CHAPTER V

RAIN FOREST RESEARCH INSTITUTE, JORHAT

The Rain Forest Research Institute, (RFRI), Jorhat was established to conduct research on ecology, regeneration, tending and management of forests in the seven north-east states of India. The mandate given to the institute was conservation methods to preserve the unique heritage of the region, containment of shifting cultivation and multi-facet use of mangroves without damage to the ecological characters.

An area of about 12 ha was taken on lease from the Assam Tea Corporation at Nahorani and plantation of varied species of fuel wood tree were raised. The site is ideal for extension and demonstration activities. The Institute is tuning its research, educational training and development efforts to contribute effectively to bring prosperity to the whole north-eastern region of India through the introduction of forest based technologies developed at RFRI, Jorhat.

PROJECTS COMPLETED DURING THE YEAR 2002-2003

Project 1: Standardization of nursery techniques for selected bamboo species of north-east India [RFRI/SM/02/1999-2003]. *For technical report contact, Principal Investigator - Mr. S. Pattanaik.*

Findings: Nursery technique for four bamboo species viz., *Bambusa tulda, Bambusa nutans, Bambusa balcooa* and *Dendrocalamus hamiltonii* has been standardized and a package of practices has been developed for the same.

Project 2: Genetic improvement of *Dipterocarpus retusus* BL. Syn. *Dipterocarpus macrocarpus* [RFRI / TI/ 02/1998-2002]. *For technical report contact, Principal Investigator - Mr. Ajay Thakur.*

Findings: A significant improvement in the vegetative multiplication of different clones has been achieved. The rooting success of about 60 per cent has been achieved in a number of clones of *D. retusus*. Juvenility is being introduced in different clones by repeated coppicing and clonal propagation. All the genotypes are being maintained in the gene bank of the Institute.

Project 3: Genetic improvement of *Gmelina arborea* [RFRI / TI/ 03/1998-2002]. *For technical report contact, Principal Investigator - Dr. Ashok Kumar.*

Findings : A clonal trial raised through chip budding of *Gmelina arborea* showed that at the age of 24 months significant variations among the clones for all the traits. Broad sense heritability was found to be 0.3122, 0.4416 and 0.3734 with a genetic gain of 18.15, 24.60 and 30.15 percent for height, DGL and DBH, respectively. The analysis depicted that DBH was the most important trait with genotypic and phenotypic coefficient of variations of 18.55 and 30.37 percent, respectively.

Project 4: High value merchantable biomass production of bamboo and teak through genetic improvement [RFRI/TI/ 05/1999-2003]. *For technical report contact, Principal Investigator - Dr. Ashok Kumar.*

Findings : All the clones collected from different regions have been established in the gene bank of the institute. The performance of different progenies in the progeny trials is being observed and periodic observations are being collected.

PROJECTS CONTINUED DURING THE YEAR 2002-2003

Project 1: Fertilizer response studies in nursery for some important species of north-east region [RFRI/SM/02/1999-2003]. *Principal Investigator - Mr. B. Goala.*

Status : To identify the optimum age of seedlings for transplantation, field trials on four different age groups with a gap of two weeks interval, seedlings of *Gmelina arborea* in container of different size have been planted and monthly recording of data for survival and quarterly growth data on two parameters i.e. on height and collar diameter are in progress. Calculated the total biomass for two years old saplings for each group of plantation.

Project 2: Germplasm evaluation of selected bamboo species for various end uses [RFRI / SM / 03/2001-2004]. *Principal Investigator- Mr. V.K.W. Bachpai.*

Status: Seedlings of bamboos viz. *Bambusa balcooa, Bambusa nutans, Bambusa tulda* and *Dendrocalamus hamiltonii* were prepared by vegetatively propagating.

Project 3: Management of seed and soil borne diseases of *Gmelina arborea* and *Dipterocarpus retusus* in nursery [RFRI/FP/05/2000-2003]. *Principal Investigator - Dr. A.N. Singh.*

Status: Various seedling abnormalities i.e. seedling with two tap root but single shoot, emergence of single radicle but non-emergence of shoot at all, seedling lacking shoot differentiation and bifurcation of main shoot into two shoots in *D. retusus* were recorded.

Various diseases of *G. arborea* like damping off, root rot, collar rot, nodal necrosis, leaf blight and leaf spot were recorded in seedlings, while sapling branch necrosis and sapling leaf defoliation were recorded in clonal saplings. Percent disease incidence and mortality was recorded in each case. Highest disease

incidence was recorded in case of leaf spot (80%) caused by *Corynespora cassicola* and leaf blight (55%) caused by *Sclerotium rolfsii,* while highest mortality was recorded in case of root-rot (45%). Identification of causal organisms is being made.

Project 4: Integrated nutrient management in shifting cultivation soil through green manuring and inorganic fertilizer [RFRI/SC/04/2001-2004]. *Principal Investigator- Dr. Jasbir Singh.*

Status: The effect of green manure and inorganic fertilizer application to enhance crop productivity and soil fertility on abandoned jhum land was studied. Crop productivity was significantly high in *Sesbania bispinosa* incorporated plot followed by *Lantana camara* incorporated plot.

Project 5: Ecological monitoring of biological diversity and the strategy of conserving thereof in the Kaziranga National Park of Assam [RERI/EE/01/1999-2001]. *Principal Investigator - Dr. P. K. Khatri.*

Status: Enumeration of important species in woodland and grassland ecosystem was carried out. Productivity of grassland was studied. Effect of burning and clipping on biomass estimation of tall grass has shown that the burning of *Phragmites karka* promotes the growth and yield of biomass. Recorded, 23 endemic, endangered and medicinal plants.

Project 6: Evaluation of current status of tropical moist forest for their sustainable utilisation with special reference to Dipterocarps [RFRI/EE/02/2000-2002]. *Principal Investigator - Dr. S. Trivedi.*

Status: Enumeration of on ehectare area of the tropical moist forest, predominantly Hollong-Mekai (*Dipterocarpus retusus-Shorea assamica*) formations in the Namdapha Tiger Reserve of Arunachal Pradesh has revealed the rich floristic diversity prevalent in the forests. Ecological studies indicated that the present conditions for the establishment of major species are being modified with the passage of time.

Project 7: Development of VAM as biofertilizer for some economically important forest plant species of Assam and Arunachal Pradesh [RFRI/FP/07/2000-2003]. *Principal Investigator - Mr. Rajib Kumar Kalita.*

Status: Twenty most widely used tree species belonging to 11 families were tested for percent VAM colonization and spore population. The lowest root infection was observed in *L. nitida* (10.67%) and highest in *S. saman* (29.33%) followed by *A. lebbek* (29.17%). Microscopic observation of root segments revealed that VAM fungi produced vesicles in 19 species and arbuscules in the roots of 8 species. One species (*L. nitida*) did not produce vesicles and similarly twelve species did not show arbuscule formation. Mycelia were however observed in all the specie studied.

Project 8: Study of seed biology of selected forest tree species of north-east India [RFRI/TI/01/1998-2003]. *Principal Investigator - Dr. M. Kundu.*

Status: Evaluation on storability of *Calamus tenuis* seeds was assessed in different storage conditions. It was observed that the seeds could best be stored

in high humid condition and reducing the moisture content before storage was not effective to extend the storage period. The developmental stages of one of the highly recalcitrant seeds of *Aquilaria agallocha* were studied. The differences in seed morphology, desiccation sensitivity and storability of different maturity stages from those of orthodox category of seeds were identified. It was observed that although the seeds developed tolerance to some dehydration at the midway of their development, the storability was acquired after full maturity. For long-term storage program, Ellis and Roberts's (1980) equations were used on one of the orthodox seeds of *Pongamia pinnata* to evaluate their applicability. Simplest equation was found to be more useful in this regard. The constants fit for this species were estimated. Also, the relation between the upper moisture limit and oil content of several orthodox species was assessed. The seeds of *Terminalia myriocarpa* were identified as orthodox species.

Project 9: To study the dynamics of soil physico-chemical and biological properties under different tree vegetation. *Principal Investigator - Dr. K.G. Prasad.*

Status: Soil properties under 20 different tree vegetation consisting of 6 legumes and 14 non legume species were studied. It was observed that soil pH decreased and total nutrient contents increased on completion of three years. Enumeration of microbial population from 20 plantation of Nahoroni study site was done by using serial dilution technique. The fungal flora was identified with the help of nature, types and colour of colonies. The number of fungal population was more as compare to bacteria and actinomycetes in all plantations.

Project 10: Study on market mechanism of NTFPs for economic upliftment of jhumias [RFRI/SC/05/2002-2005]. *Principal Investigator - Mr. H. P. Singh.*

Status : Survey conducted in selected villages revealed that about 70 % vendors are middle to old aged women's in weekly markets. In all 80 % vendors sold own collected products in markets. About 90 % vendors are not using any weighing tools for selling of NTFPs.

Karbi tribal women selling jhum crops/vegetables at a local market in Silomjan-Assam

Project 11: Studies on distribution dynamics of bamboos and canes and their *ex-situ* conservation [RFRI/EE/03/2001-2003]. *Principal Investigator- Dr. K.C. Pathak.*

Status: Germplasm collection and conservation of 30 species of bamboos have been done.

NEW PROJECTS INITIATED DURING THE YEAR 2002-2003

Project 1: Reclamation of highly eroded site of Cherapunji, Meghalaya [RFRI/SM/04]. *Principal Investigator - Mr. B. Goala.*

Status: Initiation of activities for implementation of the project is under process.

Project 2: Capacity building of village level committee for efficient forest resource management through JFM [RFRI/CFE/01]. *Principal Investigator - Mr. B.K. Pandey.*

Status: Action was initiated for formation of Village Level Committee (VLC) through people's participation and two VLCs namely (1) Gram Sakshamta Vriddhi Samiti Kamlabari and (2) Gram Sakshamta Vriddhi Samiti, Choumaimari were formed at Majuli. In-house training programme on "Macroproliferation and preservation of bamboo for rural development" was planned. Two on-site training programmes were also organized.

Mat making is one of the most prominent cottage industries of Assam

Project 3: Studies on yield and quality traits of fragrant products from selected humid-tropical aromatic plants [RFRI/CFE/02]. *Principal Investigator - Dr. Y.C. Tripathi.*

Status : Information about farmers, NGOs and private entrepreneurs engaged in *Pogostemon cabalin* (Patchouli) cultivation in different states of north-east region were collected and compiled.

Project 4 : Development of agrotechniques for patchouli (*Pogostemon cablin*) under agroforestry [RFRI/CFE/03]. *Principal Investigator - Mr. Pawan Kaushik.*

Status: Nursery of patchouli was established as a source of plant material for multiplication. Experiments were laid out to assess the effects of FYM, fungicide and nematicide application on the growth, survival and biomass production of the patchouli plants raised through cuttings, performance of cutting with different lenght and diameter on various growth and yield parameter and effect of root trainer and performance of cuttings without leaves in comparison to leafy cuttings under mist chamber and agronet conditions.

Project 5: A comparative analysis of energy efficiency of shifting cultivation areas in different location of north-east India [RFRI/SC/06]. *Principal Investigator - Dr. Jasbir Singh.*

Status: Work Initiated.

Project 6: Growth, biomass and energy production potential of selected energy plantation species. [RFRI/SC/07]. *Principal Investigator- Mr. Anup Chandra.*

Status: Work initiated.

Project 7: Stability test of various clones and progenies for different characters in *Gmelina arborea* [RFRI/TI/10]. *Principal Investigator- Dr. Ashok Kumar.*

Status: Work initiated.

EXTERNALLY AIDED PROJECTS

PROJECTS COMPLETED DURING THE YEAR 2002-2003

Project 1: Survey and evaluation of selected species for energy plantation in north-east region of India [RFRI/EP/01/MNES/1999-2001]. *For technical report contact, Principal Investigator - Mr. N.N. Zhasa.*

Findings: A report on fuel wood demand and supply in the Jorhat district of Assam has been completed. Total supply and consumption of fuel wood in the district is 4,70,083 and 4,94,102 tonnes per year respectively. Fuel wood deficit is found to be 24,018 tones per year, which counts 5% of the total consumption. A total of 35 species are being used for fuel wood purpose. An evaluation trial of 20 fuel wood species was conducted. On the basis of growth, biomass, coppicing ability and energy value, number of species identified which are suitable for energy plantation programme. These species are *Mallotus albus, Anthocephalus chinensis, G. arborea* and *Alstonia scholaris*.

Mallotus albus one of the most promising specie out of 20 tree species raised under energy plantation in degraded lands

Project 2: Resource enhancement and processing of cane and bamboo species suitable for handicrafts [RFRI/EP/02/UNDP/2000-2002]. *For technical report contact, Principal Investigator - Dr. K. G. Prasad.*

Findings: Project concluded. Data compilation and final report preparation are in progress.

NEW PROJECTS INITIATED DURING THE YEAR 2002-2003

Project 1: Indigenous knowledge of Angami tribe in sustainable management of biodiversity in Nagaland India. *Principal Investigator - Dr. Jasbir Singh.*

Status: Work initiated.

Research achievements

Name of state	No. of projects completed in 2002-2003	No. of ongoing project in 2002-2003	No. of initiated in 2002-2003
Assam	-	2	2
Arunachal Pradesh	-	-	2
Manipur	-	1	2
Meghalya	-	-	2
Mizoram	-	-	2
Nagaland	-	-	2
Tripura	-	-	2

Education and trainings

1. Shri Ajay Thakur, proceed to Oxford University, UK under Commonwealth Scholarship from 13-01-2003 to 31-10-2004 to pursue Ph.D.

Trainings organised

- The training was imparted to the officials of following state forest departments to maintain the seed production areas and seed orchards developed at their respective states.
- Dr. Ombir Singh attended the "Seventh Round Table Conference on Dipterocarp" held at Kuala Lumpr, Malaysia during October, 07-10-2002 and presented a paper on "Conservation and Genetic Improvement of *Dipterocarpus retusus* in north-east India."

- Training-cum-demonstration program on cultivation and management of bamboo plantation, nursery adaptation technique for vegetative multiplications etc. were given to 28 nos. of officers and 42 nos. NGOs and farmers on 6th, 20th, 22nd and 23rd August, 2002.

Sl. No.	Name of the State Forest Deptt.	Location of training	No. of participants
01	Manipur State Forest Department	Imphal	30
02	Mizoram State Forest Department	Kolasib	24

- A two day training cum workshop on the theme "Macroproliferation and Preservation of Bamboo for Rural Development" was organized at RFRI, Jorhat during October 09-10th, 2002.
- On-site training on Bamboo was organized at Choumaimari and Kamalabari, Majuli (Assam) on 30 and 31st January, 2003.
- Trainings were organized and technologies pertaining to the macroproliferation and preservation of bamboo were demonstrated to the farmer, NGOs and forest officials of Majuli (Assam) during the year 2002-03.

Publications

Books

1. Goala, B.; Prasad, K.G. and Borthakur, J.B. (2002). "Propagation Technique of *Gmelina arborea*. In the book: A Technology Mission at RFRI, Jorhat 2002.

2. Kumar, Ashok; Matharoo, A. K. and Gurumurthi, K. (2002). Implications of plastics in cloning of forest tree species. In : Application of plastics in Agriculture in Northeast Region (ed. K. K. Satapathy), ICAR Research Complex for NEH Region, Umiam, Meghalaya.

3. Tripathi, Y.C. (2002) Biotechnology towards enhanced production of phyto- pharmaceuticals, *In*: Recent Progress in Medicinal Plants, Vol. 4-Biotechnology and Genetic Engineering (Eds. Govil, J.N., Anand Kumar, P. and Singh, V.K.), SCI TECH PUBLISHING LLC, Houston, Texas, USA, 75-98 pp.

4. Tripathi, Y.C. and Sharma, C.P. (2002). Pharmacological validation of anti-diabetic phytomedicines of arid Rajasthan, *In*: Recent Progress in Medicinal Plants, Vol. 8 - Phytochemistry & Pharmacology II (Eds. Majumdar, D.K., Govil, J.N. and Singh, V. K.), SCI TECH PUBLISHING LLC, Houston, Texas, USA, 243-256 pp.

5. Tripathi, Y.C.; Tripathi, G. and Verma, P. (2002). Chemical toxicants and health hazards, *In*: Modem Trends in Environmental Biology (Ed. Tripathi, G.), CBS Publishers & Distributors, New Delhi.

6. Tripathi, Y.C.; Kaushik, Pawan and Pandey, B.K. (2003). Patchouli (*Pogostemon cablin*): A promising medicinal and aromatic crop for northeastern India, (Eds. Govil, J.N. and Singh, V.K.), SCI TECH PUBLISHING LLC, Houston, Texas, USA.

7. Tripathi, Y.C.; Pandey, B.K., and Kaushik, P. (2002). *Pogostemon cablin* : Research perspectives for authentication, productivity enhancement and value addition. *In*: Commercialization of Patchouli, *Proc. Workshop on commercialization of Patchouli in N.E. region*, (Eds. Ahmed, A, Deka P. and Gogoi) NEDFi, Guwahati, pp. 105-114.

8 Kaushik, Pawan; and Tripathi, Y.C. (2002). Participatory assessment of biological resources: *Proc. Modular Workshop on Documentation of Biological Resources in Madhya Pradesh*, 84-90 pp.

9. Kaushik, Pawan, Tripathi, Y.C. and Pandey, B.K. (2002). Scope of Patchouli based alley cropping in afforestation of degraded lands of northeast region of India. *In* : *Proceedings of Workshop on Application of Improved Technology for Afforestation in North East India*, (Eds. Prasad, K.G. and Goala, B.) Chapter 16: 106-115 pp.

10. Pandey, B.K.,; Kaushik, Pawan; Tripathi, Y.C. and Singh, H.P. (2002). *Dendrocalamus strictus* : A promise for afforestation in north-east. *In : Proceedings of Workshop on Application of Improved Technology for Afforestation in North East India*, (Eds. Prasad, K.G. and Goala, B.) Chapter 15: 99-105 pp

Research papers

1. Kundu, M. and Kachari, J. (2002). Preliminary studies on storage behavior of *Termunalia myriocarpa* seed. In *Danida Forest Seed Centre Newsletter* (IPGRI): No. 10.

2. Singh, A. N.; Borah, T.R.; Sarma, G.S. (2002). Seed pathogens of *Dipterocarpus retusus* and strategies for their management. *DFSC News Letter* No. 10, pp. 10-14, Denmark.

Conferences/meetings/workshops/seminars/symposia

1. Gogoi Sabi.; Singh, J. and Prasad, K.G. (2002). Role of tree in soil amelioration under different agro-forestry system. Paper presented in National Workshop on Agro-Forestry, Nov. 22nd 2002 at IFGTB, Coimbatore.

2. Pattanaik, S.; Singh, A.N.; Kundu, M.; Trivedi, S.; Tripathi, Y.C. and Prasad, K.G. (2002). Proceedings of Expert Consultations on 'strategies for sustainable Utilization of Bamboo Resources subsequent to Gregarious Flouring in the North East. Consultation organized at Rain Forest Research Institute, on April 24-25, 2002.

3. Pattanaik, S.; Pathak, K.C.; Trivedi, S.; P.K. Khetri and Prasad, K.G. (2002). 'Cohort Mapping in Bamboo Resource Management'

(i) Paper presented in the Workshop *Strategies For Sustainable Utilization of Bamboo Resources Subsequent to gregarious*

flowering in the North-East organized by Rain Forest Research Institute in association with Cane and Bamboo Technology Centre, Guwahati & United Nations Industrial Development Organization, April 24-25, 2002.

(ii). Singh, H.P.; Tripathi, Y.C. and Singh, Jasbir (2002). Marketing and utilization of bamboo with reference to flowering of *Melocanna baccifera* in northeastern India. *In: Proc. of Expert Consultation on Strategies for Sustainable Utilization of Bamboo Resources Subsequent to Gregarious Flowering in the North-East*, (Eds. Patnaik, S., Singh, A.N., Kundu, M., Trivedi, S., Tripathi, Y.C. and Prasad, K.G.), 72-79 pp.

4. Tripathi, Y.C.; Singh, H.P.; Pandey, B.K. and Kaushik, Pawan (2002). Prospects of bamboo of flowering and resource management: An industrial perspective. *In: Proc. of Expert Consultation on Strategies for Sustainable Utilization of Bamboo Resources Subsequent to Gregarious Flowering in the north-east*, (Eds. Patnaik, S.; Singh, A.N.; Kundu, M.; Trivedi, S.; Tripathi, Y.C. and Prasad, K.G.), 80-91 pp.

5. Trivedi, Sudhir; Singh, Jasbir and Prasad, K.G. (2002). Biodiversity in North-east India-major threats and mitigation options. Paper presented during "Workshop on International Year of Mountain 2002" from 12 to 14 November, 2002, Organized by the Department of Environment and Forests, Government of Mizoram at Aizwal.

6. Khatri, P.K.; Trivedi, S. and Prasad, K.G. (2003). "A carbon sequestration option for north-east India with special reference to carbon emission points". Paper presented in National Seminar on Management of Degraded forests for productivity enhancement and carbon sink expansion. Organized by Tropical Forest Research Institute, Jabalpur on 15-16 January 2003.

7. Khatri, P.K.; Rawat, V.R.S.; Bora, H.R. and Sharma, R. (2002). "Biomass and primary production of *Phragmites karka* in Kaziranga National Park observation on the effect of burning and clipping" paper presented in the seminar on "National seminar on Botanical research in Wildlife Sanctuaries and National Parks of Assam" organized by Handique Girls College, Guwahati on 27th and 28th July 2002.

8. Khatri, P.K.; Bora, H.R. and Sharma, R. (2002). "Vegetation Analysis of Woodland of Boruntika, Kohora Range of Kaziranga National Park Assam." Presented in National Seminar on Botanical research in Wildlife Sanctuaries and National Parks of Assam organized by Handique Girls College, Guwahati on 27th and 28th July 2002.

9. Prasad, K.G.; Trivedi, S.; Rawat, V.R.S. and Khatri, P.K. (2002). "Climate change : Impact on Biodiversity and strategies for sustainable management in north-east India" paper presented during Guwahati conference on Climate change : Issues and opportunities on 11, September 2002 organised by Ministry of Environment and Forests, Government of India, the Associate Chamber of Commerce and Industry of India and the North-east Chamber of Commerce and Industry.

10. Trivedi, S.; Singh, Jasbir and Prasad, K.G. (2002). "Biodiversity in North-east India major threats and mitigation options". Paper presented in

Workshop on International year of Mountain 2002 from 12 to 14 November, 2002 , organized by the Department of Environment and Forests, Government of Mizoram at Aizwal.

11. Dr. Y.C. Tripathi; and Shri Pawan Kaushik presented a paper entitled "*Pogostemon cablin*: Research perspectives for authentication, productivity enhancement and value addition" in the *Workshop on Commercialization of Patchouli* (*Pogostemon cablin*) organized by North-east Development and Finance Corporation (NEDFi) on 9-11 April, 2002, at Guwahati.

Linkages and collaboration

The linkages and collaboration with various forest departments of Assam, Meghalaya, Manipur, Arunachal Pradesh, Nagaland, Tripura, West Bengal and organizations like Assam Agricultural University, Jorhat, Regional Research Laboratories, Jorhat, Tocklai Experimental Station, Jorhat, North Eastern Hill University, Shillong, Central University, Tezpur, Guwahati University, Guwahati, Assam University, Silchar, North Eastern Regional Institute of Science and Technology, Naharlagoon, State Forest Research Institute, Itanagar, National Bureau of Plant Genetic Resources, New Delhi, Kerala Forest Research Institute, Peechi were developed. A MoU was developed between RFRI and TFD and the development work has already been initiated.

Distinguished visitor

- Professor K.H. Hoffmann, Head of the Department, Animal Ecology and Dean University of Bayreuth, Germany visited RFRI, Jorhat on 27th February, 2003.