FES
FOUNDATION FOR ECOLOGICAL SECURITY

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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Environmental Planning & Coordination Organisation (EPCO)

Technical Intervention for resilient village institutions through eco-restoration and sustainable livelihoods

CCA-RAI Project, 2012-14 FINAL REPORT

with support of EPCO, Madhya Pradesh and GIZ

Initial Draft

by

SHT Mandla, Foundation for Ecological Security

Contents:

Technical Intervention for resilient village institutions through eco-restoration and sustainable livelihoods

Tested in: Madhya Pradesh

Duration: 2 years

Implemented by: Foundation for Ecological Security, Spearhead Team – Mandla, MP.

Total cost: INR 22.09 lakhs/€28,441

Coverage: 2000 hectares of area in 8 villages

Geographic features: Undulating terrain, landscape dominated by forests interspersed with agriculture, high rainfall

Climatic stresses: Erratic rainfall

Non-climatic stresses: Poverty, forest degradation, weak institutions, lack of treatment of catchment of watershed

Beneficiaries and total number: 1643 Tribal farmer families of 8 villages of Niwas block benefitted from institutional processes, while about 553 farmers from livelihood interventions.

Current/predominant livelihood sources for community: Agriculture, labour and forest produce dependence

1. CCA-RAI: AN INTRODUCTION

With the aim to enhance livelihoods and adaptive capacities of vulnerable rural communities in India so that they are better equipped to cope with the climate variability and change, the Indo-German development Cooperation through its project CCA-RAI (Climate Change adaptation in the Rural Areas of India) is working with the Indian Ministry of Environment and Forests (MoEF) and the German development organization Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) in four states of India viz. Madhya Pradesh, Rajasthan, West Bengal and Tamil Nadu.

In Madhya Pradesh, Mandla district was chosen for the project's implementation. The livelihoods of tribal communities in Mandla are dependent upon small-scale farming, fishing and forest produce. Diversity of species and ecosystem services provides them with fuel, food, fodder, housing material,

medicine and spiritual sustenance. In the last few years, erratic rainfall has made crop planning go awry and decreasing agro-biodiversity leaves little alternatives for food security thereby increasing importance of forests even more. Forests are also under climatic stresses like droughts. Demographic pressure and low literacy levels combined with lower asset base further decreases adaptive capacities.

This report highlights the field interventions delivered by the Foundation for Ecological Security (FES) to implement CCA-RAI jointly with the German development organization Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) in nine project villages of the Niwas block of the Mandla District. The names of the eight project villages where the interventions were initiated as follows:

1. Kusmi
2. Luhari
3. Mohpani
4. Thanamgaon
5. Malehri
6. Patha Devgaon
7. Payalibahur
8. Harisingori

Niwas block, which is the highest part of Mandla district, with an undulating landscape with forests at the ridges and agriculture on the low lying areas is experiencing rising variability in monsoon rainfall especially from the last decade. Non-climatic stresses like degradation of forests further aggravate the impact of erratic rainfall on soil erosion, failing cropping cycles, residual soil moisture levels. Loss of forests further reduces safety net for the poor in terms of loss of various livelihood options emerging out of forests. Weak village institutions compound the problem, which leads to non-regulated use of natural resources, less control over public funds which could otherwise be used to reduce vulnerabilities.

The CCA-RAI project implementation started in Niwas block of Mandla district in November, 2011, and the key facts and findings of the interventions are presented in this report.

2. ADAPTATION HYPOTHESIS

Forest degradation, loss of biodiversity and soil erosion exacerbated through climate variability and change are immediate threats to natural resource dependent communities in rain-fed areas like in the Mandla district of Madhya Pradesh. Addressing these issues and strengthening village institutions reduces the vulnerability of communities.

MODELS IMPLEMENTED:

2.1. Institutional Mechanisms and Actors Involved

The Foundation for Ecological Security (FES) has been working in the Mandla district since 2006, on issues concerning rural livelihoods, betterment of natural resources, strengthening of local-governance institutions, and on making local communities partners in efforts towards conservation. As an implementer of the CCA-RAI project in partnership with GIZ in the Niwas block of Mandla district, FES has activated village level institutions and capacitated for executing project activities.

Village level institutional mechanism is essential for the protection of indigenous community conserved areas. The Panchayati Raj Act, PESA, JFM and later on National Biodiversity Act provide a legal framework for these institutional mechanisms to continue to exist. In Madhya Pradesh, Gram Sabha and its committees are treated as fourth tier of the Panchayati Raj System, further providing an enabling framework for village level community based conservation oriented institutions to operate. A key aspect of FES's interventions in the villages of Mandla was the constitution of the Natural Resource Management Committees or *Prakratik Sansadhan Prabandhan Samitis* (PSPS). The *samitis*, were elected by the *Gram Sabhas* and had universal membership ensuring that every resident of the village, despite his/her social or economic standing had a say in the functioning of the *Samiti*.

2.2 Key Implementation Processes/good practices

2.2.1 Promoting judicious and sustainable use of forest resources through empowered Gram-Sabhas for arresting forest degradation and loss of biodiversity.

As a core activity, FES worked for strengthening of village institutions in all the project villages. This activity has played in the key role in assisting vulnerable communities to adapt to climate change, because weak institutions could not have supported the interventions for climate change adaptation in the first place. It was important to deliver a message among the communities that the depletion of the natural resource base would harm them severely in the long run if they do not take a collective responsibility to conserve forests and use their resources sustainably. The loss of forest resources would mean the loss of important sources of their alternative livelihoods such as NTFPs and fuel-wood, and climate change will only worsen their plight. This required following interventions which FES carried out in the project villages

a) Mobilizing village communities in the villages where technical interventions were necessary: The community mobilization process in all the villages involved discussing the issues of conservation with men and women separately, building an understanding of degradation of natural resources within the groups and the committee and thereafter taking

the issue to the forum of Gram Sabha. FES facilitated the participatory decision making process which followed the constitution of village level institions and formation of byelaws by the village communities themselves.

b) Constitution of Village Level Institutions and Byelaws: The engagement with village institutions had begun with organizing village institutions by electing an executive committee for natural resource management, called "Prakratik Sansadhan Prabandhan Samiti (PSPS)". The samitis, being elected by gram Sabha became a part of *Panchayati Raj* system, which allows Gram Sabhas to appoint committees for specific purposes. Advising the gram Sabha on natural resource management and spearheading the process of developing rules and regulations around commons were one of the duties of the committee along with planning for natural resources and land use. Constitution of PSPS and their regular meetings ensured the participation of the local stakeholders in order to formulate the byelaws by the villagers themselves to encourage sustainable the natural resource use in all project villages.

c) Organising village level meetings in every village, and linking the agendas among different committees: FES conducted regular Gram-Sabha and PSPS meetings and ensured the participation of all the majors of all the villages under the project. FES facilitated the dialog process among the villagers as well as the representatives of various institutions including PSPS, Gram-Sabhas, Forest Department, JFM committees, etc.

d) Strengthening management of the committees: To ensure proper functioning of the PSPS and Gram-Sabhas, and the interventions that were being carried out in the field, FES conducted regular trainings of the *Gram-Mitras*[1] (para-workers) on implementation of the interventions and kept collecting the data and information in documented form from them.

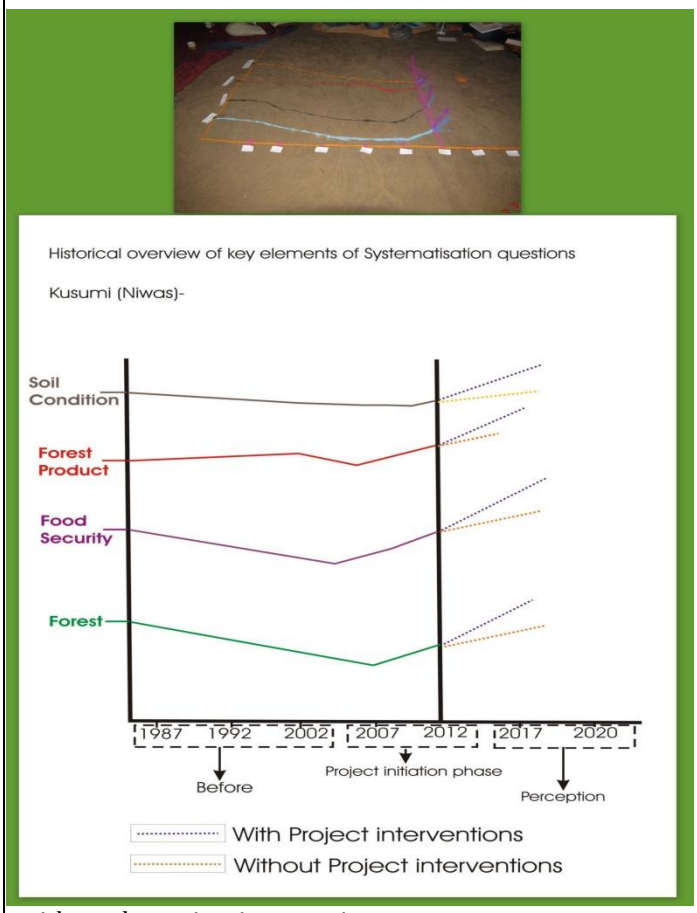
The performance of the village institutions was evaluated on the basis of late Dr. Elinor Ostrom's eight principles for sustainable governance of common-pool resources. These principles are:

1. Define clear group boundaries.
2. Match rules governing use of common goods to local needs and conditions.
3. Ensure that those affected by the rules can participate in modifying the rules.
4. Make sure the rule-making rights of community members are respected by outside authorities.
5. Develop a system, carried out by community members, for monitoring members' behaviour.
6. Use graduated sanctions for rule violators.
7. Provide accessible, low-cost means for dispute resolution.

8. Build responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system.

The evaluation of 6 out of 9 villages based on Dr. Ostrom's principles is given in the Annexure I of this report.

Community Conservation & Adaptation to Climate Change: A case from Kusmi



People of Kusumi village began protection from last 5 years (2007). Hence there has been some improvement in the regeneration from the root-stock. The follow up on rules has been strict for village Kusumi. The PRA indicated has developed to some extent and now the community is confident enough to protect it and expecting that within next 10 years they can bring the forest to a sound condition. They require outside help to achieve this objectives. Otherwise it may take some more years to come to that point.

The PRA output indicates the positive trend towards eco-restoration owing to improved conservation of forests on the ridge. On asking whether further intervention of FES is required in order to facilitate for community conservation, people of Kusumi indicated that they are capable of enforcing rules by themselves. Our continued presence will be even better but they can do without the project intervention too.

Commons need commons

Notably, Kusumi has come out of a major conflict around another common property resource, which is the village pond. Few years back, entire village was involved in collective fishing from the pond. A village account was maintained to regulate sharing of fish. However, Panchayat granted the fishing rights on the pond to an SHG, robbing people's rights on the pond. The event brought conflict in the village which not only affected the pond but also forests. People of different factions began to disregard their own rules and stopped protecting

forests. As the discussions over commons were re-initiated in the project, old bickering also re-surfaced. With several rounds of discussion, the villagers arrived at some amicable solution with the SHG on sharing of fish and regulating fish prices. Then only, the movement towards conservation could be initiated.

2.2.2 Construction of stone exits and stone bunds in upland farms for arresting soil-erosion due to erratic rainfall and soil-moisture retention in farmlands in the undulating terrain.

As per the Agricultural Contingency Plan 2008, prepared by the Ministry of Agriculture, Government of India, nearly 60% of the soils in the district of Mandla are shallow. When coupled with the undulating terrain and the considerable rainfall—mean annual rainfall of 1455 mm—that the district experiences, one sees that the soil erosion in the district is very high; and this is one of the principal factors that make agriculture in the district vulnerable.

Most of the agricultural land located at the foot hills of the *Marjat* jungle (a reserved forest protected by the villagers themselves). The table tops of the ridges are usually agriculture lands. Heavy soil erosion has been a common occurrence in last few years. With the increase in heavy precipitation events and the degradation of forests there has been a very high increase in runoff and the resultant soil erosion causing rill formation in the farm lands and erodes productivity of lands over the years.

Traditional outlet in farm lands are made of mud and stones with a pipe provided at the floor level of the farm to drain water. The flow from pipe is sharp enough to cause soil erosion downstream. Moreover, at times, there is no outlet, especially in the bunds made under MGNREGA. This eventually leads to cracking and even rupturing of the bund. However, the new outlets are actually loose boulder check dams, which reduce the velocity of running water, retain soil as well as prevent the formation of rills but also levels the farm.

It is in this context that the soil and moisture conservation efforts of FES, in the shape of improved water inlets and outlets, built on agricultural fields assume significance. By arresting soil and moisture on the agricultural fields, the organisation is helping the rural communities improve the fertility of their soils and thereby improve agricultural productivity. A significant portion of the uplands are held by the Adivaasis like the *Gonds* and *Baigas* (the latter classified as Particularly Vulnerable Tribal Group); and any attempts to improve the quality of their lands would help them fortify their livelihoods and emerge from the rut of poverty.

FES's intervention on soil and moisture conservation through the construction of stone-exits and stone bunds proved to be very successful in terms of soil level improvement and moisture retention. Several villagers testified the increase in soil volume in their fields and they shifted to

double cropping which consequently increased their incomes. More details on the results and impacts of this intervention are given in the following section.

2.2.3 Strengthening livelihood portfolios:

Climate Change Adaptation implies diversification of the livelihood sources of the communities most vulnerable to the adverse effects of climate change. It simply suggests that a poor farmer should have several, not few, sources of earning or making a living for himself and his family especially when climate change threatens to harm a few of such sources in the current era. Diversity of options leads to spreading of risk, thereby reducing vulnerability. Crux of this strategy revolved around enhancing the existing livelihood options adopting interventions which were technologically sound as well as cost effective.

a. Crop based Options

The idea was to improve the cultivation practices to enhance crop-productivity by improving the traditional methods of cultivation to protect farmers from the market driven high input-high output agriculture.

FES intervened to revive and strengthen millet cultivation and other cereal crops through seed replacement and promoting other improved techniques of agriculture. The knowledge of millets is a common pool resource that is integral to the sustenance and cultural needs of the communities of Niwas. The interventions were as much geared towards conserving the knowledge commons embodied by millets as it was to revive millets and address malnutrition.

The interventions based on crop-based options comprised of several important dimensions:

- Intervening with millets in particular together with other cereal crops like paddy and maize to support the diversity of food crops cultivated in the region.
- Superior varieties of ragi, kodo millet, and little millet were selected by pulling them in from different sources. In doing so, it was ensured that high quality seeds were delivered to the communities, thus ensuring a higher rate of germination and survival, in turn translating into higher yield rates.
- Institutional mechanisms to ensure sharing and propagation of seeds, facilitating farmers to reduce the costs of cultivation.
- Introduce practices like weeding, manuring to uplands for millets cultivation.

- Improvement in seed selection, seed bed preparation, line sowing and transplantation practices in paddy and seed selection and line sowing specifically in maize.
- The use of pure line selection method, seed-banks and locally developed seed drill, that allowed the farmer to control the number of seeds sown and the distance between two seeds sown, to ensure better productivity of the crops.

Quantity of seeds distributed by the seed bank (kgs)			
VILLAGE NAME	**KODO**	**KUTKI**	**RAGI**
Patha Devgaon	5	4	2
Payalibahur	2	0	2
Kusmi	1	0	0
Luhari	2	0	1
Thanamgaon	5	5	6
Mohpani	2	0	0
Malehri	10	3	0
TOTAL	**27**	**12**	**11**

b. Tree Based Options

Another important livelihood diversification option was eco-restoration through agro-forestry on forest fringes and slopes, and plantations on bunds. It was believed that bund-plantations and agro-forestry enhance the productive capacities of farmlands and ensure the provision of resources like wood and fruits, to add to the incomes of farmers in future. Tree based options are supposedly much more robust and long-lasting than crop based options for climate change adaptation, though their impacts can only be assessed in long term. Once successfully implemented, tree based options are much more resilient to climate change than crop-based options.

Care was taken in selecting the tree species for agro-forestry and bund-plantations as it was important to preserve the genetic pool of native tree species while avoiding the introduction of any alien species not conducive the local environment. It helped conservation of water also, as native tree species would not absorb too much water from the soil. Plantations on the forest fringes ensured the checking of soil-erosion, addition to the humus layer that would accumulate in the fields through rain-water runoff and enhance soil fertility, and bund-plantations would check the breakage of bunds during heavy rainfall in addition to securing the supply of fruits, fuel-wood and timber for the future.

2.3 Cost Benefit Ratio for each Measure

2.3.4 Strengthening Village Institutions:

A total of more than 500 hectares of forest is now being actively conserved by the community institutions. A comparison between non-community conserved forest patch with a community conserved patch indicates that each hectare of a community conserved forest has 60% more regeneration, 37% more plant density and about 40% more number of plant species. Greater biodiversity indicates strength of an ecosystem and its ability to absorb shocks.

2.3.5 Construction stone exits and stone bunds:

The soil conservation measures resulted in a total of 37,319 $m^3$of soil saved. More than half of the farmers reported improvement in yield and shift to double cropping. From those farmlands only, the average income increased by 25 – 50% approximately (against the baseline average annual income of INR 16,468 for a farmer belonging to the medium income group), depending on the types of crops cultivated and their market rates. It is important to note that in each farmland, which on average was $1/10^{th}$ of a hectare, the average income increased by INR 4000 to INR 8000 approximately.

2.3.6 Strengthening the livelihood portfolio:

Through improved agriculture practices, a 23% improvement in the productivity of kodo millet, 16% increase in the productivity of Kutki (little millet), 19% improvement in the productivity of maize, whereas 30% increase in the productivity paddy was recorded in the trial plots over control plots. This led to an increase in income which is given in the table below:

Crop	Average Increase in Production (kg/1000 sq m)	Market rate for selling (INR)	Average Baseline Income from control plots (INR per 1000 sq m)	Average Increased income from trial plots (INR per 1000 m)	Increase in income (INR per 1000 sq m)	Percent Increase in agricultural income
Maize	6.02	12	419.7	492	72.3	17.2%
Paddy	21.7	12	862.3	1122.5	260.2	30.2%
Kodo	3.8	15-20	323 – 431	380 - 506	56 - 75	17.4%
Kutki	6	15-20	622 – 829	713 - 951	91 - 122	14.7%

The collective average annual income of farmers against the baseline of INR16,468 by strengthening the livelihood portfolio increased by 2.9 - 3.2%

Agro-forestry and bund plantation: 300 farmers undertook plantation on bunds and about 25 farmers undertook agro-forestry on plots on the forest fringes. In the next 5 years, the portfolio of the farmer's income will stand diversified, with trees providing a part of the income and tree cover will arrest forest degradation and fragmentation.

3 OUTPUTS, BENEFITS AND IMPACTS

3.1 Strengthening Village Institutions:

The executive committees are raising issues of natural resource management in the Gram Sabhas, which shows a positive trend towards eco-restoration owing to improved conservation of forests. Reintroduction of the *Pari* system of protection in 5 out of 9 villages which involves every household taking turns to guard the forest. A total of more than 500 hectares of forest is now being actively conserved by the community. A comparison between non-community conserved forest patch with a community conserved patch indicates that each hectare of a community conserved forest saves 57 MT more of carbon, 212 MT more of biomass and has 60% more regeneration, 37% more plant density and about 40% more number of plant species. Greater biodiversity indicates strength of an ecosystem and its ability to absorb shocks. The summary of the study done by FES on Natural Resource Accounting System is given below:

Parameter	Unit	Community Conserved Forest Area (Kusmi)	Non-Conserved Forest Area (Malehri)
Growing Stock			
Timber-wood	MT/ha	1,132	820
Fire-wood	MT/ha	556	656
Bamboo (Clumps)	No/ha	521	-
Diversity			
Diversity Index*	Index (Simpson's)	0.14	0.37
Total Species	# of species	24	10
Population density	# of plants/ ha	5,150	3,746
Soil Fertility			
Nitrogen	Kg./ha	-	-
Phosphorous	Kg./ha	-	-

Potash	Kg./ha	-	-
Carbon sink	MT/ha	454	397
Natural Regeneration	Sapling/ha	3,239	2,035

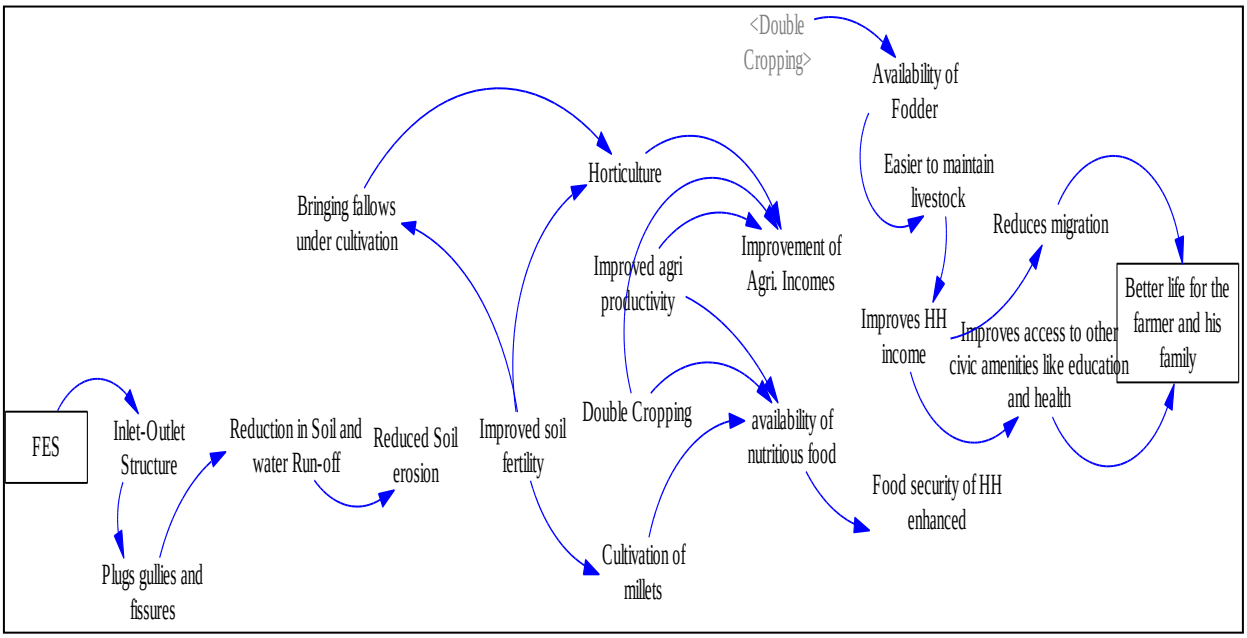
**** the smaller the value of index, the higher the diversity.***

3.2 Soil and Moisture Conservation:

The intervention by FES encompassed 167 farmers and more than 300 upland farms spread across six villages of Niwas block. Total volume of then stone exits created across five villages exceeds 37,000 m^3. Thanks to this intervention, about 0.56 m^3 of soil was added on an average. The range of the soil retained across the villages is between 0.15 $m^3$and 2.5 m^3. Due to the addition of soil on agricultural lands, gullies and fissures on the lands of many farmers were treated and lands that had been left fallow had been brought back into cultivation.

Total volume of stone exit outlet structures created (cubic m)	
Malehri	2047.9
Mohpani	20653.4
Patha Devgaon	265.3
Payali Bahur	12422.6
Thanamgaon	1930.4
TOTAL	**37319.6**

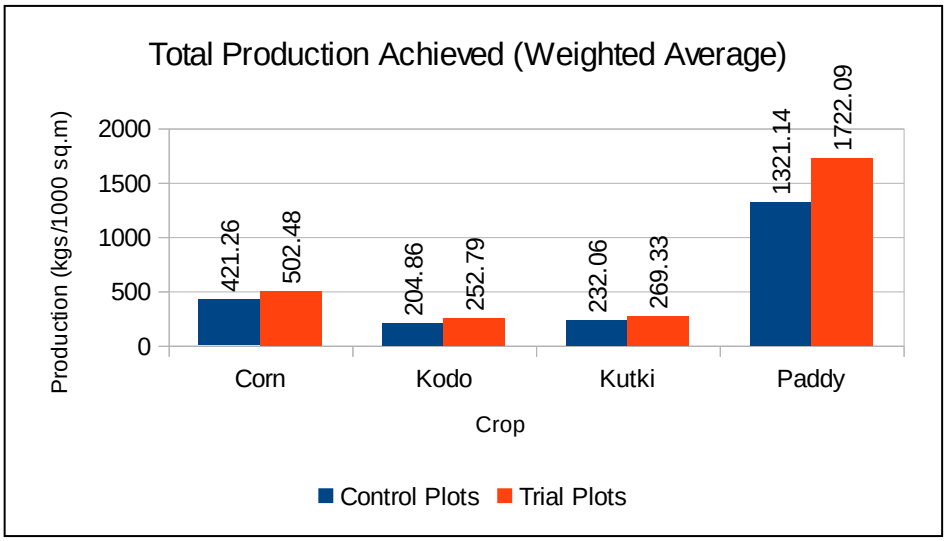
The benefits of the Stone exit structures can be encapsulated in the following diagram:



The diagram given above has been prepared with the help of the narratives that emerged from the field. As can be seen here, the construction of the inlet-outlet structures on agricultural fields results in a reduction in soil erosion, which in turn improves soil fertility. According to the narrative recounted by the communities, improvement in soil fertility leads to an improvement in agricultural productivity, an opportunity to grow two crops in a year and to cultivate nutritious food on their lands. All these benefits together lead to an improvement in the availability of food from their own lands. In addition, they also enable the farmers to cultivate crops like green gram, black gram and other pulses which fetch a good price in the market. Yet another outcome of double cropping is the increased availability of fodder which enables the farmers to maintain livestock. Together these three factors contribute to an improvement in the household food security and enhance household incomes. An improvement in household income and food security would also have an impact on the community's ability to access other civic amenities like health and education. All these, in the words of the community members, would lead to a reduction in seasonal migration in the long run and thence to a better life for the farmer and his family.

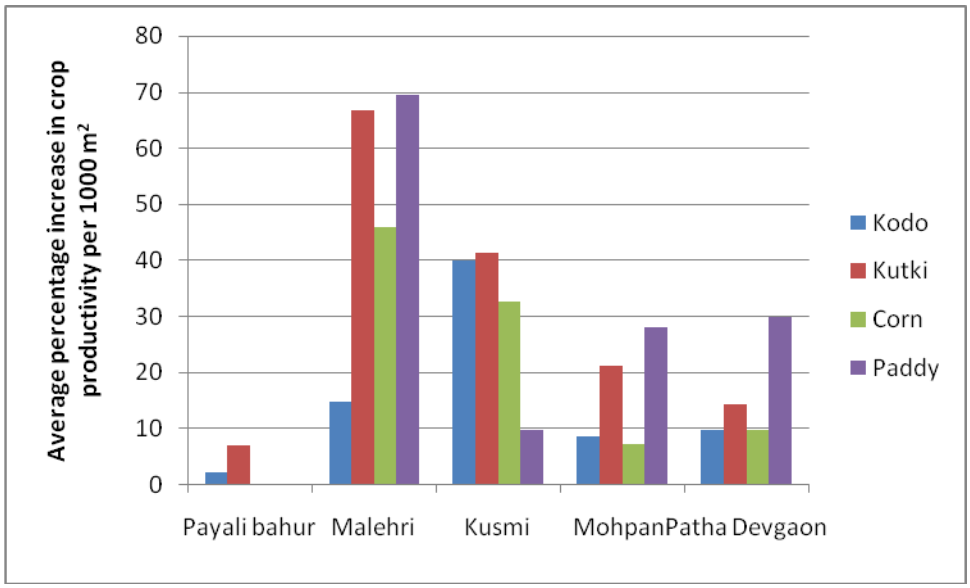
3.3 Strengthening Livelihood Portfolio:

The existing portfolio of activities undertaken by farmers was further enhanced and strengthened in the project by focusing on both crop based and tree based options. Presented here is the average production per 1000 sq. meters, achieved for each crop in each of the project villages.



As can be seen in the figure above, across all the villages, the production levels achieved through the use of improved agricultural practices is higher than the more conventional practices that underpinned the control plots. The average production for all the four crops in the five project villages increased the trial plots as compared with the control plots. In the case of maize, the trial plots showed a 19% improvement in the production over control plots. Similarly, in the case of kodo millet, this figure stands at 23%, for little millet it stands at 16% and in the case of paddy, it

stands at about 30%. The following figures show the percentage increase in crop production per 1000 m^2 between trial and control plots of for five project villages:



Besides this, 300 farmers undertook plantation on bunds and about 25 farmers undertook agro-forestry on plots on the forest fringes.

The detailed and categorized analysis of outputs, benefits and impacts are given in the Annexure II.

4 RECOMMENDATIONS FOR SCALING UP

2.4 Potential areas for replication

Following measures have multiple advantages to scale up:

- Strengthening village level institutions for conservation and protection of natural resources.
- Stone drainage outlets on farm ridges.
- SRI and other measures to improve paddy and millet cultivation.
- Agro-forestry/horticulture on uplands for eco-restoration.

Please see Annexure III for categorized details of scaling up recommendations

2.5 Adoption rate

Shital Singh Dhumketi, 48 years, Farmer and President: PSPS, Payalibahur):

(PSPS for community based forest/natural resource conservation)

"We started community based forest conservation around our village through byelaws formation more than a year ago to strengthen our efforts to protect the forests with the help of FES's intervention. So far we have successfully established boundaries in three forest blocks, out of which resource use in one of the blocks is completely prohibited. We have managed to protect around 200 hectares of forest with through PSPS. Four volunteers from our village daily monitor the forest blocks, and assist the forest department in their protection. Our rules on resource use from forests are strictly and religiously followed by all the villagers."

Dashrath Oyam, 35 years, Farmer, Payalibahur

(Stone-exits and SRI)

"I used to suffer a lot of soil erosion in my farmland before FES helped me with the construction of stone-exits in my field before the arrival of rainy season in 2013. The construction helped retaining soil in my field and the fissures made in my field due to erosion are levelled up. Last year, crop yield from that land increased by 20 kg. Also, around 70% of the plants which were planted in my farm 2 years ago have survived and I'm hopeful that they will bear fruits and timber for my family in the coming years. With the help of FES's intervention, I have been using line-sowing (SRI) technique for paddy cultivation and last year my paddy yield increased by 80 – 90 kg from the previous year."

Hari Singh Bhavedi, 45 years, Farmer, Patha Devgaon.

(SRI and Stone-exits)

"The line sowing technique for paddy cultivation has really helped me a lot. I have been using this technique with the help of FES for the last 3-4 years and now I am getting bigger *'baliyas'* (panicles). Paddy production from my field has increased from 1200 kg to 1600 kg approx from 0.05 acres of land only. I am looking forward to use more area of my land to use this technique. The construction of stone-exit last year before monsoon has also helped filling the fissure of 1.5mx22m made by soil erosion with new soil"

Dasrath Singh Uraiti, 38 years, Farmer, Kusmi

(Bund-plantation and Vermi-compost)

"Around two years ago, 50 plants were planted on the edges of my farmland, of different varieties such as *Khamair, Aonla,* Mango*, Saja, Karonda* and *Mahua*. 30 plants are surviving and flourishing which are *Khamair*, *Aonla* and *Mahua*. I hope these plants will grow to provide me timber and fuel-wood and fruits in future and they will surely provide strength to the edges of my farmland to stop soil erosion and fallen leaf litter will act as natural fertilizer for my crops. The vermi-compost fertilizer has started to give results already and I am getting much healthier crops now in terms of texture, colour and length of the panicles."

Tikku Singh Bhavedi, 58 years, Farmer, Patha Devgaon

(Stone-bunding)

"Construction of stone bunds around the my field is helping restoration of soil in my farmland as well as fallow land. These bunds have stopped soil from being eroded from my fallow land and new layer of soil is slowly accumulating on my land which I have not been using for any purpose.

I hope that very soon a thick layer of soil will be there with the help of the soil and humus coming from the forest with the water-flow during rainy season, and I will be able to use that land for cultivation in next 2-3 years."

Devlal, 42 years, Farmer, Kusmi:

(Millets Cultivation and Agro-horticulture)

"I have been growing kodo/kutki (millets), ramtila on my farmland which is a 'padti' (fallow) land. I have to leave the land open without the cultivation of any crops for long times. FES provided my improved seeds of kodo/kutki which I used for cultivation. I had better produce last year. Also, with FES's intervention and support, a year ago I started fGuava, Mango, *Khamair*, *Bel* and *Kanji*. I am taking care of these trees with the hope that they will provide me with fruits and timber, and will add to my income in future. I am continuing with the cultivation of millets on my farmland."

2.6 Technical feasibility and sustainability

Demonstration over last 2 years has sufficiently established the technical viability of interventions made. All measures are built on locally available resources and the institutional mechanisms at village level will ensure sustainability of measures and impacts achieved.

2.7 Recommendations on national/state/local actors that can be involved and schemes and programs:

The recommended adaptation measures can be dovetailed with ongoing Rural climatic and topographical conditions. For instance measures related to improving agricultural practices can be converged with Krishi Vigyan Kendras and Agricultural Universities for scaling up. Similarly the recent budget allocation for the Panchayat ministry provides a great opportunity for up-scaling of interventions like strengthening of PSPS and holding monthly Gram Sabhas. (*Please see Annexure III for Recommendations for scaling up for each adaptation measure*).

There are many other institutions at the local as well as state level institutions like Gram Panchayats, Gram Sabhas, PSPS, Biodiversity Management Committees, Forest Department, State Biodiversity Boards and Land revenue administration, which can be nested together for de-centralizing of decision making processes and providing a possibility for more robust governance at the local level.

At the national scale, various central and state ministries along with research institutions can share knowledge and resources to enhance cooperation to achieve multiple objectives surrounding Climate Change Adaptation as well as Mitigation. Ministry of Environment and Forests can work on several schemes under the ministries of Agriculture, Rural Development, Labour and Employment, Tribal Affairs, Women and Child Development, Social Justice and Empowerment, and Human Resource Development for holistic development of marginalized and vulnerable communities of India in response to climate change. Leading academic research institutions having expertise in Forestry, Ecology, Natural Resource Management, Business, Sustainability, Sociology, Anthropology, Humanities, law and Economics can also be roped in for cutting edge interdisciplinary and multidisciplinary research to come up with novel ideas with a problem-solving approach for combating climate change.