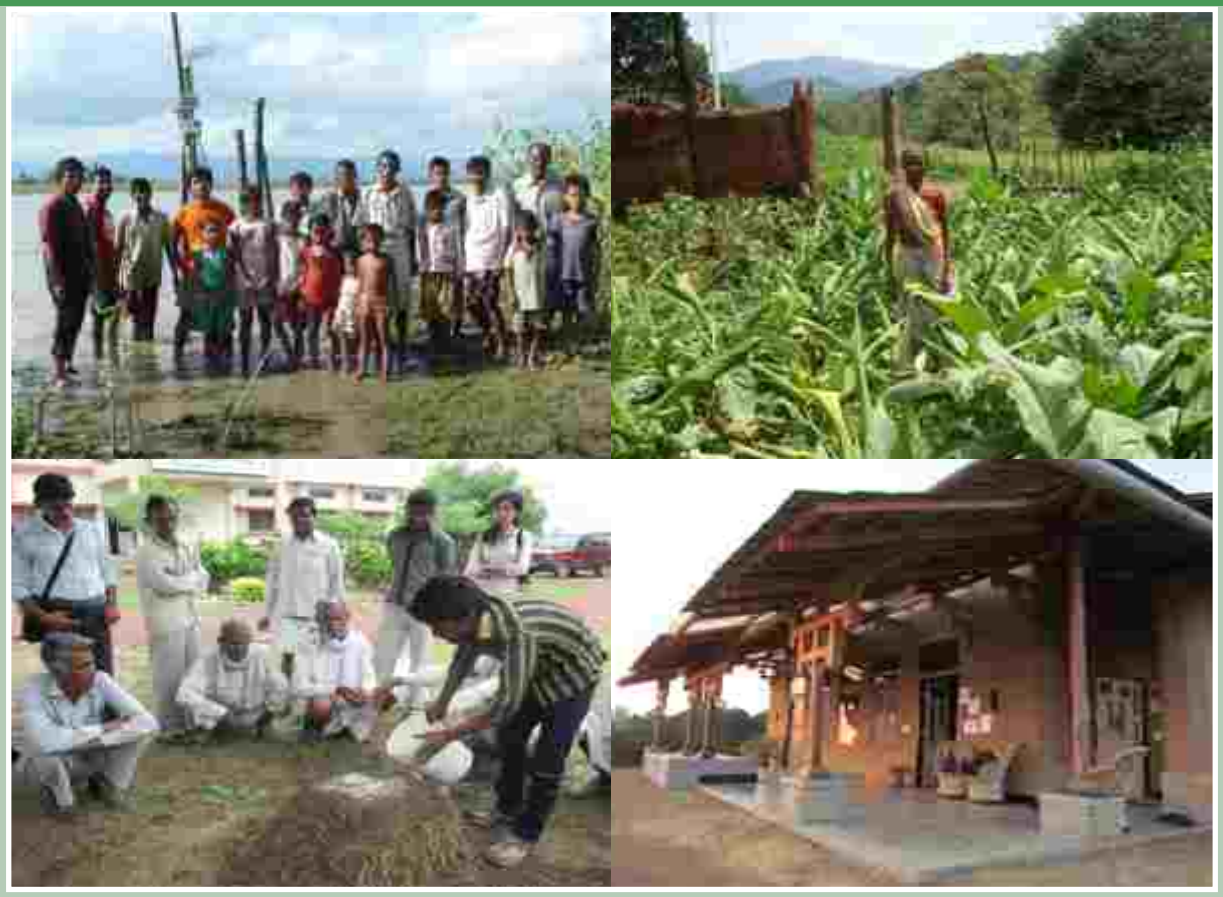
CASE STUDIES

# CLIMATE ADAPTIVE PRACTICES GRASSROOTS INITIATIVES



Development Alternatives

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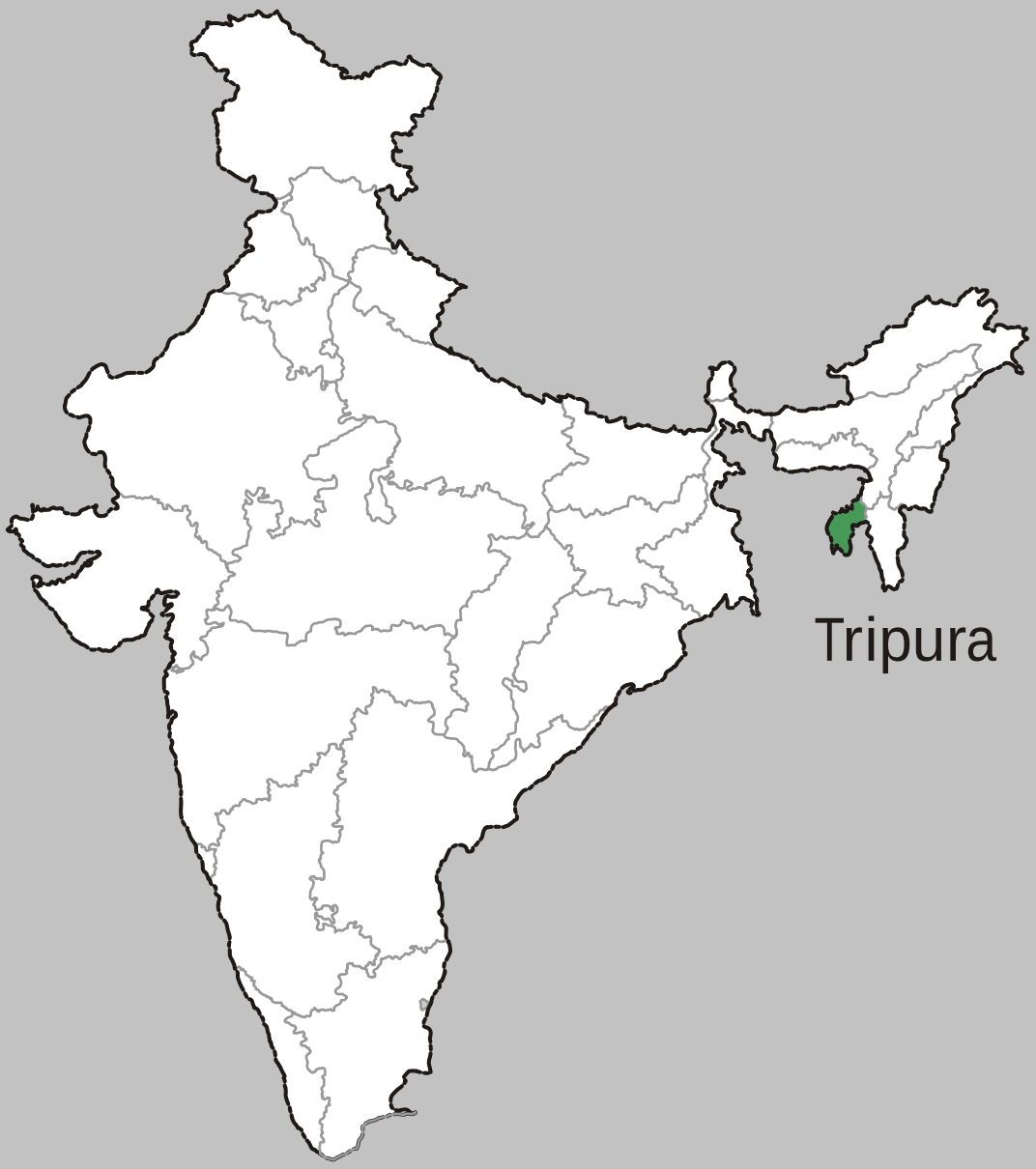
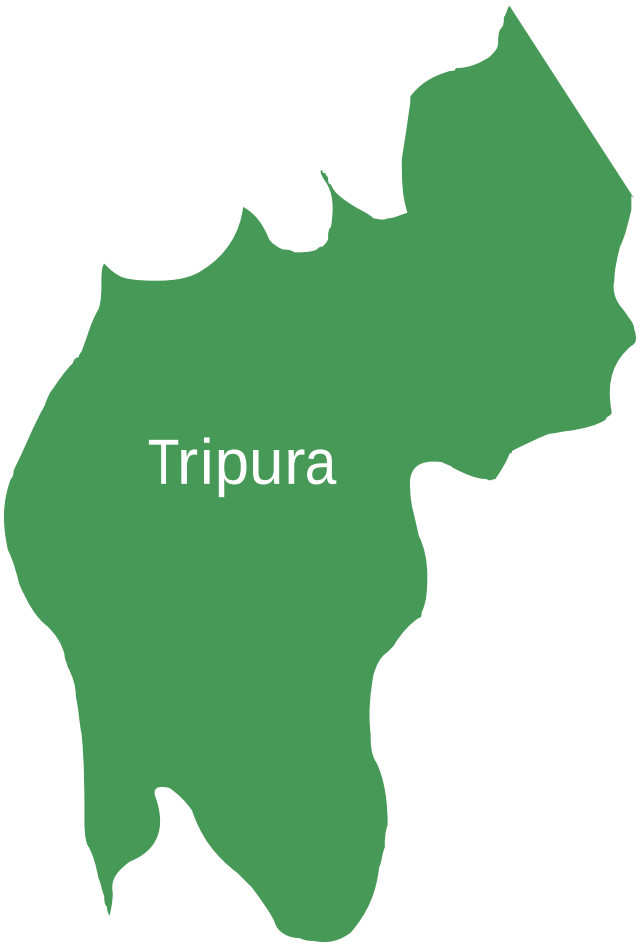



| | |
|---|---|
| Population | As per 2011 census, Tripura has a population of 3,671,032, and Ranks 22nd in India in terms of population.[1] |
| Climate | The state has a tropical savanna climate, designated Aw under the Köppen climate classification. The undulating topography leads to local variations, 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*

# Diversified Prosperity

Key Messages

- Agro forestry has the potential to contribute to both climate change mitigation and adaptation by enhancing resilience and reducing threats
- Economic diversification facilitates building resilience of communities

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## 1. Context

1.1. Need:

In the state of Tripura, 60% of the state is under forest cover and indigenous forest dependent communities comprise 25% of the total population. These tribal communities depend heavily on the forest for their daily living and income generation. Due to pressures on these forestlands and shifting (*Jhum*) cultivation cycles has led to depletion of soil fertility and reduction in crop yield.

In addition, errtic rainfall, deforestation and depletion of topsoil are stressors getting serious by the season due to climate change. Producers are also already experiencing noticeable weather patterns outside of climate norms ie. floods in northern Tripura, scanty rainfall in east Tripura district and early onset of winter frost.

Prediction of future climate conditions for the North East include higher summer temperatures, unreliable rainfalls which could lead to heat waves, greater incidences of flash floods and droughts, and onset of insects and weeds earlier not seen in the area. Climate change drives many stressors and interacts with many non-climatic stressors, which make it difficult to forecast the outcomes in one particular direction. There is consensus however, that existing threats like erosion, water availability and pest control are problems that will be exacerbated under shifting climate.

1.2. Response:

There are several methods to bring together a climate change integrated conservation toolbox for these lands and agro-forestry is one such method. Agro-forestry is a scientific system of growing agriculture, horticulture and forest crops on the same piece of land for optimum utilisation of the land. The topography of Tripura is that of undulating lands with hills and valleys that are under forest cover. Agro-forestry is highly suitable

for such lands and for raising crops on the less productive hilly slopes of Tripura and on the lands on which heavy shifting cultivation was practiced.

Agro forestry has the potential to contribute to both climate change mitigation and adaptation by sequestering carbon, reducing greenhouse gas emissions, enhancing resilience and reducing threats, while facilitating migration to more favorable condition in the highly fragmented agriculture landscape. Agriculture is a sector that is most vulnerable to climate change.

"Agro forestry has the potential to contribute to both climate change mitigation and adaptation by enhancing resilience and reducing threats"

## 2. Objectives

This pilot is a joint initiative of the Uttarayan Agriculure Research Society of Tripura and ICAR (Indian council of Agicultural Research) complex for North-East Hill region, Tripura centre. Some financial assistance has been provided by NICRA. The specific objectives of this joint initiative were:

- Demonstrate an agro-forestry model to the local farmers.
- Conversion of waste land into fertile land.
- Demonstrate sustainability of the model and profitability per hectare.
- Act as a catalyst between research organisations and farmers.

## 3. Approach

The land upon which this pilot has been initiated is approximately 5 hectares and contains uplands, medium lands and lowlands. This plot perfectly replicates the conditions for Tripura state as a whole and thus forms a demonstrable site for small farmers.

The land was first bought, leveled and tilled with nearby community members under the guidance of Uttarayan and ICAR. These two organisations were also responsible for conceptualising and implementing the project. The planting of the saplings was assisted through by ICAR.

Plowing, maintenance and harvesting of the plants, crops and produce have been done by the community members. Their ownership of the plot of land and its products has been a key component of the approach.

## 4. Key Stakeholders

Tribal communities living around the area of Nepali Basti, just outside of Agartala were the direct beneficiaries of this pilot project. In addition, the following organisations were the stakeholders in developing and executing the initiative:

- ICAR, Tripura.
- Uttarayan Agricultural Research Center.
- Centre for Forest based Livelihood and Training (CFLE).
- Department of Biotechnology, Tripura State Government.

## 5. Key Components

The organisation has implemented this pilot to cover approximately 2.5 hectares of land.

Process

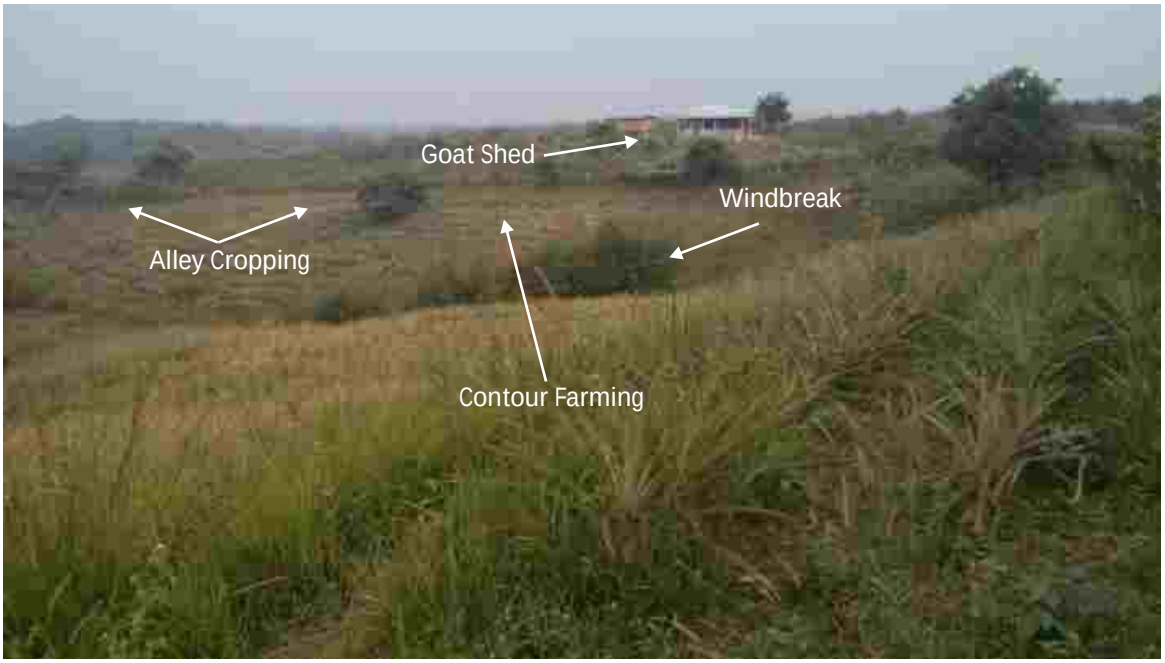
The works in the plantation were started in late 2012 all through to mid 2013. In that time duration, most of the input into the plot of land was performed along with the heavy manual labour. The crops were planted, and large pond for water supply was also created.

There was an issue after the first season of planting, where water scarcity was observed during important growing months for Maize. In 2013, the rain was very scanty and the crops suffered. As a direct response to that learning experience, a simple bore well was dug where water was found at 12ft and a lowland pond was created. The gullies and small trenches from around the plot lead to this pond to collect any extra run-off and rain water. At the same time, bamboo was planted in these gullies to break the fast flow of water. Though the maize crop suffered, the pineapple crop which requires little water, grew well during that season.

The lowland plant now contains fish, fed by oil cakes made from leftover crops. The fish are slated to be another source of income by the next season.

Multiple row farming is seen on these hills where high density plantation of pineapples, bananas, maize, lemons, organges, kinnows and mangoes were taken up. This agro technique allows for greater resource efficiency, while in growth phase.

Alley cropping is a technique where widely spaced rows of high-value trees create alleyways for crops. The crop strips alternate between rows. In this case, it is pineapple, ginger, paddy, maize, watermelons, cherra (aram) that are intercropped between main trees of bananas, bamboo, orange, lemon, mango and kinnows. The main crops are planted in strips of two rows, which concentrate the nutrients and intensify the yield. In any vacant gap, dry straw had been






*Agricultural land with various techniques visible*

© DA

*Agricultural land with boundary systems visible*

put over the ground to retain moisture and also form a cover over the topsoil.

Another key component of protecting the slope from soil erosion is the practice of contour farming, where the farming and planting of major crops is across a slope, following the elevation contour lines ie. The ruts and plow lines are made perpendicular to the slope rather than parallel, resulting in furrows that curve around the land. These create water breaks that reduce formation of rills and gullies during times of heavy water run-off.

Boundary systems like windbreaks and riparian buffers are seen:

- Windbreaks are rows of trees and shrubs that reduce wind speed. They improve crop yields, reduce soil erosion, improve water-efficiency and protect livestock. Large strip crops of Bamboo and bananas have been planted in gulleys and downstream areas to reduce soil erosion and form the barrier from strong winds and water movement.
- Riparian buffers are strips of permanent vegetation location along or near active water collecting ponds/ditches, where run-off water concentrates. Plantings help stabilise stream banks around the small pond that has been built in the area. Around the pond are gulleys, which leads left over run-off water into the pond, and surrounding the pond are large bamboo plants that hold the soil on the edge.

The goatery made in the same area is an example of Silvopasture system, where the trees benefit the fauna. In this case, upon a slopey upland, a goat shed has been situated, which is in use for 4 months and in the remaining 8 months there are crops on that slope. The trees in use are mango and bamboo and they benefit the goats, as they browse and graze under the trees. In hotter climates, the animals can graze in a cooler shadier environment, and/or also direct eat the lower leaves.

Finances:

- Initial investment:
  - Rs. 25,000 – well
  - Rs. 5,000 – pipes

- Rs. 5,000 – motor
- Rs. 10,000 – pond
- = Total Rs. 50,000 investment for one hectare of land

Active technical support was provided by ICAR Tripura Centre and CFLE. This has helped to prepare bamboo nursery and bamboo plant suckers

## 6. Outcomes and Impacts

The benefits from agro-forestry models are some which are well studied and completely match the requirements of the topography of Tripura. Since it is a sustainable practice, agro-forestry achieves both mitigation and adaptation objectives, while remaining relevant to the livelihoods of the poor small farmers and also addresses various on-farm adaption needs.

Agro-forestry shows promise for co-delivery of adaptation to and mitigation of climate change through the direct impacts outlined below:

- Improved soil structure and organic matter content.
- Improved soil fertility.
- Economic diversification of farming produce.

Some planted crops were as follows:

- 20,000 pineapples
- 2,000 bananas
- 1,000 lemons
- 400 mangoes
- 200 Oranges
- 50 Kinnows
- 1,000 arecanuts
- 45 papayas

Fishery

- 2.5 mt X 200 mt X 100 mt fishery

| Product / Activity | Total Expense (Rs.) | Assistance | Income in FY2014 (Rs.) | Proposed Income in FY 2015 (Rs.) |
|---|---|---|---|---|
| Infrastructure Creation | 6,80,000 | 1,10,000 | NA | NA |
| Banana Cultivation (Sucker & Fruits) | 1,50,000 | 25,000 | 70,000 + 5,000 | 80,000+25,000 |
| Pineapple | 50,000 | 25,000 | 4,000 | 1,50,000 |
| Bamboo | 20,000 | Nil | Nil | 25,000 anticipated to be Rs.1,50,000 during FY 2016 |
| Misc Plantations like Orange, Lemon, Mango, Kinnowetc | 80,000 | 30,000 | Nil | Production in FY2017 |
| Short term crops like Paddy, Maize, Ginger, Cherra (Aram), Water melon etc | 80,000 | 35,000 | 30,000 | 50,000 |
| Goatary | 30,000 | 15,000 | 10,000 + 14,000 (to be realized) | 50,000 |
| Fishery | 3,50,000 | 2,70,000 | Nil | 1,50,000 |
| Total | 14,40,000 | 5,10,000 | 1,33,000 | 5,05,000 |

*The table shows expenses made and income earned from various agro-forestry activities*

Goatery

- 1 Ha goat fodder area
- 5 goats with goat house

In addition, it has led to an increased resource efficiency and reduced nutrient run-off on this plot of land following the initiative.

## 7. Lessons Learnt

- While the farm area does not use fertilisers or pesticides, the project is considering trials with bio-fertilisers and bio-pesticides. To take that thought forward, a nursery of neem plants will be set up in collaboration with the Department of Biotechnology, to study their utility as bio-pesticides and bio-fertilisers.
- Institutional support systems can be of assistance for scalability of the Agro-Forestry model to a larger land area and replicability of the model to other parts of the state.
- Usage of mechanised tools could enhance productivity per person, and allow for expansion to larger tracts of land.