

Institute of Wood Science and Technology Bangalore

The Institute of Wood Science and Technology (IWST), Bangalore formed in 1988, is mandated to conduct research on Wood Science and Technology as its national objective and focuses its research on important forestry research needs of the States of Karnataka, Andhra Pradesh and Goa at regional level. Taking into consideration the expertise available and contributions made, the Indian Council of Forestry Research and Education (ICFRE), Dehradun has assigned the Institute the status of Centre for Advanced Studies in the areas of Improved Utilization of Wood, Mangroves and Coastal Ecology and Research on Sandal. The focus of research being carried out at IWST is in consonance with and in response to the aims of National Forest Policy in the areas of utilization of timber and non-timber products and increasing productivity. The Institute mainly aims to develop strategies for use and production of wood and other forest products in a way that sustain their supply.

PROJECTS COMPLETED DURING THE YEAR 2005-2006

Project 1: Evaluation of wood quality parameters of plantation grown *Eucalyptus citriodora* for different end uses [IWST/WPU/X09/2002-2006]

Findings: Data on physical, mechanical and anatomical properties were generated on 20 years old trees obtained from Yeslur range of Sakleshpura, Hassan district, Karnataka. Significant variation was found in bark thickness. Heart wood percentage was found to be correlated with bark thickness. Significant variation within tree and between tree variation in respect to specific gravity of wood, fibre characteristics and vessel characteristics were observed. The data obtained indicates its suitability for constructional purposes like poles, beams and rafters. Experiences of the artisans have indicated the potential of this timber for making export oriented artifacts. Physical and mechanical properties generated on 20 years *E. citriodora* indicated that wood is suitable for furniture, construction and for lacquer ware craft.



Wood of *Eucalyptus citriodora* and an artifact made out of it



Project 2: Assessment of wood quality of *Simarouba glauca* for its timber value [IWST/WPU/X10/2003-2006]

Findings: Data for stem wood and branch wood on anatomical, physical and mechanical properties of plantation raised juvenile wood characteristics were obtained. Office of the Development Commissioner, Handicrafts Bangalore, found out that the wood has a very good potential as an alternate timber for handicrafts for domestic consumption. There is no



Handicrafts and turnery articles made of *Simarouba glauca*

report of making handicrafts from this timber so far. Study suggested that the timber is dimensionally stable due to low shrinkage and may be utilized for the purposes where high dimensional stability is required. It has a great potential as alternate timber for handicrafts.

Project 3: Use of sonic and ultrasonic testing techniques to evaluate wood strength of plantation species - A non-destructive test method [IWST/WPU/X17/ 2003-2006]

Findings: Strength properties of three timber species were evaluated using non-destructive testing technique. A relationship was established between the values obtained by non-destructive and conventional test methods. Result of the study will be helpful for the assessment of quality and detection of defects in converted timber/logs by non-destructive technique and it will also improve the selection criteria of timbers for better utilization for various purposes.

Project 4: Evaluation of treatability of selected refractory species [IWST/WSP/ 2002-2006]

Findings: To ensure adequate absorption of preservatives in such species pretreatments like ponding, steaming and incising techniques have been employed by various researchers worldwide. In this direction *Eucalyptus* sp. are considered to be refractory to treatment. In this present case ponding process as a pretreatment has been employed to



evaluate the treatability of *Eucalyptus* hybrid. No uniform penetration was observed across the treated samples. The assay test indicated that samples ponded for 2 months showed almost equal absorption as that of 4 months ponded samples.

Project 5: Analytic studies on viscoelastic behaviour of wood and tree biomechanics [IWST/WSP/X06/2002-2005]

Findings: A model was developed on the principles of viscoelasticity to explain time dependent behaviour. This model was applied on experimental results of creep and stress relaxation. Viscoelastic behaviour was studied using four element model, consisting of one Maxwell body (having one spring and one dashpot in series) and Kelvin body (having one spring and one dashpot in parallel). Irreversible deformation, delayed and instantaneous elastic behaviour are explained through this model. Four element model was studied to find the roles of its different components. Dashpot of Maxwell body, which describes the viscous flow and irreversible creep, is related to the slow movement of woody constituents like cellulose, hemicelluloses, and lignin under the influence of external load. Studies proposed will provide a fundamental understanding of deformation of wood and will suggest ways to control it. It also provides a platform for future work related to defects in wood.

Project 6: Studies on fibre formation in wood [IWST/WSP/X07/2002-2005]

Findings: A model based on thermodynamic parameters has been developed for the description of the formation of one dimensional fibrils from disordered fluid. Analysis of defects in crystalline lattice of cellulose as a mechanism for the paracrystalline nature of cellulose were made. Processes of crystallization with simultaneous polymerization were analyzed as a possible mechanism of fibre formation in wood. Result of the study suggest possibilities in control of fibre formation and hence may find uses in tree improvement.

Project 7: Performance and evaluation of selected bamboo species treated by modified Boucherie process [IWST/WSP/X44/2004-2006]

Findings: Freshly felled bamboo species *Dendrocalamus strictus*, *Pseudoxanthanthera stocksii* and *Bambusa arundinaceae* were treated with CCA, CCB and Boric Acid Borax by modified boucherie process.

Observation of specimens after one year of exposure and field trials showed that all the treated as well as the untreated specimens are all in sound condition. In future it will give the real data on the efficacy of the preservative as well as the treatment.

Project 8: Chemical induction of heartwood in Sandal [CFP-001/ 2000-2006]

Findings: Faintly heartwood formed core material in treated and control plants was measured (after 6 dose of treatment) for extractive content (Benzine and alcohol in 2:1 ratio) and this clearly indicates that the formation of heartwood in treated plants is at an early stage than in control plants. Percentage of sandalwood oil in faintly heartwood formed core samples material and control plants was measured by UV spectroscopic method.



Project 9: Gender identification of *Garcinia indica* and *Simarouba glauca* using isoenzyme studies and assessment of fruit characters, yield and market potential of *Garcinia indica* in Karnataka state [IWST/CFP/X39/2004-2006]

Findings: Laboratory test method, based on electrophoresis, was developed for characterizing male and female plants of *Garcinia indica* and *Simarouba glauca*. Early determination of gender of these plants will enable the grower to maintain a proper ratio of male and female plants right from the beginning for proper pollination and fruit yield.



Peroxidase colour reaction (BPR) for gender identification in *Garcinia indica*



Peroxidase colour reaction (GPR) for gender identification in *Simarouba glauca*

Project 10: Studies on teak heartwood borer *Alcterogystia (cossus) cadambae moore* and its management [IWST-29/WBD-9/2000-2006]

Findings: The studies on bioecology and methods for monitoring and managing the pest have been completed. The pest population in the field was monitored using electrically and solar powered light traps. Management of the pest using nematodes, *Bacillus thuringiensis* and neem products were tested in the laboratory as well as field conditions and were found effective. The detail study on the pest and its ecology and findings on suitable management strategies is very useful for the proper growth of the tree and utilization of teak wood.

Project 11: Standardization of protocol for viability testing and prolonging the viability and vigour of *Santalum album* seeds in storage [IWST/TIP/2003-2005]

Findings: The sandal seeds with the three different moisture content were stored at five different storage temperatures for 18 months. These were periodically tested for viability.

The adsorption isotherms obtained at different temperatures were subjected to BET analysis. High correlation was observed between experimentally obtained isotherm and those obtained by theoretical analysis. The present study would help in better understanding the effect and the relationship between temperature and moisture content on the viability of seed during storage.

Project 12: Genetic screening of *Jatropha curcas* an important biofuel species of dry areas [IWST/TIP/2003-2006]

Findings: Estimated the variation in oil content in 24 accessions of *Jatropha curcas*. Clonal germplasm bank was established at Nallal field station comprising 24 accession and each accession comprising 5 ramets. The study showed statistically significant differences for all the parameters studied. It was found that the provenance Kaivara Hills with an oil percentage of 44.23 percent was most promising. Other promising provenances were Kolar and Magdi with oil percentage of 39.40 and 35.33 percent respectively.

Project 13: Evaluation of genetic variability and mating system analysis of *Aegle marmelos* Corr. and *Feronia elephantum* Corr. using isoenzyme markers [IWST/TIP/X42 /2004-2006]

Findings: Seeds of six genotypes of *Aegle marmelos* were sown for germination for variability studies. Isozymes marker studies using different enzyme systems. In both the species all the isozymes studied polymorphic with two loci. In *Aegle marmelos* isozymes analysis showed consistent variation among clones. In *Feronia elephantum* less heterozygosity was observed among natural population and clones.

PROJECTS CONTINUED DURING THE YEAR 2005-2006

Project 1: Evaluation of culm quality before, during and after flowering in bamboo (*Bambusa bambos* and *Dendrocalamus strictus*) species [IWST/WPU/ X14/2003-2007]

Status: Within culm variation in starch content by gravimetric from base to top has been completed in *Bambusa bambos* (after flowering). Histo-anatomical studies carried out in relation to starch content, total proteins and phenolics in a culm of already flowered *Bambusa bambos*. Testing carried out for different strength properties (static bending MOE and MOR, compression parallel to grain) in air-dry condition on after flowering stages of *Bambusa bambos*.

Project 2: Assessment of wood quality of *Tectona grandis* (Teak) clones from Thithimathi (Karnataka) and Andhra Pradesh [IWST/WPU/X15/2003-2007]

Status: Analysis of physical properties of Teak clones has shown higher standard specific gravity of Thithimathi clones as compared to Haliyal clones. Evaluation of mechanical properties in air-dry condition is carried out. Increment core samples of Teak clone were collected from CMA at Meredumilli, Andhra Pradesh. Collection of initial moisture content and whole core specific gravity data of these cores is completed.



Project 3: Studies on fracture mechanics in solid wood and wood composites using acoustic emissions [IWST/WPU/X16/2003-2007]

Status: Longitudinally compressed samples have shown characteristic fracture patterns. Microscopic observations of the longitudinally compressed specimens revealed a characteristic fracture band of buckled fibres and branching failure lines were also observed. Notched teak wood samples were tested in crack opening mode under in bending for determining the fracture toughness. Teak wood exhibited more fracture toughness in LT plane than in LR plane. Acoustic activity (cumulative signal intensity) was found to be increasing with the application of increasing loads and also with time till the sample failure.

Project 4: Characterization and identification of imported timbers available in the timber markets and sea ports [IWST/WPU/X43/2004-2007]

Status: Collected timbers from Visakapatnam and Mangalore port and timber markets of the town for various samples, and also from Bangalore timber market collected 25 species of timbers. A draft copy of information series titled “A guide to some Imported Timbers in south Indian markets” was prepared on 25 species of Imported timbers in which information on the trade name (original country's), family to which it belongs, other common names, distribution, general appearance, weight and specific gravity, some information on mechanical properties, seasoning, durability, preservation and uses were given to help the public.

Project 5: Studies on the gas permeability of secondary species of timbers [IWST/WSP/2003-2008]

Status: The permeability of *Acacia auriculiformis* has been studied to understand its behaviour towards impregnation of preservatives as well as drying, where liquids are removed. It is observed that considerably a very low flow rate occurred in longitudinal direction of the wood, but in transverse direction a very little flow occurred.

Project 6: Influence of pretreatment techniques on the treatability of hardwood species grown in Karnataka [IWST/WSP/X3/2004-2007]

Status: The wood of *Eucalyptus grandis* has been procured and further experimentation has been initiated.

Project 7: Polymerization filled composites [IWST/WSP/2003-2006]

Status: Polymerization of ethylene using filler supported catalyst at elevated pressure was completed. Using this new 'Polymerization Filling Technique', we have achieved one step formation of homogeneously filled composites with high degree of filler content in a high pressure polymerization reactor using slurry process. Studies on effect of time on polymerization yield and catalyst activity has been completed. Studies on effect of monomer concentration on polymerization kinetics have also been completed. Polymerization of ethylene using the filler supported catalyst with different concentrations of catalyst/cocatalyst continues and is expected to be completed. The effect of mass transfer resistances on Rate of polymerization with time is being studied.



Project 8: Studies on drying characteristics of plantation timbers in dehumidifier drying kiln (Old title: Development of seasoning schedules for plantation timbers using dehumidification based drying) [IWST/WSP/X32/2004-2007]

Status: Drying behaviour of plantation grown timbers namely Eucalyptus, Silver Oak, Casuarinas and Rubber wood were studied in the desiccant based dehumidifying wood drying system. There was no significant difference in the magnitude of drying degrades with two drying conditions in case of Eucalyptus.

The drying trial with Silver Oak (*Gravellia robusta*) wood was carried out. Some of the wood samples exhibited excessive distortion and surface checking after drying. This might be due to higher temperature of drying.

In this study, potential of acoustic measurements in monitoring moisture content in boards during drying and in sorting out extremely poor quality material before drying was explored. Acoustic velocity in boards increased with reduction in moisture content.

Acoustic velocity measurements were taken in all the boards after drying. There was a good association between acoustic velocity in boards before drying and after drying.

Drying studies with Casua rinas and Rubber wood were also carried out.

Project 9: Studies on natural durability of treated and untreated timbers of secondary species [IWST/WSP-X34/2004-2007]

Status: *Lophopetalum wightianum*, *Lagerstromia lanceolata* and *Artocarpus heterophyllus* specimens were treated by Full Cell process with 3 preservatives CCA, CCB and Creosote and Furnace oil 1:1, for 4 different levels of absorption. The treatment schedule for all the three species for different loadings of absorption were developed. The treated specimens along with the untreated control specimens are exposed to the field test in Test Yard.

The observations of the control specimens of these 3 species show that *Lagerstromia lanceolata* is the most durable one and *Lophopetalum wightianum* is least durable one.

Project 10: Wood fibre plastic composite foams with improved cell morphology by continuous process [IWST/WSP/X37/20042006]

Status: A series of polystyrene wood fibre/wood flour composite materials having 10, 20, 30 and 40 weight % of wood were prepared as reported in the last report. The die which was fabricated in November 2005 for foaming experiment was not suitable and the experiments using this die have failed. The design of the die was modified and now the die with new design is ready.



Project 11: Development of colouring reagents based on enzymesubstrate reaction for differentiating oil yielders of sandal in field [IWST/CFP/ X12/2002-2007]

Status: Colour reaction using Guaiacol and benzedine substrate was carried out with large number of sandal plants of known oil content for verification of results.

Results of the colour reactions have been verified in the field.

Project 12: Studies on the sucking pest complexes of Sandal and their management [IWST/WBD/X13/2004-2007]

Status: Among the 44 sucking pests found breeding on sandal, 42 pests belonging to twelve families were identified to the species level and eight species are reported for the first time. They are *Fiorinia fioriniae* (Diaspididae), *Icerya aegyptiaca*, *I. purchasi*, *I. seychellarum*, *Hemaspidoproctus cinerus* (Margarodidae), *Ferrisia virgata*, *Nipaecoccus viridis* and *Pseudococcus longispinus* (Psuedococcidae).

Project 13: Role of Fungi biodeterioration of timber under marine conditions [IWST/WBD/X35/2004-2007]

Status: CCA and CCB treated test samples of *Paraserianthes falcataria* and *Mangifera indica* were exposed to seawater in inter-tidal zone at Fishing harbour jetty, Vishakapatnam Port Trust. Periodically, one set of samples was retrieved, biological growth was observed, and weight loss of each sample was recorded and brought to IWST for further studies. Temperature and salinity of water also recorded regularly. Isolation of bacteria, actinomycetes and fungi are being done from infested samples by using various media.

Project 14: Impact of disturbance on canopy insect biodiversity: an assessment of forest health [IWST/WBD/2003-2007]

Status: The project aimed at standardizing the methodology for sampling insects from the emergent canopies of the rainforests of the Western Ghats, generating preliminary data on the diversity and comparing insect diversity in the disturbed canopies with the undisturbed ones. During the current year pre-monsoon samples were drawn from four canopies of *Vateria indica*. About 30,000 individuals collected so far have been sorted.

Project 15: Investigations on the resistance of commercially available bamboo species in Karnataka against insect borers and termites [IWST/WBD/X45/2004-2008]

Status: Length wise durability of 2 commercially available Bamboo species, *Bambusa bambos* and *Dendrocalamus strictus*, against termites and borers are being tested. These 2 species of Bamboo were treated with 8 chemicals and are being tested against termites in the field. Shock wave treated bamboo (new technique), Hot and cold process and CCA 4% Pressure treated bamboo were tested for their durability against termites.



Project 16: Clonal test trials on *Casuarina equisetifolia* L. in North coastal Andhra region (Old title: Species, provenance and clonal test trials on *Casuarina* spp. in North Andhra) [IWST/WBD-Marine/X004/2003-2008]

Status: Ten clones of *Casuarina equisetifolia* L. were collected from Regional Forest Research Centre, Rajahmundry. Survival percentage studied. Growth performance in terms of height, basal stem diameter and branching pattern at ground level were recorded.

Project 17: Ethnobotanical studies of Godavari valley in Andhra Pradesh [IWST/WBD-Marine/X04/2002-2007]

Status: Ethnobotanical data on 82 plant species was collected from the tribes of Godavari valley on various uses of plants. Herbarium was made and documented for the species collected.



Musa ornata Roxb. A rare wild banana -rhizome extract used as coolant by Godavari valley tribes

Project 18: Community involvement in coastal forestry through periodical returns by value added produce [IWST/WBD-Marine/X24/2003-2008]

Status: Herbage from the three plantation areas was collected and essential oil distilled. Essential oil yield from the three areas was estimated. Samples of essential oil are being tested for quality.



Project 19: Environmental impact of leachates from Copper-Chrome-Arsenic (CCA) wood preservative under marine condition [IWST/WBD-Marine/X23/2003-2007]

Status: Macro grain pattern of test panels was analyzed. “End penetration test”, as per IS: 401-1981, was performed. Untreated mango panels were prepared to serve as controls. All treated panels were end sealed to arrest preservative leaching from free ends. All treated panels were sorted into four CCA retention groups besides controls and made into 200 test ladders, each having triplicates. Preliminary experiments on CCA leaching and effectiveness of end coating in preventing chemical leaching were carried out in the laboratory.

Project 20: Studies on recruitment and metamorphosis of marine wood borer larvae [IWST/WBD-Marine/X22/2003-2008]

Status: Generations of wood boring teredinids were maintained in the laboratory for use as stock for larval production. Two species of algae, namely, *Chaetoceros* sp. and *Isochrysis* sp. were procured and maintained in the laboratory. Experiments on the influence of algal species on the recruitment of teredinid wood borer larvae on wood surface and subsequent metamorphosis were carried out. Test panels immersed in the fishing harbour at Visakhapatnam to facilitate formation of primary film and were removed after 24 hrs. Colonies of microorganisms in the primary film separated and pure cultures of them maintained in the laboratory in appropriate culture media. Regular maintenance of running seawater system done.



Aristolochia bracteolata Lam. A medicinal plant found along the coast of north Andhra region



Arthrocnemum indicum (Willd.) Moq. A halophyte extensively growing along with mangrove areas of northern coast of Andhra Pradesh

Project 21: Inventory of coastal plant communities of north Andhra region [IWST/WBD - Marine/X25/2003-2007]

Status: Several coastal areas in Visakhapatnam, East and West Godavari Districts were surveyed. Plant specimens collected, inventorized and herbarium prepared. A total of 554 plant specimens belonging to sand binders, mangroves, mangrove associates, halophytes, shelterbelt species and medicinal plants were collected and 242 of them identified.



Collected a rare and endemic plant species, namely, *Dimorphocalyx glabellus* Thw. from the coastal hilly area near Bangarammapalem, Visakhapatnam District. Ethnobotanical data were collected wherever available.

Project 22: Studies on Productivity and Management of Teak (*Tectona grandis*) in agroforestry practices in Karnataka and Andhra Pradesh [IWST/TIP/X38/2004-2007]

Status: Survey was conducted among beneficiary farmers covered under a previous UNDP programme in Tirupati (Andhra Pradesh) and Devanahally (Karnataka) and some fields were identified for detailed studies. Farm teak trees (10 years) of block plantations in farm lots and field boundaries were sampled. The trees were felled for estimating productivity by recording data on above ground (stem, branch wood, leaves/twigs) and below ground parameters (taproots, lateral roots etc). Wood samples from felled teak trees (green and air-dry samples) collected and samples were prepared for tangential and radial directions for testing various wood properties as per standard procedure.

Project 23: Productivity and interaction studies in *Acacia* hybrid based agroforestry practices in Karnataka [IWST/TIP/X40/2004-2009]

Status: Ramets of *Acacia* hybrid were procured from Mysore Paper Mills. One site each in Kolar and Doddaballapur was identified and trials were raised with maize and red gram as inter-crops. Growth data is being periodically recorded.

Project 24: Screening clonal propagation, *ex-situ* conservation and genetic improvement of *Pongamia pinnata* [IWST/TIP/X36/2004-2007]

Status: Collected seeds of plus trees from 4 silvicultural zones namely, Central, Southern, Eastern and Northern zones



Northern Silvicultural Zone



Eastern Silvicultural Zone



Suthern Silvicultural Zone



Rooting of Cuttings (Larger)



Central Silvicultural Zone



of Karnataka. Conducted variability studies on fruits, seeds and its germination. Estimated oil content in seeds of *Pongamia pinnata* collected from 4 different silvicultural zones of Karnataka to screen the plus trees with higher oil content. Completed studies on the effect of various auxins and their concentration, and the size of cutting for the refinement of vegetative propagation of *P. pinnata*. Raised seedlings from the seeds of 25 plus trees source and established progeny trial at Nallal field research station in 0.6 ha. of land with 375 seedlings.

Project 25: Comprehensive tree improvement program for *Gmelina arborea* in Karnataka Phase I- Progeny trial [IWST/TIP/X41/2004-2009]

Status: Seeds of 49 families of *G. arborea* were procured twice from RFRI, Jorhat both the lots exhibited poor germination. Seventeen plus trees have been identified for collection of seeds.

Project 26: Seed studies of some of the economically important species of Western Ghats [IWST/TIP/2003-2007]

Status: The seeds of *Garcinia gummigutta* stored at various temperature level and room temperature was periodically tested for viability. Complete loss of viability was recorded for seeds stored at RT, -10 and 5 °C. Maximum viability was maintained by seeds stored at 25°C with 49.5 % moisture content and at 15 °C at both the moistures contents. The desiccation and storage studies reveal that the seeds of *G. gummigutta* are dormant recalcitrant in nature. In *Garcinia gummigutta* a unique pattern of germination of seed fractions (> 1cm) was recorded. The internal structure of seed reveled the presence of vascular bundle in the centre running along the length of the seed. The seeds of *Dipterocarpus indicus* were infested by weevils. Infestation was recorded in 98% of the seeds.



Independent seedlings arising from two equal fractions of the same seed



Project 27: Carbonisation of selected fuelwood species [IWST-34/WE1/2004-2007]

Status: Variation in basic density of wood, bark and wood/bark ratio of 2 to 6 years of *Eucalyptus* hybrid and 1 to 6 years *Acacia auriculaeformis* with age and height of the tree was carried out. Variation in calorific value of *Eucalyptus* hybrid (2 to 6 years) and *A. auriculaeformis* (1, 3, 4, 5 and 6 years) with age and height (bottom to top) was studied. Ash content was higher at lower age and top of the tree. There was no significant variation in other parameters. Elemental analysis (ultimate carbon and hydrogen) of *A. auriculaeformis* and *E. hybrid* with age and height were carried out. No significant change in these parameters was observed.

NEW PROJECTS INITIATED DURING THE YEAR 2005-2006

Project 1: Standardization of anti-leaching treatment for *Pterocarpus marsupium*, *Pterocarpus soyaxii* and *Intsia* spp. [IWST/CFP/X51/2005-2007]

Status: Woods of *Pterocarpus marsupium*, *Pterocarpus soyaxii* and *Intsia* spp. were procured. Design of experiment was made. Samples of the above wood prepared. FTIR studies to ascertain the degree of modification due to treatment is being carried out.

Project 2: Analysis of active principles in *Gymnema sylvestre* and *Phyllanthus amarus* from the forest of Southern India [IWST/CFP/X46/2005-2008]

Status: Eleven MPCA were selected in Karnataka state for this study. Plant materials are collected from selected place of Karnataka. Collected materials were processed for extraction of gymnemic acid.



Charmadi ghats (Karnataka state) - One of the rich source of *Gymnema sylvestre*

Project 3: Screening and evaluation of wild varieties of *Emblica officinalis* fruit in various agroclimatic zones of Western Ghats [IWST/CFP/X48/2005-2008]

Status: Methods for estimation of Ascorbic acid has been standardized. *Emblica officinalis* fruits were collected from BR hills of Karnataka state. Collected fruits were processed for extraction of Ascorbic acid.



Project 4: Extraction and separation of chemical constituents of *Dysoxylum malabaricum* Bedd. Wood [IWST/CFP/X52/2005-2007]

Status: Extraction of oil has been carried out from white cedar wood from Sirsi. Extracted white cedar wood oil was analyzed through GCMS at ITC lab, Bangalore. Results are showing 28 important chemical compounds such as Alpgha-Muurolene, T-Muurolol, Delta cadinene and others.

Project 5: Studies on age related durability of plantation timbers [IWST/WBD X50/2005-2009]

Status: *Acacia auriculiformis*, *A. mangium*, *Eucalyptus tereticornis*, *Grevillea robusta* and *Melia dubia* of different age group of timbers from Nallal experimental plot of KFD have been collected, converted and samples being prepared. Samples are being exposed to wood rot fungi under accelerated laboratory condition to study the natural durability of different age group timbers.

Project 6: Assessment of seed quality in unimproved populations, seed production areas and seed orchards of *Tectona grandis* [IWST/TIP/X48/2005-2007]

Status: Seeds have been collected from Seed Production Area at Virnoli, Barchi and Baghwati in Haliyal forest division and from Seedling Seed Orchard at Tirupati.

Project 7: Studies on seed source variation, determination of age of the trees and establishment of germplasm bank in Sandal [IWST/TIP/X47 2005-2008]

Status: Seed collections from different geographical areas such as Shimoga, Sirsi, Kadur, Bellary, Raichur, Mysore totaling to ten locations have been collected from Karnataka. Land preparation completed for the establishment of germplasm bank.

PROJECTS COMPLETED DURING THE YEAR 2005-2006 (Externally Aided)

Project 1: Characterization and quantitative analysis of decayed wood by fluorescence and Fourier transform infrared (FTIR) spectroscopy. Funding Agency: International Foundation for Science, Sweden) [2003-2006]

Findings: FTIR spectroscopy was used to examine qualitative and quantitative changes in lignin and carbohydrate components relative to one another in wood decayed by brown-rot and white-rot fungi. *Pinus sylvestris* L. (Scots pine) and *Fagus sylvatica* L. (beech) were decayed by *Coniophora putenea* (a brown rot fungus) and two white rots (*Coriolus versicolor* and *Phanerochaete chrysosporium*) whereas *Pinus roxburghii* (Chir pine), *Hevea brasiliensis* (Rubberwood) and *Mangifera indica* (Mango wood) were decayed by *Polyporus meliae* (a brown rot) and two white rots (*Trametes hirsuta* and *Coriolus versicolor*). Results demonstrate usefulness of this technique for the rapid detection of wood decay



at early stages by brown rot fungi and identifying the type/nature of decaying fungi and determining quantitative changes in wood constituents with relative to each other. Brown rots removed structural carbohydrate components selectively leaving elevated levels of the syringyl moiety in hardwood and guaiacyl moiety in softwood. This results in an increase in the lignin:carbohydrate peak intensity ratio as decay proceeded. In wood decayed by white rot, the lignin content decreased as decay progressed, as did the xylan content. All the white-rots studied in this study showed preference for lignin reflected in a reduction in the lignin:carbohydrate peak intensity ratio as decay progressed. The ratios of reference peaks for lignin against polysaccharide FTIR peaks were compared with lignin content of the wood determined by the acetyl bromide method in beech and Scots pine decayed to different weight losses by the brown-rot fungus *C. puteana*. Project has been completed and Scientific Report of the project has been submitted to IFS Sweden.

PROJECTS CONTINUED DURING THE YEAR 2005-2006 (Externally Aided)

Project 1: Investigations on lesser known aspects of mangrove biodiversity and ecology in the states of Goa, Karnataka and Andhra Pradesh. Funding Agency: Ministry of Environment and Forest (MoEF) [April 2004 to March 2008]

Status: Plant samples of mangrove species were collected. Bark and wood samples from *Rhizophora mucronata* and *Excoecaria agallocha* were processed separately for extraction of their chemical constituents. Extraction process with solvents of different polarity is under progress. Thin layer Chromatography for *Rhizophora mucronata* bark extract was carried out using different solvent system.

Collected 436 plant specimens of mangrove, their associates, halophytes and sea grasses and all the specimens were poisoned, preserved and made into herbarium. Data were collected for various parameters to study the vegetation ecology besides DBH of the trees in each quadrat. Water and soil samples were collected from all the sites and being analyzed. The calorific values of various mangrove species which are used as fire wood in coastal areas have been studied. Seed germination studies were done in *Sonneratia alba* and *Avicennia* species. Vegetative propagation studies were done in *Rhizophora* and *Sonneratia* sp. Permanent slides of TS, TLS and RLS were prepared using microtome for *Sonneratia*. Data on fibre and vessel morphology were collected for *Sonneratia alba*, *Avicennia officinalis*, *A. alba* and *A. marina*.



Extensive conservation of mangrove wetlands for aquaculture farms in East Godavari District

Project 2: Establishment of Advanced Wood Working Training Centre at IWST. Funding Agency: Italian Trade Commission/ACIMALL

Status: Total number of students trained upto March 2006 -1382 module wise. Percentage unemployed benefited for employment after the course 92%. Name of states from which the students attended the course Karnataka, Tamil Nadu, Andhra Pradesh, Kerala, Maharastra, Dehli, Meghalaya, Orissa, Assam, West Bengal, Madhya Pradesh, Tripura,



Rajasthan, Gujarat, Uttaranchal and Arunachal Pradesh. Different qualified students attended the course other than S.S.L.C. pass PUC, ITI, Diploma Holders, Degree Holders (BA, BSc., MA, MSc., LLB, MSW, BSc. (Ag) and BCom.), Engineering Holders, industrialists etc. The salary earned by the trainees after their employment in wood working companies in India From 3000 to 15000 per month depends upon their qualification, experience etc. No of companies benefited by the trained personnel of AWWTC more than 36 companies all over India.

Project 3: Refinement of protocols for rapid clonal propagation of Sandal and Red sanders; Demonstration of field performance and evaluation of genetic fidelity. Funding Agency: Department of Biotechnology, Govt. of India [2003- 2006]

Status: In sandal, studies on the effect of TDZ and polyamines on shoot multiplication and rooting and the effect of genotypes on shoot multiplication and rooting was carried out. Based on the protocol developed 5 genotype wise production of plants through axillary shoot proliferation was carried out. About 200 plants through axillary shoot proliferation were produced through axillary shoot proliferation. Conducted studies on media, growth hormones, sucrose, agar agar, pH on callus multiplication and high frequency synchronized somatic embryogenesis in sandal. About 400 plants were produced through somatic embryogenesis, somatic embryos are in germinations stage.

Project 4: Biocomposites From Engineered Natural Fibres. Funding Agency: Ministry of Environment and Forests (MoEF)

Status: A series of wood filled polypropylene composites having 10 to 50 weight percentage of wood content were prepared using the co-rotating twin screw extrusion system. Both wood fibres and wood flour were used as filler material. To understand the effect of coupling agents, all the formulations were prepared without any coupling agent. The compounded material was injection moulded into standard ASTM type test specimens and evaluated for their mechanical properties.

Project 5: Community ecology of a detritus systems. Insects and fungi associated with fallen trees in the Nilgiri Biosphere Reserve. Funding Agency: MoEF, Govt. of India [2004-2007]

Status: A weather recorder was installed in the field, for studying the effect of seasonal variation in insect and fungal biodiversity. The collected insects were identified upto family level. About 80 morpho species of beetles have been recorded from the fallen logs. The collected insects are compared across various physical and chemical characteristics of the logs.

Project 6: Studies on the Entomofaunal diversity and their interactions in selected provenances of sandal. Funding Agency: Ministry of Environment and Forests [(MoEF)2004-2007]

Status: The studies on entomofauna diversity in all six selected sandal provenances of south India is continued and listing of identified species of insects belonging to different orders of class Insecta. The study indicated the presence of



56 species of butterflies representing 4 families and 21 species of Odonata belonging to 16 genera, 4 families and 2 suborders from the six selected provenances of sandal during the study period. Insects representing 10 orders were found active and collected during the study period. The study to document the Entomofauna associated with flowers of sandal and their role as pollinator during the flowering seasons of sandal were completed.

Project 7: Revision of subfamily Ponerinae (Hymenoptera : Formicidae) in India with special emphasis to western ghats. Funding Agency: DST-Fast Track Scheme [2004-2007]

Status: Ponerinae are loaned from National Insect Collection Museum Forest Research Institute Dehradun for study, which includes collection from North - East India and Andaman Nicobar islands since 1921. The specimens are photographed and their identity is documented according to museum numbers. Survey is completed for the state of Goa and continuing in the States of Karnataka, Kerala and Tamil Nadu. Synoptic classification list for the Ponerinae and of the world and Oriental region prepared. The type species distribution list for the species of the genera represented from India and Oriental region is prepared. The genus Odontoponera is recorded for the first time from South India. Key to the species of rare and genus Platythyrea Roger and Harpegnathos is prepared. The Recognizable Taxonomic Units (RTUs) were isolated and drawings were made.

Project 8: Investigations on the mechanisms of success of *Mytilopsis sallei* (Recluz) in managing toxic load arising out of biodeterioration control measures. Funding Agency: Department of Science and Technology [2005-2008]

Status: Permissions for utilizing jetty facilities for trapping *Mytilopsis sallei* were obtained from State Institute of Fisheries Technology, Kakinada and Deputy Conservator, Visakhapatnam, Port Trust.

Project 9: Development of protocols for rapid and mass clonal propagation of *Bambusa pallida* Munro and *Phyllostachys bambusoides* Sieb. et Jucc. Funding Agency: Department of Bio technology (2004-2007)

Status: For genotype studies offset cuttings of four CPCs of *Bambusa pallida* were collected from RFRI, Jorhat and established at germplasm bank at Gottipura for micropropagation studies. Studies on effect of media and PGRs and TDZ on shoot multiplication was carried out on both the species. In *Phyllostachys bambusoides* studies were conducted for direct root and shoot development from the explants. In *Bambusa pallida* effect of explant type and auxins on callus induction for somatic embryogenesis was studied. Shoot multiplication rate was about 4 fold in *Bambusa pallida* in 4 weeks period.

Project 10: Field performance of micro and macropropagated planting stock of selected five commercially important bamboo species (Collaborative project with KFRI & IFGTB). Funding Agency: Department of Biotechnology [2004-2007]

Status: Established field trials of micro and macropropagated planting material of five bamboo species viz; *B. bambos*, *B. balcooa*, *D. asper*, *D. strictus* and *P. stocksii* in 13.0ha in Karnataka (Gottipura, Nallal and Yelwala) and 3.7 ha. in



Andhra Pradesh (FRC, Hyderabad). In Karnataka different trials established are; mode of regeneration, spacing and effect of fertilisers on growth. Whereas, in Andhra Pradesh trials are on effect of spacing and fertilizer treatment on growth.

Project 11: The properties of coffee wood as indicators of white stem borer resistance. Funding Agency: Central Coffee Research Institute [2005-2008]

Status: Training was imparted to the in-service officials of coffee board on histo-chemistry. Starch, lipid, protein contents based on staining technique for borer affected and controls for 8 cultivars were analysed.

**NEW PROJECTS INITIATED DURING THE YEAR 2005-2006
(Externally Aided)**

Project 1: Studies on the assessing growth performance and standardization of management practices for *Guadua angustifolia* Kunth in Karnataka Funding Agency: NMBA[2005-2008]

Status: Established field trials at two sites (each site of 1.3 ha). The trials were established in Randomized Block Design in two spacing schedules with seven treatments and three replications. Nine plants per replicate were established and 388 Guadua plants were planted in each site. Observations related to survival rate, height of the plant and number of culms were collected.

Project 2: Investigations on the fungi and insects associated with fruits and seeds of selected endemic trees of western ghats. Funding Agency: MoEF [2006-2009]

Status: The project work has been initiated in March, 2006.

Project 3: Bamboo Locational Trials (BLT). Funding Agency: NMBA [2005-2007]

Status: Under species trial eight bamboo species were selected and trials established at Nallal (Karnataka) and FRC, Hyderabad (AP). Nutrient management trial with 5 m x 5m spacing, bamboo based cropping system trial and clump management trial were established using *Pseudoxylonanthera stocksii* at Nallal in Karnataka.

Project 4: Multilocational introduction cum demonstration trials and field evaluation of six important bamboo species viz., *Bambusa balcooa*, *B. nutans*, *Dendrocalamus asper*, *D. hamiltonii*, *Guadua angustifolia* and *Pseudoxylonanthera stocksii* in Andhra Pradesh, Karnataka and Goa. Funding Agency: DBT [2005-2009]

Status: Shoot multiplication and rooting in *D. asper* initiated. Initiated work on establishment of cultures of *B. nutans* and *B. balcooa* from selected CPC material.



Project 5: Insect-plant relationship with special reference to herbivory in the mangroves of South India. Funding Agency: MoEF [2005-2008]

Status: The purchase of the equipments (Leaf Area Meter, Digital Camera and Solar Light Traps) were processed. The Solar Light Traps (4 Nos.) have been received and installed in study sites at Upinkudru, Masoor and Dev bagh. Survey and collections are made on a routine basis (monthly) in three coastal districts of Karnataka (at mangroves of Karwar, Honnawar, Kundapur and Mangalore). Insects from the day and night collections are being sorted out and identified. 56 species are identified upto species level.

Abstract: No. of Projects

	No. of projects completed in 2005-2006	No. of ongoing projects in 2005-2006	No. of projects initiated in 2005-2006
Plan Projects	13	27	7
External Projects	1	11	5
Total	14	38	12

TECHNOLOGY ASSESSED AND TRANSFERRED

1. A demonstration programme on "Forestry and Wood Science Technologies" was organized at Forest Technical and Administration Training Institute (FTATI) Kadugodi, Karnataka on 2nd September 2005.
2. A demonstration programme on "Forestry and Wood Science Technologies" was organized at Hassan on 16th September 2005.
3. Operation of portable distillation unit meant for extraction of essential oils was demonstrated to the officers and staff of the Andhra Pradesh Forest Department and members of VSS/NGO at Vizianagaram on 27th February 2006.
4. Evaluated the potential of *Simarouba glauca* and *Eucalyptus citriodora* for Development Commissioner Handicraft (Bangalore) for handicrafts as new raw material resource.

EDUCATION AND TRAINING

Education

1. A total of 307 students from different universities visited the Institute from April 2005 to March 2006.
2. Students of Wood Science and Technology, FRI (Deemed University) were given lectures on wood quality.

Training

1. Conducted training course on "Techniques of wood anatomy" to the officials of Central Coffee Research Institute, Chikkamagalur.



2. Conducted Training course on "Classification and grading of timbers" to the in-service officials of Ordnance Factory, Trichirapalli and M/s Moser Baer India Pvt. Ltd., Greater Noida, from 09th to 11th January 2006.
3. Dr. R. Sundararaj and Smt. H.C. Nagaveni imparted training and practicals for trainees of TNFD officials on Biofertiliser and Pest and Disease management in nurseries from 15th to 17th February 2006.
4. Conducted Training course on "Joinery" to the in-service officials of Andaman & Nicobar Forest Department, Port Blair from 9th to 13th January 2006.
5. Conducted Training course on "Field identification of important timbers" to the in-service officials of Tamil Nadu Forest Department from 20th to 24th February 2006.
6. Conducted training course for official of Andaman & Nicobar Island in Wood Seasoning and Preservation from 16th to 20th January 2006.
7. IWST supported a training programme organized by EMPRI from 7th to 11th November 2005.
8. Training on "Preservation of rubber wood and silver wood for Industrial packaging application" was organized from 31st August to 2nd September 2005 for 7 trainees from M/s Wheels India Limited, Chennai.
9. Compulsory Training Course for IFS officers on IPR on Forestry issues from 2nd to 6th January 2006 was organized in the Institute. A total of 30 officers participated. 2 days Training Workshop on "Advancements in Wood Production and Utilization" was organized on 30th and 31st January 2006.
10. Conducted one week training programme on "Modern Seed and Nursery Technology" for RFOs and Foresters of Tamil Nadu State Forest Department from 16th to 21st February 2006.

Attended

Dr. R. Vijendra Rao, Scientist- F, Mrs. M. Sujatha RA Gr. I and Mrs. S. Shashikala, RA Gr. I attended training on Histo-chemistry techniques given by Prof. K.V. Krishnamurthy of Bharatidasan University, Tiruchirapalli on 21st and 22nd July 2005.

LINKAGES AND COLLABORATION

1. Linkages with State Forest Department, Karnataka, Andhra Pradesh Forest department, Goa Forest Department, Bangalore University, University of Agricultural Sciences, Bangalore, University of Agricultural Sciences, Dharwad and Indian Institute of Science, Bangalore, PESIT, Bangalore, IFGTB, Coimbatore and KFRI, Peechi.
2. Two DBT projects being undertaken in collaboration one with KFRI, Peechi and IFGTB, Coimbatore on "Field performance of micro and macropropagated planting stock of selected five commercially important bamboo species" and another with KFD, Karnataka, APFD, Hyderabad, GFD, Goa on "Multilocational introduction cum demonstration trials and field evaluation of six important bamboo species viz; *Bambusa balcooa*, *B. nutans*, *Dendrocalamus asper*, *hamiltonii*, *Guadua angustifolia* and *Pseudoxytenanthera stocksii* in Andhra Pradesh, Karnataka and Goa".
3. Linkages developed with DCF Sirsi, DCF Sagara and DCF Mangalore for the collection of information on management practices followed by the department.
4. Had good linkages with A.P. Forest and Fisheries Departments, Toy making industries, Universities and Research Institutes in Andhra Pradesh.
5. MoU signed between Central Coffee Research Institute (CCRI), Coffee Research Station, Chikkamanglur district



and IWST, Bangalore for Rs. 5.35 lakhs. IWST will collaborate with CCRI in carrying out Research studies on the properties of coffee wood as indicators of white borer for resistance.

PUBLICATIONS

Project Completion Reports

1. Dhyan Singh, P. Kumar and Anthony Das (2005). Development and popularization of packing boxes of plantation grown timbers from South India for Horticulture produces. Project No. IWST/WPU/X18.
2. Hemavathi T.R, R. Vijendra Rao, S.R. Shukla, M. Sujatha, S. Shashikala and Maddurappa (2005). Assessment of wood quality (Anatomical) of 8-10 years old *Acacia auriculaeformis* and *Acacia mangium* hybrids. Project No. IWST/WPU/X04.
3. Nirmal Kumar Upreti, S.S. Chauhan and Anil Kumar Sethy (June 2004) Studies on forced air drying of plantation grown timbers. Project No. IWST/WSP/X01.
4. D. Venmalar and P. Ramlal (2005). Development of alternative preservatives of more economic value and schedules for their incorporation in wood. Project No. IWST/WSP-009.
5. P. Narayananappa, K.S. Rao and V. Kuppusamy (2005). Evaluation of ammonia based preservatives against Indian termites. Project No. IWST/WSP/X02.
6. Pankaj Kumar Aggarwal, D. Venmalar and C.N. Vani (2005). Effect of temperature, humidity and pH on CCB fixation in wood. Project No. IWST/WSP/X11.
7. Gairola S.C. and S.S. Chauhan (2005). Studies on the drying behaviour of timber used for handicrafts. Project No. IWST/WSP/X20.
8. Angadi, V.G. K.H. Shankaranarayana, G. Ravikumar and K.T. Chandrashekhar (2005). Natural products evaluation of extractives of plant origin for biological and pharmacological activity *Nothapodytes nimmoniana* and *Garcinia indica*. Project No. IWST/CFP003.
9. Nagaveni H.C. and G. Vijayalakshmi (2005). Role of biofertilizer in ecorestoration of problematic site like mine reject soil in Goa. Project No. IWST/WBD-003.
10. Remadevi O.K., Rajamuthukrishnan, (2005). Studies on entomofauna of mangroves of Karnataka, Goa and Andhra Pradesh Project No. IWST-24/WBD-7/2005.
11. Nagaveni H.C., K.H. Shankaranarayana, G. Vijayalakshmi (2005). Control of biodeterioration of wood with the help of eco-friendly preservatives and bioactive substances on staining and decay fungi under terrestrial conditions Project No. IWST/WBD-008.
12. Srinivasa Y.B. and O.K. Remadevi (2005) Biosystematic studies on parasitoid complex of sandal coccids and their utilization in biological control. Project No. IWST/WBD-16.
13. Rathore T.S., Ashutosh Srivastava, Geeta Pandey (September 2004). Development of modern nursery techniques for propagation of important species of Goa *Terminalia tomentosa*, *Xylia xylocarpa*, *Myristica fragrans*, *Bambusa arundinacea* and *Dendrocalamus strictus*. Project No. IWST/TIP 3.
14. Rathore T.S., Ashutosh Srivastava and P.V. Somashekhar (2005). Studies on micropropagation field evaluation and conservation of *Pseudoxytenanthera stocksii* (*Oxytenanthera stocksii*)- Threatened species. Project No. IWST/TIP-002.



15. Arun Kumar A.N., Geeta Joshi and Nataraja Karaba (2005). Variation in photosynthesis in clones of Sandal and Eucalyptus. Project No. IWST/TIP-X28.

Publications

1. Institute Profile (2005-2006)
2. Research highlights (1988-2005) of the institute

CONFERENCE/ MEETINGS/ WORKSHOPS/ SEMINARS/ SYMPOSIA/ EXHIBITIONS

Organized

1. Organisation of 36th Annual conference of International Research Group on Wood Preservation (IRG), Sweden from 24th to 28th April 2005.
2. A one-day seminar on "Quality issues in forestry and forest products" was conducted on 20th September 2005.
3. A national workshop on "Advancements in Wood Production and Utilization" for IFS Officers was conducted at institute on 30th and 31st January 2006.
4. Two days Regional Workshop on "Forestry Extension: Experience sharing and perspectives" was organized on 8th and 9th November 2005.
5. National Workshop on "Lesser Known Non-Timber Forest Products: Status, Conservation, Management and Sustainable Utilization" was conducted on 28th and 29th March, 2006. Workshop was sponsored by CSIR.

Attended

1. A total of 11 Officers/Scientists from the institute attended 36th Annual Conference of International Research Group on "Wood Protection" held in Bangalore from 24th to 28th April 2005.
2. A total of 33 scientists participated in Indo-Italian Seminar on "Quality Issues in Forestry and Forest Products" held at IWST, Bangalore on 20th September 2005.
3. All the scientists of the institute attended Regional Workshop on "Forestry Extension: Experience Sharing and Perspective" held at IWST Bangalore on 8th and 9th November 2005.
4. Scientists upto the level of Scientist D attended seminar on "Quality issues in Forestry and Forest Products" conducted by NABARD at Bangalore on 11th November 2005.
5. All the scientists of the division participated in Research Advisory Group Meeting on 29th and 30th November 2005 and presented new project proposals for ICFRE/external funding.
6. All the officers and scientists of the institute attended National Workshop on "Lesser Known Non-Timber Forest Products: Status, Conservation, Management and Sustainable Utilization" on 28th and 29th March 2006.
7. All the scientists attended a Lecture on Preparation of "Research proposal for funding" by Prof. M.G. Chandrakanth, Gandhi Krishi Vidya Kendra (GKV), Bangalore.
8. Scientists and technical staff participated in 'Krishimela' and demonstrated the products/technologies of the institute at University of Agricultural Sciences, GKV, Bangalore from 17th to 20th November 2005.



9. Scientist of the CFP division of the institute participated in programme on Cultivation and Processing of Medicinal and Aromatic plants organized by “ National Institute of Rural Development, Rajendranagar, Hyderabad from 12th to 18th May 2005.
10. Dr. O.K. Remadevi, Mr. Y.B. Srinivasa, Mr. Gaurav Sharma and Ms. P. Sarasija attended International Conference on “Biodiversity of Insects: Challenging issues in management and conservation” held at Department of Zoology, Bharathiyar University from 30th January to 3rd February 2006. Dr. O. K. Remadevi acted as judge for poster session.
11. Dr. N. Rama Rao, Scientist-E, Shri. M. V. Rao, Scientist-C and P. K. Swain, JRF of MoEF Mangrove project participated in the *National Symposium on trends in Plant Science Research* at Visakhapatnam from 8th to 10th December 2005.
12. Dr. K.S. Shashidhar and Dr. R. Vijendra Rao participated and presented a paper on “Need to introduce Wood Science in the educational curriculum” and “ Certification in forest products- opportunities, challenges and future needs” in the National Symposium on Trends in Plant science Research organized at Andhra University, Visakhapatnam from 8th to 10th December 2005.
13. Dr. Balaji and M. V. Rao, Scientists-C participated in the Workshop on Coastal Zone Management at Visakhapatnam by the MSSRF on 25th February 2006.
14. Dr. S.K. Sharma and Mr. P. Kumar participated and presented a write-up on “Utilization of Bamboo culms” in State Level Consultative meet on Bamboo at NABARD Karnataka RO., Bangalore organized by NABARD, Bangalore on 25th November 2005.
15. Dr. R. Vijendra Rao, Scientist-F -
 - ↳ Attended the Eighth meeting of the Timber and Timber Stores Sectional Committee conducted by Bureau of Indian Standards, Bangalore on 16th November 2005
 - ↳ Attended Academic Council Meeting of FRI Deemed University at Dehradun on 11th November 2005.
 - ↳ Attended the Eleventh meeting of the wood and lignocellulosic products Sectional Committee CED 20 organised by Bureau of Indian Standards, Bangalore on 20th December 2005.
16. Dr. O.K. Remadevi, Scientist-E-
 - ↳ Attended the review meeting of the TIFAC (DST) Project in Delhi on 8th July 2005 and presented the findings.
 - ↳ Attended the Workshop on Promotion of Sericulture conducted by AHADS, Kerala on 4th and 5th August 2005.
 - ↳ Participated and presented a paper as an invitee in the National Symposium on Coastal resources and their Sustainable Management: Issues & Strategies held by Bidhan Chandra Krishi Viswavidyalaya, West Bengal from 23rd to 27th November 2005.
 - ↳ As an ICFRE nominated delegate, participated in the APFISN Workshop on Early Warning Systems for Forest Invasive Species at Kerala Forest Research Institute, Peechi from 21st to 24th February 2006.
17. Dr. T.S. Rathore, Scientist E
 - ↳ Participated in the workshop on “Integrating IPR culture with R & D and regional seminar on Intellectual property, protection, valuation and commercialization” on 5th and 6th December 2005 at Bangalore.
 - ↳ Participated in National Conference on Tree Biotechnology: Indian scenario held at TFRI, Jabalpur on 9th and 10th February 2006.
 - ↳ Participated in Regional workshop on recent advances in teak research and management in Central India organized by the EDMC, Maharashtra Ltd., Nagpur, during 17th and 18th March 2006.



18. Dr. N. Rama Rao Scientist-E
 - ↳ Participated in the National Conference on Current Trends in Plant Sciences at Kakatiya University, Warangal during 16th and 17th April 2005.
 - ↳ Participated in the Workshop on Coastal Zone Management at Visakhapatnam by the MSSRF on 25th February 2006.
 - ↳ Attended as advisory committee member at the State level seminar on Biodiversity and conservation of flora and fauna of Andhra Pradesh at Kavali on 11th and 12th March 2006.
19. Dr. K. K. Pandey, Scientist-E
 - ↳ Participated in a Seminar on Fundamentals of Weathering (Part II) in Bangalore on 22nd July 2005 organized by Atlas Material Testing Solutions Chennai.
 - ↳ Visited Gottingen University, Germany and delivered two seminars on “Photodegradation of unmodified and chemically Modified wood” and “FTIR methodology Applications in Wood Science as a Guest Speaker from 12th to 23rd December 2005.
20. Dr. R. Sundararaj, Scientist-E
 - ↳ Attended the National “Brainstorming workshop on Biodiversity” organized by NCSTC Network, New Delhi in collaboration with Karnataka Rajya Vijnana Parishat and Centre for Ecological Sciences, Indian Institute of Science at Bangalore on 16th June 2005.
 - ↳ Attended the regional Conference on “Science Technology Society” on 17th September 2005 held at Bangalore, organized by Karnataka Regional Branch, Indian Institute of Public Administration, New Delhi.
 - ↳ Attended the VI Discussion meeting on Emerging Technologies and Resistance Dynamics in Insects and Crop plants held at COSTED Auditorium, Chennai on 2nd December 2005.
 - ↳ Attended the “National Conference on Biodiversity” held at School of Entomology and Center for National Resources Management, Loyola College, Chennai on 30th and 31st January 2006.
21. Dr. S. Viswanath, Scientist D
 - ↳ Participated in the Workshop on “Promotion of Bio-pesticides and Biofertilizers in Agriculture from 20th to 22nd September 2005 at National Institute of Rural Development (NIRD), Hyderabad.
 - ↳ Attended National Workshop on Clean Development Mechanism (CDM) and Indian Rubber Sector, RRII, on 12th August 2005 at Rubber Research Institute of India, Kottayam.
 - ↳ Attended National Workshop cum training on Bamboo Locational trial, Bambusetum and propagation from 14th to 16th February 2006, conducted by NMBA at Bamboo co-ordinating centre, GB Pant University of Agriculture & Tech., Pantnagar, Uttarakhand. Presented progress of NMBA-BLT experiments being carried out at IWST in Hoskote, Bangalore and FRC, Hyderabad.
 - ↳ Participated in the Workshop on Improvement of Pronunciation and expression skills in Hindi language at Kendriya Hindi Training Institute, Kendriya Sadan, Bangalore on 24th and 25th November 2005.
22. Mr. P. Kumar, Scientist-B
 - ↳ Attended the meeting of Selection cum- Promotion Committee for selection of candidates for various posts at IPIRTI, Bangalore for conducting trade test on 15th and 16th July 2005.
 - ↳ Delivered a lecture during Training to Trainers and Master crafts persons programme on “Wood Based



Crafts" held at office of the Development Commissioner (Handicrafts), Bangalore from 20th February to 3rd March 2006.

23. Shri Gaurav Sharma, SRF

- ↳ Attended the VII Asian Symposium on Odontology and recent trends in Zoology held at Hislop College, Nagpur from 9th to 11th January 2006 and presented a paper. He was awarded Gold Medal in the symposium for the best presentation.
- ↳ Attended the "National Conference of Entomology" held at Department of Zoology, Punjab University, Patiala from 15th to 17th March 2006 and presented two papers.

24. Dr. S.P.S. Rawat, Scientist E participated in National Seminar on "Emerging Scenario of Patents' Protection, Valuation and Commercialization", organized by NRDC at Chennai on 27 April 2005.

25. Sri. Y.B. Srinivasa attended the workshop on *Opisina arenosella* on 27th November 2005 at GKVK and presented an invited talk on "Research on *Opisina arenosella*, What next?"

26. Mr. R. Nainamalai, Scientist B, attended and participated in the National Workshop on "Recent Advances in Forestry Sciences" held at Guru Ghasidas University at Bilaspur in Chhattisgarh on 30th and 31st January 2006.

Exhibition

1. IWST participated in "KRISHIMELA" organized by University of Agricultural Sciences from 17th to 20th November 2005 by putting up a stall of Institute activities.
2. India Wood 2006 exhibition was arranged from 16th to 20th February 2006 at Palace Grounds in which the Institute exhibited stall: Properties and uses of plantation timbers; Advantages of Seasoning and Preservation; Ammonia Fumigation Technique; Sap Displacement Technique; Portable distillation unit; Advantages of root trainers for sandal and teak seedlings; and Wood polymer composites.

Meeting

1. Institute organized 15th meeting of review committee on 12th and 13th December 2005 for the progress of ongoing projects and completed projects of Eastern and Western Ghats, MoEF on behalf of MoEF.
2. The Research Advisory Group Meeting of the institute was held on 30th November 2005 at the institute.

CONSULTANCY

1. Monitoring and evaluation of 40 NMPB funded projects was undertaken by the Institute.
2. Impact assessment of Wild Fauna with the diversion of forest land (154.96 ha) for mining at SCCL, Kothagudem, Andhra Pradesh.
3. Analytical service was rendered to Police Department, Forest Department and public in analysis of essential oils from sandalwood samples. A number of technical inquiries on utilization of various Non-Wood Forest Products from Government Departments and public were attended to and advice given.



4. Attended several enquiries from Forest department officials and NGOs with respect to entomological and pathological problems in nursery, plantations and timber in-service and suitable remedial measures were suggested.
5. Testing services were rendered to different users from Industry, Government departments, Police, Vigilance, CBI, Defence, Railways, Construction industry, NGOs and Private sectors on (a) Timber Identification, (b) Moisture content, (c) Strength property determination and (d) Bulk density and specific gravity.
6. Efficacies of commercial preservatives against wood rotters and termites are being tested for various agencies. The test report on the bioefficacy of TERMINATOR 'A' and 'E' against termite and borer was prepared and submitted to M/s Pidilite Industries, Mumbai.
7. Dr. O.K. Remadevi, Dr. R. Sundararaj and H.C. Nagaveni visited and inspected the teak plantation at Chordi Range, *Shorea talura* plantation at Chandragutti State Natural Forest from 11th to 15th April 2005 and the report on the mortality reasons was submitted to the Forest Department.
8. Dr. O.K. Remadevi, Dr. R. Sundararaj and H.C. Nagaveni visited the Yellapur range of Uttara Kannada Division of Karnataka Forest Department from 7th to 9th May 2005 and analysed the factors responsible for the mortality of *Terminalia tomentosa*.
9. As per the instruction of the Asst. Registrar cum Administrative Officer, Shimoga District, Shri Raja Muthukrishnan attended the court of Shimoga on 4th July 2005 with the permission of Director, IWST, Bangalore.
10. 20 wood samples and preservative solutions received from Government, and other user agencies were analyzed for their preservative content. Problems connected with wood preservation were discussed and suitable advices were given based on their enquiries.

DISTINGUISHED VISITORS

- Dr. Andrees Ropp, DFH (Federal Research Centre for Forestry and Forest Products of Germany) Head, Wood Protection, Leuschnerstrasse 91, 21031 Hamburg, Germany visited the institute on 29th April 2005.
- The IRG delegates Dr. Andrew H.H. Wong, Malaysia Philip D. Evans, Canada and Mark Mankowski, USA visited Entomology laboratory on 29th April 2005.
- Mr. David Venables, European Director, American Hardwood Export Council, London and Mr. Roderick Wiles, Broadleaf Consulting, Hampshire, UK visited the institute on 12th July 2005 regarding collaborative work in wood science.
- Ms. Alexis Chan and Ms. Adeline Goli, Executive Trade Promotion and marketing division, Malaysian Timber Council visited the Institute on 21st October 2005.
- Mr. Ashok Bhatia, Director, MoEF, New Delhi visited the institute on 12th and 13th December 2005.
- Sri Lankan and Nepalese officials visited the labs and had an interaction meeting with the officers of this division during December 2005.
- Dr. S.K. Pandey, Advisor, N MBA visited the Institute on 2nd February 2006.
- Representatives from M/s. Asian Paints, Mumbai visited the Institute on 17th February 2006.
- Italian delegates (ACIMALL, ICE) visited the Institute on 17th February 2006.
- American Softwood Council delegates visited the Institute on 17th February 2006.
- A meeting was arranged with Director, Group Co-ordinator Research and Division Head with Danny Day, President, EPRIDA- to discuss regarding carbon sequestration with the use of charcoal and biofertilizer.