Assisted Natural Regeneration (ANR) (Md. Fazlay Arafat)

Assisted Natural Regeneration (Bangladesh)

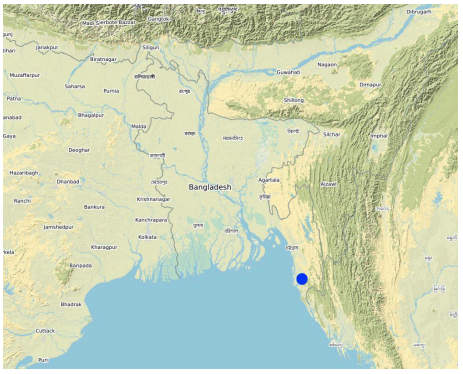
ANR

DESCRIPTION

Assisted natural regeneration (ANR) is a simple, low-cost forest restoration method that can effectively convert deforested lands to more productive forests.

Medhakachapia National Park (MKNP) is nationally known for protecting the most extensive stands of mature critically endangered Garjan (Dipterocarpus turbinatus) trees in Bangladesh. Other native trees present in MKNP include Telsur Hopea odorata, Boilam Anisoptera scaphula, Gamar Gmelina arborea and Chapalish Artocarpus chaplasha. MKNP is tropical semi-evergreen forest in the low hills of the Fulchari Forest Range and covers 396 hectares. The park is located in Chakaria Upazila, not far from Cox's Bazar in the southeast part of the country. Originally, the entire park area was densely covered with Garjan forest, but now there are about 9000 mature Garjan trees as many parts have been encroached upon with agriculture. MKNP is bordered by 13 villages where most of the people depend directly or indirectly upon the forest. Encroachment by settlements and agriculture has been associated with illegal tree cutting, hunting, and collection of fuel wood, bamboo and cane and other forest products. These activities are encouraged by sawmills in the vicinity and unemployment. Due to reduced canopy coverage, the forest soils have been exposed degraded. In order to restore forest health, the Bangladesh Forest Department introduced Assisted Natural Regeneration (ANR) practice. The access for public recreation and education and research is allowed inside national park. However, the collection of fuel woods and non-timber forest product from national park area by the local communities is a common scenario here.
ANR aims to accelerate, rather than replace, natural succession processes by removing or reducing barriers to natural forest regeneration such as competition with weedy species and recurring disturbances (e.g., fuel wood collection, grazing, fire and wood harvesting). Compared to conventional reforestation methods, which involve planting tree seedlings, ANR offers the significant advantage avoiding costs associated with propagating, raising, and planting seedlings. ANR is most effectively utilized at the landscape level in restoring the forest protective functions, such as soil protection, and is most suitable for restoring areas where some level of natural succession is already in progress. ANR offers distinct advantages over other forest restoration methods but also has some limitations. ANR is much cheaper to implement and can be applied over larger areas than other restoration planting approaches, but may be less effective in enhancing floristic diversity at the initial stages. Some of ANR's disadvantages can be overcome by enrichment planting with desirable species. ANR aims to accelerate, rather than replace natural succession process by removing or reducing barriers to natural forest regeneration.
Soil degradation of MKNP has been greatly reduced through practicing ANR and co-management. In MKNP co-management was established on 2009 engaging local communities. As a part of co-management activities, the Forest Department (FD) formed a Community Patrolling Group (CPG) with 35 members from the local community to protect the Garjan trees and look after the whole forest along with forester officers. Under the support from Climate-Resilient Ecosystems and Livelihoods (CREL) project of USAID, the CPG along with FD intensively patrol the forest in rotating groups to ensure that no harm is done to the mature trees and natural seedlings. As a result, sufficient tree regeneration is now taking place and their growth is accelerating. Even where weeds dominate, seedlings of pioneer tree species are often found. The minimum required number of preexisting seedlings to implement ANR depends on the acceptable length of time for the forest to be restored and site-specific conditions that influence the rate of forest recovery. As a general reference, a density range of 200–800 seedlings/ha (>15 cm in height; counting clumps in 1 m2 as one seedling) has been suggested for ANR reforestation, and it has been estimated that at least 700 seedlings/ha are needed during the early treatment period in order to achieve canopy closure within three years. Although the forest restored through ANR in MKNP will have lower commercial value in terms of timber, it will support greater biodiversity and more effectively provide for the subsistence needs of the local people compared to commercial plantations.

LOCATION



Location: Medakacchapia National Park under Cox's Bazar North Forest division, Chittagong division, Bangladesh

No. of Technology sites analysed: 2-10 sites

Geo-reference of selected sites
- 92.07593, 21.63648
- 92.07468, 21.63786
- 92.07557, 21.63423
- 92.07901, 21.63793
- 92.07825, 21.63505

Spread of the Technology: evenly spread over an area (approx. 1-10 km2)

In a permanently protected area?: Yes

Date of implementation: 2014

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

Uncovering seedlings from grass (Unknown)

Assisted Natural Regeneration in Dipterocarpus forest (Md. Fazlay Arafat)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [ ] improve production
- [x] reduce, prevent, restore land degradation
- [x] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [x] 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
- [x] create beneficial social impact

Land use

Land use mixed within the same land unit: No

Forest/ woodlands

- (Semi-)natural forests/ woodlands. Management: Dead wood/ prunings removal

Tree types (mixed deciduous/ evergreen): n.a.
Products and services: Timber, Fuelwood, Fruits and nuts, Nature conservation/ protection, Recreation/ tourism, Oil from Dipterocarpus turbinatus

Water supply

- [x] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [ ] prevent land degradation
- [x] 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, Wg: gully erosion/ gullying

biological degradation - Bc: reduction of vegetation cover, Bq: quantity/ biomass decline, Bs: quality and species composition/ diversity decline

SLM group

- natural and semi-natural forest management
- improved ground/ vegetation cover

SLM measures

vegetative measures - V1: Tree and shrub cover

management measures - M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications

Step 1: Marking of Woody Regeneration
Once the target area is identified and its boundaries are demarcated, the site is surveyed to assess its succession status and to locate any natural woody regeneration growing in the weedy vegetation. The located seedlings should be clearly marked with stakes. Decision on the minimum size of seedlings to be protected and released depends on the density and distribution of seedlings in the area, as well as budget and time constraints. However, the seedlings should be large enough to have a reasonable chance of survival.
Step 2: Liberation and Tending of Woody Regeneration
The next step is to accelerate the growth of the marked seedlings by reducing competition from the weedy species for water, nutrients, and light. The initial weeding and climber cutting should be implemented at the onset of the rainy season so that the liberated seedlings will have the full growing season of accelerated growth. All competing vegetation such as weeds and climbers within at least 0.5 m radius around the stem of the marked seedlings are removed. In some cases, clumps of woody seedlings may need to be thinned in order to liberate the largest individuals or the more desirable species.
Step 3: Protection from Disturbance.
Protecting against fire and other forms of disturbance is the most important ANR activity. Establishing firebreaks around blocks of ANR-treated sites is important, if the area is prone to fire. If animal grazing is prevalent in the area, fencing should be established, or patrols/guards should be assigned to protect the site from such activity. Long-term community involvement and support is critical in preventing the re-occurrence of disturbance events that will set back succession to the before-treatment state.
Step 4: Maintenance and Enrichment Planting.
It is suggested that the maintenance of weeding, and liberation of any additional seedlings that establish or that are newly found, should be conducted three times in first two years and two times in next two years. In the fifth year one climber cutting should be conducted in rainy season. The frequency of maintenance operations can be adjusted according to field observation and monitoring data on the growth of the liberated seedlings and the density of natural woody regeneration. Enrichment planting can also be carried out to accelerate canopy closure, add useful tree species, and increase floral diversity. Even after the restoration of canopy cover, large-seeded primary forest trees and rare species are unlikely to colonize naturally. If restoring some of the floral diversity of the original forest is one of the restoration objectives, species or functional groups of trees lacking in natural regeneration will need to be planted either at the initial treatment stage or after canopy closure depending on the ecological requirements of the species.

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ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **1 hectare**; conversion factor to one hectare: **1 ha = 1 ha = 2.47 acres**)
- Currency used for cost calculation: **BDT**
- Exchange rate (to USD): 1 USD = 84.0 BDT
- Average wage cost of hired labour per day: 500 BDT

Most important factors affecting the costs

The most important factor affecting the costs is labor

Establishment activities

1. Site preparation (Boundary demarcation, site map preparation with GPS, marking of woody regeneration) (Timing/ frequency: May-June)
2. Care and maintenance of natural regeneration (liberation and tending of woody regeneration, protection from disturbance) (Timing/ frequency: June-July)

Establishment inputs and costs (per 1 hectare)

Specify input	Unit	Quantity	Costs per Unit (BDT)	Total costs per input (BDT)	% of costs borne by land users
Labour					
Survey for map preparation and marking of woody regeneration	person-days	1.0	500.0	500.0	
Tying up seedlings and young trees	person-days	4.0	500.0	2000.0	
Tending of woody regeneration	person-days	10.0	500.0	5000.0	
Application of fertilizers	person-days	4.0	500.0	2000.0	
Equipment					
Weeding equipment (manual weeding tool)	lump sum	1.0	1000.0	1000.0	
Bamboo sticks for tying up seedlings	pieces	800.0	2.0	1600.0	
Rope	lump sum	1.0	1000.0	1000.0	

Fertilizers and biocides					
Compost fertilizer	Kg	625.0	4.0	2500.0	
Construction material					
Rod, Cement, Sand, Khoa, etc for RCC signboard	Lump sum	1.0	1000.0	1000.0	
Total costs for establishment of the Technology				**16'600.0**	
Total costs for establishment of the Technology in USD				*197.62*	

Maintenance activities

1. 1st year weeding (Timing/ frequency: 3 times)
2. 2nd year weeding (Timing/ frequency: 3 times)
3. 3rd year weeding (Timing/ frequency: 2 times)
4. 4th year weeding (Timing/ frequency: 2 times)
5. 5th year climber cutting (Timing/ frequency: 1 time)

Maintenance inputs and costs (per 1 hectare)

Specify input	Unit	Quantity	Costs per Unit (BDT)	Total costs per input (BDT)	% of costs borne by land users
Labour					
1st year weeding	person-days	15.0	500.0	7500.0	
2nd year weeding	person-days	15.0	500.0	7500.0	
3rd year weeding	person-days	10.0	500.0	5000.0	
4th year weeding and 5th year climber cutting	person-days	15.0	500.0	7500.0	100.0
Equipment					
Weeding equipment (manual weeding tools)	lump sum	1.0	1000.0	1000.0	
Total costs for maintenance of the Technology				**28'500.0**	
Total costs for maintenance of the Technology in USD				*339.29*	

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
- [ ] 2,001-3,000 mm
- [x] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone

- [x] humid
- [ ] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate

Average annual rainfall in mm: 3770.0
The driest month is December. The greatest amount of precipitation occurs in June.
Mean annual temperature is 25.6 °C

Slope

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

Landforms

- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [x] 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)
- [x] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)

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

Soil texture (> 20 cm below surface)

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

Topsoil organic matter content

- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table

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

Availability of surface water

- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)

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

Water quality refers to: surface water

Is salinity a problem?

- [ ] Yes
- [x] No

Occurrence of flooding

- [ ] Yes
- [x] No

Species diversity

- [ ] high
- [x] medium
- [ ] low

Habitat diversity

- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

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

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

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

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

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

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

Gender
- [x] women
- [x] men

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

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [x] 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
- [x] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

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

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

wood production

decreased ✓ increased

ANR support the growth of woody vegetation and regular monitoring of ANR also provide security to the mature trees of the stand

forest/ woodland quality: decreased ✓ increased

non-wood forest production: decreased ✓ increased

risk of production failure: increased ✓ decreased

production area (new land under cultivation/ use): decreased ✓ increased

Through ANR the fellow and degraded forest land now bring under productive forest

land management

hindered ✓ simplified

ANR is a comparatively easy method than clear felling with artificial regeneration, mixed plantation or enrichment plantation to manage forest area

diversity of income sources

decreased ✓ increased

The local communities can collect NTFP from the ANR site. Due to the increase of vegetation and presence of wildlife in MKNP, the area also attract tourists. The CPG people also worked as tourist guide

Socio-cultural impacts

cultural opportunities (eg spiritual, aesthetic, others): reduced ✓ improved

aesthetic beauty of forest improved

recreational opportunities: reduced ✓ improved

eco-tourism increased

SLM/ land degradation knowledge: reduced ✓ improved

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

Poor people working in Community Patrolling Group (CPG) taking care of ANR with forest department. Social status of these poor people improved.

Ecological impacts

surface runoff	increased	decreased	
groundwater table/ aquifer	lowered	recharge	
evaporation	increased	decreased	Due to increased canopy coverage evaporation decreased
soil moisture	decreased	increased	
soil cover	reduced	improved	
soil loss	increased	decreased	
nutrient cycling/ recharge	decreased	increased	
soil organic matter/ below ground C	decreased	increased	
vegetation cover	decreased	increased	
biomass/ above ground C	decreased	increased	
plant diversity	decreased	increased	
invasive alien species	increased	reduced	Through ANR only native plant species promoted to grow here
animal diversity	decreased	increased	Animal diversity increased as the habitat improved
beneficial species (predators, earthworms, pollinators)	decreased	increased	
habitat diversity	decreased	increased	habitat diversity increased with the canopy coverage and tree density improvement
landslides/ debris flows	increased	decreased	
emission of carbon and greenhouse gases	increased	decreased	

Off-site impacts

reliable and stable stream flows in dry season (incl. low flows)	reduced	increased	Due to the presence of vegetation on slope the stream flow become stable
downstream siltation	increased	decreased	
impact of greenhouse gases	increased	reduced	

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

Gradual climate change

annual temperature increase	not well at all	very well	
seasonal temperature increase	not well at all	very well	Season: summer
annual rainfall decrease	not well at all	very well	
seasonal rainfall increase	not well at all	very well	Season: wet/ rainy season

Climate-related extremes (disasters)

landslide	not well at all	very well

ADOPTION AND ADAPTATION

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

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

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

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

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

- [ ] Yes
- [x] No

To which changing conditions?

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

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- It is a low cost intervention to regain the protective roles of the forest.
- Community Patrolling Group (CPG) are involved in maintenance of ANR forest through co-management of natural resources. Regular patrolling activity reduces the disturbance in forest and help to prevent land degradation.

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

- Biodiversity conservation and wildlife habitat restoration are accelerated through ANR.

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

- ANR is less effective in enhancing floral diversity than techniques e.g. mixed plantation, enrichment plantation, selection cum improvement etc. It promotes the existing regeneration and significant portion of regeneration comes from the dominant trees of the stand. Enrichment plantations with ANR can increase the floral diversity.
- The forest restored through ANR may have less commercial value in terms of timber compared to commercial plantation. This weakness of ANR is only valid for the forest which is managed for production purpose. Desirable timber species can be planted as enrichment with ANR.

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

- ANR is suitable for areas where some level of natural succession is in progress. This, because sufficient tree regeneration must be present on the targeted site so their growth can be accelerate through ANR. Plantation activity with other restoration method should be practiced where natural succession is low or absent.

REFERENCES

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Resource persons
Hoq Mahabub Morshed - land user
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Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4372/

Linked SLM data
n.a.

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Key references

- Shono, K., E. A. Cadaweng & P. B. Durst (2007) Application of assisted natural regeneration to restore degraded tropical forestlands. Restoration Ecology, 15, 620-626.: http://www.fao.org/forestry/19102-0bf30dd3d800687636a5ddc85e409044a.pdf

Links to relevant information which is available online
- Medhakachapia National Park: http://nishorgo.org/project/medhakachapia-national-park/