CASE STUDIES

CLIMATE ADAPTIVE PRACTICES GRASSROOTS INITIATIVES

Development Alternatives

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Population	As per 2011 census, Tripura has a population of 3,671,032, and Ranks 22nd in India in terms of population.[1]
Climate	The state has a tropical savanna climate, designated Aw under the Köppen climate classification. The undulating topography leads to local variations, particularly in the hill ranges.[2] The four main seasons are winter, from December to February; pre-monsoon or summer, from March to April; monsoon, from May to September; and post-monsoon, from October to November.[3]
Climate Vulnerabilities	Changing weather patterns and rising temperatures, cropping patter (. Jhum cultivation can affect forestry). According to a United Nations Development Programme report, the state lies in "very high damage risk" zone from wind and cyclones.[4]
Average Annual Rainfall	2336.7 millimetre[5]
Economy	Tripura is an agrarian state with more than half of the population dependent on agriculture and allied activities. However, due to hilly terrain and forest cover, only 27 per cent of the land is available for cultivation.[6]

[1] *2011 Census of India.*
[2] *"Land, soil and climate". Department of Agriculture, Government of Tripura. Archived from the original on 20 April 2012.*
[3] *"Annual plan 2011–12" (PDF). Department of Agriculture, Government of Tripura.*
[4] *"Hazard profiles of Indian districts" (PDF). National capacity building project in disaster management. UNDP.*
[5] *District-wise monthly rainfall data from 2004-2010 for the whole of India by Indian Meteorological department from www.indiaportal.org*
[6] *"Economic review of Tripura 2010–11" (PDF). Directorate of Economics and Statistics, Planning (Statistics) Department, Government of Tripura. pp. 8–10.*

Tripura is a state in Northeast India. Its capital is Agartala and it is the third-smallest state in the country. Due to its geographical isolation, economic progress in the state is hindered. Poverty and unemployment continue to plague Tripura, which has a limited infrastructure. Most residents are involved in agriculture and allied activities, although the service sector is the largest contributor to the state's gross domestic product. Vulnerabilities arising out of climate change are multidimensional in nature. One sector can compound the vulnerability in the other (e.g. Jhum cultivation can affect forestry). Changes in Tripura's biophysical environment due to the Climatic variability can alter the stable dynamic equilibrium[1].

[1] *http://www.moef.nic.in/sites/default/files/sapcc/TRIPURA.pdf*

Integrated Investment

Key Messages

- Integrated intervention approach prevents erosion from upstream catchment slopes at the same time preventing sedimentation in downstream water bodies.
- Combining livelihood approach to soil and moisture conservation measures facilitates in better ownership and sustainability of the initiative.

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1. Context

1.1. Need:

The topography of Tripura sees undulating lands with a lot of hilly areas. The rivers that flow from these hills make it downstream with a lot of sediment; river beds have been rising due to continuous siltation. As a result, floods become furious and cause wide disruption to the people and property. Tripura is known to be prone to various natural and human induced disasters, both in recurrent and non-recurrent features. The geographic area is surrounded by Bangladesh and 100 kms from the Bay of Bengal and is prone to high winds and cyclones. Tripura faces recurrent floods during monsoons and flash floods in hilly areas.

The likely consequences of climate change on the soil-water front in Tripura are I) change in rainfall patterns that affect the soil erosion and ii) sudden bursts of rain over small periods of time causing floods. A standard characteristic of climate change is too much water in some places and too little in others. This is seen in Tripura as well; where some locations are prone to flash floods and dry spells also occur during the summer season. Crop cover and forest cover gets affected by intermittent rainfall, which in turn affects the ability of top soil to hold together. This leads to more erosion. There is consensus that existing threats like top soil erosion and water availability are problems that will be exacerbated under shifting climate. In fact, the frequencies of these climate disparities are increasing.

The issues of vulnerability of Tripura to climate change are inexorably linked to the state's location and affect the large indigenous population. 25% of the state's population primarily depends on natural

resources for their livelihoods. The need for a climate mitigation strategy is necessary and there are several ways to bring together a climate change integrated conservation toolbox for these lands. Soil and water management is one of them.

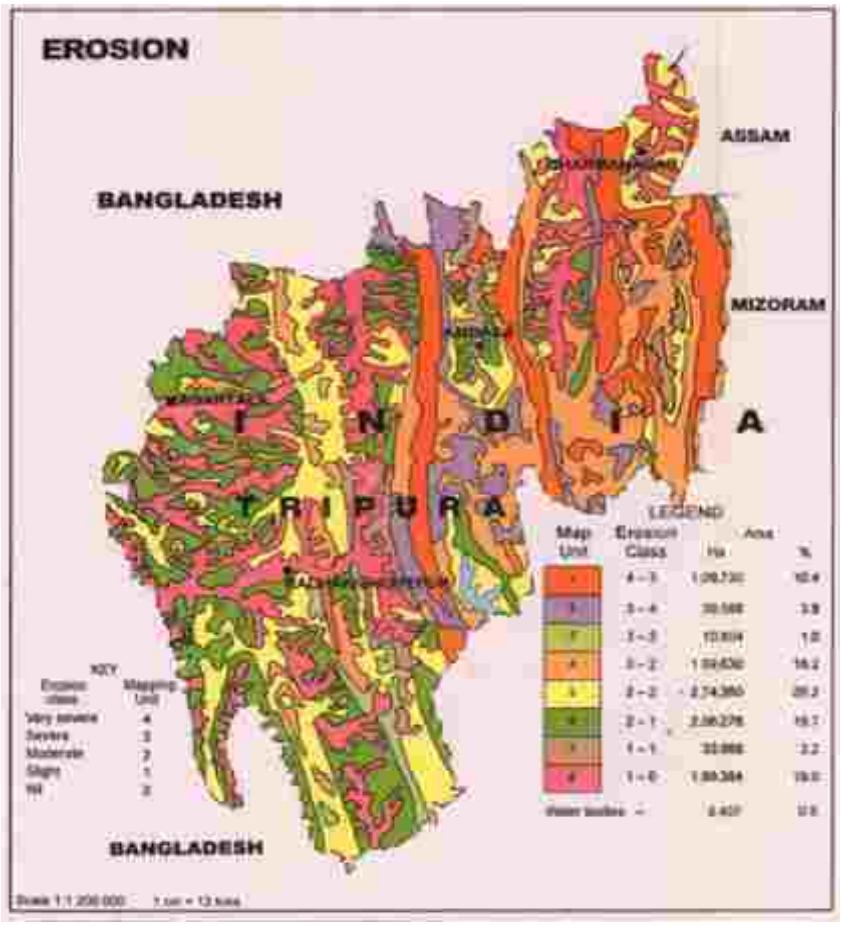
Soil and water conservation is a set of control measures which include managerial, vegetative and structural practices to reduce the loss of soil and better maintenance of natural water sources. Reduction in surface run off by structure or by changes in land management will also help to reduce erosion. Similarly, reducing erosion will usually involve preventing fast flow of water to increase infiltration and so ultimately helps to conserve water.

2. Objectives

The Forest Department, Government of Tripura has entered into an agreement with the Japan International Cooperation Agency (JICA) for a project called the Tripura Forest Environment Improvement and Poverty Alleviation Project. There are several project components under this project, of which soil and water conservation is one.

This soil and water conservation component of the project was started to achieve the following objectives:

- Maintain water regime and soil fertility of the target areas.
- Improve water table levels.
- Prevent negative impacts of natural disasters.



Soil Erosion in Tripura. Source: EU Soils, JRC

"Integrated intervention approach prevents erosion from upstream catchment slopes at the same time preventing sedimentation in downstream water bodies"

3. Approach

The soil and water conservation work adopted an integrated intervention, which targeted the whole area from up-stream catchment to downstream command within the same micro-watershed. This is an integrated approach, as it focuses on the watershed as a whole as opposed to catchment areas. The strategies and techniques required for upstream vary from those required for downstream eg. prevention of top soil erosion is the main concern upstream, whereas sedimentation becomes the main concern downstream.

This same integrated approach was applied in around 100 villages in 7 districts of Tripura, over a period of 6 years. Joint Forest Management Committees (JFMC) and cluster approach were at the core of implementation. Involvement of around 450 JFMCs and 1400 SHGs has occurred this far for implementation of the initiative.

There has been fund convergence between this project and MNREGA. MNREGA funds have been used to pay wages, whereas infrastructure and capacity building costs have been paid for through the project. For the construction of one checkdam built in 2013, Rs. 1,85,740 were paid to 135 people. This accounted for a total of 1,375 man days.

4. Key Stakeholders

Scheduled Tribes and Other Traditional Forest dwellers were the main stakeholders and beneficiaries in this initiative. They were organised into self-help groups and self-governing management committees (eg. JFMCs) to build and maintain the soil and water conservation measures that were undertaken within this project.

In addition, there were project field facilitators, who helped set up the project initially and helped later with regular maintenance of the structures and finances (bank loans or project loans). The Gram *Panchayat* was also involved in recommending land area to the project officers and tribal communities. The state government was involved in the implementation of projects and monitoring:

- Divisional Forest Officers (DFO), Forest Department.
- Chief Project Officer (CPO), Forest Department.
- Department of Agriculture, Tripura.
- Department of Fisheries, Tripura.

Activity	Output
Survey and mapping of project area	7,023 km2covered
Demarcation of JFMC area	400 hamlets/groups of hamlets
Soil and water conservation works	80 checkdams constructed

Table shows the activity and output of the integrated soil and water conservation

5. Key Components

Process

The first stage of the initiative was preparatory work done to identify areas that required intervention. This was done on the basis of a large number of indicators that included soil depth, slope, rainfall, soil texture, severity of erosion, soil degradation, infiltration rate, sediment load etc. Since community participation was of utmost importance, willingness of the JFMC for utilisation of the resources was also considered, while construction of the water harvesting structures.

Integrated Intervention

Three models have been implemented over target areas, depending on their placement relative to the micro-watershed. The models, their terrain conditions and detailing are given in the Table below.

Check dams were constructed to harvest water and cut peak flows; in order to moderate floods, meet critical irrigation needs, provide sediment storage and store water for livestock use, fisheries and environmental improvement through on-site and off-site effects. The two types seen were:

- Brushwood check dams: Constructed using locally available bamboo posts supported by bamboo/wooden stakes.
- Small earthen check dams: Constructed with local soil across the stream.

Catchment Conservation was required to prolong life span of check dams. It minimised

Model	Terrain Conditions	Major Installation Structures
Model 1 (Upstream)	• Narrow Valley • Steep slope (>20%) • Small catchment area (<5 Ha) • 2 Ha water spread area	• Embankment ie. Small earthen check dam • Gully Plugging ▸ 5 avenues ▸ 3 pallasiding work ▸ Brush wood check dam • Catchment Conservation ▸ Staggered contour trench ▸ Half-moon terrace Mulching
Model 2 (Middle part of micro-watershed)	• Narrow Valley • Steep to Moderate slope (10 - 20%) • Small catchment area (<10Ha)	• Embankment ▸ Cement Core embankment ▸ Mud core embankment ▸ Submerged spillway ▸ Partially submerged spillway • Gully Plugging ▸ Same as Model 1 • Catchment Conservation ▸ Same as model 1 ▸ Bench terracing
Model 3 (Downstream areas)	• Wide valley • Gentle slope (<10%) • Small catchment area (<20Ha) • Water spread area (around 2 Ha)	• Embankment ▸ Same as Model 2 • Gully Plugging ▸ Same as Model 1 and 2 • Catchment Conservation ▸ Same as Model 2 ▸ Contour bunding for 1000m ▸ Plantation along water body

Table shows various model and their terrain conditions

Brushwood Check Dams

Small Earthen Check Dams

the soil erosion around the structure and contributed to regeneration of vegetation around the water body.

Vegetative materials like bamboo plantations were used to line the embankment surfaces to reduce the amount of soil flowing from the slopes into the water and to prevent sedimentation. Vegetative stabilisation was also used on gully banks. Gully plugging work was required for reduction in run-off velocities and to control gully erosion of micro-watersheds. Locally available bamboo posts were used for gully plugging.

Fisheries

In conjunction with the local SHGs, an alternative income source was started at the reservoirs or small ponds that were made through this initiative. The fishlings were provided to the SHGs by the Department of Fisheries. The feed and oil cakes were made by the SHGs/villages themselves from leftover crops. Financial assistance was provided by access to loans by banks and some starter money through the project itself. The SHGs have been able to successfully sell the fish in nearby markets and recover their investments.

6. Outcomes and Impacts

Demonstrated replicability and scalability has been visible in sites across the state. So far, the project has succeeded in making 1,995 ponds. Currently, the soil and water conservation parts of the overall project are active in the following 8 Forest divisions in 7 districts:

- Kanchanpur, North Tripura District
- Kailshahar, Unakoti District
- Teliamura, Khowai District
- Sadar, West Tripura and Sepahijala
- Udaipur, Gomati District
- Bagafa, South Tripura
- Gumti, Gomati District
- Trishna Wild Life Sanctuary, South Tripura

Increased the ground water level and well water levels after the construction of check dams. The villagers living around those areas have mentioned that simple bore wells would get water after 12-15m of digging, but now

water is found at 8-10m. Water table levels in existing wells were found to have moved up by 20% after a good rain season in 2012. This indicates that check dams have helped in recharging wells.

The integrated intervention approach succeeded in preventing erosion from upstream catchment slopes and preventing sedimentation in downstream water bodies. The velocity of the stream has reduced in all the implementation areas, resulting in reduced soil erosion.

Income through fisheries has increased for the tribal communities. In one village area, Rs. 30,000 profit was earned in 2013. Another village SHG managed to pay back a loan of Rs. 60,000 solely through earnings made by sale of fish from a check dam. Overall, 495 SHGs are actively involved in fisheries and have made 61% profit so far.

The water from the check dam reservoir has been able to supplement everyday activity in the villages nearby. Earlier water for washing and cooking would be drawn from wells, but now that same water can come from the check dam. This has also helped the women of the villages, as water for household activities and for animals is available near the house.

7. Lessons Learnt

- Increase in water conservation and water-use efficiency has had noticeable effect on yield improvement and production stability in agriculture in the surrounding areas.
- An observable change in the farmer's behavior towards investment in water harvesting structures has been noticed vis-à-vis return on that investment via increased yield and ground water replenishment.

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Checkdam reservoir also used for fishery