ARANNAYK FOUNDATION
Conserving forests for the future

Evaluation Report

Name of the project
Recolonization and Mass Propagation of Banspata (*Podocarpus nerifolia)*

Implementing entity
Chittagong University

Evaluated and prepared by:
Dr. A.F.M. Akhtaruzzaman
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Executive Summary

Banspata, also known as pencil wood, is a large evergreen tree. It is the only conifer wood naturally occurring in the forest of Bangladesh. The wood yields very good quality pulp. Pencils made from treated banspata are of high quality and is considered to be a substitute of eastern red ceder (*Tuniperus virgeniana*) pencil. However, due to clear felling of forests, the species has become critically endangered and will be extinct very soon unless appropriate measures are taken. Scarce availability seeds makes it difficult to raise seedlings of banspata in large scale in the nursery. From this point of view the study on recolonization and mass propagation of banspata is undertaken by the Institute of Forestry and Environmental Sciences, Chittagong University with the financial support of Arannayk Foundation

There are eight objectives of the study centering on recolonization and mass propagation of the species. An exhaustive field survey located only 111 species of banspata in entire Bangladesh. This status shows the extent of vulnerability of the species. Therefore extensive research was conducted on raising of seedlings and stecklings (cuttings) in the nursery. The seedlings responded better than the clones. As the natural seed source of banspata is very limited, clonal propagation (steckling) is only the potential way of mass multiplication for the restoration and recolonization of banspata. Cuttings treated with 4000 and 6000 ppm IBA can significantly increase the number of root per cutting, mean root length and rooting percentage. An area of 1.25 ha has been covered with banspata in Chittagong University campus both with seedlings and stecklings for use as the source of propagating materials. The weaknesses of recolonization of the species have been identified. Finally, it is recommended to continue such kind of research activities with 10-15 endangered species under one project. Meanwhile, interim fund should be available for maintenance of existing plantation already established in Chittagong University campus.

Introduction

There is an indiscriminate destruction of forest all over the world. Annually, 14 million ha of tropical forests are being depleted. Ironically half of the forest cover is gone, and the growing demand for food and wood threatens the remaining.

The tropical forest represents only about 8% of the forest globally. In spite of that it holds tremendous significance, because it has the highest diversity of flora and fauna comprising two-thirds of the world's biodiversity. The trend in deforestation of the tropical forest is even more. As a result, there is an imminent danger of losing the valuable biodiversity. Arannayk Foundation, also known as the Bangladesh Tropical Forest Conservation Foundation, aims at improved management, conservation and restoration of natural forest and biodiversity in the country through providing grants for:

- Promoting conservation, protection, restoration and sustainable use and management of tropical forests in Bangladesh
- Involvement of the community in the promotional and marketing activities of forest produce
- Livelihood improvement program with farmers and local community based organisations, especially with emphasis on gender equity , on homestead agroforestry development activities
- Development of micro enterprise /income generating activities (IGA)/Alternate Income Generation (AIG) based on natural resources management and utilization.
- Innovative approach of herbal and medicinal plants cultivation
- Conservation of forest resource

On completion of the project Arannayk Foundation seeks external support to review the activities of the projects. At present the Foundation has undertaken an initiative to appraise the activities of 20 projects on their completion. Recolonization and Mass Propagation of banspata (*Podocarpus nerifolia)* implemented by Institute of Forestry and Environmental Sciences of the University of Chittagong (IFESCU) is one of such projects.

This evaluation assignment was carried out through consultation of relevant documents in connection of the project, discussion with the project personnel, group discussion with the faculty members of IFESCU, and site visit in Chittagong University campus.

Context and Objectives of the Project

Banspata also known as pencil wood is a large evergreen tree with straight cylindrical bole. It is the only conifer wood naturally occurring in the forest of Bangladesh. The wood yields very good quality pulp. Pencils made from treated banspata are of high quality and is considered to be a substitute of eastern red ceder (*Tuniperus virgeniana*) pencil. However, due to clear felling of forests the species has become endangered and will be extinct very soon unless appropriate measures are taken. Banspata was recommended for extensive cultivation in Bangladesh for pencils and also a wide variety

of other uses requiring smooth finish, fine texture and dimensional stability. But no large scale plantation of the species has yet been raised for lack of quality planting materials. It is difficult to raise seedlings of banspata in large scale in the nursery for the scarcity of seeds from the scarcely available stock in the forest. Moreover the species does not bear seed every year. From this point of view the study on recolonization and mass propagation of banspata is undertaken.

The objectives of the projects are:

- Objective 1: Exploration of the status of banspata in its natural and plantation habitats
- Objective 2: To develop techniques for nursery raising and plantation establishment for the species
- Objective 3: To develop a protocol for low cost propagation method through cuttings and tissue culture for mass clonal propagation
- Objective 4: To develop a stockplants management system to allow production of a large and continuous supply of planting stock
- Objective 5: To evaluate the growth characteristics of seedlings, stecklings and the tissue culture propagules
- Objective 6: To establish seedling seed orchard and clonal seed orchard and clone bank
- Objective 7: To develop nursery manual for the species, dissemination of propagation techniques to the relevant stakeholders and awareness generation activities through training, workshop and other promotional approaches
- Objectives 8: To promote recolonization and restoration of habitat through plantation in public and private sectors

Project Activities and Outcomes

Objective 1: Exploration of the status of banspata in its natural and plantation habitats

Extensive field study was conducted for exploration of the status of the species. In addition to the assessment in the field, the research team visited and consulted with the personnel of Bangladesh Forest Research Institute (BFRI), Forest Department (FD), Bangladesh Agricultural Research Council (BARC), IFESCU and individuals. They also collected available documents and reports related to the status, silviculture and management of banspata in Bangladesh and elsewhere.

The findings on the stocking of banspata in Bangladesh are summarized in Table 1.

Table 1. Present Status of Banspata in Bangladesh

Nos.	Area/Site	No. of individuals	Conditions	Remarks
1.	Masalong in agaichari, Khagrachari	06	Naturally occurring, over mature and vulnerable	Extremely depleting trees
2.	Korerhat, Ctg. (N) Forest Div.	01	Planted in guest house premises	Pole stage
3.	Near Padua Rest	01	Planted in guest house	Pole stage

	house		premises	
4.	Hazarikhill Forests	03	Planted near silviculture office	Trees
5.	Ukhia Forests	02	Naturally occurring, illicit cutting	Coppice
6.	Lawachara Forests	04	Planted/Natural	Trees
7	Near Beat office of Ukhia Range	02	Planted	Poles
8	Lawachara	02	Planted near Silviculture office	Sapling
9	Sitakunda Eco-park	05	Planted at Eco-park	Pole stage
10	Silviculture nursery, BFRI, Chittagong	03	Planted at BFRI premises	Pole stage
11	IFESCU	03	Planted at IFESCU Campus	Pole stage
12	Botanical Garden & Soil Research Institute, CU	02	Planted at CU Campus	Pole stage
13.	Baldha Garden	01	Planted Baldha Garden, Dhaka	Tree
14.	National Herbarium	01	Planted, Dhaka	Tree
15.	Botanical Garden, Dhaka	51	Planted	Saplings, poles and trees
16.	Ukhia, Cox'sbazar at homesteads	15	Planted in office compound and homesteads	Seedlings, saplings and poles
17.	Mymensingh B.A.U.	05	Planted in the Botanical Garden	Tree, Pole, Sapling and seedling
I8.	Jahangirnagar University	03	Planted in the Botanical Garden	Pole, sapling and seedling
19	Keochia Research station	01		pole stage
Total		**111**		

Table 1 shows to the utter dismay that only 111 banspata trees are available in the country. Of these only 10 are in the natural forests. The others are planted for research or for aesthetic beauty. This situation calls for immediate conservation of the species. To this end the FD should include this species its plantation programmes in hill forests without any delay.

Objective 2: To develop techniques for nursery raising and plantation establishment for the species

- The first step in this direction was establishment permanent propagator house (4.8m x 14m) that was constructed for mass propagation of the planting materials. A small tissue culture laboratory within the existing room has been established with modified infrastructure. This facility was grown mainly for capacity development of the students and conducting related research.

- Subsequent to this, banspata trees were identified for collection of seeds needed in this study from Botanical Garden, Dhaka and Lawachara forests. The collected seeds were sown in the bed of the propagator house and in the natural condition outside the propagator house, and systematic research on seeding raising were conducted. Better response was found from the seeds sown inside the propagator house.

- The seedlings of banspata cannot tolerate direct exposure to sunlight. The poly bags containing the seedlings kept directly exposed to the sunlight showed very poor germination and survival. But in the partial shade, both germination and survival was better. Germination media also greatly influenced the rate of germination and survival. Maximum germination was found (98%) in the propagator house. Better result came from the growing media in Sylhet sand. It seems that the temperature retaining capacity of Sylhet sand is comparatively more than other growing media in ordinary sand and soil. Water holding capacity of Sylhet sand seems to be optimum.

- For the study on clonal propagation, three small hedge beds with 30 seedlings were established in the IFESCU nursery and are being used for clonal planting materials. Juvenile shoots/ cuttings were collected from the seedlings in the hedge beds for rooting trials and placed in the propagator house.

- The rooted stecklings were transplanted from the propagator house bed to the poly bags and were placed in milder sun light and temperature inside the nursery shed for a few days and after hardening, the stecklings were transferred to the normal light condition out side the nursery shed and the work continued up to the end of the project. The mean rooting and survival percentage of the stecklings were 73% and 71% respectively irrespective of collection source of propagation materials. The mean growth of seedlings and stecklings in plantation were 1.35 cm/month and 1.62 cm/month respectively. The difference between these two values was statistically insignificant. Seedlings were more susceptible to cutworm attack than the stecklings. Cutworms attacked 8% of the seed originated seedlings while only 2% for stecklings.

- As the natural seed source of Banspata is very limited, clonal propagation is only the potential way of mass multiplication for the restoration and recolonization of banspata. Cuttings treated with 4000 and 6000 ppm IBA can significantly increase the number of root per cutting, mean root length and rooting percentage.

- Banspata seed stands have been established in 1.25 ha in the campus of the university that may be used for future seed sources

Objective 3: To develop a protocol for low cost propagation method through cuttings and tissue culture for mass clonal propagation

- Tissue culture laboratory in a small scale is ready now for experiments. Tissue culture laboratory has been developed up to working condition and from now on the students are being imparted academic lessons in the area. As a result , their knowledge is up-dated.

Objectives 4:To develop a stockplants management system to allow production of a large and continuous supply of planting stock

It was noted earlier that stecklings are effective propagating materials for large scale plantation of banspata. It was found that semi-hard cuttings are the best for development

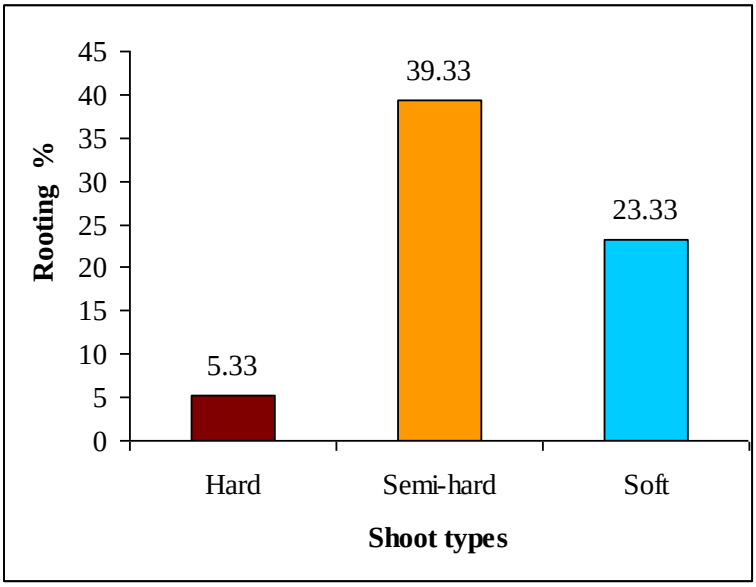

Fig.1. Type of shoots in development of stecklings of banspata

Roots. A detailed sudy of managemt of stock plants was done. It was seen that the stecking performs better when planted under shed. However, there occurs top dying and leaf spots in the saplings in the nersury as reported in Table 2.

Table 2. Diseases encountered in the saplings if banspata in the nursery

Disease	Symptoms	Causal organism	% attacked
Top Dying	• Dying starts from the apical bud of the stecklings and gradually proceeds down wards. • The upper leaves turn brown and gradually proceeds towards the base of the stecklings and ultimately the stecklings die. • By uprooting stecklings it has been found that the roots remained healthy.	*Uromyces* *	40%
Leaf Spot	• Green leaves gradually become gray and eventually turns into black. • Irregular spots develop on the dorsal surface of the leaves and rotening starts at the advanced stage of spot development.	*Uromyces* *	53%

Objective 5: To evaluate the growth characteristics of seedlings, stecklings and the tissue culture propagules

The investigation proved that branch formation was more in seedlings in than the stecklings. However collar diameter was superior in stecklings. Survival rate of the seedlings was higher with the saplings. The seedlings also responded more positively than the stecklings. Mean growth of seedlings and stecklings were recorded 22.12 cm/yr and 16.74 cm/yr respectively in the ten months old plantation during the third week of March. In spite of this facts, because of scarcity of the seeds justifies plantation of banspata from the stecklings as these can be made available in large scale in a short span of time.

Objective 6: To establish seedling seed orchard and clonal seed orchard and clone bank

An area of 1.25 ha of seed orchard with seedlings and stecklings in Chittagong University campus has been established to serve as seed source and clone bank. A view of the orchards is shown in Fig.2. It is seen that both of these perform well. The

Fig.2. A view of the orchard with seedling (left) and steckling (right)

Total numbers of plants for the purpose were about 3,500 in 1.25 ha at different sites given in Table 3. Of these, about 700 were from seedlings and the rest from stecklings.

Table 3. plantation of seedlings and stecklings of banspata in Chittagong University campus to serve as propagating materials

Nos.	Planted in CU Campus	No. of individuals
1.	IFESCU-2008	100
2.	Near Nipoban school-2009	300
3.	Near Khaleda Zia Hall-2009	100
4.	Near Marine Science Inst.-2009	20
5.	Behind Khaleda Zia Hall-2010	1500
6.	Near Marine Science Inst.2011	620
7.	Different halls of C U-2011	50
8.	Near Khaleda Zia Hall 2011	490
9.	Near Khaleda Zia Hall 2011	320
Total		3500

Objective 7: To develop nursery manual for the species, dissemination of propagation techniques to the relevant stakeholders and awareness generation activities through training, workshop and other promotional approaches

- Two one-day long workshops were held in which a total of 57 participants attended. The first one was held on 16 June 2008 and the other on 25 March 2009 .The present status of banspata, its process of its recolonization, dissemination of propagation techniques were the themes of discussion in the workshop. IFESCU, BFRI, Forest Department, BCSIR, AF Nursery, SUST, Forest Academy, Khulna University,Botany Department of Chittagong University and NGOs participated at the workshop. The recommendations of the first workshop were:

  - Details on silvicultural and phenological aspects of banspata should be documented
  - Nurseries at grass-root level should be involved in raising seedlings of native and threatened tree species including banspata with necessary incentives
  - Both seedling seed orchard(SSO) and clonal seed orchard (CSO) of banspata should be established at CU campus
  - Recolonization of banspata should be established in its natural habitat
  - Threatened species should be included in the mainstream plantation programs of FD along with the protected areas keeping minimum quota for the native threatened species *ie.,* banspata and civit.
  - Planting of banspata in the homesteads, academic institutions, governmental and non governmental organizations should be explored and encouraged

The recommendations of the second workshops were:

- Action should be taken to disseminate knowledge and information related to banspata to all relevant organizations to ensure the flow of expertise and technology
- Low cost propagules should be produced and distributed at nominal price rather than free of charge
- Documentation of best nursery practices should be explored and published for distribution
- Plantation should be carried out in Protected Areas (PAs) accommodating at least 10% native species including banspata in the plantation programme
- Both ex-situ and in-situ conservation of banspata germplasm programme should be undertaken
- Government should come forward with both financial and technical support for the conservation of native threatened species
- Awareness should be created among the people through mass media for the conservation of all native and threatened tree species including banspata.

- o A booklet and one folder have been published and distributed to different stakeholders, students, nurserymen, NGOs and individuals
- o A vedio programme has been produced and supplied to different projects through Arannayk Foundation and showed to the students and academic staff members
- o Awareness was developed through daily newspapers several times
- o A monograph is ready for preparation

Objectives 8: To promote recolonization and restoration of habitat through plantation in public and private sectors

Public and private sectors were encouraged to promote recolonization and restoration of the species. To this aim in view, seedlings and stecklings of banspata were distributed to different sectors as recorded in Table 4. In addition, at the moment about 2,000 rooted stecklings in the poly bags are available for plantation/distribution .

Table 4. List of distribution of banspata seedlings/stecklings

Nos.	Area/ Site of distribution	No. of individuals
1.	Sitakunda Eco-park	15
2.	Botanical Garden, Dhaka	15
3.	CODEC, Ctg.	35
4.	BCSIR, Ctg.	10
5.	Rangamati Forest Division	30
6.	South Forest Division, Cox's Bazar	50
7.	Proyttashi	50
8.	PHP, Chittagong	25
9.	Beran khgrachari	25
10.	D.F.O, Chittagong	10
11.	D.F.O., Moulavi Bazar	05
12.	Shahjalal University	05
13.	M.C. College, Sylhet	03
14.	Tilagar Ecopark, Shlhet	02
15.	Ram Sagar, Dinajpur	03
16.	Haji Danesh University, Dinajpur	05
17.	Paike Banda Range, Rajshahi Social FD	03
18.	Rajshahi Forest School	03
19.	Dhaka University	05
20.	Hill Flower (NGO), Rangamati	10
21.	Baldha Garden, Dhaka	02
22.	Jahangirnagor University	20
23.	National Herbarium	03
Sub Total		**329**

Nos.	Area/Site of distribution	No. of individuals
24	National Botanical Garden, Dhaka(2^{nd} time)	10
25	Rangamati Forest Division	30
26	Bangabandhu Safary Park	20
27	Cox's Bazar Forest Divisions	30
28	CODEC	50
29	PHP	25
30	BIRAM, Khagrachari	25
31	Chitttagong Forest Division	10
32	Sitakunda Eco-Park	20
	Sub Total (Two hundred)	200
	Seedlings distributed during 2011	
33	Chittagong circle	10
34	Inani Range , Ukhia	50
35	Conchord	50
36	Different Halls of CU	50

37	!st Semester Students 2011	30
38	DFO, Bakhtiar Nur Siddiqui	25
39	Cox,s Bazar North and South Div.	20
	Sub Total	235
	Grand total	734

Impacts

Awareness and capacity development: The awareness has been development through distribution of brochure and holding of two workshops. The details of such activities have been discussed in objective 7. As a result of this awareness, 39 different organizations received 743 seedlings for domestication of the species during 2008 – 2011. Mass awareness on conservation programmes of native tree species in Chittagong University campus has been published by different dailies of the country. Some TV channels also broadcast the findings on different occasions.

The capacity building was achieved through pursuit of research by the students at the B.Sc and M.Sc. levels. Two B.Sc. students and two M.Sc. students conducted thesis on different aspects in conservation of the species. The faculty members also have a thorough insight on the biodiversity of the country. This will help them to conduct problem-led research.

Livelihood: The project activities is not directly linked to livelihood.

Institutional Development: The following institutional facilities were set up as a joint effort with restoration of banspata:

- A propagator for raising seedlings/stecklings was established jointly with the project on civit. This facilitates to conduct research in raising propagules
- A mini tissue culture laboratory was set up jointly with the project on civit. This will enable to render practical training to the students on micro propagation technique.

Forest and biodiversity conservation: Establishment of seed orchard in the University campus is a great effort from point of view in proliferation and conservation of the species. The knowledge gathered on dwindling condition of the species will create caution among the planners and the policy makers for its conservation. The awareness created on the issue will also attract the field workers for its conservation in the forest.

Sustainability Potential

Establishment of 1.25 ha of orchard of banspata in Chittagong University campus has created an opportunity in collected propagating stock of this threatened species. This will enable to collect quality planting materials for large scale plantation. So, the achievements will greatly influence on sustainability.

Weaknesses

- Banspata is seriously depleted and threatened

- Phenological events are not well known
- People are not well aware of the species, resulting indiscriminate cutting of the species
- Seed collection sources are very limited and seed collection is very difficult
- It takes long time to develop root from shoot cuttings
- Cutworm infestation and fungal attack in the nursery and out planting are serious problems
- Lack of importance in research on the species

Recommendations

Two separate projects for scientific study for recolonization and mass propagation of cavit and banspata appears too ambitious. There are so many species that are threatened. It is recommended to take up a single project to conduct study on 10-15 threatened species. The species can be selected through feedback from Forest Department, Bangladesh Forest Research Institute, Timber Merchants Association and the relevant NGOs.

IFESCU have established orchards of banspata and some threatened species in Chittagong University campus. Many of the valuable plants established through the efforts during the last five years may even loose their existence if silvicultural practices are not done properly for want of fund. Thus, it is also recommended to make available of critical fund for this purpose till a follow-up programme is launched.