

FORESTRY RESEARCH IN ASSAM

Forestry research in Assam is headed by Chief Conservator of Forests (Research, Education and Working Plans) and Conservator of Forests (Research & Education). There are 2 Divisions – Silviculture and Genetics. The Silviculture Division has 5 Ranges at Basistha, Rani, Amsoi, Loharband & Jeypore and the Genetics Division has 4 Ranges with Hd/Qr at Rani, Basistha, Potasali & Lakhpathar There is only 1 Scientist & 1 Research officer in the wing.

A full fledged Silviculturist was appointed in Forest Dept by the Assam Govt. during the year 1927 with Hd/Qr at Shillong, erstwhile capital of the State. Prior to this, a botanical officer used to carry out the activities of the Silviculturist. Initially, the main works under taken by the Silviculturist were directed towards the following domains, **a) laying out experimental plots b) formation of incremental plots c) classification of forest types in the State & d) laying out of sample plots of important economical species.** However, over the decades experiments carried out by the Silviculturist encompassed issues like feasibility of introduction of exotic species, determining suitable propagation techniques & optimum thinning cycle of several species, study on growth & yield of bark & many more. Some outstanding officers like Late M.L.Saikia, Late M.N.Pait, Late J.Swer, Late S. Rajkhowa & Late D.P.Neog headed the prestigious Silviculture division

II. IMPORTANT STUDIES UNDERTAKEN DURING THE LAST 10 YEARS

a. Experimental Planting of Gurjan (*Dipterocarpus turbinatus*) – Gurjan, a lofty tree which yields a superior quality of wood oil and timber for use in plywood industry, is species indigenous to Cachar district of Assam.

- Exp. No. 92 of 84-85

The experiment was laid during May 1984 at Loharbond centre to study the growth performance. Total 375 Nos of 2 years old nursery seedlings were planted at a spacing of 2m x 4m, and height measurements were recorded during Dec-1994. Out of 375 plants 134 plants are surviving with an average height of 6.7m.

- Exp. No.12 of 83-84

Another trial was carried at Basistha centre to see the performance of growth in the moist mixed deciduous forest in the Brahmaputra Valley. Total 200 nos of polypot seedling were collected from Loharbond centre and planted at Basistha during May/1984 at a spacing of 3m x 3m out of 200 seedling 109 plants survived when observed during Dec/1989. Plants had attained an average height of 12.14 m & an average diameter of 15.39 cm when observed during Dec/1993. During last year in the month of Nov/2014,

measurements observed the average height of Gurjan as 16.06 m & average girth as 1.28 m. So within this last 20 years the girth increment is much higher than the increment of height.

- Exp.No. 12 of 1983-84

Experimental plot was laid out at Meleng centre with a total of 117 one year old polypot seedlings and 119 Nos. of seeds planted in separate blocks at spacing of 5m x 5m during May 1984. In both the treatments more than 90 percent plants are surviving. Seedlings have attained an average height of 6.03 m and the seed origin plants have attained an average height of 5.68 mtr when observed during Dec/1994.

From the trial it is seen that growth performance of Gurjan is significantly higher at Basistha centre. In Loharbond and Melleng Centre Gurjan seedlings were planted in plain area and at Basistha centre it was in the Hill slopes.

Presently the data of Loharband & Meleng is not updated.

b. Preservation plots have been laid out in different forest types of Assam as one of the important means for conserving and protecting the existing biodiversity of important floral species as well as for assessing ecological changes occurring in such areas over a period of time.

i. Narlota at Upper Dihing Reserve Forest –

Digboi division

Area 20.5 ha,

Forest type : Assam Valley Tropical wet Evergreen (Dipterocarpus)

Type: 1B/C1

Date of formation - 1980

The dominant species are *Dipterocarpus macrocarpus* (Hollong), *Shorea assamica* (Mekai), *Canarium resiniferum* (Dhuna), *Ailanthus integrifolia* (Barpat).

ii. Jeypore at Jeypore Reserve Forest (Tipam)

Dibrugarh division

Area 4.2 ha

Forest type : Assam Valley Tropical wet Evergreen (Dipterocarpus)

Type: 1B/C1

Date of formation – 1970

The dominant species are *Dipterocarpus macrocarpus* (Hollong), *Shorea assamica* (Mekai), *Ailanthus integrifolia* (Barpat), *Altingia exelsa* (Jutuli) and *Artocarpus chaplasi* (Sam)

iii. Kulsai at Kulsai Reserve Forest

Kamrup West division

Area: 4.0 ha

Forest type : Khasi hill Sal forest

Type: 3C/C1/(a)(ii)

Date of formation – 1969

The dominant species are *Tectona grandis* (Segun) and *Shorea robusta* (Sal).

iv. Dullung at Dullung Reserve Forest

Lakhimpur division

Area: 4.0 ha

Forest type: Upper Assam Valley Tropical Evergreen Forest

Type: 1B/C2

Date of formation: 1971

The dominant species are *Kayea assamica* (Sia Nahar), *Ailanthus integrifolia* (Barpat), *Dysoxylum binectiferum* (Bandardima)

c. Studies on sal seeds due to their recalcitrant nature and periodic good seeding

- i. Performance trial of Sal plantation through direct dibbling of seeds and polypot seedlings (Exp No.7 of 93-94): The Sal experiment was laid out at Bangalduba centre under Haltugaon Range during June/1993 to Oct/1993 in an area of 0.52 ha. There were three treatment as follows:

T- 1 Dibbled Sal seeds directly at a spacing of 5 cm x 15 cm immediately after seed collection.

T-2 Planting of polypot Sal seedlings of 2 months old in hoed strips.

T-3 Planting of polypot Sal seedlings of 4 months old in hoed strips. All the treatments were maintained properly by 3 times weeding a year and fire protection.

Survival percentage due to different treatments was recorded during Dec/1994 as follows:

| Treatment | RI | RII | RIII | RIV | RV | RVI | RVII | RVIII | Total | mean |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|
| T-1 | 36.3 | 38.94 | 47.85 | 51.48 | 40.26 | 40.26 | 39.27 | 31.02 | 325.38 | 40.67 |
| T-2 | 31.35 | 25.74 | 27.39 | 22.44 | 23.76 | 12.87 | 18.15 | 18.81 | 180.51 | 22.56 |
| T-3 | 26.73 | 16.83 | 21.78 | 18.15 | 16.5 | 9.90 | 11.20 | 16.83 | 137.94 | 17.24 |

Analysis of the data shows highly significant ($P < .001$) difference due to different treatments. It appears direct dibbling of Sal seed is better than polypot planting. In case of polypot seedlings 2 months old seedlings are better for planting than 4 months old.

- ii. As a follow up of the work done by Dr Alka Bhargava, APCCF (REWP) during her deputation at Tropical Forest Research Institute, Jabalpur and presentation of a paper titled 'Use of halogens in enhancing storability of sal (*Shorea robusta*) seeds' at IUFRO International Symposium on Recalcitrant Seeds, Kuala Lumpur, Malaysia in 1998, a trial nursery was laid at the Western Assam Afforestation Division, Manikpur in 2002 in field situation. The viability of the seeds was found to have been increased to 6 days, enough for collection of seeds and transportation to the nursery site for sowing. The results are planned to be replicated once again in the Silviculture Division for scaling up.

d. Studies on Propagation of Cane

Exp. No. 6 of 1993-94 : To study the performance of stumps and seedlings for artificial regeneration of canes.

Cane brakes are seen in the evergreen and semi evergreen forests of Assam in the permanently wet soil, usually with fine clay and rich in humus. Natural reproduction of cane takes place through root suckers from the established root system and from seeds. But for artificial regeneration no data was available on the soil condition requirements. Therefore an experiment was laid out at Basistha centre in permanently wet area during May/1993 using polypot seedlings and stumps and planting them by making mounds and in wet areas. Thus there were four treatments as follows.

- T-1 Planting polypot seedlings in wet areas.
T-2 Planting polypot seedlings on mound.
T-3 Planting stump in wet areas.

T-4 Planting stump in mound.

Survival under different treatments was recorded during Feb/1994 as follows:

| Treatments | No of seedling /stump planting | No of Survival | Survival percentage |
|------------|-----------------------------------|----------------|---------------------|
| T-1 | 225 | 125 | 55.5 |
| T-2 | 225 | 178 | 79.1 |
| T-3 | 105 | 67 | 63.8 |
| T-4 | 105 | 58 | 55.2 |

From the data it is seen that planting of polypot seedling by making mound gives higher survival i.e. 79.1 % as compared to other treatments.

e. Studies on Bamboo propagation

The Silviculture Division has created a Bamboo Nursery at Bashishta where studies on vegetative propagation of bamboo through culm cutting are being carried out for research and extension. Brick bounded beds filled with good quality sand have been prepared. 2-noded bamboo culms are placed horizontally two in a line at a distance of 0.50 m apart. Sprouting is noticed within 25-30 days after being placed in the beds. Protocols for 3 species, namely *Bambusa tulda*, *B. balcooa*, and *B. vulgaris*, have been standardised. Root formation in case of *B. tulda* is slow, taking 45-50 days. Treatment with hormones IBA and NAA has shown little significance in case of 2-noded culms of *B. tulda*. The attack by leaf roller and sap sucker after sprouting can be controlled by spraying insecticides. The use of biopesticides is being studied. Generally the succulent sprouts are vulnerable to fungus attack after insect attack and are controlled by using fungicides. The planting material raised continues to be supplied to the other Divisions as well as to private growers. Regular trainings are also conducted for frontline staff of the Department as well as for students and private growers.

f. Conservation of Orchids

Orchid research was started under the Silviculture Division in 1973-74. The aim of the program is to conserve the endemic species and improve the multiplication techniques.

i. Collection, conservation and evaluation of germplasm of 84 species from different parts of Assam and also from neighbouring States have been done. These are being maintained successfully in three orchid houses of Silviculture Division. Low cost orchid compost has been developed from biological materials (water hyacinth, coconut husk, leaf mold, etc) in earthen pot for terrestrial orchids and on hanging pieces of stem in case of epiphytic species. Vegetative propagation techniques have been standardized as also control of disease infestation in the orchid plants.

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|-------------------------------------|--|
| - <i>Acampe multiflora</i> | Tropical epiphytic orchid |
| - <i>Acanthephippium sylhetense</i> | Tropical and sub-tropical terrestrial or lithophytic orchid |
| - <i>Aerides multiflorum</i> | Tropical epiphytic orchid. |
| - <i>A. odoratum</i> | Tropical epiphytic orchid |
| - <i>A. fildinghaii</i> | Tropical epiphytic orchid |
| - <i>Acampe papillosa</i> | Tropical epiphytic orchid |
| - <i>Anoectochilus sikkimensis</i> | Tropical orchid growing on the decayed leaves and debris of the forest floor under humid condition |
| - <i>Arachnis clarkeii</i> | Tropical and sub - tropical epiphytic orchid. |
| - <i>Arundia graminifolia</i> | Tropical ground orchid. |
| - <i>Ascocontrum ampullaceum</i> | Tropical or sub - tropical epiphytic orchid. |
| - <i>Bulbophyllum spp</i> | Tropical epiphytic orchid |
| - <i>Bulbophyllum leopardiana</i> | Sub - tropical epiphytic orchid. |
| - <i>Blue vanda</i> | Tropical or sub - tropical epiphytic orchid. |
| - <i>Calenthe masuca</i> | Tropical or sub - tropical terrestrial orchid. |
| - <i>Catteleya bowrinigiana</i> | An exotic epiphytic orchid |
| - <i>Cymbidium aloifolium</i> | Tropical epiphytic orchid |
| - <i>C. graminifolia</i> | Tropical epiphytic orchid |
| - <i>C.ponctulata</i> | Tropical epiphytic orchid |
| - <i>C.pendulum</i> | Tropical epiphytic orchid |
| - <i>C. masterii</i> | Sub - tropical and temperate epiphytic orchid. |
| - <i>C.bruneum</i> | Sub - tropical epiphytic orchid |
| - <i>C. giganteum</i> | Sub - tropical epiphytic orchid |
| - <i>C. punctulata</i> | Sub - tropical epiphytic orchid |
| - <i>C. elatus</i> | Tropical and sub - tropical epiphytic orchid |
| - <i>Coelogyne corymbosa</i> | Sub - tropical and temperate epiphytic orchid |
| - <i>Dendrobium polssi</i> | Tropical epiphytic orchid |
| - <i>D. oculatum</i> | Tropical epiphytic orchid |
| - <i>D. farmer</i> | Tropical or sub - tropical epiphytic orchid |
| - <i>D. fimbriatum</i> | Tropical epiphytic orchid |
| - <i>D.densiflorum</i> | Tropical or sub - tropical epiphytic orchid |
| - <i>D. macria</i> | Tropical epiphytic orchid |
| - <i>D. moschatum</i> | Tropical epiphytic orchid |
| - <i>D. formosum</i> | Tropical epiphytic orchid |
| - <i>D. jenkinsii</i> | Tropical epiphytic orchid |

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| - <i>D. aggregatum</i> | Tropical epiphytic orchid |
| - <i>D. transparence</i> | Tropical epiphytic orchid |
| - <i>D. aphyllum</i> | Tropical epiphytic orchid |
| - <i>D. devonianum</i> | Sub - tropical epiphytic orchid |
| - <i>D. heterocarpum</i> | Sub - tropical epiphytic orchid |
| - <i>D. pieradii</i> | Tropical and sub - tropical epiphytic orchid |
| - <i>D. chrysotoxum</i> | Sub - tropical epiphytic orchid |
| - <i>D. williamsonii</i> | Sub - tropical epiphytic orchid |
| - <i>D. bansonai</i> | Tropical epiphytic orchid |
| - <i>D. primulinum</i> | Sub - tropical epiphytic orchid |
| - <i>D. orchreatum</i> | Sub - tropical epiphytic orchid |
| - <i>D. nobile</i> | Tropical and sub - tropical epiphytic orchid |
| - <i>D. lituiflorum</i> | Tropical epiphytic orchid |
| - <i>D. gibsoni</i> | Sub - tropical epiphytic orchid |
| - <i>D. falconeri</i> | Sub - tropical epiphytic orchid |
| - <i>D. crepidatum</i> | Sub - tropical epiphytic orchid |
| - <i>D. chrysathum</i> | Sub-tropical epiphytic orchid |
| - <i>D. thysiflorum</i> | Temperate epiphytic orchid |
| - <i>D. anceps</i> | Tropical epiphytic orchid |
| - <i>Eria fragrans</i> | Tropical epiphytic orchid |
| - <i>E. flava</i> | Tropical epiphytic orchid |
| - <i>E. cristata</i> | Tropical and sub - tropical epiphytic orchid |
| - <i>E. spicata</i> | Tropical epiphytic orchid |
| - <i>E. stricta</i> | Tropical epiphytic orchid |
| - <i>Geodorum purpureum</i> | Tropical terrestrial orchid |
| - <i>Gastrochilus inconspicus</i> | Tropical and sub - tropical epiphytic orchid |
| - <i>Oberinia jenkinsiana</i> | Tropical epiphytic orchid |
| - <i>Phaius wallichii</i> | Tropical and sub-tropical ground orchid |
| - <i>P. flavus</i> | Tropical and sub-tropical ground orchid |
| - <i>Pholidota rubra</i> | Tropical and sub-tropical ground orchid |
| - <i>Papillenothe teres</i> | Tropical epiphytic orchid |
| - <i>Phallenopsis manii</i> | Tropical epiphytic orchid |
| - <i>Pholidota imbricate</i> | Tropical or sub - tropical epiphytic orchid |
| - <i>Pholidota articulate</i> | Tropical epiphytic orchid |
| - <i>Pholidota rubra</i> | Sub - tropical epiphytic orchid |
| - <i>Phaius tankervilleae</i> | Sub-tropical terrestrial orchid |
| - <i>Paphiopedilum insigne</i> | Tropical terrestrial orchid |
| - <i>P. hirsutissimum</i> | Tropical terrestrial orchid |
| - <i>P. venustum</i> | Tropical terrestrial orchid |
| - <i>P. villosum</i> | Tropical terrestrial orchid |
| - <i>P. spicerianum</i> | Tropical terrestrial orchid |
| - <i>Rhyncostylis retusa</i> | Tropical epiphytic orchid |
| - <i>Renanthera imschootiana</i> | Temperate or tropical epiphytic orchid |
| - <i>Thunia marsillena</i> | Tropical or sub - tropical epiphytic orchid |
| - <i>T. alba</i> | Tropical and sub-tropical epiphytic or lithophytic orchid |
| - <i>Luisia macrantha</i> | Tropical and sub - tropical epiphytic orchid |

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|-----------------------------|---|
| - <i>Vanda parisai</i> | Tropical or sub - tropical epiphytic orchid |
| - <i>Vanda stringnana</i> | Tropical or sub - tropical epiphytic orchid |
| - <i>Vanilla planifloia</i> | Tropical or sub - tropical ground orchid |
| - <i>V.pellifera</i> | Tropical ground orchid |

ii. Orchid tissue culture has been taken up to develop protocol for conservation of some endangered orchids species and establishment of seedlings under natural conditions. Protocols by tissue culture (*in vitro*) propagation technique has been standardized for the following species :

- *Rhynchostylis retusa* (Linn) Bl.
- *Aerides multiflora*. Roxb.
- *Dendrobium farmer* Paxt.
- *Phaius wallichii* Lindl.

iii. Transfer of technology to Government and non-Government Organization, College students etc. through periodic training & demonstration for officers of Govt. departments & students during their exposure visit & study tours. Researchers also being encompassed for field/lab demonstration & lectures.

g. Cultivation of Azolla as Biofertilizer

Azolla culture was started in 2014 in Silviculture Division for use as a biofertilizer due to its ability to fix nitrogen. It contains necessary nutrients for plant, fish, cattle pig, poultry etc. Species being cultured at present is *Azolla pinnata*. A simple Bio- fertilizer production through Azolla culture method for large scale multiplication of Azolla in the field has to be evolved for easy adoption by the farmers.

Altogether three number of *Azolla pinnata* samples were collected from different rice field soils in the Kamrup District of Assam and isolated. One sample out of three were inoculated in the medium for studies.

The experiment were carried out at Basistha under Silviculture Division in different medium under natural environment to standardize the cultivation technique—

- To develop an efficient method for Azolla cultivation.
- Study the effect of a few media and components.
- Study the effect of temperature in the medium
- Study the effect of P^H in the medium.

The works are under progress

h. Seed Orchards

Two Seed Orchards have been created under the Genetic Cell Division

i. Under Central Assam Genetic Range at Nellie :

Area: 5 Ha

Year of creation: 2006-07

Species: *Syzigium cuminii* (Jam), *Terminalia arjuna* (Arjun), *Mansonia dipikai* (Badam), *Garcinia spp.* (Thekera), *Embilica officinalis* (Amlakhi), *Eleocarpus floribunda* (Jalphai), *Putranjiva roxburghii* (Putronjiba).

As the Orchard is only 7 years old, seed production has not yet started.

ii. Under Northern Assam Genetic Range at Potasali

Area: 1 Ha

Year of creation: 1990

Species: *Altingia excelsa* (Jutuli).

Seeding has not yet started.

iii. Another 2 seed orchards of 0.5 ha. are being created during 2014-15

a) 1 at Nellie under CAG Range will be covered with *Aquillaria agullocha*, *Gmelina arborea*, *Shorea robusta*, *Dalbergia sissoo*

b) 1 at Potasali under NAG Range with *Duabanga sonneratioides*, *Mesua ferrea*, *Chikrassia tabularis*, *Morus laevigata*.

i. Seed Production Area

There are 146 ha. of Seed Production Areas under Genetic cell Division, Assam spread throughout 4 Ranges as follows:

a) **CAG Range, Basistha** - Area: 45 ha.

b) **WAG Range, Rani** – 39 ha.

c) **NAG Range, Potasali** – 23 ha.

d) **EAG Range, Lakhipather** – 39 ha.

Total – 146 ha.

j. Seed Stands

There are 111 ha. of Seed Stand Areas under Genetic cell Division, Assam spread throughout 4 Ranges as follows:

- a) **CAG Range, Basistha** – 27 ha.
- b) **WAG Range, Rani** – 41 ha.
- c) **NAG Range, Potasali** – 20 ha.
- d) **EAG Range, Lakhipather** – 39 ha.

Total – 111 Ha.

Total area covered under Seed Stand & Seed Production area are 257 Ha. for *Shorea robusta*, *Tectona grandis*, *Gmelina arborea*, *Chikrassia tabularis*, *Michelia champaka*, *Dipterocarpus macrocarpus*, *Shorea assamica*, *Altengia excels*, *Bombax ceiba*, *Lagerstromea speciosa*, *Canarium resiniferum*.

k. Bambusetum

A bambusteam has been established during the year 2008-09 covering an area of 5 ha. and being maintained by Silviculture Division with a repository of the following species:

1. *Bambusa balcooa* (Bhaluka Bah)
2. *B. nutans* (Makal Bah)
3. *B. pallida* (Bijuli Bah)
4. *B. tulda* (Jati Bah)
5. *B. vulgaris* (Yellow haladhia bah)
6. *B. multiplex* (Hedge Bah)
7. *B. vulgaris* (green Jai Bhaluka Bah)
8. *B. vulgaris*, Wamini (Budha Bah)
9. *Dendrocalamus strictus* (Lathi Bah)
10. *D. hamiltonii* (Kako Bah)
11. *Dinochloa scandens* (Kola lota bah)
12. *Melocanna baccifera* (Muli Bah)
13. *Oxytennera parvifolia* (Pahari Jati Bah)
14. *Oxytennera albociliata* (Kalisundi Bah)
15. *Oxytennera nigrociliata* (Tripuri Bah)
16. *Physosasa japonica* (Japani hedge Bah)
17. *Schizostachyum dulloa* (Dulu Bah)

l. Cane and Rattan conservation

An *ex situ* conservation area was created during 2013-14 at Eastern Assam Genetic Range, Lakhpathar for conservation of various species found in Assam, which include *Calamus erectus* (Jori bet), *Calamus tenuis* (Jati bet), *Calamus rotang* (Raidang bet), *Calamus flagellum* (Chuli bet), *Calamus floribundus* (Lejai bet) etc. Efforts are underway for planting remaining 9 indigenous species of Assam (*Altogether 14 species of cane are available in Assam*) and subsequent establishment of propagation protocols with a view to conserve as well as identifying source of additional income for the JFMC members from commercially viable species.

m. Conservation of Ferns

An ex-situ conservation area has been created through the establishment of one Fern House during 2013-14 at Basistha Botanical Garden under Central Assam Genetic Range. The species include *Cyathea dealbata* (Silver fern), *Silajinella* spp. *Cyathea gigantea* (Tree fern), *Adiantum capillus* (Climber fern), *Lycopodium clavatum*, *Phleleodium aureum* (Golden fern) and the no. of species is being increased.

n. Ex-situ conservation of Indigenous and RET species

A 2 ha area at Dhekiajuli was established in 2011-12 with the following species:

Bambusa vulgaris (Sonali bah), *Bambusa pallida* (Bijuli bah), *Bambusa tulda* (Jati bah), *Bambusa balcooa* (Bhaluka bah), *Dillenia indica* (Outenga), *Aquillaria agallocha* (Agar), *Emblica officinalis* (Amlakhi), *Sapindus mangifera* (Amara), *Terminalia belerica* (Bhomora), *Averrhoa carambola* (Kardo), *Phoenix dactylifera* (Khejur), *Terminalia chebula* (Silikha), *Terminalia arjuna* (Arjun), *Lagerstromia speciosa* (Ajar), *Mimosops elengii* (Bakul), *Cinnamomum tamala* (Tezpat), *Elaeocarpus ganitrus* (Rudraksh), *Artocarpus integrifolia* (Kathal), *Thea chinensis* (Tea), *Mesua ferrea* (Nahar), *Cassia fistula* (Sonaru), *Altingia exelsa* (Jutuli), *Terminalia myriocarpa* (Halakh), *Dipterocarpus macrocarpus* (Hollong), *Duabanga sonneratiodes* (Khokan), *Michelia champaca* (Titasopa), *Areca lutesceus* (momai tamul), *Piper longum* (Pipali), *Baccaurea sapida* (Leteku), *Stereospermum chelonoides* (Paruli), *Magnolia* spp., *Citrus lemon* (Nemu) etc.

o. Herbal Garden

Created in 2013-14 by Silviculture Division, the main aim is *ex-situ* conservation, demonstration and propagation of rare & endangered and useful medicinal plants. Presently there are 23 nos of herb, 4 nos climber, 13 nos shrub and 27 nos of tree species of medicinal value in addition to already existing 24 nos tree species of varied medicinal use. List of the species are enclosed herewith. The list of the species in herbal garden are as below:-

Herbs:

| No. | Local Name | Botanical Name | Uses | Part of use |
|-----|--------------------|------------------------------------|--|-------------|
| 1. | Sarpagandha | <i>Rauwolfia serpentina</i> | High Blood Pressure | Root |
| 2. | Brahmi | <i>Bacopa monnieri</i> | Improves memory power, for hair growth | Whole plant |
| 3. | Machandari | <i>Houttuynia cordata</i> | Dysentery | Leaf |
| 4. | Sarumani muni | <i>Hydrocotyle rotundifolia</i> | Stomach disorder | Whole plant |
| 5. | Barmani muni | <i>Lentella asiatica</i> | Stomach disorder | Wholeplant |
| 6. | Nayantara | <i>Catharanthus roseus.</i> | Diabetes | Leaf |
| 7. | Amada. | <i>Curcuma amada (Roxb)</i> | Appetizer, antipyretic, skin diseases | Rhizome |
| 8. | Pategaja | <i>Bryophyllum pinnatum</i> | Kidney stone | Leaf |
| 9. | Kalatulsi | <i>Ocimum sanctum</i> | Cough, Ringworm | Leaf |
| 10. | Gandh Kachu | <i>Homolomena aromatica</i> | Oil from rhizome use as traditional medicine | Rhizome |
| 11. | Kala Haldi | <i>Curcuma zadoria</i> | Blood purify | Rhizome |
| 12. | Moran ada | <i>Zingiber officinale</i> | Infections, Cough | Rhizome |
| 13. | Pipoli | <i>Piper longum</i> | Diarrhoea | Leaf |
| 14. | Doron | <i>Leucas cephalites</i> | Liver diseases, Cough, pneumonia | Leaf |
| 15. | Bishalyakarni | <i>Aerva javanica</i> | Fever, insect bite | Leaf |
| 16. | Agyachita | <i>Plumbago zeylenica</i> | Piles, Gastric problem, Lack of appetite | Root |
| 17. | Bhot jalakia | <i>Capsicum chinense</i> | Antacid | Fruit |
| 18. | Nephaphu | <i>Clerodendrum colebrookianum</i> | High pressure | Leaf |
| 19. | Purnanawa | <i>Boerhahavia diffusa/repens</i> | Anti-diabetic, jaundice, pain relief | Root leaf |
| 20. | Kehraj (Bhringraj) | <i>Eclipta alfa</i> | Hair growth, jaundice | Leaf |

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|-----|-------------|-----------------------------|---|---------------|
| 21. | Sarpagandha | <i>Rauvolfia canescens</i> | Heart disease/Blood pressure, rheumatism. | Root |
| 22. | Cham Kachu | <i>Typhonium trilobatum</i> | Root part locally apply for curing ulcer in animal, in stomach complaints use as vegetable. | Root and leaf |
| 23. | Bon tulsi | <i>Ocimum canum</i> | Malaria, Jaundis, Piles | Root & Seed |

Shrubs:

| No. | Local Name | Botanical Name | Uses in diseases | Part of plant use |
|-----|---------------|-----------------------------------|---|-------------------------|
| 1. | Bos | <i>Acorus calamus</i> | Headache, Epilepsy | Whole plant, Root |
| 2. | Takma | <i>Hyptis suaveolens</i> | Antiseptic in burns, wonds, and various skin complain | Leaf |
| 3. | Baga bahak | <i>Adhatoda vasica</i> | use in cough, bronchial dieases | Leaf |
| 4. | Ranga bahak | <i>Phlogocanthus thrysiformis</i> | Antidot to pox | Flower |
| 5. | Bhekuritita | <i>Solanum viarum</i> | Vomiting | Leaf, Seed |
| 6. | Akan | <i>Calotropis gigantea</i> | Epilepsy, Migraine | Flower leaf, stem, root |
| 7. | Jam Lakhuti | <i>Costus speciosus</i> | Jaundice | Root |
| 8. | Chitranaala | <i>Cymbopogon nardus</i> | Pesticide | Leaf |
| 9. | Mahabhringraj | <i>Spilanthes paniculata</i> | Hair growth | Leaf |
| 10. | Harjora | <i>Cissus quadrangularis</i> | Piles, Fracture | Whole plant |
| 11. | Sauldhuwa | <i>Glycosmis arborea</i> | Viral fever | Leaf |
| 12. | Sthalapadma | <i>Hibiscus mutabilis</i> | Skin disease | Leaf |
| 13. | Nag champa | <i>Cycas pectinata</i> | Stomach worm | Leaf |

Climbers:

| No. | Local Name | Botanical Name | Uses in diseases | Part of plant use |
|-----|--------------|-----------------------------|---|-------------------|
| 1. | Sagunilata | <i>Tinospora cordifolia</i> | Urinary disorder, Liver disorder, vomiting | Whole plant |
| 2. | Bhedhai lata | <i>Paederia foetida</i> | Stomach disorder, Dysentry | Whole plant |
| 3. | Satmul | | Cough, Dry cough, Headache, urinary disorders | Root, leaf |

| | | | | |
|----|----------|----------------------------|------------|---------|
| 4. | Iswarmul | <i>Aristolochia indica</i> | Sanke Bite | Rhizome |
|----|----------|----------------------------|------------|---------|

Trees:

| No. | Local Name | Botanical Name | Uses | Parts Used |
|-----|---------------|-------------------------------|-----------------------------|---------------------|
| 1 | Robab tenga | <i>Citrus grandis</i> | Anti-oxidant | Fruit |
| 2 | Dalmogra | <i>Gynocordia odorata</i> | Leprosy | Seed |
| 3 | Bogjjamuk | <i>Syzigium kurzi</i> | Diabetes | Seed |
| 4 | Teteli | <i>Tamarindus indica</i> | Do | Seed |
| 5 | Kardo | <i>Averrhoa carambula</i> | Jaundice | Fruit |
| 6 | Samindh | <i>Acacia polyacantha</i> | Skin disease | Bark |
| 7 | Ahat | <i>Ficus religiosa</i> | Traditional medicine | Root, Leaves |
| 8 | Borthekera | <i>Garcinia pedunculata</i> | Dysentery | Fruit |
| 9 | Bhomora | <i>Terminalia belerica</i> | Liver tonic | Fruit |
| 10 | Hilikha | <i>Terminalia chebula</i> | Purgative | Fruit |
| 11 | Bel | <i>Aegel marmelos</i> | Laxative | Fruit |
| 12 | Putranjiba | <i>Putranjiva roxburgii</i> | Malaria | Leaf |
| 13 | Bokul | <i>Mimusops elengi</i> | Chronic dysentery | Fruit |
| 14 | Sonaru | <i>Cassia fistula</i> | Laxative | Fruit |
| 15 | Konibih | <i>Croton tiglium</i> | Skin infection & diarrhoea | Oil seed |
| 16 | Tepor tenga | <i>Garcinia xanthochymus</i> | Dysentery | Fruit |
| 17 | Boga kanchan | <i>Bauhinia variegata</i> | Malaria | Leaf |
| 18 | Tezpat | <i>Cinnamomum tamala</i> | Diabetes | Leaf |
| 19 | Kuji thekera | <i>Garcinia cowa</i> | Dysentery | Fruit |
| 20 | Dalchini | <i>Cinnamomum zeylanicum</i> | Headache, Cough | Bark oil |
| 21 | Karpur | <i>Cinnamomum camphora</i> | Insecticide, anti-microbial | Oil |
| 22 | Amlokhi | <i>Emblica officinalis</i> | Jaundice | Fruit |
| 23 | Rakta Chandan | <i>Pterocarpus santalinum</i> | Skin disease | wood |
| 24 | Arjun | <i>Terminilia arjuna</i> | Heart disease | Bark |
| 25 | Ritha | <i>Sapindus mukurossi</i> | Anti-dandruff | Seed |
| 26 | Sazina | <i>Moringa oleifera</i> | Diabetes | Flower, fruit, leaf |
| 27 | Koras | <i>Pongamia pinnata</i> | Skin disease | Seed, oil, bark |

p. Digitization of all research plots and assessment as per current requirements

All experimental plots are being geo-referenced and being reconciled based on satellite imageries along with the preparation of working plans. This will enable real time tracking of status of these plots, along with field data collection of various parameters.

- q. In the month of October, 2010 mortality of *Mimusops elengi* trees planted in 1994 in the campus of Assam Administrative Staff College, Guwahati. Twelve trees, out of a total number of 25, were found dead. Studies revealed the cause to be root rot by *Ganoderma applanatum*, which leads to decline in productivity and the death of the trees. The disease was reported for the first time in India on *M. elengi* tree. These studies have been reported in a paper communicated to Indian Forester.

IV. FORESTRY RESEARCH PRIORITIES FOR NEXT 20-25 YEARS

- a. Estimation of forest carbon stock in all Divisions as preparedness of REDD+ projects
- b. Standardization of protocols for payment of ecosystem services so as to quantify the total contribution of forests to GDP
- c. Studies into change in vegetation in response to climate change, vulnerability studies of forest ecology to climate change including assessment of changes in forest types / sub types
- d. Assess and streamline existing market channels for forest products- Identification and certification of timber and non timber forest products, including commercially important medicinal and aromatic plants, standardization of propagation and harvesting protocols, research on improved value addition so as to fulfill industrial demand, ensure sustainable livelihoods and at the same time conserve the gene pool
- e. Collaborate with National Research Center for Orchids, Pakyong, Sikkim to strengthen the efforts of the State in conservation of endemic and endangered species as well as identification of commercially potential species for cultivation and propagation. This would enable conserving the gene pool as well as tap this valuable resource as an additional income option for the forest dwellers.
- f. Assist in establishment of a multi location National Forest Germplasm Bank
- g. Establish a new wood balance study

- h. Analysis of land use change at periodic intervals to assess status of forests in Assam and recommend appropriate management and conservation practices.

V. TECHNOLOGIES ALREADY DEVELOPED AND OPERATIONAL IN THE FIELD

- a. Raising quality planting material for bamboo: Silviculture Division has been carrying out research for last over 10 years on production of quality planting stocks of different bamboo species as given in III (e) above. Trainings have been imparted to frontline staff of other Divisions for using this technique in site / central nurseries.

VI. CASE STUDIES OF FORESTRY RESEARCH EXTENSION

- a. Vegetative Propagation Center of Bamboo: The main objectives are
 - i. Development & implementation of a sustainable community based production of Bamboo
 - r. Development & implementation of bamboo based economic development programs
 - s. Resource development within and outside forest area.
 - t. Capacity building of farmers/cultivators/ craftsman and intensification and deepening of Bamboo based activities etc.

Around five lakh bamboo planting stocks have been raised by the standardized technique and provided to various agencies including Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore; State Silviculturist, Andhra Pradesh; State Forest Research Institute, Jabalpur, Nagaland Bamboo Development Agency; State Forest Department of Sikkim, Meghalaya, Bihar; various JFMCs, other various individuals/ organization in and outside Assam. One training manual “Bah Gashar Bansha Bistaran Padhatii” on propagation of bamboo has been published in Assamese.

II. RESEARCH PAPERS

- a. Alka Bhargava, Amit Sahai, A.S.Bhandari and Vishakha Kumbhare, 2000, Halogenation for controlling deterioration of tropical tree seeds, XXI IUFRO World Congress, Kuala Lumpur, Malaysia, Vol. 2, 52.

- b. Mamta Purohit and Alka Bhargava, 2000, Tetrazolium test- a tool for predicting the viability of some tropical tree seeds, XXI IUFRO World Congress, Kuala Lumpur, Malaysia, Vol. 2, 55-56
- c. Neelu Singh and Alka Bhargava, 2000, Plant derivatives from oil yielding forest species, their utility in pest control, XXI IUFRO World Congress, Kuala Lumpur, Malaysia, Vol. 3, 396
- d. Amit Sahai, G.R.S.Reddy, Alka Bhargava and U.Prakasam, 2000, Interactions of *Dalbergia sissoo* Roxb. and *Cajanus cajan* Linn., XXI IUFRO World Congress, Kuala Lumpur, Malaysia, Vol. 3, 65
- e. R. M. Dubey, P.S. Das and Reeta Choudhury, 2008, An investigation into macroproliferation of some selected bamboo species of Assam, Indian Forester, 134 (3)
- f. Reeta Choudhury and R. M. Dubey, 2013, Pathological investigation of dying in *Mimusops elengi* Linn. in avenue trees in Assam, Indian Forester, 139 (2) : 166-169
- g. Reeta Choudhury and D. Jaman, 2014, Comparative study of two different medium used for mass production of field planting stocks of four commercially important bamboo species vegetatively through culm cutting with macro proliferation technique, paper presentation in National Seminar on Recent Advances in Bamboo Research and Development in India, RFRI, Jorhat, February 6-7
- h. Alka Bhargava, 2014, Sustainable forest management: does the solution lies outside forests? Presented at the 13th Silviculture Conference, FRI, Dehradun
- i. Alka Bhargava, 2014, Benefit sharing and livelihoods in REDD+ programs linked to watershed management: an inclusive landscape approach, Working paper prepared for the World Bank as a Hubert H. Humphrey Fellow (2013-14) , (in press)
- j. Reeta Choudhury and Alka Bhargava, An investigation into root rot disease of *Cinnamomum camphora* – communicated to Indian Forester

STATE PLAN SCHEME AND DETAILED ACTION PLAN OF FOREST RESEARCH FOR 2014-2015.

A. Silviculture Division

| SL No | Project Title | Research activities | Item of works | Unit/Cost (Rs) | Total cost(Rs) |
|-------|---|--|--|---|---|
| 1. | Experimental and Sample plots studies for biodiversity conservation (continuous works). | To collect and document the present status data of Preservation plots, Sample plots and Experimental plots. Preservation plots: 2 no at Jeypore, 1 no at Rani & 1 at Dullung. Sample plots: 6 no at Jeypore, 5 no at Rani and 5 no at Loharbond. Experimental plots: 2 no at Jeypore, 4 no at Rani 3 no at Lohurbond, 2 n0 at Amsoi. | a)Data collection. b) Protection/Maintenances works. c) Purchase of paint, tag etc | @7000x31 | 2,17,000 |
| | | | | Total | 2,32,000 |
| 3. | Orchid Research and conservation (continuous works) | a) To study diversity of orchid in North East zone. b)Collection of germplasm and multiplication. c) Providing misting facility in orchid house no-2 . d) Maintenance and replacement of water pipe line, electrification etc in orchid house 1 and 3. e)Maintenance of Sprinkler irrigation facility in orchid house no- 1 &3 f)Maintenance of orchid house -1, 2 &3 g) Photogallery works. h) Planting material for epiphytic orchid species. i)Planting material for terrestrial orchids. j) Disease/pest control of | a)TA expenses @ 10,000 b) Cost of Orchid species. c) Installation of misting facility. d) Cost of maintenance water tank, water pipeline, Electrification etc.in orchid house- 1 & 3. e) Replacement of nozzole,Iron wire, water pump etc. f)Replacement of Agro net iron net, wall repairing etc. g)Cost of bulb,replacement of photo etc. h) Cost of bamboo, iron wire, circoal, brick, earthen pots etc. i)Cost of sand, compost, Cowdung, knife, sprayer etc. j)Cost of | 10,000x2 10,000 2,00000 15,000x2 10,000x2 20,000x3 13,000 15,000 8000 | 20,000 10,000 2,00000 30,000 20,000 60,000 13,000 15,000 8000 |

| | | | | | |
|----|---|---|---|---|--|
| | | Orchid . k)Labour engagement/ Watch and Ward for 1,2,3 Orchid house: orchid multiplication, compost preparation, watering etc. when necessary. | Fungicide/Insecticide, micronutrient, disinfectant, broom etc. k)Two DLS for 200days @Rs 140 | 10,000 28000x2 Total | 10,000 56,000 4,42,000 |
| 4. | Research Laboratory (continuous works) | a) Continuing works & Transfer the plantlets to the different potting media and standardize under natural conditions. b) Disease & Pest infestation management works under forestry line. c)Plant physiology works: pH, moisture content, preparation of GR,soil studies, seed testing,, Analytical works etc. . | a) Repairing cost of Laboratory building-: Painting. b)Replacement of the Fluorescent bulb, choke, holder, starter, in culture room. c)Cost of chemicals: media materials for tissue culture and pathology. d)Lab disinfectant: Formaldehyde, Ab. Alcohol, cotton etc. e) Replacement of old electric wiring. | 20,000 5000 20,000 5000 10,000 Total | 20,000 5000 20,000 5000 10,000 60,000 |
| 5. | Studies on some Threatened and endemic species of Assam by <i>in situ</i> conservation and <i>ex situ</i> cultivation technique <i>Shorea assamica</i> <i>Keya</i> | a) Survey and status studies in RF at Dulong, UDRF,Joypor,Laxkipathar RF etc. b)Germplasm collection. c)Silviculture operation for <i>in situ</i> conservation at 10 location 5 ha each. d) <i>Ex situ</i> conservation: *seed nursery | a)traveling f expenses at least two times a year b)Cost of germplasm collection and TA expenses at least three times a year. c)@Rs 1200 .per ha.x5 = 6000 | 15,000x2 6500x3 6000x10 | 30,000 19,500 60,000 |

| | | | | | |
|----|--|--|---|--|---|
| | <p><i>assamica</i> <i>Jewel</i> orchid, Medicinal plants ,<i>Magnolia</i> species and other orchid species etc. (started on during (2011-12) : continuing works.</p> | <p>*clonal nursery at mist Chamber. *Root trainer nursery.</p> <p>e) Studies of the poor regeneration of the above species in natural forest.</p> <p>f) Watch and Ward-1 No.</p> | <p>d)Cost of Mist chamber maintenance: *cost of pipe line, *cost of poly sheet, *cost of maintenance of line for electrification and fixing of light for prevention of elephant Depredation. *cost of vermiculite, *cost of plant tags, *cost of GR, Fungicide, insecticide.</p> <p>e) Cost of 10 No earthen bed preparation@Rs2000. f)Cost of raw material:cowdung,sand etc. g) Cost of nursery kits, sprayer, trolley etc. . . h)Cost of DLS @140 for 310 days.</p> | <p>5,000 10,000</p> <p>30,000 10,000 3,000 10,000</p> <p>2000x10</p> <p>12,000</p> <p>4000</p> <p>140x310</p> <p>Total</p> | <p>5,000 10,000</p> <p>30,000 10,000 3,000 10,000</p> <p>20,000</p> <p>12,000</p> <p>4000</p> <p>43,400</p> <p>2,56,320</p> |
| 6. | <p>Maintenance of High Tech Nurseries at Bogapani (created during (2011-12)</p> | <p>a)Standardization of the production of quality planting stock of the different plant species. b)Studies on the effect of different soil medium response on the rooting of vegetative propagation Of different plant species. c) Installation of cutter with shed for organic compost production. d)Training programme for Stakeholders on propagation technique</p> | <p>a) Maintenance of Root trainers stands with shed & cost of Vermiculites, plastic tags etc. b)Creation of at least 30,000 no of plantlets in root trainers. @ Rs 1.50 per seedling in root trainers. c)Maintenance of water supply,fencing,equipments ,vermicompost production, Earthen bed preparation etc. d) Cost of raw materials for compost production @ Rs 26,000</p> | <p>35,000</p> <p>30,000x1.50</p> <p>40,000</p> <p>20,000</p> | <p>35,000</p> <p>45,000</p> <p>40,000</p> <p>20,000</p> |

| | | | | | |
|----|--|--|--|--|--|
| | | | f)One Watch and Ward for 310 days @Rs140per day . | 43,400 | 43,400 |
| | | | | Total | 1,83400 |
| 7. | <i>Ex situ</i> conservation, Exhibition/ Demonstration and propagation of Rare, Endangered and useful medicinal plants through the establishment of Herbal Garden with studies of nursery, plantation technique, harvesting and uses along with documentation/demonstration at Basistha. | a) Germplasm collection. b) Standardization of nursery technique. c) Standardization of plantation technique. d) Studies of scientific harvest and storage technique. e) Studies of herbal uses. f) Investigation on the effect of soil properties texture, moisture, etc on establishment of seedlings. f) Documentation. | a) Germplasm collection cost. b) Maintenance of Fencing when necessary. c) Preparation of permanent blocks for other collected species. d) Secondary inspection path along with blocks . e) Soil works, composting, (cowdung, sand, raw materials for vermicompost, organic compost , etc.and propagation . f) Management : Weeding, disease/ pest control, protection. g) Extension of water pipe line with accessories & maintenance. | @10,000x 1 40,000 L/SRs 5000x15 L/SRs 50,000 @ 1500x25 40 no DLS @ Rs 140x 4 L/S Rs 50,000 | 10,000 40,000 75,000 50,000 37,500 22,400 50,000 |
| | | | | Total | 2,84,900 |
| 8. | Study of Observation Plots of different tree species. | a) Observation plots of different plant species (40 tree species) at Digboi arboretum and JFMC plantation at Digboi with a view to study the annual growth increment over the year (two times in each year). b) Data to be recorded on the growth table. | Cost of painting, Clearing, traveling etc @ Rs 56,000 for observation of two spot in one time. | 56,000x2 | 1,12,000 |
| | | | | Total | 1,12,000 |
| 9. | Biofertilizer production. | a) Production of low cost biofertilizer through Azolla culture. b) Production of low cost leaf mold. | a) Continuing culture b) Maintenance of tank, Shed , pipe and other accessories. . | 30,000 5000 | 30,000 5000 |

| | | | | | |
|-----|--|---|--|---|--------------------------|
| | | C) Documentation and transfer the technology to the Stake-holders. | | Total | 35,000 |
| 10. | Experimental plantation of Dhuna , Bogipoma, Kadam and Simalu at Bogapani, Digboi. | 4 n0 plots (0.25 h each) | a)Site clearing & burning b) Pit digging & soil working c) 3 Weeding | @ Rs 8000/per plot x4 | 32,000 |
| 11. | Establishment of Model nursery at Amsoi.. | Evolving standard nursery technique to raise quality planting materials of important species to accelerate reforestation programmes . | As per Annexure-1 | | 6,00000 |
| 12. | Renovation & extension of cactus house for in situ research and preservation | a) Extension of the present cactus house. b) Renovation. c) Maintenance of cactus house | 300x@ Rs 140 | 51,780 52,000 42,000 Total | 1,45,780 |