Gram Vikas Secretary. The group was keen to learn the method, its process and marketing of the product and identified the problem of lack of quality of broodlac and its marketing at village level. PI informed the group about available marketing channels and other buyers of Jabalpur region.

Efforts were made to motivate other farmers of the study sites to cultivate lac on the non-conventional lac hosts in their courtyard to get the income during the lean period. Experiments were conducted to cultivate baisakhi crop of rangini strain of Lac after the pruning of lac host trees i.e. *Butea monosperma and Zizyphus mauritiana e*xisting in farmer's field. Assessed the yield of lac and it was observed that the crop gives maximum yield from the trees existing nearby the water stream.

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

The project was conceptualized to evaluate harvest practices for collection of tendu leaves with reference to their sustainability, natural regeneration of tree species and quality of leaves in Gondia and Gadchiroli forest divisions of Maharashtra. This is the first year of the project. Selected pruned and unpruned sites in Gondia and Gadchiroli forest divisions of Maharashtra, laid out quadrats and pruned the tendu bushes. Each bush was marked and tagged by Aluminium foil with unique ID. Collected baseline information on tendu leaves and shoots before pruning of bushes.

Experiment on pruning of tendu bushes conducted at Gondia forest division of Maharashtra

Control fire experiment conducted at Gondia forest division

(iv) Status of sal heartwood borer, *Hoplocerambyx spinicornis* Newman and its management.

Objectives:

1. To monitor sal borer population in sal forest areas with special emphasis on areas of maximum incidence during last epidemic.
2. To investigate natural enemies of the sal borer.
3. To determine the effects of biorational and ecofriendly management strategies under IPM.

Achievements:

Surveyed sal forest areas of MP for monitoring of sal borer and collection of information on borer incidence, and abiotic and biotic factors. Investigated sal borer incidence in M.P. Identified sal borer incidence in Bajag, East and West Karanjia and South Samnapur forest ranges of Dindori Forest Division, Baihar forest range of North Balaghat Forest Division, and Mawai and Motinala forest ranges of East Mandla Forest Division, MP. Collected information on sal borer incidence in two ranges of core zone and one range of buffer zone of Satpura Tiger Reserve, Hoshangabad, MP. Collected information on sal borer incidence in seven ranges of core zone and six ranges of buffer zone of Kanha Tiger Reserve, Mandla. During the year 2012, sal borer incidence revealed a total of 3764 sal trees (345 in East Karanjia Forest range, 187 in South Samnapur Forest Range, and 167 in Bajag Forest Range in Dindori Forest Division and 3065 in Kanha Tiger Reserve) belonging to different categories of borer attack. During the year 2013, sal borer incidence revealed a total of 39,572 sal trees (22997 in Kanha Tiger Reserve, 10024 in

Satpura Tiger Reserve, 6139 in Dindori Forest Division, 394 in East Mandla Forest Division and 18 trees in North Balaghat Forest Division) belonging to different categories of borer attack . During the year 2014, sal borer incidence revealed a total of 87,427 sal trees (35462 in Kanha Tiger Reserve, 10024 in Satpura Tiger Reserve, 22583 in East Mandla Forest Division and 29382 in Dindori Forest Division) belonging to different categories of borer attack. During the year 2015, data on sal borer incidence obtained from Kanha Tiger Reserve, Mandla, Mawai Forest Range of East Mandla Forest Division and Bajag Forest Range of Dindori Forest Division revealed a total of 34,501 sal trees (26,267 in Kanha Tiger Reserve, 5,932 in East Mandla Forest Division and 2,302 in Dindori Forest Division) belonging to different categories of borer attack. Collected meteorological data of Kanha Tiger Reserve to correlate with sal borer incidence.

Surveyed sal forests and timber depots of MP for collection of natural enemies of sal borer. Collected grubs and adult beetles of sal borer predator from timber depot identified as *Alaus sordidus* (Westwood) (Coleoptera : Elatridae). Collected and identified red tree ant, *Oecophylla smaragdina* Fabricius (Hymenoptera : Formicidae) as a predator found feeding on grubs of borer inside the tree in sal forests. Collected ichneumon wasp (Hymenoptera : Ichneumonidae), a larval-pupal parasite of sal borer from timber depot.

Carried out trap tree operation and pesticidal experiments using biopesticide (Spinosad) and chemical pesticides (Monocrotophos and Cartap hydrochloride) against borer beetles in captivity, sal forests and timber depots for its management. In captivity experiments, toxicity of Spinosad sprayed bark revealed 100% mortality of beetles by 0.4% after 72 hours of treatment whereas Cartap Hydrochloride and Monocrotophos exhibited 100% mortality of beetles by 0.2% after 48 hours. Efficacy of bio- and chemical pesticides when sprayed in tree traps showed 75% mortality of beetles by 0.4% Spinosad and 100% by both 0.4% Cartap Hydrochloride and 0.4% Monocrotophos after 72 hours. The results suggest that spraying of 0.4% Cartap Hydrochloride or 0.4% Monocrotophos followed by 0.4% Spinosad can be used in tree traps for killing sal borer beetles. The treatment of logs by spraying chemical pesticides exhibited 100% mortality of beetles in 15 days by 0.7% Dichlorvos, whereas Cartap Hydrochloride, Chlorpyriphos, Cypermethrin and Monocrotophos caused 100% mortality of beetles by 0.05% after 30 days. Worked out intensity of borer beetles, which varied from 313-733/cmt in logs in timber depot.

Imparted two trainings on sal heartwood borer and its management to the frontline staff of State Forest Departments during the year 2015-2016. Distributed leaflet on sal heartwood borer, categorization of borer affected trees and trap tree operation during the training programmes.

(v) Studies on insect biocontrol agent, *Chrysoperla carnea* and its potentiality as insect predator" .

Objectives:

1. To undertake periodical survey of teak, sal and bamboo forest areas of M.P., C.G and M.H. for collection and observation on predator, its habit and habitat
2. To study the status of predator, its identification and laboratory experiments on life cycle.
3. To screen alternate hosts for rearing of predator throughout the year.
4. To conduct host-developmental stage specificity tests and predation potential of predator.

Achievements:

Under the project, sites in M.P., Chhattisgarh and Maharashtra were surveyed and native populations were collected. Surveyed natural forest and nursery of teak and bamboo in Dudhiya nursery Rukhar M.P., and Mul road chandrapur (Maharashtra), nursery and plantation of Bamboo , Teak in Dindori and Mandla forest, TFRI nurseries and plantations Jabalpur (M.P.). Sal forest of Chilpi Karwardha (Chattisgarh) and Nursery, Plantaion and Natural forest of Teak, Bamboo,in Jhirri, Rukhar, Khamtra and Sal Forest of Motinala, Mandla, M.P. Collected the adult and eggs of predator. Rearing of *C. carnea* and observation recorded on predatory potential. Most promissing populations were reared in laboratory and mass-multiplied. After developing mass-multiplication protocal through experiments the populations were evaluated for their potentiality as biological control agent against insect pests species, viz. *Hyblaea puera, Eutectona machaeralis, Plecoptera reflexa* and sisham defoliator. It was found that 27^0C ±1 in RH 70 ± 5% was the most suitable for mass-multiplication. Rice moth Corcycera *cephalonica* was found the best host. *C. cephalonica* rice moth larvae were used for the first time as against only egg used for rearing these insect till date.

The predatory insect, which feeds on egg and larvae, proved promissing biological control agent against major insect pest like *Hyblaea puera, Eutectona machaeralis, Plecoptera reflexa* and sisham defoliator. It could consume 7-8 larvae or 80-90 egg per day in case of first instar larva of *Hyblaea puera* and with others.

Laboratory experiment on life cycle of predator was completed. Rearing of predator on *C. cephalonica* as alternate host in the laboratory and Predatory potential of C. carnea on larvae of bamboo leaf roller, shisham/teak defoliator was investigated and related observations were recorded. Life cycles of *C. carnea* were investigated: Male 21-25 days and female 34-40 days. Egg period 3-4 days, larval period 8-10 days, pupal period 7-8 days data was recorded.

(vi) Studies on effect of introduction of Honey Bee on seed production of teak seed orchards.

Objectives:

1. To examine the impact of bee hives in seed production.
2. To examine the yield of honey and bee wax.
3. To assess the improvement in qualitative and quantitative parameters of teak seeds due to honey bee pollination.

Achievements:

After visits to teak seed orchards and seed production areas, TSO, Ghissi, Behrai and TSO, Nanditola (Dharana), both under Research & Extension Circle, Seoni, M.P. State Forest Department were selected. At TSO, Ghissi, 800 trees were marked in 5 hec. area, whereas in Nanditola 500 trees were marked and numbered for recording observations during the flowering/ fruiting season. Initial data on fruit/ seed production at both the sites were recorded. Flowering status was recorded in both the sites during the flowering season. Honey bee colonies of *Apis mellifera* were procured, maintained and multiplied in the institute for field introduction. The colonies were released in selected field of TSO, Behrai @ 1 colony per hec., during the flowering season. Simultaneously, colony of local honey bee species, *Apis indica* was also initiated, maintained and multiplied. It was noticed that the working in TSO, Nanditola, Dharana was difficult due to frequent movement of nearby villagers and also that the area was disturbed, flowering and fruiting was also very negligible. Since the first site, ie., Gissi, Behrai solved the purpose, the site was follow up for studies. Post-release data was also recorded, by collecting fruits/ seeds of teak and various qualitative and quantitative parameters were recorded. Since, the project was sanctioned on October 2014 and the PI got transferred by the time, this was handed over to new PI and thus season of 2013-2014 could not be availed. The first field data was collected in the year 2014-2015, i.e., pre-introduction data, followed by first post-introduction data in 2015-16. To get second year data on post-introduction request was made for 1 year extension and thus the further work is in progress, only after getting further observations, results can be concluded.

(vii) "Distribution, field biology and Integrated pest management of major white grub species infesting teak seedlings in Madhya Pradesh".

Objectives :

1. To determine the status of incidence/ intensity by white grub species based on population and seedlings damage in teak forest nurseries of Madhya Pradesh, through periodical surveys.
2. To investigate location and species specific field biology of the major white grub species vis-à-vis climatic and edaphic parameters.
3. Field evaluation of Entomopathogenic nematodes as biological control agent and to develop locality and species specific Integrated Pest Management (IPM) model.

Achievements:

The available literature on white grubs was updated time to time. Process for procurement of consumables completed. Surveyed 29 forest nurseries falling under ACZ of Chhattisgarh plains, GIRD Zone, Jhabua Hills, Kymore Plateau & Satpura Hills, Malwa Plateau Nimar Valley, Northern Hill zone of Chhattisgarh, Satpura Plateau and Vindhyan Plateau, Central forest nurseries Sanpna, Dhapada, Narmadanagar and Oberi were surveyed during the period for emergence and and status of the white grub adults. Observations recorded in teak nurseries and the adjacent crop fields for host range and their distribution in different host plant species.

Culture of *G. mellonella* larvae maintained throughout the year on artificial diet in laboratory for EPN culture. Six populations of entomopathogenic nematodes were maintained in the laboratory. Field experiments were laid out in Darauli Forest Nursery, Research & Extension Circle and Obery Forest Nursery, Rewa-Sidhi Project, MPFDC, Bhopal and observations recorded. Observations will be repeated in selected identified nurseries with major attack and new nurseries will also be visited falling under different ACZs as per the targets.

(viii) Studies on harvesting time of some medicinal plants for their natural antioxidants constituents

The samples of *Asparagus racemosus*, *Argeria. speciosa and Curcuilogo orchioides* were collected from Maharashtra and estimated antioxidant activity and phytochemicals- phenol, flavonoids , active constituents –phenolic acids, querecetin, β –sitosterol and ,lupeol for the determination of suitable harvesting time with respect to antioxidant chemicals

The total antioxidant activity of *A.speciosa* was obsereved to be maximum in samples collected in the month of October (0.031 mg/ml, low $IC_{50value}$) followed by January. The IC_{50} value in the leaves varied between 0.031-0.804mg/ml.

The antioxidant activity of *C.orchioides* root was evaluated in samples collected in months i.e. October, January and April. The IC_{50} value varied from 0.0151 to 0.939mg/ml in different months. The lowest total antioxidant activity (equivalent to highest IC_{50} value) was estimated in samples collected in the month of July. It was determined that antioxidant activity was highest (low IC_{50}) in the month of January followed by April.

(ix) Standardization of non-destructive harvesting practices of *Commiphora wightii* (Guggal) gum oleogum resin in Madhya Pradesh

Surveyed different regions of Madhya Pradesh for the identification of potential areas to conduct experiments for sustainable harvesting of Guggul. Different girth sized (10-20,20-30,30-40cm) plants were selected at Piprai, Amba (Murena), Kankura, Barhi,Oosad (Bhind) in Madhya Pradesh. Experiments were laid out using different types of incision in different months and quantity and quality of Oleogum resin was evaluated to standardize harvesting technique. Method was standardized for the estimation of active ingredients Guggulsterone Z

&E with the help of HPTLC. Quantity and quality of oleo-gum resin-Guggulsterone Z &E was estimated in samples collected in different periods. Samples were stored in different containers i.e. Polythene Black &White,Jute Bags, Plastics Bags, Plastics Bottles and Glass Bottle in light and dark. Guggulsterone Z &E was estimated in stored samples monthly. The quantity of Guggulsterone Z &E varied 0.249-1.02% and 0.47-1.96%,respectively. Maximum quantity of Guggulsterone Z &E was observed in samples stored in glass bottles in dark conditions.

(x) Evaluation of *Schleichera oleosa* (Kusum) fruits for their nutritional value and development of value added products for economic development of local people

Value added products (Kusum Vati, Kusum Jam, Kusum Sauce, Kusum Thandai, Kusum Squash, Kusum Sarbat, Kusum Morabba & Kusum Powder) from fruits of *Schleichera oleosa* were prepared. The products showed excellent acceptability on 9 – point Hedanoic Scale. Value added products are being evaluated for their shelf lives.

Figure. Value added products prepared from Kusum fruits

(xi) Standardization of processing and storage techniques of Malkangni *(Celastrus paniculatis*), Baheda (*Terminalia belerica)* & Baividang (*Embelia tsjeriam –cottam*) fruits/seeds

The fruits/ seeds of Malkangni, Baividung & Baheda were collected from the forest areas of Chhindwara district of Madhya Pradesh. The collected fruits/ seeds were dried & processed. Dried seeds of Malkangni (*Celastrus paniculatus*), Baividung (*Embelia tsjeriam – cottam*) and rind of Baheda (*Terminalia belerica*) fruits were stored in different containers (jute, polythene, markin cloth, tin, glass and plastic) and control was kept open environment. The study showed the polythene containers at room temperature were found suitable for storing the said plant materials.

(xii) Studies on the causes of *Gmelina arborea* mortality in plantation of MP, CG and its integrated management.

Objectives:

1. To undertake a systematic survey of *Gmelina arborea* mortality in different regions of MP and CG
2. To identify and evaluate the symptoms of mortality and its causal factors in different regions
3. To develop a sustainable management package for protection of *Gmelina arborea* from disease and insect pest

Achievements:

Disease and insect survey in *Gmelina arborea* plantation was conducted to record mortality status in MP and CG (one site each of MS and Odisha was also included for comparison of results). On an average only 16.5% trees were found healthy with no infection while rest 83.5% trees showed low to heavy infestation (40.39% trees showed low infestation, 30.06% medium and 13.03% showed heavy infestation) at different sites. Eight insects, *Eucanthecona furcellata, Eupterote geminata, Hapalia aureolalis, Indarbella quadrinotata, Tingis beesonii* , a leaf binder, a bark eating cutter pillar and a grasshopper and 8 fungi, *Ganoderma lucidum, Griphosphaeria gmelinae, Epicoccum nigrum, Flavodon flavus, Hendersonula toruloidea, Hexagonia tenuis, Hypoxylon rubigenosum* and *Torula herbarum* were identified as associated with mortality of khamer. The bark (up to 2 meters) trees were also damaged by animal at one site (Sidhi). Field experiments at four sites, three in, Madhya Pradesh (Betul, Chhindawada and Jabalpur) and one in Chhattishgarh (Bilaspur) were conducted for management of *Gmelina* mortality. Treatments applied in these experiments include fungicide, (ridomil 0.2%) and insecticide (monocrotophos 0.05%) along with organic matter and vermicompost in RBD. Average % increase in girth over control was obtained in mulch + vermicompost treatment followed by Ridomil + Monocrotophos application after one year. In standing trees branches showing die back due to disease insect attack or damage were cut and the cut ends were painted with modified Chaubattia paste. The recovery of cut ends was found to be 28.6% more in so treated as compared to control after nine months of application.

(xiii)Title of the project: Formulation of biofertilizers consortium and their distribution to forest department.

Objectives:

1. Collection of beneficial forest tree specific soil microbes such as *Rhizobium*, *Azotobacter,* phosphate solublizing bacteria and *Azospirillum* from Madhya Pradesh.
2. Identification and selection of the strains beneficial for forest tree species by laying nursery experiments.
3. Preparation of host specific culture of the collected microbes.

Achievments:

Strains of bacterial biofertilizers and AM fungi were isolated for selected tree species of Madhya Pradesh. Inoculants of bacterial biofertilzers and consortium of AM fungi were prepared for selected species. Carrier materials being used for making packets of bacterial biofertilizers are: activated charcoal powder, saw dust, grinded and filtered soil (clay loam), vermicompost, calcium carbonate. Carrier based packets of different selected bacterial biofertilizers were prepared for distribution to forest department. Inoculants of AM fungi were also prepared in bulk in cemented beds (1 x 1 x 0.75m). Soil, sand and FYA in 2:1:0.5 ratios were used as carrier for production of AM inocula for beeja-sal, sissoo and teak.

(xiv) Standardization of plantation techniques for major forest plant species in Madhya Pradesh

Achievments:

- The plantation was maintained. Data for growth (quarterly) was recorded.
- Soil sample was collected from each plot for analysis.
- Weeding and gap filling work was completed.
- Quarterly recording and evaluation of growth data was done.
- Observations on eight species revealed that during the year 2015-16 the maximum average height was attained by Dendrocalamus strictus (294.25 cms) followed by Dalbergia sissoo (242.13 cms) and minimum in case of *Terminalia bellerica* (77.50 cms).
- Regarding individual performance best growth was observed in D. strictus (294.25 cms) at spacing 3x3m, pit size 60 x60x60 cms & irrigated , D.sissoo (242.13 cms ht) at spacing 2x2m, 45x45x45 cms &irrigated, Gmelina arborea (156.63 cms) at spacing 3x3m, pit size 60 x60x60 cms &non irrigated, Terminalia arjuna (115.88 cms) at spacing 2x2 m, 60x60x60 cms&non irrigated , Albizia procera (126 cms) at spacing 2x2 m, 60x60x60 cms & non-irrigated, D. latifolia (101 cms) at spacing 3x3 m, 45x45x45 cms & irrigated, Tectona grandis (85.13 cms) at spacing 3x3 m, 30x30x30 cms & non irrigated and T.bellerica(77.50 cms) at spacing 5x5 m, 60x60x60 cms & irrigated.

Photograph for A. procera plants, October 2015

Photograph for Baheda plants, October 2015

Photograph for Bamboo plant , October 2015

Photograph for D. sissoo plants , October 2015

3. Biodiversity Conservation and Ecological Security

(i) Study on Indigenous knowledge and Documentation of extent of utilization of herbs in folk- medicines prevalent in tribal pockets of Madhya Pradesh

- The study was conducted in districts of Chhatarpur, Panna , Satna , Jabalpur , Seoni, Chhindwara and Hoshangabad
- The survey recorded information from tribal communities belonging to Saur , Raj Gond, Gond , Khirwar , Bhariya and Mawasi .
- Recording of information from vaidraj and local community of use of indigenous flora and plant parts used in herbal medicines.
- Recording of information on existing flora : species overexploited and at verge of extinction being recorded from local community and traditional healers for plant parts used in herbal medicines- name of indigenous flora local and scientific name, formulations prepared , dosage in cure of ailment .
- Recording of information on utilization and collection methods of plants : The information from local community for *utilization* of plants and collection methods of plant parts , and method of collection of local flora.
- The plant species Over exploited are documented : There are 12 species in Chhindwara & Hoshangabad district, which are over exploited on account of trade and high volume utilization in ethno -medicines by traditional healers are *Amorphophalus campanutus* (Jangali surn), *Costus specious* (Keokand) , *Mucuna pureins* (safed kemach), *Jatropha curcus* (Ratanjot), *Litsea glutinosa* (Maida lakdi) , *Trichosanthes bracteata* (Indrayan choti) , *Citrulus colocynthis* (Indrayan Badi), *Abrus precatorius* (Lal gunchi) , *Peucedanum nagpurnse* (Tejraj), *Peucedanum dhana* (Bhojraj) and *Parkia biglanbulosa* (Shivlangi). The plant species which are abundant has been tabulated clusterwise.
- The plant species at the verge of extinction are documented :

1) Plant species at the verge of extinction in Chhindwara & Hoshangabad district are *Amorphophallus campanuiatus* (Jangali suran), *Abrus precatorius* (safed gunchi) , *Citrulus colocythis* (Badi Indrayan, Kahira), *Costus specious* (Keokand), *Dillenia pentagyna* (Suarukh), *Jatropha curcus* (Ratanjot) *Peucedanum nagpurnse* (Tejraj), *Peucedanum dhana* (Bhojraj), *Parkia biglanbulosa* (Shivlingi), *Litsea glutinosa* (Maida lakdi) , *Mucuna pureins* (safed Kemach), *Trichosanthes bracteata (Ind*rayan choti)

2) Plant species at the verge of extinction in Jabalpur and Seoni districts are *Abroma angusta* (Ulat kambal) , *Abelmoschus moschatus,* (Bajrakand) , *Abrus precatorius* (Gunchi) , *Butea parvilora* (Palsh bel) *Curculigo orchoides* (Kali musli) ,*Terminalia arjuna* (Arjun) , Vajradanti , *Dioscorea hispida* (Bechandi) *Curcuma angustifolia* (Tikhur) , *Curculigo orchoides* (Kali musli) , *Mucuna pureins* (Kemach) *Grewia*

hirsuta (Gudsakri) ,*Gloria suberba* (Kalihari) , *Terminalia bellarica* (Baheda) and *Terminalia chebula* (Harra)

Fig.: Plant herbal formulations recorded in market survey


DIABETES POWDER


VAIDRAJ


ALLERGY


OBESITY


SKIN WHITE SPOT


Bilari kand


COLD & COUGH


ARJUN BARK
HEART AILMENT


Kidney stone


Pitambari oil :
Scitica arthritis


Dysentry : Rasna jadi Reetha


Gulbakawli eye drop : Motiabind


Amla prickles ; Shaktivardhak


Keokand :Scitica, Arthiritis

(ii) Population dynamics of Threated Medicinal plant species growing in buffer zone ofTadoba Andheri Tiger Reserve Maharashtra

Matrices has emerged as an important tool to study age/stage structured populations, simulation and elasticity analysis for population projection matrices help us predict the fate of populations. The population dynamics study of endangered species will help in devising effective conservation strategies. Survey was conducted in TATR, buffer zone 714 species were recorded of which 98 species were documented to be used by the traditional healers for preparation of various herbal formulations during the study. Two medicinal plant species Uraria picta and Andrographis paniculata were selected for studying population dynamics in Buffer zone of Tadoba –Andheri Tiger Reserve.

Seed production, viability and survival percentage of the species varied between different populations of Uraria picta Habitat conditions at Palasgaon and Phuljhari populations were found to be the most suitable for growth and establishment of the species. Highest seed production was recorded in Mul populations, also the survival percent (in laboratory conditions) was higher in the seeds collected from this population. Thus, seeds from Mul population can be used to raise nursery for artificial propagation of the species. the plant is susceptible to hostile conditions at younger stages only 5-13 out of every 1000 seedlings reach to flowering stage (lowest in Mul population and highest in Palasgaon) providing protection at young stages will improve the density of this species in natural conditions.

Andrographis paniculata showed a stable population structure and growth rate in all the seven populations studied. Of the four populations of Uraria picta, populations in Phuljhari and Palasgaon showed stable structure and growth rate while at the other two sites the population growth rate is negative.

Due to high seed production and viability, seeds from Mul population of Uraria picta and Nimelda population of Andographis paniculata can be used for artificial propagation of this species. Artificial broadcasting of seeds collected from these populations in the sites where survival percent is high will increase the density of the species and thus the growth rate of the population.

Laying out semi-permanent quadrat for population dynamics study in Buffer region of Tadoba-Andheri Tiger Reserve

(iii) Preparation of user-friendly data-base of phytodiversity in Satpura plateau agro-climatic zone of Madhya Pradesh.

Data collection on floristic diversity of SAtpura Plateau ecoregion was carried out through collection of secondary data, a total of 1335 species have been tabulated so far. Field tours are being undertaken for filling the gaps in the existing floral documentation of the Region Threat status of the plants as per International Union for Conservation of Nature and Natural Resources (IUCN) classification is being documented. The plants of Ethno botanical importance growing in the region is being documented.

A user friendly user interface for data entry, editing and retrievals was developed using Dot net technology. Database structure was designed based on the available information. Loopholes were identified in the design and are being currently fixed. Loop holes were identified during the trial, the same are being fixed. Development of user-interface is in progress

Photographs for Electronic database of Satpura Ecoregion

(iv) Establishing Arachnarium at TFRI, Jabalpur, M.P.

The project involves spider taxonomy and conservation. Work on local survey, collection, identification, digital imaging and checklist preparations are well in progress. Till date, a checklist of 100 species of spiders was finalized. Renovation of existing building in the form of an Arachnarium is complete. Landscaping for aquatic habitat and terrestrial habitats are almost complete.

Motinala Forest Range, Bichhia and Bijadandi forest area were surveyed and four aquatic habitats were selected where "Hydrophilic" spider families were found.

Nilus phipsoni (Family: Pisauridae) were collected and found to be a new state record for Madhya Pradesh. Moreover one species of Pisaura was also recorded. Four families of spiders reared in the laboratory, viz. Pisauridae, Araneidae, Oxyopidae and Lycosidae, were released in the Arachnarium.

Newly established Arachnarium at TFRI, Jabalpur

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

The research project titled "Carbon sequestration through afforestation at Rourkela Steel Plant (RSP), Odisha" has been conceptualised to quantify carbon stock and annual sequestration in vegetation, litter and soil in more than 42.12 lakh tree plantations raised by Rourkela Steel Plant in 2504 acres of land till 2013-14 and in the nearby natural forest. The objectives of the study are to assess CO2 released by RSP to the atmosphere through the processes of manufacturing steel and to monitor seasonal, diurnal and locational variation in its concentration. Valuation of plantations for their tangible and intangible benefits will be assessed and outcomes

of the project will be disseminated to the stakeholders through training programmes to officers and staff of SAIL.

This is the third year of the project. Sites have been selected and quadrats for trees, shrubs, herbs and litter have been laid out in the plantations and natural forest and biophysical parameters including growth of trees and soil moisture are being studied. As part of the programme, a 10 Acre plantation including 12 tree species having higher carbon sequestration potential has been raised at Rourkela Steel Plant, Rourkela with the help of Odisha state forest department.

Vegetation survey of plantations and nearby natural forest conducted through 68 quadrats recorded 30 tree species with maximum number of Tectona grandis in plantations and 12 tree species with 12 different genus, 11 families and Ficus racemosa – Bombax ceiba – Mallotus philippensis community in natural forest.

An average of 0.88% soil organic carbon (SOC) was found in the 200 soil samples collected from RSP concluding that soil of RSP contains 32.19 t C/ha. Other physico-chemical characteristics of soil samples have been estimated. Allometric equations for quantifying biomass, thereby carbon, by non-destructive method against GBH have been developed. One 2 days training on 'Carbon Sequestration' for Steel Authority of India (SAIL) staff was conducted at RSP during 1-2 December 2015. Collected data on atmospheric CO2 from 15 locations in different seasons.

Estimated carbon stock in vegetation, litter and ground flora by 'Quadrat Method'.

Training programme for officers and staff of SAIL conducted at RSP, Odisha

Field visit by the trainees to plantation site at RSP

A 10-Acre plantation raised at RSP

(vi) Standardization of the techniques for germination, collection and maintenance of maximum viability of four important tropical species: Bridelia retusa, Sterculia urens, Boswellia serrata and Saraca indica

Achievments:

- The objectives of the project was to standardize the best treatments for germination, to identify the maturation indices and storage category and storage treatment to retain maximum viability of four species.
- Effect of temperature, light, soil type and quality on germination of Sterculia urens, Boswellia serrata and Saraca indica was evaluated.
- Best pretreatment for germination of Sterculia urens was standardized. Seeds of Bridelia retusa were incapable to germinate at any stages of maturation and seeds were found dead before full ripening. But 2% seeds were found germinated in soil in the next year.
- Maturation index of seeds of Sterculia urens, Boswellia serrata and Saraca indica was determined on the basis of physical parameters and germination and desiccation tolerance test. Storage behaviour of seeds of Sterculia uren, Boswellia serrata and Saraca indica was evaluated.
- Seeds of Sterculia urens, and Boswellia serrata were identified as orthodox category and those of Saraca indica was identified as recalcitrant seeds.
- Seeds of Boswellia serrata,, Sterculia urens and Saraca indica were stored at different conditions and Stored seeds were sampled at intervals for evaluation of moisture content and viability.

4. Forest and Climate Change

(i) Impact of forest covers change on streamflows of the Narmada River Basin using Macroscale Hydrological Model

Achievments:

- Study has been initiated to identify as well as quantify the forest patches regulating most of the sustainable flow of Narmada River using macroscale hydrological model named SWAT (Soil and Water Assessment Tool).
- The climatic, soil and land use data were procured from India Meteorological Department (IMD) Pune, NBSS&LUP Nagpur and NRSC Hyderabad respectively.
- The SWAT model was set up and basin boundary, watersheds and channels were derived using cartosat DEM v1.3.
- With the help of CWC and India WRIS reports all gauging sites were enlisted and discharge data for all gauging stations (till year 2011) was collected from India WRIS.
- Groundwater observation well data was acquired from Regional Groundwater Board, Bhopal.

5. Forest Genetic Resource Management and Tree Improvement

(i) Studies on variation in reserpine content in some high yielding genotypes of in vitro and seedling raised Rauvolfia serpentina Benth

The chemical estimation of 5 genotypes for reserpine content has been completed. The cultivar OR-AG (Odisha) was found to containing maximum reserpine content. The sample of MP-CW (M.P) stood second. Both cultivars were proposed for release as new variety in the meeting of implementation team followed by regional variety testing committee (RVTC).

(ii) Germplasm collection and ex situ conservation of *Pterocarpus marsupium* Roxb

The work of germplasm collection was done in three agro climatic zones of Chhattisgarh. The seedlings raised from the locality of Tamnar (Raigarh), Asna (Jagdalpur), Baisgaon (Antagarh), Tadoki (Antagarh), Raipur, Ambikapur, Balod (Durg), Bharuadih (Bilaspur), Gurda (Kharsia, Raigarh) and Hati (Dharamjaygarh) were used for raising trial in Naya Raipur Chhattisgarh. This trial, referred to as seed source trial, was established in three replications with 10 seed source (treatments) and 6 number of plants in each replication under Complete Randomized Block Design (CRBD). Therefore, a total of 180 plants were planted in 7595 m^2 area. Similarly, in Chindwara locality the seed source trial were established using the seedlings from Tadoki , Bhaisadwar, Bhanupratappur, Balod, Raipur, Kharsia, Hati, Ambikapur, and Bilaspur. Seed source trial, was established in three replications with 09 seed source (treatments) and 6 numbers of plants in each replication followed by CRBD. A total of 162 plants were planted in 4760 m^2 area. 21 Families in Raipur and 09 families in Chhindwara were planted with 25 plants in block design. Therefore, a total of 525 and 225 plants were planted in Raipur and Chhindwara, respectively as progeny trial.

Fig: Establishment of progeny trial of *Pterocarpus marsupium* in (a & b) Naya Raipur (c & d) CFRHRD campus, Chhindwara

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

Sub project 1: Selection of plus trees, raising their progeny trials and establishing germplasm bank

The areas of Rukhad and Kurai (South Seoni, Pali (Bilaspur), Devpur (Raipur), Kalpi (Jabalpur) were visited and seeds from the available plus trees were collected. Some additional trees were also marked as Candidate Plus Trees (CPTs) with check trees in Kalpi Jabalpur area. The seeds were also collected from clonal seed orchard raised in the campus of TFRI. The collected seeds are under treatment for germination and raising their progeny.

Fig. Selection of CPTs in Kalpi (a & b) and (c) seed size variation in collected seeds (d) mechanical scarification of collected seeds before germination.

Sub-project 2: Development of management practices of teak seed production areas, seedling seed orchards and clonal seed orchards

A tour was conducted to Clonal Seed Orchards (CSOs) located at Ghasipur (Bilaspur), Ghodi and Mura (Raipur) and Seedling seed orchard (SSO) located at Mura (Raipur) in Chhattisgarh state.

Fig: (a & b) CSO of teak at Ghasipur (Bilsapir) and collection of soil samples (c & d) CSO at Godhi (Raipur)

Sub project: 3 Production of transgenic teak tolerant to defoliating pests

Teak drupes were collected from five different plus trees of Teak Seed Orchard at TFRI. Fruits were graded according to size in three different sizes, viz., small, medium and large. Diameter of fruits and weight of 100 fruits was noted down in three replications. An experiment was carried out with seeds of these five trees for germination on half strength hormone free MS medium. Three grades of seeds in three different positions (embryo in upside position, embryo in downside position and embryo placed horizontally on the medium) were inoculated on this medium. Maximum germination was obtained in fruits of medium size. In the seeds inoculated with embryo in downside position, maximum germination was obtained. Another two-factorial experiment was conducted for callusing and somatic embryo formation with cotyledons of teak seeds. Different concentrations of 2, 4-D (0, 0.1 and 0.5 µM) and kinetin (0, 0.01 and 0.1 µM) were screened. Maximum callusing was obtained on MS medium supplemented with 0.1 µM 2, 4-D and 0.01 µM kinetin followed by 0.5 µM 2, 4-D and 0.5 µM 2, 4-d and 0.1 µM kinetin. Another two factorial experiment was carried out to study the effect of different pH values (4.8, 5.8 and 6.8) along with different BA doses (0, 0.1 and 0.5 µM) on shoot multiplication parameters like number of shoots, shoot length and number of nodes.

Sub-project 4: Studies on population structure, linkage disequilibrium and marker-trait association mapping of Indian teak.

1. Out of the 15 teak dominated agro-climatic zones identified for collection, material (leaf, wood core and soil) from nine zones i.e. Northern Hill Region of Chattisgarh (Mandla), Chattisgarh Plain Balaghat (Balaghat), Kymore Plateau Satpura Hills (Seoni), Satpura Plateau (Betul), Nimar Plains (Khandwa), Malwa Plateau (Dewas), Chhattisgarh plain zone (Dhamtari), Bastar plateau zone (Jagdalpur) and Moderate rainfall zone (Chandrapur) has been collected (20 trees/zones) and data on morpho-metric trait (GBH, Plant height & clear bole height) was recorded.
2. Genomic DNA from collected samples (180 trees) was isolated and quantified. Wood fibre slides of all the collected samples were prepared and wood fibre length & breadth (10 fibers / tree) were measured for first six zones.
3. Genotyping of the collected material (first six zones) is under progress. Fourteen SSR primers were completed.
4. Preliminary statistical analysis of morphometric data of first six zones revealed that there is significant differences for all the traits studies i.e. Girth Breadth Height (GBH), Plant height, clear bole height, wood fibre length, wood density except fibre breadth.
5. Data generation on the samples collected from three zones in last season is under progress.

Fig. Extraction of wood core sample and recording of data during field visit (Chandrapur Forest division, MS)

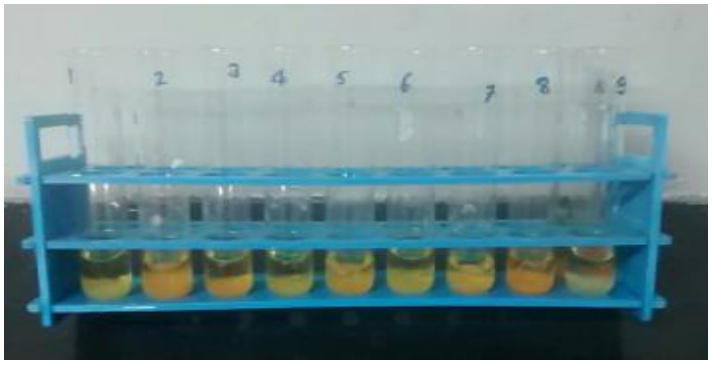


Fig. Wood core digestion of the samples from three agro-climatic zones is under process

(iv) Collection of germplasm of *Madhuca indica* J. F. Gmel for identification of best sources in Chhattisgarh through phytochemical evaluation.

Fruits were collected from trees of five girth classes, viz., 61-90 cm, 91-120 cm, 121-150 cm, 151-180 cm and over 181 cm from Sarguja and Jashpur. Five trees per girth class were selected. GPS location of trees was noted. Height, GBH and crown length of the trees was measured. Around 1-2 kg fruits per tree were collected. Physical parameters of fruits and seeds were measured. Fruit length, fruit width and fruit weight, seed length, seed width and seed weight of 30 seeds per tree in three replications were noted. Oil content and saponin content in seeds of Bilaspur, Jashpur, Kanker, Sarguja and Jagdalpur was estimated. For the samples of Bilaspur, girth class as well as individual trees and their interactions had significant effect for saponin content. Minimum saponin content was obtained in seeds of girth class 151-180 cm. In the seeds of Jagdalpur, oil content ranged from17.30 to 63.90 %. Similarly, saponin content ranged from 4.40 to 34.64 %. Compilation of data and statistical analysis for all the parameters was completed.

(v) Genetic Improvement of *Dalbergia latifolia* Roxb. through selection and evaluation of germplasm in central India

Sub project 1: Survey and selection of plus trees and establishment of progeny trials of *Dalbergia latifolia*.

Forest areas of Maharashtra, Odisha and Chhattisgarh were surveyed and candidate plus trees were selected. In Allapalli Range 16 CPTs along with check trees were selected in 6 different beats of Patanil, Raiguda, Nender, Jimalgatta, Mirkal and Talwada. In Odisha, from Balangir Range 8 CPTs along with check trees were selected. In Chhattisgarh in Manendragarh Range 3 CPTs were selected. The morphological data on total height, clear bole height, GBH, crown diameter, number of primary branches, status of flowering and fruiting was noted down. GPS data was also noted down. Half-sib seeds were collected from these trees. Physical parameters of pods, viz., pod length and number of seeds present were noted in 3 replications. 100 seed weight was noted down. Seeds were sown in three replications for germination.

Sub project 2: To refine existing micro-propagation protocols of *Dalbergia latifolia* for production of improved planting stock).

In vitro shoot cultures were multiplied and maintained on MS medium supplemented with 0.5 µM BA. The experiment for shoot organogenesis/ somatic embryogenesis through immature cotyledons of *Dalbergia latifolia* collected 30, 60, 90, and 120 days after flowering was continued. Somatic embryos were obtained on the cotyledons of seeds collected from the trees 90 days after flowering. The somatic embryos were formed on the margin of cotyledons. After 15 days of inoculation, the effect of 2, 4-D was found to be highly significant for somatic embryo formation (%). Highest somatic embryo formation was obtained on 0.5 mg l^{-1} 2, 4-D (56 %) which was significantly higher than somatic embryo formation in any other treatment. Very few embryos were formed on control. After 30 days of inoculation the effect of 2, 4-D was found to be not significant for somatic embryo formation. The somatic embryos were inoculated on MS medium supplemented with different concentrations of BA for maturation. Shoot formation and elongation was achieved.

(vi) Collection and morpho-molecular characterization of critically endangered *Litsea glutinosa* germplasm from Madhya Pradesh and Chhattisgarh

Tour was conducted in the potential areas of *Litsea glutinosa* from Balaghat (Lanjhi), Seoni (Rukhad), Chhindwara (Tamia & Dellakhari), Jabalpur (TFRI campus & adjoining villages), Rewa (Purva and Keuti waterfall area), Satna (Maihar), Anuppur (Amarkantak), Marvahi (Keonchi), Dhamtari (Mohda, Nagri and Khergaon), Kondagaon (Rojgarpara) and Jagdalpur (Asna) forest divisions. Total 101 trees have been located and detailed morpho-metric data was recorded along with GPS location in specified format. Propagating material (seeds and root suckers) has been collected and established in the nursery of the division. One full fledge experiment on macropropagation was laid out to assess the possibility of propagation through branch cuttings.

Germplasm bank of this critically endangered species was established at the institute with of material from ten locations with three replications. Three plants per plot were planted. Work on the molecular characterization of the germplasm bank is under process.

Fig: Germplasm bank of the critically endangered *Litsea glutinosa* established under the project at the campus of the institute.

(vii) Bamboo genetic evaluation, improvement and propagation

Germplasm bank established in the Silviculture nursery of the institute was maintained. The multiplication of planting materials of four species assigned to the institute viz, *Bambusa tulda, Bambusa vulgaris, Dendrocalamus strictus* and *Bambusa bamboos* is in progress. The propagation of four species from the rhizomes assembled in germplasm bank is continued. The propagated plants are maintained by further process of macroproliferation.

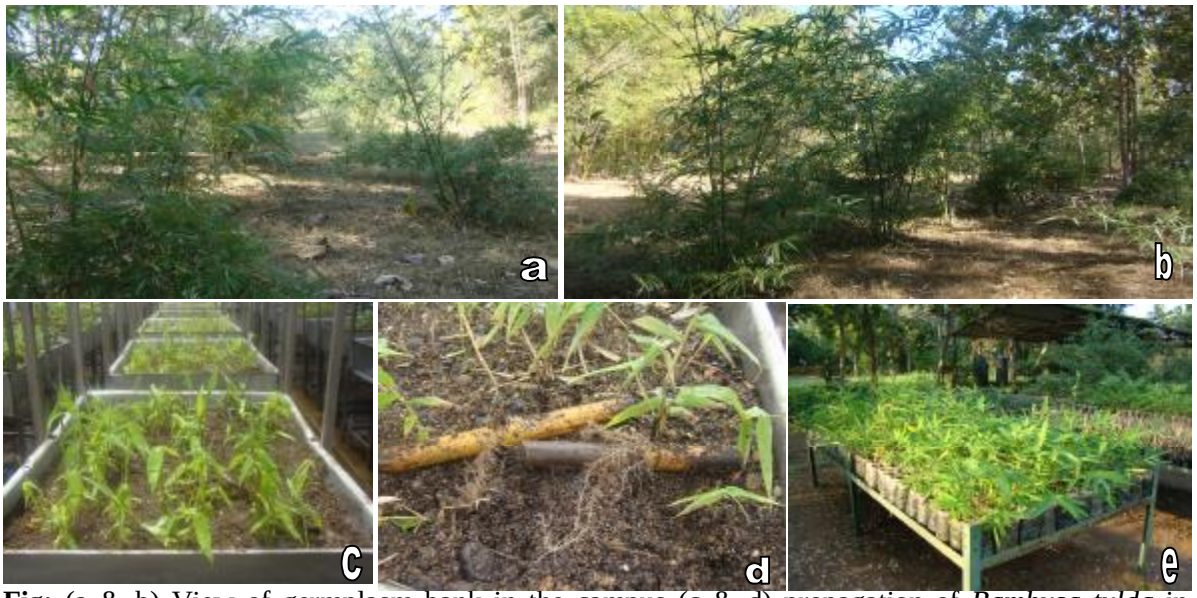


Fig: (a & b) View of germplasm bank in the campus (c & d) propagation of *Bambusa tulda* in mist chamber (e) transfer of *B. vulgaris* plants in polythene bags.

(viii) Commercial production of quality planting material of bamboo species

The cultures of four assigned species viz, *Bambusa nutans, Bambusa tulda, B. vulgaris* var. Green, and *Bambusa balcooa* have been initiated. The explants of *Bambusa tulda* and *B. vulgaris* were collected from the established germplasm under the above project. The explants of *Bambusa balcooa* and *B. nutans* were collected from superior plus clumps available in the bambusetum of the institute. The process of shoot multiplication is in progress in four species. The binodal cuttings in *B.balcooa* and mini cuttings in *B.vulgaris* were tried for propagation through macropropagation.

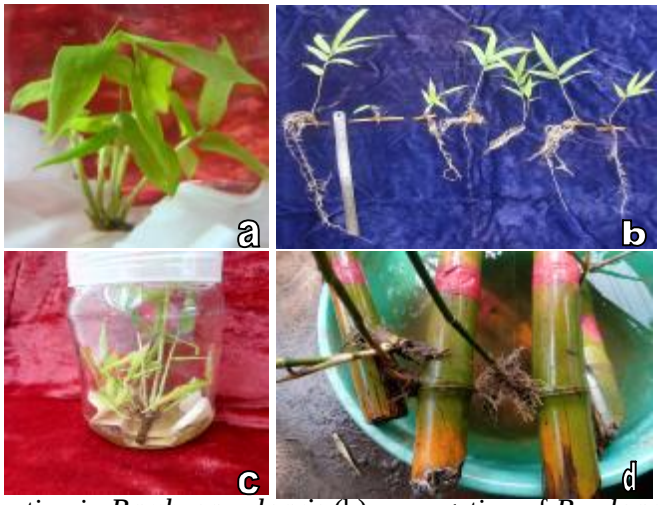


Fig: (a) Shoot multiplication in *Bambusa vulgaris* (b) propagation of *B.vulgaris* through mini cuttings (c) shoot proliferation in *B.tulda* (d) propagation of *B.balcooa* through binodal cuttings

(ix) Assessment of genetic structure, linkage disequilibrium and marker-wood trait association in CPTs of teak (Tectona grandis L.f.) maintained at National Teak Germplasm Bank, Chandrapur (M.S.), using molecular markers ID No. 219

This project is just initiated i.e. in February 2016

(x) "Comparative field performance of seedling and clonal planting stock of Buchanania lanzan Spreng." (Pr. ID. No. 200/CFRHRD/2013-1 (MPSBB) (18)

External Funding project: One research project was ongoing during the year funded by Madhya Pradesh State Biodiversity Board (MPSBB), Bhopal and completed in April 2015.

6. Forestry Education and Policy Research to Meet Emerging Challenges

6.1. Improving Formal Forestry Education-

6.1.1 FRI University (Applicable to FRI University only)

6.2 Accreditation of Universities: (Applicable to FRI University only)

6.3 Networking Forestry Education with Research and Extension

6.3.1 Participation in Seminar/Symposia/Workshop/Trainings/Meetings/Key Lecture delivered etc.

- Dr. Nanita Berry, Scientist 'E', attended and presented paper titled " Gloriosa superba, an endangered medicinal plants need to conserve through silvi-medicinal system' in the National Seminar on "Recent Advances in Research and Development in Medicinal and Aromatic Plants-A Country Scenario" held from 27-28 November 2015 at State Forest Research Institute, Jabalpur (M.P.).
- Dr. Nanita Berry, Scientist 'E', published abstract on " "Assessment of root and fruit yield of Ravoulfia serpentina (L.) Benth. ex Kurz and Withania somnifera L. Dunal under silvi-agri-medicinal system", in the National Seminar on "Recent Advances in Research and Development in Medicinal and Aromatic Plants-A Country Scenario" held from 27-28 November 2015 at State Forest Research Institute, Jabalpur (M.P.).
- Dr. Nanita Berry, Scientist 'E' attended and presented a research paper on Assessment of Bamboo-wheat silvi-agri system in Jabalpur (M.P.) in " National Seminar on "Bamboo Reserve Management and Advances in utilization options " held at Institute of Wood Science and Technology, Bangalore (Karnataka) from 23-25 February 2016..
- Dr. Nanita Berry, Scientist 'E' attended and presented invited lecture on "Collaborative Research Project with Maharashtra titled "Development of Silvi-agri-medicinal and agri-medicinal system in Vidharbh region of Maharashtra" during one day workshop with senior forest officials of Maharashtra" held on 6 January 2016 at Nagpur(M.S.)
- Dr. Nanita Berry, Scientist 'E' attended and participated as a resource person on Bamboo based Agroforestry in One day workshop on Farmers-Industrialist meet on 11 January 2016 sponsored by the State Bamboo Mission, Bhopal (M.P.) held at Jabalpur(M.P.)
- Dr. Nanita Berry, Scientist 'E' attended and presented on the topic of "Agroforestry" during Round table conference on short and medium term strategies for agriculture development and its adaptation to climate change in Madhya Pradesh on 12th and 13 January 2016 at JNAU, Jabalpur(M.P.)
- Dr. Nanita Berry, Scientist 'E' attended and acted as a resource person on the " meeting of Network project of conservation of Lac insect genetic resources on 28-29 January 2016 held at SFRI, Jabalpur (M.P.)
- Dr. Nanita Berry, Scientist 'E' attended and participated as a resource person in One day training workshop cum "Shetkari Melawa" (Farmer's Mela) on 19 February 2016 at KVK, Amravati (Maharashtra).

- Sanjay Singh , Scientist 'C' participated in National Consultation Workshop on draft report of "Study cum survey to assess the demand and supply of medicinal Plants of India" on 23 March 2016 at ICFRE, Dehradun
- Sanjay Singh , Scientist 'C' presented keynote address on "Life history strategy determining Invasive Potential of the Species" At National Workshop on Invasive Weed Management in Forests and Grasslands of Wildlife Protected Areas organized by M P Forest Department and SFRI at SFRI Jabalpur on 13-14 February
- Roychoudhury, N., Sharma, R. and Mishra, R.K. (2015). Needs for conservation of medicinal and aromatic plants in Achanakmar-Amarkantak biosphere reserve. Paper presented in National Seminar on "Recent Advances in Research and Development in Medicinal and Aromatic Plants – A country Scenario", 27-28 November 2015, State Forest Research Institute, Jabalpur, Madhya Pradesh, p. 12 (abstract).
- डा0 नितिन कुलकर्णी, वैज्ञानिक–जी द्वारा संस्थान द्वारा वन विज्ञान केन्द्र, कोरापुट, उड़ीसा में वन रोपणियों तथा वृक्षा रोपण में कीटों तथा रोगों का समन्वित प्रबंधन विषय पर आयोजित प्रशिक्षण कार्यक्रम में दिनांक 3–11–2015 को रोपणी क्षेत्रों में प्राकृतिक वनों के कीट व उनका प्रबंधन एवं वन रोपणी में कीटों का एकीकृत प्रबंधन विषयों पर व्यख्यान व प्रशिक्षण वन अमलों को दिया गया।
- डा0 नितिन कुलकर्णी, वैज्ञानिक–जी द्वारा संस्थान द्वारा वन विज्ञान केन्द्र, कोरापुट, उड़ीसा में भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद् द्वारा विकसित अनुसंधान निष्कार्षो के विस्तार हेतु नेटवर्क का सशक्तिकरण विषय पर आयोजित प्रशिक्षण कार्यक्रम में दिनांक 6–11–2015 को वन रोपणी क्षेत्रों में श्वेत इल्लियों का समन्वित प्रबंधन एवं सागौन के वृक्षा रोपण में कीटों का जैविक नियंत्रण विषयों पर व्यख्यान व प्रशिक्षण वन अमलों को दिया गया।
- Dr. P.B. Meshram, Scientist-F attended National Seminar on "Recent advances in research & development in medicinal & aromatic plants – a country scenario" and presented research paper entitled "Modern control mechanism of insect pests of important medicinal plants – Abelmoschus moschatus, Gloriosa superba and Withania somnifera" at SFRI, Jabalpur during 27-28 November 2015.
- Dr. Y.Mishra attended national seminar on 'Recent advances in research and development in medicinal and aromatic plants: A country scenario' held at SFRI, Jablapur from 27-28 November 2015, and presented paper on 'Variability, heritability and association of floral, leaf and seed traits in Rauvolfia serpentine.
- Dr. Naseer Mohammad attended national seminar on 'Recent advances in research and development in medicinal and aromatic plants: A country scenario' held at SFRI, Jablapur from 27-28 November 2015, and presented paper on 'Ex situ conservation of critically endangered Litsea glutinosa'.
- Smt. Neelu Singh, Scientist-F & Head and Sri Hari Om Saxena participated in National Seminar on "Recent Advances in Research and Development in Medicinal and Aromatic Plants – A Country Scenario" at SFRI, Jabalpur on 27-28 November 2015.
- Smt. Neelu Singh, Scientist-F & Head, participated in extension workshop at VVK Odisha at Koraput on 6-7 November 2015.
- Smt. Neelu Singh, Scientist-F & Head, participated Inception workshop of NMPB Project "Study-cum-survey to assess the Demand and supply of Medicinal Plants in India" at ICFRE, Dehradun on 8 May 2015
- Smt. Neelu Singh, Scientist-F & Head, attended a workshop "Document supply and value chains of major medicinal plants in select mandies and to identify gaps and priorities for action by National Medicinal Plants Board of India" at SFRI, Jabalpur on 22 April 2015

Trainings

- Smt. Neelu Singh, Scientist-F & Head, participated as resource person in training programme on महत्वपूर्ण औषधीय पौधों की कृषि तकनीक एवं उनकी विनाशविहीन विदोहन, प्रसंस्करण तथा मूल्य संवर्धन at VVK Odisha at Koraput on 5 November 2015
- Smt. Neelu Singh, Scientist-F & Head, as resource person in one week Course Programme on 'Agroforestry' held at TFRI, Jabalpur from 2-6 June 2015.
- Smt. Neelu Singh, Scientist-F & Head, as resource person in one week Course Programme on 'Agroforestry' held at TFRI, Jabalpur from 2-6 June 2015.
- Smt. Neelu Singh, Scientist-F & Head, participated as resource person in training programme on उन्नत नर्सरी, बीज प्रौद्योगिकी, वृक्ष सुधार तकनीक एवं कृषि वानिकी पर प्रशिक्षण'' at VVK Odisha at Koraput during last week of OCt., 2015.
- Shri Hari Om Saxena participated in National Seminar on "Recent Advances in Research & Development in Medicinal & Aromatic Plants – A Country Scenario" held on 27-28 November 2015 at SFRI, Jabalpur (MP) and presented paper - "Quantification of Plumbagin in roots of Plumbago zeylanica using HPTLC for identification of superior chemotype and its conservation in Madhya Pradesh".
- Shri Hari Om Saxena participated in National Conference on "Materials & Methods for Sustainable Development" 29 -30 January 2016 and presented paper – "Quantification of Colchicine in tubers of Gloriosa superba using HPTLC for identification of superior chemotype and its conservation in Madhya Pradesh".
- Dr. R.K. Verma, Scientist 'F' delivered lecture to trainees on 'Biofertilizers for Agroforestry' in one week summer course on Agroforestry at TFRI, Jabalpur on 3/6/2015.
- Dr. R.K. Verma, Scientist 'F' delivered 6 lectures in a training program organized at Koraput, Odisha by VVK during 3-7 November 2015
- Dr. R.K. Verma, Scientist 'F' delivered lecture on "Role of biofertilizers in afforestation of stress sites" in a training program organized at Rourkela, Odisha for SAIL officials during 1-2 December 2015
- Dr. R.K. Verma, Scientist 'F' delivered lecture and practical demonstration on biofertilizers to trainees of Maharashtra Forest Department during 29-30 December 2015
- Ganguly M, Verma RK (2016). Isolation and screening of PSBs and KSBs for their application in the teak nurseries. p. 149. Paper orally presented in the 6th International Conference "Plant, Pathogens and People" session 14, IARI, New Delhi, 23-27 February 2016
- Ganguly M, Verma RK (2015). Studies on the beneficial microbes associated with rhizospheric region of Bael (Aegel marmelos). Paper orally presented in National Seminar on Recent Advances in Research and Development in Medicinal and Aromatic Plants, SFRI, Jabalpur. 27-28 November 2015
- Dr. M. Kundu and Mr. N. P. S. Nain participated in teaching programme on Compulsory Basic Forestry Course for Ph. D students of FRI University.
- Dr. M. Kundu and Mr. Dheeraj Gupta participated for teaching the interested students in One week special summer course on Agroforestry systems and management practices from 1 June to 5 June 2015.

- Dr. Vishakha Kumbhare, Scientist –C, CFRHRD, Chhindwara participated in the one day workshop on "Biodiversity Conservation and Rural Livelihood Improvement" organized by State Forest Department (SFD), Chhindwara on 2.5.2015 at Samvad Sadan, Forest Circle Office, Khajri Square, Chhindwara and briefed the house about the research and extension activities (training programmes) being conducted by CFRHRD, Chhindwara.
- Dr. Vishakha Kumbhare, Scientist - D and Shri. N.D. Khobragade, Scientist - C attended Workshop for Finalization of Bamboo Working Manual at T.F.R.I. Jabalpur on 13/08/2015.
- Dr. Vishakha Kumbhare, Scientist –D of the centre acted as resource person and conducted training of trainers (ToT) programme entitled "NTFPs collection, processing and conservation" on 8.12.2015 under the UNDP project at Range office, West Batkakhapa for UNDP beneficiaries. 125 persons participated in the training programme including SFD officials.
- Dr. Vishakha Kumbhare, Scientist –D of the centre acted as resource person and delivered a lecture on "Medicinal plants utility and their conservation" during the National workshop on "Tools and Techniques of Ethnobiology" held during 19-25 February 2016 organized by Govt. Autonomous P.G. College, Chhindwara (MP).
- Shri. A.J.K. Asaiya, Research Officer of the centre acted as resource person and delivered a lecture on "Ethnomycology" during the National workshop on "Tools and Techniques of Ethnobiology" held during 19 -25 February 2016 organized by Govt. Autonomous P.G. College, Chhindwara (MP).
- Shri. N.D. Khobragade, Scientist –C participated in the National workshop on "Tools and Techniques of Ethnobiology" held on 22.2.2016 at the centre and organized by Govt. Autonomous P.G. College, Chhindwara (MP).
- Smt. Mamta Meshram, Research Officer participated in the National workshop on "Tools and Techniques of Ethnobiology" held on 22.2.2016 at the centre and organized by Govt. Autonomous P.G. College, Chhindwara (MP).
- Smt. Shalini Bhowate, Research Officer participated in the National workshop on "Tools and Techniques of Ethnobiology" held on 22.2.2016 at the centre and organized by Govt. Autonomous P.G. College, Chhindwara (MP).

6.3.2 Visits Abroad: NIL

6.4 Capacity Building Scientific and Management Cadre (Trainings organized)

- Dr. Avinash Jain and M. Rajkumar organized training on "Carbon sequestration through afforestation" at Rourkela Steel Plant (Odisha) for the officers and staff of Steel Authority of India Limited (SAIL) on 1-2 December 2015.
- Five days training programme was organized for B.Sc. Biotechnology students of Government Model Science College, Jabalpur (in 4 batches).

CFRHRD, Chhindwara organized 10 training programmes on various subjects of forestry during 2015-16 out of which 7 trainings were conducted in field and 3 trainings were conducted in-house and total number of participants were 294. Details are given below -

S. No	Date	Topics	Target groups	In-house/Field	Number of participants
1	5.6.2015	Environmental Awareness	Villagers/women/ children	Field(Moadei village)	35
2	25.8.2015	Biofertilizers and Organic farming	Farmers/ villagers	Field(Karaboh village)	27
3	23.9.2015	Environmental Awareness	Students(Govt. Higher Secondary School, Gangiwada)	In-house	37
4	14.10.2015	Agroforestry / NTFPs harvesting, processing and value addition / Food from forest	Students (JNKVV, Jabalpur)	In-house	18
5	26.11.2015	Diseases and Insect pests in forest nurseries and plantations and their control measures	SFDs (East Forest Division, Chhindwara)	In-house	21
6	22.12.2015	Utilization of Wastelands	Farmers/ villagers	Field (Bhaisadand village)	27
7	20.01.2016	NTFPs harvesting, processing and value addition / Food from forest	SFDs/JFMCs/Actual collectors	Field (Chhindi Range Office)	26
8	17.02.2016	Pollinators / farmer friendly Insects and biopesticides	Farmers/ villagers	Field(Patpada village)	42
9	18.03.2016	Nursery Techniques of *B. lanzan* Chironji	Farmers/ villagers	Field (Mordongri khurd village)	33
10	29.03.2016	Collection methods of Mahua / Biofertilizers and biopesticides.	Farmers/ Villagers	Field (Amla village)	28

Other Extension Activities :

- Students of Bhagwan Shrichand School, Chhindwara visited the centre on 08.08.2015 during their educational tour.
- Students of class 6th to 9th of Delhi Public School, Chhindwara visited the centre during their study tour on 22.08.2015. During their visit, students were given brief information about the biodiversity of plant species available at CFRHRD campus and their uses.
- B.Sc (Microbiology) students of Little Step College of Science and Technology, Borgaon, Tahsil Sausar, Chhindwara District (MP) visited the centre on 14.12.2015 during their study tour. Students were given exposure on medicinal plants available at CFRHRD nursery and brief information about the research and extension activities of the centre.
- B.Sc (Microbiology) students of Central India Management and Technology Institute, Ridhora, Tahsil Sausar, Chhindwara District (MP) visited the centre on 21.1.2016 during their study tour. Students were given exposure on medicinal plants available at CFRHRD nursery and brief information about the research and extension activities of the centre.
- Team of students from Govt College, Sausar visited the centre on 02.02.2016
- Team of 32 persons of national workshop on "Tools and Techniques of Ethnomycology" held at Govt. Autonomous P.G. College, Chhindwara visited the centre on 22.02.2016. The participants were briefed about the research and extension activities of the centre. Information about medicinal plants and their uses available in the nursery were given. Field visit of existing plantations viz. *Tectona grandis* (teak), *Buchanania lanzan* (chironji) *Phyllanthus emblica* (aonla), azolla, vermicompost and jeevamrut units were conducted.
- Team of 33 farmers visited the centre on 24.02.2016 under the scheme "मुख्यमंत्री खेत तीर्थ दर्शन ".Information about medicinal plants and their uses available in the nursery were given. Field visit of existing plantations viz. *Tectona grandis* (teak), *Buchanania lanzan* (chironji) *Phyllanthus emblica* (aonla), azolla, vermicompost and jeevamrut units were conducted.
- Centre for Forestry Research and Human Resource Development (CFRHRD), Chhindwara (MP) has been empanelled as one of the Implementing agency/Resource Centre of Tribal Co-Operative Marketing Development Federation of India Ltd, Bhopal under Ministry of Tribal Affairs, Govt. of India for imparting training and skill up-gradation / development programmes related to Minor Forest Produce vide letter no. TFD/ROB/MFP/Skillupgradation13-14/15/781, dt. 09.03.2016.

Other important activities

- Study cum survey was conducted during July at Nagpur, Chandrapur, Wardha (Maharashtra) and Chhindwara, Seoni, Ghodadongri, Betul, Indore and Bhopal (Madhya Pradesh) by Shri. N. D. Khobragade, Scientist –C for assessment of the demand and supply of medicinal plants in India.
- Study cum survey was conducted during August at Chandrapur, Mumbai (Maharashtra) and Sausar Chhindwara (M.P.) by Shri. N. D. Khobragade., Scientist –C for assessment of the demand and supply of medicinal plants in India.
- Shri. N.D. Khobragade, Scientist –C of the centre attended Annual Review Meeting at TFRI, Jabalpur on 21.12.2015 and presented annual progress of the project entitled

"Comparative field performance of seedling and clonal planting stock of ***Buchnania lanzan*** Spreng" ID No.- 200/CFRHRD/2013-1(MPSBB) (18) funded by Madhya Pradesh State Biodiversity Board, Bhopal (MP).

- Study cum survey of demand and supply of medicinal plants was carried out by Shri. N. D. Khobragade, Scientist –C of the centre at Mumbai and Navi Mumbai market.

- Shri. N.D. Khobragade, Scientist –C of the centre attended one day conference on "Forestry Research for Senior Forest Officers" of Maharashtra State at Centre Point Hotel, Ramdaspeth, Nagpur on 06.01.2016 organized by Maharashtra State Forest Department.

- Shri. N. D. Khobragade, Scientist –C of the centre attended Variety Release Committee meeting at TFRI, Jabalpur on 15.01.2016.

- Shri. N.D. Khobragade**,** Scientist – C and Shri. A.J.K. Asaiya, Research Officer conducted concurrent evaluation work of FDA where advance work has been carried out in the financial year 2011-12 and plantation was done in the year July 2012 in West Forest Division, Betul District (Madhya Pradesh).

7. Forestry Extension for Taking Research to People

7.1 Collection Compilation and Publication of Forestry Reports/Journals

1. Dr. Nanita Berry prepared and submitted "Project completion report of " Development of multitier cropping (silvi-agri-spice) system ".

7.1.1 Research Publications (Book, Book Chapters, National journals, International journals, Abstracts, Proceedings, Reports etc.)

Rai Rajiv (2015) . Herbal home made remedies in cure of Diabetes in Folk claims in Central India by Dr Rajiv Rai for publication in book Drugs from plants in book edited by Dr P C TRIVEDI .

Rai Rajiv etal (2015) Manpower Potential , Employment status and forest based livelihood opportunities among tribal communities of Jharkhand, India.[International Journal]

Rai Rajiv et al (2015) Exploration of variables predicting livelihood assets status of tribal communities substing in forest in Jharkhand by. in J. Human Ecology 47(3) : 241-249.[International Journal]

Rai Rajiv (2015) Ethno -medicinal Study On Medicinal plant used in Folk Medicines in Cure Of Dysentery prevalent in Central India [J of Tropical Forestry] .

Rai Rajiv (2015) Herbal Folk Remedies in cure of Arthritis by Ethnic communities in Madhya Pradesh, India. Annals of Forestry ,Romania. .[International Journal].

Rai Rajiv (2015) Adaptation and Mitigation strategies In Relation to Climate Change And their Impact on Agricultural productivity With Emphasis On Pulses Production .

M.A. Islam1, PA Sofi, Rajiv Rai &, SMQuli (2014). Communication Intervention among Forest Dependent Ethnic Communities of Jharkhand. Trends in Bioscience 7(9):715-719

Rai Rajiv (2015) Conservation Needs for Medicinal Plants of Threatened and Endangered Species in Seoni district .In Abs National Seminar on Advances in Research and Development in Medicinal and Aromatic Plants –A country Scenario :27p.

Rai Rajiv (2015) Ethnobotanical Studies Of Promising Medicinal Plants In Human Health Care . In Abs National Seminar on Advances in Research and Development in Medicinal and Aromatic Plants –A country Scenario :59p.

Rai Rajiv (2015) Current Scenario in Conservation Of Medicinal Plants In Sacred Groves in Tribal pockets by Ethnic communities In Abs National Seminar on Advances in Research and

Development in Medicinal and Aromatic Plants –A country Scenario :29p

Rai Rajiv (2015) Gum and resins in social and livelihood needs of Tribals in MP .Van Sangyan 2(4):43-51.

Rai Rajiv (2015) Ethno -medicinal uses uses of trees prevalent among tribal communities in Madhya Pradesh Van Sangyan 2(5):39- 49.

Rai Rajiv (2015) Ethnobotanical Studies on Plants used in folk medicines in cure of Diabetes in Gondwana Region of Madhya Pradesh in Asian Press Journal .[International Journal].

Rai Rajiv (2015) Assessment of Medicinal Plants Floristic Diversity Status in Seoni district, Madhya Pradesh on account Threats and Sustainable Utilization in herbal medicines .[Current Science]

Rai Rajiv (2015) Ethno-medicinal uses and Traditional Knowledge prevalent in cure of Pain ailments as Herbal Medicine in Chhattarpur district, Madhya Pradesh [Tropical Plant Research]

Md Ajaz-ul-Islam, SMQuli , Rajiv Rai ,AngrejAli & SA Gangoo (2015) Forest Biomass flow for fuelwood , fodder,and timber security among tribal communities of Jharkhand.Journal of Enviromental Biology . 36 (1):221-228.

M.A. Islam1,, Rajiv Rai , SMQuli & MS Tramboo (2015). Socio Economic and demographic descriptions of tribal people subsisting in forest resources of Jharkhand ,India, Asain Jounal of BioScience , .10(1):75-82

Md Ajaz-ul-Islam, Rai , Rajiv & SMQuli(2015). Forest Resources Use for Building Livelihood Resilience in Ethnic communities of Jharkhand. Trends in Bioscience 8(5):1256 - 1264 .

Berry, Nanita (2015) " Gloriosa superba, en endangered medicinal plants need to conserve through silvi-medicinal system' in Proceedings of National Seminar on "Recent Advances in Research and Development in Medicinal and Aromatic Plants-A Country Scenario" held from 27-28 November 2015 at State Forest Research Institute, Jabalpur (M.P.).

Berry, Nanita (2015), "Assessment of root and fruit yield of Ravoulfia serpentina (L.) Benth. ex Kurz and Withania somnifera L. Dunal under silvi-agri-medicinal system", in Proceeding on National Seminar on "Recent Advances in Research and Development in Medicinal and Aromatic Plants-A Country Scenario" held from 27-28 November 2015 at State Forest Research Institute, Jabalpur (M.P.).

Berry, Nanita (2016) "Assessment of Bamboo-wheat silvi-agri system in Jabalpur (M.P.), in Proceedings of National Seminar on "Bamboo Reserve Management and Advances in utilization options " held from 23-25 February 2016 at Institute of Wood Science and Technology, Bangalore (Karnataka).

Published a Course book on 'Agroforestry' during one week summer course on "Agroforestry & its management" held from 1 June 2015 to 5 June 2015 for the B.Sc. students of Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHIATS), Allahabad (U.P.)

Poonam Verma, Sanjay Singh and R K Verma (2016) Heavy Metal Biosorption byFusarium strains Isolated from Iron Ore Mines Overburden Soil. International Journal of environmental Science and Toxicology Research (Accepted).

Poonam Verma, Sanjay Singh and RK Verma (2016) Impact of plantation on Iron Ore Mined Overburden at Durg in Chhattisgarh (India). (Communited).

Published Technical Guidelines entitled "Trees for Road Side Plantation" for avenue plantation in IIITDM

Drafted "Bamboo Working Manual" For MP State Bamboo Mission

Singh and Khatri (2015) Windbreaks and Shelterbelts, Pages 112-118 In Agroforestry: Notes of Agroforestry Principles and Management Practices Eds. Berry and Rai. TFRI, Jabalpur

Prepared Proceedings of the Workshop for finalization of Bamboo Working Manual organized at TFRI in collaboration with MP State Bamboo Mission on 13August 2015

Prepared Proceedings of National workshop on “Biological diversity Act 2002: Constraints and opportunities for scientific community” on 19-20 March 2015 at TFRI

Thakur, B., S. Chakrabarti & M. Kumar.2015. Detailed Larval Biology of Indian Gypsy Moth Lymantria obfuscata Walker on Quercus leucotrichophora Roxb. in Himachal Pradesh (India). American International Journal of Research in Formal, Applied & Natural Sciences, 10(1):31-34.

Thakur, B. & S. Chakrabarti, 2016. Exploring efficacy of native baculovirus Lymantria obfuscata nuclear polyhedrosis virus (LONPV) and its perspectives as biocontrol agent in Himachal Pradesh. Insight, 2:29-34.

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7.1.2 National Forest Library and Information Centre (NFLIC) (Applicable for FRI, Dehradun only)

7.1.3 Environmental Information System (ENVIS) (Applicable for FRI, Dehradun only)

7.2 Dissemination of developed technologies

- Dr. N. Kulkarni, Scientist-G, Shri Subhash Chander, Scientist-C and Shri Anand Kumar Das, Research Associate imparted theoretical and practical trainings on Sal borer and its management to Sub Divisional Officer (SDO), Range Officers and front line staff in Korba Forest Division (CG) on 31.05.2015.
- Dr. N. Kulkarni, Scientist-G, Shri Subhash Chander, Scientist-C and Shri Anand Kumar Das, Research Associate imparted theoretical and practical trainings on Sal borer and its management to Sub Divisional Officer (SDO), Range Officers and front line staff in Jagdalpur Forest Division (CG) on 03.06.2015.
- Dr. N. Roychoudhury, Scientist-G imparted theoretical and practical trainings on Sal borer and its management in Chada, Bajag Forest range, Dindori Forest Division on 03.07.2015 and Mawai, Mawai Forest range, East Mandla Forest Division on 23.07.2015 and submitted detailed reports. Demonstrated categorization of borer affected trees and trap tree operation for management of borer beetles. Distributed leaflet on Sal borer, categorization of borer affected trees and trap tree operation to front line staff of Forest Department.

7.2.1 Van Vigyan Kendras (VVKs) and Demo Village (DVs)

To disseminate information about various technologies developed, institute provide regular funds to organize training programmes by them and also provide literature published in Hindi, English and regional language. Four VVKs one each in the state of Madhya Pradesh, Chhattisgarh, Maharshtra and Odisha and one Demo village at Moiya Nala, in Bijadandi West Mandla Forest division is working under the institute.

Extension activities in Van Vigyan Kendra (VVKs) and Demo Villages (DVs)

In all 4 training programmes including one Workshop cum training programme were organized by the institute as per details given herein below in Van Vigyan Kendra, Koraput, Odisha for the frontline staff of state forest department, NGOs, SHGs and farmers.

- One day training programme organized by Forest Extension Division in Van Vigyan Kendra Koraput, Odisha on the topic " वन रोपणियों तथा वृक्षारोपणों के कीटों तथा रोगो का समन्वित प्रबंधन" at Koraput on 3/11/2015
- One day Training programme organized by Forest Extension Division in Van Vigyan Kendra Koraput, Odisha on the topic " उन्नत नर्सरी तकनिक " on 4/11/2015.
- One day Training programme organized by Forest Extension Division in Van Vigyan Kendra Koraput, Odisha on " कृषि वानिकी तकनिक " on 5/11/2015.
- A two day workshop-cum-training programme was organized by TFRI, during 6-7/11/2015 in Van Vigyan Kendra Koraput, Odisha for Strengthening Network for Outreach of research Findings of ICFRE and its institute under OTSG to ICFRE. For this workshop cum training programme 20 technologies developed by TFRI and other ICFRE institutes, which are suitable for Chhattisgarh were presented and extended to the participants for extension in Odisha state.

In the Demo village at Moyia nala, at present plantations of following two technologies are being maintained by Forest Entomology and Forest Pathology division respectively.

a. Relative resistance in some teak clones against defoliator and skeletionizer.
b. Use of biofertilizer (VAM and Azospirillium) in forestry tree species.

Regular watch and ward as well as maintenance activities are being undertaken.

Other Extension activities (Such as Van Mahotsava, Forestry Day and Other occasions)

- International Day for Biological Diversity celebrated on 22/5/2015 in the institute. Lectures, Quiz, Painting, Essay competition and film show were organized for children to generate awareness about conservation of Biodiversity.

Organization of Training programme in VVK Odisha, Koraput during 3rd Nov. to 7th Nov. 2015

- Dr. Nanita Berry, Scientist 'E' participated and delivered lectures on Agroforestry and agroforestry models developed by TFRI during Van Vigyan training programme jointly organized by the TFRI and Odisha Forest department held on 4th to 6 November 2015 at VVK, Koraput (Odisha) to the forest officials , NGOs , Women SHGs and progressive farmers of Odisha state.

7.2.2 Direct to consumer Scheme:– **Nil**

7.2.3 Technologies transferred:-

Demonstration of agroforestry models:

Demonstrated experimental area of developed technology on agroforestry system such as Silvi-medicinal system, Bamboo based silvi-agri system and horti-silvi-agri system to the number of groups of Forest guard/ Farmers/ Scientist/ Students of various organization at TFRI during the period at Balaghat, Shivpuri and Mandla.

1. A Group of forest officials of Balaghat.
2. A Group of forest guards of Shivpuri
3. A Group of Forest guards of Mandla

Results of the research project 'Standardization of technique to enhance the quality and sustainable production of Diospyros melanoxylon leaves in Chhattisgarh' were disseminated to State Forest Departments.

Eight technologies listed below transferred to stakeolders at Angul (Orissa) during 12-13 March 2014.

a) Processing technique of Bael fruits.
b) Drum-dryer techniques for NTFPs.
c) Development of handmade paper/Paper making from Lantana.
d) Non destructive harvesting techniques of Arjuna bark.
e) Agro-techniques of Asparagus racemosus.
f) Agro-techniques of Andrographis paniculata.
g) Agro-techniques of Rauvolfia serpentina.
h) Agro-techniques of Withania somnifera Linn.

Information was disseminated through various training programmes being conducted by the centre on mahua flowers collection method, low cost technology for raising of seedlings of B. lanzan (chironji) and by giving demonstrations on preparation of Jivamrut (biofertilizer) and plant based biopesticide.

7.3 Evolving and coordinating comprehensive extension strategies in forestry research

7.3.1 SLEM - NIL

7.3.2. Seminar/Symposia/Workshops/Training Organized

TFRI, Jabalpur organized the following workshop/training programs during the year:-

- Dr. Nanita Berry ,Scientist 'E' has organized one week summer course on "Agroforestry & its management" as Course Director held from 1 June 2015 to 5 June 2015 for the B.Sc. students of Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHIATS), Allahabad (U.P.) at TFRI, Jabalpur(M.P.)
- Organized a one day consultation workshop for finalization of Bamboo Working Manual on 13 August 2015

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

During 2015-16 TFRI and CFRHRD celebrated/organized following day/week/pakhwara. Various cultural and competitive activities were organized in this period to create awareness about the events among children, employees and general public.

- Radio Talk: Dr. S. Chakrabarti, Scientist F, delivered 2 talks which was broadcasted from All India Radio (Bhopal, Indore, Jabalpur) on 18 March & 23 March 2016, on the following topics.:

  1): Utilization of spider-silk through biotechnology.

  2): Prospects of spiders as bio-control agent of pest insects in organic farming.

- Dr. N. Roychoudhury, Scientist-G attended as a member of Second Meeting of Scientific Advisory Committee of Basic Tasar Silkworm Seed Organisation, Central Silk Board (Ministry of Textiles, Govt. of India) at Bilaspur on 13 May 2015.
- Dr. N. Roychoudhury, Scientist-G attended 1st Meeting of the Indian National Man and Biosphere as a Project Leader of Lead Institution for Achanakmar-Amarkantak biosphere reserve and made presentation on research progress, held on 11 February 2016 at Ministry of Environment, Forests and Climate Change, New Delhi.
- Dr. N. Roychoudhury, Scientist-G attended as a member of second meeting of Scientific Advisory Committee of Basic Tasar Silkworm Seed Organisation, Central Silk Board (Ministry of Textiles, Govt. of India) at Bilaspur on 17 March 2016.
- "International Biodiversity Day was celebrated by the centre on 22.5.2015 by conducting Awareness programme on Biodiversity Conservation for Sustainable Development for the villagers of Manegaon village, Chhindwara District."
- "World Environment Day" was celebrated by the centre on 05.06.2015 by conducting Awareness-cum-Training Programme on Environmental Awareness for Sustainable Development" in Moadei village, Chhindwara District for the villagers including women and children. During the occasion, lectures were delivered by scientists and research officers on various aspects of environment conservation and impact of the usage of polythene bags on environment. Awareness posters in hindi language containing multiple

aspects related to environment viz. soil, water and biodiversity conservation were distributed to the village children.

- "Van Mahotsava" was celebrated by the centre on 07.07.2015 by conducting plantation at CFRHRD campus and seedlings were also distributed to the CFRHRD residents.
- "Independence Day" was celebrated by the centre on 15.8.2015
- During the Wildlife Conservation Week programme being organized by State Forest Department, Chhindwara during 1st -7th October 2015, centre had conducted Bird Watching Campaign and Nature Awareness programmes for school students of various schools of Chhindwara District from 2nd – 4th October 2015.
- CFRHRD, Chhindwara conducted Nature Awareness programme for children of Shubham Nishakt Technical Vidyalaya, Chhindwara on 14.10.2015
- Awareness programme on "Biodiversity Conservation" was conducted by CFRHRD, Chhindwara for students of Govt. College, Sausar, Chhindwara District on 28.11.2015 during their study tour.
- "Biodiversity Conservation/Nature Awareness" programme was conducted by CFRHRD, Chhindwara for the Youth Adventure Club members of Chhindwara on 30.11.2015 during their visit to the centre.
- "Republic Day" was celebrated by the centre on 26.01.2016
- Under the programme "स्वच्छ भारत अभियान," centre conducted "स्वच्छता अभियान "on 25.02.2016 at the centre. All officers and staff actively participated and contributed their services towards cleanliness of the office campus.

7.4 Consultancy Services

- Evaluation of present status of CFC, Need analyses and capacity building of stakeholders funded by MPSBM (As PI)
- Avenue plantation at PDP-IIITDM campus in tandem with ecological integrity of the area funded by IIITDM, Jabalpur (As PI)
- Consultancy activities were taken up for public sector organisations such as South Eastern Coalfields Limited (SECL) and Chhattisgarh East Railway Limited (CERL) and Chhattisgarh East West Railway Limited (CEWRL). Preparation of Wildlife Conservation Plan for four different mines and two railway projects were carried out during the year.

- Preparation of Wildlife Conservation Plans for Ketki Underground Coal Mine, Amgaon Open Cast Coal mine and Mahan-II Open Cast Coal mine under South Eastern Coalfields Limited (SECL), Chhattisgarh.

- The existing vegetation structure and presence of wildlife in each mine and its 10 Km buffer area was first assessed by field based surveys and after proper evaluation, mitigative measures and restoration strategies were proposed to tackle the adverse impacts of mines. Suggestions on Habitat improvement, Raising plantations in and around the mine area, methods to manage water bodies, invasive species and wildlife around the mine was also suggested.

- Preparation of Wildlife Conservation Plans for East Corridor (Kharsia to Dharamjaigarh) Railway line and East West Corridor (Gevra road to Pendra road) Railway line

- Status of flora along the proposed railway line and wildlife occupancy surveys in the zone of influence (ie. 500 meters on both sides) were carried out by field based surveys and after proper evaluation, mitigative measures and restoration strategies were proposed to tackle the adverse impacts of railway line. Suggestions on Habitat improvement, raising compensatory plantations, methods to do biodiversity monitoring and water quality monitoring were suggested. In places where large mammals such as Elephants are likely to cross the railway line and straying in nearby villages, necessary measures for constructing elephant proof trenches and underpasses were suggested.

- Prepared final report of the consultancy project titled "Assessment of green cover and its tangible and intangible benefits and tree cover management plan for STPP-Korba Project" and submitted to the funding agency, NTPC Korba.

- Analysis of organic carbon content in soil (1047) and forest floor samples (289) received from Forest Survey of India, Nagpur was done. Total 1336 samples were analyzed.

7.5 Activities of Rajbhasa

उष्णकटिबंधीय वन अनुसंधान संस्थान,(टी.एफ.आर.आई), जबलपुर में
वर्ष 2015 –16 के दौरान संचालित राजभाषा गतिविधियों की सचित्र सूचना

उष्णकटिबंधीय वन अनुसंधान संस्थान, (टी.एफ.आर.आई), जबलपुर में संघ की राजभाषा नीति का अनुपालन सुनिश्चित करने की दिशा में वर्ष 2015–16 के दौरान निम्नलिखित राजभाषा गतिविधियाँ संचालित की गई । संस्थान में निदेशक की अध्यक्षता में गठित राजभाषा कार्यान्वयन समिति की तिमाही बैठकें अनुबद्ध समय पर आयोजित की गई और राजभाषा कार्यान्वयन कार्य संबंध में आई.सी.एफ.आर.ई. मुख्यालय द्वारा दिये गये दिशा–निर्देशों का समुचित पालन सुनिश्चित करने हेतु निर्णय लिये गये और आयोजित बैठकों की कार्यवाही आई.सी.एफ.आर.ई. मुख्यालय तथा अन्य संबंधित कार्यालयों को सूचना एवं अपेक्षित कार्रवाई हेतु तय समय पर प्रेषित की गई ।

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

संस्थान की राजभाषा हिन्दी के प्रगामी प्रयोग से संबंधित अवधिक रिपोर्टें जैसा कि हिन्दी के प्रगामी प्रयोग की तिमाही, अर्द्धवार्षिक तथा वार्षिक मूल्यांकन रिपोर्टें तय समय पर संबंधित कार्यालय के सूचना एवं अपेक्षित कार्रवाई हेतु प्रेषित की गई । भारत सरकार के मार्गदर्शी रूपरेखा के अनुरूप, संस्थान द्वारा वर्ष 2015 के दौरान सितम्बर माह, 2015 के दौरान हिन्दी दिवस हिन्दी पखवाड़ा समारोह आयोजित किया किया गया । इस दौरान हिन्दी की विविध प्रतियोगिताएँ आयोजित की एवं प्रतियोंगिता में सफलता प्राप्त पदाधिकारी वर्ग को पुरस्कार–पत्र प्रदान कर किये गये ।

वर्ष 2015 –16 के दौरान आयोजित राजभाषा कार्यान्वयन समिति की बैठक, हिन्दी पखवाड़ा समारोह के दौरान आयोजित हिन्दी प्रतियोगिता एवं हिन्दी प्रतियोगिता पुरस्कार वितरण के आलोकचित्र

The following Rajbhasha activities were conducted at the Tropical Forest Research Institute (TFRI), Jabalpur during the year of 2015 -16 in order to ensure the compliance of the official language policy of the union. The Meetings of the official language implementation committee which already existed in this institute under the chairmanship of the Director were held regularly in each quarter and decisions were taken on the directives issued from time to time by the ICFRE head quarter with regard to official language implementation work and decisions were also taken to complied with the same and the proceedings of the meetings were sent to ICFRE head quarter and other relevant offices within the stipulated time for their information & for required action.

The documents which comes under section 3(3) of the Official Language Act 1963 were issued in bilingual viz Hindi and English simultaneously and achieved the prescribed target of Hindi correspondence in each quarter was achieved.

The periodical reports such as quarterly, half yearly progressive report pertaining to the official language implementation work of this institute were sent to the respective offices for information and necessary action. The Hindi Day and Hindi fortnight celebration was celebrated by this Institute during the month of September 2015 as per the guideline issued by the Govt. of India and several Hindi competitions were also conducted for institute's staff and prizes were awarded to the winners in the competitions.

Photographs of the Hindi Day, Hindi fortnight celebrated by this institute during the year of 2015 -16

All official correspondence is being dealt in hindi as far as possible. All computers in the centre have been provided with hindi font. All seals and name plates are in bilingual as per the Govt. of India's direction.

7.6 Awards and Honours: NIL

8 ADMINISTRATION AND INFORMATION TECHNOLOGY

8.1 Information Technology

The institute has 100 MBPS NKN link provided under the National Knowledge Network (NKN) scheme of NIC project. The NKN comprises an ultra-high speed CORE (multiples of 10 Gbps), complimented with a distribution layer at appropriate speeds to support Overlay, Dedicated and Virtual Networks. The institute has a 100 MBPS fast Ethernet fiber optic backbone LAN, which is used for Internet access and other online activity. Video Conferencing facility also been used throughout the year.

Under IFRIS project various modules including Personal Information Management System (PIMS), Research Information System (RIMS), Payroll Management System (PMS), and Financial Accounting System (FAS) have been successfully operational. The web site of the institute and it's satellite centre CFRHRD, Chhindwara are frequently updated to showcase various activities of the institute. A web page has been created for the institute's online open access e-magazine ***'Van Sangyan'*** (ISSN 2395 - 468X) and linked with institute's web site. The pages have been updated on regular basis and issues have been uploaded on monthly basis over it for ease of access to the users. The reports have been generated for all the activities held at the institutes like conferences/seminars/workshops/trainings/visits of dignitaries/visits etc. and the material received from the concerned organizers and uploaded over institute's web site and also sent to the headquarter for uploading over ICFRE web site. The pages earlier generated for Achanakmar-Amarkantak Biosphere Reserve and institute's bi-annual journal 'Indian Journal of Tropical Biodiversity (IJTB)" has been updated with latest information on regular basis. The contents of the IJTB along with abstracts have been uploaded over web site for access to the users. A link has also provided for the lectures delivered by the speakers during weekly seminar for the users locally. From there they can access the lecture Power Point at any time within the institute.

8.2 Sevottam

Activities related to the Citizens/Clients Charter are mentioned as under-

8.2.1 Action taken to formulate the Charter for the Institute and its subordinate formation

Citizen's Charter is being drafted by the Institute. Provision for Annual Review of the Charter after approval is as:

- The Services provided by the Institute as per the charter will be reviewed annually.
- The timely redressal of public grievances is being monitored by the Public Grievance Officer.
- Steps are initiated to take remedial measures for quick disposal of complaints, specifically on those, which are of repetitive nature.

8.2.2 Action taken to implement the Charter

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

8.2.3 Details of Training Programmes, Workshops, etc. held for proper implementation of Charter : --------

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

8.2.5 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.

8.3 Welfare measures for the SC/ST/Backward/minority communities -

One day training entitled "Non-Timber Forest Produce Sustainable Harvesting, Processing and Value Addition" was conducted at Chhindi Rest House, East Forest Division, Chhindwara District for actual collectors (tribals), Joint Forest Management Committees and State Forest Department officials on 20.01.2016.

9. Balance Sheet

To be prepared at ICFRE level

10. ANNEXURES

1. RTI

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	Dr. U. Prakasham, Director, TFRI, Jabalpur	Shri A. K. Sharma, Under Secretary, TFRI, Jabalpur	As per provision and guidlines provided under RTI Act, 2005.
Centre for Forestry Research & Human Resource Development, Chhindwara	P. Subramanyam, Director, CFRHRD, Chhindwara	Director, CFRHRD, Chhindwara	As per provision and guidlines provided under RTI Act, 2005

2. Email and Postal addresses

a. 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

b. 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 – 2920613(O)
e-mail **–** dir_cfrhrd@rediffmail.com

3. Intellectual Property

3.1 Patents Granted – Nil

3.2 Others-Nil

List of Abbreviations

CFRHRD-Centre for forestry Research & Human Resource Development

CPTs- Candidate Plus Trees

CRBD - Complete Randomized Block Design

CSOs - Clonal Seed Orchards

DNA- Deoxyribonucleic acid

FDA – Forest Development Agency

FRI- Forest Research Institute

FSI- Forest Survey of India

GBH- Girth Breadth Height

HPLTC- High-Performance Liquid Thin Chromotography

IMD- India Meteorological Department

IPM- Integrated Pest Management

IUCN- International Union for Conservation of Nature and Natural Resources

JBP- Jabalpur

JFMCs – Joint Forest Management Committees

JNKVV- Jawaharlal Nehru Krishi Vishwavidyalaya

MS- Maharashtra

MP- Madhya Pradesh

MPCST - Madhya Pradesh Council of Science and Technology

MPFDC - Madhya Pradesh Forest Development Corporation

MPSBB – Madhya Pradesh State Biodiversity Board

NIC – National Informatics Centre

NKN – National Knowledge Network

NTFP- Non-Timber Forest Produce

NWFP –Non-Wood Forest Produce

OR- Odisha

OTSG- One Time Special Grant

RFRC - Regional Forest Research Centre

RSP - Rourkela Steel Plant

RVTC - Regional Variety Testing Committee

SSO - Seedling seed orchard

SOC - soil organic carbon

SAIL- Steel Authority of India

SFD- State Forest Department

SLEM- Sustainable Landuse Ecosystem Management

SWAT- Soil and Water Assessment Tool

TATR- Tadoba Andhari Tiger Reserve

TFRI- Tropical Forest Research Institute

ToT – Training of Trainers

TRIFED- Tribal Co-Operative Marketing Development Federation of India Ltd

UNDP- United Nations Development Programme

VVK- Van Vigyan Kendra