

ANNUAL RESEARCH PROGRESS
2014 – 2015



Government of the people's Republic of Bangladesh
Bangladesh Forest Research Institute
Chittagong
2016

Contents of the Research Progress: 2014 – 2015

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Summary of the Research Progress: 2014-2015

Sl. No.	Name of the Division/Section	Total Number of Studies		
		On-going	New	Total
FOREST MANAGEMENT WING				
01	Forest Botany Division	03	00	03
02	Forest Economics Division	02	00	02
03	Forest Inventory Division	02	00	02
04	Forest Protection Division	03	00	03
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07	Plantation Trial Unit Division	06	00	06
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09	Silviculture Genetics Division	04	00	04
10	Silviculture Research Division	07	00	07
11	Soil Science Division	03	00	03
12	Wildlife Section	02	01	03
Sub-Total:		47	03	50
FOREST PRODUCT WING				
13	Forest Chemistry Division	02	02	04
14	Pulp and Paper Division	03	01	04
15	Seasoning and Timber Physics Division	03	00	03
16	Veneer and Composite Wood Products Division	02	02	04
17	Wood Preservation Division	02	03	05
18	Wood Working and Timber Engineering Division	01	01	02
Sub-Total:		13	09	22
Total:		60	12	72

FOREST BOTANY DIVISION

1 Title of the Study : Floristic composition and restoration of village common forest of Kapru Para, Bandarban Hill District

1.1 Objective(s) :

1.1.1 To assess the qualitative and quantitative floristic composition of common village forest of Kapru Para.

1.1.2 To motivate the local people for restoration of the village common forest.

1.2 Study period :

1.2.1 Starting year : 2013-2014

1.2.2 Completion year: 2015-2016

1.3 Progress:

1.3.1 Previous years, if any: Total 57 sample plots having 10 m x10 m size were lay out in three different slopes (upper, medium, lower hill portion and along the jhiri) for data collection and vegetation analysis through the discussion meeting with the karbaries and community people. Among the listed available plant species in each plot, *Lepidagathis incurve*, *Holarrhena antidysenterica*, *Arorosa dioica*, *Baccaurea ramiflora*, *Litsea glutinosa* and *Ficus hispida* were most common species in all sample plots. Two hundred twenty three botanical samples were collected from the sample plots, processed and preserved in the herbarium and 122 botanical samples were identified. About 6300 seedlings of twenty three indigenous species have been distributed to Kapru para and Sita pahar for enrichment plantation in the community reserve.

1.3.2 This year: Two group discussions meeting were carried out with the community people for collecting information on biodiversity conservation in Village Common Forest (VCF). Site map prepared and 32 sample plots of 10 m x 10 m size were set in different slopes for data collection and vegetation analysis. One hundred fifty botanical samples were collected and classified into trees, shrubs, herbs and climbers. A total of 93 species under 42 genera of 22 families have been identified comparing with the authentic samples of the BFRI herbarium. Among them 40 trees, 18 shrubs, 20 herbs and 15 climbers and persevered in the BFRI herbarium. Total 6800 seedlings of 20 indigenous tree species distributed among the community people for VCF enrichment plantation.

1.4 Findings: BFRI herbarium is being enriched with voucher specimens of the VCF.

1.5 Financial Statement :

1.5.1 Total cost : Tk. 5,00,000.00

1.5.2 Cost of the year : Tk. 1,84,850.00

2 Title of the Study : Ethno-botanical plants used by the Chakma community of Rangamati and Khagrachari Hill District

2.1 Objective(s) :

2.1.1 To collect the ethno-botanical plants and their information used by the Chakma tribe of Rangamati and Khagrachari Hill District.

2.1.2 To find out conservation strategy and to develop data base for ethno medicinal plants.

2.2 Study period :

2.2.1 Starting year : 2013-2014

2.2.2 Completion year: 2015-2016

2.3 Progress:

2.3.1 Previous years, if any: Four group discussions meeting with the local herbal healer and local people of Nirbanpur, Rangamati and Matiranga, Khagrachari area were conducted to know about the present situation of medicinal plant of the area. Samples of 115 ethno-medicinal plants were collected from the Matiranga and Laxmichari of Khagrachari hill district area and Duluchari and Nirbanpur of Rangamati hill district forests area. Among them 12 trees, 32 shrubs, 48 herbs and 53 climbers species. Collected samples were processed and preserved in the BFRI herbarium. Information on use of the species, local name, habit, habitat, parts used and mode of preparation were documented with the help of herbal healer.

2.3.2 This year: Three group discussion meetings with herbal healers and local people were conducted to know the present status of ethno-medicinal plants. Total 295 ethno-medicinal samples plants were collected from Khagrachari and Rangamati hill district forests area. Among them, 22 trees, 68 shrubs, 113 herbs and 92 climbers species. Total 198 species were identified and preserved in the BFRI herbarium. All the collected ethno-botanical plant samples were classified with scientific name, family, chakma name and local names. Information on use of the species, habit, habitat, parts used and mode of preparation were documented with the help of herbal healer.

2.4 Findings: A total of 20 plant species are used to body ache followed by 18 species for paralysis, 17 bone fracture, 16 tumor/boils, 16 for heart disease, 15 species for skin disease, 14 species for female disease, 14 for diabetes, 14 species for cold, 13 species for high blood pressure, 12 species for kidney/urinary problem, 12 species for jaundice, 12 for tooth ache, 11 species for snake bite, 11 for fever, 11 for diarrhea, and 10 species for blood purifier, 10 for breathing problem, 10 for asthma, 9 species for eye problem, 8 species for constipation, 7 species for stomach pain, 6 species for head ache, 5 species for dysentery and 4 species for piles. Most of the plant species used for different diseases. Leaves are the major part of the plant used in the treatment of diseases.

2.5 Financial Statement :

2.5.1 Total cost : Tk. 4,00,000.00

2.5.2 Cost of the year : Tk. 1,42,650.00

3 Title of the Study : Anatomical properties of lambu (*Khaya anthotheca*) tree grown in Bangladesh

3.1 Objective (s) :

3.1.1 To determine the detail gross and minute anatomical features of the species grown in Bangladesh.

3.1.2 To develop a database on anatomical properties of this species for determining better utilization.

3.2 Study period :

3.2.1 Starting year : 2011-2012

3.2.2 Completion year: 2014-2015

3.3 Progress:

3.3.1 Previous years, if any: Wood samples were collected from Jessore District. Gross anatomical features namely colour, texture, grain, parenchyma and ray type cell have been studied and recorded.

3.3.2 This year: Gross anatomical features namely colour, texture, grain, parenchyma and ray type cell have been studied and recorded.

3.4 Findings: Sapwood is light pinkish and heartwood is pinkish brown in colour. Diffuse porous wood, medium coarse texture, interlocked grain and vasicentric parenchyma were found. Sapwood and heartwood are easily demarcated by colour. It is medium density wood and easy to saw and work, although the presence of interlocked grain may cause some problem. The wood of lambu (*Khaya anthotheca*) is very similar to that of Mahogany (*Swietenia* sp.). But lambu is considered as inferior to mahogany in wood quality. The wood is suitable for making furniture, cabinet work, decorative boxes, veneer, ply wood, window frames and doors.

3.5 Financial Statement :

3.5.1 Total cost : Tk. 1,30,000.00

3.5.2 Cost of the year : Tk. 22,500.00

FOREST ECONOMICS DIVISION

1 Title of the study : Determination of financial rotation of babla (*Acacia nilotica*) plantations in Bangladesh

1.2 Objective(s) :

1.2.1 To determine the financial rotation of babla (*Acacia nilotica*) based on its existing utilization.

1.3 Study period :

1.3.1 Starting year : 2011-2012

1.3.2 Completion year: 2014-2015

1.4 Progress:

1.4.1 Previous years, if any: Collected data from the mixed and mono plantations of babla species established during 1976-1977 to 2004-2005 under Social Forestry Division of Barisal and Coastal Afforestation Division of Bhola, Patuakhali and Chittagong.

1.4.2 This year: Collected data from the sample plots (Size 0.01 ha) of mixed plantations of babla species established during 1991-1992 to 2008-2009 under the Social Forestry Division of Faridpur.

1.5 Findings: Considering financial parameters for the babla plantations in selected locations, age period for financial rotation within 11 to 14 years were found optimum. So, in raising and managing the babla plantations within this period would be most profitable in south western part of the country.

1.6 Financial Statement :

1.6.1 Total cost : Tk. 3,10,000.00

1.6.2 Cost of the year : Tk. 42,600.00

2 Title of the study : Impact of the Coastal afforestation of Bangladesh in respect of financial and socioeconomic conditions of local people

2.2 Objective(s) :

- 2.2.1 To find out production system through intercropping of seasonal and/or annual crop in the forest floor of afforestation areas.
- 2.2.2 To assess income generation of local people.
- 2.2.3 To make financial analysis of afforestation in Coastal zone.
- 2.2.4 To estimate the sequestered carbon in the selected years of plantations of Coastal afforestation.

2.3 Study period :

2.3.1 Starting year : 2012-2013

2.3.2 Completion year: 2015-2016

2.4 Progress:

- 2.4.1 Previous years, if any: Analyzed the collected information on the strip plantations raised from 1993-1994 to 2000-2001 under the Coastal Afforestation Division (CAD) of Noakhali and Social Forestry Division (SFD) of Bagerhat were. The targeted plantations of two Divisions were 1922 and 2742 seedling km respectively. The generated income on targeted strip plantations for local beneficiaries was estimated in current price which was about 840 million taka in Noakhali CAD and 656 million taka in Bagerhat.
- 2.4.2 This year: Collected information on the strip plantations raised from 1995-1996 to 2000-2001 under the Social Forestry Division of Barisal and Coastal Afforestation Division of Bhola. Areas of the targeted year of total plantations were 900 (360 ha) and 818 (327 ha) seedling km respectively.

2.5 Findings: Year wise present values of investment (Tk/ha) were 162 thousand for Barisal and 120 thousand for Bhola. The present values of average financial net benefit (PVNB) were (Tk/ha) 388 and 215 thousand respectively. Accordingly, generated total standing incomes on targeted year of plantations were estimated in current price as 464 and 202 million taka for the local poor participants of the coastal areas.

2.6 Financial Statement :

2.6.1 Total cost : Tk. 6,50,000.00

2.6.2 Cost of the year : Tk. 1,57,400.00

FOREST INVENTORY DIVISION

1 Title of the study : Growth and yield assessment of akashmoni (*Acacia auriculiformis*) and mahogany (*Swietenia macrophylla*) through establishment of permanent sample plots (PSPs)

1.3 Objective(s) :

- 1.2.1 To generate information on growth and yield of the akashmoni and mahogani in plantation forests of Bangladesh.
- 1.2.2 To set the physical rotation of these species.

1.3 Study period :

1.3.1 Starting year : 2010-2011

1.3.2 Completion year: 2014-2015

1.4 Progress:

1.4.1 Previous years, if any: Re-measurement growth parameter of mahogany trees from 44 PSPs at Faridpur and Rajbari Forest Division and akashmoni trees from 27 PSPs at Chittagong (12 nos) and Cox's Bazar (15 nos) Forest Divisions have been done.

1.4.2 This year: Re-measurement growth parameter of akashmoni and mahogany was done from 71 PSPs in Cox's Bazar, Chittagong, Faridpur and Rajbari Forest Division.

1.5 Findings: The mean annual increment (GBH and height) of akashmoni was found higher (4.0cm and 1.4m) in Cox's Bazar in compare to Hyanko, Chittagong (3.5cm and 1.2m) at the age of more than 10 years plantation. In case of mahogany, the mean annual increment (GBH and height) was 3.4cm and 0.8m at the age of more than 16 years plantation in Faridpur and Rajbari.

1.6 Financial Statement :

1.6.1 Total cost : Tk. 5,00,000.00

1.6.2 Cost of the year : Tk. 47,500.00

2 Title of the study : Growth and yield assessment of keora (*Sonneratia apetala*) and baen (*Avicennia sp.*) in the coastal plantations of Bangladesh (5th Phase)

2.2 Objective(s) :

2.2.1 To generate information on growth and yield of the keora and baen in the coastal plantations of Bangladesh

2.2.2 To set the physical rotation of these species.

2.3 Study period :

2.3.1 Starting year : 2012-2013

2.3.2 Completion year: 2014-2015

2.4 Progress:

2.4.1 Previous years, if any: Re-measurement growth parameter of keora and baen trees from 30 PSPs at Chitagong (18 nos) and Cox's Bazar (12 nos) Forest Divisions have been done.

2.4.2 This year: Re-measurement growth parameter of keora and baen was done from 30 PSPs at Chittagong (18) and Cox's Bazar (12) coastal areas.

2.5 Findings: The mean annual increment (GBH and height) of baen was 2.2cm and 0.5m) in Moheshkhsli, Cox's Bazar at the age of more than 19 years plantation. In case of keora, the mean annual increment (GBH and height) was 2.1cm and 0.6m) at the age of more than 24 years plantation in Kattali, Chittagong.

2.6 Financial Statement :

2.6.1 Total cost : Tk. 1,05,000.00

2.6.2 Cost of the year : Tk. 27,500.00

FOREST PROTECTION DIVISION

1 Title of the study : Major pests and diseases of commercially important medicinal plants and their management

1.1 Objective (s) :

- 1.1.1 To identify pests and pathogens of commercially important medicinal plants.
- 1.1.2 To determine the nature and extent of damage by each pest and pathogen.
- 1.1.3 To know the biology and ecology of key pests and pathogens.
- 1.1.4 To develop/adapt suitable management techniques for key pests/pathogens.

1.2 Study period :

- 1.2.1 Starting year : 2012-2013
- 1.2.2 Completion year: 2014-2015

1.3 Progress:

1.3.1 Previous years, if any: Five *Trichoderma* strains were used to control the root rot disease of ashwagandha in *in vitro* condition where *T. harzianum* IMI-392432 showed the best performance. Neem oil, urea, sulphur, turmeric powder, omite was applied to control red mite of ashwagandha. The result showed that omite was most effective (98.0%) to control red mite.

1.3.2 This year: Four diseases of different medicinal plant with their incidence and severity were recorded in Tangail, Bogra, Gaibandha and Natore region. Pest sample aphid of tulsi (*Ocimum sanctum*), was collected from Tangail; Mite & aphid of ashwagandha (*Withania somnifera*) from FPD, nursery at BFRI campus.

1.4 Findings: The highest leaf blight (55%) and root rot (45%) of ashwagandha was recorded at Palashbari sadar upazila of Gaibandha. The highest root rot of bashak (43%) and tulsi (40%) was recorded at Dighalkandi, Bogra Sadar upazila. The higher leaf spot (27%) of aloe vera and stem rot of kalomeagh (33%) was recorded at Kolabari, Natore and Palshbari Gaibandha, respectively. Tulsi was infested by scale insect, powdery mildew and root rot at 50.0%, 90.0% and 80.0%, respectively. Five *Trichoderma* strains were evaluated to control the root rot disease of ashwagandha in *in vitro* condition and the *T. harzianum* IMI-392432 showed the best performance. Neem oil was applied (4ml/L) to control the scale insect, aphid and mite of bashak (*Adhatoda vasica*), ashwagandha (*Withania somnifera*), tulsi (*Ocimum sanctum*), and shotomoly (*Asparagus racemosus*) under field condition. The result showed that Neem oil controlled the 95% pest effectively.

1.5 Financial Statement :

- 1.5.1 Total cost : Tk. 10, 00,000.00
- 1.5.2 Cost of the year : Tk 2, 00,000.00

2 Title of the study : Major pests and diseases of forest seeds and their management (2nd Phase)

2.1 Objective (s) :

- 2.1.1. To identify pests and pathogens of forest seeds in the field and storage condition.
- 2.1.2. To determine the nature and extent of damage by each pest and pathogen.
- 2.1.3. To develop suitable management techniques of key pests and pathogens.

2.2 Study period :

- 2.2.1 Starting year : 2012-2013
- 2.2.2 Completion year: 2014-2015

2.3 Progress:

2.3.1 Previous years, if any: Collected seeds of forest tree species (sil koroi, ipil ipil, jarul, akashmoni, acacia hybrid, teak, and mahogany) are dried and kept with Neem oil mixture,

Savin powder, Classic, Malathion and Bavistin for observation. Nature and extent of damage are recorded from collected seeds.

2.3.2 This year: Seeds of kankra, passur, sundri, baen, singra, amur and gewa were collected from Sundarbans. Among these seeds insect infestation rate was 66.0% in sundri, 61.0% in kankra, 43.0 % in baen, 23.0% in singra, 15.0% in amur, 14.0% in gewa, and 5.0% in passur. Fresh dried seeds of different trees viz. sada koroï, silkoroï koroï, ipilipil, jarul, akasmoni, acacia hybrid, teak, rain tree were kept with neem oil (3ml/kg), biskatali (2.5gm/kg), aata powder (green) (2.5gm/kg), neem powder (2.5gm/kg), sevin powder (2.5gm/kg), diazinon (3ml/kg), and malathion (3ml/kg) were used to observe insect pest infestation in laboratory condition.

2.4 Findings: Biskatali, Aata powder showed low effective, Neem powder showed moderately effective and Sevin powder, Diazinon, Malathion showed highly effective against different types of seed pests.

2.5 Financial Statement :

2.5.1 Total cost : Tk. 15, 00,000.00

2.5.2 Cost of the year : Tk 1, 00,000.00

3 Title of the study : Pests and diseases of bamboos in Bangladesh and its management

3.1 Objective (s) :

- 3.1.1. To survey and assess the present status of pest and disease infestation in bamboos from different areas of the country.
- 3.1.2. To collect and identify major pests and pathogens of bamboos.
- 3.1.3. To study nature and extent of damage by pest and pathogens.
- 3.1.4. To study the biology and ecology of the causal agent(s).
- 3.1.5 To develop suitable management techniques for controlling pest and disease.

3.2 Study period :

3.2.1 Starting year : 2013-2014

3.2.2 Completion year: 2015-2016

3.3 Progress:

3.3.1 Previous years, if any: A Lepidopteran moth (leaf roller) was collected from seedlings raised from bamboo branch cutting at nursery of Silviculture Genetics Division of BFRI and Lama, Bandarban. Scale insect, aphid were recorded from different areas of Jessore, Satkhira, Khulna and Bagerhat.

3.3.2 This year: A survey was conducted in Kustia, Maherpur, Pabna, Rajshahi, Nilphamari, Chapinawabgonj, Chittagonjg Hill Tracts and Dhaka regions. The highest insect infestation and disease prevalence was found in Chittagonjg Hill Tracts areas. The lowest insects and disease prevalence was recorded in Kustia, Maherpur and Pabna regions.

3.4 Findings: Bamboo culms rot disease caused by *Fusarium* sp. and scale insect and borer insect of bamboo caused by leaf roller (*Pyrausta bambusivora* and *P. coclesalis*).

3.5 Financial Statement :

3.5.1 Total cost : Tk. 12, 00,000.00

3.5.2 Cost of the year : Tk 2, 50,000.00

MANGROVE SILVICULTURE DIVISION

1 Title of the study : Vegetation dynamics and regeneration pattern in relation to salinity and siltation of the Sundarban (2nd Phase)

1.1 Objective(s) :

- 1.1.1. To determine the species composition.
- 1.1.2. To determine the natural regeneration status of major mangrove species.
- 1.1.3. To understand the vegetation dynamics in the Sundarban over time.
- 1.1.4. To assess the impact of salinity and siltation on the change of vegetation.

1.2 Study period :

- 1.2.1 Starting year : 2012-2013
- 1.2.2 Completion year: 2015-2016

1.3 Progress:

- 1.3.1 Previous years, if any: Thirty Permanent Sample Plots (PSPs) were maintained. Data on species composition, number of trees of different species, height, DBH, regeneration of the seedlings recruitment of mangrove species were recorded from 30 PSPs. Seedlings recruitment of major mangrove species were recorded from the PSPs since inception of the study.
- 1.3.2 This year: Data on regeneration and seedling recruitment of major mangrove species were recorded from 30 PSPs.

1.4 Findings: Average seedlings recruitment in the year 2014 was found 34,489/ha/year. Among them, *Heritiera fomes* constituted 34.83%, *Excoecaria agallocha* 31.86%, *Ceriops decandra* 15.63%, *Bruguiera sexangula* 7.57%, *Avicennia officinalis* 0.71%, *Aegiceras corniculatum* 3.64%, *Xylocarpus mekongensis* 1.13%, *Amoora cuculata* 0.61%, *Cynometra ramiflora* 1.03%, *Phoenix paludosa* 0.52%, *Sonneratia apetala* 0.97%, *Nypa fruticans* 1.10% and *Rhizophora mucronata* 0.42% were recorded.

1.5 Financial Statement :

- 1.5.1 Total cost : Tk. 10,00,000.00
- 1.5.2 Cost of the year : Tk 1,50,000.00

2 Title of the study : Centralization and conservation of mangrove vegetation in three salinity zones of the Sundarban (2nd Phase)

2.1 Objective(s) :

- 2.1.1. To conserve mangrove species in their natural habitat.
- 2.1.2. To centralize threatened mangrove species.
- 2.1.3. To observe the flora-fauna interaction over time.
- 2.1.4. To demonstrate flora and fauna in natural habitat in the Sundarban.

2.2 Study period :

- 2.2.1 Starting year : 2011-2012
- 2.2.2 Completion year: 2015-2016

2.3 Progress:

- 2.3.1 Previous years, if any: Three conservation plots covering an area of 60.0 ha were established in three salinity zones of the Sundarban. Initially it was recorded that there

are thirty 37 species in the less saline zone, 31 species in the moderate saline zone and 22 species in the strong saline zone of the conservation plots. Eight species were centralized in three conservation plots in different saline zones.

2.3.2 This year: A total of 12,600 seedlings of three mangrove species namely passur, singra and khalshi were raised for raising experimental plantation. Previously raised experimental plantations of kirpa (1.8 ha), passur (1.2 ha), jhana (0.6 ha), khalshi (2 ha), amur (1.8 ha) bakul kankra(1.8 ha), amdhekur (0.9ha), dhundul (1.8 ha) and maricha baen (0.9 ha) were maintained. Survival and growth data from the experimental plantations were collected twice a year.

2.4 Findings: Three conservation plots (20.0 ha at each saline zone) were established at Dhangmari, Bogi and Munshiganj in the Sundarban. Five mangrove species were centralized in the three conservation plots of the Sundarban.

2.5 Financial Statement :

2.5.1 Total cost : Tk. 14,00,000.00

2.5.2 Cost of the year : Tk 3,50,000.00

3 Title of the study : Growth performance of mangrove and non-mangrove experimental plantations in the Sundarban (2nd Phase)

3.1 Objective(s) :

3.1.1. To determine the growth performance of mangrove and non-mangrove experimental plantations in the Sundarban.

3.2 Study period :

3.2.1 Starting year : 2012-2013

3.2.2 Completion year: 2015-2016

3.3 Progress:

3.3.1 Previous years, if any: A total of 3.5 ha mangrove and 3.5 ha non-mangrove species plantations were maintained. Growth data of one non-mangrove and eight mangrove species were recorded and analyzed.

3.3.2 This year: Survival and growth data (survivability, height, dbh, bole height, etc.) have been recorded from the experimental plantations.

3.4 Findings: Growth performance of jarul is very promising in the raised land of the Sundarban. Average survival percentage, height and DBH of jarul was 83, 6.9m and 12.2cm at the age of 15 years at Khatakhali in the less saline zone of the Sundarban. The average survival of sundri, gewa and kirpa were 21, 70 and 63% as well as average height of those species were 1.8m, 5.0m and 5.5m respectively at the age of 14 years at Burigoalini in the strong saline zone. The average survival of jhana and gewa were 26 and 86% as well as average height of those species were 5.6m and 3.2m respectively at the age of 11 years at Khashitana in the strong saline zone of the Sundarban. The average of survival of gewa and goran were 61 and 55% as well as average height of those species were 2.1m and 1.6m respectively at the age of 10 years at Andermanik in the strong saline zone of the Sundarban.

3.5 Financial Statement :

3.5.1 Total cost : Tk. 9,00,000.00

3.5.2 Cost of the year : Tk 2,50,000.00

4 Title of the study : Development of a mangrove museum (2nd Phase)

4.1 Objective(s) :

4.1.1. To collect and preserve the representative specimens of flora and fauna from the Sundarban.

4.1.2. To demonstrate the specimens of flora and fauna to the students, teachers, researchers and visitors.

4.2 Study period :

4.2.1 Starting year : 2013-2014

4.2.2 Completion year: 2015-2016

4.3 Progress:

4.3.1 Previous years, if any: A museum has been established at the Divisional Head Quarter of Mangrove Silviculture Division, Khulna having 55 flora and 50 faunal specimens and sixteen wood samples of mangrove tree species. One number of tiger hide and one piece of deer hide were reprocessed and stuffed as well as demonstrated in the Mangrove museum.

4.3.2 This year: Fleshy fruits and plant parts of major mangrove species and fish specimens have been collected from the Sundarbans and preserved in the museum. Previously collected flora and faunal specimens from the Sundarban in the museum were maintained.

4.4 Findings: fifteen fish specimens were collected from the Sundarbans. Five digital banners and 50 nos of still pictures of different sizes were printed and laminated.

4.5 Financial Statement :

4.5.1 Total cost : Tk. 10,00,000.00

4.5.2 Cost of the year : Tk 1,30,000.00

5 Title of the study : Development of nursery and plantation techniques of khalshi (*Aegiceras corniculatum*) in the coastal zone of Bangladesh

5.1 Objective(s) :

5.1.1. To develop nursery and plantation techniques of Khalshi.

5.1.2. To conserve and extension of the species.

5.2 Study period :

5.2.1 Starting year : 2010-2011

5.2.2 Completion year: 2014-2015

5.3 Progress:

5.3.1 Previous years, if any: Three experimental plantations of khalshi (*Aegiceras corniculatum*) were raised at three locations of the Sundarban.

5.3.2 This year: Seeds of khalshi were collected from the Sundarban and 9,000 seedlings were raised for next year experimental plantation. Data collected on growth performance of khalshi at different locations in different years in three salinity zones of the Sundarbans.

5.4 Findings: The highest average survival and height of khalshi was found in moderate saline zone (94 and 0.8m) followed by strong saline zone (75% and 0.4m) and less saline zone (61% and 0.3m) respectively.

5.5 Financial Statement :

5.5.1 Total cost : Tk. 12,00,000.00

5.5.2 Cost of the year : Tk 2,80,000.00

6 Title of the study : Selection and development of the top dying tolerant sundari (*Heritiera fomes*) trees in the Sundarban (2nd Phase)

6.1 Objective(s) :

6.1.1. To develop a pure line of top dying tolerant sundri trees.

6.2 Study period :

6.2.1 Starting year : 2013-2014

6.2.2 Completion year: 2015-2016

6.3 Progress:

6.3.1 Previous years, if any: Forty numbers (10 nos. in each location) of healthy (disease free) sundari trees have been selected for development of pure line in the Sundarban.

6.3.2 This year: Experimental plantations were raised with the seedlings of selected sundari trees at three locations of the Sundarban. Growth performance of sundari at different locations in different years of the Sundarban was recorded.

6.4 Findings: The highest average survival and height of sundari was found at Bogi (85 and 2.8m) in the Sundarban.

6.5 Financial Statement :

6.5.1 Total cost : Tk. 12,50,000.00

6.5.2 Cost of the year : Tk 2,40,000.00

MINOR FOREST PRODUCTS DIVISION

1 Title of the study : Nursery and plantation-management techniques of ten rattan species of Bangladesh (3rd Phase)

1.2 Objective(s) :

1.2.1. To develop suitable techniques for production of quality planting materials of ten rattan species.

1.2.2. To develop appropriate plantation techniques and site suitability of ten rattan species.

1.2.3 To determine the optimum harvesting age and sound management system for maintaining sustainable production of different rattan species.

1.3 Study period :

1.3.1 Starting year : 2013-2014

1.3.2 Completion year: 2014-2015

1.4 Progress:

1.4.1 Previous years, if any: Established 3.0 ha experimental plantations and conservation plots of jali (*Calamus tenuis*), kerak (*C. viminalis*), golla (*Daemonorops jenkinsiana*),

udum (*C. longisetus*) and sundi (*Calamus guruba*) at BFRI Headquarter and Hinguli Research Station.

1.4.2 This year: Raised 17,000 seedlings of jail, kerak and golla bet and 1.0 ha trial plantation with two species (jali and golla) at Hinguli Research Station. Collected data on germination percentage of sita bet treated with different concentration of H₂SO₄.

1.5 Findings: Seeds soaked in 10% H₂SO₄ acid for 20 minutes gives the highest (68%) germination.

1.6 Financial Statement :

1.6.1 Total cost : Tk. 8,00,000.00

1.6.2 Cost of the year : Tk. 1,32,000.00

2 Title of the study : Nursery and plantation techniques of five selected medicinal plants: iswarmul (*Aristolochia indica*), kurchi (*Holarrhena pubescence*), gajpipul (*Scindapsus officinalis*) antamul (*Tylophora indica*) and chandan (*Santalum album*)

2.2 Objective(s) :

2.2.1. To develop nursery techniques for production of planting materials.

2.2.2. To develop plantation and management techniques for sustained yield.

2.2.3. To popularize cultivation and use of those medicinal plants.

2.3 Study period :

2.3.1 Starting year : 2014-2015

2.3.2 Completion year: 2016-2017

2.4 Progress:

2.4.1 Previous years, if any: New study

2.4.2 This year: Raised 1,000 seedlings of kurchi, ishwarmul, gajpipul, antamul and chandan. Recorded information on germination percentage with pre sowing treatment for nursery technique development.

2.5 Findings: The highest germination was found in antamul (50%) when seeds soaked in normal water for 6 hours and Gajpipul (70%) in without treatment. The highest germination of kurchi and chandan seeds was 100 and 56% when seeds soaked in tap water for 6 hours and 36 hours.

2.6 Financial Statement :

2.6.1 Total cost : Tk. 3,50,000.00

2.6.2 Cost of the year : Tk. 80,000.00

3 Title of the study : Germplasm conservation and management practices of different medicinal plants

3.1 Objective(s) :

3.1.1. To authenticate correct identification of medicinal plants.

3.1.2. To conserve medicinal plants for scientific study and demonstration.

3.1.3. To develop a gene pool of medicinal plants species for propagation purposes.

3.1.4. To popularize the cultivation and use of medicinal plants.

3.1.5. To determine management techniques for maximum yield of medicinal plants.

3.2 Study period :

3.2.1 Starting year : 2010-2011

3.2.2 Completion year: 2014-2015

3.3 Progress:

3.3.1 Previous years, if any: Three perennial and 09 annual medicinal plant species were collected from different locations of Bangladesh and conserved them at BFRI HQs nursery.

3.3.2 This year: Propagating materials of 11 medicinal plants such as ashphal, alubokhara, daruchini, lotkon, nagmoni, passion fruit, kakrashing, koashia, joyphal, shamlata, borakanda, keu, palas were collected and conserve in conservation plots. Raised 4,000 seedlings of 35 species for re-establishment of conservation plots.

3.4 Findings: Conserved 90 perennial and 89 annual medicinal plant species at BFRI campus as a permanent source of propagating materials.

3.5 Financial Statement :

3.5.1 Total cost : Tk. 6,80,000.00

3.5.2 Cost of the year : Tk 1,17,500.00

4 Title of the study : Study on nursery and plantation technique of dhup (*Canarium resiniferum*)

4.1 Objective(s)

4.1.1. To observe the phenological character of dhup.

4.1.2. To standardize nursery techniques of dhup.

4.1.3. To develop plantation techniques of dhup.

4.2 Study period :

4.2.1 Starting year : 2011-2012

4.2.2 Completion year: 2015-2016

4.3 Progress:

4.3.1 Previous years, if any: Phenology (flowering, fruiting, leaf shedding etc.), germination percentage, germination period of seeds were studied. Twenty seedlings have conserved at BFRI campus.

4.3.2 This year: Raised experimental plots of dhup at Mirpur Botanical Garden, Dhaka; Chittagong University, International Islamic University, Kumira; Sitakund eco-park, Chittagong; Jahangirnagar University, Savar and BFRI campus. Recorded seed germination percentage which was treated with three techniques.

4.4 Findings: The highest germination percentage (80) was found in de-pulped seeds dried under sunlight for 02 days.

4.5 Financial Statement :

4.5.1 Total cost : Tk. 5,00,000.00

4.5.2 Cost of the year : Tk 1,12,000.00

5 Title of the study : Study on ethnomedicinal plants used by the *Khasia* community of Moulvibazar district

5.1 Objective(s) :

5.1.1. To collect the ethnomedicinal plants and their information used by the *Khasia* community of Moulvibazar district.

5.1.2. To find out the conservation strategy and to develop database for ethnomedicinal plants.

5.2 Study period :

5.2.1 Starting year : 2014-2015

5.2.2 Completion year: 2016-2017

5.3 Progress:

5.3.1 Previous years, if any: New study

5.3.2 This year: Three group discussion meetings were conducted with *Khasia* people and herbal practitioner to get information on medicinal plants they used.

5.4 Findings: Around 50 plant species was collected and 50 formulations were also collected from that group discussion.

5.5 Financial Statement :

5.5.1 Total cost : Tk. 2,50,000.00

5.5.2 Cost of the year : Tk 70,000.00

PLANTATION TRIAL UNIT DIVISION

1 Title of the study : Introduction of bamboo, rattan and golpata in the coastal homesteads of Bangladesh (2nd phase)

1.1 Objective(s) :

1.1.1. To investigate the possibility for introduction of bamboo rattan and golpata in coastal homesteads of Bangladesh.

1.1.2. To select site suitability of bamboo, rattan and golpata in the coastal areas.

1.1.3. To increase the productivity of bamboo, rattan and golpata in the coastal areas.

1.2 Study period :

1.2.1 Starting year : 2010-2011

1.2.2 Completion year: 2015-2016

1.3 Progress:

1.3.1 Previous years, if any: Totals of 1721 coastal homesteads were selected till 2015 for introducing bamboo, rattan and golpata. A total of 14,642 seedlings of bamboo, 22,456 seedlings of rattan and 10,460 seedlings of golpata have been distributed to the coastal farmers.

1.3.2 This year: Three awareness meeting were organized with coastal rural people for cultivating bamboo, rattan and golpata in the coastal homesteads. Bamboo, rattan and golpata plantations raised during 2010-2014 have been maintained. Seedlings of bamboo and rattan were supplied to the coastal farmers.

1.4 Findings: Two thousand and three hundred fifty eight and 2012 no. of seedlings of bamboo and rattan were supplied to 372 and 347 coastal farmers.

1.5 Financial Statement :

1.5.1 Total cost : Tk. 15, 00,000.00

1.5.2 Cost of the year : Tk 2, 50,000.00

2 Title of the study : Introduction of major bee foraging mangrove plant species in the coastal belts of Bangladesh

2.1 Objective(s) :

2.1.1. To develop better silvicultural techniques for each bee foraging mangrove plant species.

2.1.2. To provide the sources of honey plants.

2.2 Study period :

2.2.1 Starting year : 2010-2011

2.2.2 Completion year: 2014-2015

2.3 Progress:

2.3.1 Previous years, if any: A total of 10.4 ha experimental mixed plantations of some bee foraging mangrove plant species have been raised at Rangabali, Char kukri-Mukri, Sitakundu and Char Osman Research Stations.

2.3.2 This year: Raised mixed plantation with 14,000 seedlings of six bee foraging species at 4 Research Stations.

2.4 Findings: Raised 4.0 ha mixed plantation of six bee foraging species.

2.5 Financial Statement :

2.5.1 Total cost : Tk. 10, 00,000.00

2.5.2 Cost of the year : Tk 2, 20,000.00

3 Title of the study : Development of model vegetation to protect soil erosion, salt spray and other climatic changes in the coastal belt of Bangladesh

3.1 Objective(s) :

3.1.1. To develop a better model plantation of suitable species against major climatic changes in the coastal belt of Bangladesh.

3.1.2. To select mangrove species that can tolerate cyclonic and salt hazard.

3.1.3. To increase the coastal forest product.

3.2 Study period :

3.2.1 Starting year : 2010-2011

3.2.2 Completion year: 2014-2015

3.3 Progress:

3.3.1 Previous years, if any: A total of 14.0 ha experimental model plantations in different length and size have been established at 4 research stations.

3.3.2 This year: Seeds of keora, baen and golpata for newly accreted lands; sundari, kankra, passur, gewa, shingra and khalshi for moderately established lands were collected for raising model plantations.

3.4 Findings: Raised a total of 5.44 ha experimental model plantations in different length and size with 24,000 seedlings of these mangrove species at 4 Research Stations.

3.5 Financial Statement :

3.5.1 Total cost : Tk. 20, 00,000.00

3.5.2 Cost of the year : Tk 3, 00,000.00

4 Title of the study : Ecological succession in the man-made coastal forests in relation to age and other related factors

4.1 Objective(s) :

4.1.1. To observe the changes of vegetation and natural regeneration in the coastal man-made forests.

4.1.2. To determine the impact of related climatic factors, which are responsible for the ecological succession in the coastal forests.

4.1.3. To increase coastal forest resources of the country.

4.2 Study period :

4.2.1 Starting year : 2012-2013

4.2.2 Completion year: 2016-2017

4.3 Progress:

4.3.1 Previous years, if any: A total of 108 Temporary Sample Plots (TSP) have been established at different chars and offshore islands in Rangabali, Char kukri-Mukri, Char Osman and Sitakundu Research Stations.

4.3.2 This year: Data on the status of natural regeneration have been recorded from Western and Eastern coastal belts.

4.4 Findings: A total of 53163 and 63000 no of seedlings of 09 mangrove species were regenerated per hectare inside keora plantation in the Western and Eastern coastal belts.

4.5 Financial Statement :

4.5.1 Total cost : Tk. 20, 00,000.00

4.5.2 Cost of the year : Tk 1, 25,000.00

5 Title of the study : Monitoring and maintenance of existing trial plantations in the coastal areas of Bangladesh

5.1 Objective(s) :

5.1.1. To assess the growth performance and phenology of different mangrove and non-mangrove species at different char lands.

5.1.2. To develop future seed sources for sustainable coastal forest management.

5.2 Study period :

5.2.1 Starting year : 2013-2014

5.2.2 Completion year: 2017-2018

5.3 Progress:

5.3.1 Previous years, if any: A total of 30.0 ha experimental plantations of mangrove (25.0 ha), non-mangrove (4.0 ha) and palm (1.0 ha) species have been established at different sites of Rangabali, Char Kukri-Mukri, Char Osman and Sitakundu Forest Research Stations.

5.3.2 This year: A total of 30.0 ha older trials of mangrove (25.0 ha), non-mangrove (4.0 ha) and palm (1.0 ha) plantation have been maintained by weeding, cleaning, climber cutting, barbed wire fence repairing, etc. at different islands under Rangabali, Char Kukri-Mukri, Char Osman and Sitakunda Research Stations.

5.4 Findings: Established 30.0 ha plantations of mangrove, non-mangrove and palm species at four coastal research stations.

5.5 Financial Statement :

5.5.1 Total cost : Tk. 15, 00,000.00

5.5.2 Cost of the year : Tk 3, 00,000.00

6 Title of the study : Selection of salt tolerant fruit and medicinal tree species in the coastal areas of Bangladesh

6.1 Objective(s) :

6.1.1. To select suitable salt tolerant fruit and medicinal tree species in the coastal areas of Bangladesh.

6.1.2. To observe the growth performance of different fruit and medicinal tree species in different sites.

6.1.3. To assess the production of fruits in different fruit tree species.

6.2 Study period :

6.2.1 Starting year : 2013-2014

6.2.2 Completion year: 2017-2018

6.3 Progress:

6.3.1 Previous years, if any: A total of 6745 seedlings of different fruit tree species have been distributed among 150 farmer's homesteads. Totals of 4.0 ha plantations of different medicinal tree species have been raised at 4 Research Stations.

6.3.2 This year: A total of 8,400 seedlings of some major fruit tree species such as coconut, mango, jackfruit, black berry, guava, tamarind, ber, pummelo, hog plant, litchi, elephant apple, indian olive, velvety apple and amloki were raised for distribution. Seedlings of different fruit trees (6745 nos.) have been distributed and planted in 150 coastal homesteads at 6 Research Stations.

6.4 Findings: Four hectares experimental plantations of medicinal tree species have been raised at 4 Research Stations.

6.5 Financial Statement :

6.5.1 Total cost : Tk. 20, 00,000.00

6.5.2 Cost of the year : Tk 3,75,000.00

SEED ORCHARD DIVISION

1 Title of the Study : Selection of plus trees of important agroforestry and forest tree species (4th Phase)

1.1 Objective(s) :

1.1.1. To establish sources of superior quality seeds from selected clones or progenies.

1.1.2. To obtain best possible gains from the breeding programmes by testing progenies/clones of the selected plus trees.

1.1.3. To popularize superior quality seeds produced in seed orchards.

1.2 Study period:

1.2.1 Starting year : 2012-2013

1.2.2 Completion year : 2015-2016

1.3 Progress :

1.3.1 Previous years : A total of 2129 plus trees of 59 different forest tree species were selected and seeds are being collected from selected species. Distributed /sold 9536 kg seeds of 33 different forest tree species to different tree planting agencies.

1.3.2 This year : Remarkd a total 230 previously selected plus trees of 40 different forest tree species at seven Seed Orchard Centres. Collected 100 kg seeds of 17 different forest tree species from plus trees and supplied to private planters, DNMS and other private organizations.

1.4 Findings: Two thousand one hundred twenty nine plus trees of more than forty species were selected and 9536 kg seeds were collected and distributed. Better quality seed sources were created having broader genetic base.

1.5 Financial statement :
1.5.1 Total cost : Tk. 9,40,000.00
1.5.2 Cost of the year : Tk. 32,000.00

2 Title of the Study : Establishment and management of seed orchard (4th phase)

2.1 Objective(s) :

- 2.1.1. To establish and manage superior quality seed sources from selected clones or progenies.
- 2.1.2. To preserve better genetic stocks under *ex situ* condition from the natural stands and plantations for future breeding and tree improvement programme.
- 2.1.3. To develop suitable techniques for mass production of clonal planting materials.
- 2.1.4. To screen best clones/progenies.
- 2.1.5. To supply quality seeds to related stakeholders.

2.2 Study period:

- 2.2.1 Starting year : 2014-2015
- 2.2.2 Completion year : 2018-2019

2.3 Progress :

2.3.1 Previous years : Collected 4700 kg seeds of teak, gamar, pine, telsur and eucalyptus from different seed orchards and distributed to different stakeholders. Raised 71.0 ha seedling seed orchard of teli-garjan, dholi-garjan (*Dipterocarpus pilosus*), dhakijam, chapalish, eucalyptus sp, akashmoni and gamar and 45.5 ha clonal seed orchard of teak, gamar, and mahogany.

2.3.2 This year: Raised 17500 seedlings and 5,000 root stocks of different forest tree species at different seed orchard centres(SOCs) for the establishment of clonal seed orchard (CSO) and seedling seed orchard (SSO). Established 3.5 ha SSO and 3.0 ha CSO at different SOC. Maintained previously raised seed orchards at different SOC.

2.4 Findings: Established 32.0 ha clonal seed orchard of teak, gamar and mahogany and 25.0 ha seedling seed orchard of garjan, dholigarjan, dhakijam, chapalish, eucalyptus (*Eucalyptus camaldulensis*, *E. tereticornis*, *E. europhylla*), akashmoni and gamar at different SOC. Seeds are being collected from teak and gamar seed orchard at Kaptai.

2.5 Financial statement :
2.5.1 Total cost : Tk. 21,000,000.00
2.5.2 Cost of the year : Tk. 6,69,500.00

3 Title of the study : Superior stands/ woodlots selection and conversion into Seed Production Area(SPA)(4th phase)

3.1 Objective(s):

- 3.1.1. To develop an interim source of seeds.
- 3.1.2. To ensure supply of better quality seeds.

3.2 Study period:

- 3.2.1 Starting year : 2013-2014
- 3.2.2 Completion year : 2015-2016

3.3 Progress:

3.3.1 Previous years : Two hectare SPA of akashmoni were established and seed collection and production are going on. About 262 kg seeds of akashmoni were collected from established SPA and distributed to DNMS, FD, and private planters.

3.3.2 This year: Data on vigour, bole form, branching habits, apical dominance, forking, health and flowering/fruitletting of *Acacia* hybrid (*auriculiformis x mangium*) plantation was collected at Salna Seed Orchard Center.

3.4 Findings: Established 2.0 ha SPA of akashmoni from where seed collection is going on.

3.5 Financial statement :

- 3.5.1 Total cost : Tk. 3,90,000.00
- 3.5.2 Cost of the year : Tk. 1,000.00

4 Title of the study : Popularizing quality seeds and planting materials through distribution (4th Phase)

4.1 Objective(s) :

- 4.1.1. To develop awareness about the importance and benefits of using quality seeds and seedlings.
- 4.1.2. To increase the quality and quantity of tree production in plantation and homesteads.

4.2 Study period:

- 4.2.1 Starting year : 2013-2014
- 4.2.2 Completion year : 2015-2016

4.3 Progress:

4.3.1 Previous years : Distributed 13,000 quality seedlings of 13 species.

4.3.2 This year : Raised 10,000 seedlings of ten different forest tree species and produced 3000 rooted cuttings of acacia hybrid and distributed to DNMS and different tree planters. Data were collected on germination period, germination % and survival % of raised seedlings.

4.4 Findings: The ranges of germination period of ten different forest tree species at nursery stage varied from species to species (5-30days), germination percentage (60-90%) and survival percentage (90-95%).

4.5 Financial statement :

- 4.5.1 Total cost : Tk. 17,80,000.00
- 4.5.2 Cost of the year : Tk. 39,000.00

5 Title of the study : Testing of seeds before distribution and standardization of storage behaviour (5th Phase)

5.1 Objective(s):

5.1.1. To develop a unified system of seed collection, storage, export, import, testing and distribution of forest tree seeds.

5.1.2. To ensure the supply of quality seeds to the planters.

5.1.3. To strengthen the BFRI seed testing laboratory.

5.2 Study period:

5.2.1 Starting year : 2012-2013

5.2.2 Completion year : 2016-2017

5.3 Progress:

5.3.1 Previous years : Storage behaviour of civit and agar and routine testing of the collected seeds were done prior to distribution of seeds.

5.3.2 This year : Observed seed storage behaviour of telsur treated in six media, viz.- T₀: control, T₁: sand, T₂: chalk-powder, T₃: normal- refrigerator, T₄: saw-dust and T₅: ash.

5.4 Findings: Seed germination showed better (50.0%) in the storage condition of refrigerator (normal) and viability of seeds up to 12 days storage since seed collection.

5.5 Financial statement :

5.5.1 Total cost : Tk. 3,50,000.00

5.5.2 Cost of the year : Tk. 45,000.00

6 Title of the study : Centralization of high yielding clones of rubber (*Hevea brasiliensis*) and establishment of orchard (2nd Phase)

6.1 Objective(s):

6.1.1. To increase the productivity of latex by selecting better yielding rubber plant/ clone.

6.1.2. Centralization of high yielding clones in hedge orchard.

6.2 Study period:

6.2.1 Starting year : 2014-2015

6.2.2 Completion year : 2018-2019

6.3 Progress:

6.3.1 Previous years : One hundred twenty trees were selected at Datmara Rubber estate, 20,000 root stocks were raised to produce ramets by using selected clones. Raised 2.5 ha clonal trial plots at Datmara rubber estate from 32 selected trees.

6.3.2 This year : Prepared 1000 nos. of rubber ramets at Hyankoo SOC. Established 1.2 ha rubber plantation (CSO-0.6 ha & SSO-0.6ha) at Dantmara Rubber Estate, Hyanko. Growth data collected from last year clonal plantation.

6.4 Findings: The survivability of different clones of rubber was 84- 92%. The average height and dbh was 2.2 - 3.5m and 1.6 - 2.23cm.

6.5 Financial statement :

6.5.1 Total cost : Tk. 28,50,000.00

6.5.2 Cost of the year : Tk. 4,13,500.00

SILVICULTURE GENETICS DIVISION

1 Title of the Study : Mass propagation of bamboos (*Dendrocalamus giganteus*, *D. longispathus*, *Bambusa balcooa*, *B. vulgaris*, *B. bambos*, *B.*

***cacharensis*, *B. multiplex*, and *D. brandisii*) through branch cuttings and seedlings proliferation (3rd Phase)**

1.1 Objective(s):

- 1.1.1. To make available bamboo propagules for wider distribution and dissemination with developed technology.
- 1.1.2. To develop linkage with different stakeholders.

1.2 Study period:

- 1.2.1 Starting year : 2014-2015
- 1.2.2 Completion year : 2019-2020

1.3 Progress:

1.3.1 Previous years: Raised twenty seven thousand propagules of five demanding bamboo species (*Dendrocalamus giganteus*, *Bambusa vulgaris*, *B. balcooa*, *B. bambos*, *B. tulda* and *Schizostachyum dullooa*) and distributed to the planters.

1.3.3 This year: Seven thousand bamboo propagules of different species were raised through branch cutting and seedling proliferation techniques. The propagules were distributed among the different stakeholders such as Government and Non-government organizations, Universities and individual farmer level.

1.4 Findings : The survival rate of cuttings for *Dendrocalamus giganteus* was about 18 % and 40 – 90% for other species. People’s awareness increased for bamboo cultivation through planting branch cuttings propagules.

1.5 Financial statement :

- 1.5.1 Total cost : Tk. 12,50,000.00
- 1.5.2 Cost of the year : Tk. 1,06,620.00

2 Title of the Study: Conservation of threatened plant species through domestication (2nd Phase)

2.1 Objective(s):

- 2.1.1. To conserve and centralize the gene resource of threatened forest plant species.
- 2.1.2. To domesticate the threatened species for conservation.
- 2.1.3. To raise demonstration and resource plots for conservation purpose.

2.2 Study period:

- 2.2.1 Starting year : 2014-2015
- 2.2.2 Completion year : 2018-2019

2.3 Progress :

2.3.1 Previous years : Raised eighteen thousands seedlings of twenty two threatened forest tree species for the establishment of conservation plots.

2.3.2 This year : Raised 3000 seedlings of boilam (*Anisoptera scaphula*), pitali (*Trewia nudiflora*), tamal (*Diospyros montana*), haldu (*Adina cordifolia*) narikeli (*Pterigota alata*), civit (*Swintonia floribunda*) and maintained previously raised 2.0 acres plantation of 22 threatened forest tree species at IFESCU campus of Chittagong University.

2.4 Findings: Raised 0.5 acre conservation plots of eight threatened forest tree species at Foy’s Lake and two acres of 22 threatened forest tree species at IFESCU campus as gene resource conservation plot.

2.5 Financial statement	:
2.5.1 Total cost	: Tk. 6,50,000.00
2.5.2 Cost of the year	: Tk. 54,400.00

3 Title of the Study: Development of tissue culture techniques for different bamboo species viz. Farua (*Bambusa polymorpha*), Bhudum (*Dendrocalamus giganteus*), China bamboo (*D. latiflorus*), Wappi (*Thyrsostachys sp.*) and Pencha (*D. hamiltonii*) (2nd Phase)

3.1 Objective(s):

- 3.1.1. To develop micro-propagation techniques for the bamboo species.
- 3.1.2. To produce a homogenous plant population.
- 3.1.3. To conserve *in vitro* plants.

3.2 Study period:

- 3.2.1 Starting year : 2014-2015
- 3.2.2 Completion year : 2018-2019

3.3 Progress:

3.3.1 Previous years : Culture establishment and multiple shoot production of farua (*Bambusa polymorpha*), bhudum (*Dendrocalamus giganteus*), dolu (*Schizostachyum dullooa*), membra (*D.membranaceus*), ora (*D. longispathus*), China bamboo (*D. latiflorus*), wappi (*Thyrsostachys sp.*) and pencha (*D. hamiltonii*) bamboos have been done. The rooted plantlets of *D. brandisii* and *B. balcooa* were transferred to green house.

3.3.2 This year: Established culture and optimized multiple shoot production of four bamboo species viz. Farua (*Bambusa polymorpha*), Wappi (*Thyrsostachys sp.*), China (*Dendrocalamus latiflorus*) and Bhudum (*Dendrocalamus giganteus*).

3.4 Findings: Developed rooted plantlets of *D. brandisii* and *B. balcooa*.

3.5 Financial statement	:
3.5.1 Total cost	: Tk. 21,50,000.00
3.5.2 Cost of the year	: Tk. 86,780.00

4 Title of the Study: Development of tissue culture techniques for 1) Timber trees: boilam (*Anisoptera scaphula*), tamal (*Diospoyros montana*), 2) Medicinal plant: amloki (*Phyllanthus emblica*) and 3) Fruit tree: lotkon (*Baccaurea sapida*) (2nd Phase)

4.1 Objective(s):

- 4.1.1. To develop micro-propagation techniques for the species.
- 4.1.2. To produce a homogenous plant population.
- 4.1.3. To conserve *in vitro* plants.

4.2 Study period:

- 4.2.1 Starting year : 2014-2015
- 4.2.2 Completion year : 2018-2019

4.3 Progress :

4.3.1 Previous years : Culture establishment and multiple shoot production of amloki and tamal have been done.

4.3.2 This year : Developed callus of amloki (*Phyllanthus emblica*) from Cotyledon direct plant regeneration From shoot tip culture and indirect regeneration from cotyledon derived callus

4.4 Findings: Culture has been established from the shoot tip explants (seedling shoot tip) of *Phyllanthus emblica* and *Diospoyros montana*.

4.5 Financial statement :

4.5.1 Total cost : Tk. 6,00,000.00

4.5.2 Cost of the year : Tk. 1,02,200.00

SILVICULTURE RESEARCH DIVISION

1 Title of the Study : Development of planting technique of Sal (*Shorea robusta*)

1.1 Objective(s) :

1.1.1 To develop suitable planting technique of sal.

1.1.2 To enrich the degraded sal forest through aided regeneration.

1.1.3 To monitor the change of biodiversity of sal forest overtime after establishing the plantation.

1.2 Study period :

1.2.1 Starting year : 2010-2011

1.2.2 Completion year : 2014-2015

1.3 Progress:

1.3.1 Previous years, if any: Established 5.0 ha experimental plantation at Charaljani (1.5 ha) and Charkai (3.5 ha) SR stations through planting seedlings, stump and sowing direct seeds.

1.3.2 This year: Raised 2000 seedlings and established 1.0 ha experimental plantations at Charkai research station by seedlings, stumps and direct seed sowing in thalli. Maintained 5.0 ha previous experimental plantations through weeding and climber cutting. Collected and summarized data on survival and growth.

1.4 Findings: Initial survival and height growth performance in relation to different types of planting materials have been identified. Plantation raised with seedlings showed the best survival and height growth performance followed by stumps and direct seed sowing. However, there is no significant difference in survival and height growth performance was found among the different planting materials. Plantation of sal can be raised easily and economically through direct seed sowing in thallis. In this case 2-3 seeds should be sown in each thali.

1.5 Financial Statement :

1.5.1 Total cost : Tk. 5,00,000.00

1.5.2 Cost of the year : Tk. 68,000.00

2 Title of the Study : Study on the development of oil palm (*Elaeis guineensis*) cultivation in Bangladesh.

2.1 Objective(s) :

- 2.1.1 To determine present status of oil palm plantation in Bangladesh.
- 2.1.2 To standardize nursery raising technique and management.
- 2.1.3 To standardize plantation (spacing) and management technique of oil palm.
- 2.1.4 To study the reproductive biology of oil palm in plantations of Bangladesh.
- 2.1.5 To introduce and test the high yielding variety (HYV) of oil palm.

2.2 Study period :

- 2.2.1 Starting year : 2010-2011
- 2.2.2 Completion year : 2014-2015

2.3 Progress :

2.3.1 Previous years: Raised 13.5ha experimental plantations at Charaljani, Keochia, Hinguli and Charkai research stations (RS).

2.3.2 This year:

Collected oil palm seeds and raised five hundred seedlings and observed germination capacity, germination period, seedlings' growth, etc. at Charkai research stations. Germination started 32 days after seed sowing and completed within 58 days in the nursery. Germination percentage was 67.0 and seedlings attained an average height of 25.4cm within six months. Maintained 13.5

ha previous experimental plantations through weeding, gap-filling, cleaning, climber cutting, watering during dry season, etc.

Raised 1.5 ha oil palm plantation with three spacing's (viz. 5m x 5m, 6m x 6m, and 7m x 7m) with RCBD design at Charkai research station. Collected and summarized survival and growth performance data at six months interval.

2.4 Findings: No significant difference has been observed in survival and initial growth of the plants due to spacing. No significant difference has also been observed in survival at three locations. But a great variation in growth performance of the plants has been observed in different sites where it was better at Charaljani than Keochia and Charkai. At Charaljani, 50-60% plants were found in fruiting stage at four years age plantation. It is suggested to continue the study to observe the variation of growth and fruit production in relation to site condition and spacing.

2.5 Financial statement :

- 2.5.1 Total cost : Tk. 15,00,000.00
- 2.5.2 Cost of the year : Tk. 1,44,000.00

3 Title of the Study : Growth performance of different forest tree species in research plots (4th Phase)

3.1 Objective(s) :

- 3.1.1 To assess the growth performance of different tree species in four agro-ecological regions of the country.
- 3.1.2 To determine the silvics of different forest tree species.
- 3.1.3 To develop future quality seed sources.

3.2 Study period :

- 3.2.1 Starting year : 2012-2013
- 3.2.2 Completion year: 2014-2015

3.3 Progress:

3.3.1 Previous years: Up to 2014, raised 135.0 ha experimental plantations (species elimination trials; provenance trials, coppicing trials, spacing trials, mixed planting trials, under planting trials, planting technique, arboretum of 36 species, Ex-situ conservation etc.) at four Silviculture Research Stations. Maintained those plantations by weeding, cleaning, climber cutting, pruning, etc. Compiled phenological data of 240 indigenous and exotic tree species.

3.3.2 This year : Maintained 80.0 ha previously raised experimental plantations (ex-situ conservation plots, species elimination and site suitability trial, provenance trial, mixed species trial plantations, bamboo plantations, etc.) by weeding at Keochia, Lawachara, Charaljani and Charkai SR stations.

3.4 Findings: Determined phenological characters of 240 indigenous and exotic species, selected site specific species/ provenance for large scale plantation (15 fast-growing species, 21 medium rotation species, 17 long rotation species, 4 provenance of *A. auriculiformis*, 6 provenance of *Acacia mangium*, 3 provenance of *Pinus caribaea*, 3 provenance of *P. oocarpa*, 4 provenance of *Glericidiasepium*, 3, 2, 2, 2 provenance of *Eucalyptus camaldulensis*, *E. brassiana*, *E. tereticornis*, *E. urophylla* respectively), established plantations of 70 indigenous and exotic tree species. Assessed biomass of three eucalyptus species viz. *Eucalyptus camaldulensis*, *E. tereticornis* and *E. brassiana* (3rd rotation) at Charkai SR Station.

3.5 Financial statement :

3.5.1 Total estimated cost : Tk. 40, 00,000.00

3.5.2 Cost of the year : Tk. 3,00,000.00

4 Title of the Study: Large scale production of quality seedlings of important forest tree species (2nd Phase)

4.1 Objective(s) :

4.1.1 To determine age, height and root-shoot ratio of seedlings for dispatch from nursery to plantation.

4.1.2 To provide quality seedlings to planters for successful plantation establishment.

4.1.3 To develop linkages with planters for awareness development about quality seedling.

4.2 Study period :

4.2.1 Starting year : 2010-2011

4.2.2 Completion year: 2014-2015

4.3 Progress :

4.3.1 Previous progress: Raised and distributed more than 11 lakh quality seedlings of different indigenous and exotic forest tree species.

4.3.2 This year: Raised and distributed 30,000 quality seedlings of different popular forest tree species such as mahogany raintree, segun, jarul, arjun, amra, sil-koro), horitoki, kat-badam, amloki, chickrassi, toon, telsur, teli-garjan, hybrid acacia, janglibox badam, haldu, raktan, sonalu, bohera, peyara, jalpai, bakul, agar, lambu, simul, civit, sonalu, sal, parul, gandhi-gazari, etc. at HQs nursery.

Maintained existing seedlings in the nursery through watering, weeding, sorting, rearrangement, etc. Collected data on survival (%), height, and collar diameter of seedlings of different species are shown in Table 1.

Table 1. Seed germination, survival and growth of seedlings of 32 forest tree species

Sl. No	Scientific name	Germination period		Germination %	Survival (%)	Av. ht. (cm)	Collar dia (cm)	Age (month)
		Started (days)	Completed (days)					
1	Raintree (<i>Samanea saman</i>)	5	10	68	61	72.0	5.1	5
2	Sil-koroi (<i>Albizia. Procera</i>)	7	10	76	83	78.2	4.3	6
3	Box badam (<i>Sterculia foetida</i>)	10	20	80	23	50.5	7.2	5
4	Chickrassi (<i>Chukrassia velutina</i>)	7	15	70	90	27.6	3.1	5
5	Hybrid acacia (<i>Acacia auriculiformis X A. Mangium</i>)	5	15	80	97	64.0	6.1	5
6	Mahogany (<i>Swietenia mahagoni</i>)	2	20	70	62	34.6	4.2	5
7	Segun (<i>Tectona grandis</i>)	40	35	50	94	31.6	4.6	5
8	Arjun (<i>Terminalia arjuna</i>)	35	20	80	46	46.4	4.1	5
9	Kat-badam (<i>Terminalia catappa</i>)	5-7	25	60	86.4	39.8	7.0	5
10	Amloki (<i>Phyllanthus emblica</i>)	12	10	65	91	61.5	4.0	6
11	Hartoki (<i>Terminalia chebula</i>)	12	22	70	23	24.6	4.2	6
12	Jalpai (<i>Elaeocarpus varunua</i>)	16	22	65	60	35.4	3.9	6
13	Bohera (<i>Terminalia bellirica</i>)	50	45	80	86	36.3	4.5	6
14	Jarul (<i>Lagerstroemia speciosa</i>)	20	15	50	35	26.2	3.0	6
15	Sonalu (<i>Cassia fistula</i>)			70	84	13.2	2.6	4
16	Sal (<i>Shorea robusta</i>)	4	5-10	60	72	9.2	1.1	2
17	Civit (<i>Swintonia floribunda</i>)	3	5	75	80	12.1	2.5	3

4.4 Findings: Developed appropriate nursery technique for 30 indigenous and exotic forest tree species.

4.5 Financial Statement :

4.5.1 Total estimated cost : Tk. 15,00,000.00

4.5.2 Cost of the year : Tk. 1,40,000.00

5 Title of the Study : Spacing trial of agar plantation (*Aquilaria malaccensis*)

5.1 Objective(s) :

5.1.1 To determine the optimum spacing for agar plantation.

5.1.2 To assess biomass production and effect of spacing on agar formation.

5.2 Study period :

5.2.1 Starting year : 2010-2011

5.2.2 Completion year : 2014-2015

5.3 Progress :

5.3.1 Previous progress: Raised 10.44 ha experimental plantations at Keochia and Charaljani research stations.

5.3.2 This year: Collected agar seeds and raised 2000 seedlings at Charkai research station.

Maintained 10.44 ha experimental plantations through weeding at Charkai and Keochia research stations. Raised 1.16 ha new agar plantation at four spacing (viz. 1.5 m x 1.5 m, 2.0 m x 2.0 m, 2.5 m x 2.5 m and 3.0 m x 3.0 m) at Charkai research station.

5.4 Findings: Effect of spacing and site condition on survival and initial growth of agar plants has been determined. No significant difference has been observed in survival and initial growth of the plants due to spacing. Variation in survival and plant growth was found among three sites and also in different site conditions in each site. Survival and height growth of the plants were found to vary in different years. Best survival and growth of the plants was observed in plain land at Charaljani and Keochia. However growth of the plants was found very low at Charkai though the plantation site is plain land. Survival and growth of plants were found poorest in the plantation raised during 2012 at Keochia having moderate slope and hardy soil condition. It is suggested to raise agar plantation in well drained plain land and low elevated foot hill sites with sufficient moisture content in the soil.

5.5 Financial statement :

5.6.1 Total estimated cost : Tk. 5,40,000.00

5.6.2 Cost of the year : Tk. 99,000.00

6 Title of the Study: Conservation of indigenous/native forest tree species in different agro-ecological regions of Bangladesh

6.1 Objective(s) :

6.1.1 To conserve germplasm of indigenous forest tree species in different agro ecological regions of Bangladesh.

6.1.2 To observe their suitability in particular sites.

6.2 Study period :

6.3.1 Starting year : 2013-2014

6.3.2 Completion year : 2017-2018

6.3 Progress:

6.3.1 Previous progress: Raised 75,000 seedlings of more than 80 indigenous forest tree species to raise 25 ha experimental plantations at Keochia, Lawachara, Charaljani and Charkai SRS.

6.3.2 This year: Raised 20,000 seedlings of different indigenous forest tree species at Charkai, Charaljani, Lawachara and Keochia research stations. Raised 25.0 hectares plantations with 82 species at Charkai, Charaljani, Lawachara and Keochia research stations.

6.4 Findings : Conserved 25.0 ha of 192 indigenous forest tree species at four silviculture research stations.

6.5 Financial statement :

6.5.1 Total estimated cost : Tk. 21,50,000.00

6.5.2 Cost of the year : Tk. 5,60,000.00

7 Title of the Study : **Suitability of *Khaya anthotheca* (lambu) plantation in Bangladesh**

7.1 Objective(s) :

7.1.1 To develop/standardize nursery technique of lambu.

7.1.2 To develop suitable plantation technique of lambu.

7.1.3 To find out survival, growth and site suitability of lambu.

7.1.4 To observe the disease infestation, environmental effect, etc. if any in the plantation.

7.2 Study period :

7.2.1 Starting year : 2013-2014

7.2.2 Completion year : 2017-2018

7.3 Progress :

7.3.1 Previous progress: Raised 2.0 ha trial plantation at four (Charkai, Charaljani, Lawachara and Keochia) Silviculture Research Stations.

7.3.2 This year: Raised 6000 seedlings. Maintained 2.0 ha experimental plantations. Raised trial plantation over an area of 2.0 ha (0.5 ha in each station) at four (Charkai, Charaljani, Lawachara and Keochia) Silviculture Research Stations. In one year plantation, the average highest (90%) survival was found at Charaljani, followed by Charkai (88%), Keochia (63.3%) and Lawachara (61.7%).

7.4 Findings : NA

7.5 Financial statement :

7.5.1 Total estimated cost : Tk. 6,50,000.00

7.5.2 Cost of the year : Tk. 89,000.00

SOIL SCIENCE DIVISION

1 Title of the study : **Effect of integrated soil fertility management in rubber plantation at Dantmara Rubber Estate, Fatikchari, Chittagong**

1.2 Objective(s) :

1.2.1. To utilize litter fall of rubber trees as organic compost.

1.2.2. To assess the effect of compost on growth and latex production in new and mature rubber plantation

1.2.3. To evaluate the role of different nitrogen fixing crops in new rubber plantation.

1.3 Study period :

1.3.1 Starting year : 2010-2011

1.3.2 Completion year: 2014-2015

1.4 Progress:

1.4.1 Previous years, if any: Secondary soil and compost samples were analyzed. Selected 144 mature rubber trees in Dantmara Rubber Estates for applying different treatments (compost and NPK fertilizers dose) on latex yield and applied compost in new rubber plantation.

1.4.2 This year: Data on latex yield from selected mature rubber plantation were collected from July, 2014 to June, 2015 (3 times per month).

1.5 Findings: Maximum latex yield (128cc/tree/day) was attained by the application of NPK fertilizers dose at the rate of 150 gm urea + 100 gm TSP + 100 gm MP per tree compared to compost of rubber leaf litter + PKS fertilizers (126 cc/tree/day). Maximum GBH and height (25.64 cm and 6.70 m) was attained by the application of thai lazzabati as a cover crop in the rubber plantation compared to pueraria (23.22 cm and 6.04 m) and arhar (20.83 cm and 5.83m) in the rubber plantation.

1.6 Financial Statement :

1.6.1 Total cost : Tk. 5,00,000.00

1.6.2 Cost of the year : Tk. 1,79,300.00

2 Title of the study : Assessment of carbon storage trends in the soil-plant system in different forest areas of Bangladesh

2.2 Objective(s) :

2.2.1. To determine carbon storage of different forest tree species and adjacent soil.

2.2.2. To assess the correlation between soil and plant system on carbon storage trends.

2.3 Study period :

2.3.1 Starting year : 2010-2011

2.3.2 Completion year: 2014-2015

2.4 Progress:

2.4.1 Previous years, if any: Organic carbon content of 38 (thirty eight) species (12 mangrove, 12 forest and 14 bamboo species) and soil samples from adjacent selected tree species were analyzed and recorded.

2.4.2 This year: Different plant parts (root, stem, branch, twig and leaf samples) from two forest tree species (mahogany and rubber) at different age groups (1-5, 6-10, 11-15, 16-20, 21-25 and 26-30 years) were collected from Comilla and Dabua Rubber Estate, Rowzan, Chittagong. On the other hand, soil samples for soil bulk density and organic carbon analysis were also collected from the adjacent selected tree species.

2.5 Findings: At the age of 11-15 years of mahogany contained highest amount of carbon (54.99%) compared to the age of 16-20 years. But in the rubber tree, there was not found any difference of carbon content at different age groups. The total carbon content of soil in rubber at Dabua Rubber Estate, Rowzan and mahogany at Comilla was 17.79

& 15.26 ton/ha and 17.76 & 13.57 ton/ha under the soil depth 0-15 and 15-30 cm respectively.

2.6 Financial Statement :

2.6.1 Total cost : Tk. 6,00,000.00

2.6.2 Cost of the year : Tk. 68,380.00

3 Title of the study : Effect of using preservative treated bamboo materials on soil properties and production of betel leaf in betel leaf cultivation

3.2 Objective(s) :

3.2.1. To monitor the changes in soil properties for using preservative treated bamboo materials in betel leaf cultivation.

3.2.2. To assess the yield and quality of betel leaf in the betel leaf farms.

3.3 Study period :

3.3.1 Starting year : 2013-2014

3.3.2 Completion year: 2015-2016

3.4 Progress:

3.4.1 Previous years, if any: Initial and second time soil and leaf samples were collected and analyzed from the experimental plot at shitakunda.

3.4.2 This year: Soil and betel leaf samples from treated and untreated bamboo materials using plots were collected and nutrient status were analyzed.

3.5 Findings: There was no significance difference in nutrient status of soil between the treated and untreated plots. But in plant samples analysis, Fe (1282 ppm), B (458 ppm) and Cr (30.74 ppm) were found higher in the treated plot compared to untreated plot (1098 ppm, 113 ppm and 7.32 ppm respectively).

3.6 Financial Statement :

3.6.1 Total cost : Tk. 4,00,000.00

3.6.2 Cost of the year : Tk. 1,02,380.00

WILDLIFE SECTION

1 Title of the study : Development and maintenance of wildlife Museum (2nd Phase)

1.1 Objective(s) :

1.1.1. To collect wildlife specimens, preservation and routine care.

1.1.2. To preserve wildlife specimens for future demonstration and research.

1.2 Study period :

1.2.1 Starting year : 2011-2012

1.2.2 Completion year: 2015-2016

1.3 Progress:

1.3.1 Previous years, if any: A total of 30 wildlife specimens including Amphibia-04, Reptilia-10, Aves-10, Mammalia-06 were collected and preserved in the wildlife museum.

1.3.2 This year: Six were collected and preserved in the wildlife museum.

1.4 Findings: Reptilia-03, Amphibia-01 and skin of Large Indian Civet (*Viverra zibetha*) are preserved in the wildlife museum.

1.5 Financial Statement :

1.5.1 Total cost : Tk. 5,00,000.00

1.5.2 Cost of the year : Tk. 27,000.00

2 Title of the study : Present status of Phayre's leaf monkey (*Trachypithecus phayrei*), Pig-tailed macaque (*Macaca nemestrina*) and Capped leaf monkey (*Trachypithecus pileatus*) in hill forest of Bangladesh

2.1 Objective(s) :

2.1.1. To evaluate the distributions and population of the non human primate species in hill forest of Bangladesh for sustainable conservation.

2.2 Study period :

2.2.1 Starting year : 2012-2013

2.2.2 Completion year: 2014-2015

2.3 Progress:

2.3.1 Previous years, if any: Information on present status, population and major threats of three non-human primate species in protected areas of Chittagong and Kaptai NP, Chittagong Hill Tracts have been collected. One scientific paper has been published in the journal of Tigerpaper, Thailand in 2015.

2.3.2 **This year:** Surveys were made in Khadimnagar NP, Sylhet; LawacharaNP, Moulovibazar; Satchari NP and Rema-KalengaWS, Hobigong for the determination of distribution and assessment of population of three non-human primates.

2.4 Findings: A total of 31 individuals of capped leaf monkey in 3 groups, 2 group of phayre's leaf monkey constitute a total of 33 individuals and pig-tailed macaque in 4 groups consist of 94 individuals were recorded from Lawachara NP. In Rema-Kalenga WS a total of 75 numbers of capped leaf monkey in 7groups, 2 group of phayre's leaf monkey constitute a total of 30 individuals and pig-tailed macaque 2 group consist a total of 27 individuals were recorded. But in Satchari NP a total of 86 individuals of capped leaf monkey in 8 groups, 1 group of phayre's leaf monkey constitute a total of 15 individuals and Pig-tailed macaque in 3 groups consist of 133 individuals were recorded.

2.5 Financial Statement :

2.5.1 Total cost : Tk. 8,00,000.00

2.5.2 Cost of the year : Tk. 1,23,200.00

3 Title of the study : Status of wildlife in Baraiyadhala National Park

3.1 Objective(s) :

3.1.1. Establishment of sampling transects based on Google earth map of the site and field visit.

3.1.1. To evaluate the status of wildlife population in Baraiyadhala National Park.

3.2 Study period :

3.2.1 Starting year : 2014-2015

3.2.2 Completion year: 2015-2016

3.3 Progress:

3.3.1 Previous years, if any: New study

3.3.2 This year: Periodical survey was made in the Hazarikhil Wildlife Sanctuary following sample line transect method. GPS was utilized to determine transects position and coverage areas in the National Park region.

3.4 Findings: Recorded 81 species of bird, 22 species of mammals, 17 species of reptiles and 07 species of amphibian from Baraiyadhala National Park.

3.5 Financial Statement :

3.5.1 Total cost : Tk. 4,00,000.00

3.5.2 Cost of the year : Tk. 1,49,800.00

FOREST PRODUCT WING

FOREST CHEMISTRY DIVISION

1. Title of the Study : Extraction of agar (*Aquilaria malaccensis* Lam.) oil from artificial inoculated agar trees.

1.1 Objective(s) :

1.1.1 To determine suitable artificial inoculation method for formation of agar.

1.1.2 To evaluate the effect of wounding density in formation of oil in agar trees.

1.1.3 To assess the site and location factors on the yield and quality of agar.

1.2 Study period :

1.2.1 Starting year : 2012-2013

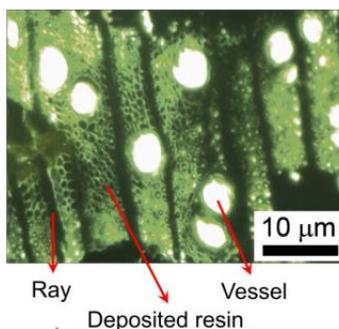
1.2.2 Completion year : 2014-2015

1.3. Progress :

1.3.1 **Previous progress** : Six experimental agar plantation sites were visited and investigated previously marked and nailed 167 trees to explore the nailing distance effect for the best formation of agar wood resins. Of them 7 trees were cut and brought into laboratory for further analysis.

1.3.2 **This year** :

Nearly 20 kg dried agarwood chips with scatteredly deposited resins were collected from Borolekha, Moulovibazar. Using lab scale distillation apparatus two experiments were carried out to extract oil from the chips by hydro-distillation process. No improved results were observed compared to our previous experiment that was reported to yield 0.6 % wt/wt (dried wood). For more successful extraction experiment, we proposed for a new type of hydro-distillery system that will use indirect heating to the chips that will save from charring. Several attempts were taken to locate the position of resin deposition inside the cell and also find out their deposition nature under light microscope. Some black dots were observed inside resin rich agarwood cell which were assumed to be the bundle of deposited resin which are absent in normal agarwood cell. Electron micrographs are usually better for such purposes.



1.4 **Findings** : N/A

1.5 **Financial Statement** :

1.5.1 Total cost :Tk. 7,00,000.00

1.5.2 Cost of the year : Tk. 70,000.00

2 Title of the Study : Chemical characterization of wood and bamboo species for various end uses

2.1 **Objective(s)** :

2.1.1 To evaluate chemical properties of different wood and bamboo species.

2.1 **Study period** :

2.1.1 Starting year : 2012-2013

2.1.2 Completion year : 2014-2015

2.3. **Progress** :

2.3.1 Previous progress : Extractive contents and major chemical constituents such as holo-cellulose, alpha-cellulose, lignin etc. of katbadam (*Terminaliacatappa*), jolpai (*Eleocarpus Robustus* (Roxb.)) arjun (*Terminalia arjuna* (Roxb.)) and sil-koroi (*Albizia procera*) were determined.

2.3.2 This year :

Three wood species namely lambu (*Khaya sp.*), rajkoroi (*Albizia richardiana*), jhau (*Tamarix gallica*) and one bamboo species mitinga (*Bambusa tulda*) were collected. Specimen samples of four species were prepared. Extractive contents of four species were determined. Major chemical constituents of four species were determined (Table-1).

2.4 **Findings** : N/A.

2.5 **Financial statement** :

2.5.1 Total cost : Tk. 6,00,000.00

2.5.2 Cost of the year : Tk. 60,000.00

Table-1. Extractive contents and major chemical constituents of wood species.

Sl. No.	Name of the experiment	Name of the species			
		Lambu	Rajkoroi	Jhau	Mitinga Bamboo
1.	Moisture content (%)	9.61	9.80	9.94	8.48
2.	Cold water solubility (%)	4.55	5.50	1.02	3.45

3.	Hot water solubility (%)	4.35	2.56	2.15	5.52
4.	1% caustic soda solubility (%)	18.17	16.54	16.06	26.30
5.	Extractive content (%)	3.58	3.41	1.74	2.38
6.	Holo-cellulose (%)	68.22	72.62	72.14	67.94
7.	Alpha-cellulose (%)	39.86	42.09	40.28	45.69
8.	Lignin (%)	34.09	20.36	23.67	28.24

3 Title of the Study : Artificial Inoculation of Agar wood (*Aquilariamalaccensis* Lam.) by Chemical Inducing Agent(s).

3.1 Objective(s) :

- 3.1.1 To explore an efficient and suitable chemical inducing agent(s) for the artificial inoculation of agar tree.
- 3.1.2 To develop and optimize the inoculation technique for the best formation of agar resins.
- 3.1.3 To investigate the origin or process of agar resin deposition.

3.2 Study period :

3.2.1 Starting year : 2014-2015

3.2.2 Completion year : 2018-2019

3.3. Progress :

3.3.1 Previous progress : N/A

3.3.2 This year :

Several attempts were taken under light microscopic investigation. Agar trees are selected in different agar plantations of Forest Department namely- Korerhat, Chittagong; Fashiyakhali, Cox's Bazar; Holudia, Banderban and Latitila, Moulovibazar. Around 20 types of individual or blended chemical inducers were applied into 10 agar trees of different agar plantations of Forest Department areas of Bangladesh namely: Korer Hat, Chittagong; Fashiyakhali, Cox's Bazar; Holudia, Banderban and Latitila, Moulovibazar. The work was mostly conducted by BFRI and BCSIR Labs, Chittagong. Within very short period of time (three to six months) the white wood turned to black around the zone of application and mostly in the longitudinal direction as shown in Figure-1. The burning of those black parts smelled special smell that is only found in agarwood.

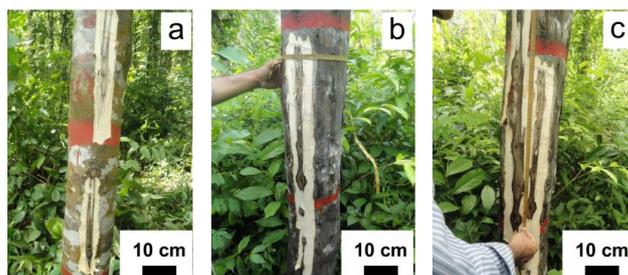


Fig-1. The black discoloration indicates the deposition of agar resins after application of chemical inducing-agent after six months. (a) and (b) HoludiaAgarwood Garden, Banderban district. (c) FashiyakhaliAgarwood Garden, Cox's Bazar.

3.4 **Findings** : Application of chemical inducing agent accelerates agarwood resin formation.

3.5 **Financial statement** :

3.5.1 Total cost : Tk. 10,00,000/-

3.5.2 Cost of the year : Tk. 2,00,000/-

4. Title of the Study : Phytochemical analysis and antioxidant potential of five indigenous medicinal plants

4.1 **Objective(s)** :

4.1.1 To estimate the phytochemicals qualitatively in medicinal plants.

4.1.2 To determine the antioxidant potential for assessment their efficacy.

4.2 **Study period** :

4.2.1 Starting year : 2014-15

4.2.2 Completion year : 2016-17

4.3. **Progress** :

4.3.1 Previous progress : N/A

4.3.2 This year :

Five less explored medicinal plants viz. Ashoke (*Saracaasoca*), Khonachhal (*Oroxylumindicum*), Dudhiya (*Euphorbia hirta*), Mutha/VadalGhas (*Kyllinganemoralic*), Shetodrone (*Leucasindica/aspara*) samples were collected and dried in shade and also preserved for extraction and determination of antioxidant properties. On test basis, phytochemical screening of one sample was carried out. Preparation of methodologies for carrying out experiments has been completed.

4.4 Findings : N/A.

4.5 **Financial statement** :

4.5.1 Total cost : Tk. 5,00,000/-

4.5.2 Cost of the year : Tk. 1,70,000/-

PULP AND PAPER DIVISION

1 Title of the study : Production of high yield pulp from bagasse, wastes of sugar mill of Bangladesh.

1.1 **Objective (s)** :

1.1.1 .Pulping process improvement for the production of high yield pulp.

1.2. **Study period** :

1.2.1 Starting year : 2010-11

1.2.2 Completion year : 2014-15.

1.3 Progress :

1.3.1 **Previous years:** Bagasse sample was collected from Faridpur Sugar Mills Ltd., Modhukhali, Faridpur. Dry matter content was 85 %. Bagasse contains high percentage of pith (35 – 40%) along with fiber. It is non-fibrous in nature and rich in juice. Pith creates problems during pulping like requirement of high cooking chemical, inferior quality of pulp and poor black liquor properties. So, removal of pith from bagasse is prerequisite prior pulping for making quality paper. Due to this, the collected bagasse was depithed and then was preserved in open air for air dry. Bagasse pulps were produced at 0.1M NH₄OH solution with the variation of KOH doses viz. 11, 13, 15 and 17%. The methyl anthraquinone was 0.1% based on OD material. The temperature was maintained at 165°C. Pulps were also produced in kraft and soda process for comparison. The yield varied from 55-68%. Kappa number was high at lower doses of chemicals with high percentage of rejects. However at 15% doses of KOH the kappa number lowered and reached at 23.9%

1.3.2 This year :

In all 108 nos. hand sheets of bagasse pulp in three different freeness levels were made. The sheets were then conditioned at 23±1°C and 50±1% relative humidity. The test sample were prepared and strength properties likely tear tensile and burst were determined (Table 1)

1.4. **Findings:** The delignification is poor for lower doses of cooking chemical. However at 15% KOH bleachable grade pulp was produced.

1.5 Financial Statement

1.5.1 Total cost : Tk. 2,50,000.00

1.5.2 Cost of the year : TK. 50,000.00

Table 1: Strength properties of the pulps made from bagasse

Species composition (%)	AA (%)	MAQ %	Kappa No	Rejects (%)	Tear index mNm ² /g		Tensile index Nm/g		Burst index KPa.m ² /g	
KOH-MAQ In presence of 1M NH ₃ solution	11	0.1	61.2	13.64	5.23	4.92	55.87	62.47	3.70	4.92
	13	0.1	47.0	5.96	6.20	5.80	58.25	65.20	4.05	5.20
	15	0.1	23.9	Nil	5.85	5.54	65.50	70.45	4.60	5.33
	17	0.1	20.1	Nil	5.94	5.90	59.54	67.88	4.50	5.75
Kraft	12	--	35.4	0.63	6.65	6.35	52.09	51.90	4.20	4.80
Soda	12	0.05	27.8	0.40	6.95	6.01	51.90	50.15	4.15	5.03
Soda	12	0.1	24.0	0.48	6.71	6.31	52.51	52.80	4.37	5.82

2 **Title of the study** : **Oxygen delignification of kraft pulp of stem and branches of rubber tree (*Hevea brasiliensis*).**

2.1 Objective (s):

2.1.1 . To investigate the bleaching response of rubber wood pulp for using as high quality paper .

2.2. **Study period** :

2.2.1. Starting year : 2011-12

2.2.2. Completion year : 2015-16

2.3 Progress:

2.3.1 Previous years: Bleachable grade kraft and soda pulp from stem and branch of rubber wood were prepared. The colour of the pulp of rubber stem is more brownish compared to branch. Some hardened rubber particle was found during stem pulp washing. It seemed that during cooking the latex leached out from the chips and on cooling it became hardened. Some bleaching experiments on kraft pulp, prepared with 18% active alkali, were done. It was found that the kappa number reduced from 27 to 16 for stem pulp and 18 to 12 for branch pulp. The pulps of stem and branches of rubber tree (*Hevea brasiliensis*) were bleached at 110 psi oxygen pressure for 60 min. at 95°C. Kappa number was determined. It was found that the kappa number reduced from 22.5 to 18.7 for stem pulp and 15.5 to 11.7 for branch pulp produced in kraft process. The similar trend was observed for pulps produced in soda process

2.3.2 This year:

Eight pulps of rubber were bleached with oxygen at 110PSI by maintaining 110°C temperatures. Kappa numbers were determined (Table 2).

2.4. Findings : Delignification was found easier in case of branches compared to stem.

2.5 Financial statement :

2.5.1 Total cost : Tk. 3,00,000

2.5.2 Cost of the year : Tk.60,000

Table 2. Yield and kappa number of unbleached and bleached kraft pulp of rubber stem and branch (*Hevea brasiliensis*)

Species	Processes	A.A. %	Sulphidity %	Yield %	Kappa no	
					Before delignification	After delignification
Rubber stem	kraft	18 (0.1% AQ)	25	42.26	38.29	23.14
Rubber branch	kraft,	18 (0.1% AQ)	25	51.71	24.71	11.99
Rubber stem	soda	18 (0.1% AQ)	--	47.40	23.56	13.34
Rubber branch	soda	18 (0.1% AQ)	--	53.05	18.37	10.65

Oxygen delignification conditions: Oxygen pressure:110 psi; Time: 60 min.; Temperature: 95°C; Consistency-10%

3 Title of the study: Production of nano composite from fibers of *Acacia hybrid* and *simul (Bombax ceiba)* tree species of Bangladesh.

3.1 Objective(s):

3.1.1. To develop modern technique for extraction of nanocellulose from wood pulp.

3.1.2 To produce environment friendly packaging materials.

3.1.3. To produce ethanol from hemicelluloses of wood.

- 3.2. **Study period** :
- 3.2.1. Starting year : 2013-14
- 3.2.2. Completion year : 2017-18
- 3.3. **Progress**
- 3.3.1. Previous year:
Acacia hybrids were collected from Banshkhali, Chittagong. These were converted into planks of size 3" ×3"× length of the bolt and preserved in the division for air drying.
- 3.3.2. This year :
The *Acacia* hybrid chips were treated in water and Na₂CO₃. Cold water, hot water, 1% alkali solubility, ash content, holocellulose, alpha cellulose of untreated and treated chips of *Acacia* hybrid species has been determined (Table 3).Six kraft pulps were prepared with the untreated chips at 25% sulphidity by maintaining 2000 H-Factor. The alkali doses were varied from 14 to 18% at 2% increments. Six soda pulps were prepared with and without anthraquinone by varying alkali doses of 14, 16 and 18%. The black liquor of pulps were analysed for residual alkali
- 3.4. **Findings** : Nil.
- 3.5 **Financial statement** :
- 3.5.1 Total cost of the study : Tk. 25,00,000.00
- 3.5.2 Cost of the year : Tk. 1,50,000.00

Table 3. Chemical composition of untreated and treated wood of *Acacia* hybrid

Chemical component (%)	Untreated	Treated with H ₂ O	Treated with Na ₂ CO ₃
Cold water solubility	5.23	2.12	2.76
Hot water solubility	7.35	3.86	5.50
1% caustic soda solubility	20.18	20.92	22.07
Alcohol-toluene solubility	11.50	14.80	10.76
Holocellulose	75	65	64
Ash(%)	0.4842	0.4018	0.9536

4 Title of the study: Suitability of *Acacia* hybrid and rubber tree (*Hevea brasiliensis*) for making hardboard (New)

- 4.1 **Objective(s):**
- 4.1.1. To investigate the suitability of *Acacia* hybrid and rubber tree (*Hevea brasiliensis*) for making hardboard
- 4.2. **Study period** :
- a. Starting year : 2014-15
- b. Completion year : 2016-17
- 4.3. **Progress**
- 4.3.1. Previous year, if any : N/A
- 4.3.2. This year :

The freshly cut *Acacia* hybrid logs were debarked and chipped. These were screened to remove oversized and pin chips. In addition, the knots, barks and decayed wood chips were removed. The accepted chips were about 20 mm in length, 10 mm in width and 3 mm in thickness. The chips were cooked in steam for 30, 60 and 90 minutes in laboratory model stainless steel rotary digesters. The pressure at the time of experiment was 100 and 150 psi. The steamed cooked chips were then defiberised in a single rotating disk attrition mill at different plate clearances. Three pulps of different freenesses were made from each cook. Then hardboards (smooth in one side) were made in hot press

4.4 **Findings** : Nil.

4.5 **Financial statement** :

4.5.1 Total cost of the study : Tk. 3,00,000

4.5.2 Cost of the year : Tk. 1,10,000

SEASONING AND TIMBER PHYSICS DIVISION

1 Title of the study: Solar kiln for efficient seasoning of different thicknesses of wood.

1.1 Objective(s):

1.1.1. To determine the seasoning characteristics of different thicknesses of wood.

1.2 Study Period :

1.2.1 Starting year : 2011-12

1.2.2 Completion year : 2015-16

1.3 Progress :

1.3.1 Previous years :

Seasoning schedule of ghora-neem (*Melia azadarach*) and rain tree (*Samanea saman*) wood of different thickness (2.5-4.0-5.0) cm were developed in three conditions (air dry, solar kiln and solar kiln with burner). Seasoning schedule of silkoroi (*Albizia procera*) and gamar (*Gmelina arborea*) wood of different thickness (2.5-4.0-5.0) cm were developed in two conditions (air dry and solar kiln).

40.3.2 This year :

40ft. round wood of mango (*Mangifera indica*) and 35 cft. round wood of *Hybrid acacia* were collected at Bandarban Hill District and 122-183 cm x 25-30 cm x 2.5-4.0-5.0 cm planks size sample were prepared. Testing of sample planks were done for determination of seasoning efficiency in two seasoning conditions (air dry and solar kiln) Data were recorded and shown in table-1. Existing solar kilns were maintained by repairing and painting.

Table-1: Seasoning schedule of mango (*Mangifera indica*) and *Hybrid acacia* species in 2 conditions

Species	Thickness (cm)	Moisture Level (%)	Seasoning conditions	
			Air dry (Rainy season, May-July) in days	Solar kiln (Rainy season, May-July) in days
<i>Mango (Mangifera indica)</i>	2.5	15-20	62-68	16-18
	4.0	20-30	71-77	20-22

	5.0	20-30	81-89	24-28
<i>Hybrid acacia</i>	2.5	15-20	68-72	18-20
	4.0	20-30	78-86	22-26
	5.0	20-30	89-99	28-32

1.4 **Findings:** Ali, M. Rowson, Alam, M. J., Rokeya, U. K. and Paul S. P 2013. Determination of seasoning schedule of rain tree (*Samanea saman*) sawn wood with different thickness using solar kiln. *Scholarly Journal of Agricultural Science* 3 (7): 289-293

1.5 **Financial Statement** :
 1.5.1 Total cost : Tk. 7, 84,550.00
 1.5.2 Cost of the year : Tk. 1, 62,200.00

2 Title of the study : Dissemination of solar kiln technology to the stakeholders for efficient seasoning of wood

2.1 **Objective(s)** :
 2.1.1 .To disseminate solar kiln technology to the wood traders, furniture makers and wood based cottage industries.
 2.2 **Study Period**
 2.2.1 Starting year : 2011-12
 2.2.2 Completion year : 2014-15
 2.3 **Progress** :
 2.3.1 Previous years :
 Ten training programme were conducted at different places in Bangladesh.
 2.3.2 This year :
 Total one hundred twenty stakeholders were selected and four training were conducted for different categories of wood traders; saw mill owners and furniture makers at different place of Bangladesh (Sadar Upazila, Meherpur and Sadar Upazila, Panchagarh, Sadar Upazila, Rangamati and Balaghata Bazar, Bandarban)
 2.4 **Findings** : NA
 2.5 **Financial Statement** :
 2.5.1 Total cost : Tk. 3, 60,650.00
 2.5.2 Cost of the year : Tk. 79,400.00

3 Title of the study : Studies on physical and mechanical properties of palmyra palm (*Borassus flabellifer*) wood

3.1 **Objective (s):**
 3.1.1. To assess the suitability of palmyra palm wood for making furniture and construction materials.
 3.2 **Study Period** :
 3.2.1 Starting year : 2013-14
 3.2.2 Completion year : 2014-15
 3.3 **Progress** :
 3.3.1 Previous years :

3.3.2 This year :
Physical and mechanical properties of palmyra palm were determined in air dry condition. Data were recorded and shown in table-1.

Table-1: Data on physical and mechanical properties of palmyra palm in air dry condition

Sl no.	Properties	Species/Values	
		Palmyra palm	Teak
01.	Specific gravity	0.56	0.59
02.	Static bending (kg/cm ²)	420	628
	Stress at proportional limit	714	1008
	Modulus of rupture	82	131
	Modulus of elasticity		
03.	Compression parallel to grain (kg/cm ²)	293	374
	Stress at proportional limit	484	513
	Maximum crushing strength		
04.	Compression perpendicular to grain	74	119
	Stress at proportional limit (kg/cm ²)		
05.	Shear parallel to grain(kg/cm ²)	74	106
06.	Hardness (kg)	813	532
	Side	1000	541
	End		
07.	Nail withdrawal (kg) Side	49	80
	End	39	68
08.	Toughness (cm-kg)	408	324
09.	Tension perpendicular to grain (kg / cm ²)	11	44
10.	Cleavage load to cause splitting: (kg/cm of width)	14	72

3.4. Findings :
3.5 Financial Statement :
3.5.1 Total cost : Tk. 1, 20,000.00
3.5.2 Cost of the year : Tk. 8,400.00

VENEER AND COMPOSITE WOOD PRODUCTS DIVISION

1. Title of the study: Design and fabrication of furniture using bamboo composites.

1.1 Objective(s):

- 1.1.1 To assess the potential of bamboo composites for making quality furniture.
- 1.1.2 To assess economic feasibility of commercially valuable furniture made of bamboo composites.

1.2 Study period:

- 1.2.1 Starting year: 2005-2006
- 1.2.2 Completion year: 2014-2015

1.3 Progress:

1.3.1 Previous Years:

Different types of composite products such as, bamboo mat wood veneer board, bamboo ply and flattened bamboo ply were made using muli (*Melocanna baccifera*) bamboo. One chair, one shelf and one table were prepared and kept for service test. Bamboo mat overlaid particleboard and bamboo ply were made using bhyjja (*Bambusa vulgaris*) bamboo. Twelve molded chair and two tables were made and distributed for popularizing the technology. Four molded chairs were made using bamboo mat wood veneer board and bamboo ply and kept for service test. Twelve molded chairs and three tables were fabricated by composite products of borak (*Bambusa balcooa*) bamboo and kept as exhibits in Director,s office, CRO,s office, BFRI show rooms, Dhaka and Chittagong, for exhibit and dissemination of the technology. Two shelves, one dining Table and four chairs were fabricated and kept for service test in VCWP Division. Four armed chairs and one almirah were fabricated using bamboo particleboard and bamboo Ply. Two single sofa and one three seated sofa, two book shelves and one computer table were prepared using bamboo ply and bamboo strips overlaid particle board . One show case, four moulded chair and one alna were prepared using bamboo ply and bamboo mat overlaid veneer board. One sofa set were made using bamboo mat overlaid particleboard. The bamboo composite furniture are kept in VCWP division for service test. One dining table and four dining chair using bamboo mat overlaid particleboard were made and are kept in VCWP division for service test.

1.3.2 This year:

Bamboo plantation area in Rangamati and furniture shop & industries in Dhaka were visited. End-users were encouraged and advised to visit BFRI and seek for the technology in the related field. Bamboo composite products were selected for making one bed and two bedside table using bamboo panel and bamboo mat overlaid particle boards. Borak (*Bambusa balcooa*) bamboos were collected from Borkol upozilla, in Rangamati District, Chittagong. Strips were prepared and treated with 10% borax-boric acid solution. Bamboo mats were prepared using Mitinga (*Bambusa tulda*). Mats were treated with borax-boric acid solution. Bamboo composite products such as bamboo particleboard and bamboo mat over laying particle board were made using borak (*Bambusa balcooa*) bamboo, strength properties were calculated (Table-1) .Bamboo particleboards were made by using bamboo chips and planner shaving. Borax-boric acid (2%) was added with UF glue. Bamboo panel and bamboo mat overlaid particle boards were prepared and one bed and two bed side table were made. The composites furniture are kept in VCWP Division. Price of the raw materials and manufacturing cost were calculated.(Table-2)

1.4 **Findings:** Bamboo composites can be used as furniture materials which can be promoted to exportable commodity. Furniture industries, plywood and particleboard industries, farmers/bamboo growers, general people, village women, NGOs. will get benefit by planting/ producing/marketing bamboo/bamboo products.

1.5 Financial statement :

1.5.1 Total cost	: Tk 9, 50,500.00
1.5.2. Cost of the year	: Tk 1, 05,000.00

Table-1: Strength properties of particleboard made of planer shavings

Bamboo species	Particleboard	Thickness (mm)	Density (Kg/m ³)	Bending strength (MOR) (N/mm ²)	Internal bond strength (N/mm ²)
<i>Bambusa balcooa</i>	Bamboo particleboard (BPB)	12	832	15.80	1.25
	Bamboo mat overlaid particleboard (BMPB)	13	824	24.75	1.28
<i>Bambusa vulgaris</i>	Bamboo particleboard (BPB)	12	856	17.90	1.35
	Bamboo mat overlaid particleboard (BMPB)	13	868	25.85	1.31
Standard	IS:3087	6-40	500-900	11.20	0.8
	B:S 5669	6-19	-	15.0	0.35

Table-2: Different bamboo furniture made from composite products (This year)

Furniture	Size	Bamboo species	Composite products	Material cost	Manufacturing cost
One bed	5ft.× 3ft.	<i>Bambusa balcooa</i> & <i>Bambusa tulda</i> .	Bamboo panel bamboo mat overlaid particle boards	4,000/-	2,500/-
Bed side table	1.5ft.× 1ft.	<i>Bambusa balcooa</i> & <i>Bambusa tulda</i> .	Bamboo panel bamboo mat overlaid particle boards	1,000/-	500/-

2. Title of the study: Particleboard made of rubber wood (*Hevea brasiliensis*), gol pata (*Nipa fruticans*) and raj kori wood (*Albizia richardiana*).

2.1: Objectives:

2.1.1 To determine the suitability of making particleboard of mixed wood species

2.2 Study period:

2.2.1 Starting year: 2013-14

2.2.2 Completion year: 2014-15

2.3 Progress:

2.3.1 Previous Years:

Raw materials of rubber wood were collected. Logs were peeled using veneer Lathe machine. Knife angle and pressure bar were adjusted for 1.5 mm thickness veneer. Veneers were dried up to suitable moisture (8%) content.

2.3.2 This year:

Dry veneers were cut into small size in clipper machine and put in hammer mill machine for making chips. Chips were dried in batch oven for target moisture (5%). Particleboard were manufactured in Laboratory hot press machine. Test samples of particleboards were prepared and were conditioned in condition room. Bending strength, Internal bond strength, Thickness swelling and Water absorption of the particleboards were performed. (Table-1, 2). Akiz Plywood and particleboard industry, Manikgonja, Dhaka was visited.

2.4 **Findings:** Furniture industries, plywood and particleboard industries, farmers/ growers, general people, NGOs. will get benefit .

2.5 **Financial statement** :
 2.5.1 Total cost : Tk 2,50,000.00
 2.5.2. Cost of the year : Tk 1,30,000.00

Table-1. Static bending strength and tensile strength of particleboard.

Requirements/ Specification of some standers	Particles (%)			Modulus of rupture (MOR) (kg/cm ²)	Internal bond strength (IB) (kg/cm ²)	Moisture content of boards (%)
	Golpata Chips	Rajkori wood chips	Rubber wood chips			
A	100	0	0	57.00	2.00	10
B	0	100	0	110.00	6.40	10
C	0	0	100	114.00	12.14	10
D	50	50	0	73.00	2.10	10
E	50	0	50	80.00	3.20	10
F	25	75	0	60.00	1.98	10
G	25	0	75	64.00	2.90	10
I:S 3087 (Anon-1985b)	-	-		112.00	8	
German Sd.Din:68761 (Verkor and Ledune 1975)	-	-		180.00	3.50	-
BS Spec. 5669 (Anon1979)	-	-		140.72	3.47	-

Table-2. Thickness swelling and water absorption of particleboard after 2 and 24 hours water soaking.

Requirements/ Specification of some standers	Particles (%)	Thickness swelling (%)	Water absorption (%)	Moisture content of boards (%)
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	Golpata Chips	Rajkori wood chips	Rubber wood chips	2 hrs	24 hrs	2 hrs	24 hrs	
A	100	0	0	4.76	8.90	30.84	47.17	10
B	0	100	0	20.51	28.50	47.25	59.21	10
C	0	0	100	14.81	21.05	51.05	70.36	10
D	50	50	0	11.53	21.00	42.88	59.75	10
E	50	0	50	11.33	20.80	29.32	59.50	10
F	25	75	0	25.64	36.20	59.00	71.80	10
G	25	0	75	14.94	21.25	57.97	77.19	10
I:S 3087 (Anon1985b)	-	-						
German Stand. Din68761 (Verkor1975)	-	-		max -6	-	-	-	-
BS 5669 (Anon1979)	-	-		2 (1hr, soaking)	-	-	-	-

3. Title of the Study: Development of doors and partition using bamboo composite products.

3.1 Objectives:

- 3.1.1 To assess the potential of bamboo composites for making doors and partition.
- 3.1.2 To assess economic feasibility of doors and partition made of bamboo composites.
- 3.1.3 To disseminate the information to the end-users.

3.2 Study period:

3.2.1 Starting year : 2014-2015

3.2.2 Completion year: 2019-2020

3.3.0 Progress:

3.3.1 This year:

Bamboo composite products were selected for making doors and partition. Borak (*Bambusa balcooa*) bamboos were collected from Borkol upazilla, Shonachari Union in Rangamati District, Chittagong. Strips were prepared and treated with borax-boric acid solution. Bamboo mats were prepared using Mitinga (*Bambusa tulda*). Mats were treated with borax-boric acid solution. Bamboo composite products such as bamboo panel board and bamboo mat over laying particle board were made using borak (*Bambusa balcooa*) bamboo. Bamboo particleboard was made by using bamboo chips and planer shaving. Borax-boric acid (2%) was added with UF glue. Bamboo panel bamboo mat overlaid particle boards were prepared and one door & one partition were made. The composites products are kept in VCWP Division. Bamboo furniture shop & industries in Rangamati and Dhaka were visited. End-users were encouraged and advised to visit BFRI and seek for the technology in the related field. Price of the raw materials and manufacturing cost were calculated (Table-1).

3.4 **Findings:** Door & windows industries, Bamboo/wood plywood and particleboard industries, village women, different type of NGOs will get benefit by planting/producing/marketing bamboo/bamboo products.

3.5 **Financial statement :**

3.5.1 Total cost of the study : Tk. 5,00,000.00

3.5.2 Cost of the year : Tk 1,25,000.00

Table-1: Different bamboo composite products

Furniture	Size	Bamboo species	Composite products	Material cost	Manufacturing cost
Bamboo door	7ft.×3ft	<i>Bambusa balcooa</i>	Bamboo Laminated board	7,000/-	3,000/-
Bamboo partition	5ft.×4ft	<i>Bambusa balcooa</i>	Bamboo Laminated board & Bamboo mat overlaid particle board	1,500/-	1,000/-

4. Title of the study: Suitability of manufacturing medium density fiberboard (MDF) from rubber (*Hevea brasiliensis*) wood and hybrid *acacia* wood.

4.1 **Objective(s):**

4.1.1 To determine the suitability medium density fiberboard made from rubber (*Hevea brasiliensis*) wood and hybrid *acacia* Wood.

4.2 **Study period :**

4.2.1 Starting year : 2014-2015

4.2.2 Completion year: 2019-2020

4.3 **Progress:**

4.3.1 Previous year: N/A

4.3.2 This year:

Raw material rubber wood were collected from Bangladesh Forest Development Corporation (BFIDC). Logs were cross cut of suitable length and preserved in log pond. Logs were peeled using veneer Lathe machine. Knife angle and pressure bar were adjusted for 1.5 mm thickness veneer

4.4.0 **Findings:**N/A

4.5 **Financial statement:**

4.5.1 Total cost of the study: Tk 7,00,000.00

4.5.2 Cost of the year: Tk. 95,000.00

WOOD PRESERVATION DIVISION

1. Title of the Study: **Investigation of preservative chemicals leaching from treated materials in water and soil. (On-going)**

1.1. Objective(s) :

- 1.1.1 To investigate the water and soil contamination due to preservative treatment.
- 1.1.2 To disseminate the information to the end-users.

1.2. Study period :

- 1.2.1 Starting year : 2012-2013
- 1.2.2. Completion year : 2014-2015

1.3 Progress :

1.3.1. Previous progress, if any :

Treated bamboo sticks were supplied in betel leaf farm at Barisal and Gybanda. Soil and water samples were collected from betel leaf farm at Barisal and Gybanda. Soil and water samples were prepared at BFRI and analyzed in soil science division, Bangladesh Agriculture Research Institute (BARI) to investigate the presence of preservative chemicals.

1.3.2. This year:

Bamboo and chemicals were procured. Bamboo strips were dried and then treated. Contamination area was selected at betel leaf farm, Batajor, Barisal & Palasbari, Gaibhanda. Soil samples were collected from Barisal & Gaibhanda. Treated materials were soaked under water and water samples were collected after leaching. Water and soil samples were analyzed at Bangladesh Agriculture Research Institute (BARI), Gazipur. (Table-1). Data analysis and report writing are in progress.

3.1 **Findings:** The study will develop the information for the wood & bamboo users, betel leaf farmers, general public and cottage industries about the leaching of the preservative chemicals in soil and water.

3.2 Financial statement :

- 1.5.1 Total cost : Tk. 4, 50,000.00
- 1.5.2 Cost of the year : Tk. 1,10,000.00

Table-1: The analytical data of micro nutrients of soil after using the treated bamboo sticks in betel leaf farm in three year duration.

Soil properties	Unit	Treated soil sample-1			Treated soil sample-2			Treated soil sample-3		
		0-15	15-30	30-50	0-15	15-30	30-50	0-15	15-30	30-50
pH		6.4	7.3	7.2	7.3	7.0	7.3	6.4	7.2	7.6
Boron	µg/ml	0.70	0.70	0.90	0.62	0.82	0.82	0.45	0.75	0.72
Copper		1.80	2.00	1.90	1.90	2.8	2.00	2.6	2.10	2.3
Sodium		0.032	0.024	0.040	0.040	0.068	0.036	0.036	0.028	0.044
Chromium		0.603	0.311	0.504	0.532	0.454	0.669	0.440	0.505	0.536

2 Title of the Study : Treatability and natural durability of bhudum bamboo (*Dendrocalamus giganteus*) species (On going).

2.1 Objective(s) :

- 2.1.1. To develop treating schedule for preservative treatment.
- 2.1.2 To determine outdoor service life of bamboo species treated with CCB preservative.
- 2.1.3 .To disseminate the information to the end-users.

2.2 Study Period

- 2.2.1 Starting year : 2013- 2014
- 2.2.2 Completion year : 2017 – 2018

2.3 Progress

2.3.1 This year :
 Preservative, Treatment materials, Bamboo etc. were procured from different areas and market. For preservative treatment nine nos of following different sizes bamboo samples were prepared; 3.04 m× dia 15.24 cm.; 3.04 m× dia 14.22 cm.; 3.04 m× dia 13.97 cm. Nine numbers of bamboo samples have been treated with 10% CCB solution using soaking method (Table-1). Treated samples were installed at BFRI campus, Chittagong and Plantation Trial Unit (PTU) in Barisal stake-yard for investigating service life. The observations are shown in Table 2 & 1, Table 3. Data analyzed and Group: C determined as treatable group;

2.4 Findings : The study will be helpful for the bamboo users, Betel leaf farms, general public and cottage industries.

2.5 Financial statement :

- 2.5.1 Total cost : Tk. 6,00,000.00
- 2.5.2 Cost of the year : Tk. 1,05,000.00
- 2.5.3 Expenditure of the year : Tk. 95,000.00

Table-1: Retention of preservatives through bhudum (*Dendrocalamus giganteus*) bamboo treated by soaking method

Charge No.	Size	Average moisture content (%)	Soaking period (day)	Average retention (kg/m ³)
1	3.04 m × dia 15.24 cm.	45	10	6.60
2	3.04 m × dia 14.22 cm.	50	12	8.82
3	3.04 m × dia 13.97 cm.	52	15	11.21

Table 2. Observation of stake-yard wood and bamboo sample at BFRI campus

SL. NO	Date of installation	Date of inspection	Name of species	Treatment method & Name of preservative	Attack of biodegrading agent		
					Fungi	Termite	Borer
1	02-11-2008	20-12-2014 & 21-06-2015	Rajkori (<i>Albizia richardiana</i>) wood	Pressure, 10% CCB solution	Not attacked	Not attacked	Not attacked
2	10-12-2009	20-12-2014 & 21-06-2015	Rubber (<i>Hevea brasiliensis</i>) wood	Pressure, 10% CCB solution	Samples are somehow missed from stake-yard.		
3	05-11-2010	20-12-2014 & 21-06-2015	Lambu (<i>Khaya anthotheca</i>) wood	Pressure, 10% CCB solution	Samples are somehow missed from stake-yard.		
4	15-11-2011	20-12-2014 & 21-06-2015	Baijja (<i>Bambusa vulgaris</i>) bamboo	Sap-displacement, 20% CCB solution	Not attacked	Not attacked	Not attacked
5	28-11-2012	20-12-2014 & 21-06-2015	Borak (<i>Bambusa balcooa</i>) bamboo	Sap-displacement, 20% CCB solution	Not attacked	Not attacked	Not attacked
6	11-12-2013	20-12-2014 & 21-06-2015	Muli (<i>Melocanna baccifera</i>) bamboo	Pressure, 10% CCB solution	Samples are somehow missed from stake-yard.		
7	13-11-2014	01-04-2015	Bhudum (<i>Dendrocalamus giganteus</i>)	Sap-displacement, 20% CCB solution	Not attacked	Not attacked	Not attacked

Table 3. Observation of stake-yard wood and bamboo sample at Barisal PTU campus

SL. NO	Date of installation	Date of inspection	Name of species	Treatment method & Name of preservative	Attack of biodegrading agent		
					Fungi	Termite	Borer
1	12-11-2008	10-06-2015	Rajkori (<i>Albizia richardiana</i>) wood	Pressure, 10% CCB solution	100% attacked	Not attacked	Not attacked
2	25-12-2009	10-06-2015	Rubber (<i>Hevea brasiliensis</i>) wood	Pressure, 10% CCB solution	100% attacked	Not attacked	Not attacked
3	18-11-2010	10-06-2015	lambu (<i>Khaya anthotheca</i>) wood	Pressure, 10% CCB solution	20% & 50% attacked	Not attacked	Not attacked
4	30-11-2011	10-06-2015	Baijja (<i>Bambusa vulgaris</i>) bamboo	Sap-displacement, 20% CCB solution	Not attacked	Not attacked	Not attacked

5	02-12-2012	10-06-2015	Borak (<i>Bambusa balcooa</i>) bamboo	Sap-displacement, 20% CCB solution	Not attacked	Not attacked	Not attacked
6	21-12-2013	10-06-2015	Muli (<i>Melocanna baccifera</i>) bamboo	Pressure, 10% CCB solution	20% & 40% attacked	Not attacked	Not attacked
7	25-12-2014	10-06-2015	Bhudum (<i>Dendrocalamus giganteus</i>)	Sap-displacement, 20% CCB solution	Not attacked	Not attacked	Not attacked

2.9. **Achievements (s), if any** :

3. **Title of the Study : Popularization of preservation treatment technology through training and entrepreneurship development.**

3.1 **Objective(s)** :

3.1.1. To motivate people through training, group discussions, personal contacts etc.

3.1.2. To provide technical support to the business initiators for development of entrepreneurship.

3.2 **Study period** :

3.3 **Progress** :

3.3.1. Previous progress, if any : Previous progress : Bhudum (*Dendrocalamus giganteus*) bamboo were treated by sap-displacement method. Retention & penetration of preservative chemicals were determined.

3.3.2. This year:

Raw materials, chemicals and other inputs were procured. Housing materials were treated and repaired two bamboo model houses at Dulahazra Safari park in Cox's Bazar. Training and motivational activities were arranged in Achingate, Bagmara, Rajshahi and Tomchar, Ramgati, Laxipur. 1000 nos. of bamboo sticks were processed and treated by soaking method to using 10% CCB solution.

1000 nos. of treated bamboo sticks were distributed to near the betel leaf & vegetable farmers at Rajshahi and Laxmipur.

3.4. **Findings** : The study will be helpful for the bamboo users, Betel leaf farms, general public and cottage industries.

3.5 Starting year : 2014 – 2015

3.5.1 Completion year : 2016 – 2017

3.6 **Personnels** :

3.6.1 Study Leader : Abdus Salam, RO.

3.6.2 Associates : Dr. Khurshid Akhter, DO; Md. Anisur Rahman, SRO; & Mozammel Hoque Chy, R O.

3.7 **Achievement(s),if any** : NA

3.8 **Financial statement** :

3.8.1 Total cost : Tk. 6,00,000.00

3.8.2 Cost of the year : Tk. 1,45,850.00

3.8.3 Expenditure of the year : Tk. 1,45,850.00

3.8.4 Source of fund : GOB

- 3.9 **Beneficiaries** : NGOs, general public, particularly the users of wood and bamboo.
4. Study: New
- 4.1 Programme Area: Post Harvest Utilization –Chemical Processing
- 4.2 **Title of the study: Durability assessment of Baijja (*Bambusa vulgaris*) and Borak (*Bambusa balcooa*) bamboo under different duration of water treatment.**
- 4.3 **Justification:** Preservative chemicals are used to enhance the durability of wood/ bamboo and wood/bamboo products. Such chemicals are Copper Sulphate, Sodium dichromate, Boric Acid, Borax etc. Although these preservatives are useful to protect bamboo and wood from bio-deterioration. But environmental toxicity is also related with those chemicals. Water treatment is traditional methods which decrease the attack of bio-deteriorating agent. But the period of immersion and extent of attack are need to be investigated.. It was observed that starch content is related with the durability which increases the borer attack of bamboo. The present study is undertaken to investigate the the durability of different bamboo species under different duration of water treatment instead of preservative chemicals.
- 4.4 **Objectives(s) of the study:**
- 4.4.1 To assess the durability of bamboo after immersion under water.
- 4.4.2 To determine indoor service life of bamboo products after water treatment.
- 4.5 **Expected output:**
- a) Development of environmental friendly treatment process
- b) Increase the service life of wood, bamboo and other lignocellulose material.
- c) Decrease the pressure on forest resources.
- 4.6 **Study period :**
- 4.6.1 Starting year : 2014-2015
- 4.6.2 Completion year: 2016-2017
- 4.7 **Personnel:**
- 4.7.1 Project Leader: Dr. Khurshid Akhter, (DO)
- 4.7.2 Associates: Mohammad Anisur Rahman, SRO; Abdus Salam, RO and M.H. chy, RO
- 4.8 **Progress :**
- 4.8.1. Previous progress, if any : NA
- 4.8.2 Activities of this year:
- Six number of literature have been reviewed. Randomized complete block design (RCBD) was selected. *Bambusa vulgaris* were procured. Processing of bamboo and 4 sizes of bamboo samples were prepared. Diameter, weight and moisture content of samples were measured. Six bundles of bamboo were immersed under water. (Table-1). Making products using by water treated bamboo and kept for service test.
- 4.9 Achievements, if any : NA
- 4.10 **Financial statement**
- 4.10.1 Total cost : 1, 80,000/-
- 4.10.2 Cost of the year : 1, 04,100/-
- 4.10.3 Expenditure of the year : 1, 04,100/-
- 4.10.4 Source of fund : GOB
- 4.11 Beneficiaries: BFIDC, NGO's and general public sectors.
- Table-1: Diameter, weight and moisture content of Baijja Bamboo samples

Size of sample	MC%	Weight(kg)	Diameter (cm)	Thickness (cm)
01 Feet	42-60	0.50-0.80	06-08	0.60
02 Feet	42-65	1.00-1.50	-do-	-do-
03 Feet	45-70	1.20-2.50	-do-	-do-
04 Feet	46-75	2.00-4.00	-do-	-do-

5. Study : New

5.1 Programme Area: Post Harvest Utilization –Chemical Processing

5.2 **Title of the Study: Development of neem (*Azadirachta indica*) leaves and mehagani (*Sweitenia microphylla*) seeds as eco-friendly wood preservative.**

5.3 **Justification:** Conventional wood preservatives like CCA and CCB are facing lot of criticism all over the world. Most of these preservatives although found to be very effective against wood destroying agencies, being of synthetic origin, are said to cause a serious threat to the environment and to health of wood treatment workers. For the past few years there has been a substantial global awareness to outcast the conventional proprietary wood preservatives by the one which is of natural origin. It is essential to address the problem in view of environment protection. Eco-friendly wood preservatives may be considered as one option. The present study is an exploration of neem leaves and mahogany seeds against wood decaying fungi and termites. *Azadirachta indica*, commonly known as neem is one of the most widely recognized and extensively studied plant species of Bangladesh. Every part of the tree has been thoroughly evaluated for its marked activity against insects, microbes, pests etc. and has gain world-wide recognition as potential therapeutic agent. Present study has been undertaken for further work on neem leaves and mahogany seeds to develop potential eco-friendly wood preservatives.

5.4 **Objectives :**

5.4.1 To develop environmental friendly wood preservatives

5.4.2 To investigate the effect of wood preservatives on wood against the wood decay agents.

5.5 **Expected output:**

a) Development of environmental friendly wood preservatives

b) Increase the service life of wood, bamboo and other lignocellulose material.

c) Decrease the pressure on forest resources.

5.6 **Study period :**

5.6.1 Starting year : 2014-2015

5.6.2 Completion year : 2016-2017

5.7 **Personnels :**

5.7.1 Study Leader : Mohammad Anisur Rahman, SRO

5.7.1 Associates : Dr. Khurshid Akhter, DO; Abdus Salam, R O & M. H. Chowdhury, RO.

5.8 **Progress :**

5.8.1 Previous progress, if any: NA

5.8.2 Activities of this year:

Randomized complete block design was selected. Required chemicals, pH meter, glassware were procured. Neem leaves and mahogani seeds were collected and dried. Wood and bamboo were collected and prepared samples. pH of the solution and moisture content of wood & bamboo shown in (Table-1). Neem leaves and mahogani seeds were soaked in cold water. Treatment of wood/bamboo samples using by 5% Neem leaves and mahogani seeds solution. (Table-2)

Table-1: pH of the Neem leaves & Mahogani seed solution and moisture content of wood & bamboo sample.

Sl. No.	pH of the Neem leaves solution	pH of the Mahogani seed solution	Moisture content of wood (%)	Moisture content of bamboo (%)
1	7.6	7.2	18	24
2	7.6	7.3	22	22
3	7.9	7.2	20	24

Table- 2: Treatment of wood and bamboo samples by 5% Neem leaves & Mahogani seed solution.

Sample in 5% Neem leaves & Mahogani seed solution	Thickness of wood/bamboo (cm)	Duration		
		Observation (No. of sample)		
		5 days	6 days	7 days
Wood	1.5	5	5	5
Bamboo	1.0	5	5	5

5.9 Achievement(s),if any : NA.

5.10 **Financial statement** :

5.10.1 Total cost of the study : Tk. 3, 60,750.00

5.10.2 Cost of the year : Tk.1, 25,750.00

5.10.3 Expenditure of the year : TK.1, 25,750.00

5.10.4 Source of fund : GOB

5.11 **Beneficiaries** : Environmental friendly preservative, Nontoxic for betel leaf farmers and general public.

WOOD WORKING AND TIMBER ENGINEERING DIVISION

1 **Title of the Study** : **Potential uses of treated round bamboo for making quality furniture.**

1.1 **Objective(s)** :

1.1.1. To establish round bamboo as a quality furniture material after preservative treatment.

1.1.2. To improve the design and quality of bamboo furniture.

1.1.3. To increase the uses of bamboo for making furniture as an alternative to timber.

1.2 **Study period** :

1.2.1 Starting year : 2011-12

1.2.2 Completion year : 2014-15

- 1.3 **Progress** :
- 1.3.1 Previous years : Two chairs, two tea tables, three alna, one single seat sofa and one double seat sofa were manufactured by Rangoon bamboo and kept for service test.
- 1.3.2 This year :
Research materials such as bamboo, polishing materials-carpa, gala, seguni powder, chalk powder, polishing cloth and sand paper (0,1,1.5,2) were collected. Sample was treated Bamboo using 10% borax-boric acid solution. Three low benches, three high benches, one table, two chairs and one cot were fabricated and kept for service test. Cost comparison was shown in table-1.
- 1.4 **Findings** : Thick and thin walled bamboo species produce quality furniture.
- 1.5 **Financial statement** :
- 1.5.1 Total cost : Tk 3,037,00.00
- 1.5.2 Cost of the year : Tk 1,03,000.00

Table-1 shows cost comparison of bamboo furniture (2015).

Sl. No.	Name of the Item	Size	Production cost (BFRI)	Market price (Teak)
1.	Bench	5'x 1'x 2'	5500	11000
2.	Table	3'x 2'x 2.5'	8000	17000
3.	Armless Chair	Standard size	5500	9000
4.	Cot (bed)	7'x 4'x 12"	23000	60000

2. Title of the Study : Survey and improvement of sawing technique of different wood species for maximum yield.

- 2.1 **Objective(s)** :
- 2.1.1. To determine the cause of timber loss during sawing.
- 2.1.2. To maximize the yields of timber by applying improved sawing techniques.
- 2.2 **Study period** :
- 2.2.1 Starting year : 2014-15
- 2.2.2 Completion year : 2017-18
- 2.3 **Progress** :
- 2.3.1 Previous years : N/A
- 2.3.2 This year :
Collection mango wood was completed. Sawmills at two locations, namely- Dhaka and Chittagong were visited. Information on present sawing status for low density wood species from saw mills at Dhaka and Chittagong was collected. Implementation of different sawing techniques and collection of data for low density wood species at Chittagong was done.
- 2.4 **Findings** : N/A
- 2.5 **Financial statement** :
- 2.5.1 Total cost : Tk 7,00,000.00
- 2.5.2 Cost of the year : Tk 38,000.00