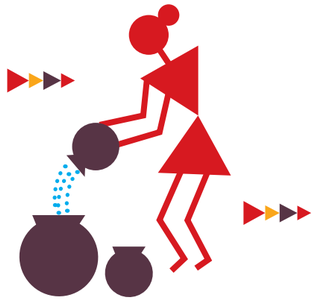
BUILDING COMMUNITY RESILIENCE IN A CLIMATE CHANGING ENVIRONMENT IN THE ADIVASI CONTEXT

A STORY OF CHANGE

Abstract

This story of change is about ‘building community resilience in a climate changing environment’ set in a remote ‘tribal’ or ‘Adivasi’ area of Andhra Pradesh. This effort fraught with constraints and potentials is a huge, ongoing and lifetime challenge for those of us, who have been engaged in grassroots action in the Adivasi areas.

However, from a practical perspective this ‘change story’ illustrates and analyses three identified key interventions of resilience building in such communities: ‘good practices in sustainable farming’ towards food and income security, ‘locally relevant, climate-friendly and low carbon technologies’ that enhance their quality of life and ‘climate change education’ that inculcates learning processes for the development of capacities and creating opportunities for informed choices on matters related to well-being.



In the final analysis, we do believe that change is a continuous process and communities are influenced by multiple forces internal and external. The climate changing reality is an additional external factor that has added to the vulnerability of Adivasi communities today, and hence becomes a central concern in our field level engagement.

This study thus focuses on responses and efforts made, results experienced and challenges faced in the course of LAYA’s engagement with Adivasi communities.

Introduction

LAYA is a non-profit organisation with its main office based in Visakhapatnam and its areas of operation in East Godavari, Visakhapatnam, Vizianagaram and Srikakulam districts of north Andhra Pradesh. LAYA’s perspective of the problem situation of the marginalised communities, mostly Adivasis[1], are that they are the victims of changing societal pressures and lack the capacity to safeguard their entitlements and secure basic services that are due to them. The vulnerability of such communities is under greater threat with the mainstream forces and the climate crisis, which militate against their survival, dignity and well-being interests.

In this context LAYA has been involved with the issues of Adivasi societies since its inception in 1989. ‘LAYA’ represents ‘rhythm’ and belief in the wisdom of the ‘rhythm’ underlying Adivasi societies.

This ‘change story’ focuses on measures taken in the last decade on building community resilience among Adivasi societies located in a Climate Changing Environment in four Scheduled Areas in the state of Andhra Pradesh.

[1] In this document ‘Adivasi societies’ are synonymously used with the term ‘tribal societies’.

The Development Context of the Adivasis from a National Perspective

Andhra Pradesh is one of the 10 states including others like Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan and Telangana which have 'Scheduled Areas'. The Indian Constitution categorized the Adivasi communities living in the Scheduled Areas as Scheduled Tribes in order to provide special welfare provisions to them. Article 366 (25) of the Constitution defines 'Scheduled Tribes' as *"Scheduled Tribes means such tribes or tribal communities or parts of or groups within such tribes or tribal communities as are deemed under Article 342 to be Scheduled Tribes for the purposes of this Constitution."*

The first census of independent India in 1951, recognised 212 Scheduled Tribes in the Country. This increased to 432 during the 1971 census. Today there are about 705 ethnic groups included in the list of Scheduled Tribes and are described as 'very isolated', 'still living in caves', 'living in forest areas' or more vaguely, 'are primitive jungle tribes', 'having tribal characteristics', 'very backward tribe' and have 'distinctive dress and customs. However, the Adivasis living in the Scheduled Areas differ considerably in terms of their population size, mode of livelihood and occupation. For example, they may be hunters and gatherers, shifting cultivators, settled agriculturalists, pastoralists, artisans, farm labourers and plantation or industrial workers. They also demonstrate varying levels of integration in the economy.

From a socio demographic perspective, most of the Adivasi population are low on the BPL indicator as well as on infant mortality rate as compared to the national average. They also manifest lower than average literacy rates. This is largely attributed to the abysmal education infrastructure in these areas, inadequately trained or absentee teachers, alienating curriculum and irrelevant mode of imparting knowledge.

Indicators	Total Population	Scheduled Tribes
Rural BPL (2011-12) (Tendulkar Method)	25.7%	45.3%
Literacy Rate: Census 2011	73.0%	59.0%
Infant Mortality Rate (number of infant deaths per 1,000 live births during the year): National Family Health Survey (NFHS-4), 2015-16	40.7	44.4
Source: Government of India, Ministry of Tribal Affairs Lok Sabha unstarred question no. 4617 answered on 22.07.2019		

Certain Adivasi groups have been characterised as Particularly Vulnerable Tribal Groups (PVTGs), earlier known as Primitive Tribal Groups (PTGs) on the basis of their greater 'vulnerability' even among the tribal groups. PVTGs, currently include 75 out of 705 Scheduled Tribes, spread over 17 States and one Union Territory (UT), in the Country (2011 census).

They have been, identified on the basis of the following criteria:

i) Forest-dependent livelihoods
ii) Pre-agricultural level of existence
iii) Stagnant or declining population
iv) Low literacy rates
v) A subsistence-based economy

Andhra Pradesh harbours 12 such groups, second only to Odisha State. The vulnerability of the PVTGs has been attributed primarily to the loss of their traditional livelihoods, habitats and customary resource rights through the gradual exploitative intrusion of the market and the State into their areas in the form of industrial projects, conservation efforts, tourism and the forest bureaucracy and so on. These conditions have led to the loss of their land and resources resulting in chronic malnutrition and ill health among these groups. Many PVTGs are forest dwellers and depend mostly on land and forest resources for their subsistent livelihoods. Their habitats continue to be declared as Reserved Forests or Protected Forests, National Parks leading to displacement and eviction without compensation.

What seems to be a common issue for most Adivasis is dispossession of their lands, induced backwardness due to alienation of their lands, forests and resources, erosion of personal and cultural identity. Today, the Adivasis are recognised as a distinct entity whose struggle has always been to safeguard their rights over natural resources against the external pressure for control by mainstream society.

Habitat rights for PVTGs guaranteed by the Forest Rights Act section 3(1) (e) of the Forest Rights Act 2006[2] (FRA) recognises the "rights including community tenures of habitat and habitation for primitive tribal groups and pre-agricultural communities" and Section 2(h) defines 'habitat' as the "area comprising of the customary habitat and such other habitats in Reserved Forests and Protected Forests of Primitive Tribal Groups and Pre-agricultural Communities and other Forest Dwelling Scheduled Tribes".

Studies have pointed out to the flaw in 'delivering development' to the tribal areas. Interestingly, the National Advisory Council, 2013 stated and recommended, "there is a significant risk that vulnerabilities may be exacerbated rather than reduced through Government intervention and therefore due caution must be exercised in all cases. Vulnerabilities must be addressed through taking account of their food production and distribution systems and their rich repertoire of traditional skills and knowledge".

Despite such reflections and perspectives, over several decades, lopsided development projects and policies have led to greater vulnerability of the tribal communities. Tribes".

[2] Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. It provides for restitution of deprived forest rights across India, including both individual rights to cultivated land in forested landscapes and collective rights to control manage and use forests as common property. (Available from: https://www.researchgate.net/publication/42762034_The_Indian_Forest_Rights_Act_2006_Commoning_Enclosures[accessed July 31 2018].

The Adivasi Context in LAYA's Working Area

LAYA works through its field offices across 4 Scheduled Areas of Andhra Pradesh reaching out to 45 panchayats and approximately 10,000 Adivasi households. This entire area is remote but rich in natural resources: land, water and forests.

The major issues affecting the Adivasis in this region are displacement and land alienation. The region's high natural resource base is under threat of indiscriminate multi market demands from agri-business (cotton, tobacco, tapioca, coffee cashew in particular), mining, hydropower etc.

Though there are special protective laws in the Scheduled Areas, they do no prevent violation of the rights of the Adivasis at the grassroots related to access and control over natural resources; threat to livelihood; inadequate basic infrastructure for survival; lack of access to basic health & education; and the threat to their identity. The nature of violations become increasingly complex in an environment, which has an accelerated exposure to unregulated market forces.

Adivasis in this region primarily depend on agriculture and to some extent collection of Non-timber Forest Produce (NTFP). Agriculture however is mostly limited to the 'Kharif' season from June to September, which is also the monsoon season. The second cycle of operations is difficult as the area is rain fed and has limited access to water for irrigation. Cash income comes from the Government promoted schemes like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). Subsidised food and daily ration are made available on a monthly basis through the Government Public Distribution System (PDS).
The livelihood system of these communities is becoming Government dependent on doles and giveaways thus denying these communities from developing the skills and capacity for becoming increasingly self-reliant.

The ecological situation is increasingly becoming a matter of concern. The new reality of climate change is compounding the existing socio-economic vulnerabilities of these Adivasi communities. It is well known, ironically that the impacts of climate change affect those who are the most marginalised and who have least contributed to the problem of climate change. Variation in climate has a direct adverse impact on the livelihood of the Adivasi communities: on agricultural productivity and shifting crop patterns which could jeopardise food security. Every small change in temperature and rainfall has a significant effect on productivity, in terms of quantity and quality of crops. Other significant impacts on the poor and the marginalised are soil erosion and soil degradation impacting soil fertility and soil health. Droughts, scanty rainfall and seasonal water scarcity combined with warmer temperatures are big threats.

The Adivasi farmer households that LAYA works with are experiencing erratic and untimely rainfall, long dry periods, short sharp winters and extreme events faced by increasing climate variability. One of the areas that LAYA works where PVTGs reside have witnessed 8 extreme events since 2010. (Local study of weather patterns and disasters, 2010-2017). In general, reports (State of Forest Report, AP 2014) indicate there has been a gradual loss of forest cover and biodiversity. Besides many perennial streams are seen to be getting dryer with every passing year.

The Climate Changing Environment

The additionality of the impacts of Climate Change in the development narrative of Adivasis is worth considering given the already existing levels of marginalisation in these communities. Climate Change tends to impact those that are in any way marginalised and augments their vulnerability. Within the Indian context the erratic rainfall patterns, temperature rise, and higher frequency of extreme events add to the vulnerability of marginalised communities especially those living in habitats, which are resource dependent.

In the words of Murla Abbaireddy, 56 years old, a priest from Kopullakotta village:

"We came here about 20 years back. We used blankets from the onset of North East monsoons for a good three months, now we use blankets for not more than 3 weeks in December-January. The dry hot period has become the longest, the monsoons are behaving in a way that it has become difficult for me to suggest sowing dates for the community. Farming decisions have become very difficult to make."

Salient Aspects in Climate Variability: Community Perception in LAYA's Areas of Work	
(i)	High temperature with increase in warming periods through the year
(ii)	Loss of rainfall predictability
(iii)	Delayed rainfall[3] – Delay is becoming a new normal. Monsoons in the area arrives after the 12th of June and retreats by mid-September
(iv)	Sporadic showers are experienced, sometimes very heavy showers. Continuous rains over few days takes place only in some area
(v)	'Dry years' with less rainfall on the rise
(vi)	Rainy days decreasing with more rain in less days
(vii)	Winter rains getting more and more unpredictable
(viii)	Winters arriving a month late and leaving early (2 weeks to 3 weeks before) in this area
(ix)	Sharp changes in seasons
Source: An FGD with Konda Reddis: PVTG	

[3] Delayed in climatic terms refers to delay in monsoon arrival from a 30-year average. For the community the delay refers to operational and agricultural delays.

The Climate Resilience Agenda

The Theory of Change for farmer resilience in a climate changing context below captures the theoretical framework within which LAYA currently operates.

Problem Statement

The impact of climate change aggravates the livelihood and ecological vulnerability of marginalised ecosystem communities. Mainstream adaptation measures lack community-centric perspective to build community resilience.

LAYA will do

- Will explore, undertake and enable demonstrative initiatives for sustainable farming practices in other strategic locations
- Will explore, demonstrate and upscale relevant climate friendly tehnologies suited to a forest ecosystem
- Will develope curricula on climate change and sustainable development for various target groups in collaboration with INECC (urban schools, ashram schools, urban and rural college students, young professionals etc.)
- Will build capacity of various stakeholders
- Will explore and collaborate with INECC and other national groups such as CANSA, PAIRVI, Developmen Alternatives etc.
- Will develope relevant communication tools and aids for dissemination

With the assumption

- Intensity and magnitude of climate change impacts will increase willingness of the various stakeholders to engage on community resilience
- Human and financial resource availability
- Favourite policy environment for advocacy

Stakeholders will do

- Progressive farmers including women will undertake sustainable farming practices
- A variety of target groups especially women will adopt climate friendly technologies
- Youth including young women will play leadership roles in promoting meassures for community resilience
- Various interest groups including school authorities progressive community representatives including youth and young professionals will engage on climate education
- CSOs will engage on aspects of sustainable farming practices, climate friendly technologies, climate change education and advocacy initiatives
- Govt. officials and elected representatives at various levels will take affirmative actions contributing to climate resilience

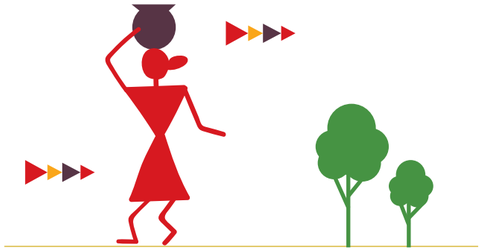
Leading to these outcomes

By 2023

- The vulnerability of marginalised farming households will be reduced in identified pockets
- Community-centric climate friendly technologies advocated for by a variety of end users, especially women
- Implimentation on short term and long term courses enabled on climate change and sustainable development for various interest groups
- LAYA in collaboration with Indian network on Ethics and climate change (INECC) and other such groups and networks, nationally, regionally and internationally, to contribute to a community-centric adaptation policy and implimentation

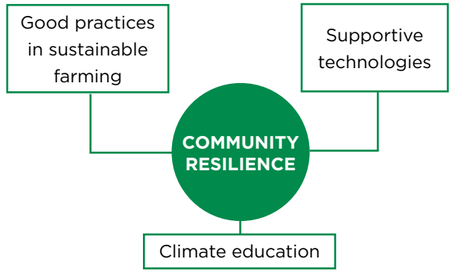
And impact

Reduced vulnerability and increased resilience of marginalised communities. Communities and various stakeholders become empowered to take up relevant adaptation decisions in the context of the Sustainable Development Goals.



Focus of this Case Study

This case study illustrates and analyses the insights gained through interventions which play a vital role towards addressing Climate Change and Sustainable Development, hence building resilience. The effort towards building community resilience hinges on three identified key components as indicated.



LAYA's Approach to Resilience Building

I. GOOD PRACTICES IN SUSTAINABLE FARMING

LAYA's intervention has translated into developing a basket of good practices which, when taken together, works as a pragmatic model towards building community resilience to climate change.

How do we Know What's a Good Practice in Sustainable Farming?

Some of the key indicators that we have adopted are:

- Addresses food and income security
- Low external input, low investment and reasonable returns
- Ensures ecological sustainability
- In keeping with the tribal cultural ethos and traditional knowledge systems
- Easy to adopt
- Farmers feel confident
- Practice continues despite withdrawal of support

In 2009 in one remote Adivasi area, LAYA engaged with 934 Adivasi households towards promoting resilience through farming practices among the Konda Reddy PVTG, from four panchayats and 40 villages of Y. Ramavaram mandal, East Godavari district, Andhra Pradesh. These four panchayats have 48 ward members of which 19 are women. Two of the Sarpanches are also women.

Given our experience in other locations, we promoted 6 agricultural package of practices, which we considered would contribute to community resilience. These included the following practices:

i. **Manure Preparation and Application at the Household Level**
ii. **Mixed Cropping System**
iii. **System of Rice Intensification**
iv. **Soil and Moisture Conservation**
v. **Bio-fencing**
vi. **Homestead Land Development**

The value of each package of practices from our experience was that they contributed to food security, increased income and the improved health of the soil. The assumption was that when these practices were simultaneously adopted by a particular farmer the overall resilience of the family would increase to making food available throughout the year, add to annual income and sustain the fertility of the soil. The farmers were tracked on a sustainability outcome and categorised into A, B and C categories based on adoption of the package of practices. It is important to understand the practices that were promoted and how they could contribute to farmer sustainability.

1. Manure Preparation and Application at Household level

Earlier about 20-30% of households were applying farmyard manure in their fields. Our value addition was to initiate almost all the farmers into manure application demonstrating to them newer and more effective methods of conserving or developing green manure; introducing the 'Nadep'[4] technology of organic composting and vermin compost. Supported by the State Horticultural Mission and ATMA (Agricultural Technology Management Agency) we were able to reach out to 932 farmer households covering an area of 1,654 acres in 4 panchayats.

2. Promotion of Mixed Cropping System

Mixed cropping is the traditional practice of growing two or more crops together on the same piece of land in a crop season. Within the target area of 4 panchayats we noted that the farmers were practicing traditional forms of mixed cropping involving millets, pulses (red gram) and cereals (maize and dry paddy). However, the general productivity of the output from the mixed crops was relatively low and could be enhanced. Hence, after studying the situation we introduced:

- Improved combination of crops by adding nitrogen fixing crops such as cowpea and black gram. The advantage of nitrogen fixing crops is that they have the property of enriching the soil
- Effective utilisation of space by introducing a second cropping system in the late 'Kharif' and early 'Rabi' season
- Improved method of cultivation from broad casting seeds haphazardly to row cultivation which helps in weed control and loosening the soil. This also allows for harvesting in an easy manner and for sowing the second crop

These minor alterations resulted in an increase of yield output by 30% thereby contributing to their food security. In addition, the cultivation of pulses as a second crop generated some additional income.

3. Promotion of System of Rice Intensification (SRI)

SRI is a system of production with a combination of several practices with four main components, viz., soil fertility management, planting method, weed control and water (irrigation) management.
This system necessitates changes in nursery management, time of transplanting, water and weed management. On SRI we worked with 120 farmers in 'pallam' (wet) lands in the 4 identified panchayats. The advantages of using SRI are enormous. For SRI only 2 kgs of seed material is required, as compared to 35-40 kgs per acre in the conventional method of paddy cultivation. This cuts down the cost of seed input considerably.

The labour costs decreased by 50% during transplantation and weeding. Newer methods of organic manure to enhance productivity, and natural biological pest control methods were utilised for increased effectiveness. The overall increase in output was as much as 40%. The challenges related to working with the mindset of the farmers, ensuring critical irrigation at the stage of panicle initiation and grain filling.
Besides SRI is most challenging in rainfed conditions because water access is not in our control. Lack of timely availability of tools such as weeders, which is an external technology, adds to the problem of management of SRI.

[4] Reference: 'ecoursesonline.iasri.res.in/mod/page/view'

However, our efforts sustained 80% of the 120 farmers who had taken up SRI cultivation and they continue to practice this method. Furthermore, approximately 150 farmers in the 4 panchayats who were not part of our target community have adopted some of the practices on their own such as line transplantation with spacing which assures them a 20% enhanced income.

System of Rice Intensification (SRI), Balaraju Reddy, Pathakota, Y. Ramavaram mandal, East Godavari district

'Balaraju Reddy had 3 acres of Pallam (wetland) and 2 acres of Gavurulu (slope) land. Until LAYA came to the area, he and other farmers were dependent on subsidised seeds, urea and Di-ammonium Phosphate for paddy cultivation. He started to experiment SRI in 2 cents of his land in 2010 and increased it to 2.5 acres by 2014. He shifted to organic farming using bio-fertilisers and bio-pesticides (Ghana and Drava Jeevamrutham). Reflecting on paddy crop in SRI, he observes that paddy in his field has taken root and resists weather variations better; organic manuring of fields has improved grain filling, and reduced pests. His crop yields improved too. He did acknowledge that he used half a kilo of urea with the organic fertilisers. Others used higher amount of urea in SRI method, he shared. Balaraju observed that mutual sharing of labour was a common practice in tribal society and with smaller families and seasonal migration of youth, farming households were hiring labour for specific farming activities. While he paid INR 20 per day for locally hired labour, the migrant labourers from Odisha charged INR 50 per day. Apart from SRI, Balaraju cultivated millets, black and red gram, vegetables on his Gavurulu land and earned a small income from his grocery shop. His wife, Lingamma, has a fuel-efficient cook stove and talked about how she cooked two dishes at a time and had more time to do other household chores. Balaraju shared that adoption of SRI method of rice cultivation gave him 90 bags of paddy in comparison to 50 bags of paddy, which he was harvesting earlier. He could sell 20 bags of paddy in the market and earned money.'

Source: LAYA Project Evaluation Report, August 2018, p. 22

4. Soil and Moisture Conservation

Before LAYA's intervention only about 25% of farmers practiced ad hoc measures for soil and moisture conservation through haphazard and unsystematic methods. We brought in new knowledge to control topsoil erosion through the construction of earthen and stone bunds on 'podu' and slope lands interspersed with trenches. This practice was adopted by 802 (85%) farmers covering an extent of 2,956 acres. Besides controlling topsoil erosion this practice increased the moisture retention period and finally resulted in a 20% increase in crop productivity. This was revealed by data generated through crop cutting experiments. Furthermore, in one panchayat, Pathakota, 4 farm ponds were introduced for pisci-culture mainly for local consumption and sale where feasible.

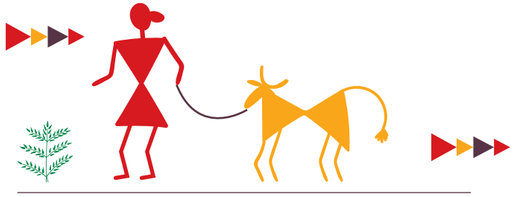
5. Practice of Bio-fencing

This involved the promotion of live fencing with fruit bearing plants such as sapota, lemon, guava, custard apple and other hardy plants like jatropha and bamboo. Earlier only 10-15% farmers undertook dry fencing of bamboo mats, twigs and wood pieces. Others left their lands open to cattle threat and other wild animals. This practice of bio-fencing contributed to their food security and brought in some income. We were able to outreach 637 (68%) of farmers from the target community.

6. Homestead Land Development

Earlier most of the farmers grew maize and few vegetables on their homestead lands, which comprised about 10 cents of land close to their habitation.
We encouraged them to continue this practice but motivated them to also add other crops like turmeric, ginger, tubers (colocacia) and bananas by seeking assistance from the State Horticulture Department and Agriculture Technology Management Agency (ATMA).

This intervention was a thumping success as it scaled up both horizontally and vertically. The seed materials and banana rhizomes developed by the initial 880 farmers were shared with new farmers. About 250 additional farmers adopted this practice on their own. Many innovations are being introduced by the farmers themselves. Some of the farmers increased their land size and further added other agro-forestry species such as broom grass, tamarind, amla, teak and red sandal.



Case Study of Killo Ramdas,
Farmer, Gurthedu panchayat,
Y. Ramavaram mandal,
East Godavari district:

This farmer came under category A of the farmers adopting several good practices in his farm. He used 1 acre and 10 cents for homestead land cultivation. He owns 2.5 acres. He belongs to the Porangi Porja tribe. He is 35 years old and has 6 members in his family (wife and 4 children). His engagement in a multi cropping system in various land categories has yielded him far greater benefits than what he would normally get. Normally from the homestead he would get approximately ₹30,000. However, he was able to earn a net income of ₹70,150 in 2018 as indicated in the table.

S.No	Crop	Extent	Investment	Returns	Net Income
1	Turmeric	0.25	5,000	25,000	20,000
2	Ginger	0.25	5,200	15,600	10,400
3	Chamadumpa (Colocasia)	0.25	3,000	12,500	9,500
4	Brinjal	0.10	1,000	5,600	4,600
5	Chillies	0.25	2,500	10,000	7,500
6	Ridge guord	Fence	250	4,500	4,250
7	Tubers	Borderline	500	6,000	5,500
8	Maize	Intercrop	500	6,000	5,500
9	Alasandalu (Black-eyed beans)	Intercrop	100	3,000	2,900
Total			18,050	88,200	70,150

"I am extremely happy because my food security is assured, and my income has more than doubled."
says Killo Ramdas

At the end of the project we observed that as many as 824 farmers came under category A and hence stood to benefit immensely from the perspective of food and income security. This engagement led to this area being selected under the State's Zero Budget Natural Farming (ZBNF) project in 2017. Most of the farmers that LAYA had worked with got incorporated into this scheme continued their practices and added further value by introducing 'gana, dhrava jeevaamrutam', which was part of the ZBNF implementation plan. Today LAYA has been selected as a facilitating agency by the State Government to introduce ZBNF in 86 hamlets of 4 panchayats covering 2,157 households. The philosophy of encouraging natural farming in ZBNF closely aligns with the practices of resilience that LAYA is promoting.

Results of Project Intervention from 2017-2019

Category	Male	Female	Total
A	718	106	824
B	45	4	49
C	54	7	61
Total	**817**	**117**	**934**

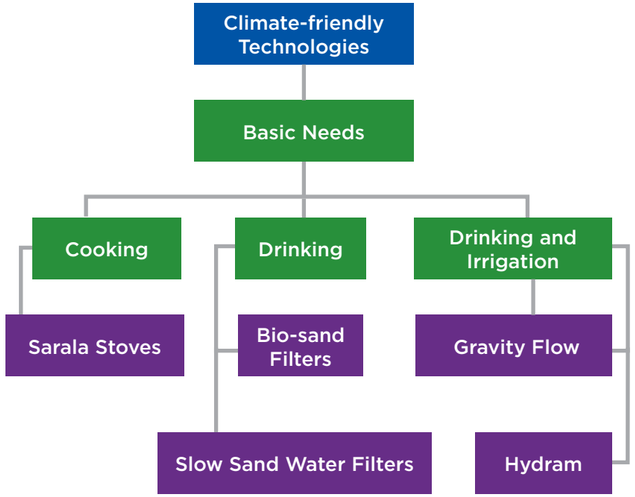
Lessons Learned

Our experience revealed that a mix of sustainable farming practices can contribute to food and income security as well as to improved soil health. However, there are also several lurking threats from external commercial crop investors, who come with very tempting incentives, which could drive farmers into converting their lands to cash crops, thereby risking long term sustainability for short term gains.

For community resilience to be sustained actions need to be taken to meet the multiple needs of basic communities. Apart from nurturing sustainable farming measures, interventions which can add value to the quality of life of the community, enhances their capacity for resilience. In this context we do believe that the role of locally relevant technologies can be path-breaking in contributing to resilience without disturbing the sanctity of the natural environment.

II. LOCALLY RELEVANT CLIMATE-FRIENDLY AND LOW-CARBON TECHNOLOGIES

These technologies refer to a package of decentralised, adapted or locally developed systems, that address basic development needs.
The technologies promoted by LAYA, based on participatory energy needs assessments and subsequent feasibility studies, focused on cooking, clean potable water and irrigation needs.



Although these villages are very remote, they have an abundance of natural sources that can be leveraged to benefit the local communities. At a time when increasing access to modern energy services is seen as a key development priority, as we attempt to achieve the Sustainable Development Goals (SDG) in the context of a changing climate, LAYA believes that contextual and locally relevant approaches to energy and development is needed. The transition to clean energy, community-owned energy systems can support the building of resilient and robust communities.

Value of Improved Cook Stoves in Remote Habitats of Adivasi Communities

LAYA embarked on its journey towards facilitating clean cooking post a feasibility study assisted by Technology Informatics Design Endeavour (TIDE), an expert agency based at Bangalore, which helped in piloting the 'Sarala' fuel-efficient cook stoves in the Adivasi households in Paderu mandal, Visakhapatnam district. We were very much aware that earlier such initiatives by the Government of India, had failed because of being culturally out of tune with the Adivasi way of life.

The energy need assessment that LAYA in collaboration with TIDE conducted highlighted the enormous time and drudgery involved in fuelwood collection by the Adivasi women and young girls. The 'Sarala' model was considered as the ideal cooking device, which would not only be more efficient (cooks faster and requires lesser fuelwood) but reduces indoor air pollution[5] and is culturally not alien.

[5] The 2014 health data from WHO estimates that 4.3 million people die annually from household air pollution caused by cooking with biomass and coal. It is the greatest health risk in the world after high blood pressure, tobacco and alcohol. More people are dying from the incremental, ongoing inhalation of smoke from fires they ignite in their homes than from malaria, tuberculosis and HIV/AIDS combined.

LAYA's Experience with the 'Sarala' Cook Stoves

The location, Paderu is a fairly remote, hilly region where the access to the villages in spite of recent improvements in roads, is challenging with hamlets scattered on hill slopes and valleys. The hills are generally depleted of forest cover except for small clusters of plantations. Collection of firewood for cooking and keeping warm in winter has been a challenge. Adivasi women and children are often seen walking with heavy loads of firewood piles on their heads every day during summers and winters to ensure availability of firewood for their families. The traditional cook stoves have very low levels of thermal efficiency. Also, the indoor pollution generated by the smoke, the inhalation of which has been a threat to the health of the Adivasi women and children in the region.

The introduction of Sarala cook stoves as an improved way of cooking has transformed Adivasi women's lives. It has reduced the drudgery of women and has facilitated a cleaner and healthier indoor kitchen environment. "With time saved in collecting wood, we now have more quality time with our family and friends. Also, we feel much healthier, with less frequent trips to the doctor" say some of the Adivasi women stove users.

More than 11,000 cook stoves have been built across 2 districts: East Godavari and Visakhapatnam. The Adivasi women have benefited from this intervention as it reduces the burden of carrying wood and the kitchens are relatively smoke free, while the technology also facilitates faster and more efficient cooking. Plus, smog-free homes, reduced charring of utensils, apart from reduced burden of collecting firewood and cooking time have all led to effective social and economic impact with better health and well-being of these Adivasi women and children.

Moreover, the overall environment impact is that each stove reduces 1.3 tons of carbon emissions annually due to reduced burning of firewood.

[5] The 2014 health data from WHO estimates that 4.3 million people die annually from household air pollution caused by cooking with biomass and coal. It is the greatest health risk in the world after high blood pressure, tobacco and alcohol. More people are dying from the incremental, ongoing inhalation of smoke from fires they ignite in their homes than from malaria, tuberculosis and HIV/AIDS combined.

A Brief Testimony

"My name is Geetha. Four years ago, before I received the Sarala cook stove, I used the traditional stove. At that time, I faced several issues with the amount of smoke coming from the stove. It was especially a challenge to cook while holding my infant baby. Also, I used to spend more time collecting firewood as the stove needed more wood, along with the wood pieces needing to be larger and heavier. In those days and my children and I walked almost 4 hours a day to ensure that we had enough firewood throughout the rainy season."

Gemmali Geetha, Kunthurla village, Hukumpeta mandal, Visakhapatnam district.

"After we received the Sarala cook stove, my life has changed. There is almost no smoke in the kitchen. My vessels have much less soot on them. I can get much lighter headloads from the forest. Since that kind of wood can be got from nearby fields, I spend much less time in collecting firewood. Now I spend that time with my children, family and friends. Also, I have more time to collect non-timber forest produce. I also realise that since I got my improved cook stove, I have been keeping better health, with less frequent trips to the doctor. I am very happy with my new Sarala cook stove; it has made my life better and healthier."

Benefits of Improved Cook Stoves

1. The Sarala stove has a 25% increased thermal efficiency against the traditional cook stoves
2. It reduces the drudgery of women by reducing the time and need to travel long distances to collect firewood
3. It improves women's and children's overall health situation by reducing indoor air pollution significantly
4. It reduces cooking time: the 'Sarala' cook stove transmits heat more efficiently as compared to traditional stoves
5. There is much less effort formation on vessels thereby reducing the of women in washing utensils

Like Geetha many have benefited greatly from the new efficient cook stoves. However, there are several women in similar contexts, who continue to experience the drudgery of fetching heavy loads of firewood and kitchens filled with smoke.

Other Testimonies

"One change is that the firewood size has decreased, so we travel less distance to collect wood because the type of fuel that we collect can be smaller more like twigs and things, which are much easier to find near my village. Now I have more time for myself and with my family." (Female Improved Cook Stove User)

"Now we have much extra time to use as we choose, whether MGNREGS, for agriculture, or whatever, it's our time." (Female Improved Cook Stove User)

"At that time, we used to spend up to 12 hours to collect wood. We had to walk long distances, now this has changed. We spend only 1 hour because we are collecting fuel from our own fields." (Female Improved Cook Stove User)

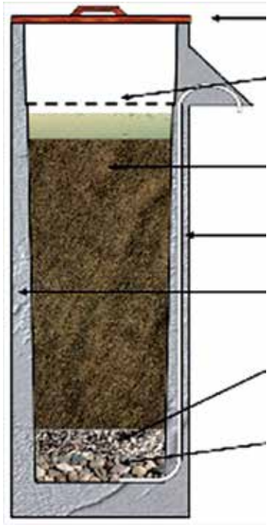
"In our life, cooking food is a major activity. Because this is much faster, we are spending more time with our families and in the village, but cooking is our primary work, so we only go out to do other things when this is finished." (Female Improved Cook Stove User)

It is LAYA's endeavour to involve, inspire and educate other stakeholders to facilitate communities to make the shift to similar or better technologies that will improve lives of women in these regions.

Clean Drinking Water Enhances Quality of Life

LAYA's quest for providing clean drinking water solutions that are low cost with little maintenance, long-term and climate-friendly became a reality through an initial study undertaken by a water expert from the Netherlands, who volunteered his services to come up with a feasibility report of an appropriate technology suitable for Adivasi communities in remote areas. The suggested model was a simple technology by way of Bio-sand Water Filters (BSFs).

The BSF is an adaptation of the traditional slow sand filter suitable for household use. The filter container can be made of concrete locally and is filled with layers of specially selected and prepared sand and gravel. Pathogens and suspended solids are removed through a combination of biological and physical processes that take place in the bio-layer and within the sand layer. This is a one-time investment and there are no on-going costs and negligible replaceable parts. The filter is durable and robust and fabricated from local materials and can be easily fitted into the household. The filter provides safe drinking water, which otherwise is achieved through boiling water on the cook stove using fuelwood.



Lid - Tight fitting prevents contamination and unwanted pests

Diffuser - Prevents disturbing the filtrations and layer and protects the biolayer when water is poured into the filter

Filtration Sand Layer - Removes pathogens and suspended solids

Outlet Tube - Required to conduct water from the base to the outside of the filter

Filter Body - Holds the sand and gravel layers.

Separating Gravel Layer - Supports the filtration sand and prevents it from going into the drainage layer and outlet tube

Drainage Gravel Layer - Supports the separating gravel layer and helps water to flow into the outlet tube

Subsequently, an expert agency, based in Canada, Center for Affordable Water and Sanitation Technology (CAWST) served as technical advisor to train one of our team members to implement the BSF technology in the local area. LAYA has so far piloted 250 BSFs benefitting individual households in Visakhapatnam and East Godavari districts.

This is what the field study expert from CAWST reported on the use of the bio-sand water filters constructed by LAYA, “The bio-sand water filter users are very happy with the quality of water produced and all of them mentioned that their health improved after they started using BSFs”.

Improved Quality of Life Due to Access to Clean Drinking Water - the Story of Poloraju Srilakshmi

Poloraju Srilaxmi is resides in an interior village, M. Bheemavaram, Dakodu panchayat, Addateegala mandal, East Godavari district. She belongs to the Konda Reddy tribe, a PVTG. She depends on agriculture, collection of non-timber forest produce and MGNREGS for her day to day survival. Her annual income as per her BPL ration card is ₹30,000 per annum. She is married and has one child.

There are 6 hand bore wells in her village, of which 3 are not functioning. Of the three bore wells that are in working condition, there is high iron content emanating strong iron taste and smell. Besides the water is yellowish in colour. Furthermore, there is an overhead tank in the village with a capacity of 5,000 litres. This water is also red in colour and has a foul smell. Hence the community uses all the existing sources of water for purposes other than drinking. For potable water she depends on a stream, which is 1km away from the village, as the water tastes better. Unfortunately, this stream is also infected by faecal pathogens due to open defecation. Besides, the stream water tends to get muddy in the rainy season. Srilaxmi complained that her family members frequently fell ill. They visited Registered Medical Practitioner (RMP) clinics at least twice in a month and she spent on an average ₹300 per trip.

We further learnt that due to unsafe drinking water several of the community members were affected by waterborne diseases such as jaundice, diarrhea and typhoid. Hence, we sensitised the community on the possible problems related to unsafe drinking water and explained the value of the BSFs.

Srilaxmi was the first person who agreed to install the BSF in her house and even motivated other households to do likewise. She regularly uses the BSF. Interestingly no waterborne diseases have been experienced in her family as of April 2018. She says that her family has reduced visits to the RMP clinics. As a result, last year, she saved approximately ₹2,400.

Importance of a Technology Mix for Access to Water for Domestic Needs and for Irrigation

LAYA has been promoting a unique mix of climate-friendly technologies to improve access for domestic needs, village based clean water solutions and irrigation in a way that does not impinge on reducing groundwater. The blend of technologies has been effectively adapted to suit diverse contexts and locations. This intervention becomes very relevant particularly in water-scarce rain-fed areas especially where climate change is impacting rainfall patterns.

Gravity Flow and Hydram Technologies

These technologies work best in hilly, rural areas where Adivasi women, particularly have to carry water for long distances over steep terrain. The water used for the 'gravity flow' is from a natural spring or perennial source of flowing water which is tanked and then fed into taps in the heart of the community, using the earth's gravity. This means that there is no need for expensive pumps thereby reducing the requirement of overall costs.

The infrastructure of gravity flow systems consist of a running spring, a main pipeline including a pipe bridge, an elevated reservoir tank and a distribution network that leads to a central location in a hamlet or village.

Hydram Unit:
Muvvalavariveedhi village

Gravity Flow System: Allurigedda village

The hydram technology is ideal where there is a need to uplift water up to the height of a residential habitat. Its basic ingredient is a hydraulic ram pump, an automatic pumping device, which uses a large flow of water falling through a lower head, to lift a small flow of water through a higher head. In simple words, this renewable energy technology uses power available from flowing water to lift a certain volume of water to a greater height where it is required. The moving parts of the hydram are only two valves; therefore, it is mechanically very simple. This gives high reliability, low operating costs, minimal maintenance and a long operation life to the system.

After a feasibility study and tests to measure the water pressure and other details, LAYA initiated the first gravity scheme flow in 2010 in the tiny hamlet of Munagalapudi, Y. Ramavaram mandal, East Godavari district and later in 2013 we installed the first hydram in Sesharayi village, Y. Ramavaram mandal, East Godavari district. Subsequently, a few more such systems were erected in strategic locations for demonstrative purposes. This resulted in the Rural Water Supply Department approaching LAYA to facilitate both gravity flow and hydram systems in 10 more suitable sites.

The advantages of gravity flow systems and hydrams in the Adivasi context are plenty. This intervention essentially allows doorstep water access and reduces labour and time spent for water collection. These systems have proved to be community centric as well as socially inclusive. Besides, in some cases the systems have enabled to provide irrigation at critical stages and have revived previously fallow lands that lacked irrigation especially during dry periods. The technology used entails almost zero-emission.

Today, approximately 600 Adivasi households benefit by access to water from these schemes in the East Godavari, Visakhapatnam and Vizianagaram districts. In addition, thanks to these systems about 80 acres of land is subject to irrigation. Some of the families have shown an annual increase of ₹35,000 per acre from growing cashew now. However, these systems most importantly have allowed for domestic water access at the doorstep, thus reducing the drudgery and time spent in collecting water from far away and steep locations. According to several studies, about 11,000 - 20,000 women hours per year are spent only in water collection from nearby springs and streams.

This is what some of the local women have to say about these technologies:

Pulli Venkatalaxmi from Allurigedda village,
Y. Ramavaram mandal, East Godavari district, says:

"Access to water from the gravity water flow system reduced time for water collection. I used to spend at least 2 hours every day to collect water for my family of 6. We now have 11 taps which provide 24x7 water access in the village through the gravity flow system. Water availability has also encouraged good sanitation practices leading to improved health."

Lalita Priya, also from Gangavada village stresses on the value of proximity of water availability:

"The value of the hydram in our area is found most in enabling easier and quicker access to water source, especially reducing the drudgery in water collection from the distant stream. Irrigation is second priority. Getting water access within our premises is a topmost priority!"

Rukmini, a young mother from Gangavada,
Y. Ramavaram mandal, East Godavari district, says:

"We now have water reaching our village. It has saved our time spent in collecting water. The women of the village had to walk great distances daily just to fetch water. Some of us even had to negotiate tough terrain to reach either natural springs or perennial streams."

Slow Sand Water Filter

The Slow Sand Water Filter (SSWF) has been introduced recently, improvising the technology of the BSF to suit village access. Spring water quality may not meet drinking water standards at all times and can be particularly impaired after heavy rainfall. LAYA has set up three such systems in the East Godavari and Visakhapatnam districts. The hydram or gravity flow technology supplies the water to the SSWF. The tanks can hold 1,000 litres of filtered water for the community. The total number of households that benefit from this system is about 88 households.

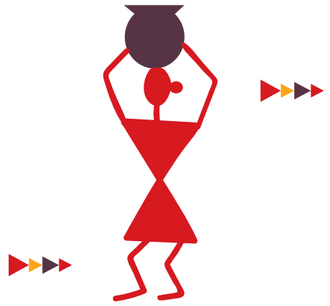
Introduction of the slow sand filter has created access to clean drinking water available at a distance of about 200 metres from the houses. Adivasi women save 2-4 hours of their time every day. The proximity of the tank has reduced the drudgery of women as they do not have to carry headloads of water for long distances. The system is community controlled and managed, where local youth are trained to maintain it. The villagers claim that the availability of clean drinking water in the tanks has reduced the number of ailments among the households.

Gangavada village

Sadala Somalamma, 39 years, from Gangavada village, Y. Ramavaram mandal, testifies:

"My daughter and I would collect water from the stream at least 3-4 times during the day. We no longer have to do that. The water is now available ten steps away from my home. The food also tastes 'good' using the water from the SSWF. Good, as in clean, tasty and odourless!"

In short, the above initiatives are significant because as they do not require electricity, have minimum emissions, require minimum maintenance, while also improving agricultural income and employing the local youth in setting up and maintaining the technologies. The communities are directly involved from the initial stage of the feasibility studies as well as in the installation of the technologies. They have contributed labour in kind by helping in carrying out civil works for installation of the systems. This has enhanced community ownership. The success of the pilot initiative has motivated sarpanches to promote these technologies in their panchayats as well.



What makes this technology feasible?

- Cost-effectiveness
- Congruent with community needs
- Maintenance strategy in place

What are the challenges involved?

- Counterproductive Government intervention
- Scale factor
- Community conflicts

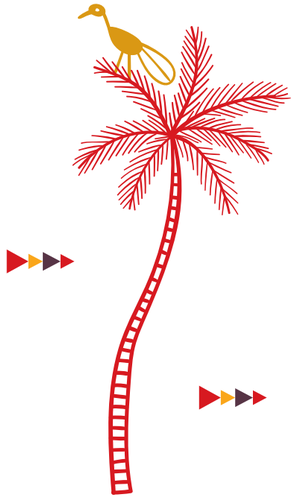
Yet, the challenges are also many. Management, operation and maintenance of gravity flow schemes requires appropriate knowledge and skills of identified community representatives and those responsible for its maintenance. Capacity-building activities must be an integral part of the technology implementation process. Besides, additional challenges could emanate from within the community or due to external intervention. For example, in one village community conflicts have resulted in a breakdown in the maintenance system, in another the Government has introduced an overhead tank with taps for community access, which has made the hydram superfluous, except when the electricity supply fails. The ultimate challenges from a long-term perspective revolve around economies of scale and policy acceptance and promotion of community owned and managed appropriate technology systems.

In the final analysis, we do believe that development needs can be met through a strategic mix and use of low carbon technologies and that relevant and context-based technologies can make a difference to people's lives and well-being.

III. CLIMATE CHANGE EDUCATION

Building community resilience in a climate changing environment implies revisiting assumptions of understanding changing weather behaviour, application of newer farming methodologies technology options contextualised within changing grassroots realities.

There is little doubt that climatic variations present an additional challenge as it increases the risk of managing natural resources and addressing issues of agricultural productivity, on which many Adivasi communities depend. As owners of their ancestral domain, there is a huge scope to maximise benefits such that sustainable farming could become not only a source of survival but also an enterprise in the long-run.



This perspective thus entails a learning environment, where diverse target groups are enabled to understand the environment changes, cope with the changes and over time build increasing resilience as a community. Hence, rather than being pushed out of their environment, the vision is to contribute to transforming the environment with which communities have a symbiotic relationship.

Our strategy hence has been to engage with different target groups and promote learning tools to engage with a climate changing environment. In this context, we have so far engaged with children in Ashram schools on the agenda of environment, climate & sustainable development and with young farmers with a one-year course on sustainable farming practices.

Initiatives at the School Level with 3 Ashram Schools with Students Combined from 6th and 7th classes

These schools are situated in the same location, where we have engaged in sustainable agriculture practices with farmer households. After interacting with the headmasters of the schools, we conducted sessions within the school premises with students and teachers linked to 6th and 7th classes. We conducted 4 sessions in each school on climate change concepts and presented possible actions that could be adopted at the school level related to energy audit of the ashram schools, water saving practices, fuelwood efficiency in cook stoves, plantation activities, waste disposal etc.

Interestingly, various actions were adopted by the school authorities based on their interest levels. Incandescent bulbs were replaced with LED, more efficient fans replaced old fans, plantation activity of fruit bearing trees and flowers were taken up in the school premises involving children and teachers, rainwater harvesting was introduced by establishing a soak pit besides the bore well and unused solar panels were repaired. In one of the panchayats the sarpanch who had earlier benefitted from LAYA's literacy initiatives was also very encouraging.

Climate Change Education Course for High School (9th Class) Adivasi Students

The objective of this course was to introduce climate change concepts and encourage a sense of activism on climate change issues among students. This course comprised of 8 sessions, covered in 4 modules. The curriculum comprised key concepts related to the science, including the impacts of climate change in a forest ecosystem, the man-made consequences of climate change, the ethical issues of greed versus need, the importance of local actions to cope and address the issue at the individual, school and community level. The students were involved in relevant activities in the schools: planting saplings, less usage of plastic, and protection of natural resources. This course has so far been introduced in 11 schools as a part of their subject on 'environment and education'.

LAYA as an active member of the Indian Network on Ethics and Climate Change (INECC) is engaged with **multiple spaces for learning** integrated within the context of ensuring community resilience in a climate changing scenario:

Formal school/college: Dialogue with parents and children, classes for students and workshops for teachers thus strengthening links between schools/ colleges and communities.

Structured non-formal education spaces: Workshops for members of trade unions, local Governance personnel, bureaucrats, political parties, media personnel etc.

Non-structured community-based education spaces: Interaction with local communities to value their community wisdom and to enable them to withstand counterproductive forces from mainstream vested interests.

Focus on girls and women: Educating girls and women on climate vulnerabilities is one of the best ways of ensuring that communities are better able to adapt and thus be less vulnerable to extreme weather events and climate change.

Policy focused education spaces: Linking with the UN Sustainable Development Goals (SDGs), citizen movements, using the urgency of climate action as a rallying call, to demand stronger Government action and corporate regulation; to divest from fossil fuel industries and instead invest in sustainable and renewable alternatives. Policymakers have not fully engaged in the climate change education process, even though existing climate change frameworks are in place that could utilise education as a mitigation and adaptation strategy.

Conclusion

Building 'community resilience' in a climate changing environment in the Adivasi context is fraught with constraints and potentials. Building 'community resilience' in the true sense of the word implies touching various dimensions of life of Adivasi societies: food security, income enhancement, access to quality education and health, access to improved infrastructure etc. while safeguarding the cultural wisdom and ethos. This is a huge, ongoing and lifetime challenge for those of us, who have been engaged in grassroots action in the Adivasi areas.

However, from a practical perspective it is important to partialise the problem situation and address some aspects of the most urgent needs at hand. Hence, this 'change story' has been focused on 3 aspects of resilience building in such communities: sustainable farming towards food and income security, decentralised technology options that enhances their quality of life, and inculcation of learning processes for development of capacities and creating opportunities for informed choices on matters related to well-being.

In the final analysis, we do believe that change is a continuous process and communities are influenced by multiple forces internal and external. The climate changing reality is an additional external factor that has added to the vulnerability of Adivasi communities today, and hence becomes a central concern in our field level engagement. This study focuses on responses and efforts made, results experienced and challenges faced in the course of LAYA's engagement with Adivasi communities.

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