

# CLIMATE RESILIENT MEASURES AT THIRUVANMALAI

## Case Studies

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## INTRODUCTION

Tiruvannamalai is one of the sacred temple towns of Tamil Nadu located in the northeastern agro-climate zone with a geographical extent of 6312.05 sq.km and accounts for 4.85 per cent of the geographical area of Tamil Nadu. This district is endowed with bountiful natural resources. However, population growth and commercial activities led to a drastic decrease in the quality and quantity of natural resources since few decades. It is projected from the global climate models, that in Thiruvannamalai district, there would be an increase of 1oC in maximum temperature in mid-century period (2041-2070) and 1.5oC increase in end-century period (2071-2100) from the baseline scenario under RCP 4.5 climate scenario. Therefore, robust measures are needed to strengthen the adaptive capacity of rural communities to address climate risks and withstand extreme weather events.

The GIZ – Water Security and Climate Adaptation (WASCA) programme has planned, developed, and implemented the Climate Resilient Measures (CRM) at Thiruvannamalai district to transcend the policy to actions right at the cadastral Gram Panchayat (GP) level. Bringing success in such kind of actions at GP level is a challenging task which was brought very successful in our case study in GPs of Thiruvannamalai district. These case studies play a vital role in supporting Gram Panchayat level, Block level, District level and State Level decision-makers in their efforts to cope with the effects of climate change by demonstrating the implementation of site-specific adaptation measures.

The CRM detailed in this booklet are initiated to meet a range of policy objectives which co-benefits the whole ecosystem covering water augmentation (surface and ground water), increase in green cover, prevention of soil erosion, protecting indigenous flora, improve health and well-being of rural population. The mode of implementing the actions emphasized in the Sustainable Development Goals (SDGs) were carried out through the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), ensures livelihood enhancement of the rural population especially the people living below poverty levels. The study also covers different risks such as drought, extreme temperatures, flooding, water scarcity, loss biodiversity and reversal of land degradation in all GPs with a visible scale of success in implementing sectoral needs as mentioned above. Let's catch the case studies sectoral wise as in the table contents.

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## I. ENHANCEMENT OF GREEN COVER

Thiruvanamalai district faces exposure to climate extremities with high increase in daytime temperature of 1.2 degree Celsius since 1951. This district has experienced drought during the past years particularly in 2003 and 2009 and severe drought during 2016- 2017. All parts of the district are affected by drought and its consequences, like crop losses in large area and drinking water scarcity. On the other hand, there is every possibility of receiving heavy rainfall and flood during the northeast monsoon season, leading to damage of agricultural crops. These extreme climate conditions poses a threat to the highly vulnerability marginal farmers, who constitute 94.7% of the population of this district.

Thiruvnamalai is bestowed with fragmented hills which are nothing but the off shoot of the Eastern Ghats, and one sixth of the district area is covered by reserve forest and hills. Important hills in this district are Jawadi hills and Yelagiri hills (2500 ft MSL). The green cover of these hills is gradually depleting owing to anthropogenic influences. Excessive runoff due to intense rainfall and soil erosion is visibly noticed in many of the foothills of forest. The GIZ team well addressed the improvement of catchment in this area to avoid further deterioration of the site quality by improving surface water storage and soil as well. Staggered contour trenches and mound planting are good enough to sustain this district prone for heavy drought.

Another observation is that the soils of the district plain region are red-loamy in nature with poor amount soil organic carbon which tend to suffer by not providing adequate plant growth during summer. Keeping in mind GIZ team carefully crafted the trench and mound afforestation programme with good amount of soil conservation measures, as silvi-pasture lands. This kind of conversion of wasteland with site specific treatments are highly needed to address the climate proof activities in rural India.

Nursery development, Greening of Hillocks, Silvipasture development and massive tree plantation are implemented to enhance the adaptive capacity of the rural communities to climate change. These activities provide multi-dimensional co-benefits to the people and make them resilient to challenges in water management and agriculture practices.

## I.A. Nurturing Nursery for Ensuring Climate Resilience



Nursery development activity is proposed in priority blocks of Thiruvanamalai district under the Water Security and Climate Adaptation (WASCA) integrating -MGNREGA works. Village level nurseries are initiated in Kattampoondi GP of Thiruvanamalai block at a cost of Rs. 11,80,000/- comprising 452 mandays at a daily wage of Rs.273/-. The block level nursery at Vallivagai GP of Thuringapuram block, is established at a cost of 20.25 lakhs, at a daily wage of Rs.256/- The block level nursery has provision for raising 50,000 saplings. In another village Sanananth GP, the nursery is developed at a cost of Rs.16,65,00/- Rs. 273/- as daily wage. The indigenous species were raised in nursery with improvised irrigation system in order to save water.



## I.B. Greening of Hillocks: an excellent carbon sink



Climate extremes such as intensive rainfall and prolonged drought are challenging task to tackle the water resources, agriculture practices and afforestation activities. To address these multiple and complex issue the GIZ-WASCA team proposed to take up the Greening of Hillocks work, which integrates the activities under the MGNREGA resulted in overall sustainable management of the village. Greening of Hillocks is a benchmark activity to facilitate the enhancement of

carbon sequestration potential of the degraded hillocks around the village and such kind of programme is the answer to increase the carbon sink as envisaged in NDC.

The Greening of Hillocks is a major work, conceived and brought to implementation with concerted efforts from all levels of administration. The GoH involves activities that completely transform the dry hill area into a green covered area. These include clearing the scrub jungle, pitting for plants of various size in ordinary and hard Soil, planting the saplings and stone bunding using the hard rocks, cutting trenches and maintaining the saplings to wade off pests and diseases. The GoH work at Vallivagai for an extent of one hectare was carried out with an estimate of 8,85,000/- at the total of 3150 person days. Predominantly tamarind trees are planted along the slopes of the hillocks, for providing future revenue to the village. The trenches and mounds plays major role in moisture conservation and contour stone wall provide adequate soil conservation in this locality. To assess its carbon sequestration potential, it will take another three to five years once they reach tree size.

### **I.C. Silvi-pasture Development- enabling marginal farmers**



Developing the wasteland into silvipasture areas is implemented as a climate resilient measure, which helps the agricultural laborers earn income during the off-season or non-cropping periods. Silvipasture has been initiated in six Gram Panchayats across 4 blocks and proposed in seven more GPs. Mangalam, Vadapulithiyur, Kattampoondi, Kidampalayam, Mattavettu,



Mariyanallur, Kattampoondi are the GPs where silvi pasture cultivation is taken up. In these GPs, saplings of native fodder trees like *Agathi* (*Sesbania grandiflora*), *Kalyana murungai* (*Erythrina indica*) and neem (*Azadirachta indica*) are planted. These trees also act as live fencing. Fodder crops like *Stylosanthes hamata*, *Stylosanthes scabra* and *Stylosanthes humilis* are sown in the inter spaces between the trees planted in silvipastoral plantations for fodder production. This activity is implemented at an estimated cost of Rs. 1,42,000/- involving with 290 mandays in the GPs mentioned above.

#### I.D. Massive Tree Plantation



The Massive Tree Plantation (MTP) activities are implemented on a wide scale in Thiruvanamalai district and is helping towards achieving NDC targets. This activity is proposed in Tiruvannamali, Thandrampet, Cheypet, Chengam, Keelpenathur, Anakkavur and Thellar blocks of Thiruvanamalai district. It is estimated that to carry out the work at GP level will require Rs.1,40,000/- with 551 man-days. At block level plantation an estimate of 8,80,000/- is provisioned with 2981 person days is proposed. With the Massive Tree Plantation activity around 37.45 Hectare area will be brought under green cover. The trees reduce the runoff from slopes and help to conserve water. The trenches adjacent to plantation pits provide uninterrupted water to the plants. And infiltration over a long period enhances the soil moisture and ground water level.





The activities taken under improving the green cover helps to tackle many direct and indirect impacts from climate change as a Climate Resilient Measure. The ways in which these activities help to enhance the capacity of rural communities is as follows:

1. The major afforestation activities planned under various schemes of the government can be effective only by planting quality saplings, specific to the sites. Village and block level nurseries developed at Thiruvanamalai will help in encouraging more plantation activities, thereby striding the district towards achieving the target of **increasing the green cover of the district to 33% as envisaged in the India's Nationally Determined Contributions.**
2. Loss of standing crop at initial stages of plant growth due to untimely or scanty rains at critical growth periods is the major reason of crop failure in rain-fed agriculture systems of Thiruvanamalai district. In the event of predicted climate change, the incidences of unseasonal rain events will increase, thereby aggravating the problem of crop loss. In such circumstances, the rural community must be prepared and be resilient to continue their agriculture activities. Nurseries of commercial fruit bearing, medicinal plants and

floriculture can **help the marginal farmers to cope with the situation to cater the needs of the urbanised population in and around GPs.**

3. Complete crop failures due to climate change mediated floods and droughts, pest and disease incidence can lead to loss of indigenous crop variety unless otherwise the community intervenes with adequate adaptive measures to preserve it. Nurseries planned under **WASCA-MGNREGA have proved that indigenous species performs well and have tolerance to the existing prolonged dry spell and poor topsoil.**
4. Due to natural calamities like droughts, scanty rains or floods, farmers do not have either sufficient time to raise new nursery nor would he get sufficient seedlings from his fellow farmers and he is prone to lose a complete season. Such situations can be addressed by protected community nurseries managed by resourceful farmer-groups. This present project facilitates cultivation of high-quality seedlings on commercial basis in protected structures like polyhouses. Thus, community nurseries could provide sustainable livelihood through employment and facilitates to conserve the ecosystem with its own indigenous species. **These GPs are act as a precursor for implementing the same kind of programme in all GPs in the days to come.**
5. Availability of quality sapling within the village or block could also provide the seedlings required for other areas of GPs to increase the green cover in the whole district. **Such kind of action could alone improve the green cover to fulfil the NDC promises to increase the carbon sink.**
6. Raising of commercial value timber species like bamboo, mahogany, and teak will ensure **sustainability in improving the livelihood** of rural poor.
7. Silvipasture development both raising of fodder trees and fodder grasses help to prevent soil erosion and retain soil moisture. The productivity of wastelands increases. Individual farmers need not seek fodder from other places and landless farmers can make use of the common pastures. Un-interrupted availability of fodder to livestock improve their sustenance and coping capacity. The trees after a particular stage of growth, will act as carbon sinks and add on to the green cover of the area.
8. The leguminous fodder crop Stylosanthes species are C4 plants and experiments have shown that Stylosanthes species is able to produce 85% higher fresh and dry biomass at elevated CO<sub>2</sub>. Also, S. hamata intercropping system has a potential to be a sink for increasing level of CO<sub>2</sub> in the semi-arid tropics.

Therefore, silvopasture development can prove to be a potent climate resilient measure

for the marginally poor farmers of Thiruvanamalai district. Sustainability can be achieved if it is under individual ownership.

9. Massive tree plantation serves to restore forest landscapes. The MTP at Thiruvnamalai which is scientifically supported by the GIZ-WASCA team, is striding towards success as a combination of indigenous varieties of tree species like Tamarind, Guava, Neem Drumstick, Teak etc. and new varieties like cashew are planted. Indigenous species are able to withstand long-term changes and thus will have a **potential contribution towards carbon sequestration**. The new varieties of Cashew will yield **commercial benefits** within a short duration of plantation. Commercial plants attract **community to**

## Community Voices

Through our rapid rural assessment of all the activities, it is observed that with the support from the Village head, the Engineers and GIZ-WASCA team, a seamless effort is taken up in implementing nursery and afforestation programme.

Marimuthu from Vallivagai says, *“we started as a small nursery work under MNREGA that provided 100 days of employment and facilitated the supply of more than 500 saplings to the other blocks of Thiruvanamalai district. This helps in generating corpus fund for our village and learnt technical knowhow in raising modern nurseries with careful utilization of water through micro-irrigation. We need to maintain them well.”*

On the programme implementation side, we interacted with Mr. Ravichandran, Engineer and the Gram Panchayat leader Mrs. Sasikala of Vallivagai expressed their view that the technical inputs from the GIZ-WASCA led to address the requirement of the village by integrating all works whether micro or macro level of work, which leads to wholistic transformation of the village as visibly seen today. The planning was innovative which included other activities like fencing the nursery, farm ponds and check-dams for augmenting water for the nursery. Though many MGNREGA works are fragmentive, the GIZ brought under one umbrella addressing towards SDGs. This unique activities in the village not only increase the natural resources but significantly plays role on alleviation of rural poverty through promising employment as well.





The afforestation carried out with the help of these nurseries are promising well at field as they are very indigenous species have drought tolerance and provide usufruct products like fruits, development of beehives and increase the soil health. Although GIZ team implemented very good afforestation programme, villagers feel that there is a urgent need to provide surface water storage in order to tide over the summer season. The villagers feel that the increased green cover created a conducive micro-climate will serve as a future pastureland for their cattle and goats.

The Panchayat head of Melpasar GP, has taken personal interest in bringing a community change, by initiating GoH at his GP. *“We have just started and planted more than 500 saplings, which are income generating. We ensure proper maintenance and mobilize the works in the long term with added efforts”.*

Shankaran from Kattampoondi Gram Panchayat says, *“Now I need not take my cattle to distant places for fodder. Our people can use the time to develop works that enhance our livelihood. The varieties of fodder grown here are indigenous and we are very familiar with its growth pattern. They can withstand dry seasons to some extent, we are reclaiming our livelihood and shall work for maintaining fodder growing lands.”*

Shakthivel of Kattukannallur narrates, *“My family is living in the nearby village and we come to the Subramaniya Swamy temple since childhood. After the massive tree plantation that has been initiated by the GIZ under MGNREGA, we could see the place being transformed to a Greenery area. Many people come to the temple now. We can also visualize futuristically that*

*our kids will get benefit from the variety of trees planted here. Its very good natural way of development.”*

**Hallmark of Nursery Development, Greening of Hillocks, Silviculture Development and Massive Tree Plantation towards Climate Resilience**

1. Provides short term and long-term employment opportunity
2. Aids in effective afforestation activities leads to increase in green cover
3. Help the marginal farmers to have Good Agricultural Practices using vermicompost and drip irrigation to have climate proof practices
4. Facilitate the conservation of indigenous plant species which is going to act as a fine carbon sink in future
5. Provided permanent sources of revenue throughout silvicultural activity
6. Sustained availability of green fodder for livestock
7. Promote retention of soil moisture and enhance soil organic carbon

## II. Conservation of ethnobotany species

In modern days the medicinal plants used with traditional knowledge is gaining importance to cater the needs of medicinal plants which are natural curing agents without side effects. The realization of conserving such a natural traditional species is imperative to enhance our ayurvedic and siddha practices in rural areas to replace the English medicine. Realizing this importance, the GIZ team consulted the villagers and *nattuvaidyas* (herbal medical practitioners) to raise the indigenous herbal medicines in the village wastelands as well as in agriculture lands. The following important medicinal species are raised to cater the traditional medical requirements of local *nattuvaidyas*. Ashwagandha (*Withania somnifera*), Nilavembu (*Andrographis paniculata*), Tulsi (*Ocimum sanctum*), Seenthil (*Tinospora cordifolia*), SakkaraiKolli (*Gymnema sylvestre*), Shatavari (*Asparagus racemosus*), Kaanthal (*Gloriosa superba*), Neem (*Azadiracta indica*), Soththu kattralai (*Aloe barbadensis*) etc.

Villagers started raising medicinal plants supplied from the GIZ team as homestead plantation which serves as a good curative agent for instant treatment of diseases. Womenfolk who do not have adequate employment can be deployed for such kind of medicinal plant nurseries which will facilitate raw material supply of medicinal plant to the big pharma companies in turn, increase the employment opportunity and creation of corpus fund for the village.

On the programme implementation side, we interacted with Mr. Ravichandran, Engineer and the Gram Panchayat leader Mrs. Sasikala of Vallivagai expressed their view that the technical inputs from the GIZ-WASCA led to address the requirement of the village by integrating all works whether micro or macro level of work, which leads to wholistic transformation of the village as visibly seen today. The planning was innovative which included other activities like fencing the nursery, farm ponds and check-dams for augmenting water for the nursery. Though many MGNREGA works are fragmentive, the GIZ brought under one umbrella addressing towards SDGs. This unique activities in the village not only increase the natural resources but significantly plays role on alleviation of rural poverty through promising employment as well.





Ashwagandha



Nilavembu



Tulsi



Seenthil



Sakkaraikolli



Shatavari

Vetiver (*Vetiveria zizanioides*) is an excellent body coolant agent and air purifier is predominantly cultivated as bund planting in most of the waste and dry lands. There are ready buyers to take this raw material for the local market. Hence, medicinal plants could be taken up with more number of species and quantity in future to raise the rural economy. It not only serves to improve the economy but also serves as a very good soil binder to prevent soil erosion. The plantations raised in the Mariyannallur of Cheyyar block at an estimated cost of Rs. 6,19,000/- with a total of 1781 man days, is a successful case study representing assured rural employment and economy as well. These kinds of successful stories can be taken up to other villages of this district to facilitate the small holding farmers as a co-benefitting programme with their main agriculture work. The GIZ team has the plan to improve the water augmentation programme and good agriculture practices throughout micro irrigation, vermi-compost, mulching etc. in the days to come. The villagers are already motivated by the GIZ team while performing PRA exercise.

### III. Water Augmentation and Farm Ponds:



Among all the works carried out by GIZ, our Rapid appraisal reveals that there is overwhelming agreement of the villagers that farm ponds are giving the visible remedial measures in raising ground water in this village. Over ground water extraction in this district is a major threat as many places the fluoride content of the ground water causes Osteoporosis. Now raising surface water clearly proves that the ground water level also increased, and surface water is available for drinking as well as irrigation purposes. This programme is the primordial work that addressed the climate risk factors especially enduring drought.

A humongous effort is taken up to address the above climate-mediated challenges through the construction of farm ponds at multiple locations in Thiruvanamalai district in a short spell of time. With the assistance from the Department of Rural Development, 1118 farm ponds in 541 GPs of 18 blocks are created at a unit cost of Rs. 1.78 lakhs with the total project cost amounting to Rs. 19.96 crores. The construction of 1121 farm ponds in a short period under MGNREGA is certified as a world record by the Elite World Records as “Most farm ponds





created at multiple locations in 30 days”. This is a significant stride engaging 23478 man-days throughout the year. The capacity of each farm pond is 0.0364 HaM, which led to the augmentation of 40.6952 HaM of water from the 1121 farm ponds in agriculture land. This is a spectacular achievement in Tamil Nadu, and it needs to be taken forward to the rest of India wherever the same vulnerability index exists as per the report furnished by GIZ through Anna University Chennai.



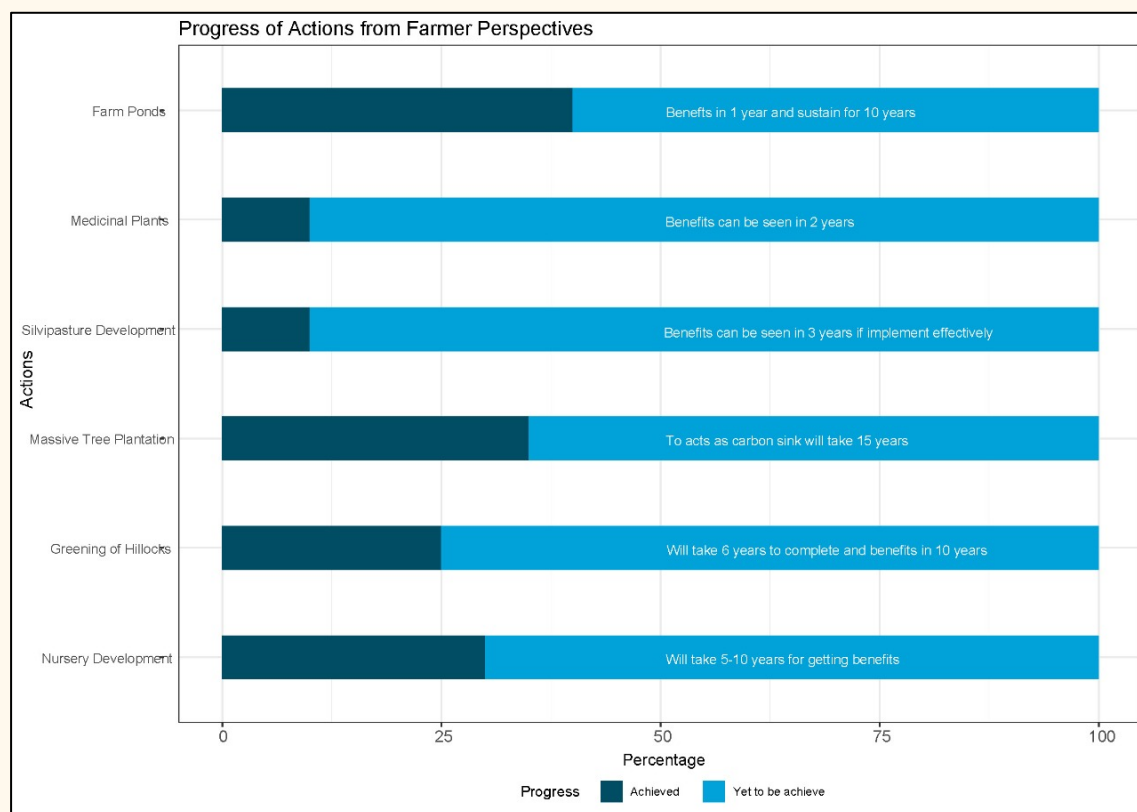


It is observed that there is little erosion in the farm ponds on the inner side of the unearthed bunds. This area also must be taken up with Vetiver (*Vetiveria zizanioides*) and Naar kattalai (*Agave sisalana*) as a inner biological lining to prevent soil erosion. In rainy season, when the ponds are filled with water, aquaculture like fish farming or azolla cultivation may be taken up to enrich the soil. Such kind of integrated farming and multiple utility of water bodies are highly required at this point of time. This kind of idea emerged out from the villagers, while we have interaction with them during our study.

#### **IV. GIZ and a way forward:**

Though, MGNREGA is implemented throughout India, Tamil Nadu is one of the pioneers in state implementing the programme very successfully. Despite all efforts, the real rural development yet to take off to improve the rural infrastructure and economy. Using this knowledge gap, GIZ played a pivotal role, taking the science and technology-based programmes to the villages and implemented systematically with people participation. This

proves that it could be possible, to reach the sustainable development through proper scientific tools involving the local people, local knowledge, and indigenous technology.



During our rapid rural appraisal with the people of the Vallivagai, Kattampoondi, Melpasar, Kattukanallur and Poosimalaikuppam GPs, we interacted with the vertical section of the community and learned through them that the progress of the various schemes carried out by the GIZ team are at greater progress. However, they felt the that works must be carried further to reach the sustainable growth in all works. The approximate percentage of progress assessed from the community is as shown below based on our ground truth verification.

Through the community assessment and ground truth verification, it is observed that though afforestation activities in wasteland has progressed extensively, yet we need greater attention to tackle hillock afforestation. The upper reaches of the hills are poor in soil and boulders devoid of parent soil. In such places more concentration for soil amelioration is required for future afforestation work. The situation thus warrants soil amendment and nutrient enrichment in future, to promote complete greening of the hillocks.

In the present study we were able to measure, from the voice of the people that about 30-35% of the resources in the village have reached substantial sustainability. Yet we must go a long way to reach the goal using appropriate scientific tools with further improvisation. Such programme devised by GIZ in implementing rural programme must be incorporated in all government and non-governmental participation involving local community.

These successful stories may be visually documented and put across the media to reach each and every part of the country. Our wishes to the GIZ.