Health and Energy Facilities at Pathardi Village, Mokhada

Submitted to-
GKN Sinter Metals Pvt. Ltd.
Pimpri-Chinchwad, Pimpri

Team:

Dr. Anjali Parasnis	Project Directo
Ms. Swati Tomar	Principle Investigator (PI)
Ms. Bhargavi Thorve	Co-PI
Mr. Ajay Kr. Chaubey	Team Member
Ms. Roshni George	Team Member
Mr. Sushant Bornak	Team Member

For more information

Ms. Roshni George

T E R I **Tel**. 27580021

318, Raheja Arcade **E-mail:** roshni.george@teri.res.in

Sector-11, CBD Belapur **Fax:** 27580022

Navi Mumbai – 400614 **Web:** www.teriin.org

India India: +91 Mumbai (0)22

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Executive Summary

TERI along with GKN Sinter Metals Pvt. Ltd. has been implementing various initiatives, since 2014, in Pathardi in Mokhada block of Palghar to transform it into a sustainable village model. Simple sustainable solutions have been devised to address the issues directly or indirectly pertaining to the nutritional status of the village, while focusing on the Nutrition-Water–Energy-Livelihood nexus. Figure 1 enlists various initiatives undertaken to ensure sustainable utilization of natural resources.

The initiatives undertaken and successfully implemented include decentralized domestic lighting, promotion and capacity building to cultivate nutritious vegetables in household backyard, health check-up camps to monitor nutritional status of the target groups, solutions for water management, and so on (Annexure 1.)

The focus of TERI's interventions has always been to improve the overall health status of the villagers while improving access to energy without causing stress to the available natural resources, improving the utilization efficiency of available energy. TERI devised strategies to increase energy efficiency, provide fruit and energy plantations, while continuing to improve water accessibility and prevailing nutritional status.

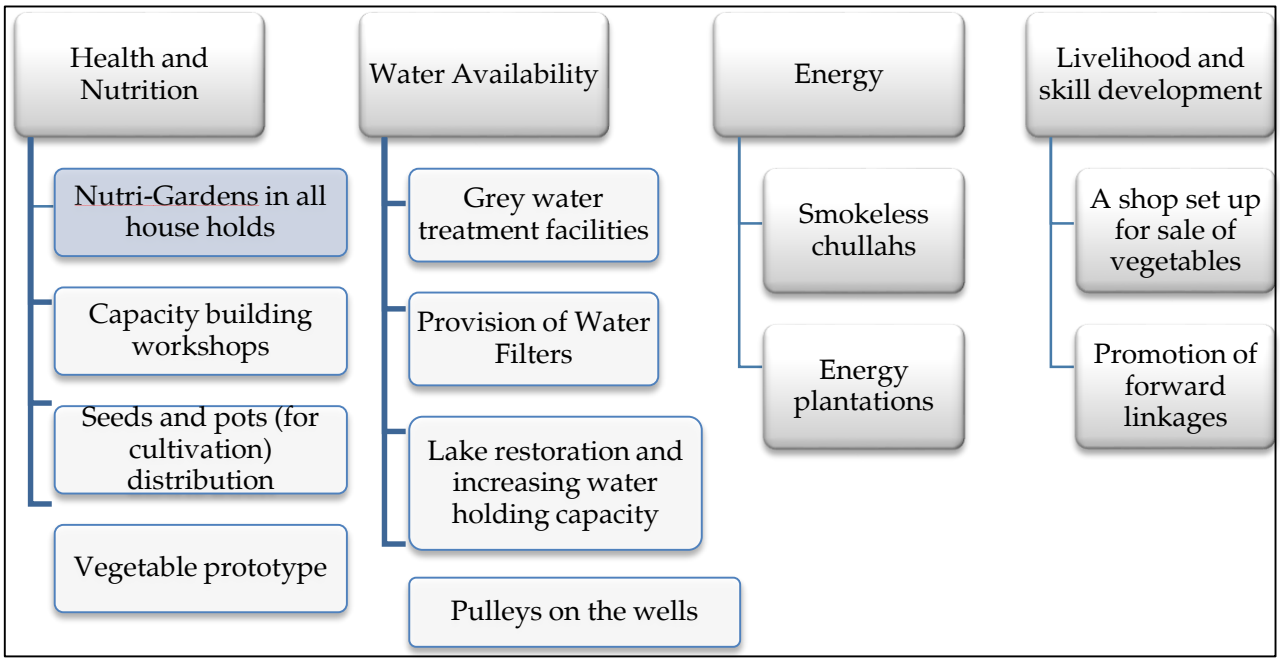


Figure No. 1: Interventions carried out by TERI in the current phase

The interventions involved planting and developing fruit orchards, nutri (vegetable) gardens as well as short term interventions like providing health supplements. The highlights of the interventions are the following:

- More than 600 fruit trees of Custard apple, Mango, Lemon, Guava, Chikoo, Jack fruit and so on were planted in May 2016, in the land (back yards, fields and community lands) owned by the villagers with more than 55% survival rate in July 2017
- All the 57 households in Pathardi village have now established and maintained a nutri-garden in their back yard
- 27 households out of 57 have been installed with grey water treatment facilities enabling them water availability for maintaining their nutri-gardens perennially.
- Updates regarding the health status of the women and children were taken at regular intervals, with the help of the anganwadi sevika and checkup camps, depending on which appropriate measures were taken
- All 57 households provided with energy efficient cook stoves
- Energy plants (including Bamboo, Acacia and Neem) distributed to the villagers

The whole provision of fruit saplings would also ensure the added benefits of reducing soil erosion and improving soil filtration in the long run, while providing nutritional benefits and a livelihood through sale of surplus fruits produced. The initiatives such as nutri-gardens, grey water treatment systems, water filters, smokeless stoves, fruit plantation would play a direct and indirect role in improving the overall health status of the villagers and especially women and children.

Objectives: Phase III

In the current phase, TERI enlisted objectives to emphasize on the following priority areas.

1. Energy Access, 2. Health and Nutrition and 3. Livelihood and skill development

Energy access

- To carry out 'energy plantations' to reduce the dependence on forests for fuel wood
- To provide energy efficient cook-stoves which are fuel efficient and can improve the living conditions of women

Health and nutrition

- To carry out fruit tree distribution to ensure sustainable supply of nutritious food in the long run.
- To establish a nutri-garden in all the households of Pathardi
- To create a vegetable garden prototype to ensure cultivation of vegetables in a limited available space
- To regularly monitor the health status of the women and children in the village
- To increase access to clean drinking water by repairing the existing wells and providing pulleys on 3 wells for convenience and ease of usage
- To install a water purifier at the school to provide clean drinking water to school children.

- To establish a riparian zone around the existing village pond to increase water retention.
- To install grey-water treatment systems at 19 more households that have suitably constructed bathrooms.

Livelihood and skill development

- To distribute mogra saplings to villagers having small land holdings. The sale of flowers is expected to provide an additional source of income.
- Establishment of a vegetable shop in the village to promote forward and backward linkages for the sale of the cultivated vegetables.

Project activities

Energy Access

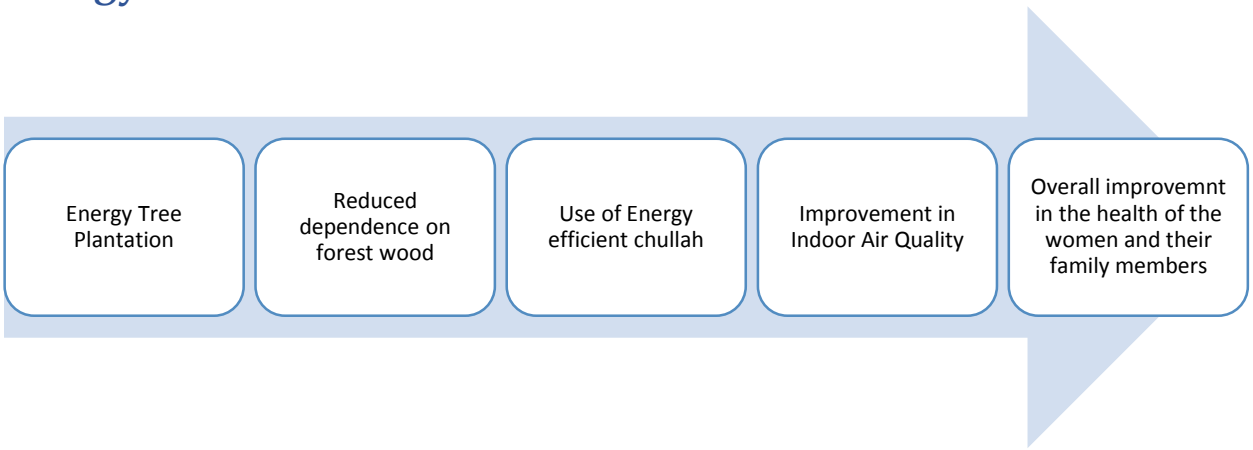


Figure No. 2: Significance of energy plantation

A. Energy plantations: A Sustainable source of fuel wood

In most developing countries, solid biomass fuels serves as a major energy source in rural households. The villagers in Pathardi are no exception. They have a high dependence on firewood for their energy requirements. When there is very little firewood available in the village and surrounding areas, they are left with no other option but to obtain firewood from the forest. Helping the villagers sustainably source fuel was thus a much needed intervention and was carried out in two steps.

1. Assessing the requirement of fuel wood.

Annual (300 days) minimal fuel wood requirement in Pathardi village (considered after discounting the usage of other biomass like cow-dung and gas cylinders) was estimated to be approximately 171 tonnes as given below in Table No. 1.

Table No. 1: Estimate of annual fuelwood requirement

Fuel wood requirement per household per meal*	**Approx. 4-5 kg**
Total daily requirement per household (2 meals cooked on average)	**10 kg**
Total requirement for 57 households per day (for cooking 2 meals)	**570 kg**
Annual requirement (300 days)= 570 kg X 300	**171000 kg**

**Number varies depending on the number of members in the family and amount of food being cooked, hence approx. number taken using average.*

2. **Selection, distribution and plantation of saplings**.

Thus, energy tree saplings such as Bamboo and *Acacia sp.* were selected for plantation on barren lands. These plants were chosen based on their energy output and the economic benefits that the villagers can sustainably extract in the long run while helping meet their energy requirements without causing any excess stress to the surrounding eco-system.

Picture 1: Acacia and Bamboo saplings planted in the village

A total of 300 teak, 80 acacia and 350 (200 in 2016 and the rest in 2017) bamboo saplings were distributed to the villagers in the year (2016-2017) (Annexure 2). Care was taken to ensure that the saplings distributed were 1-2 years old and slightly mature so as to ensure the best possible survival rate. In order to harvest the required amount of fire wood, only the side branches need to be cut off, without harming the rest of the tree. The trees would thus be long term providers of biomass to partially satisfy Pathardi's energy requirements.

Most bamboo species produce mature fiber in 3 years, sooner than any tree species and are normally ready to be harvested in 3 to 5 years[1]. The annual yield in tonnes/ ha depends on the environment as well as the species. It is generally 5-12 tons/ ha from plantations. Plants grown per acre (0.405 ha) is normally 870, hence 2.33- 5.59 kg of biomass can be obtained from a single plant sustainably. It is estimated that almost 25% of the biomass in the tropics and 20% in the subtropics, come from bamboo.

Bamboo can easily grow on degraded land and can also adapt to climatic variations, along with acting as a carbon sink and helping reduce the greenhouse effect. It can also be an extremely important source of income in rural areas. Handicrafts and furniture made from bamboo, too, can be a highly profitable livelihood option.

Table No. 2: Estimated Bamboo yield 2-

Year	**5th year**	**6th year**	**7th year**	**8th year**	**9th year onwards**
No. of culms per clump	5	7	9	10	10
No. of culm per acre	900	1260	1620	1800	1800
Wt. in Kg / Culm	15	20	25	30	30
Yield in ton	13.5	25.2	40.5	54	54

[1] http://keralaagriculture.gov.in/htmle/bankableagriprojects/fw/Bamboo.htm
[2] http://www.growmorebiotech.com/bamboo_economics.htm

Other than their obvious significance for environmental and economic reasons, they can also help in nutritional security. Tender bamboo shoots are edible and are even considered a delicacy in several parts of the country. Bamboo shoots contain high amount of proteins, amino acids, carbohydrates, several minerals, and vitamins; freshly collected bamboo shoots also have a good amount of thiamine, niacin, vitamin A, vitamin B6, and vitamin E.[3]

Table No. 3: Estimated acacia and bamboo yield

Biomass per tree (culm for bamboo) in kg.		**No of trees distributed**	**Total expected yield (after 4 years) in Kg**
Acacia (after 4 years)	278	80	22240
Bamboo (after 5 years)	15	350	5250
			27,490

Acacia trees have been known to provide one of the highest rates of return in terms of wood extraction. It is also known for its fast growing properties. Therefore, it is considered one of the best species for biomass plantations and is extensively cultivated for energy purposes in India and around the world. Acacia species can provide around 50 tonnes per ha in 4 years. An average of 180 trees can grow per hectare[4], thus one acacia tree can yield around 278 kg of biomass in 4 years.

Therefore, annual fuel wood requirement will be fulfilled partially (up to 20%) from the energy plantations carried out in the year 2016-17 along with fuel wood from the remaining distributed saplings.

B. Energy Efficient Smokeless Cookstoves (Chulhas)

TERI distributed energy efficient cookstoves (chulhas) to all the 57 households in Pathardi. The improved chulhas consume 30% less fire wood and emit less smoke as compared to the traditional ones. A demonstration workshop was conducted to familiarize the villagers with the benefits of using the improved cook stove and its advantages (listed below) over the traditional stove, working, cleaning mechanism and so on.

The use of the energy efficient chulhas would lead to the following advantages:

i. Improvement in the health of the women using the cookstoves and their family members by curbing the long term detrimental impacts of the smokeless chulhas (breathing problems, itching, and watering of the eyes, and so on)
ii. Improvement in the Indoor Air quality
iii. Avoiding wood wastage due to the high energy requirement in traditional cook stoves

[3] https://www.hindawi.com/journals/isrn/2014/679073/
[4] http://www.fao.org/docrep/005/y7209e/y7209e08.htm

Picture No. 1: (Left) Mr. Hemant Nighojkar, MD, GKN Sinter Metals Pvt. Ltd. distributing the energy efficient stove in Pathardi; (Right) a lady using the cook-stoves after the distribution

Use of biomass is the main reason for household air pollution (HAP) in rural India (Smith, 2000). According to the World Health Organization and World Bank reports, the premature deaths of around 2 million people worldwide can be directly linked to HAP caused by burning of solid biomass fuels such as wood, animal dung and crop residue in traditional cook-stoves (WHO, 2006; World Bank, 2011). A study on global burden of disease shows that 7% of the global disability-adjusted life (DALY) years can be attributed to HAP (Lim et al., 2012). The health, environmental and economic concerns due to biomass burning led to the conception of a variety of better stove designs.

Impact

The cook-stoves provided ensure efficient cooking with minimal smoke generation and no adverse effects on health. It also did not produce any soot. Being energy efficient, the quantity of wood required for it was less as compared to the traditional cook-stoves. The women using the new cook-stoves observed a marked difference in their health and reduction in the quantity of wood required decreasing the amount of wood to be collected.

Pollutants emitted during the incomplete combustion in traditional cook stoves include some major climate pollutants such as black carbon. They emanate a large amount of soot and smoke that is harmful for human health with adverse impacts in the long run. The women cooking food using these cook-stoves are the most affected with inhalation of this smoke causing itchiness in the throat, irritation in the eyes, headaches, and so on. The soot leaves a grey or black coating on the walls and sometimes even clothes. The long-term impacts of using the smokeless cook-stoves include chest and lung ailments.

Study on Impact of the smokeless stoves on indoor Air quality

A study was carried out on IAQ (Indoor air quality) monitoring conducted within the households (HHs) of the energy efficient cook stove beneficiaries. The aim was to assess the improvement in indoor air quality with the introduction of improved cook stoves as a replacement to the traditional mud cook stove commonly used in the area.

Study design

A cross-sectional study design was used wherein IAQ monitoring was conducted during cooking hours in six households using the improved cook stove (ICS), five HHs using the traditional mud cook stove (TCS) and three HHs using LPG for cooking.

Sampling locations

The sampling was conducted in the kitchens where the PM monitoring instrument was installed at a distance of ~ 100 cm away from the cook stove chamber and a height of ~100 cm from the floor, which closely represented the breathing zone of the person involved in the cooking activity.

Picture No. 2: Placement of PM monitoring instrument

Result

The study showed that the use of energy efficient chullahs improved the indoor air quality to a great extent with reduced smoke emission.

- The mean cooking time concentration in HHs using ICS was found to be 445 ± 40 µg/m3 which was ~28% lower than the mean concentration (619±75 µg/m3) measured in HHs using traditional cook stoves
- Compared to TCS the reduction in mean cooking time concentration of PM2.5 in LPG using HHs was ~63%.

Table No. 4: Summary of mean cooking time PM2.5 (µg/m3) concentrations in the selected HHs

HH	ICS	LPG	TCS
1	413.5	262.1	645.8
2	405.8	172.0	614.4
3	456.0	247.9	697.0
4	426.5	-	496.3
5	516.0	-	642.8
6	451.9	-	-
Mean	**444.9**	**227.3 (for 3 households)**	**619.2 (for 5 households)**
Stdev	**40.2**	**48.4**	**74.9**

Source: TERI

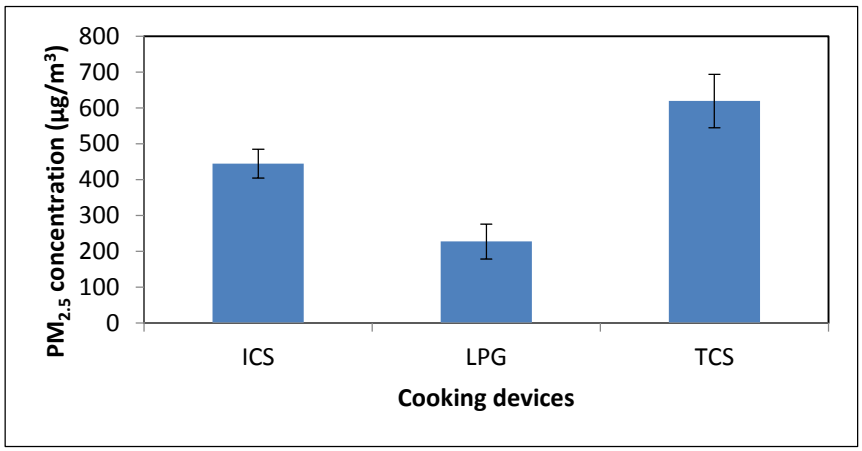


Figure No. 3: Graph showing mean cooking time PM2.5 (µg/m3) concentrations in ICS, LPG and TCS using HHs

The improved cook-stoves ensured efficient cooking with minimal smoke generation and no adverse effects on health. They also did not produce any smoot. Being energy efficient, the quantity of wood required for it was much less as compared to the traditional cook-stoves. The women using the cook-stoves observed a marked difference in their health after they began using the energy efficient cook-stoves. The decrease in the quantity of wood required also reduced the need to constantly keep looking for wood that could be collected and carried home.

Health and Nutrition

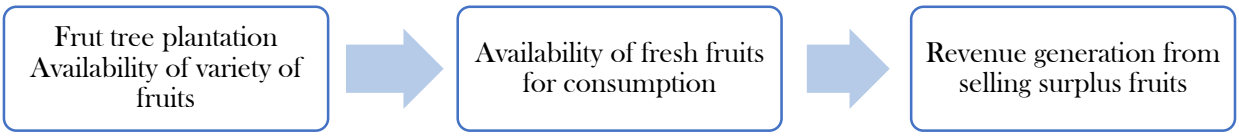
Various initiatives undertaken in the previous phases of the project to improve the health status of the villagers in Pathardi, such as medical check-ups and distribution of nutritional supplements based on the results for women and children, promotion and establishment of nutri-gardens to enable vegetable cultivation, and so on, were continued in the third phase along with a few additional activities planned to increase the impact and ensure long term health and nutritional benefits to the villagers.

A. Orchard Plantation

A total of 654 fruit tree saplings of sapota (chickoo), mango, cashew-nut, jackfruit, lemon and custard apple were distributed to the villagers to promote the consumption of these fruits (Annexure 2).

According to WHO (World Health Organization) reports, approximately 1.7 million (2.8%) deaths worldwide are attributable to low fruit and vegetable consumption, also low fruit and vegetable intake is among the top 10 selected risk factors for global mortality[5].

The saplings provided would start flowering and fruiting in the next 2-4 years. The main objective of promoting fruit sapling cultivation was to ensure a sustainable supply of fruits in the future and promote their consumption.



Due to the extreme and harsh weather conditions in the area and the shortage of water to water the saplings, some of the saplings did not survive and so a 100% survival rate could not be achieved.

Nevertheless, the ones that have survived the first year after planting are sturdy enough to grow into robust and resilient trees. Out of the total 654 trees distributed and planted in the fields and community lands around 334 trees survived after the summer season (the harshest season of the region) providing a 51 per cent survival rate.

Picture No. 3: Distribution of fruit tree saplings in Pathardi village

[5] http://www.who.int/dietphysicalactivity/fruit/en/index2.html

Picture No. 4: Plantation of Mango and Lemon sapling near the fields and hill slopes

Picture No. 5: Chickoo plantation on a farm (left); mango plants (right)

B. Perennial Nutri-Gardens

Seeds of a variety of vegetables were distributed for the villagers at the onset of monsoon. The villagers with less or no area available to create kitchen gardens were provided with pots and encouraged to grow vegetables in these pots.

Nutri-gardens or kitchen gardens can play an important role in providing vegetables during the post- monsoon period at the household level. TERI distributed seeds for a variety of vegetables with an objective to bring diversity into the diet of the villagers (Pictures 3 & 4). Tomato, capsicum, cluster beans, french beans, ridge gourd, okra and bitter gourd were some of the vegetables that the villagers were encouraged to cultivate in their backyard. Also, if and when there is a surplus of produce, the villagers could sell or trade for other goods in the market through a traditional barter system.

Picture No. 6: Vegetable seeds distributed to every household (left); Distribution of pots to every household for vegetable cultivation to combat lack of land of cultivation (right)

Impact

With TERI's help, the villagers, planted several vegetable plants in their backyard, planting vegetables in pots (where there was a lack of space), fruits and energy trees on their individual farms as well as on the community land. A survey conducted 11 after plantation showed that villagers had actively taken care of the saplings to protect and maintain them.

The rate of survival was for saplings of large trees planted at the household level was found to be 60%. Also, plants that had been watered using the treated grey water showed a good survival rate due to the continuous water supply available to them.

Picture No. 7: Cucumber (planted in the pots); tomato plants in a nutri-garden in the village (right)

C. Vegetable garden prototype

Picture No. 8: The vegetable garden prototype at the school premises, vegetables being grown in the prototype nutri-0garden (right)

A vegetable garden, inspired by the keyhole garden model, was established using a small space in the premises of the Zilla Parishad Primary school in the village. This prototype has been designed to grow vegetables for household consumption using small spaces; so that a high production in proportion to the space used is possible.

The model is a raised structure and like the keyhole garden model, has a hole in the centre with mesh wiring for composting organic matter like uncooked fruit and vegetable waste, treated recycled grey-water, manure, and other organic waste. The size of the hole in the garden can vary according to the space availability and convenience of the cultivator. The nutrients from the mesh covered hole can slowly penetrate to the outer edges and thus reach the entire space of the garden.

The wall of the garden is made up of stones which helps in moisture retention. However any material such as bricks, mud, old tiles and so on, can also be used. Green leafy vegetables, root

vegetables like carrots, beetroots, wild edible varieties, herbs and vegetables such as brinjal, ladyfinger, can easily be grown in this model with minimum effort.

The vegetables grown in model set up in the school could be added to the mid-day meals in the school. An organic compost mix was added to the soil of this prototype garden to make it more fertile and improve the quantity and quality of the vegetables grown.

TERI experts also provided training to the villagers on the design and construction, use and maintenance of these gardens. The benefits of using this model were also explained.

D. Health check-up and remedial measures

Regular health status updates were taken to ensure that the good health of the women and children. The health status of the children (aged 0-6 years) was obtained with the help of the anganwadi sevika. As the health status of the women was not available, a health check-up camp was conducted to analyze the micro-nutrient deficiency prevalent amongst the women of Pathardi village. Women and children between the ages of 0 to 6 are two of the most important target groups while trying to combat malnutrition.

a) Children (0-6 years)

28 children in the village belong to the age group 0-6 years (as of 2017). According to the Anganwadi Sevika, a half yearly checkup conducted on the 9th of February 2017, showed that 3 children out of the 28 suffered from MAM while one child suffered from SAM i.e. only 14 percent children were malnourished (Figure 5). There is a marked improvement from the number of SAM and MAM cases as compared to the numbers observed in the previous years which was around 60% as per the survey conducted by TERI. According to Pathardi's Anganwadi Sevika, the number of children suffering from MAM or SAM in Pathardi is less as compared to other villages in the vicinity.

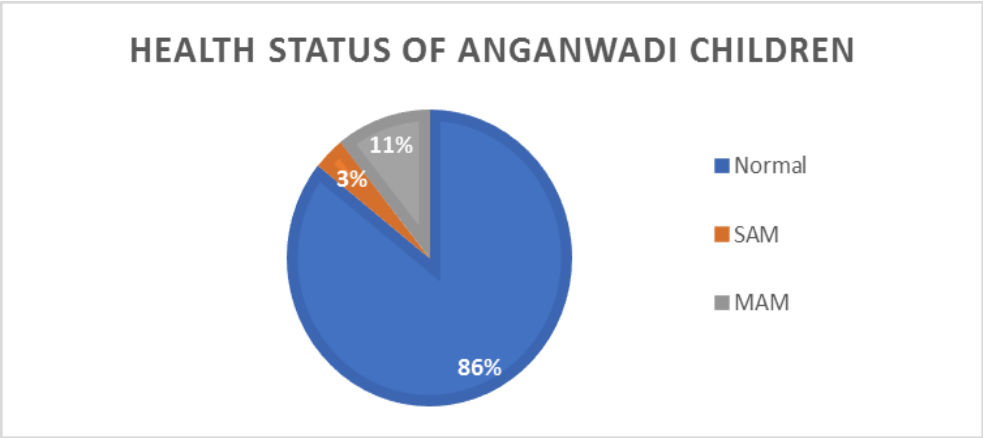


Figure No. 4: Health status of children aged 0-6 years under anganwadi centre

b) Women

The blood samples of 17 women, aged 19 years and above, were collected for analysis. The reports showed that more than 53% (Figure 6) of the tested women suffer from Calcium deficiency and 82% suffer from Vitamin D deficiency.

It was evident that 100% of the women tested were either Vitamin D deficient or insufficient, which is a major concern in terms of health-related problems such as osteoporosis that can occur at a later stage in life. Vitamin D deficiency is attributed when serum 25(OH)D level is below 20 ng/ml and insufficiency, when the level of 25(OH)D is less than 30 ng/ml (75 nmol/liter).[6]

E. Distribution of health supplements as short-term solution to improve health

Picture No. 9: Distribution of supplements; (right) distribution of Mushroom powder

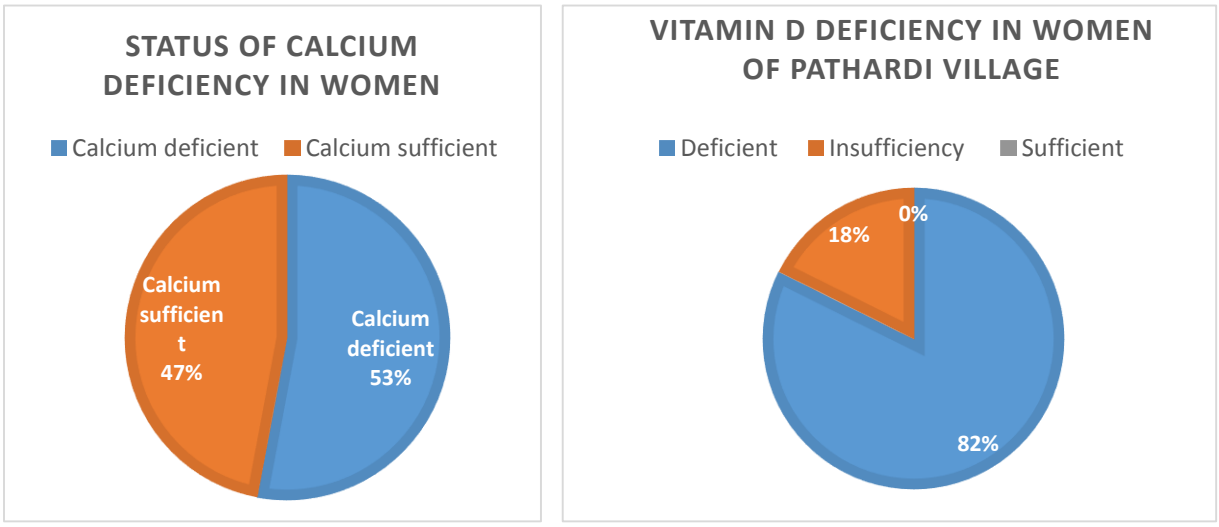


Figure No. 5: Status of Calcium (Left) and Vitamin D (Right) in the studied population

[6] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2902062/

TERI distributed nutrition supplements aiming to decrease the micro-nutrient deficiencies over a period of three months and assess the improvement in the health status of women. The supplements for women and children were distributed with the help of anganwadi sevikas. The medicinal supplements were selected as per the prescription provided by the PHC Doctors. Supplementary tablets for iron, calcium and mushroom powder for women and children respectively, were distributed in the village.

Although there have been no malnutrition related deaths in the village so far, there was a need to continuously monitor and provide timely support so as to keep the level of malnutrition under control and improve

The number of cases of MAM (Moderately Acute Malnourished, SAM (Severely Acute Malnourished), SUW (Severe Underweight) and MUW (Moderate Underweight) were high due to a number of socio-economic reasons, prior to Project's interventions. Critically malnourished children were identified and provided with immediate help through the distribution of health supplements and additional nutritional food ingredients such as mushroom powder, sago, fruits and so on.

Impact

The results recorded from the two health check-up camps before and after the health supplements distribution were quiet encouraging with a definite improvement in the deficiency status of the women examined, as shown below:

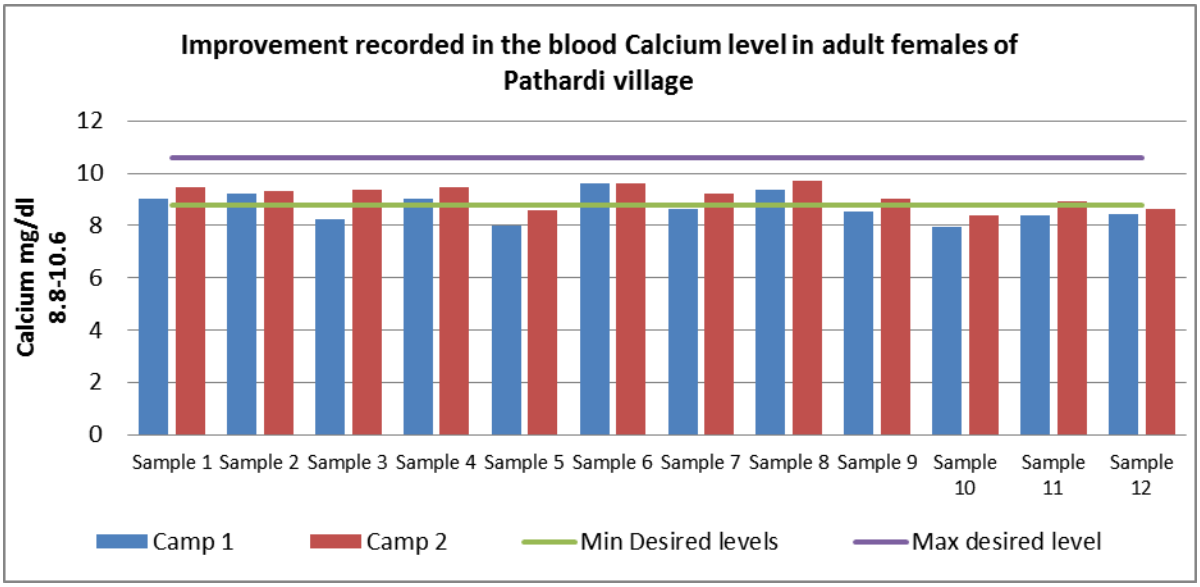


Figure No. 6: Blood Calcium level (before- Camp 1 and after- Camp 2) in the sample 10 women of Pathardi village

Regular consumption of supplements and following TERI's instructions helped the women improve their health. However, supplements alone, would not be able to make a drastic difference especially in case of Vitamin D deficiency. It is encouraging to note that in few of the

subjects the increase was almost 40 per cent (figure 8). Alhough not in the sufficiency range, any improvement is always encouraging.

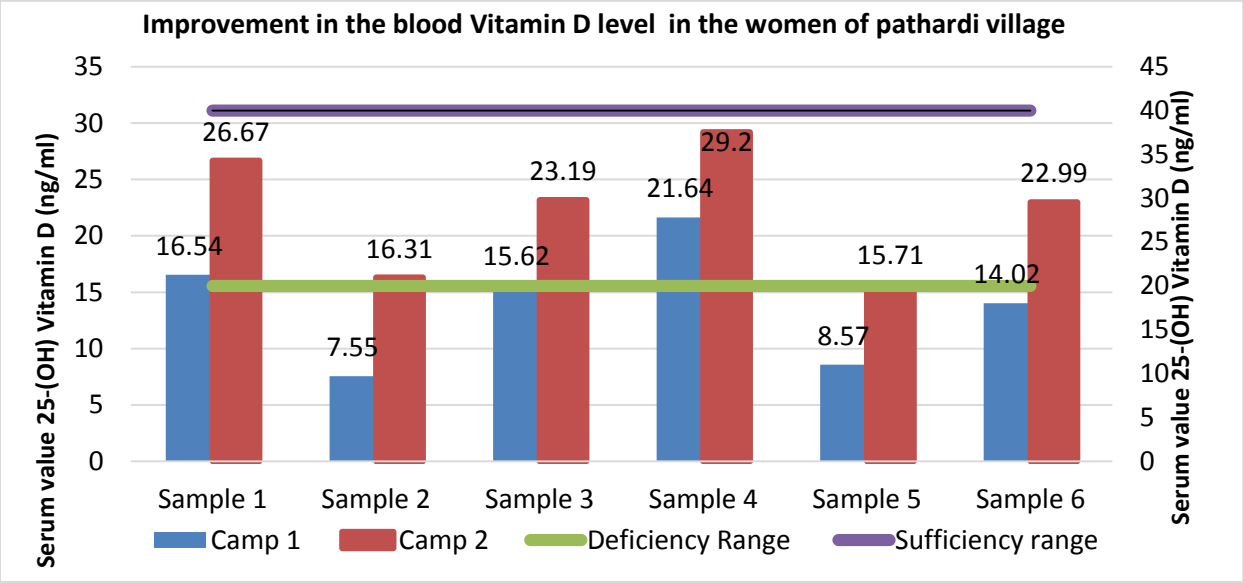


Figure No. 7: Increase in the Vitamin D level (before- Camp 1 and after- Camp 2) in the sample 6 women of Pathardi village

F. Provision of clean drinking water

1. Mechanical water filters and electrical filter for the school

A simple mechanical water filter can help remove a lot of impurities present in the water, especially the particulate matter and suspended solids. The filtered water can then be treated or boiled as per the household requirement. The filtration procedure ensures that the filtered water is clean and gets rid of any coloration, odor and so on.

The unavailability of safe drinking water is one of the biggest problems faced by rural India today, especially in states like Maharashtra where 40% of the area is drought prone[7]. According to a State study, 25 per cent of the samples collected from rural areas and analyzed at 30 public health laboratories in the state over two years, were found to be unfit for drinking with an extremely high level of microbial contamination. Poor water quality is extremely dangerous and is a hidden factor causing large scale impacts on the health of the population. It is also a major factor causing epidemics and even deaths due to water borne diseases.

Unprotected water sources like rivers and well water can become easily contaminated with heavy metal content from the soil, agricultural run-off and leaching, fecal coliform and so on. It is thus important to filter water for drinking and cooking purposes to ensure that particulate matter and other pollutants present in the water are removed before consumption. Groundwater is the major

[7] http://www.mwrra.org/introduction.php?link=wr

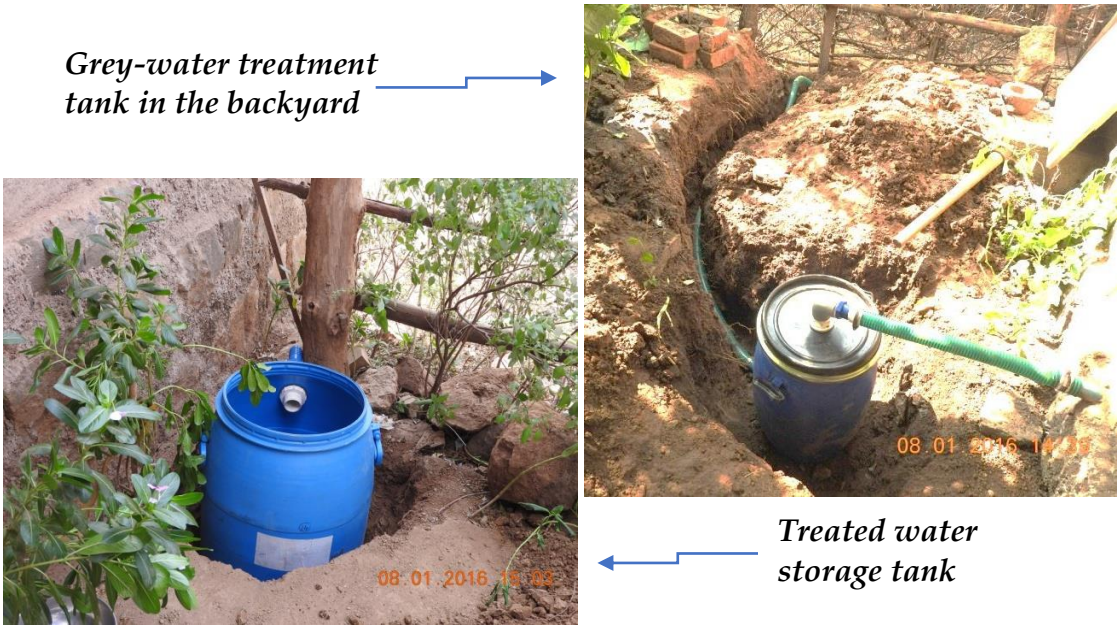
source of drinking water for a large part of the population. Hence it is important to ensure that this water is filtered before use.

A workshop was conducted at Pathardi village in order to train the villagers on how they could make a simple filter using earthen pots, sand, pebbles, and so on, materials that could be easily obtained by the villagers if a replacement is required at later stage. Also, it was decided to provide the school in Pathardi with an electrical water filter to ensure that the students had continuous access to clean drinking water. This filter will run on the off grid electricity that has been provided through solar panels and will be installed during the course of the next phase.

The people of Pathardi access water for drinking from the wells in the village. The water in the wells is usually treated with chlorine, the mechanical water filters would take care of removing the remaining impurities and suspended particles that chlorine treatment will not tackle. The electrical filter in the school will ensure that the children do not suffer from any water borne diseases.

2. Continued establishment of the grey-water treatment systems

The grey water treatment systems, which treat water at the primary level, were installed at 19 more households, taking the total number of filter installed households to 27. Considering the filtration losses, approximately 20-40 litres of water can be collected per household. Thus, the people were encouraged to use the treated water for the nutri-gardens. The leftover water was used for other secondary purposes such as floor cleaning. The 27 houses were selected after examining the condition of the bathrooms in these households and ascertaining their suitability to install the system with the appropriate outlets. Thus, supply of recycled grey water to the kitchen gardens was ensured wherever possible.



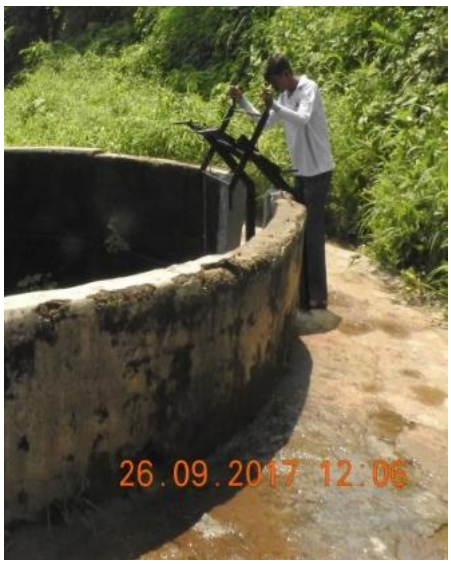
Picture No. 10: Grey-water treatment system installed at household level

Related interventions

Repair of existing wells and pulleys

Picture No. 11: Women drawing water using a rope and bucket

Pulleys have been fixed on the three wells within the village to increase the ease with which the water can be drawn out. Earlier, the women would draw water using a piece of rope with a tiny bucket tied to one end. This method is not only inconvenient, with the possibility of dropping the bucket into the well, but also dangerous. The pulleys installed on these wells would be especially useful during summer when the water table of the wells situated in the village is extremely low, almost reaching the bottom, thereby making it very difficult to draw out this water.



Picture No. 12: A newly installed pulley on one of the wells

Riparian zone around the village Pond – An additional source of water

A riparian zone is the area adjacent to or around ponds, streams, rivers, lakes, and wetlands and are extremely important for a healthy watershed development and contribute to a number of ecological functions. They are not only crucial for fauna but also greatly improve the water quality of the wetland associated with it. A riparian zone acts as a buffer and helps filter pollutants such as sediment while reducing stream bank erosion. Vegetation on the riparian zone provides shade and also reduces the temperature of and around the water, thereby decreasing the rate of evaporation of the water.

TERI commemorated "World Wetlands Day" celebrations on 2nd February 2016, to explain the importance of natural wetlands. The activities conducted during the program were as follows:

- Natural wetland conservation drive through community participation: Around 25 women actively participated in the '*Shramadan*' (help) activity with an objective to clean the pond.
- De-siltation of up to 4ft was carried out by deploying mechanical devices

This shall help enhance the water holding capacity of the pond which can later provide water for irrigating trees in the riparian zone around the pond.

Riparian zone plantation was carried out at the onset of the monsoon. The objective behind the plantation activity was to trap top soil and reduce soil erosion. A mixture of vegetation including Canna, lily, Butterfly ginger lily which are the rhizomatous perennial flowering plants along with the native species such as arjun, neem, jamun and Indian fig trees have been planted around the periphery of the pond. It has been observed that during the rains the pond temporarily holds water however given the porous nature of the top soil and fractures in the basalt rock, the water gets drained out immediately over a span of 8-10 days post monsoon.

Picture No. 13: Area around pond before and after plantation in the riparian zone.

Picture No. 14: De-siltation carried out with community participation and with the help of the mechanical device

Exploring option of digging a Bore well in the village.

a) : Hydrogeological investigation of Pathardi village

To explore the possibility of making water available even during the crucial dry months of the year, TERI investigated hydro-geology of the area. The hydro-geological analysis showed that digging up of the bore-well in the village would not be beneficial as the water table conditions are not suitable for a bore-well. Salient geological observations regarding the location are tabulated in Figure 9.

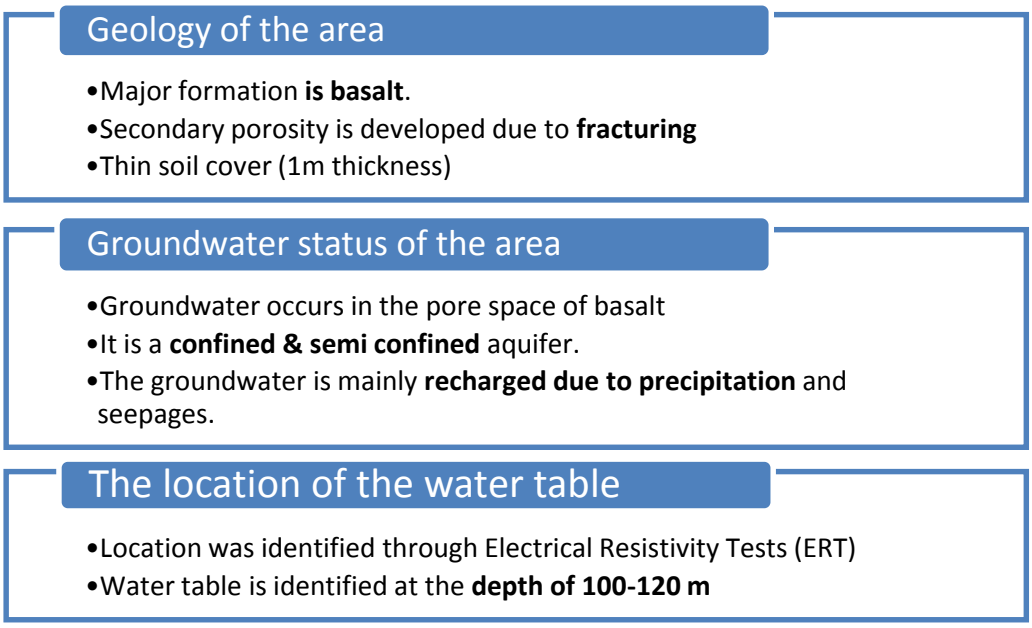


Figure No. 8: Hydrogeological report of the area

b) Analysis by a bore well contractor

Possible sites to dig borewells as perennial drinking water sources were explored with the help of the villagers. All the possible options were studied keeping in mind the feasibility and logistics for drilling a bore well.

On the basis of the observations made by the expert, it was found that borewells at the sites available would not act as round the year water sources given the topography of the village. Also, certain logistical issues would make it difficult to get the machinery for constructing the borewells to the spots selected.

Thus, on the basis of the 2 study results, it was decided that a bore-well at the designated areas was not feasible. The remainder of the budget allocated for this activity would be utilized for some activity as per the village requirement such as constructing a boundary wall for the village school.

E. Livelihood and skill development

TERI has been continually striving to improve the standard of living of the villagers in Pathardi. In the past, interventions were planned to provide the villagers with livelihood opportunities whenever possible, such as, providing horticulture training to youth in the village, promoting vegetable cultivation for sale of surplus produce, and involving villagers for any intervention that required labor-intensive work so as to provide the participating villagers with wages as an extra income.

1. Vegetable Shop in Pathardi

A villager, Mr. Umakant, was trained to undertake this activity and provided with monetary support on a credit loan basis, to open a vegetable shop within Pathardi. He is now successfully operating the shop and has made it very easy for the villagers to obtain vegetables right in the village instead of travelling far away for the same. It also provides the villagers with a market linkage and the opportunity to sell surplus vegetables grown in the nutri-gardens.

Picture No. 15: The vegetable shop in Mokhada for the sale of vegetables on a small-scale

2. Jasmine Plantation

Saplings of Jasmine (Mogra) were distributed to villagers with suitable land available for cultivation. Cultivation of this crop has the potential to help provide a sustainable source of income. There is a high demand of the mogra buds in cities like Mumbai and Nashik which are easily accessible to the villagers and can thus provide a market for the crop. Thus, TERI encouraged jasmine cultivation as an additional income generation activity.

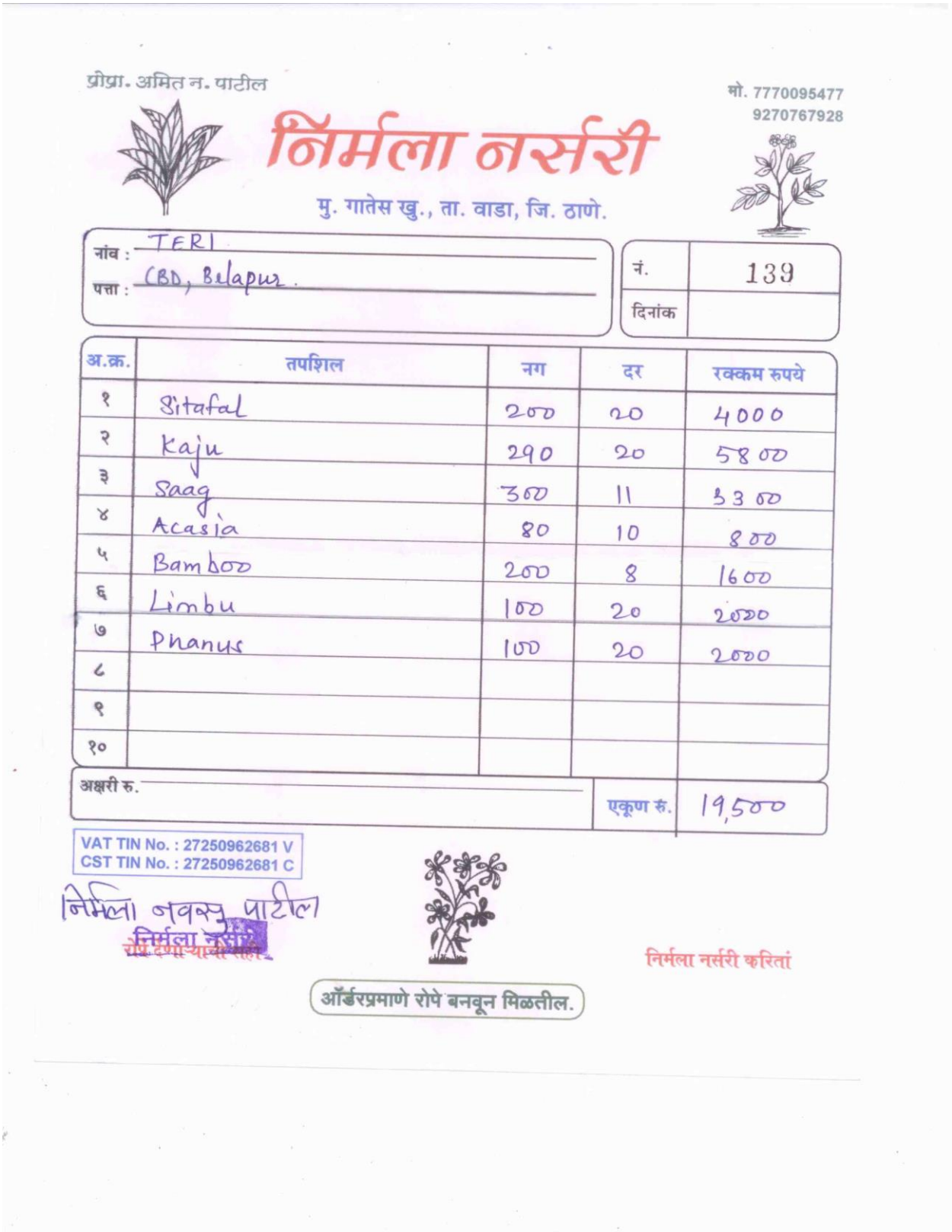
Picture No. 16: Mogra plantation site on a private land

Annexure 1

Previous projects and their impacts

Sr. No.	Project Title	Year	Theme	Impact
1	LaBL (Lighting a Billion Lives), Palghar LaBL, Buldhana	2014-15 2015-16	Energy	The main objective of the project was to provide the villagers with at least minimal lighting requirements to do their daily activities. According to Census of India 2011, more than 2015 villages in Maharashtra are un-electrified and most of them still depend on kerosene or other biomass for the lighting and cooking needs. This not only results in to insufficient illumination to carry out basic tasks related to household chores and schoolwork but also increases the indoor air pollution. As a result, work productivity, health, and education is greatly affected. TERI with a vision of sustainable development and to create innovative solutions for a better tomorrow, has been addressing energy needs of rural poor since 2008 through its initiative of Lighting a Billion Lives (LaBL). TERI has successfully implemented LaBL program in the 7 villages of Palghar district and 4 villages of Buldhana district, to provide the villagers with at least minimal lighting requirements. **300 solar powered lanterns** were distributed.
2	PROTEIN	2014-15	Health	Nutrient supplements have been provided to 51 SAM and MAM children and their mothers as a temporary and immediate remedy to address malnourishment under Botoshi Gram Panchayat.
3	Canteen for Teens	2014-15	Health	The initiative with an approach of "Know, Grow and Cook your own food" has helped addressing the issue of malnourishment among the 700 urban teenagers and their parents in two cities.
4	Promotion of Nutri-Gardens and its allied activities to address malnutrition	2015-16	Water and Health	8 houses have been installed with grey water treatment systems. Establishment of nutri-garden in all the 57 households to address the issues of micro-nutrient deficiencies and water scarcity to improve the health status of the villagers has been undertaken.

Annexure 2



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निर्मला नर्सरी

मु. गातेस खु., ता. वाडा, जि. ठाणे.

नांव : TERI

पत्ता : CBD, Belapur.

नं. 139

दिनांक

अ.क्र.	तपशिल	नग	दर	रक्कम रुपये
१	Sitafal	200	20	4000
२	Kaju	290	20	5800
३	Saag	300	11	3300
४	Acasia	80	10	800
५	Bamboo	200	8	1600
६	Limbu	100	20	2000
७	Phanus	100	20	2000
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अक्षरी रु.

एकूण रु. 19,500

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CST TIN No. : 27250962681 C

निर्मला नवरू पाटील

निर्मला नर्सरी

निर्मला नर्सरी करितां

ऑर्डरप्रमाणे रोपे बनवून मिळतील.