Sustainable Land, Water and Biodiversity
Conservation and Management for Improved
Livelihood in Uttarakhand Watershed Sector

BEST PRACTICES

**WATERSHED MANAGEMENT DIRECTORATE,
UTTARAKHAND
FOREST COLONY, INDIRANAGAR, DEHRADUN**

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Content

Abbreviation

CIMAP	Central Institute of Medicinal and Aromatic Plant
CPD	Chief Project Director
DLT	Drainage Line Treatment
DPD	Deputy Project Director
FIG	Farmer Interest Group
GP	Gram Panchayat
GPWDP	Gram Panchayat Watershed Development Plan
IGA	Income Generation Activity
INR	Indian National Rupee
KVIC	Khadi Village Industries Commission
LPG	Liquefied Petroleum Gas
MAP	Medicinal and aromatic plants
MSL	Mean Sea Level
MWS	Micro Watershed
NTFP	Non Timber Forest Produce
O&M	Operation & Maintenance
PDO	Project Development Objective
RF	Reserve Forest
RVC	Revenue Village Committees
SHG	Self Help Group
SLEM	Sustainable Land, Water and Biodiversity Conservation and Management for Improved Livelihood In Uttarakhand Watershed Sector
SMC	Soil Moisture Conservation
UG	User Group
UDWDP	Uttarakhand Decentralized Watershed Development Project
UREDA	Uttarakhand Renewable Energy Development Agency
WMD	Watershed Management Directorate
WWMC	Water and Watershed Management Committee
VP	Van Panchayat

Nala/Dhara is a local term for seasonal stream

Naula are the little depression springs that communities in Uttarakhand use to collect drinking water

Tok is a local term used for hamlet

A Step Forward...

Sustainable land, water and biodiversity conservation and management for improved livelihood in Uttarakhand watershed sector (SLEM) was an endeavour to bring about changes in the life of communities through inputs amd interventions in the environment and social field. The focus of the SLEM project was on biodiversity conservation through land and water source protection, sustainable livelihood development, use of alternative energy resources and capacity building of communities on biodiversity issues through demonstration, documentation and dissemination of good practices.

The communities belonging to the selected micro watersheds actively participated in the entire project activities from planning, implementation, O&M to monitoring and evaluation.Major activities by which project have taken forward an important step towards suatainable ecosystem management are :

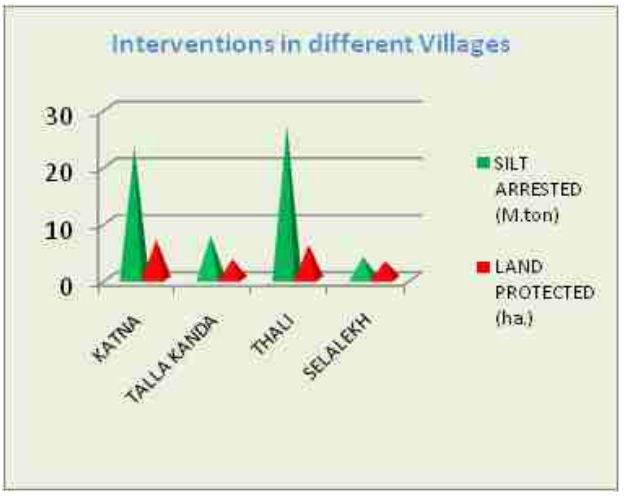
- Interventions for controlling land degradation through soil and moisture conservation works, afforestration activities, water recharge and harvesting and water source sustainability works
- Reducing pressure and dependence on the natural resource base through promotion of alternative energy interventions (viz pine briquette, biogas and revival of water mills). Marketing potential for NTFP products such as pine briquette was created
- Biodiversity conservation through cultivation of medicinal and aromatic plants and establishing market linkages for the products.
- Creation of sustainable livelihoods through promotion of income generation activities
- Capacity development through technical trainings and exposure visits
- Mainstreaming of the best practices through demonstration, documentation and dissemination

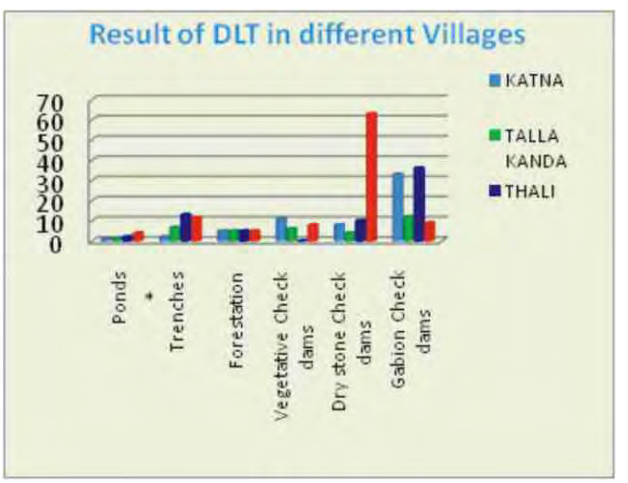
These initiatives have significantly impacted the project area and the communities residing there in terms of improving productive potential of natural resources especially in the fields of biodiversity conservation, controlling land degradetion and rejuvenation of traditional water sources. Livelihood support to Self Help Groups and adpotion of alternative energy sources by the households have brought about enhancement in their quality of life. The involovement of the community in project activities from the conceptualization stage to project completion has resulted in greater ownership of the project at the local level. The best practices and success stories from the project in the following pages attempt to provide an overview of the endeavours towards achieving the objectives of SLEM

Protecting land and lives through comprehensive drainage line treatment activities

Division-Nainital
GP- Katna, Talla Kanda, Thali and Selalekh

In the last few years, Uttarakhand hills have witnessed widespread landslides and soil erosion due to heavy rains. There has been large scale damage to life and property in the project area as well. In the parent UDWDP (Gramya) project, drainage line treatment and other interventions were successfully carried out to check soil erosion and prevent further damage to valuable land and water resources in the project area. Under SLEM, the successful Gramya DLT model was replicated in many gram panchayat of Nainital division with good results.





Villagers of Gram panchayat Tala Kanda, Katna, Thali and Selalekha were struggling with the devastation of their valuable agriculture land due to landslides. Over the years, their traditional water sources (Naulas) had either dried up or the discharge had gone down. During the planning phase, the villagers prioritized and demanded greater number of DLT and water source rejuvenation works in their area. Comprehensive treatment using an integrated watershed approach was followed and a variety of SMC, DLT, afforestration and water recharge and harvesting activities were carried out.

1. Gram Panchayat Talla

Kanda is situated more than 110 Km from the division head quarters and is one of the remotest GP of the project area.

Interventions

Following activities were carried out by the water and watershed management committee (WWMC) of the GP

- Village pond (1453.50 cum) with 666 staggered contour trenches 465.75 cum)
- Afforestation in 5 Ha area were done by WWMC

"These structures have saved our agriculture land, our lives and our animals.We can never thank the project enough for this"

Shri Sher Singh Lamgaria, Katna

- The Nala in the Barsim hamlet was adversely affecting the lives and livestock in the vicinity. It was treated upto a length of 0.175 km. by constructing 6 vegetative check dams, 4 drystone checkdams (25.84 cum) and 12 crate wire check dams (170.03 cum)
- Cost of construction was about INR 4 hundred thousand

Impact

- The interventions were successful in arresting a silt load of about 75.8 tons behind the structures. These endeavors were able to protect almost 3.5 ha of agricultural land even during the tough monsoon seasons.
- These interventions were also found to be effective in rejuvenation of two naulas in the village viz. the Matiyali I & II. In the beginning of the project, water availability in these traditional water sources was for only 10 months with a discharge of just 1.7 and 1.5 Lpm. The rejuvenation efforts not only turned these sources into perennial sources (12 months availability) but has also saved the women from the drudgery of walking nearly 0.425 km daily to fetch water for their domestic chores in the tough summers. Presently these Naulas are providing 3.6 and 3.5 Lpm water throughout the year.

2. Gram Panchayat Katna

Katna is another gram panchayat on the same route and distance.

Interventions

- A village pond (259.20 cum) with 200 contour trenches (150 cum) and afforestation in an area of 5.0 Ha was carried out
- A nala in the Aroli hamlet of the Katna revenue village was a perpetual danger to life and property as most of the villagers lived in its vicinity. This nala was treated to a length of 585 m.

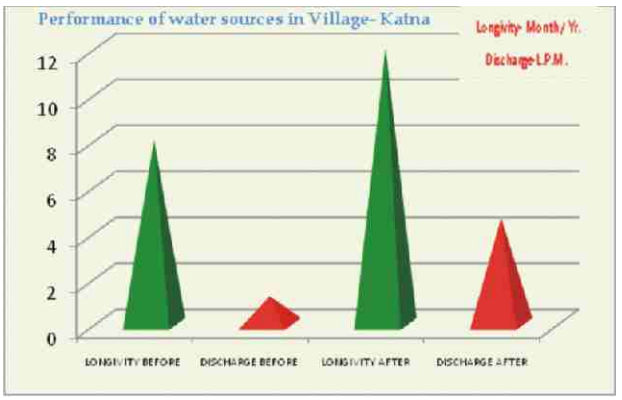
"This pipeline is a boon to our college, as there was scarcity of drinking water in the college especially during summers."

Principal, GIC Katna

- The village has a model of 11 vegetative checkdams, 8 dry stone checkdams (80.0 cum) and 33 crate wire checkdams (533.33 cum). The vegetative checkdam covered a distance of 60m; dry stone checkdams covered 80m length and gabion structures 17 nos. (sized 5 x 1.05m) covered 205m distance, followed by 7 (6 x 1.05m size) covering 100m and 9 (7 x 1.05m) covering another 140m distance.

Impact

- The DLT works were effective in arresting a load of nearly 233.86 tons of silt and protecting about 6 to 7 ha. of agricultural land of the village.
- Water sources rejuvenation works has revived the Gaud Naula of the village. At the start of the project (March 2009), this Naula was catering to the daily water needs of only 2 households for 8 months with a discharge of merely 1.2 Lpm. The efforts for rejuvenation of water sources in the hamlet have now enabled 8 households to benefit from the source throughout the year (12 months) with a discharge of nearly 4.60 Lpm.



- The villagers were able to tap another perennial source of water with the help of a pipeline (200 to 500m long) which is quite successfully catering to the needs of the Government Inter College, in Katna and is quenching the thirsts of its 250 students.

3. Gram Panchayat Thali

is located at the bottom of a forest slope and suffered from large scale damage to habitation and agriculture fields due to heavy surface runoff during rains. Past rains had already damaged 38 agriculture terraces. Danger to life and property of nearly 23 households was the main concern.

Intervention

- To protect the arable land and habitations, 400m long diversions drain was constructed to intercept the water running off the slope above and divert it across the slope into a natural drainage course.
- 5 Dug-out ponds (3 of 248.20 cum and 2 of 410.0 cum capacity) along with 1500 contour trenches (975.00 cum) constructed and afforestation in 5.0 Ha. area was carried out.
- 4 Brush wood checkdams over a stream length of 15m, 10 dry stone checkdams (3.0 x 1.0m size) covering 125m distance and another 800m distance was covered with 38 Gabion check dams on a nala in the vicinity of Kanai hamlet of Thali revenue village. Thus treating a length of 1.0 Km of the 1.5 km long Nala.

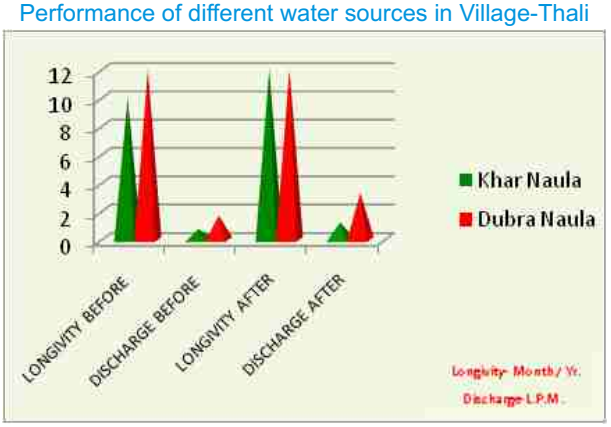
We must have more of these kinds of works in the village, especially when we were the worst affected ones during Aapada in 2010."

Mr. Bhawani Datt Sharma, Khetra Panchayat member

Impact

- The diversion drain protected a catchment area of 10.0 ha. above the drain and a command area of about 4.0 ha, which has nearly 206 terraces in its command (each terrace approximately 65 x 3m, about 1 Nali).

Performance of different water sources in Village-Thali



- Drainage line treatment works were found to be effective in arresting 269.5 Tons of silt, and protecting 5 to 6 ha. of valuable agricultural land.
- The efforts of water recharge were also quite fruitful in the area. The two main water sources viz. Khar naula and Dubra naula used to cater to only 2 households in the beginning (March 2009) and lasted for only 10 months in a year, with discharges of 0.75 and 1.70 Lpm. After the water recharge efforts in the area, 9 households are now able to make use of these water sources as 1.2 and 3.3 Lpm water is now available throughout the year.
- This has saved the villagers from the drudgery of walking to a distant water source Gujgad gadhera.
- Project staff was also able to motivate the villagers to tap some perennial water resources in the vicinity of the village, to lay pipelines in the Kanai hamlet and Gailgara hamlet which are now catering to 6 and 2 families respectively for 12 months of the year.

"Our village is highly indebted to project staff for their unrelenting efforts in motivating our people for their own welfare and to help us in protecting our land and lives"

Shri Birendra Ram Arya, Thali

Panchayat member

Above interventions have resulted in conservation of natural resources, protection of valuable agriculture land and the lives of people and animals of the inhabitants of the project area. Revival of traditional water sources has reduced the drudgery relaeted to accessing of drinking water to some extent. Efforts towards conservation of biodiversity is a continous process and the above interventions under SLEM project are small but important steps in that direction.

Protecting valuable agriculture land and assets through stream bank protection works

Division - Bageshwar
GP- Sumati-Baisani

Sumati-Baisani gram panchyat is located at an altitude of 1300 m above M.S.L. in Gagnigad micro watershed. The distance of Sumati - Baisani G.P. is 24 Km. from Kapkot block. Sumati, Baisani and Pausari are the three revenue villages with 55, 125 and 36 households respectively. Most of the agriculture land in GP is situated near the Gagnigad nala, Jagthana nala, Sumati nala and Pausari nala. Due to road cutting in the recent past, a lot of debris was directly thrown into these streams, which has resulted in raising of stream bed level. In September 2010, a cloud burst incident occurred in Pudkuni and

Jagthana villages causing land slide and erosion along the sides of these streams. After that incident ,villagers proposed to takeup stream bank protection works along the stream in SLEM project.

Exposure trip of 25 farmers was organized to different project villages where these interventions had been successfully carried out in the parent UDWDP (Gramya) project. Demonstration of basic of soil conservation works, netting the wire mesh, erecting gabion structure and other technical aspects was also shown to the farmers and villagers. A group of workers were also engaged at Baisani village to assist the villagers during execution of work.

Interventions

- The villagers constructed 45 protection walls, 5 check dams and one cross barrier along Pausari nala and Gagni-gad.
- A sum of Rs.6.15 Lakh was incurred for the construction of 812.12 cum wire crate work.
- In Sumati village, 27 Structures (400 Cum.) along sumati stream and 14 structure (300 cum) along Jagthana stream along a stretch of 2.5 Km were constructed. A sum of INR. 5.46 hundred thousand was incurred for the construction of these structures.
- At Pausari nala, a wire crated cross barrier of 11.0 m length was also constructed to divert the water to the irrigation channel for irrigation purpose of 40 nali agriculture land. Earlier people use to construct temporary head work after every monsoon season across the nala for diverting the water for irrigation purpose.
- In GP Sumati Baisani 16 vegetative checkdams, 224.17 cum dry stone checkdams, 111.21 cum crate wire checkdams, 2385.53 cum river bank protection works and 153.12 cum dry stone retaining wall were constructed.

Impact

- About 2.30 ha. agriculture land belonging to 86 farmers and 6.75 ha barren land has been saved from erosion. The work successfully reduced the amount of soil erosion and protected the kharif crop cultivated along the Gagnigad bank side.

Villagers have created a fund of Rs. 10000.00 in each Revenue village for operation and maintenance of these common structures

- After the construction of wire crated cross barrier in Pausari nala as a permanent head work, farmers are getting assured irrigation in 1.0 Ha land, even during lean season.
- Now 0.8 Ha additional area is under irrigation. The productivity has also been increased by 20% (by sowing improved varieties) due to assured irrigation.

The exhisting assets near the stream viz 6 Gharat and 3 footbridge, 6 houses & a primary school have also been saved by these protection measures.

A step forward towords biodiversiy conservation

Biological and Mechanical Conservation measures

Division Bageshwar
GP- Uttrauda

Uttrauda Gram panchyat of Gainargad MWS in Bageshwar Division is situated at an altitude of 1000-1100 m above M.S.L. Agriculture, Horticulture and livestock are the primary livelihood activities practiced in the village. In the year 2007-08 a massive landslide followed by subsidence of land took place in the upper reaches of the Panora hamlet. This slide continued to pose a serious threat to life and property of the inhabitants of the hamlet.

Under SLEM project, various biological and mechanical conservation measures were carried out for slope stabilization. In addition interventions for promotion of biogas to reduce fuel wood

dependence on forest and enhancing fodder availability within Gram panchayat areas were also taken up.

Interventions

- Construction of vegetative checkdams and twenty dry stone masonry check dam (262 cum) at a cost of INR 69634.00 .
- Agave suckers and Oak seedlings were planted by the villagers.
- A total 88.73 cum random rubble masonary (1:6 cement sand mortar) for check dams and side walls was executed at a cost of INR 120000. This work was carried out for mainly safe disposal of excessive water during monsoon season.
- Napier grass planting on the bunds of the agriculture fields and waste land was done by all the villagers to reduce the pressure on forest for fodder.
- Fifteen bio-gas plants have been established by the project.

Environmental Impact

- Vegetative and mechanical treatment measures have checked further soil sliding in the landslide area. The area now has a good vegetation cover comprising of oak trees, grasses and shrubs. The vegetation and vegetative check dams has reduced the runoff during rainy season.
- Adoption of biogas interventions by the villagers has reduced the pressure on the adjoining forest for fuel wood by 75 to 80%. This has resulted in conserving 25628kg of biomass estimated to reduce 35 tons of CO2 emission in the environment annually (equal to the cutting of 30 trees/ year.
- Due to soil and water conservation measures, the lean season discharge of five water sources have been increased from 61 lpm to 68.90 lpm. As a result, the lean season availability of water for drinking and irrigation purposes has increased by 12 %. in

The village community itself has decided to restrict grazing their cattle in the forest area and has also ensured that each and every member will plant Napier grass in the field bunds and waste lands. Now the villagers are also showing keen interest for adoption of alternative energy sources.

Socio- Economic Impact

- Due to increase in availability of water for irrigation by 12% and use of bio-gas slurry, the average productivity of off-season vegetables and agriculture crops have increased by 30%.
- The average time saving by the womenfolk is 2 to 3 hrs per day per household, which they utilize for income generation activities, education to children and household chores.

Milk production has also increased by 10 % due to availability of green fodder during winter season.

Every Drop is Precious

Water source rejuvenation in Gram panchayat Selalekh

Division-Nainital
GP- Selalekh

Residents of Selalekh Gram panchayat were facing problem of water scarcity inspite of the occurrence of 4 water sources (viz Ratora naula , Lamejar Naula, Badna Naula and Kanala Dhara) in the area. Over the years, the discharge in these sources had considerably reduced with the water being available only for 7-8 months in a year.Prior to project implementation, 43 families residing in the vicinity of Ratora naula had the water availability of about 8.0 LPM which was available for barely eight months in a year. Similarly, 29 families dwelling near the Lamejar Naula received nearly 6.0 LPM water for 7.0 months/year, while the 28 families dwelling in the

vicinity of Badna Gadera and 22 families residing near the Kanala Dhaara had water availability of 8.0 LPM for 8.0 and 7.0 months/year respectively. The womenfolk were forced to fetch water from Badna Naula (1.25km away), Lamejar Naula (0.75 km away) and Ladua Gadera (2.0 km away) respectively during the lean seasons for their domestic requirements. Since the women of the Gram panchayat were facing the daily durgery of walking long distances for fetching water under scorching summer heat, therefore this issue was raised by them prominently in the Mahila Aam Sabhas. The Gram panchayat under the progressive leadership of Gram Pradhan Jagdish Chandra Joshi was sensitized to these issues and they were adequately addressed in the SLEM project.

Interventions:

- Villagers contributed Shram Dan (voluntary labour) for digging of Kachha ponds (earthen dugout ponds) in the Van Panchayat area of Ratora Hamlet.
- 4 ponds (182.81 cu m) with a total number of 1166 staggered contour trenches (3.0 x 0.5 x 0.5m each) and 5.0 hectares of land was covered under afforestation with recommended species like banj, Kharsu, Bhimal, Utees, Majnu, Tejpat.
- Lemon Grass was planted on the bunds of the trenches for its binding qualities.
- DLT in village which was located down the slopes was done with construction of 8 vegetative or brush wood checkdams, 63 loose boulder or dry stone check dams (700.77 cu m) and 9 gabion or crate wire check dams (183.30 cu m).
- All the interventions were carried out at a cost of INR Rs. 5.85 hundred thousand.

Interventions		No./Unit	Volume (cu.m)
Ponds		4	182.81
Trenches		1166	874.5
Plantation		5 ha.	-
Vegetative check dams		8	-
Dry stone check dams		63	700.77
Gabion check dams		9	183.30

Impact on water availability

- Digging of the kaccha ponds in Ratora, Kauwa-chad and Gorkhagada resulted in source rejuvenation of the naulas that were located in the catchment area of Lamejar hamlet, directly beneath the mountain on which the Ratora hamlet's van panchayat was situated.
- The same also had a visibly measurable impact on the water sources in both Selalekh and the neighbouring Jalna Neel Pahari GPs.
- The result was manifested in the year round availability of water in the naulas of the villages. 48 households are now using the water source of Ratora Naula, with 14.0 LPM discharge from the source for 12 months a year. Similarly the number of households now depending on Lamejar Naula has now risen to 32 with 12.0 LPM water for the year, and 12.0 and 12.5 LPM water discharges round the year from Badna Gadera and Kanala Dhaara respectively; having 25 and 22 families in their vicinity today (by the end of the FY 2011-12).
- Now the women folk do not have to travel long distances in search of alternate source for fetching drinking water. This has reduced women drudgery and the time hence saved is being used in other productive works.

Impact on Agriculture

- These activities resulted in increased water availability for irrigation and in the form of improved soil moisture regime in the middle and lower ridges. As a result construction of irrigation tanks in the area was promoted.

- Owing to assured irrigation, there was a shift toward vegetable cultivation. A shift from traditional crop cycle of- Potato- wheat, potato- cabbage, to cultivation of potato- pea- cabbage- cauliflower and French bean in the area has been observed.
- The farmers in Lamejar hamlet even formed their own self help group to utilize the water sources in a rather more productive way by convergence with other line department.
- Farmers have formed their farmer interest groups (FIG) and a federation after they have started receiving surplus productions due to change in planting technique and adoption of better yielding varieties, adding value to their produce by way of grading and semi-processing.

Impact of water source rejuvenation works (before and after project)

Water Sources	Before Project (2005)				After Project (2011-12)			
	No. Of HH. Dependent on Source	Duration of Water Availability (Months)	Months for which water is Unavailable	Water Discharge (LPM) March	No. Of HH. Dependent on Source	Duration of Water Availability (Months)	Months for which water is Unavailable	Water Discharge (LPM) March
Ratoura Naula	43	8	4	8	48	12	-	14
Lamejar Naula	29	7	5	6	32	12	-	12
Badna Naula	28	8	4	8	25	12	-	12
Kanala Dhara	22	7	5	8	22	12	-	12.5
Distance of Alternate source	**0.75 km from Lamezar Naula 1.25km from Badna Naula 2.0 km from Lamezar is Ladua Gadera.**							
Crop Cycle	**Potato – Wheat, Potato – Cabbage.**				**Potato, Tomato, Pea, French bean – Pea, Cabbage , Cauliflower, French bean**			

The Gram panchayat Selalekh and the project team was recognized at the national level by the Ministry of Water Resources of Govt. of India. The Gram Panchayat Selalekh was awarded with the National Ground Water Augmentation Award 2010 for its efforts.

Reviving traditional water conservation practices

Recharging Source through Pond Construction

Division-Agastyamuni
GP- Agar

Gram panchayat Agar of Agastyamuni Division is located on the ridge of a mountain. Due to high gradient, the water retention capacity of soil is very low resulting in excessive surface runoff during rainy season. Most of the rain water flows down to various small streams located below the villages. The farmers were not practicing any water and moisture conservation activities in the area. The rain water was neither being harvested nor could be utilized to recharge the water sources or to help in keeping the moisture content in the soil.

During summer season the villagers were facing drought like condition with low water availability in the villagers for drinking and agriculture purposes.. In the excessive dry spell in the year 2008 -09 and 09-10, the water bodies and Pandera water fall were nearly dried up resulting in severe drought like situation in the Kholu bagnu ***tok***[3] (hamlet) area of this village.

Perils of ignoring traditional water conservation practice

In a project meeting in May 2010, villagers recollected that 40 years back there was a pond over and above the Pandera stream, which was maintained by the villagers themselves before rains. This annual maintenance helped the water body to retain and recharge the water for longer duration ensuring enough water in the area. But this practice was discontinued by the villagers due to dependency on the various government schemes. Over the years, due to lack of maintenance of the pond, water sources feeding from the pond dried up and the pond was being used as a pasture land for cattle grazing.

Intervention

This issue was taken up by the community members with the project team and a treatment plan was formulated. The villages were keen on reviving the existing Pandera water stream. For recharging the water source it was important to dig a pond above the Pandera stream area, the water from the pond will recharge the stream.

- In the year 2010 – 11, a pond was constructed with the help of the project. The measure of the pond is 12 mtr x 7 mtr x 1.50 mtr (L x W x D) and the water carrying capacity is 126 cubic meter.
- A clay flume was also built and connected to seasonal water bodies to restrict the chances of soil erosion through excessive water flows

Impact

- The effect is clearly visible in the discharge of Pandera stream. As per the study, it recharges around 100,000 liter of water per day during the rainy season.
- With the construction of the pond the other dried water bodies in the area are also getting recharged and there is an increase in the water level by three to four times. Now the two gram panchayats get enough drinking water in the summer season.
- With all these interventions the earlier waste and degraded lands within the command area have turned green and producing sufficient green fodder to the animals. Vegetative growth along these ponds and flume is helping to check the soil and water erosion.

Pre project situation	Post project situation	Impact of interventions
Scarcity of water both for irrigation and drinking purposes specifically during the summer season	Through ponds and flume construction, water recharging and water availability has increased	Decrease in vulnerability
Pandera stream was short of water in the dry spell due to non recharge of ground water	There is three to four times increase in the water availability	Increased vegetation and green fodder supporting the milk animals from the degraded land
The older water bodies were turned into flat land	With the construction of pond, water is accumulating due to recharge	Increased water availability to the gram panchayat
Distress and high vulnerability due to water shortage	Water availability is maintained even in the dry periods	Feeling of contentment and saving in time and energy to fetch water

[3] *Tok is a local term used for hamlet*

Conserving natural resources through alternative energy use

Successful adoption of biogas as an alternative fuel in Uttrauda Gram Panchayat

Division-Bageshwar
GP- Uttrauda

Introduction

Gram Panchayat Uttrauda is located at an altitude of 1200 m above MSL and at a distance of 27 km from Bageshwar district HQ. In 2009-10, during a village meeting, project team came to know that Mr. Nandan Singh who is a resident of Panaura hamlet of the Gram panchayat was successfully using biogas plant of 2 cum capacity with a Fixed Dome Type Model for the last twenty years. He was a beneficiary from an earlier Govt. scheme which promoted biogas use. He was highly satisfied with the performance of the biogas plant. In addition to biogas use,

Nandan Singh was storing the digested slurry from the plant in a compost pit of 13 chambers and selling the vermi-compost in the village and nearby market for Rs 5 per kg. He was also using the digested slurry as a feed in pisciculture.

Situational Assessment

- Situational assessment of the village showed that, in spite of the availability of sufficient desirable farm resources, feasible condition and technological acceptance to run biogas plants, not a single farmer apart from Nandan Singh had adopted this activity in the last 20 years. The reason behind this situation was found to be the inability of the farmers to bear the initial high investment cost required for the establishment of such plants.
- There are 38 households residing in the hamlet with a population of 173 persons including 86 females. Fuel, fodder and fertilizer requirement of the households in the hamlet was being met from the adjoining forest.
- The area under the forest is only 19 ha. Due to the unavailability of alternative sources of fuel and fodder, the adjoining forest area was under extensive pressure for fuel wood and fodder requirement. Therefore, the need for biogas intervention was realized as an alternative to firewood.

Intervention

- In 2009-10 in Panaura hamlet of Uttrauda village, the SLEM project installed 3 floating drum type biogas plants recommended by KVIC of 3 cum capacity each and costing Rs 33000 per unit.
- Subsequently 12 biogas plants costing Rs 41000 per unit were established during 2011-12 after the successful and satisfied run of the plants installed in 2009-10. Two more plants were installed in the village in 2012-13.
- The plants were provided to such needful beneficiary, who had sufficient cattle and agriculture land required to run the units.
- To meet the requirement of fodder for cattle, project mobilized the community to upscale the production of Napier grass which was introduced during UDWDP period.

Environmental Impacts

- The dependency on the forest for fuelwood has been reduced to a large extent among biogas users in Panaura hamlet of the Uttrauda GP. Now the biogas farmers are using fuel wood only in winters from mid November to mid February for heating and cooking dinner only, as biogas production goes down this time to half of its efficiency due to low temperature. This indicates that biogas interventions have been able to replace the firewood as a fuel by 75 to 80%.
- Due to reduction in dependency on firewood for the purpose of cooking, the losses of biomass in forest in the vicinity have been reduced from a total of 34170[4] kg to 8542 kg. The net 25628 Kg of biomass conserved in the forest ecosystem have been estimated to reduce more than 35 tons of carbon dioxide (CO2) emission[5] in the environment.
- As a result of anaerobic fermentation, about 30 to 40 percent of organic carbon present in the dung is decomposed as carbon dioxide and methane. The rest is retained as such and contains plant nutrients. When fully digested, the slurry from a biogas plant is odorless and does not attract insects or flies. The organic fraction of slurry may contain upto 30-40 percent of lignin, undigested cellulose and lipid material, on a dry weight basis. The remainder consists of substances (mineral, salts, etc.) originally present in the raw materials but not subject to bacterial decomposition. The amount of bacterial cell mass is low (less than 20 percent of the substrate is converted to cells). Therefore, there is less risk of creating odour and insect breading problems.
- Soil-erosion is reduced considerable due to forest conservation and good stand of vegetation. Water holding capacity of soil has been increased. The availability of water for drinking and irrigation purpose has been increased in lean season also.

[4] SLEM Primary Survey 2011-12

[5] CMS, Nepal (1960), "BIOGAS TECHNOLOGY: A TRAINING MANUAL FOR EXTENSION" FAO SUPPORT FOR DEVELOPMENT OF NATIONAL BIOGAS PROGRAMME (FAO/TCP/NEP/4415-T), Session 3-PP 11.

Social Impacts

- The collection of fuel wood from the forest and stacking involves drudgery of the women in the family. They start this activity early in the morning and the time involved for the collection of one headload is approx. 4-5 hours. To meet the requirement of fuel wood for the whole year, they stock firewood in 4 months from December to March on a routine basis. Thus, it can be assumed that the firewood collection by the women takes a total of 120 days in a year.
- After establishment of the bio-gas plants, women drudgery has been reduced from 120 days to 30-35 days in above said months. The women now collect and stack the firewood only for heating in winters or/and cooking dinner as during winter period the biogas production declines to half of the production in summers. Thus, biogas interventions have been able to reduce their drudgery by 4 hours per day in above said months for 85 to 90 days.
- After installing a biogas plant, per woman per household time saved on workload is about 2.5 hours. Time saving on account of biogas related activities is shown in following Table :

Impact of a Biogas Plant on the time saving of a Household

S.No.	Activity	Saving in Time (Hour/day)
1	Collection of water	(-) 0:15
2	Mixing of water and dung	(-) 0:15
3	Collection of firewood	(+) 1:00
4	Cooking	(+) 1:30
5	Cleaning of cooking utensil	(+) 0:30
6	Total	(+) 2:30

The women are using this saved time in so many different ways such as opportunity for income generation, education, and improvement in health by providing some leisure time. There are also incidental advantages of hygienic improvement, the absence of smoke and soot in gas burning, convenience in cooking.

Economic Impact

- Benefit over LPG Gas - Biogas production of each plant on an average has been estimated to be 488 cum, which is equivalent to 14.71 cylinder of LPG per household per year. These cylinders have been valued at Rs. 8276 including subsidy and non-subsidy factor. The value of slurry is another important economic benefit valued at Rs. 5256 per year.
- Thus, the biogas has been able to save Rs. 13646 per annum per household, if initial investment cost is ignored. The net returns were estimated to be Rs. 10577 per biogas plant.

Benefit over Firewood

Monthly requirement of firewood of a household was estimated to be 167.50 kg valued of Rs. 670.The market price of the, firewood saved is Rs4.00/kg, hence each bio gas users is saving Rs 8040 per annum.

Increase in Productivity

The slurry is an important by product of the biogas production. With the biogas intervention, the annual intake of about 230 tons of fresh cattle dung in biogas plants has been recycled into 563 tons slurry which on applying in field crops, improves the texture and water holding of 8 hectares agriculture land of all the users ultimately helping in conservation and productive potential of soils. The preliminary experiment carried out so far indicated that the yield of crops and vegetables has been increased from 10 to 30 percent by the application of biogas slurry.

Sustainability

The economic life of a biogas plants in terms of its parts like digester, gas holder etc. is considered to be 20 years. However, if properly managed, a biogas plant's life span can be

Biogas users from Uttrauda village reported that villagers from adjoining areas are visiting their village to see biogas plants and are also approaching the Uttarakhand Renewal Energy Development Agency (UREDA) at district HQ for getting these plants. Three households from the Nan-kanyalikot village (one of the villages of project area), have established 3 biogas plants last year with support of UREDA.

enhanced to 30 years. All the users here have been organized into a group titled as Krishak Ichchhak Samuh, Panaura for solving their own future problems, need and maintenance of these plants in a collective and participatory mode. The group is also linked up with a Mini Bank Uttrauda (Sadhan Sahkari Samiti), a sister concern of Almora District Cooperative Bank having a present saving of INR 9000/. The group has been provided the training about the management and maintenance of the biogas plants.

Up scaling and Replication

The project involved locals during the construction and establishment of biogas plants in village, so that the technical know how acquired by the locals could be useful for other villagers who are desirous of adopting this activity.

Cost-benefit analysis

The analysis shows that the net annual income of approximately Rs. 10557/- shows that the capital investment of Rs. 33000/-and Rs 41000/can be recouped in about three and four years respectively.

Cost-Benefit analysis of biogas plant established under SLEM (Floating drum Type plants of 3/ CuM / day Capacity)

[A] Investment Cost	**Rupees**
Gas holder and frame Pipe and stove Material & civil work Year2009-10 Year2010-11	 33000.00 41000.00
Total	**33000.00/ 41000.00**
[B] Annual Expenditure	**Rupees**
Depreciation on biogas plant @ 7.5% p.a. Depreciation on piping and stove @ 7.5% p.a. Depreciation on structure @ 7.5%	2475.00
Cost of painting, once a year	500.00
Total	**2975.00**
[C] Annual Production	**Rupees**
1- Gas Production with Av. 40 kg of dung supply (per day)	1.6
2- From March to October (in 245 day)	392
3- From November to February (in 120 day)	96
4- Total biogas production (in 365 day)	488
5- Biogas production equivalent to Butane(488CuM x 0.43) (in Kg)	209.84
6- Biogas equivalent to Butane cylinder (209.84 Kg/ 14.5) (in No.)	14.71
[D] Annual Returns	**Rupees**
1- Value at subsidy rate (Rs. 412/ Cylinder) of Butane	3708.00
2- Value at subsidy rate (Rs. 820 / Cylinder) of Butane	4568.00
3- Total value of biogas production (D. 1 +2)	8276.00
4- Value of slurry (365×40×24%) @ Rs. 1.50 / Kg	5256.00
5- Total returns from biogas plants (D. 3+4)	13532.00
[E] Net Annual Returns (c-b)	10557.00

This project intervention has become successful in communicating the importance and need of biogas plants as a source of alternative fuel. This intervention has been seen by the public representatives like President Zila Panchayat, MLA Kapkot etc., will be helpful in influencing their agenda in favour of biodiversity conservation issues in public interest. Due to high adoption rate, these activities can be scaled up in future projects.

Reducing drudgery through harnessing solar energy

Use of solar cooker

Division-Agastyamuni
GP- Rumsi

Kundan Singh, a 72 year old poor man and resident of Rumsi gram panchayat in Baniyarigad MWS, lives alone with his wife. With advancing age, Kundan Singh was finding it difficult to carryout his routine activities on daily basis. One of his routine task, is the collection of fire wood from adjoining forest for cooking daily meals. Day by day, it was getting difficult for him to collect fire wood as he was unable to carry more than 10 kg at a time.

SLEM intervention

In one of the project meetings, the team learnt about Kundan Singh's problem and challenges. During one such workshop the use of different solar devices was explained and demonstrated to the villagers One such idea, the use of solar cooker aroused the interest of Kundan Singh due to his circumstances. He realised the importance of using solar cooker for addressing his need for alternative fuel and at the same time making his life easier. Kundan queried more about it from the project staff and requested them to provide one solar cooker for his family. A proposal in the meeting for solar cooker was passed by villagers.

Life made easier

The solar cooker was like a blessing in his life. Kundan Singh clearly feels that using solar cooker for cooking has made life easier for him and his wife. One of the greatest benefits is reduction in time and labour to collect fire wood from the forests. Now he does not go daily to the forest as his requirement for fuel wood has reduced and he needs it only for cooking during the night time. This has helped both of them to feel much better as it is a smokeless operation.

> ***Earlier our utensils got burnt and turned black but these are saved now. The time and energy saved from firewood collection is being used in our meetings, socializing and for rest, as this is the prime need in our age.... (Laughter).***
>
> Sri Kundan Singh, Rumsi

Costs and benefit analysis

Expenses before the project	Expenses after the project intervention
For 365 days of coo king he used on an average 6 kg of wood/day; in total 2190 kg a year	Now he only needs wood for the preparation of food in night
Due to old age he could bring 10 kg maximum at a time; it took 3 hours	Now he has to work for 146 days; saves 73 days and 219 hours of his labor
It took 219 days to collect 2190 kg of wood with 657 hours of time a year	he works only 438 hours to collect 1460 kg of wood
Total cost in a year = 2190 x 4 = Rs. 8760	Total cost in a year = Rs. 1460x4 = **Rs. 5840**
No savings	**Saving of Rs. 2920 in a year** ; the saved money is used for other necessities

Towards a bright future

The Solar light story

Division-Agastyamuni
GP- Saudi

The solar light story is from gram panchayat Saudi of Agastyamuni division. Maasanti Devi and Roshni Devi shared their solar light story with the project team.

“We belong to Saudi gram panchayat. We are awfully poor as we do not have a good livelihood option. It was difficult for us to provide for even the basic family needs especially the educational requirements of our children. We do not have electricity connection and depended on the low kerosene lamp light for completing our domestic

It was like living in the darkness I use to feel very bad about my vulnerable condition.

Smt. Roshni Devi

chores in the evening. Throughout the day we toiled hard to complete all our work before sunset.

This darkness in our lives was badly affecting our children's education were affected due to that darkness. They have to complete as much of homework before the evening while all day long they are in school and travelling. As they were unable to complete their work, they felt embarrassed in the class next day. Many times they would come home crying from the school as they were unable to learn and complete the work given by teacher.

We got the information from project facilitators in a village meeting that one of the project component was energy conservation in which there was provision of solar light. We requested the project team to provide us with solar light as it was of utmost necessity to us. Our proposal was passed in the meeting and after some time we got solar light unit.

With the installation of this solar light, our life has become easier. Now our children are able to study in the night too as there is sufficient light for them. They complete all their home work and feel happy to go to school and come back smiling as their teachers are now appreciating their work. Our household work also gets completed well in time. This intervention has helped us in saving the monthly expenditure on kerosene oil. The solar light can be operated for continuously 3-4 hours. We to turn on the solar light at 7 pm till 10 pm which is quite sufficient time for the children to study and for us to wrap up our household tasks."

I used to purchase kerosene oil for Rs. 45/ltr. My children found it difficult in studying under kerosene lamp light. Now with solar light, our house is lightened and we are living a happy life.

Smt. Maasanti Devi

Analysis of the costs and benefits

Before the project intervention	After the project intervention
We were totally dependent on the kerosene oil for light in the night	The dependency on the kerosene oil is over
It costs Rs. 45/liter for which I have shell out Rs. 200/per month and at times dependent on neighbors due to non-availability	No expenditure on the purchase of oil, I am saving Rs. 200/month
Low light, headaches, inability by children's to complete their home work	Children's and ourselves are able to complete our work on time

Converting biomass waste to valuable energy

Pine Charcoal Briquettes making

Division-Bageshwar
GP- Harsila, Uttrauda, Gairkhet, Baisani

Pine trees are commercially used as timber and resin extraction. However, in contrast to these qualities, the needles of pine trees are the major hazard of forest fires. Keeping in view the, pine charcoal briquetting technology has been promoted under SLEM project areas with the objectives to meet alternative fuel requirement and income generation.

Implementation

Pine charcoal briquetting activities in the division have been initiated since 2009-10 onwards. Presently, 25 SHGs linking 201 households are involved in pine briquette production and marketing.

Details of SHG involved in Pine briquette making

Name of SHG	Location	Distance from District HQ	Total Members	Year of Intervention
Sherawali Maa	Harsila	12	15	2009-10
Adarsh	Uttrauda	25	10	2009-10
Pragati	Gairkhet	15	07	2010-11
Gorakhnath	Baisani	27	09	2011-12

Details of Pine briquette consumption among the SHGs studied

Name of SHG/ Location/ total members	Home consumed briquettes	Per household statistics of Briquettes (kg)		Reduction in dependency in 2011-12	
		Consumption	**Value in terms of firewood**	**In (%)**	**In Days**
SherawaliMaa, Harsila (15)	2400 Kg	160.00	381.28	19.03	67
Adarsh, Uttrauda (10)	2100 kg	210.00	500.43	24.97	88
Pragati, Gairkhet (07)	2000 kg	285.71	680.86	33.97	120
Bhagwati, Baisani (09)	1200 kg	133.33	317.73	15.85	56
Households (41)	**7700 kg**	**187.80**	**447.54**	**22.33**	**79**

Technology

The pine charcoal briquetting technology includes the steps: 1) carbonizing pine needles into char in the absence of oxygen in a closed drum to get the carbonized char, 2) moulding the carbonized char with binder mix (animal dung or starch powder or clay) in electric pine briquette moulding machine to get small and cylindrical pieces of pine briquettes, and 3) drying briquettes.

The carbonization drum accommodates 30 kg of dry pine needles at a time and yielded 10 kg of char, which takes a time of 30 minutes in charring and 45 minutes in cooling of drums. Therefore, in a day, a SHG burns 150 Kg of needles to get 50 kg of Char. The cow dung as binder is used at the rate of 3-5% .

Operational Management

- Collection of raw material - Pine needles for briquette making are collected by women (members of SHGs). They collect the needles from nearby forest area located at a distance of 4 to 5 KM, which takes a time of 3 to 4 hours in a day early in the morning.Pine needles remain available in the forests during the hottest months of April, May and June in year. During this period, SHG members in a collective and participatory basis collect the needles and stock their loads (one load approximately equals 30 to 35 kg).
- Carbonization of Pine Needles The carbonization of needles to prepare char is accomplished in of July, August and September of the year excluding the days of monsoon's rainfalls.
- Briquetting of Carbonized Char - Finally, briquetting process starts by the end of September and continues till the char stock is completely used. Major stock of the char is used in the months of November, December and January when the winter cold remains in its peak and the demand for briquettes within and outside the SHG is higher.

Environmental Impacts

- By adopting this activity, the average dependency of a household on forest firewood has been reduced by 22.33%.
- Reduced dependency has helped in saving of an estimated biomass of 447.54 kg in forest per household in 2011-12, which prevents an estimated 627.00 kg of carbon dioxide (CO2) emission in the environment. Overall the sample SHGs together helped in an estimated reduction of 25.70 tons of carbon dioxide (CO2) emission by using 7700 kg of briquettes.
- The annual needle fall in the forest is considered to be 4.6 tons per hectare of pine forest. Therefore, the production of 200 and 300 quintals of pine briquettes in the 2020-11 and 2011-12 helped in to evacuate 13.04 and area 19.57 hectare of forest area, respectively and at the same time recycled 600 and 900 quintals of useless pine needle waste from the forest, respectively. These evacuated forest area helped in regeneration of other plant species like grass for feeding animals.

Economic Impacts

- Benefits as an alternative fuel -Annual consumption of firewood of a household in the project area are estimated to be 20.04 quintals. With the current level of production of the SHGs, it has been estimated that pine briquettes has been able to provide an alternative source of fuel for a maximum of 120 days in Gairkhet and a minimum in Baisani. Overall, it was found an alternative source of fuel for 79 days for a member of SHG.
- Benefits as a Cash Income - In addition to home consumption of pine briquettes as fuel, it has been a source of cash income to the members of SHGs involved in the activity. Sherawali Maa SHG has emerged as highest income earning SHG in the project area during last three years, followed by Adarsh and Pragati SHG together, and Bhagwati SHG, respectively. However, per capita income was found to highest in Pragati SHG and minimum in Bhagwati S HG. Overall, the income of the SHGs per member was estimated to be Rs. 1902

Details of Pine Briquette Income among the SHGs studied

Name of SHG/ Location/ total members	Briquettes marketed (Kg)				Briquettes marketed (Kg)				Total Income earned (Rs.)
	2010-11	2011-12	2012-13	Total	2010-11	2011-12	2012-13	Total	
SherawaliMaa, Harsila (15)	7	11	4	22	10500	16500	6000	33000	2200.0
Adarsh, Uttrauda (10)	4	7	2	13	6000	10500	3000	19500	1950.0
Pragati, Gairkhet (07)	5	7	1	13	7500	10500	1500	19500	2785.7
Bhagwati, Baisani (09)	0	3	1	4	0	4500	1500	6000	666.67
Households 41)	**16**	**28**	**8**	**52**	**24000**	**42000**	**12000**	**78000**	**1902.44**

Gender Empowerment

- Pine briquetting for fuel and cash income generation improved the confidence and organizational skills of women. They have been involved in all stages of the activity right from production to the marketing of the briquettes.
- One of the women members has become a master trainer and is now imparting trainings to other organization such as Jan Sikshan Sansthan to train other village women on different aspects of livelihood and income generating activity.

Two women were trained to be as Master Trainer for village level training from Sherawali Maa SHG at Harsila. Both of them provided eight trainings to the SHGs in different villages of the project on pine briquetting.

Social Impacts

- Using pine briquettes have incidental advantages of hygienic improvement and the absence of smoke in cooking.
- Collection of 3600 quintals of pine needles this year 2012-13 helped in preventing forest fires in 5 cases out of the 22 found in the sample villages studied.

Reduction in the cases of forest fire in the village forest

Sl. No.	Village	Total cases of forest fire	Total cases of prevention
1	Harsila	07	3
2	Uttrauda	04	1
3	Gairkhet	05	1
4	Baisani	04	0
	Total	22	5

Replication and up scaling

The success and hard work of the Pragati SHG at Gairkhet in pine briquetting activity has motivated other women in the same village to replicate and upscale this activity.




Farmer field school

Story of a progressive farmer

Division-Nainital
GP- Majuli

Khajan Verma's farm in Gram Panchayat Majuli of Nainital Division has now become the most visited spot in the project area. He is a progressive farmer who has utilized to the fullest extent the technical and input support that was provided in the project. He took keen interest in the project meetings and actively participated in the technical trainings conducted by the project. Whatever he learned in those trainings were transferred by him to his land as he adopted practices of organic agriculture, IPM and IPNM, soil moisture conservation practices and irrigation tank. He also installed sprinkler, power tiller, diesel pump on his own

expenditure to further maximize the gain. His interventions and efforts bore fruits when he started getting good returns from his land. Being a progressive farmer, Khajan Verma wanted to share his learnings with other farmers of the area. With project support, exposure visit for groups of farmers and FIGs from other Divisions of the project area or other units of Nainital division were organized to Verma's farms thus turning it into a farmer field school.At his school, visiting farmers get exposed to how he has utilized the improved techniques and his resources to improve his earnings and living status by proper planning and learning the tricks of the trade and through belief in the schemes that come to their village.

The reasons why Khajan became popular from the very inception can be summarized as under:

1. Adoption of Organic/ Cultural Practices:

When the initial meetings of Gramya took place he seemed quite keen on demanding organic products to improving his farming. He soon adopted these cultural practices.

- **Deep Ploughing:** Khajan soon learned the advantages of Deep Ploughing. Not only did this activity facilitate better aeration of soil in the field but while ploughing the birds were able to pick the exposed white grubs, hidden eggs, pupa of insects, nematodes, rhizomes and bulbs of persistent weeds and other organisms.
- Time of Planting and crop duration: Khajan used to sow almost all the vegetables like tomato, pea etc. early which used to fetch him good money, early sowing of Mustard prevented the infestation of aphids. Similarly late sowing also fetched him good money and he could easily avoid the glut in the markets
- **Solarization:** This technique is found extremely helpful in disinfecting the area for almost all crops (except for the family Cruciferae). For which the only need was a thick gauged Alkathene /Polythene sheet which was covered over a well dug area where the nursery was being planned and was made air tight from all the sides using mud, bricks or heavy boulders.
- **Pruning, destruction of crop residues and chaubattia Paste:** Village level workshops and trainings organised during Gramya had developed the concept of the local farmers on issues like removal of diseased and unhealthy portions of fruit trees, where the conidia, spores or other hibernating forms of pests take refuge. Most important was the knowledge of pruning in such a manner as would help the branches with flower buds in right direction by pruning them at the right time, collecting the diseased cut parts and burning them at an isolated corner of the field, followed by application of chaubattia Paste which prevents infestation through cut or injured parts

"Now I've also learnt the use of simple techniques which have helped in controlling pests and insects on my fields. Other farmers are also adopting these techniques after recognizing their advanteges.

Khajan's elder brother

of the fruit trees. chaubattia paste is always in demand from progressive farmers like Khajan in the project area.

- **Vermi Composting:** He already had a Vermi-Composting Mother Unit in his field built on his farm by the State Agriculture Department. Due to lack of scientific knowledge he was unable to optimise the use of that structure, but now he has a good knowledge about it.
- **Pheromone Traps:** An exposure trip of Farmers from the area was organized and all the progressive farmers were sent to G.B. Pant University of Agriculture and Technology, Pantnagar. This visit encouraged Khajan to use the Pheromone Traps.
- **Trichoderma Powder :** Khajan after receiving some training in the block which was organized by the State Horticulture department, and he also received a small sample of Trichoderma viridii powder. He used it in the Pre-nursery treatment of some of his vegetable seeds.

2. Improvement of Water Harvesting techniques -

Improving Water Harvesting is one of the most important mandates of Gramya. Several trainings and workshops to cater to such needs were also organized in the area time to time by the Gramya field staff and they had their impacts on the minds of village masses. Khajan was no exception to it, he also opted these water harvesting techniques viz. Irrigation Tanks, Water Harvesting Tanks and LDPE Tanks

3. Crop Diversification-

Of the various interventions which were adopted by the farmers in Majuli and particularly by Khajan Verma some were:

- Plastic Culture and Protected Cultivation of cash crops: He was first to use the Poly-tunnels for managing the nurseries during setting up of Offseason vegetable nurseries in his field. Similarly he used the small poly house on his field for offseason crop nurseries and had gradually learned the tricks of the trade to raise good nurseries using plastic culture.
- **Irrigated and Un-irrigated Crops-** Although initially Khajan also used to rely more on the unirrigated crops like wheat, soya bean, lentil and finger millet, but gradually he too started shifted to cultivation of irrigated crops on larger area after having received several Community and individual water harvesting assets.

"Nala treatment has not only saved our lives but our lands too. Now we have started growing vegetables in the fields down the slope which we had abandoned in the past due to the lurking danger of their washing away; we can never thank you enough for saving our lands!"

Khajan Verma

4. **Land Development and Terrace Repair-** Having learned the importance of saving their fields, the villagers learned to protect their fields which were their bread and butter. Khajan also repaired the terraces down the slope where they had abandoned the land near the nala and started ploughing those terraces and growing the cash crops and cereals etc. there.

5. **Mechanisation:** During the past five years of Gramya's presence in the village, almost all the villagers had a lot of exposure to advance techniques of cultivation, improved tools and implements, new varieties of seed etc. Similarly they were now quite open to mechanisation as well. Now he is using Power Tiller, Diesel pump, Drip Irrigation and Sprinkler

Power Tiller takes so little time to plough the fields and the manoeuvring is also very easy, its working nice and we can work more efficiently now, I love to drive it on my field as it has increased our ploughing efficiency a lot.

I also want to show you my drip irrigation and Sprinkler, now I have spare time even when we have to tend to our potato and other vegetable crops. I don't have to bother much about the irrigation now, I can irrigate even the most distantly located fields with ease; this technique is simple yet very effective."

Khajan Verma

6. **Post Harvest Management:** Since the advent of SLEM under GEF in the area, facilitation of collection, grading and marketing of the surplus from the village FIGs and the federation was in need of a place where they could grade, and pack the partly processed, cleaned produce for better marketing. SLEM had solutions for this and it had provisions for constructing Small Infrastructure facilities for marketing support.

- **Small Infra Structure facility for Marketing support:** To cater to the grading and packaging needs of the federation, a small infrastructure facility for collecting, grading and packaging was sanctioned for Majuli
- **Crates, Cans and Bags:** The FIGs were already active owing to improved Agribusiness activity in the village, and Plastic Crates, Cans, gunny Bags to transport the vegetable and other surpluses which needed partial processing or grading for value addition were largely in demand. So, they were provided under Gramya and later under the SLEM one SHG was funded for collection, grading, packaging of the marketable surplus and a group of 8-10 women were funded for this activity.

Khajan Verma's place has now become the most visited spot in the area for many groups of farmers and FIGs from other Divisions of the project. Khajan is now the source of inspiration for many young farmers in the area who have developed their fields and orchards and are now good returns every season.

"Why don't you invite people from other line departments, like the Agriculture, Horticulture and Forestry to show what a project has done in their area and what they can adopt from here? You must do this and I will support it at my end also..."

Nidhimani Tripathi,

District Magistrate, Nainital

Recently, Chief Agriculture Officer, Nainital was contacted and the District magistrate's idea of earmarking this site as a demonstration plot was shared with him. He readily agreed to take the site as Farmer School for demonstration of methods and results of agriculture and allied activities. The proposal for the same has been forwarded by him to the higher officials of the department concerned for approval.

Today GP Majuli is the most visited site of our project area. Dignitaries like State Cabinet minister, MLA, District Magistrate, Chief Development Officers, Block Pramukhs, World Bank Consultants, Consultants for IFAD project, NABARD officials, Officials from Forest Department, IFS probationers, various teams of Forest Rangers, Foresters and Forest Guards of three different states, trainees from Forestry Training Institute, Haldwani, and visitors from other divisions of our Project have visited the site.

Endeavours in bio-diversity conservation

Division-Bageshwar
GP- Pudkuni

Pudkuni is one of the remotest village of Bageshwar division situated at an altitude of 1854 m and 20 km away from district headquarter. Agriculture and animal husbandry are the main sources of livelihood. Women are the main collectors of fodder for livestock feed in the village.

Under SLEM projects, the villagers were sensitized about the bio-diversity conservation and management through plantation of broad leaved and fodder trees along with cultivation of medicinal plants. In 2010 the Aam shabha of Gram panchayat Pudkuni proposed 10 ha. Plantation in van

panchayat land. Accordingly advanced soil work was done by the van panchayat which is the authorized work agency for forestry activities in the project. At the same time villagers were also provided training on nursery development and management.

Mr. Alam singh, a resident of village Pudkuni, was selected for the kissan nursery. The objective behind this was to sow the seeds in kissan nursery and thereafter shift the seedlings to the plantation site. Mr. Alam Singh had gained sufficient knowledge and interest on nursery techniques and he used to raise plants on his own site. He also used to distribute the plants to villagers without any charge. The project supported him by providing poly bags, seeds, HDPE pipe and fencing material. Mr. Singh developed kissan nursery on his own land which he had not used for agriculture. He filled 15000 poly bags from soil mixed with cow dung and vermicompost and planted broad leaved and fodder species. All the family members were involved in taking care of the plants. Form this nursery 10000.00 plants were sold to van panchyat by Alam Singh @ Rs. 2.00/ plants. This income boosted his morale and from this income Alam Singh purchased one T.V. and mobile set.

Alam Singh distributed 200 plants of various species to the villagers and set example & inspiration to those. While distributing plants to villagers, he do not forgot to give his message that 'this is our earth, we should love and taken care of it.

Sarpanch, Van Panchayat

Division-Bageshwar
GP- Harsila

Harsila Gram Panchayat in Bageshwar division is located at an altitude of 1100 to 1400 M in Kumgad Micro-watershed, at a distance of 12 KM form Block Headquarter. Forest area nearby Harsila village is covered mostly with chir-pine forest, where the village women go for fuel and fodder. The community decided to revive forest cover through plantation work in the Van Panchayat land under SLEM.

In 2010-11 after surveying, advance soil work was started in 10 ha land of Van Panchayat. Fencing was done to protect planted seedlings and also to get better production of fodder grasses. Subsequently, pit excavation and trench formation work was accomplished with an expenditure of INR 115439.00.

The women of the village took decision regarding social fencing of the plantation sites. No cattle was permitted to graze in the Van Panchayat land where the plantation had been carried out.

I belong to lower income group. With the project's help I raised a nursery and earned Rs. 25000 by selling 1000 plants at the rate of Rs. 2.50 per plant.

Mr. Ramesh Singh

Sarswati Devi belonging to a low income group household was unanimously appointed for supervision of the plantation area. With her dedication and hard work, the plants and grasses started flourishing. Saraswati Devi used to receive an honorarium of Rs. 2600 for supervising 10 hectare plantation area at the rate of Rs. 260 per hectare. Since July 2012 onwards, the supervision of plantation area is being done by a women group comprising three women. Each member of the group carry out the weeding work for two hours every day.

In a hot summer night during May 2012, there was fire near the plantation area. Saraswati Devi ran to the site and called villagers hurriedly. It was only because of her courage that we were able to save our plantation area.

Mr. Prem Singh

Due to absence of biotic pressure in the plantation area the production of grasses became quite good. Women took a unanimous decision to harvest the grass and share it equally amongst them. Now, they do not have to go far for collecting fodder for their animals.

Aloevera Cultivation

A boon for villagers

Division-Bageshwar
GP- Nan Kanyalikot

The Nankanyalikot gram panchyat under Kanalgad micro watershed is situated at an altitude of 1220 m and 15 km away from the district headquarter Bageshwar. In the year 2009-10, about 60 villagers were imparted training and exposure visit was conducted on cultivation of medicinal and aromatic plants by Green foundation and Central Institute for Medicinal and Aromatic Plants (CIMAP).

Intervention

After getting the successful training and exposure, 5 persons from Nankanylikot village formed Kanauli self help group. In the year 2009 they planted 8000 Aloevera saplings in 30 nali (0.6 hectare) area. In the past this rainfed area was used by farmers to grow traditional crop like wheat,

pulses and millets. But in this remote village due to the menace of wild boars and monkeys the farmers had given up traditional agriculture. The area was fenced and two poly houses were also established by the project. The group was also imparted training on use of poly houses by Krishi Vigyan Kendra Lohaghat.

Aloevera is a plant of great potential and value in the field of therapeutic and cosmetic industries. It is particularly useful for treatment of burns, bleeding wounds, as eye drop for sore eyes.

Details of sales and earnings by the Group (upto Oct 2012)

S.N.	Marketing place	Items	No.	Rate	Total Income
1	Uttrayani Mela	Saplings	1000	10.00	10000.00
2	Village Baisani	"	4000	2.50	10000.00
3	Village Chachai	"	1000	5.00	5000.00
4	Bageshwar Market	"	1000	10.00	10000.00
5	At Plantation site	"	500	5	2500.00
6	Juice in Uttrayani mela	Juice	50 bottle(1/2lt)	100.00	5000.00
7	Bageshwar Market	"	50 bottle(1/2lt)	100.00	5000.00
8	Kort Mela	"	20 bottle(1/2lt)	100.00	2000.00
9	Bageshwar Market	"	100 bottle(1/2lt)	100.00	10000.00
	TOTAL				**59500.00**

Adoption and marketing

- After their success in Aloevera farming, the president of the self help group Shyam singh Kanauli and another member have become master trainers and are now imparting trainings to other farmers at CIMAP Lucknow on Aloevera processing.
- **The alovera plantation site has been visited by the local MLA, Zila Panchyat president, various NGO representative and local farmers.**
- Inspired by the success of Kauauli SHG, the women of adjoining Baisani village have also formed a self help group and planted 5000 Aloevera sapling in 1.00 ha area.
- Narendra Singh a farmer of Chachai village has also adopted this activity and planted 1000 Aloevera sapling.
- The growth of the plants is quite encouraging. The groups have also been trained to use motorized small scale juice extraction machine. So far the Kanauli group has produced 2000 bottles of ½ liter capacity.
- The Aloevera juice produced in this area has several qualities. It is organic and natural as no urea or DPA is used. It is not irrigated or farmed but grows naturally which enhances its medicinal value. Laminated bottles are used and sealed to prevent pilferage or contamination. The method of use is given on the labels. Due to direct marketing without middle men the cost is very reasonable. The total cost of production of Aloevera juice is Rs. 100 per litre with sale price of Rs. 200 per litre with a net profit of Rs. 100/ litre.

Exploring new livelihood options

Tent house SHG of village Malli pokhari- A men's initiative

Division-Nainital
GP- Malli Pokhari

Eight male residents of village Malli Pokhari of Nainital division joined hands to form the Saim Devta SHG with Mr. Mahadev Pokharia as president and Mr. Nand Kishore Pokharia as the secretary/treasurer of the group. The group conducted regular meetings and contributed Rs. 20 per month towards a revolving fund. Inspite of their limited resources, the group was highly motivated and continued to properly maintain their documents including various registers and compliances of the decisions taken during various meetings.

The members had no knowledge of micro financing and procedures for accessing credit from different govt. schemes. Nor did they possess the skills to initiate any income generating activity. The group started inter-loaning amongst themselves for meeting their emergent and petty needs and soon realized that for taking up any IGA they required substantial funds. From time to time, the group members involved themselves actively in any such activity that could fetch them some money for the group and the earnings were deposited in the SHG bank account. This enabled them to repay the bank loans which were given to each member for the vegetable cultivation activity in their fields. They took up jobs like clearing the fences, hedges in the village lands and other labour oriented works to collect some money for their group. The collection in the bank reached an amount of Rs. 2,81,115.00/ in the year 2012.

The SHG members were confident enough to show all their documents including the proceedings register, Cash book, savings bank pass book/internal advance savings pass book of each candidate and pass book of the SHG's bank account to project staff. Their documents were quite vividly reflective of their intent to carry out the SHG work.

Since the group's inter-loaning and performance was satisfactory, block office under a government scheme provided them with a fund of Rs. 70,000.00 which they deposited in the bank as a fixed deposit under the name of SHG. This small success motivated the group members to approach the SLEM project team for supporting their group under the livelihood support programme of the SLEM project. With the technical and social facilitation of the project team, the SHG members decided to take up tent house activity as an IGA with funding support from the project.

A risk calculation was done by the project team which then decided to support the proposal of tent house activity for the SHG. A financial assistance of Rs. 125000 was provided to the group to start this activity. The SHG members were confident that investing in the tent house business in the remote block of Okhalkanda would bring good returns as there was an existing need for such kind of services in the area. The SHG started providing tent house services in marriages, household functions, pujas and fairs held in the area. The venture proved profitable for the group and they were encouraged to increase their monthly contribution to Rs.50.00 per member/month.

Now the group has increased the contribution amount to Rs. 100.00 per person/month. This has increased their corpus fund to a respectable amount. This financial autonomy has increased their level of confidence to a new height and they are some of the most talked about persons in their village. They truly represent the picture of the burgeoning new economically self sustainable Uttarakhand.

Their reputation at the block level was such that the block office invited the group and provided all the seven members a loan of Rs. 20,000.00. Thus the group received a total sum of Rs.1, 40,000.00 to start vegetable cultivation as a side business for the lean months; because tent house business was limited to the marriage season, Ram Lilas and election activities in the region.

reached to the tune of Rs. 2,81,115.00/ in the year 2012.

Every Penny counts

Tailoring as an income generation activity

Division-Chinyalisaur
Vill- Bindalkoti, Ramola

SLEM project followed a bottom-up and climate adaptive livelihood approach. While selecting the SHGs for livelihood support activity, gender equality has also been ensured. This was done by building up women's social capital and management capabilities while facilitating their empowerment by organizing them into self help groups (SHGs). Project helped them acquire financial and technical skills to initiate and successfully manage micro-enterprises.

In village Bindalkoti of Chinyalisaur division, a group of 13 women formed a self help group

Narsingh Samooh in the year 2009-10. Initially the group started saving and inter-loaning to its members during times of need. Every member of this group contributed Rs.100/-per month.

Soon after the Narsingh Samooh approached the SLEM project team for supporting their tailoring activity. The project team assessed that this group was conducting regular meetings, savings and systematic inter-loaning process within the group. It was also observed that tailoring needs of 300 households from village Bindalkoti was being catered by only 1-2 sewing machines within the village and one tailoring shop which was situated on the road head approx. 2 km. far from the village. Considering the business potential and the good performance record of the

The members of 'Narsingh Samooh' are earning Rs. 2500.00 to 3000.00 per month. Till now there saving is of Rs. 58550.00 in group's account and Rs. 20,000.00 is given as inter-loaning.

SHG, the project sanctioned Rs. 45000.00 for tailoring activity in May 2011. They purchased sewing machine @ Rs. 3000.00 for each of its members and from the remaining amount bought tailoring accessories viz scissor, needles, thread, tailoring chalk, ruler, inch-tape etc. as per their requirement.

Three members of this group namely Pawana Devi, Sonmati and Rusa Devi have established themselves professionally and opened a tailoring shop. Pawana and Sonamati were traditionally doing this activity since long time. Now they are also working as 'Master Trainer' in the area. The group is catering to the needs of approx. 150 Households of nearby villages namely Ghiyakoti, Kyarda, Dadoli, Pokhari and Majket. They are charging Rs. 100.00 for Shalwar-Kurta; blouse @ Rs.40.00; frock @ Rs. 80.00; Petticot @ Rs. 30.00 and Gown @ Rs. 60.00. The group is very happy and thankfull to the project for building up their confidence as well as financial sustainability.

Similarly in the Ramola village, two Self Help Groups (SHGs) have been given grant to start tailoring activity. Each group is comprising 10-12 women members and till November 2011, Bhagwati Swyam Sahayta Samooh had accumulated saving of Rs.16419/- and another SHG Lakshmi Swyam Sahayta Samooh had saved Rs. 15979/- in their account.

SLEM project has given a grant of Rs. 36000/- to each group. Bhagwati Swyam Sahayta Samooh received the grant in the Year Dec. 2010 and Lakshmi Swyam Sahayta Samooh in the year June 2011 to purchase tailoring machine, and other tools. These two groups are catering to the needs of village Khand, Sarot, Nawagaon etc of total population of around 1300 to 1500 persons. Group members stitch blouses, petticoat, ladies suits, school dresses, frock, gown etc. Three members of the group are working as master trainers and have professionally adopted tailoring activity while three members are doing this for their home requrement. Bhagwati Swyam Sahayta Samooh earned Rs. 9000/- in the year 2010; Rs. 24000/- in 2011; Rs. 30000/- in the year 2012 and Rs. 2800/- in the year 2013, June thus total amount Rs. 65800/- earned in 29 months. All the 12 members saved money of Rs. 400-500/ per month by stitching their own and family member's clothing.

"I was brought up in a traditional and regional surrounding. After my marriage I emulated my mother in my in-law's house. I had to follow all traditional rules and I never sat in front of elders in the family. There were many restrictions for the women. I had no right to contribute in any process of decision making."

"When one Self Help Group was formed in our village and my neighbour Lakshmi asked me to be a part of this group, I was afraid initially, but I went for training along with other members and learnt new things. Our group started regular savings and gradually started inter-loaning also."

Smt. Sushma Devi,

'Bhagwati Swyam Sahayta Samooh'

Jyoti SHG- Entrepreneurship of women from Majuli village

Division-Nainital
GP- Majuli

Majuli is a remote village of the Dhari block of Bheedapani unit of Nainital division. It is located about 75 km away from the division headquarters. After project initiatiation, women started to participate in the Mahila Aam Sabhas which were held especially for them.

When the initial ice broke, the womenfolk started to open up to the project team regarding their needs, hopes and aspirations. They formed Self help groups through which they learnt the basics of micro financing to save petty amounts, which would be helpful to them in the hours of their need.

Initially the facilitator was concerned about how the women will manage the putting up of the "shamiyanas, kanats" and all the paraphernalia associated with the catering work; but the women had clear-cut plans. "We will engage young boys from village for the job and pay them some honorarium" exclaimed Smt. Rekha Devi, a senior member of the group. They all enthusiastically told the facilitator as to who would keep the accounts and who will keep the entire material on the roadside shop. The idea gradually started sounding somewhat practical.

One such Self help group was formed in the gram panchayat Majuli, named Jyoti Self Help Group by the women. They religiously held their monthly meetings, keeping the record and collected the monthly contributions. They had learnt through their experience that petty loans from their collection in the Gramin Bank of their village had helped them a lot.

We had doubts as to how these women would come to Haldwani and buy all the necessary stuff from the market and transport back to their village. But their hard work defied all our our doubts.

Coordinator

Social staff

Jyoti SHG members observed that during marriages in their village and neighbouring villages, no Tent House business was there, to cater to the villagers needs for arranging the ceremonies. Usually the village folk themselves contributed and brought things from the Ramlila Samiti in the village which had become tattered over the years. In one of the meetings, Basanti Devi, the president of the group told the project team "Behenji! We all have decided that we will start a tent house for our village, provided we get enough financial help from the project". All the members were unanimous in their demand.

The project authorities evinced interest in the venture, although rather hesitantly initially. But having met the group, the clarity of their thoughts, the strength of their determination became quite evident to the project team. Their proposal was accepted and an initial amount of Rs. 40,000.00 was forwarded to the Gram Panchayat through cheque, which was eventually transferred into the account of the SHG opened at the nearest Gramin Bank.

The team from TERI (external consultant for final Final Impact Evalution –SLEM) also had interactions with the group members and were quite impressed by the growth which was reflected not only in the behaviour of the group members but was equally well reflected through the records which were maintained by the members themselves.

The group members went to the city and with the help of the project team members bought the material needed for the business.

The six-monthly review of the performance of the SHG brought to the notice of SLEM personnel that the tent house activity at Majuli was doing exceptionally well.

Tara Devi- A star performer

Division-Bageshwar
GP- Harsila

In 1995 Tara Devi came to village Harshila as a new bride. Her husband was owning a shop in the village and she was happy and financially sound. In 2001 her husband died due to excessive drinking. At that time her son was only 13 months old and her two elder daughters were 4 and 5 year old respectively. Life seemed to her like hell, as she had never really ventured beyond her traditional role as a daughter- in-law of the family. Her husband was the only bread winner of the family and after his death her father and mother- in –law also went into shock. She had to discharge the additional

responsibility of marrying her young sister in law. With her limited resources, Tara Devi fulfilled her husband's wish by marrying her sister-in-law within one year of his death. Gradually her financial condition deteriorated and she had to shutdown her husband's grocery shop. Her father –in –law also died in the year 2002.

In 2005-2006, when Gramya project was initiated in her village, the project staff supported her and villagers appointed her as motivator of the village. Tara Devi was educated up to middle level at that time but she fulfiled her duties successuflly. She showed keen interest in project works and participated in several training & capacity building programmes and exposure visits. She helped the project staff in community mobilizing activities. Due to her hard work and active participation in project activities, the villagers also supported her and she became the undeclared leader of women groups for all project initiatives.

“Tara is our role model, she encouraged others including me to come forward. She helped me to form a group of schedule caste households to which I belong. We consituted a group and proposed Polutry activity under livelihood. The project granted us fund and now we are earning well through polutry activity”. Bharti Devi

Tara formed a group of 7 women and has taken a training of sclupture making. This group has started idol making with project support by receiving mould and other necessary tools. Now the group is earning by selling idols of different Gods and Goddess like Shivji, Parwati, Krishnaji etc. Apart from this activity she took initiative to mobilize the women to make pine briquettes. She formed a group of 12 members for pine briquettes making and now this group is also doing well. Now she is working as master trainer for Pine Briqutte trainings. Tara Devi also took initiative and renovated her old Gharat by involving two other poor families and all three families are getting benefit from this Gharat by grinding wheat flour and receiving a part of flour as bhagwari (labour charges).

Now Tara is appearing in High School examination, with the support of project staff, along with two other ladies of this village, who also started studying after a gap of 10-15 years. Tara's three children are going to school and she has motivated other familes also to send their children to school. With her mulitple accomplishments, Tara Devi is a star performer of SLEM project Uttarakhand.

I was hiding behind a door inside the room when project staff along with villagers were discussing with my mother-in-law. They told her that, as her daughter-in law is educated till middle class and she could work for community so they wanted her to be the village motivator. The project-staff was also convincing her that by this she can also financially support the family.

I wondered whether I will be able to handle these new responsibilities as I had never gone out alone. And what about my children as my mother in law was quiet old to take care of my children. But finally they convinced us. The project team was very supportive and I also worked hard to stand confidently against all vulnerability.