## Forestry Research Project in Thrust Areas/Theme Wise

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<th>S. No.</th>
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| 1.     | Genetic Improvement (Tree Improvement) | Demonstration trial of male and female *Ailanthus excelsa* plants raised through grafting and tissue culture | 1. Establishment of demonstration trial for ex-situ conservation of improved planting stock.  
2. Identification of male and female *Ailanthus excelsa* plants using morphological markers.  
3. Production of male and female plants through grafting and tissue culture.  
4. Assessment of growth and biomass male and female plants separately | AFRI |
| 2.     | Genetic Improvement (Tree Improvement) | Genetic Improvement of *Tecomella undulate* | **Short Term Objectives:**  
• Identification of plus trees  
• Collection of superior quality of seeds for raising new plantations.  
**Long term Objectives:**  
• Assessing heritability estimates for growth characters.  
• Assessing heritability estimates for wood characters.  
• Assessing genetic variability through DNA finger printing.  
• Developing Seed Orchards.  
• Creating genetic base for future breeding work. | AFRI |
| 3.     | Genetic Improvement (Tree Improvement) | Investigation on Genetic variation and inheritance of Western Indian Teak (*Tectona grandis*) | **Short term objectives of the project**  
1. To select phenotypically superior trees from different locations of Gujarat, Rajasthan and Dadra & Nagar Haveli.  
2. To establish genetic tests for testing the growth performance and genetic worth of phenotypically superior trees of | AFRI |
western Indian origin vis-à-vis selected trees from southern and other regions of the country.
3. To investigate inheritance of teak of Western India.

Long term objective of the project
1. To identify parents with good general combining ability for advanced generation breeding.
2. To study character association in teak of Western Indian origin.
To improve the productivity and quality of teak in Western Indian region

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<th>4. Genetic Improvement (Tree Improvement)</th>
<th>Multilocational trial of <em>Eucalyptus camaldulensis</em> and <em>Dalbergia sissoo</em> clones</th>
<th>Evaluation and selection of <em>D. sissoo</em> and <em>E. camaldulensis</em> clones on the basis of Growth Parameters at different locations in Gujarat</th>
<th>AFRI</th>
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| 5. Genetic Improvement (Tree Improvement) | Screening of High Oil and azadirachtin in Neem | 1. Identification of plus trees.  
2. Superior quality of seeds for raising new plantations  
3. Identification of high oil and azadirachtin yielder.  
4. Creating genetic base for future breeding work | AFRI |
| 6. Genetic Improvement (Tree Improvement) | Productivity enhancement through selection of superior clones of *Dalbergia sissoo*. | i) Selection of superior clones on the basis of their performance in the first generation orchard  
ii) Screening of insect pest resistant clones  
iii) Screening of stress resistance clones on the basis of their water potential  
iv) Raising planting stock of superior clones and establishing clonal seed orchard for productivity enhancement | HFRI |
| 7. Genetic Improvement (Tree Improvement) | Population genetic analysis and characterization of *Cedrus deodara* germplasm through i) Analysis of population genetic structure and diversity in *Cedrus deodara* forests of Himalayas.  
ii) Characterization of selected | | HFRI |
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| 8.  | Genetic Improvement (Tree improvement) | Selection and improvement of natural dye yielding plants | 4 years (April, 2009-2013) | Long-term:  
   i) To develop a sustainable and improved package of practices for supply of quality planting material of natural dye yielding plants.  
   Short-term:  
   i) Survey and selection of superior dye yielding genotypes.  
   ii) Development of Biometric indices of natural dye yielding traits from individual species.  
   iii) Determining the minimum age for dye extraction from plant parts.  
   iv) Collection and preservation of germplasm of high yielding genotypes in the form of Natural dye plant garden for demonstration to stakeholders |
| 9.  | Genetic Improvement (Tree improvement) | Selection and Evaluation of potential seed sources and clones of selected species from Jharkhand and adjoining States | 4 years (April, 2009-2013) | i) Identification of superior seed sources and clones of selected tree spp. from Jharkhand and adjoining States  
   ii) Evaluation of above said seed sources/clones  
   iii) Identification of most promising seed sources and clones for Jharkhand  
   Establishment of SSO and CSO of superior genotypes |
| 10. | Genetic Improvement (Tree Improvement) | Characterization of Eucalyptus clones for physiological and nutritional parameters | 3 years | 1. To characterize the Eucalyptus clones of for  
   a. Photosynthetic efficiency and other related physiological characters  
   b. Dry matter allocation to |
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<th>Genetic Improvement (Tree Improvement)</th>
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<th>different biomass components c. Nutrient budgeting 2. To rank and categorize the clones on the basis of the photosynthetic efficiency, dry matter partitioning and nutrient budgeting for use in breeding and clonal forestry.</th>
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| 11. | Development of advanced generation seed orchard of \textit{A. mangium} based on biomass and wood density. | 5 years | 1. Evaluation of families of \textit{A. mangium} for better growth as well as density.  
2. Selection of trees based on index selection.  
3. Raising progeny trials of selected trees for establishment of advanced generation seed orchards after evaluation. |
|   | IFGTB |   | |
| 12. | Evaluation and characterization of clones of \textit{Casuarina} with reference to yield, tree form, biomass, pulping characteristics and key nursery pests. | 5 years | 1. Study the genetic variability and evaluate the clones of casuarina with reference to yield, biomass and tree form.  
2. Characterize the clones based on wood fibre characteristics.  
3. Screen the clones for the key nursery insect pests. |
|   | IFGTB |   | |
| 13. | Evaluation of improved germplasm of \textit{Eucalyptus camaldulensis} and \textit{E. tereticornis} for productivity, wood traits, tolerance to insect pests and diseases and management for higher seed production | 4 years | Evaluation of 110 short listed clones for productivity and wood traits in three different locations  
Screening of eucalyptus germplasm for tolerance to insect pests and diseases  
Evolving methods for enhancing seed production in seed orchards. |
<p>|   | IFGTB |   | |</p>
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| 14.  | Genetic Improvement (Tree Improvement) of Casuarina species through Second Generation Orchards. | 6 years (April, 2008-2014) | 1. To establish second generation breeding populations as progeny tests with open-pollinated families obtained from the first generation breeding orchards.  
2. To assess, rank and thin the progeny tests and convert them into seedling seed orchards.  
3. To quantify genetic parameters and the extent of genotype-environment interaction among the families and identify stable and site-specific families.  
4. To initiate genetic gain testing to quantify gains realized from second generation orchards and supply improved seeds to user groups. | IFGTB         |
| 15.  | Impact of Continuous Moisture on Growth, Flowering, Seed Production and Wood Characteristics of Canal Teak Plantations in Tamil Nadu. | 3 years (April, 2009-2012) | 1. To study the growth, phenology, reproductive traits, seed and seedling characteristics of canal teak plantations in relation to moisture regime.  
2. To select superior trees in canal plantations, multiply clonally, raise clonal trial and evaluate.  
3. To study the wood parameters of different age group of canal teak in relation to soil moisture level.  
To investigate the causes of hollowness in the stem including pest and disease problems and develop suitable management strategies. | IFGTB         |
| 16.  | Improvement of teak through selection, quality seed production, hybridization and clonal evaluation | 5 years                   | 1. Establishment of broad-based breeding populations in different agro climatic zones in Tamil Nadu and Kerala  
2. Production of intra-specific hybrids through controlled pollination  
3. Enhancement of clone bank and | IFGTB         |
| 17. | Genetic Improvement (Tree Improvement) | Progeny testing of selected clones for establishment of clonal and seedling seed orchards in Eucalyptus | 1. To test the open pollinated progenies of selected clones of Eucalyptus for growth vigour  
2. To optimize the number of clones that are to be planted in a clonal seed orchard for maintaining genetic diversity  
3. To assess the genetic gain that can be realised through clonal seed orchard | IFGTB |
| 18. | Genetic Improvement (Tree Improvement) | Studies on the suitability of *Eucalyptus tereticornis* and *E. camaldulensis* clones for various agroclimatic zones of Southern India. | • To identify stable clones across different agro climatic zones in southern part of India.  
• To evaluate and identify the best performing clones specific to each agro climatic zones in southern part of India for bio mass production. | IFGTB |
| 19. | Genetic Improvement (Tree Improvement) | Development of inter and intra specific hybrids in Eucalyptus camaldulensis | **Long term objective of the project**  
• To hybridize *Eucalyptus camaldulensis* selections and develop full sib families  
• To develop suitable controlled pollination methods for developing *Eucalyptus camaldulensis x Eucalyptus pellita* hybrid  
**Short term objective of the project**  
• To document phonological patterns and variatios among *Eucalyptus camaldulensis* clones  
• To evaluate reproductive success under articial pollination condition | IFGTB |
<p>| 20. | Genetic Improvement | Evaluation and evaluation of clones for growth | • To evaluate the influence of soil, climate and physiological | IFGTB |</p>
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<td>21.</td>
<td>Identification of optimal parameters for flowering and fruit set in different Tamarind (Tamarindus indica L.) orchards.</td>
<td>To study the effect of shoot and root pruning for improving flower and fruit production in unproductive tamarind orchards. To assess the effect of manures, potassium nitrate and paclobutrazol for enhancing vegetative growth, flowering and fruit development.</td>
<td>3 years (April- 2010- 2013)</td>
<td>IFGTB</td>
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<td>22.</td>
<td>Evaluation of Calophyllum inophyllum populations for high oil yield.</td>
<td>To identify superior trees with high fruit yield and oil content. To establish germplasm bank of the selected superior trees. To test the superiority of selected trees. To understand the relationship of seed morphology, physiology and oil yield.</td>
<td>4 years (April, 2010-2014)</td>
<td>IFGTB</td>
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<td>23.</td>
<td>Selection and Vegetative Propagation of Neolamarkia cadamba (Roxb.)Miq – An alternative species for Pencil, Match Wood and Ply Wood Industries.</td>
<td>To survey the natural population and existing plantation of Neolamarkia cadamba in Tamil Nadu, Kerala, Pondy, A &amp; N and North Eastern States and select phenotypically superior trees. To standardize the vegetative propagation technique for Neolamarkia cadamba. To standardize the clonal multiplication of Neolamarkia cadamba on a large scale.</td>
<td>4 years</td>
<td>IFGTB</td>
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| 24. | Selection of clones of *Acacia auriculiformis* with desirable stem form and wood properties for short rotation timber production. | 5 years (August, 2010-2015) | 1. Evaluation of different provenances of *A. auriculiformis* for wood properties.  
2. Selection of CPTs for better stem form and wood properties and vegetative propagation of CPTs.  
3. Evaluation of clones for growth as well as stem form in multilocations | IFGTB |
| 25. | Study on reproductive biology and breeding systems in *Ailanthus excelsa* and *Ailanthus triphysa* | 3 years (May, 2010-2013) | • To study the vegetative, reproductive and phenological variations.  
• To understand pollination biology and breeding system.  
• To comprehend levels of compatibility and to perform inter specific control pollination | IFGTB |
| 26. | Improving the accessibility and affordability of improved seeds from breeding programs to benefit large numbers of smallholder tree farms and rural communities in Tamil Nadu and Puducherry, India. | 2 years (Oct., 2009-2011) | 1. To provide IFGTB and Forestry Departments of Tamil Nadu and Puducherry higher level understanding of Australia’s seed production-distribution activities to support the development of farm forestry and the national forestry action plan on climate change.  
2. To transfer an initial batch of seeds (or grafted-clones) from IFGTB’s tree breeding programs by establishing two seed production-distribution hubs in strategically targeted tree farming areas in Tamil Nadu and Puducherry.  
3. To prepare a community-based Action Plan for facilitating the transfer and mass production-distribution of seeds from IFGTB’s tree breeding programs at more affordable prices for smallholder tree | IFGTB |
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<td>Realizing genetic gain from teak seed orchards: Enhancing seed production and outcrossing through cultural and ecological interventions.</td>
<td>3 years (Sept., 2009-2012)</td>
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<td>28.</td>
<td>Genetic Improvement (Tree Improvement)</td>
<td>Genetic improvement of <em>Melia azedarach</em> and <em>Melia dubia</em> through plus tree selection assessment of genetic variation and progeny trial establishment (Phase -1) – PLAN/6-126/FRC/08</td>
<td>4 years (April, 2007-2011)</td>
<td>IWST</td>
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| 29. | Genetic Improvement | Standardization of flower induction | • Survey, selection of plus trees and collection of seeds from Andhra Pradesh, Karnataka, Tamil Nadu to establish progeny trial in Andhra Pradesh  
• To screen the plus trees having higher oil content through quantitative analysis.  
• To asses the genetic variation of selected plus trees through Morphomatric traits and RAPD. | IWST |

4. To set up a network of trained tree farmers/community leaders, state forestry field managers and technical officers to implement the community-based seed production-distribution Action Plan for Tamil Nadu and Puducherry.

27. **Genetic Improvement (Tree Improvement)**

- **Realizing genetic gain from teak seed orchards:** Enhancing seed production and outcrossing through cultural and ecological interventions.
  - 3 years (Sept., 2009-2012)

28. **Genetic Improvement (Tree Improvement)**

- **Genetic improvement of *Melia azedarach* and *Melia dubia*** through plus tree selection assessment of genetic variation and progeny trial establishment (Phase -1) – PLAN/6-126/FRC/08
  - 4 years (April, 2007-2011)

29. **Genetic Improvement**

- **Standardization of flower induction**
  - To standardize the chemicals/harmones for flower
| (Tree Improvement) | schedule in CSO of *Tectona grandis* and its impact on fruit set. | induction in CSO of teak.  
• To standardize dosage, mode and time of application of the treatments  
• To study the effect of chemical/hormones on flowering and fruit setting. |
|-----------------|------------------------------------------------------------------|-----------------------------------------------------------------------|
| 30. Genetic Improvement (Tree Improvement) | Variability studies in *Hardwickia binata* – a multipurpose tree species in Karnataka, Andhra Pradesh and Tamil Nadu | • Study variation with reference to tree morphology, seed and seedling traits  
• Study the variability with reference to wood traits such as specific gravity, bark thickness, grain angle and calorific value.  
• To document the status of natural regeneration.  
• To characterize genetic diversity using molecular markers |
| 31. Genetic Improvement (Tree Improvement) | Study of reproductive Biology and Seed Production in Clonal Seed Orchard of *Gmelina arborea* | Long term objectives  
• To enhance the quality and quantity seed production of *Gmelina arborea*  
Short term objectives  
• To study flowering pattern and time of synchronized flowering among the clones of *Gmelina arborea*.  
• To study within and between clonal variation in reproductive structure of *Gmelina arborea*.  
• To assess seedling quality periodically after storage |
| 32. Genetic Improvement (Tree Improvement) | Reproductive biology of *Aquilaria malaccensis* Lamk. a critically endangered and economically important species for effective conservation | Long term:  
i) To develop strategies for conservation and sustainable management of the species and establishment of gene bank for future breeding studies.  
Short term:  
i) Identification of populations for studies. |
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<td>Genetic improvement of Buchanania lanzan Spreng</td>
<td>Long term: 1. To enhance the productivity of <em>Buchanania lanzan</em> 2. Selection of plus trees. 3. Establishment of progeny trial 4. To study inheritance pattern of <em>B. Lanzan</em> 5. To identify good general combiners</td>
<td>4 years (July, 2007-2011)</td>
<td>TFRI</td>
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<td>34</td>
<td>Developing methodology and parameters for selecting of CPTs of NTFPs species.</td>
<td>1. To develop methodology for selecting of CPTs of NTFPs. 2. To develop parameters for selecting of CPTs of NTFPs.</td>
<td>2 years (July, 2008-2010)</td>
<td>TFRI</td>
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<td>Field evaluation of Tissue Culture plants of <em>Eucalyptus hybrids</em> at seven agro-climatic sites</td>
<td><em>Evaluation of quantitative traits of two tissue culture raised hybrid of <em>Eucalyptus</em>. 2. Assessment and comparison of traits of tissue culture raised plants from seedling raised hybrids wherever available.</em></td>
<td>3 years (April, 2008-2011)</td>
<td>FRI</td>
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<td>36</td>
<td>Inheritance pattern of wood anatomical traits in <em>Populus deltoids</em> Bartr. Ex Marsh.</td>
<td><em>To evaluate wood quality on the basis of specific gravity, vessel and fiber morphology and other anatomical parameters in the parents and offspring.</em> 2. To analyze inheritance pattern of fiber, vessel-</td>
<td>3 years (April, 2008-2011)</td>
<td>FRI</td>
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<td>Genetic Improvement (Tree Improvement)</td>
<td>Clonal screening of <em>Dalbergia sissoo</em> in relation to nitrogen utilization and biomass production</td>
<td>Characteristics and specific gravity in offspring.</td>
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| 37. | Clonal screening of *Dalbergia sissoo* in relation to nitrogen utilization and biomass production | 5 years (April, 2008-2013) | - To assess the nitrogen utilization behaviour in some promising clones of *Dalbergia sissoo* under pot culture conditions.  
- To draw a correlation between nitrogen assimilation and fixation patterns and biomass production in the clonal materials.  
- To assess the seasonal variation effects on nitrogen assimilation and fixation. |
|   | Population genetic analysis and characterization of *Cedrus deodara* germplasm through DNA based markers | 3 years (April, 2008-2011) | - Analysis of population genetic structure and diversity in *Cedrus deodara* forests of Himalaya.  
- Characterization of the selected germplasm of deodar through DNA based markers for genetic relatedness.  
- Generating the fingerprints of deodar germplasm using DNA markers for development of DNA fingerprint database. |
| 38. | Genetic evaluation and characterization of different clones for higher productivity and hybridization in *Dalbergia sissoo* (Roxb.) | 3 years (April, 2009-2012) | - To identify most promising genotypes through multi-locational clonal trials and estimate genetic parameters and genetic correlations  
- To assess adaptability, stability and genetic resemblance among the clones  
- To characterize and develop genetic relationship in selected genotypes for physiological and wood traits |
<p>| 39. | Development of micropropagation protocol for mature superior recombinants emanating from F2 generations of Eucalyptus hybrid E. citrodora Hook. x E. torelliana F.v. Muell. | FRI | To develop complete micropropagation protocol; that is from lab to hardening in green house, for multiplication of superior F2 recombinants of <em>Eucalyptus hybrid, E. citrodora</em> and <em>E. torelliana</em>. |</p>
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<td>41.</td>
<td>Validation of chemical markers conferring Cylindrocladium leaf and seedling blight resistance in Eucalyptus germplasm</td>
<td>To validate chemical markers conferring Cylindrocladium leaf and seedling blight resistance in Eucalyptus germplasm</td>
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<td>42.</td>
<td>Interspecies hybridization between <em>Eucalyptus pellita</em> and <em>E. urophylla</em> and development of F1 Hybrids</td>
<td>To increase the productivity of Eucalyptus through selection and breeding</td>
<td>FRI</td>
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<td>43.</td>
<td>Screening of Eucalyptus germplasm for disease resistance against Cylindrocladium leaf and seedling blight</td>
<td>Short term: 1. Testing Eucalyptus germplam for disease resistance against CLSB in the genetic material currently being used by state forest departments of Uttarakhand, Haryana and Punjab. 2. Screening Eucalyptus genetic material developed at Forest Research Institute for disease resistance against CLSB. 3. Molecular characterization of Cylindroclodium quinquesptatum isolates of Uttar Pradesh causing Eucalyptus Seedling blight by RAPD-PCR and ITS region amplification of DNA.</td>
<td>FRI</td>
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| 44. | Establishment of Multilocational clonal trial and study of wood anatomical properties and cellulose content of promising clones of *Populus deltoides* | **Long term objectives** Development of superior clones of *Populus deltoides*  
**Short term objectives** Establishment of multilocation clonal trials of *Populus deltoides* Study of wood anatomical and physical properties and cellulose content of promising clones of *Populus deltoides* | FRI |
| 45. | Genetic Improvement (Tree Improvement) | Germplam collection, evaluation and planting of Jatropha and Karanja for improved productivity and higher oil content 3 years (April, 2009-2012) | • Identifying high yield clones of *Dalbergia sissoo* matching to the particular site through evaluation.  
• Physiological evaluation of different clones.  
• To estimate the degree of flowering synchronization among different clones.  
• To estimate the degree of mortality in Clonal Seed Orchards.  
• To impart training/know-how to personnel of State forest departments and other stake holders on establishment of Clonal Plantations/ Clonal Seed Orchards for the production of superior clones as well as superior quality seeds. | FRI |
| 46. | Genetic Improvement (Tree Improvement) | Assessment of wood properties and growth of the progenies of different clones of *Populus deltoides* Bartr. ex Marsh.  
3 years (March, 2010 – 2013) | 1. To analyze inter-progeny radial variations in wood and growth traits.  
2. To correlate growth parameters with wood traits.  
3. To screen progenies on the basis of wood and growth traits.  
4. To access the broad sense inheritability in *Populus deltoides* for wood and growth traits | FRI |