

Project Completion Report

on Dike Greening

Sustainable Development and Biodiversity Conservation in Coastal Protection
Forests (SDBC- Sundarbans) Project.

Contract number: 83195588



Implemented by:

Nowabenki Gonomukhi Foundation (NGF)



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Message from ED

Nowabenki Gonomukhi Foundation (NGF) is a non-profit management organization fully dedicated to develop rural community through sustainable coastal ecosystem management and development. The organization has been developing productive partnership with Govt. departments, Private sectors and different national/international donor organizations for its programme participation and implementation.

Accordingly, NGF has been developing their different services packages and innovative IGAs for coastal people focusing on climate adaptive issues in the southwest part of the country. One major area of our attention is to make our coastal community "climate resilient". Understanding the coastal context, basically, we are trying to engage people (different categorizes beneficiaries/farmers/ communities/ CBOs/Union Parishad/ Local Government agencies/ NGOs/ Service providers/ Private Sectors) under different integrated projects and program. Consequently, we were addressed of those people under Dike Greening Project.



Considering the high salinity context and economic condition, we have learned that sustained poverty alleviation can be achieved only if the poor became involved with efficient economic and climate adaptive activities. Similarly, NGF has been supporting people through different intervention solution packages related to climate adaptive activities, capacity building training, grant support, innovation/IGAs, livelihood support, VGD program, health & education, organic shrimp culture, crab fattening, food security and safety net, agriculture/livestock support both on farm & off farm, integrated WASH facilities, infrastructure, plinth raising and sustainable water supply technology promotion and accelerating different financial support to the coastal community. Furthermore, NGF has learned new ideas from Dike Greening Project that will create an alternate income option for future community based economic development. Though our initiative with GIZ was very small scale intervention, it was a turning point to start 1st "organic shrimp culture" and the initiative will be continued based on their social, economic and environmental benefit.

While submitting this Project Completion Report for public readership, I feel happy for the successful mileage that we have achieved in the project duration but this does not signify our absolute self-gratification. I do humbly acknowledge our partnership with GIZ and their Project Team for the continuous support being provided to the NGF. I also want to give my cordial thanks and best wishes to the respective project team and relevant departmental staffs of NGF. Finally, I expressed my heartiest gratitude to the project beneficiaries and different level of stakeholders who put in us their trust and utilize resources to complete a successful implementation of this project.

Md. Lutfor Rahman

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1. Executive Summary

The Dike Greening initiative is an area of intervention of the “Sustainable Development and Biodiversity Conservation in the Coastal Protection Forests (SDBC-Sundarbans)” project. The project “SDBC-Sundarbans”, is basically implemented in three pilot districts namely Khulna, Satkhira and Bagerhat, with the approach to rehabilitate and manage vulnerable embankment areas through participation of resident population as well as to institutionalize co-management and improve inter-agency coordination through capacity building and to safeguard towards conserve biodiversity in the vulnerable embankments. Dike Greening is a joint pilot project implemented by the Bangladesh Forest Department (FD) under the Bangladesh Ministry of Environment and Forests (MoEF) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH with the fund of German Federal Ministry for Economic Cooperation and Development (BMZ). But at the field level the basically dike greening segment was implemented by Nowabenki Gonomukhi Foundation (NGF); focusing on sustainable shrimp cultivation by ensuring biodiversity conservation through promoting dike greening, in a pilot district namely Satkhira. Dike greening mainly emphasizes on sustainable shrimp cultivation because it is a lucrative income generating activity for people living in the coastal areas and a large number of people are engaged with this occupation. But shrimp cultivation creates many environmental hazards that create impact on bio-diversity; however shrimp cultivation couldn't be resisted because it's totally related to people's livelihood. That's why emphasis was provided on sustainable shrimp cultivation. In all phases, dike greening strategy addresses eight broad initiatives during field level implementation, covering in total seven Unions at Shyamnagar and Kaligonj Upazila in Satkhira district.

Project description

Title: Sustainable development and biodiversity conservation in coastal protection forests (SDBC-Sundarbans)

Sub project: Dike Greening

Commissioned by: German Federal Ministry for Economic Cooperation and Development (BMZ)

Country: Bangladesh

Lead executing agency: Ministry of Environment and Forests (MoEF)

Implementing agency: Bangladesh Forest Department (FD), GIZ, NGF

Table 1: Initiatives for dike greening

Sl. No.	Dike greening strategy	Initiatives from implementing agencies
01	Baseline survey	Baseline survey was conducted over 600 farmers before farmer selection. During the first phase 100 farmers and second phase 500 farmers were brought under baseline survey.
02	Community mobilization activities	Community mobilization program was conducted at different stage in different time covering total 180 participants.
03	Stakeholder consultation program	With the collaborative presence of multi-sectorial specialist stakeholder consultation program coverage total 200 participants at different stage with different time.
04	Farmer selection	Finally total 300 target farmer were selected among the surveyed profile, based on project implementing criteria.
05	Skill promoting training	For farmers skill development total 300 farmers were trained at different stage, on tree plantation and vegetable cultivation, with the help of govt. and non govt. sectoral experts.
06	Seed/seedling, fertilizer and fencing material supply	In different stage total 61500 seedlings of 18 selected species, 6500 kg compost fertilizer, along with necessary fencing material have provided for plantation.

Sl. No.	Dike greening strategy	Initiatives from implementing agencies
07	Follow up and monitoring of the growth of planted species	Regular follow up and monitoring has done, for ensuring vegetable plantation on dikes, enhancing of growth and reducing survival rate of planted species.
08	Awareness raising	For raising awareness on dike greening for sustainable shrimp cultivation, considering bio-diversity conservation regular follow up has done by- <ul style="list-style-type: none"> a. Stakeholder consultation program b. Community mobilization activities c. Skill promoting training d. Informative display/sign board placement at the community level

Considering the vision of the project towards biodiversity conservation in coastal region, dike greening activities has started from date August 30, 2014 and all activities has completed within target project duration November 30, 2015.

Table 2: Key outcome-level highlights

1. Organic shrimp farmers are planting tree in their shrimp cultivating ponds area/ dikes.	<ul style="list-style-type: none"> 1. About 16% farmer planted additional trees in their shrimp pond as for promoting dike greening and vacancy felling after completing all plantation 2. About 7% farmer expanded tree plantation in their other shrimp cultivating ponds dike
2. Organic shrimp farmers are cultivating vegetable in their shrimp ponds dike.	<ul style="list-style-type: none"> 1. About 19% farmer cultivated vegetable in their shrimp ponds dike. 2. About 4% farmer expanded vegetable cultivation in their other shrimp cultivating ponds dike
3. Survivable rate of seedlings after completing dike greening	<ul style="list-style-type: none"> 1. At present seedlings survival rate is 72.002% after completing plantation

2. Project Background

Bangladesh is one of the most densely populated countries in the world. The south-west coastal region of Bangladesh is the most disaster-prone area in this country and is very endangered and vulnerable due to the effects of rapid climate change. As a result sea level is raising and every year up to 30 million people have to suffer from severe flood. A large number of people at south west region near side the Sundarbans in this country are critically vulnerable due to this rapid climatic change. On the other hand saline water intrusion for shrimp farming causes environmental degradation as well as weakens the river embankments. Considering all of the aspects, to protect themselves from these uneven disorders, conserving biodiversity in the embankment areas (dike) which are considered as ecologically critical area (ECA), sustainable dike greening initiative has taken for those areas.

Traditional shrimp farming is lucrative income generating activity in coastal zone, but it creates environmental impact, as well as creating negative impact on bio-diversity. Recently organic shrimp farming has been introduced in these areas, with an approach to aquaculture that follows the criteria of EU and other organic regulations, to minimise any adverse effects on the environment. That means: (i) the protection of adjacent ecosystems; meaning “50-70% of the surrounding dikes (shrimp cultivation farm) must be ‘greened’ with natural vegetation” for reducing probable loss of ecosystem; (ii) a prohibition on the use of

chemicals (such as fertiliser, pesticides or antibiotics); (iii) natural treatment in the case of disease; (iv) employing only natural and necessary inputs; (v) a prohibition on the use of genetically modified organisms; (vi) a prohibition for wild caught PL in case of stocking (vii) an extensive culture technique with a low stocking density (max 15 larvae /m²); and (viii) feeding of organic certified food as well.

As the organic shrimp cultivation is relatively new; to promote organic shrimp culture into the traditional shrimp farmers need to coping with the dike greening pattern, with saline region, without creating negative impacts on shrimp cultivation.



Figure 1: Model dike greening concept
Place: Burigoalini Union

Practically it has shown that, dike greening is possible to promote with an agroforestry concept. That means to development tree species with agricultural crops or vegetables in the barren land of (OS) shrimp cultivation farm areas or dikes. A vegetable patch or greening concept on dikes can provide additional income, reduction of soil erosion, enhance scope of nitration supply for sustainable management and conservation of biodiversity system for the Sundarbans region of Bangladesh.

3. Objectives of the Project

The overall objectives of SDBC- SUndarbans project is to conserving biodiversity and the management of ecologically sensitive embankment areas (vulnerable area of the embankment) through raising plantation which will serve as a model for others.

The Specific objectives are as follows

1. To ensure sustainable plantation along the dikes of organic shrimp ponds.
2. To promote dike greening throughout organic shrimp ponds.
3. To facilitate organic shrimp farmers in tree plantation for scaling up.

4. Strategy and Work Plan

4.1 Approach

The project works on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) and supports the implementation of the Bangladesh Climate Change Strategy and Action Plan. It is particularly relevant for the disaster management, and capacity building and institutional



Figure 2: Motivational training behind the approach
Place: Shyamnagar Union

strengthening pillars of that strategy. It is building the capacities of the local authorities and local people to contribute to improved biodiversity conservation and management in the Sundarbans. It also provides advisory services and training for ministerial staff and promotes mediation processes between user groups and government agencies with respect to user rights.

4.2 Key focus

Dike greening, sustainable management, green vegetation, organic shrimp certification, ecological balance, biodiversity conservation and costal protection

4.3 Strategy for dike greening

- A. Baseline survey for farmer selection
- B. Farmer selection
- C. Field area selection
- D. Stakeholder consultation program
- E. Community mobilization activities
- F. Species selection
- G. Farmer training program for skill promoting
- H. Plantation activities
- I. Initiate vegetable cultivation
- J. Follow up and monitoring of the growth of planted species
- K. Awareness campaign

4.4 Work plan

Sl. No.	Heads of activity	Time Line															
		2014					2015										
		Piloting phase					Phase 2										
		A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
Implemented work plan for dike greening																	
01.	Base line survey																
02.	Community mobilization activities																
03.	Stakeholder consultation program																
04.	Farmer selection																
05.	Skill promoting training																
06.	IGA training																
07.	Seed/seedling, fertilizer and fencing material supply																
08.	Vacancy felling																
09.	Follow up and monitoring on plantation																

5. Steps of Dike greening Activity in brief

5.1 Field Area Selection

Field selection was mainly based on considering organic shrimp culture practice in different unions. Total seven unions (Atulia, Burigualini, Shyamnagar Sadar, Krishnonagar, Champapul



Figure 3: Field selection for dike greening
Place: Dholbaria Union

Dhalbaria and Ratonpur) were selected under two upzila.

5.2 Baseline survey

Baseline survey was conducted over in total 600 farmers for selecting finally 300 target farmers at the different phases of dike greening. At the first phase of dike greening project baseline survey was conducted over 100 farmers for selecting 75 beneficiary and the second phase baseline survey was conducted over 500 farmers for selecting 225 beneficiary farmers for dike greening.



Figure 4: Baseline survey for dike greening
Place: Krishnonagar Union

5.3 Community Mobilization Activities

Rising awareness among the community people about importance of dike plantation due to their own benefits and to protect themselves from environmental hazards Nowabanki Gonomukhi Foundation (NGF) collaboratively with GIZ, at different places of the project implementing area has conducted community mobilization program at different phases of the project. Community mobilization



Figure 5: Community mobilization
Place: Atulia Union

program in the implanting areas helped to disseminate knowledge on importance for maintenance and protection of Sundarbans, management of sustainable ecological biodiversity of costal impact zone.

5.4 Stakeholder Consultation

Successful implementation for the project stakeholder consultation program has conducted in different places covering whole implementing areas people. In this program different sectorial people (forest, agricultural, fisheries and local representatives) were present. This program also focused on importance of maintenance and protection of Sundarbans, management of sustainable ecological biodiversity of costal impact zone.



Figure 6: Stakeholder consultation program
Place: J.C Complex, Shyamnagar Union

Table 3: Coverage from community mobilization and stakeholder consultation program

Area Coverage	Participants in community mobilization program	Participants in stakeholder consultation program
Atulia Union	40	40
Burigoalini Union	40	40
Ratonpur Union	35	40
Dholbaria Union	35	40
Shyamnagar Union	35	40
Krishnonagar Union	35	0
Total:	180	200

5.5 Farmers profile formation and Farmer selection

Under dike greening project 600 households detail profile has formed and among them finally 300 organic shrimp cultivating farmers were selected for field level implementation. Under dike greening project at first 75 farmers were selected for piloting and second stage total 225 farmers were brought under implementation comprising different seven Unions of two Upzila in Satkhira district.

Farmer selection criteria were based on:

1. The farmer who are cultivating organic shrimp in their own land they were target farmers.
2. Motivated and willing farmers were given priority for dike greening activity.
3. The organic shrimp cultivating farmers whose dikes are well condition and wide for tree plantation were selected.

Table 4: Information on Farmers profile

Total no. of farmers profile formation	600 number
Total no. of selected farmers	300 number

5.6 Farmer training on plantation

Under this project for developing skill on plantation activities along with vegetable cultivation in shrimp cultivating dikes, selected 300 target farmers were trained by multi-sectoral experts in 12 batches at different stages.

Basic outputs from the training program

1. Farmers were informed about mangrove, non-mangrove and fruit species
2. They know about soil preparing/field preparation system during plantation.



**Figure 7. Farmer training program for dike greening
Place: Atulia Union**

3. Farmers know about scientific way of fertilizing, watering and post plantation management system
4. Also trained and practically use about biological pest and disease management system

Beside this training program has made farmers aware about the importance of plantation for economical solvency, environmental protection, ecological balance and overall scientific way of plantation management.

Table 5: Coverage from farmer training program

Name of Unions	Total coverage
Atulia	80
Burigoalini	75
Dholbaria	60
Ratonpur	35
Shyamnagar	25
Krishnonagar	25
Total trained farmer number:	300

5.7 Income Generating Activities (IGAs)

Under dike greening sub project of (SDBC-Sundarbans) besides selecting 300 target farmers plantation another 150 farmers were training on income generating activities (IGA) on diversified field (such as homestead gardening, poultry rising, goat rearing, crab fattening and organic shrimp cultivation). Beside skill promoting training, those farmers were provided financial facilities from NGF for their initial establishment.



**Figure 8: Farmer training program for dike greening
Place: Dholbaria Union**

5.7.1 Farmer Training on Crab Fattening

NGF has conducted training on crab fattening under dike greening project where total 25 farmers got trained and about 80% of them successfully continuing crab fattening at their homestead pond.



**Figure 9: IGA training on crab fattening
Place: Burigoalini Union**

5.7.2 Farmer Training on Homestead Gardening

NGF has conducted training on vegetable cultivation under dike greening project where total 50 farmers got trained and presently about 75% of them successfully continuing vegetable cultivation at their homestead land.



Figure 10: IGA training on homestead gardening
Place: Raronpur Union

5.7.3 Farmer Training on Poultry Raising

NGF has conducted training on poultry raising under dike greening project where total 25 farmers got trained and presently about 60% of them successfully continuing poultry raising activities at their home land.



Figure 11: IGA training on poultry rearing
Place: Burigoalini Union

5.7.4 Farmer Training on Goat rearing

NGF has conducted training on goat rearing under dike greening project where total 25 farmers got trained and presently about 65% of them successfully continuing goat rearing activities at their home land.



Figure 12: IGA training on goat rearing
Place: Burigoalini Union

5.7.5 Farmer Training on Organic Shrimp Cultivation

NGF has conducted training on organic shrimp culture under dike greening project where total 25 farmers got trained and about 100% of them successfully continuing organic shrimp cultivation at their respective ponds.



Figure 13: IGA training on OS cultivation
Place: Ratonpur Union

Table 6: Results of Farmers Training on different IGAs

Name of IGA	Number of Trainee	Socio-economical Results
Homestead gardening	50	<ol style="list-style-type: none"> 1. Enhanced economical condition by using their land on homestead gardening. 2. Farmers have started vegetable cultivation at their unused homestead lands as well as shrimp cultivating dikes through promoting modern cultivation techniques. 3. Developed skills on towards commercial production of vegetable
Poultry rearing	25	<ol style="list-style-type: none"> 1. Being economically solvent by poultry rearing 2. Mortality rate of chickens has reduced because of increased awareness about timely treatment 3. Can promote market linkage for their products
Goat rearing	25	<ol style="list-style-type: none"> 1. Enhance economical solvency at household level 2. Meat as well as milk production rate is increasing 3. Can build market for their products
Crab fattening	25	<ol style="list-style-type: none"> 1. Changing their economic condition by crab fattening 2. Presently they can apply all modern technology for crab fattening 3. Developed skill of marketing linkage for promoting demand of their production
Organic shrimp cultivation	25	<ol style="list-style-type: none"> 1. Being aware about the necessity of organic shrimp cultivation 2. Aware about organic shrimp criteria and EU standards 3. Promoting market demand for their increasing production

5.8 Species Selection for Plantation and Seedling distribution

Based on survival capacity at saline region in Bangladesh like Satkhira district, consulting with multi-sectorial experts (forest, agricultural, fisheries departments representatives) eighteen different species were selected.



**Figure 14: Seedling transportation, stoking and distribution
Place: Shyamnagar & Kaligonj Upzila**

During species selection physical and biological factors of species were considered, so that plantation on vulnerable dike area does not make impact on organic shrimp cultivating ponds/dikes and selected seedling can grow smoothly on that vulnerable area. All of the selected species were classified in three brought categories.

Table 7: Recommended tree species

Mangrove Species		Non-mangrove Species		Fruit Species	
Local Name	Scientific name	Local Name	Scientific name	Local Name	Scientific name
Sundri	<i>Heritiera fomes</i>	Neem	<i>Azadirachta indica</i>	Peyara	<i>Psidium guajava</i>
Golpata	<i>Nypa fruticans</i>	Babla	<i>Vachellia nilotica</i>	Tetul	<i>Tamarindus indica</i>
Kakra	<i>Bruguiera sexangula</i>	Arjun	<i>Terminalia arjuna</i>	Kodbel	<i>Limonia acidissima</i>
Keora	<i>Sonneratia apetala</i>	Bohera	<i>Terminalia bellirica</i>	Noil	<i>Phyllanthus acidus</i>
Gewa	<i>Excoecaria agallocha</i>	Papul	<i>Ficus sp.</i>	Narikel	<i>Cocos nucifera</i>
Goran	<i>Ceriops decandra</i>	Kheju	<i>Phoenix sylvestris</i>	Safeda	<i>Manilkara zapota</i>

Last year, at the pilot stage 8100 seedlings were distributed among 75 selected farmers and this year considering vacancies felling 53400 seedlings were distributed among newly selected 225 farmers.

5.9 Plantation Activities

Plantation activities were performed by considering scientific techniques of plantation. At the beginning of rainy season all plantation activities has completed. For ensuring protection of plantation site fencing was done. After completing plantation regular watering, fertilizing, monitoring and mulching has ensured.



**Figure 15: Plantation activities for dike greening
Place: Burigoalini, Dholbaria & Ratonpur Union**

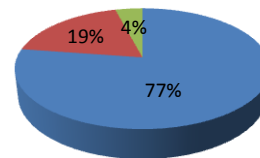
6. Vegetable cultivation on plantation dikes

Vegetable cultivation has extended during dike greening (phase 2) implementation period. Target farmers were motivated for promoting vegetable cultivation at their respective dikes. Implementing agencies has provided regular information and technology among the farmers, as a result from representing (graph-1) it can be mentioned about 19% of total farmers of (dike greening, phase 2) become motivated and promoted vegetable cultivation of different species (eg; red amaranth, indian spinach, okra, etc.) through their own investment. From this vegetable cultivation initiative about 453 decimal land areas has brought under vegetable cultivation. Also (graph-1) represents about 4% of total farmers being motivated, promotes vegetable cultivation of different species (eg; red amaranth, indian spinach, okra, etc.) through their own investment, which covers about 213 decimal additional land areas of target plantation dikes.

Also mention that mainly rainy season crops are suitable for dike cultivation due to availability of rain water. But some cases considering presence of available permanent fresh water source with the associated dikes, farmers promote winter crops.

Vegetable cultivation status on dike greening sites

- Only raised plantation
- Vegetable cultivation at plantation area
- Vegetable cultivation at outside dikes of plantation area



Graph-1



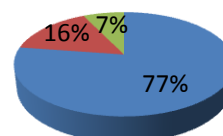
**Figure 16: Vegetable cultivation on dikes
Place: Burigoalini Union**

7. Extension of dike greening promoting through additional vegetation

During running period of dike greening (phase 2), target farmers were motivated for promoting dike plantation. Implementing agencies has provided about 61500 numbers of seedlings among 300 farmers in different phase of plantation, so that in an average every farmer gets about 200 seedlings of different species for promoting plantation.

Dike greening promoting status through extension vegetation

- Plantation through only giz contribution
- Expanded plantation through giz & farmers contribution at own dikes
- Expanded plantation other dikes through own contribution



Graph-2



**Figure 17: Extended vegetation in other dikes
Place: Dholbaria & Burigoalini Union**

From the representing (graph- 2), it has seen that about 16% of total farmers of have become motivated for promoting additional plantation and they have raised about 2309 numbers of seedlings of different species at their respective dikes. On the other hand (graph-2) also represents about 7% of total farmers of has become motivated and raised about 792 numbers of seedlings of different species at their other dikes with their own contribution.

8. Present Status of Dike Plantation Site

Dike greenig activities have conducted over two Upzila (Shyamnagor and Kaligonj) of satkhira district. This plantation activity has conducted over 300 farmers at different three stages. Though most of the cases plantation program have to started late of the rainy season which results, (i) lack of time for hardening of seedling, (ii) lack of fresh water to grow in salt region. But most of the field's present plantation site species survival rate was satisfactory.

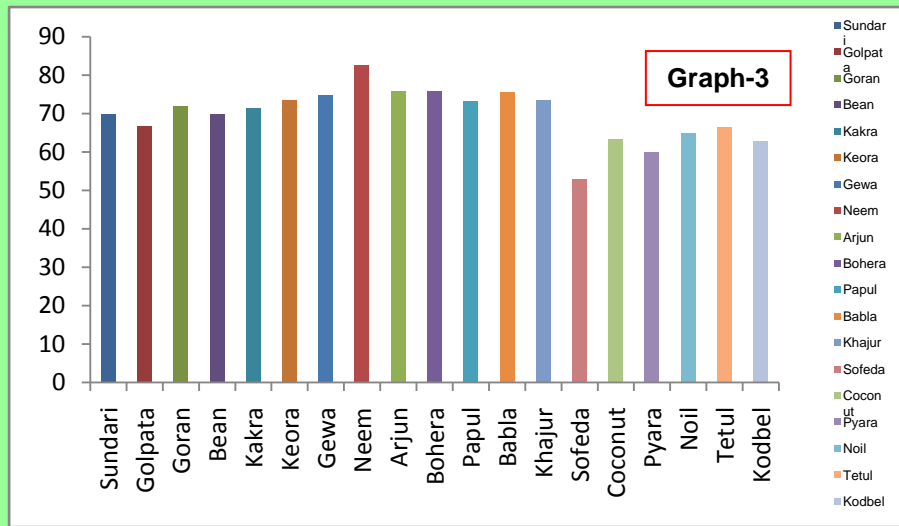


**Figure 18: Present condition of some dikes
Place: Dholbaria & Burigoalini Union**

9. Present survival rate

Here with attached (graph-3) represents the average survival rate of different species, by considering both number of planted (second and third stage) species under dike greening sub project (phase 2). At dike greening second stage of plantation overall species present survival rate (80.49%) was satisfactory but for third stage of plantation species survival rate (64.22%) was very less than the second stage of plantation. As a result at present considering both stages of plantation average survival rate of different species (represents graph-3) is 72.002%.

The (graph-3) also represents, some species (specially fruits species, eg: sofeda, pyara) has less survival capacity. Reasons are mainly lack of sufficient time for implementation (that means project contract duration very low), results is late season



plantation (third stage plantation), and as well less hardening period.

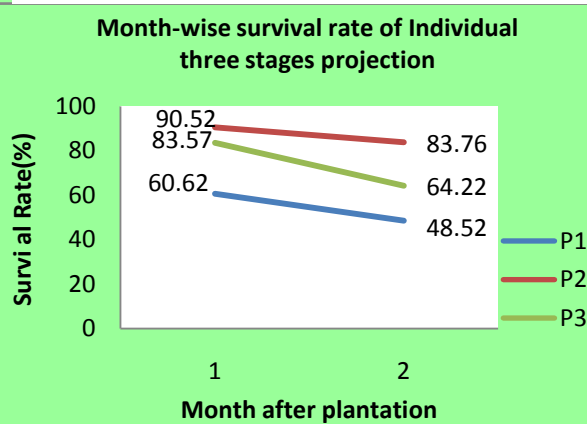
In spite of many problems (graph-3) represents, still now better survival rate for some mangrove, non-mangrove, fruit species (eg; sundary, gewa, keora, neem, babla, Kajur, arjun, narikel, kodbel, etc.). In future such types of species can take strong part for promoting dike greening activities.

10. Projection on seedlings survival rate

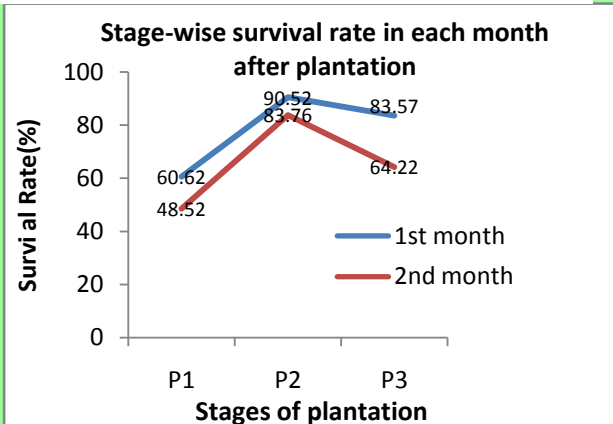
10.1 Projection on seedlings survival rate two month after plantation

At three stages total 61500 number of different seedlings has brought under plantation. Here different graphs represent the projection on survival rate of different species that's varying with different stages of plantation.

First stage plantation (Dike greening sub project, phase 1) has completed within October 2014, second stage (Dike greening sub project, phase 2) plantation has completed within July 2015 and finally third stage plantation (Dike greening sub project, phase 2) has completed within September 2015. Here with attached graphs three symbols (P1, P2, P3) respectively represents first, second and third stages of plantation.



Graph-4

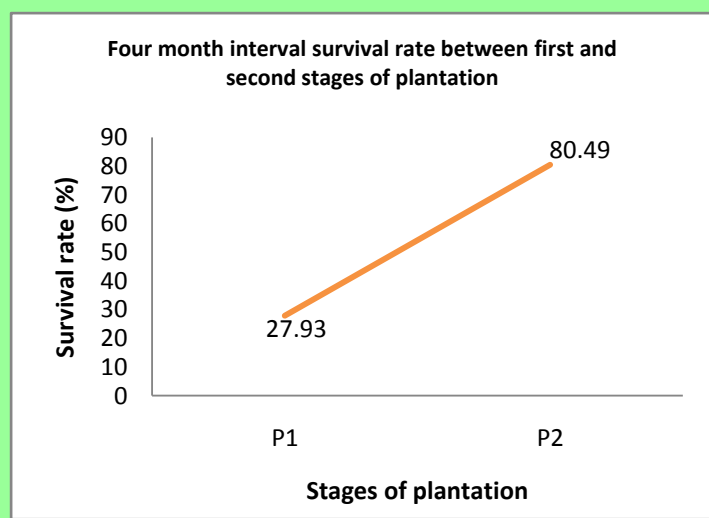


Graph-5

The attached graph - 4 represents the average survival rate of each individual stages of plantation in two consecutive months after plantation. Here, the second stage (P2) shows the highest survival rate in each month after plantation. The second one (graph -5) represents the average survival rate of species in two different months of three individual stages of plantation which also refers, the second stage of plantation is the best stage in terms of survival rate. From the above two representing graphs it has seen that, plantation stage 2 represents the best survival rate among all three stages of plantation in both of the months of observation.

10.2 Projection on seedlings survival rate four month after plantation

Moreover the attached (graph -6) represents average survival rate of four months after plantation in two stages (first and second stages) here; third stage has been eliminated from this graph due to the incompleteness of four months of this plantation. The attached (graph -6) represents vast difference on survival rate after four month of plantation in two stages. The second stage in this case again shows higher survival rate (80.49%) after four months of plantation than that of the first stage (27.93%).



Graph-6

10.3 Reason behind this survival rate of projection

During three stages of plantation all types of factors were same except plantation period which is the main reason for variation on survival rate. In case of survival rate plantation period is very important; (i) because shrimp cultivating dikes have no fresh water source and these plantation activities are mainly dike oriented; so rain water is the best source of fresh water and for this, plantation at early of rainy season will ensure maximum survival rate of seedlings .

First stage plantation has completed within October 2014, which was the late of rainy season and most of the seedlings didn't get any rain water after plantation, moreover in the year of 2014 it was less rainfall than the year of 2015 but second stage plantation has completed within July 2015; which was the early of rainy season, and for next three month after plantation, all seedlings got full rain water which shows higher survival rate of the second stage than the first stage of plantation. On the other hand third stage plantation has conducted in the month of September 2015, which was the late of rainy season and all seedlings got very little rain water than second stage plantation, but it was little bit higher than the first stage plantation, so third stage plantation survival rate is very less than the second stage of plantation but higher than first stage of plantation.

11. Outputs and Outcomes

Outcome-Level Headlines

- About 16% farmer planted additional trees in their shrimp pond as for promoting dike greening and vacancy felling after completing all plantation
- About 7% farmer expanded tree plantation in their other shrimp cultivating ponds dikes
- About 19% farmers cultivating vegetable in their other shrimp cultivating ponds dikes
- About 4% farmer expanded vegetable in their other shrimp cultivating ponds dikes
- Present survival rate of seedlings is 72.002%

Dike greening outcomes are largely strong which already has achieved before closing of the project. Though in case of seedling survival rate achievement is not complete, this is because of limitation of project implementation duration.

Table 8: Inputs, Outputs and Outcomes- Level linkages highlights

Inputs		Outputs
1. Baseline survey		1. After completing baseline survey total 500 farmers profile have been formed and among them finally 300 farmers were selected.
2. Training to the farmers on tree plantation along with vegetable cultivation		1. Under 12 batches total 300 farmers were trained on tree plantation along with vegetable cultivation for promoting vegetable cultivation in shrimp cultivating ponds dike
3. Stakeholder consultation program		1. With the presence of multi-sectoral specialist 5 stakeholder consultation meeting have been arranged.
4. Community mobilization program		1. With the presence of community level elites, from whom concept of dike greening can be disseminated, already 8 community mobilization meeting have been arranged.
5. Training to the farmers on varieties sector		Total 150 community people were trained on four income generating activity namely 25 person on goat rearing, 50 person on homestead gardening, 25 person on crab fattening, 25 person on organic shrimp cultivation and 25 person on poultry rearing.
6. Seedling distribution		1. 25000 mangrove seedlings are distributed 2. 30000 non-mangrove seedlings are distributed 3. 6500 fruit seedlings are distributed.
Outcome		
Results	Objectively verifying indicators	Outcomes
1. Organic shrimp farmers are planting tree in their shrimp pond dikes.	1. 10% farmer planted additional trees in their shrimp pond. 2. 10% farmer filled the vacancy of dead trees. 3. 5% farmer expanded tree plantation in their other shrimp pond	1. About 16% farmer planted additional trees in their shrimp pond as for promoting dike greening and vacancy felling after completing all plantation 2. About 7% farmer expanded tree plantation in their other shrimp cultivating ponds dike

2. Organic shrimp farmers are cultivating vegetable in their shrimp pond dikes	1. 10% farmer cultivated vegetable in their shrimp pond dikes	1. About 19% farmer cultivated vegetable in their shrimp ponds dike. 2. About 4% farmer expanded vegetable cultivation in their other shrimp cultivating ponds dike
3. Survivable rate of the dike greening	1. 80% trees are survived in the dikes	1. At present seedlings survival rate is 72.002% after completing plantation

12. Indicators for assessment of sustainability of the project

12.1 Concept dissemination/awareness raising on dike greening

For raising awareness on dike greening for sustainable dike plantation and shrimp cultivation, considering bio-diversity conservation regular follow up has done along with farmer training, stakeholder consultation program and community mobilization program. Already total 300 farmers has brought under training on dike plantation along with vegetable cultivation, 150 farmers on



Figure 19: Concept dissemination on dike greening
Place: Shyamnagar Sadar

different IGAs and about 400 local people together with multi-sectoral specialist were participated for stakeholder consultation program and community mobilization program at different places with the interval of time.

12.2 Present seedlings survivable rate

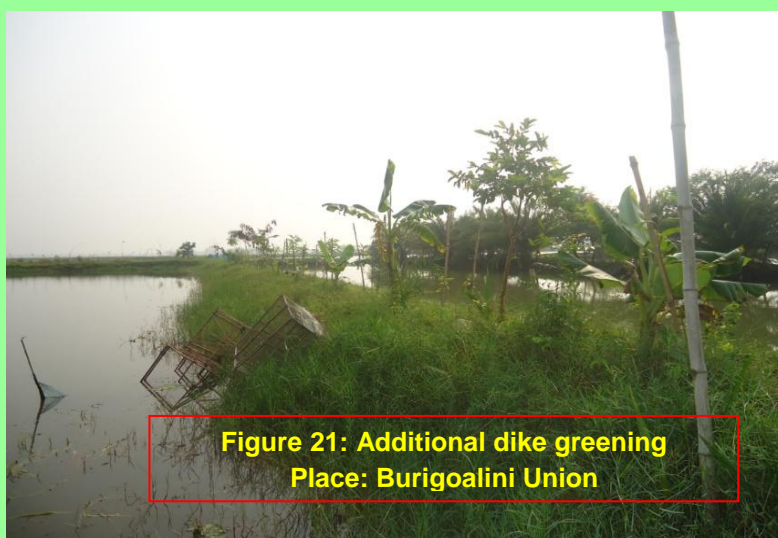
Considering many difficulties and problems during field implementation present average survival rate of different species (second and third stage of plantation) after completing few month of plantation was 72.002%.



Figure 20: Plantation on dikes
Place: Dholbaria Union

12.3 Extension of dike greening through promoting additional vegetation

During the running period of dike greening (phase 2), target farmers were motivated for promoting dike plantation. Already about 16% of total farmers of (dike greening, phase 2) become motivated for promoting additional plantation and they have raised about 2309 numbers of seedlings of different species at their respective dikes. On the other hand about 7% of total farmers of (dike greening, phase 2) become motivated and raised about 792 numbers of seedlings of different species at their other dikes with their own contribution.



**Figure 21: Additional dike greening
Place: Burigoalini Union**

12.4 Extension of dike greening through vegetable cultivation

Vegetable cultivation also has been extended during dike greening (phase 2) implementation period. Target farmers were motivated for promoting vegetable cultivation at their respective dikes. Implementing agencies has provided regular information and technology among the farmers; as a result about 19% of total farmers of (dike greening, phase 2) become motivated and promoted vegetable cultivation of different species (eg; red amaranth, indian spinach, okra, etc.) with their own investment. Also about 4% of total farmers of (dike greening, phase 2) being motivated, promotes vegetable cultivation of different species (eg; red amaranth, indian spinach, okra, etc.) with their own investment, which covers additionally about 213 decimal lands area besides target dikes.



**Figure 22: Promoting vegetable cultivation on dikes
Place: Atulia Union**

Above the discussion on some indicators (huge participation on different awareness raising program, present plantation survival rate, extension of dike greening through promoting additional seedlings plantation, extension of dike greening through vegetable cultivation from farmers own contribution) from dike greening exhibits some representative data, that can be projected towards the sustainability of the project.

13. Justification

The main focus of the Dike greening sub project under the Sustainable development and Biodiversity Conservation in Coastal Protection Forests (SDBC- Sundarbans) project is to raising plantation on dikes (embankments of shrimp cultivation gher) for sustainable biodiversity conservation. As a coastal area near side of Sundarbans which is considered for vital ecological



zone in for Bangladesh. At present sustainable ecological management is a burning question for this country. So implementation of dike greening concept was perfect decision accordance with time. Survival rate of seedlings and vegetation status along with vegetable cultivation in those dikes exhibits satisfactory result by considering implementation level challenges and limitations.

14. Conclusion

This project activity has completed accordance with the project provided timeline. It was a multi sectoral collaborative program that was completed with the help of collaborative sector. Though the project activities have completed smoothly but had some limitation. This project has start delayed and moreover project duration was short; so baseline survey, dike selection, plantation activities, motivational activities, awareness campaign were difficult to performed within the project limited duration. Moreover due to delay starting of the project; plantation program have to started late of the rainy season, seedlings were not available, occurred rain water scarcity/lack of fresh water availability that hampered the overall project goal. Also due to incompleteness of the project budget plantation activities, fertilizing, fencing and further managements were much difficult. But considering all these limitations present plantation site and survival rate of seedlings indicates satisfactory results towards the main focus of the project.

15. Lesson learnt

1. Proper dike selection in a very short time was difficult, also before going plantation some earth work can initiate for well stability of dikes.
2. Plantation program is long term activity but due to delay of the project contract, some cases plantation program had to start at late season so evaluation of actual survival rate of species in long term was very difficult.
3. Baseline survey, dike selection, plantation activities, motivational activities, awareness campaign were difficult to performed within the project limited duration.
4. Emphases need to rise towards midterm benefit from this project, so that farmers can grow more interest on dike greening.
5. Fruits seedlings survival rate is lower than the mangroves as well as some non-mangrove seedlings, so for dike plantation next time distribution of fruit seedlings should avoid except kodbel and coconut.
6. The list of species (eg: sundary, gewa, keora, neem, babla, Kajur, arjun, narikel, kodbel) can be the future major component for dike greening.
7. Most of the cases Forest departments seedlings size is very small, that is difficult to protect from biological agents.
8. Dike greening is a totally new concept for this community, so local government should involve with implementing agencies for better implementation and management in future.

16. Areas of Improvement

1. Previously selected all dike condition was not so good, proper dike selection is the prerequisite for sustainability of the plantation program so for further plantation at beginning stage dike condition should be improved or more effective dike have to be selected.
2. Plantation program is a long term activity but dike greening project duration was very short, so evaluation of actual survival rate was difficult moreover due to delay of the project contract some cases plantation program had to start late of the season that reduce the survival rate of seedlings.
3. Moreover project duration was short as well as incompleteness of the project budget hampered some activity of the project; like baseline survey, dike selection, plantation activities, fertilizing, fencing, awareness campaign, motivational activities and further management's that are the prerequisites for proper implementation of a project. So in future for promoting plantation activities need to concentrate on project duration and budget.
4. Farmer training/skill promoting training should complete before plantation so that they can fully aware about the objectives of this plantation. Skill promoting training can introduce for project associated staffs.
5. Campaign for different observation day can promote for rising awareness as well as introduction of cross visit system in planning for promoting skill and interest of beneficiary can be helpful for raising awareness about importance of dike greening.
6. Large scale community meeting with multi-sectoral specialist (forest, agricultural, fisheries and local representatives) can help to making a good decision and aware of the necessity of these activities

Annex 1

List of Abbreviation

NGF	Nowabenki Gonomuki Foundation
SDBC	Sustainable development and Biodiversity Conservation in Coastal Protection Forests
FD	Forest Department
IGA	Income Generating Activities
EU	European Union
OS	Organic Shrimp

Annex 2

At a glance achievements under dike greening project

Goal/Module objective	
1. To ensure sustainable plantation along the organic shrimp ponds dike towards biodiversity conservation of vulnerable costal region.	
Imputes	Outputs
1. Baseline survey	1. Profile has been formed on 500 farmers.
2. Community mobilization program	1. With the presence total 180 local participants, within the project duration total 8 community mobilization meeting have been arranged.
3. Stakeholder consultation program	1. With the presence of 200 multi-sectoral specialis along with local participants total 5 stakeholder consultation meeting have been arranged.
4. Field area selection	1. Total seven unions (Atulia, Burigualini, Shyamnagar Sadar, Krishnonagar, Champapul Dhalbaria and Ratonpur) were selected under two upzila.
5. Farmer selection	1. Finally total 300 target farmer among the survey profile, based on project implementing criteria.
6. Training to the farmers on tree plantation along with vegetable cultivation	1. Under 12 batches total 300 farmers were trained on tree plantation along with vegetable cultivation for promoting vegetable cultivation in shrimp cultivating ponds dike
7. IGA training to the farmers on varieties sector	1. Total 150 community people were trained on four income generating activity namely 25 person on goat rearing, 50 person on homestead gardening, 25 person on crab fattening, 25 person on organic shrimp cultivation and 25 person on poultry rearing.
8. Seedling selection	Total 18 species were selected, among them mangrove species number were 6, non-mangrove species were 6 and fruits species were 6
9. Seedling distribution	1. 25000 mangrove seedlings were distributed 2. 30000 non-mangrove seedlings were distributed 3. 6500 fruit seedlings were distributed
10. Plantation status of dikes	1. About 16% farmer planted additional trees in their shrimp pond as for promoting dike greening and vacancy felling after completing all plantation 2. About 7% farmer expanded tree plantation in their other shrimp cultivating ponds dike
11. Vegetable cultivation status of dikes	1. About 19% farmer cultivated vegetable in their shrimp ponds dike. 2. About 4% farmer expanded vegetable cultivation in their other shrimp cultivating ponds dike
12. Seedlings average survival rate	1. At present average seedlings survival rate is 72.002%