Disability inclusive, flood resilient Cluster Village (Shahidul Islam, Project Officer, CDD, Gaibandha)

Disability inclusive, flood resilient cluster village (Bangladesh)

"Protibandhita Bandhob Bonna Sohisnu Gucca Gram"

DESCRIPTION

The inclusive, flood-resilient cluster village provides safe housing, food security and income generation for multiple families, including persons with disabilities, in a highly flood prone area of Gaibandha District in northern Bangladesh. The land was raised above flood level and is protected by deep rooted fruit trees to prevent soil erosion and provide income for the land users.

The inclusive, flood-resilient cluster village was introduced in a rural area with a high risk of recurring monsoon floods. The purpose of the technology is to provide safe housing, safe shelter for livestock, food security and income generation for ten families, including persons with disabilities.

The main components of the technology are:

1) The raising of a piece of land by seven feet (213cm), to three feet (91cm) above expected highest flood levels. Solid soil was banked up to encircle a 30'000 square feet (roughly 50x57m) piece of land and then the space within was filled up with sand collected from a nearby river bank. A one-foot layer of solid soil was added to cover the entire area.

2) The protection of the raised land from soil erosion during floods by planting a combination of deep-rooted fruit- and medicine trees around the border of the raised land. The trees include a number of different types of deep-rooted and light-rooted fruit trees and one type of medicine tree, Azadirachta Indica, locally known as "Neem". In addition, the slope of the border area was covered by grass turf to protect the soil from being washed out by rain. Two types of deep-rooted and flood resistant grasses were used. A drainage system was installed to facilitate water runoff.

3) The planting of a 150 square feet (14m2) commonly used homestead vegetable garden at the center of the cluster village. The cultivated vegetables include red spinach, jute leaf, basella leaf, spinach, radish, cabbage, okra, bottle-guts, cucumber and beans, allowing for a summer and a winter harvest. Together with the fruit trees, the vegetable garden provides food security during prolonged flooding. They also provide improved nutrition and income generating opportunities through selling of a part of the harvest in the market.

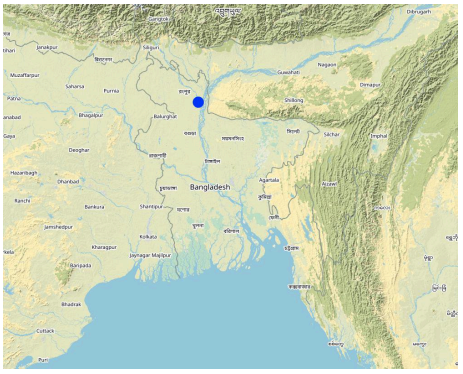
4) Making the village accessible for persons with disabilities through different accessibility measures, including the construction of a ramp, connecting the cluster village entrance with the road, and of accessible common Water-, Sanitation- and Hygiene (WASH) facilities, including a latrine, deep bore hole water source and water storage tank.

5) Installation of a solar panel to ensure uninterrupted, flood-resilient power supply. The level of power supply is sufficient to ensure coverage of electricity needs during flood season, when regular supply is around 15% below annual average.

The Cluster village was constructed as part of a disaster risk reduction project by CDD (Center for Disability in Development) from Bangladesh, with the support of CBM (Christoffel Blindenmission), an international development organization and funded by a donor from Germany. The main cost for inputs were provided to the land users by the project, including rent of construction machinery, paid labor, soil and construction material for the ramp and WASH facilities. The land users contributed labor and seedlings for the planning of the border trees and the homestead vegetable garden.

The main benefits of the technology from the perspective of land users are the protection it provides for houses and livestock, which would otherwise be in danger of loss during floods. The availability of food, water and electricity allows land users to remain in their homes during floods and avoid evacuation and the risk associated with it, including for example protection risks or the risk of theft. The flood protected vegetable gardens and fruit trees provide a year-round, sustainable source of food and income, providing food security and

LOCATION



Location: Horipur Union, Sundargonj Sub district,, Gaibandha District, Bangladesh

No. of Technology sites analysed: single site

Geo-reference of selected sites
- 89.56861, 25.53408

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?:

Date of implementation: 2016

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☐ during experiments/ research
- ☑ through projects/ external interventions

improved nutrition. The Neem tree provides medical and hygiene uses of the branches and leaves.

The cluster village is used as a safe space for the land users and other members of the community and their livestock during floods. Land users who are persons with disabilities or elderly benefit from the accessible infrastructure. With multiple families sharing land, the cluster villages provides optimal utilization of land resources. An additional benefit mentioned by land users is that the joint use by multiple families led to a more progressive social culture.

Ramp connecting the main entrance of the cluster village to the road (Shahidul Islam)

Deep rooted Mango trees planted around border of the raised land of the cluster village (Shahidul Islam)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ☐ improve production
- ☐ reduce, prevent, restore land degradation
- ☐ conserve ecosystem
- ☐ protect a watershed/ downstream areas – in combination with other Technologies
- ☐ preserve/ improve biodiversity
- ☑ reduce risk of disasters
- ☑ adapt to climate change/ extremes and its impacts
- ☐ mitigate climate change and its impacts
- ☑ create beneficial economic impact
- ☑ create beneficial social impact

Land use

Settlements, infrastructure - Settlements, buildings

Water supply

- ☐ rainfed
- ☑ mixed rainfed-irrigated
- ☐ full irrigation

Purpose related to land degradation

- ☑ prevent land degradation
- ☑ reduce land degradation
- ☐ restore/ rehabilitate severely degraded land
- ☐ adapt to land degradation
- ☐ not applicable

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion, Wr: riverbank erosion

SLM group

- improved ground/ vegetation cover
- cross-slope measure
- home gardens

SLM measures

vegetative measures - V1: Tree and shrub cover, V2: Grasses and perennial herbaceous plants

structural measures - S7: Water harvesting/ supply/ irrigation equipment, S8: Sanitation/ waste water structures, S9: Shelters for plants and animals, S10: Energy saving measures

management measures - M1: Change of land use type, M2: Change of management/ intensity level, M6: Waste management (recycling, re-use or reduce)

TECHNICAL DRAWING

Technical specifications

The drawing shows the layout of the disability inclusive, flood resilient Cluster village. The components of the technology are:

Raised land/plinth: 1) Purchase of land of a total area of 18'000 square feet (ca. 40x40m). Land ownership transferred to joint ownership of 10 families. 2) Collect 15'000 cubic feet (425m3) of solid soil from different pieces of land in the community. The soil was donated by members of the community, who were either related to the land users of the cluster village or donated in support of the construction of a safe space which can be used by the community during floods. 3) Banking up of 3 feet (91cm) of solid soil along the borders of the land. 4) Filling of area with 140'000 cubic feet (3965m3) of sand, extracted from a nearby riverbank with a rented sand extraction machine, raising the land to 6 feet (183cm). 5) Covering the entire area with one additional foot of solid soil, rasing the land to 7 feet (213cm), which means 3 feet (91cm) above the maximum expected flood levels.

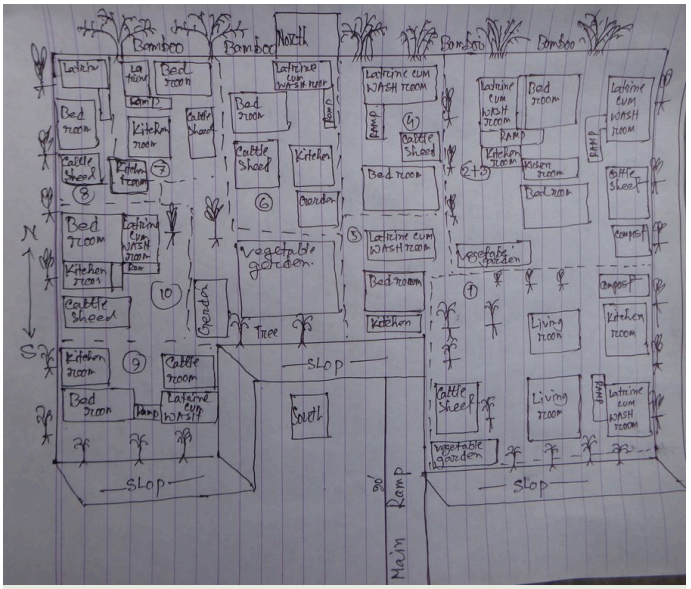
Soil protected through deep-rooted trees: 1) Planting of deep-rooted and light-rooted fruit trees, surrounding the entire border of the raised land. The trees include deep rooted fruit trees like mango, black berry, jack-fruit, guava, coconut and areca nut, light-rooted fruit trees like banana and Papaya, a deep-rooted medicine tree, locally called "Neem" and the light-rooted Dhol Kalmi tree (pink morning glory). The number of deep-rooted threes was 100, with a spacing of around 5 feet in between each. They were planted to cover the entire perimeter of the raised land. In between the deep-rooted trees, 60 light-rooted trees were planted. In front of the deep-rooted trees, 60 bamboo bushes were planted to provide additional protection from wind and rain. 2) Turfing of the entire slope surrounding the cluster village with two flood resistant grasses: Durva (Cynodon dactylon) and Catkin grass. 3) Installation of a central drainage system with 15 plastic pipes ensuring water runoff from the wastewater pond.

Road access through ramp: The connecting ramp of the cluster village is 90 feet length, 6 feet width. There are five landing point of this ramp with smooth slopping. The construction material includes class one brick, brick stone, cement, sand, polythene and red oxide color for color contrast, which is appropriate for low vision and visually impaired persons. There is a 5 inch border on both sides of the ramp for safe movement of a wheel chair user.

Accessible household water and sanitation facilities: Latrine and wash-room are constructed for every house in the cluster village, following universal design standards. Latrines are connected to the wash room and the main house through ramps. There is a railing on both sides of the latrine and the entrance is wider for access of a wheel chair users. Water system for the latrine and wash room is provided from a water tank on three pillars behind the latrine, which is also connected to the main house for provision of drinking water. The tank is filled by hand pump ('magic pump') which functions with minimal hand pressure. The WASH facilities are accessible and usable by everyone including persons with disabilities, pregnant women or aged persons.

Home vegetable gardens: Every household has an individual homestead vegetable gardens where land users cultivate seasonal vegetables year-round. Gardens vary in size between averaging about 1.5 decimal (60m2) in size and are surrounded by bamboo fencing. The land owners are using organic fertilizer/compost for the vegetable production of their choice. By using cow's manure and wastage they are producing the compost in the behind of their houses in a ditch.

Solar system: A mini solar system is installed on the roof for each house by using a small panel with a 12-volt battery . Each system has the capacity of providing power for light for 8 hours. An introduction to system maintenance was given to the land users by the provider of the solar system.



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ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **Cluster village** volume, length: **18'000 square feet piece of land**)
- Currency used for cost calculation: **Bangladeshi Taka**
- Exchange rate (to USD): 1 USD = 80.0 Bangladeshi Taka
- Average wage cost of hired labour per day: 300

Most important factors affecting the costs

Market fluctuation and scarcity of goods in the flood season.

Establishment activities

1. Selecting the place for cluster village construction (Timing/ frequency: During rainy season in 2015)
2. Establish collaboration with 10 families who will become land users (Timing/ frequency: December 2015)
3. Land Raising & Ramp construction (Timing/ frequency: December 2015 to March 2016)
4. Reconstruction the existing houses of the land users on the raised land (Timing/ frequency: April 2016, before onset of rainy season 2016)
5. Planting of deep- and light-rooted fruits trees, bamboo bushes and grass turfing along the boundery (Timing/ frequency: February 2016 to March 2016)
6. Install accessible water & sanitation system (Timing/ frequency: April-June 2016)
7. Establish home garden in front of each house (Timing/ frequency: June-July 2016)
8. Install mini solar system for each house (Timing/ frequency: Aug-sep 2016)
9. Prepare livestock shed for each house (Timing/ frequency: October 2016)

Establishment inputs and costs (per Cluster village)

Specify input	Unit	Quantity	Costs per Unit (Bangladeshi Taka)	Total costs per input (Bangladeshi Taka)	% of costs borne by land users
Labour					
Land raising, tree planting and turfing on slope	person days	290.0	300.0	87000.0	10.0
Ramp construction	person days	115.0	350.0	40250.0	10.0
House reconstruction and WASH facilities	person days	200.0	400.0	80000.0	10.0
Solar system installation	person days	10.0	300.0	3000.0	10.0
Equipment					
WASH equipment (latrine, magic pump, water tank, pipes, switch, pillars and other)	pieces	10.0	46658.0	466580.0	
Solar system	pieces	10.0	6300.0	63000.0	
Plant material					
Deep rooted trees	pieces	100.0	40.0	4000.0	100.0
Seed for vegetable	KG	5.0	1000.0	5000.0	100.0
Sapling purchase	pieces	100.0	50.0	5000.0	100.0
Light rooted tree	pieces	60.0	30.0	1800.0	
Fertilizers and biocides					
Organic fertilizer (compost)	KG	600.0	10.0	6000.0	100.0
Construction material					
Rent for shallow machine for sand extraction	Daily rent	10.0	28800.0	288000.0	
Grass turfing	square feet	15000.0	10.0	150000.0	
Allowance for house reconstruction material	House	10.0	2000.0	20000.0	
Ramp construction	Piece	1.0	125750.0	125750.0	
Other					
Project management (monitoring and support)	persons-days	180.0	2400.0	432000.0	
Total costs for establishment of the Technology				**1'777'380.0**	
Total costs for establishment of the Technology in USD				*22'217.25*	

Maintenance activities

1. Turfing: Repair leakages, replace grass etc. (Timing/ frequency: before onset of rains)
2. Tree maintenance: Cutting branches, manure of roots etc. (Timing/ frequency: Rainy season)
3. Vegetable gardening (Timing/ frequency: Summer & Winter season)
4. Housing repairs (Timing/ frequency: After harvesting season/ once in a year)
5. Water and Sanitation system servicing and repairs (Timing/ frequency: After harvesting season/once in a year)
6. Solar system maintenance (Timing/ frequency: Winter season/once in ayear)
7. Village group meeting for decision making and conflict resolution (Timing/ frequency: Once in a month)
8. Organic composting/fertilizer production (Timing/ frequency: Continuous)

Maintenance inputs and costs (per Cluster village)

Specify input	Unit	Quantity	Costs per Unit (Bangladeshi Taka)	Total costs per input (Bangladeshi Taka)	% of costs borne by land users
Labour					
House repairs	person days	10.0	300.0	3000.0	100.0
Ramp repairs	person days	10.0	300.0	3000.0	100.0
Plingth raising and plantation	person days	30.0	300.0	9000.0	100.0
Solar system servicing by technical experts	piece	10.0	500.0	5000.0	100.0
Plant material					
Seed for vegetable gardening	KG	5.0	1000.0	5000.0	
Construction material					
Soil for slope maintenance	square feet	5000.0	10.0	50000.0	
Sand for slope maintenance	KG	5000.0	2.0	10000.0	

Total costs for maintenance of the Technology	85'000.0	
Total costs for maintenance of the Technology in USD	*1'062.5*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [x] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [x] humid
- [ ] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Heavy rainfalls are one of the causes for flooding

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [x] high (>3%)
- [ ] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [x] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Yes
- [x] No

Occurrence of flooding
- [x] Yes
- [ ] No

Species diversity
- [ ] high
- [ ] medium
- [x] low

Habitat diversity
- [ ] high
- [ ] medium
- [x] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [x] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [x] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [x] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [x] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [x] group
- [ ] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

Access to services and infrastructure

health	poor ✓	good
education	poor	✓ good
technical assistance	poor ✓	good
employment (e.g. off-farm)	poor ✓	good
markets	poor ✓	good
energy	poor ✓	good
roads and transport	poor ✓	good
drinking water and sanitation	poor	✓ good
financial services	poor ✓	good

IMPACTS

Socio-economic impacts

Crop production

decreased ✓ increased

Fruit and vegetable production increased after introduction of the cluster village. Because of decreased loss of home and property during floods, labor is freed for crop production which increased overall crop production in the wider area.

crop quality

decreased ✓ increased

Fruit and vegetable quality is improved because of availability of Irrigation.

animal production

decreased ✓ increased

Livestock mortality rate is reduced because of safe space in Cluster village.

risk of production failure

increased ✓ decreased

Homestead vegetable garden and fruit tree plantation above flood level has a significantly reduced risk of production failure.

product diversity

decreased ✓ increased

The flood-protected homestead vegetable garden allows for higher product diversity.

production area (new land under cultivation/ use)

decreased ✓ increased

Increased availabilty of flood protected land for vegetable gardening.

energy generation (e.g. hydro, bio)

decreased ✓ increased

Energy supply was not available before installation of solar panel.

drinking water availability

decreased ✓ increased

Installation of deep tube well water source.

drinking water quality

decreased ✓ increased

Significantly higher water quality during flood, because of flood protected water source in cluster village.

water availability for livestock

decreased ✓ increased

Installation of deep tube well water source.

irrigation water availability

decreased ✓ increased

Irrigation available to land users after installation of deep tube well.

demand for irrigation water

increased ✓ decreased

Demand for irrigation water increased because of vegetable garden.

farm income

decreased ✓ increased

Increase of farm income through selling of fruit and vegetables.

diversity of income sources

decreased ✓ increased

Additional income source through selling of fruit and vegetables.

economic disparities

increased ✓ decreased

Decreased income disparities between the land users of the cluster village due to fruit and vegetable production available to all land users, Decrease income disparities between land users of the cluster village and other members of the communty because of the reduction of loss from flood damage.

workload

increased ✓ decreased

Somewhat increased workload for maintenance of technology but decreased because of avoidance of damaged from floods.

Socio-cultural impacts

food security/ self-sufficiency

reduced ✓ improved

Increased food security through flood prodected homestead garden and tree plantation.

health situation

worsened ✓ improved

Higher attendance of health workers because the cluster village offer suitable group meeting rooms and accomodation. Cluster village was constructed in vicinity of community clinic. Better hygiene through WASH facilities.

cultural opportunities (eg spiritual, aesthetic, others)

reduced ✓ improved

The cluster village is a suitable meeting point for the entire community, for social gatherings or festivals.

recreational opportunities

reduced ✓ improved

Cluster village offers common space for children and other land users for Joint recreational activities.

situation of socially and economically disadvantaged groups (gender, age, status, ehtnicity etc.)

worsened ✓ improved

Much improved situation for persons with disabiltiies who are part of the land users. All persons with disabiltiies in the wider community use the cluster village as a safe space during floods. Improved situation for all land users who are from marginalized parts of society (daily laborers and share croppers).

Ecological impacts

soil loss

increased ✓ decreased

Soil erosion during floods decreased because of deep- and light-rooted border tree plantation.

flood impacts

increased ✓ decreased

Raised land as safe space above flood level.

drought impacts

increased ✓ decreased

Drought impact in summer season decreased because of Irrigation.

Off-site impacts

available shelter and safe space

decreased ✓ increased

Cluster village provides additional safe space/shelter for the wider community.

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns: very negative ✓ very positive

Long-term returns: very negative ✓ very positive

Benefits compared with maintenance costs

Short-term returns: very negative ✓ very positive

Long-term returns: very negative ✓ very positive

CLIMATE CHANGE

Climate-related extremes (disasters)

drought: not well at all ✓ very well

general (river) flood: not well at all ✓ very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [ ] single cases/ experimental
- [ ] 1-10%
- [x] 11-50%
- [ ] > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

Number of households and/ or area covered

Around 10-15% of households which equals roughly 70 households.

Has the Technology been modified recently to adapt to changing conditions?

- [x] Yes
- [ ] No

To which changing conditions?

- [ ] climatic change/ extremes
- [x] changing markets
- [ ] labour availability (e.g. due to migration)

Peoples of cluster villages are selling vegetables and fruits in the local market and some of them are carrying the fruits in the distance market. They are becoming more interested to plant more fruit trees in the cluster village. If it is continue in future it would be a fruits and vegetable market in the cluster village. At the same time they started selling cows milk in the local market and its demand is increasing day to day.

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Ownership of the land user's are there. Its a community driven initiative & disability inclusive in all respect. They are happy to give shelter to the other villagers during flood season. There is an opportunity to create an example of a model village in this area.

Strengths: compiler's or other key resource person's view

- Its an innovative program. Peoples participation and their contribution is the main asset. Universal accessibility of the cluster village communicating benefit to other villagers during rainy as well as flood season. This pilot program can be replicated to other riverine areas in Bangladesh.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- The intensity of floods is difficult to predict. With average flood levels rising, land users still have to live with the risk of flood levels going beyond the level of their rised land. More research on changing weather/climatic patterns and scientific measurement of expected flood levels.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Government and Non government organizations extension services are not available in this area. Livelihood of the cluster village peoples depending on seasonal agriculture. Income raising multiple activity need to be introduces. A small scale disability inclusive comprehensive project could be implemented here.

REFERENCES

Compiler
Subir Saha

Editors
Subir Saha
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Reviewer
Alexandra Gavilano
Joana Eichenberger

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Last update: Nov. 8, 2021

Resource persons
Subir Saha - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_2005/

Linked SLM data
Approaches: Disability inclusive Disaster Risk Reduction https://qcat.wocat.net/en/wocat/approaches/view/approaches_2001/

Documentation was faciliated by

Institution
- Christoffel Blindenmission (CBM) - Switzerland

Project
- Book project: where people and their land are safer - A Compendium of Good Practices in Disaster Risk Reduction (DRR) (where people and their land are safer)