Development Alternatives

Report

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Embassy of Switzerland in India

Low Carbon Pathways
Sustainable Civil Society Initiatives

Farmers Adaptation Cluster

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Abbreviations

BKP	Bundelkhand Knowledge Platform
BMTPC	Building Materials and Technology Promotion Council
CDM	Clean Development Mechanism
CERs	Carbon Emission Reductions
CIGs	Common Interest Groups
CRIDA	Central Research Institute for Dryland Agriculture
CSOs	Civil Society Organisations
DRDA	District Rural Development Agency
DST	Department of Science and Technology
FAO	Food and Agriculture Organisation
IARI	Indian Agricultural Research Institute
IAY	Indira Awaas Yojana
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IGFRI	Indian Grassland and Fodder Research Institute
IIVR	Indian Institute of Vegetable Research
KVKs	Krishi Vigyan Kendras
MEAL	Monitoring, Evaluation, Action and Learning
MoEF	Ministry of Environment and Forests
NABARD	National Bank for Agriculture and Rural Development
NAPCC	National Action Plan for Climate Change
NIRD	National Institute of Rural Development
NRCAF	National Research Centre for Agro-Forestry
PoADD	Programme of Activities Design Document
PoP	Package of Practices
PRA	Participatory Rural Appraisal
PRI	Panchayati Raj Institutions
RCC	Reinforced Cement Concrete
SCSI	Sustainable Civil Society Initiative to Address Global Environmental Challenges
SDC	Swiss Agency for Development and Cooperation
SORs	Schedule of Rates
SSMM	Sankalp Swashakti Mahila Mandal
TKM	TARA Karigar Mandal
TNA	Training Needs Assessment
UNFCCC	United Nations Framework Convention on Climate Change
USP	Unique Selling Proposition
VERs	Voluntary Emission Reductions
VLC	Village Level Community
WEC	Women Energy Cluster
WUA	Water Users Association

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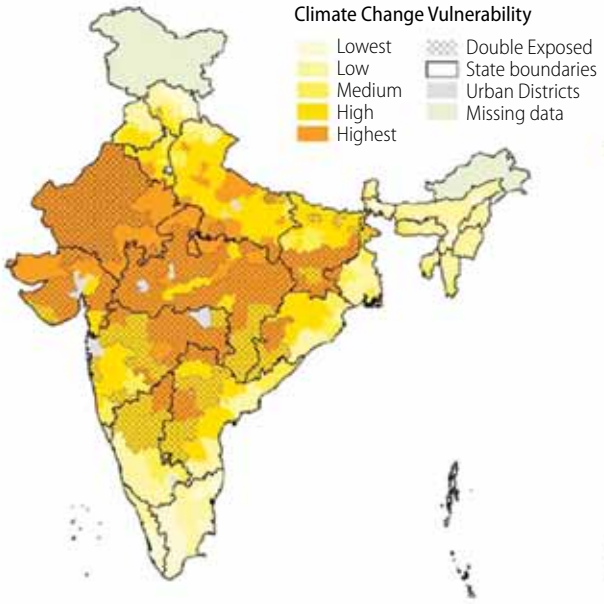
Fig. 1: Bundelkhand and the Project Areas



Source: IPCC 2007
Map not to scale

Bundelkhand and Surrounding Regions

Farmer have adopted and demonstrated sustainable agricultural practices

Introduction

Bundelkhand in central India comprising of 7 districts of Uttar Pradesh and 6 districts of Madhya Pradesh is a drought prone region with agriculture as a major source of livelihood. As a sector which is significantly influenced by the climatic conditions, agriculture is vulnerable to climate change. Adaptation to it, therefore, assumes paramount importance.

The region had faced its worst ever drought from 2004 to 2009 with a rain deficit of about 66 per cent. According to the report of an inter-ministerial central team, headed by Dr. J. S. Samra of National Rainfed Areas Authority, the region could not cultivate 40 per cent of its farms leading to about 30 per cent reduction in food grain production; more than 20,00,000 livestock were abandoned; and, around 40 per cent of the region's population had migrated.[1]

Over the years, there has been decline in groundwater recharge. Without the capacity to conserve water, even a small deviation in rainfall causes drought. Added to the cycle of ecological degradation, the prevailing farming practices of flood irrigation and deep tillage, contribute to further damage. The condition is likely to further deteriorate as monsoon precipitation may decrease by almost 15 per cent along with a rise in mean summer temperatures by about 1.5°C by the year 2030.[2]

Tillage and irrigation are energy intensive operations in agriculture and they present potential scope for not only reducing the input costs, but also green house gases arising from the direct consumption of fossil fuels or of electricity. Further, according to the estimates of Food and Agriculture Organisation of the United Nations (FAO), livestock are responsible for 18 per cent of world's green house gas emissions, more than the transport sector and a major factor contributing to land and water degradation. Emphasis thus must also be given on adopting environment friendly livestock rearing techniques considering that livestock forms a large component of a farmer's livelihood in the region with livestock to human ratio in the range of 1:1.

285 farmers of Jhansi District from the state of Uttar Pradesh are adapting to recurrent drought conditions through sustainable farming practices. Changes in tillage, seed varieties, sowing method and irrigation practices are providing benefits of improved productivity.

The Initiative

It is against this backdrop that Development Alternatives is undertaking a 15 years long Sustainable Civil Society Initiative to Address Global Environmental Challenges (henceforth SCSI) in association with and support from the Swiss Agency for Development and Cooperation / Climate Change and Development Division, Embassy of Switzerland in India. The overall focus is on farming, livestock management and infrastructure development. The selection is based on the basis of impact of changes in the climatic regime and environmental degradation and the sector's potential to contribute to reduction in carbon footprints. Given the experimental nature of the intervention, the current outcomes so far in the 3 years, are to be seen as indicative rather than conclusive. However, it is hoped that lessons from the project would lead to other comparable attempts. More importantly, the vision, spanning over 15 years of the intervention period, is to eradicate poverty and regenerate the natural resource base across 1000 villages in the region.

The Initiative includes farmers, women and artisans. This Report is concerned with SCSI in the period from 2008-2011 with the farmers, whereby a limited sample of 100 small and marginal farmers, have been involved on a pilot basis to explore and adopt measures for drought resilience, increase in productivity, enhanced incomes and greener jobs/livelihood pursuits. It is through snow balling and awareness creation that the number of farmers influenced currently is now 285. Out of these, 173 farmers are small and marginal farmers having landholding size of 5 acre or less, accounting for about 52.4 ha.

Fig 2. Structure of Farmers Institution

• To create a favourable environment that promotes formation of new lower level institutions • To strengthen the lower level institutions. • To facilitate availability/accessibility of resources especially requiring heavy inputs to the lower level institutions.
• To address and manage the common issues of member villages (common to their geographical vicinity) and act as their representative in higher level meetings. • To ensure adequate but limited number of villages as members to maintain and manage the issues and complexities. • To create and maintain a resource base at the cluster level especially which may have specific usability for the cluster.
• To spread awareness amongst the farming community about the potential threats posed by climate change and reasons thereof. • To discuss the issues of farmers and finding solutions for enhancing returns from farming and allied activities under guidelines of eco friendly, i.e., sustainable agri-practices through capacity building of farmers. • To promote appropriate agricultural practices in their villages and ensure maximum possible coverage.

The specific objective in this period of 3 years was to enable the farmers belonging to Babina and Badagaon blocks of Jhansi district in Uttar Pradesh (Fig.1) to adapt to drought conditions through use of sustainable agricultural practices with special reference to efficient use of water and energy. Overall 20 villages (10 each from the two blocks) were covered.

The outcome is being measured through the percentage increase in land productivity and reduction in agricultural water consumption against the targeted 20 per cent, reduction in energy consumption for pumping and tilling (expected 40 per cent) and an outreach of 300 hectares of land under one or multiple improved agricultural practices involving about equal numbers of farmers. It was expected that the initiative would get support from the existing human and physical infrastructure of the organisation.

Harit Kisan Maha Mandal (Farmer Adaptation Cluster) is an institutional arrangement (Fig. 2) dedicated to the process of enabling farmers to sustain and enhance their income and thereby their quality of life mainly by:

- Facilitating better management of input resources;
- Building capacities of farmers to adopt techniques such as drip/sprinkler based irrigation which conserve water and energy;
- Using climate resilient variety of seeds and green manure, etc. for better resource efficiencies;
- Establishing linkages with external stakeholders for knowledge and information accessibility; and,
- Establishing backward and forward market linkages.

The Harit Kisan Maha Mandal with its institutional arms acts as a farmers' collective. The idea is to bring the small farmers together so as to collectivise their activities. Within the project, the Maha Mandal has been referred to as the Farmers Adaptation Cluster or FAC. Its role has been:

- Conducting training programmes and exposure visits;
- Organising demonstration on sample plots;
- Procuring seeds and other inputs; and
- Renting out farm based machinery.

The Krishi Vikas Mandal acts as a bank that lends agricultural equipment to farmers, facilitates collective procurement of seeds at appropriate prices and also enables collective marketing of produce.

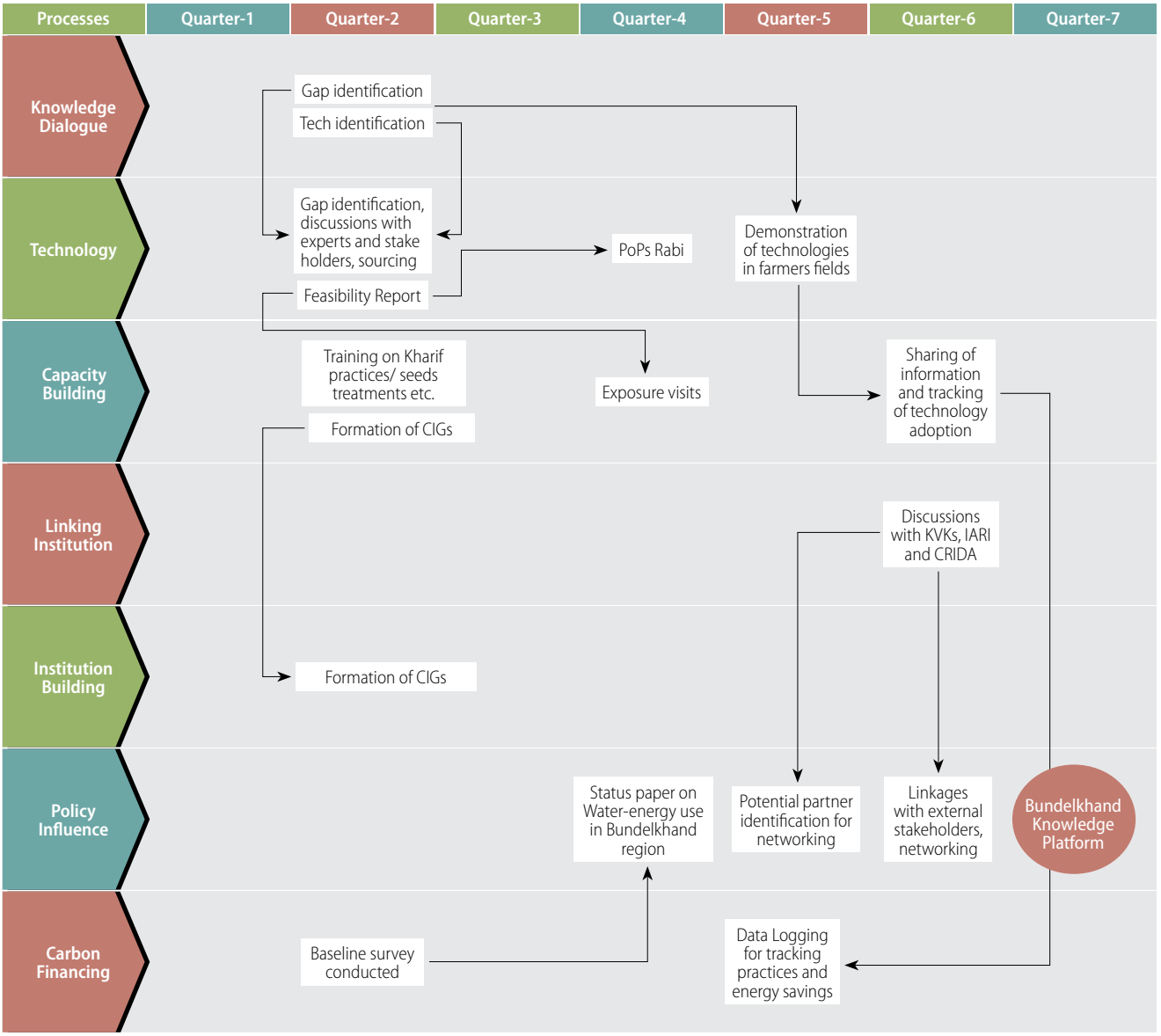
The farmers group was started on a purely voluntary basis with support from the National Bank for Agriculture and Rural Development (NABARD). In fact, farmers had launched the new initiative and envisaged it as a community based green enterprise with each farmer as an entrepreneur member.

Farmer community, amongst the most vulnerable and directly impacted by changes in the monsoon regimes are being supported to adopt new techniques and risk mitigation measures that not only reduce their vulnerability but also contribute to reducing carbon footprints – a true green revolution or *harit kranti* in agriculture.

Process and Pathways

A multi-pronged strategy which included farmers' exposure to improved and new practices, training in new techniques, formation and strengthening of farmers' collective, capacity building and information dissemination was adopted. Cost-benefit analysis and access to

Fig. 3. An Overview of the Processes



public funds was also undertaken to motivate farmers and make small changes in their agricultural practices. These activities followed the broader strategic processes that ran through the overall ideology of the Initiatives. They are:

- knowledge dialogue;
- capacity building; and
- development of green social enterprises models.

The last two points are self-explanatory. As far as `knowledge dialogue` is concerned, it involved strategic interventions with the target group of farmers that take into consideration knowledge exchange amongst them and the external facilitating agencies. This is done in order to select and adapt technologies and practices contextually suitable and to promote the interventions amongst local facilitating bodies, building capacities of the target clusters and of the local institutions to replicate the models. In addition, the project has designed strategies to influence policy frameworks at state, regional and national levels that would favour the large scale replication of 'low-carbon economic growth' for vulnerable communities in the State, Bundelkhand and across semi-arid regions in India.

Knowledge Dialogue

The project was initiated with a baseline study and various knowledge dialogues with farmers through interviews, focus group discussions (FGDs) and other group interactions and dialogues with Indian Grassland and Fodder Research Institute (IGFRI), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Krishi Vigyan Kendras (KVKs) and National Research Centre for Agro-Forestry (NRCAF), Jhansi etc. This component of the project was driven by the non-negotiable stand that climate friendly practices amongst the identified community clusters be owned by the community. Based on these discussions, different practices and options were identified, which if introduced and accepted, had the potential to bring about significant changes in returns from agriculture and at the same time reduce resource input - especially water and energy.

Mapping and Sharing: The need assessment phase started with exchange of information and issues with the farmers and experts in the target locations. Gradually it was felt that a shift in focus from influencing behavioural change in a small group to spreading the good practices amongst a large number of farmers was necessary. With this purpose, 20 animators were locally selected, later in the intervention, trained and deputed for each of the 20 villages. They were to work as change agents. The selection criteria included effective communication, leadership skills, and awareness about various programmes/schemes for the farmers, conversance with agriculture practices or membership in the farming community, capable of orienting the community on new technology adoption related to agriculture.

Throughout the Initiative, the animators motivated farmers towards the adoption of resource efficient technologies such as dry sowing of wheat, irrigational practices, high yielding varieties, integrated nutrient, pest and

Horticulture practices demonstrated at the farmers' field for diversifying agricultural practices have shown that agriculture-horticulture can buffer the risks of uncertainties in climate and resultant impacts on incomes from primary agriculture production.

weed management, use of organic manure and agriculture-horticulture cropping systems. The animators received training from the horticulture department of the government and in turn helped in leveraging process for different schemes of the government in terms of spreading awareness, selection of farmers, data collection and formalities to be completed etc.

The animators also collected the technical information related to crop trials in a given format at regular intervals as per the project team's advice. They recorded crop data on experimental and non-experimental basis for comparison and analysis later.

The informal sharing of knowledge amongst farmers was formalised through directed focus group discussions and communication of benefits of improved practices have facilitated changes in practices of farming. Regular engagement with the scientific community in the process of trials on fields, sharing knowledge and demonstration of produce at events have helped to build new knowledge and disseminate it across 20 villages.

Communication and Outreach: The primary objective of the promotional activity was to highlight the impact of climate change on agriculture and make the farmers aware of low energy consuming irrigation systems and high yielding crop varieties.

Different modes of communication, which were synchronised with each other, were identified to provide interaction opportunities among the partners. This helped the partners select the appropriate mode as per their comfort level. Following were some of the major approaches:

Radio programmes: Radio Bundelkhand[3] broadcast the recorded audios of agriculture training sessions which were held at TARAgram, Pahuj for the farmers as well as several case studies and success stories of those farmers who adopted new techniques. The formats mainly used for these programmes were interview, discussion, FGDs and radio reports. The radio team also collected feedback on its programmes via narrow casting, phone calls and field recording. Besides these programmes, Radio Bundelkhand also created many recorded and live phone-in sessions on climate change during the project period of 3 years.

Nautanki (Street Plays): Nautanki, a colloquial form of drama was used in an entertaining and interactive manner to disseminate information in the target villages. The Nautanki generated animated discussions about the changes in the climate and their impact on farming. The needs for improved practices for reducing irrigational requirements were also discussed. The Nautanki has been documented for replication.

Wall messages and paintings: Another mode of promotional activity was through wall messages and paintings. These were static messages about the need for potential changes in agricultural practices, the benefits that would accrue and sources of information and facilitatory supports for the same. The messages were painted at strategic locations in the villages, at places where farmers gather. They are used as ready references during meetings and discussions.

In addition, several events such as Farmers' Day and Crop Days, etc., were celebrated.

Meetings: Although electronic and print media are helpful in terms of the frequency, ease and reduced resource inputs including time for interaction, physical meetings are better for face-to-face personalised interactions. In fact, the idea of Bundelkhand Knowledge Platform (BKP) was first mooted at the roundtable on water-energy policy development in Bundelkhand in December 2009. The first meeting towards the

knowledge platform was held at TARAgram in April 2010. The agenda was to share the concept and identify the preliminary partners for working forward.

The second workshop held in October the same year at Chitrakoot was organised by Jan Vikas Sansthan, Akhil Bhartiya Samaj Seva Sansthan and Chitrakoot University. One of the agenda points was to share the opportunity to start a Local Area Coordinated Project under the Department of Science and Technology (DST). This led to project development workshop in February 2011 and submission of a proposal to the DST on adaptation measures for carbon reduction.

A third meeting was also held in the meantime in cooperation with NABARD at Tikamgarh in January 2011 to discuss the role of microfinance in livelihoods especially in Bundelkhand. Various allied schemes and its link with common livelihood sources were discussed.

Bundeli Vani (Voice of Bundeli People): Bundeli Vani is Development Alternatives's quarterly Hindi Newsletter being circulated amongst different stakeholders and addressing the issues of local need and context. It has been decided to use this Newsletter to include the BKP related articles so that the base of stakeholders and beneficiaries accessing the information and experiences can be increased.

Social networking sites: Social networking is rapidly growing as most people accustomed to working on the Internet find Facebook-like social networking sites appealing and easy. A Facebook account has also been created with the name of BKP. The above account can be accessed and thread can be initiated or responded. E-group modes are also used which included: i) e-group B_K_P@googlegroups.com–a non-member can become a member by sending a mail at B_K_P+subscribe@googlegroups.com; and ii) website, the address of which is http://www.bkpindia.net.

Networking and Policy Advocacy

Bundelkhand Knowledge Platform: Work and experiences of several agencies in the region appear to be shared inadequately. Given this, a round table discussion with experts and policy enablers led to the initiation of the BKP, a forum to build a knowledge base among partners through sharing of information, knowledge, experiences and lessons of partners from varied contexts. The vision behind this initiative is to build a network of all stakeholders and strengthen it with a combined knowledge base to give the correct direction to not only the planning and schemes recently diverted to this region, but also to positively influence policy which will eventually support sustainable development here. The broad objectives are to:

- Provide appropriate platform to facilitate the interaction and discussions amongst stakeholders;
- Prompt discussions among partners/stakeholders to identify largely context relevant issues and lessons especially related with climate change towards policy influence;
- Inform practice towards low carbon climate resilient growth;
- Develop understanding to inform the state and central government for mainstreaming

Local mode of communication using street theatre and radio has promoted the benefits gained by a small group of farmers across the villages in Jhansi.

climate change in planning and policy; and

- Build substantive arguments in favour of appropriately directing the Bundelkhand Package, which consisted of fund allocated for drought mitigation in the region, towards energy, water and resource resilient practices in agriculture, livestock and livelihood creation as well as supporting monitoring systems for the effective implementation of the Package.

This platform provided a forum for concerned as well as potential stakeholders to be part of the process of development in the region as also opportunities to share their experiences, lessons and wisdom with the rest. The stakeholders included civil society organisations (CSOs), research as well as economic institutes and district administration. Their association helped develop policy papers as well as make informed discussions which were shared across the region and also with the State actors. These State functionaries are involved in developing the State Action Plan on climate change whereas the State level departments are responsible for the Bundelkhand Package. BKP thus focuses on issues related to climate change that range from extensive and intensive technical matters such as water availability and conservation, reliable energy sources and fertiliser doses on one hand to institutional mechanisms, i.e., crop insurance, weather linked insurance policies and credit cards etc., on the other.

Capacity Building

Technical Training and Support: Several training programmes for various Rabi and Kharif crops were imparted to the farmers as part of the capacity building package. A key intervention in this regard was developing Package of Practices (PoP) which is now being linked to KVKs for replication. This was facilitated because of the associations with KVKs through Central Research Institute for Dryland Agriculture (CRIDA-SDC) and

Bundelkhand knowledge platform brings together stakeholders from the region to share lessons on sustainable agriculture, water management, livestock and livelihood issues. The platform raises concerns, shares good practices, collates knowledge to inform policy makers and influence practice.

Table 1. Agricultural Practices identified through Knowledge Dialogue

Objectives	Activities
Enhancing production	Improved seed / seed varieties
	Seed treatment
	Line sowing
Increasing resource efficiency	Improved irrigation methods
	Appropriate use of organic and chemical fertilisers
	Appropriate farming implements (including efficient pumping)
	Water/moisture conservation/harvesting methods
Improving practices	Alternate crop management practices as suitable for land and soil conditions such as low village

SDC National Policy Dialogue Process Workshop. Group management trainings were integrated with the capacity building programme so as to build strong farmer groups and instil qualities of leadership and confidence in the member farmers to use their collective strength. The capacity building programmes have been documented and converted into a set of training manuals which can be disseminated for widespread promotion and learning.

TARAgram, Pahuj[4], acts as the nodal point for these services and activities.

A cadre of field animators, (discussed earlier) served as conduits for feedback from the farmers regarding various interventions and to record usage of farming inputs and impact on yield. The animators' team helped in strengthening of farmers club through regular meetings, training and feedback. They also participated in organising the farmers in the form of Kisan Samuh Mandal and Maha Mandal and supported their operations. In addition, farmers provided regular feedback on various issues such as insects, pest, diseases, effect of new improved varieties etc. to the animators in their villages who in turn provided them with advice or support with the help from the project team.

Exposure Visits and Vision for a Less Vulnerable Future: The farmers group were taken on exposure visits to the Vidharba region in Maharashtra which has comparable semi-arid conditions and faces similar problems of delayed monsoons and droughts. Intensive discussions with the farmers of Hivre Bazaar Village and Jalgaon helped them visualise the potential of enhanced productivity, reduced inputs costs and risks if they opt for techniques such as drip and sprinkler irrigation, improved seeds, reduced tillage, agro-forestry etc. An exposure in Indore in Madhya Pradesh to the Prototype Production Centre of the Institute of Agriculture Engineering gave them an idea of a wide range of available small tools and equipment; some were selected for creating an equipment bank. Farmers also attended the Crop day organised and partly supported by Indian Agriculture Research Institute (IARI) for demonstration of the different wheat varieties and appropriate practices applicable to the region. Interestingly, after returning, they themselves organised a Crop Day in some of the best fields so as to reflect impacts of adoption of better practices on production.

Training cum exposure was also organised at the Indian Institute of Vegetable Research (IIVR) at Varanasi, Uttar Pradesh, which brought to the fore the role of vegetable farming. The Shade Net Technology was also demonstrated at the Pahuj Centre.

The Green Social Enterprise Model

Developing Package of Practices: Through intensive communication and promotional activity, the project built close rapport with farmers groups and helped bring changes in not only practices, but also in mindsets about climate change - adapting to it and mitigating its effect. Farmers learnt about technologies and improved practices for resource (water and energy) efficient agriculture.

Close involvement with farmers was maintained throughout the intervention, along with other stakeholders as it helped to lubricate and

Field animators are drawn from the community and have been trained to communicate information on different agriculture technologies, government schemes and facilitate capacity building. Training is conducted on fields of the farmers and results from the trials are regularly monitored.

accelerate the adoption process by farmers. The key drivers were in-situ demonstrations in the farmers field, technical guidance and timely feedback to field issues and needs.

Response to the project intervention by farmers was that of initial reluctance followed by willingness to adapt and gradual adoption by a few who now influence others. Periodic training and support led to increase in cluster members' confidence and greater participation in the project interventions. Linkages with Horticulture Department led to higher outreach and coverage under farmers cluster.

The various interventions aimed at enabling towards adaptation and mitigation are:

- Drip/sprinkler based irrigation
- Line sowing, raised bed technique
- Dry sowing
- Mixed farming
- Farm land improvement, and
- Agro-forestry and agriculture-horticulture

Apart from the promotion of new and improved practices of farming for increased returns, the SCSI also introduced an additional source of income for the FAC - a rental service - the provision for lending of farm equipment primarily to the Harit Kisan Maha Mandal members (or non members if the farmer groups so decide), which is also proving to be beneficial in providing technology support to farmers. These equipment encouraged low water and energy inputs into the fields and hence assisted the promotion of sustainable agriculture practices among farmers.

The farmers group, during the course of the intervention, met and decided on certain procedural norms and rules for issuing of the farm implements and machinery to members or non-members so as to standardise the process and maintain transparency.

Networking and Leveraging Support: Networking with IGFRI, ICRISAT and NRCAF for technical inputs led to training resources and pilot demonstrations for farmers. Likewise, links with line departments at the district level helped in leveraging financial resources for farmers to the tune of Rs. 44,000,00 from funds under public schemes for agro-forestry, sprinklers, drip irrigation subsidies and farm ponds stipulated under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).

There are a number of already existing schemes and other developmental activities in the region which may be capitalised to promote the enabling environment. Some of these are the upcoming electronic Mandi in Jhansi with an immense potential for collective marketing of farm produce by the farmers. Water Users Association (WUA) formation is being promoted along the canal routes. The WUA may be utilised for rationalising water usage in one region thereby increasing its availability downstream. Similarly, integrated Watershed Management Programme of the Government of India offers scope for all round development of farmland including bunding, farm ponds, check dams, agro-forestry and grassland development.

Accessing Carbon Markets: Reductions in carbon emission due to adopted practices and obtaining carbon credits has potential to act as a bank guarantee for these farmers, increasing their economic viability in the process. Assessment of carbon emission reduction is also essential to

Small improved farm equipment for line sowing, weeding and harvesting are now available through the farm equipment bank being maintained at the cluster level. Rental management systems and terms have been worked out. This service has already helped the farmers to improve efficiency in practices.

understand the mitigation impact of the project.

The United Nations Framework Convention on Climate Change (UNFCCC) methodology AMS II F was followed for the purpose of calculating emission reduction. This category comprises any energy efficient and/or fuel switching measure implemented in agricultural activities of facilities or processes. The methodology is particularly meant for agriculture and also has less stringent guidelines on additionalities (http://cdm.unfccc.int/methodologies/DB/RHY8O8RQR9HH95E8CK3PQDQDLR0). Since the proposed project interventions are improved energy efficient irrigation practices, they fall under this category.

In the carbon markets, the value of voluntary emission reductions (VERs) is lesser than carbon emission reductions (CERs) and hence preferred. Registration of Clean Development Mechanism (CDM) projects involves time and finance. The proposed project interventions result in small green house gas reductions and hence are not economically viable to be registered as independent projects. Under the CDM there is a provision for registering Programme of Activities (PoA). PoAs allow many similar small projects to be clubbed together facilitating easy registration - even if a time lag exists amongst the initiation dates of various projects. It also reduces costs as compared to conventional small scale CDM projects. Thus the mechanism is ideally suited for projects of this nature.

The data collected on improved farm practices, new seeds etc., under this project leading to carbon savings has been collated and Programme of Activities Design Document (PoADD) has been developed. This is now being sent for host country approval to the Ministry of Environment and Forests, Government of India.

The current set of 300 farmers may be registered under a single CDM Project Activity (CPA). The farmers which join the Farmers Adaptation Cluster may be registered at a later date under a fresh CPA. Using this strategy will lead to reduced waiting period for farmers who have already adopted proposed interventions to access carbon funds.

Outcome

The outcomes achieved over the intervention period of 3 years include changes in farm practices amongst the members in the experimental group (as pointed out earlier, initially 100 farmers eventually reaching out another 185 in the 20 project villages); risk reduction and growth in income indicated by an increase in productivity, reduction in irrigation requirement specially for the Rabi crop and in total emission. It is to be noted that the farmers have adopted various combinations of interventions.

Change in Practices

The FAC has taken up various interventions which, on one hand, have led to increase in production and on the other hand, led to decrease in the water and energy consumption. Decline in energy consumption has a positive bearing on overall reduction in carbon emissions as both grid based electrically operated as well as the diesel based pumps lead to carbon emissions. Besides these activities, the farmers have taken up the plantation of various trees which has led to sequestration of carbon dioxide from the atmosphere.

Table 2 provides details about land covered and number of farmers who have adopted various interventions. These interventions are briefly outlined below.

Improved Seed: Small and marginal farmers have tried improved seeds/change of seeds for the first time in their fields. By introducing TAG-37, TG-41 for Groundnut and Swarna (HI 1479), Poorna (HI 1544), Naveen Chandawari (HI 1418), Vidisha (DL 788) for wheat, 3 issues have been addressed: a) provision of better quality seeds; b) introduction of pest and disease resistant varieties of seeds; and c) change in seed pool in case of repeated cultivation of the same crop. Earlier the farmers used desi (unknown variety of the previous year's seasonal crop) seeds, but post-intervention 258 farmers (out of 285 farmers) had used improved seeds, procured either from the market or from the farmers who had them

Sprinkler based irrigation has reduced water use and reduced the diesel requirement in irrigation. Moving away from flood irrigation is helping retain soil nutrients and water conservation.

Table 2: Interventions

Intervention	Land Area Covered (ha) out of a total land (in %)	Number of Farmers
Drip / Sprinkler irrigation	2.28	14
New seeds	89.78	258
Line sowing	81.71	282
Dry sowing	68.18	140
Mixed farming	10.35	86
Seed Treatment	33.76	50
Agro forestry	17.89	51

Source: Farmers Adaptation Cluster- MIS Database

from the last year' crop. It is estimated that by introducing the new variety, yield potential has increased around 20 per cent (Table 2).

Line and Dry Sowing: Prior to the intervention, very few farmers were doing line sowing. However, post intervention, almost all farmers (285 who were tracked) in the project villages had adapted the practice. Dry sowing for wheat was a new practice which has been introduced in the area. Despite a general lack of acceptability of this practice, farmers who had tried this under expert supervision reported very good results in terms of production and weed control. This helped other farmers follow them. Subsequently, 140 farmers have adopted dry sowing in 527 acres of land.

Impact of the dry sowing not only reduced the water requirement, approximately by 30 per cent (of single irrigation), as per the discussions with farmers, but also had the positive influence on the production - its impact was found to be 29.4 per cent i.e., 8.9 per cent of the current productivity. The additional benefits of dry sowing is reduced compulsion for late sowing in case of delayed canal roster and reduced weed growth as compared to main crop apart from good returns with higher yields. Line sowing was also found to be influencing the productivity up to certain extent (15.4 per cent) which means approximately 4.7 per cent increase in the current productivity.

Other Interventions: Some of the other successful results were:

- Use of organic fertilisers accompanied by the minimal use of chemical fertilisers resulting in good potential for improving resource efficiencies and/or reducing the carbon emissions;
- Improvement in utilisation of land resources by mixed cropping and also putting them to multiple uses;
- Adaptation of agro-forestry in 105 acres of land by 51 farmers;
- Combined effect of line sowing along with drilling and recommended seed rate ensuring optimal density of plants; dry sowing, line sowing and new variety of treated seeds preventing crops from fungal and viral attacks; raised bed cultivation with bio-measures having desired effect on the yield; and
- Contribution of other practices such as inter-culture operations, number of proper irrigations and reduced requirement of water (contingent upon introduction of new varieties).

It was seen that the cumulative impact of the introduced practices has potential to increase the productivity by 30 per cent.

In addition to the improved productivity, another benefit that accrued to farmers was higher rates for their produce. For example, with the introduction and utilisation of improved seeds, which some of the local farmers had started to grow, the farmers could procure these seeds locally from their fellow farmers rather than travelling to distant places. Although these seeds were sold at a lower prices elsewhere i.e., at Rs 12 - 14 per kg as compared to local prices of Rs 20 per kg., farmers saved the travel costs and time involved. Moreover, the improved/new varieties seeds had resulted in improved production.

Benefits from raised bed farming and line sowing demonstrated in the fields of 11 farmers initially has influenced more than 200 farmers in 20 villages of the Harit Kisan Maha Mandal enhancing efficiencies in water and energy use.

Ecological Benefits

In order to collect data from the site, data login sheets were prepared and provided to field staff and data were recorded at the site on a weekly basis by field animators. Quality control was done at the site by cluster coordinators followed by on-field verification by professional and managerial staff before being sent to New Delhi for further analysis by the project team.

Ecological benefits can broadly be gauged through emissions and agricultural practices. Reduction in emissions is a complex process involving combined effect of soil carbon, irrigational practices and afforestation. Improved tillage (which has implications for soil carbon) during the Kharif and Rabi season was about 2 tons CO_2.[5] During the same period, total emission reduction through adoption of sprinkler based irrigation was 7.2 t CO_2.

Table 3 depicts the growth of emission and projection for the year 2012 based on the assumption that in the first year of the second phase of the SCSI project similar initiative would have been adopted in 13 districts of Bundelkhand.

Water Conservation

Practice of flood irrigation in the Rabi crop resulted in application of 242 m^3/ha of agricultural land. As opposed to flooding, sprinkler based irrigation consumed 172 m^3/ha of agricultural land. Thus substitution of flooding by efficient irrigation methods resulted in 29 per cent of the water being conserved. Table 4 provides per hectare values of emission reductions for the intervention measures taken under the FAC.

Behaviour Change

It may be recalled that the SCSI has trained farmers for adaptation to drought conditions through the use of sustainable agricultural practices with the expected outcome that the farmers would adopt and demonstrate sustainable agricultural

Table 4: Per Hectare Values of Emission Reductions

Intervention	Emission reductions/ha
Sprinkler	0.50[6]
Reduced tillage	0.05[7]
Agro-forestry	25.00[8]

Note: For calculating emission reductions, United Nations Framework Convention on Climate Changes (UNFCCC) methodology AMS II F was followed.

The shade net method of raising vegetables and nurseries in the harsh summers of Bundelkhand has found much appreciation. The challenge is in enabling finance to support farmers to utilise its benefits.

Table 3: Growth of Emission Reductions 2010 and 2011

	Annual (Year) Reduction in Emission (t CO_2)		
Activity	2010	2011	2012
Sprinkler	NA	7.2	140
Reduced Tillage	NA	2	10
Agro-forestry	NA	0	1850

Note: For calculating emission reductions, United Nations Framework Convention on Climate Changes (UNFCCC) methodology AMS II F was followed.

practices. This required the project team to not only promote new and alternative technologies, processes and practices of farming, but also actively engage with the farmers as partners in the process and influence them to adopt the proposed solutions for energy efficient agricultural practices. The early adopters were then encouraged and supported via awareness drives, training and institutional/technical linkages to influence others and promote the practices for a wider following. Dedicated efforts towards influencing the target group of farmers for a favourable change in behaviour were also essential for the sustainability of the intervention in the long run. The idea was to ensure not only a change in practices, but greater ownership and an overall change in mindset of the farmers towards climate change adaptation and mitigation.

Change Assessment: Tables 5, 6 and 7 reflect some of the specific changes in the behaviour of the farmers in the experimental group i.e., those who had received training and support under the initiative. About 82 per cent of the farmers from the experimental group have been using better irrigation facilities and farm practices. An overwhelming majority have reported the better yield and subsequent increase in income. In general, however, most of the villagers are aware that these farmers are part of a project which is concerned with climate change and its implications.

Out of the experimental group of farmers, 89 per cent are part of Kisan Samuh (Farmers Group). Membership in Kisan Samuh helps farmers in accessing information on various matters, which encourage them to motivate fellow farmers. On an average, each farmer has motivated 27 fellow farmers. On being asked how the Project has prepared them to adapt to difficult situations - they opined that information on variety of seeds and fertilisers enabled them to reduce the quantity of water for irrigation along with information on weather, 'on time',

Table 5: Outcomes of Better Irrigational and Farm Practices

	Experimental Group (%)
Better yield, better income	98.8
Enhanced social status	13.4
Well-being of the family	9.8
Base (N)	100

Table 6: Benefits from Membership in Kisan Samuh[9]

	Experimental Group (%)
Bought seeds	74.2
Rent farm equipment	28.1
Bought fertiliser	43.8
Got info on seeds, fertilisers, etc	47.2
Base (N)	89

Table 7: Awareness of the Jal Vayu Parivartan Project Among the villagers

	Experimental Group (%)
Everybody is aware	21.0
Many are aware	37.0
Few are aware	41.0
Nobody is aware	1.0
Base (N)	100

Increased productivity has been observed and can be attributed to new practices being adopted. A system to track and document the changes in practices, productivity and incomes is also providing data to calculate reduction in emissions and conservation of water.

helping them strategise and maximise their input ratio (Table 8).

Feedback from the Focus Group

According to the respondents which were from the experimental group, the Project had benefitted them as they had learnt to combat the changes. They now knew how to deal with sparse rains. When asked about the benefits of the programme, most of them had spoken about raised bed and dry sowing technique as methods which have significantly helped the yields. Also sprinklers and drip irrigation as 'modern methods' have created a lot of excitement in the group. According to them, they were doing farming since ages, but now, with training, they have learnt about new crop varieties, better fertilisers and irrigation techniques. The world is changing so the methods should also change along with it they quipped, was the overwhelming sentiment.

Apart from learning about various crops and their varieties which can be grown under the given natural constraints, farmers have also learnt about the trees that they can grow. They were hopeful that tree plantation may bring back some of the lost economic glory as also the rainfall. Almost all of them spoke about depleting water table and have said that from the methods that they have adopted, they can ensure that they do not misuse precious water anymore. The respondents were also asked what more they want from TARAgram and the Project. The following indicates their further wants:

- All the respondents wanted the training on better varieties of seeds and irrigation practices to be repeated for better understanding and involvement of more stakeholders.
- Some of the respondents spoke about unavailability of seeds despite being prepared to pay, even travelling to Jhansi to access them. Farmers urged TARAgram to ensure acquisition of required variety and quantity of seeds.
- A few respondents desired training in pest

Changes in practices are a result of an integrated support system that includes know-how, capacity building, institutional development and services to access information, tools, better seeds and collective action. Resource centre that facilitate such supports and services are critically required in the region.

Table 8: Benefits of the Project

	Spontaneous	Aided (mentioned on probing)
Information on weather on time	46.0	38.0
Information on variety of seeds and fertilisers	48.0	49.0
Information on financial schemes	18.0	42.0
Aware of alternatives other than agriculture	26.4	53.0
Aware of Monsoon to strategise work accordingly	23.8	48.0
Reduction in the quantity of water for irrigation	47.4	50.0
Reduction in the quantity of electricity	12.5	42.0
Reduction in the quantity of diesel/kerosene	0.0	31.0
Base (N)		100

control techniques to salvage mustard crop in disease prone seasons.

- Most farmers pointed to erratic power supply as a hindrance to irrigation and sought the help of TARAgram in this regard.
- Some farmers wanted training to set up small scale businesses at home. Making incense sticks and candles was mentioned by some people in the FGDs. This, they said, would be particularly helpful for their women.

The overall analysis of the farmers' responses reveal:

- Average ownership of farm implement is higher in experimental than in the control group
- Awareness about the traditional irrigation methods such as flooding and furrow is high among both the cohorts. However, awareness about more modern techniques such as sprinkler and drip irrigation is much higher among the farmers from the experimental group than the control group.
- Likewise, furrow is still the major method adopted by the villagers, usage of sprinkler being higher among the experimental group than in the control group.
- Practice of 'dry sowing' is unique to the experimental group and is seen as major step towards minimising the utilisation of water.
- More farmers in the experimental group use pesticide than in the control group.
- The mean yield for wheat was more among the experimental group than in the control group.
- Among the Kharif crops, majority of farmers in the experimental group have been growing sesame and the yield is 5 times more than that for the control group.
- More of the farmers among the experimental group as compared to the control group have reported that their yields have increased from the last year.
- The better yield is attributed to usage of different variety of seed, better technique of ploughing and irrigation methods.
- About half of the respondents from both the cohorts have taken loan, mostly for agricultural purposes.
- Majority of the farmers were part of the Kisan Samuh and the perceived benefit of being a member was that they could buy seeds, fertilisers etc.
- Overall, the farmers from the experimental group have perceived the projects and trainings initiated by TARAgram to be instrumental in enhancing yield and in combating the vagaries of climate change.

Policy Support

Along with the farmers' Project in collaboration with like-minded stakeholders which is now 3 years old, Development Alternatives has developed a Status Paper and a Perspective Paper on issues of water management, food production, and energy and livelihood security in Bundelkhand. While the Status Paper attempted to capture the current situation in the Bundelkhand region, the Perspective Paper reflects the outcomes of an elaborative consultative process with the stakeholders. The White Paper that now follows is the last step in the process crystallising the findings of the two previous documents in the form of recommendations to the State and Central Government.

Nirpat Singh Rathore from Naya Kheda village is one amongst 285 farmers now reducing fertiliser application and moving towards greater organic manure for a greener agriculture.

Challenges

Application of Improved Practices and their Replication

The introduction of micro-irrigation technologies has been a challenge. The main reason has been the initial capital costs and small number of subsidies available per village. Unless this barrier is overcome, a critical mass cannot emerge .

A number of tools and systems will be required for replication and scaling up of the enterprise model created under the initiative. While some of them have been put in place, others will need to be established. It can be seen from the earlier discussion that several tools and systems are already in place. They include BKP; PoP; Data Login Sheets; and, Institutional Structure. However, there are still more systems which need to be put in place which include:

- GIS based Village Information System for planning and visualisation purposes.
- PoADD with the Ministry of Environment and Forests as a first step towards enabling access to carbon funds; this will be useful only if number of farms practising resource efficient farming increase substantially.
- District and State Level mainstreaming of needs for climate change and adaptation at the district and state level in planning processes for ensuring creation of an enabling environment for replication and scaling up.

Leveraging Finance

Financial support and services for small and marginal farmers to facilitate them to adopt water saving technologies is a challenge. Currently, subsidies available for micro-irrigation through public sector programmes are limited to a small number per village; this has been an entry point barrier to popularize micro-irrigation technologies in the target villages. Financial support through easy credit and subsidies for sustainable agricultural practices will need to be broad based so that a large number of farmers are able to access these. Financial assistance allocated through the central government's package for Bundelkhand does not adequately cater for either institutional finance or for broad basing micro-irrigation technologies.

According to the latest market trends, the rate of a CERs is approximately Euros 13 or INR 842 per tonne CO_2 (April 2011 Issue of "IDBI – Carbon Developments" Report). At the rate of 13 Euros each farmer in the FAC on average stands to gain annually around INR 152, INR 12 and INR 8,500 for improved irrigation, tillage and agro-forestry respectively. However, agro-forestry based projects have found it difficult in past to get CERs and therefore VERs are another option.

One of the contentious issues with relation to agro-forestry based interventions is that the trees need to be more than 3 meters in height. This condition will not be met in many of the cases as high yielding varieties of many agro-forestry tree species do not meet this criterion.

The current rates of VERs are $ 1.55 or INR 71 (http://www.chicagoclimatex. com/content. jsf?id=1813) in which case the average payouts for each farmer adopting agro-forestry would be INR 722/- annually.

In order to have a viable project, the emission reductions need to be in the range of

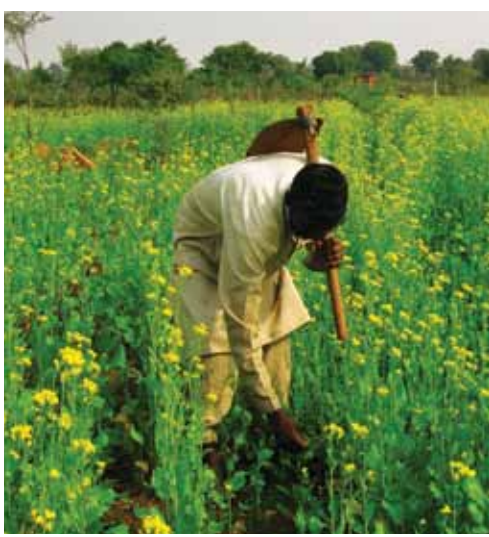
Many programmes directed to address water conservation and improved agriculture for food security are available. The need is to converge and demonstrate benefits. NABARD's WADI programme for promoting kitchen gardens in small fields is integrated with NREGS and lessons from the SCSI intervention are brought in to influence practices of vegetable farming.

15,000T CO_2 per annum. Thus, it is clear that at the current levels of emission reduction, it would require 428 ha of land to be covered with all three interventions. In this regard registering a PoADD is an appropriate solution.

The current set of farmers may be registered under a single CDM Project Activity (CPA). The farmers who join the Farmers' Adaptation Cluster may be registered at a later date under a fresh CPA. Using this strategy will lead to reduced waiting period for the farmers, who have already adopted interventions, in accessing carbon funds. Agro-forestry has the potential to sequester 25 t CO_2/year/ha. However, the trees once planted may be accounted for only after they have attained an age of 3-5 years. About 1,850 t CO_2/year stands to be sequestered with agro-forestry works.

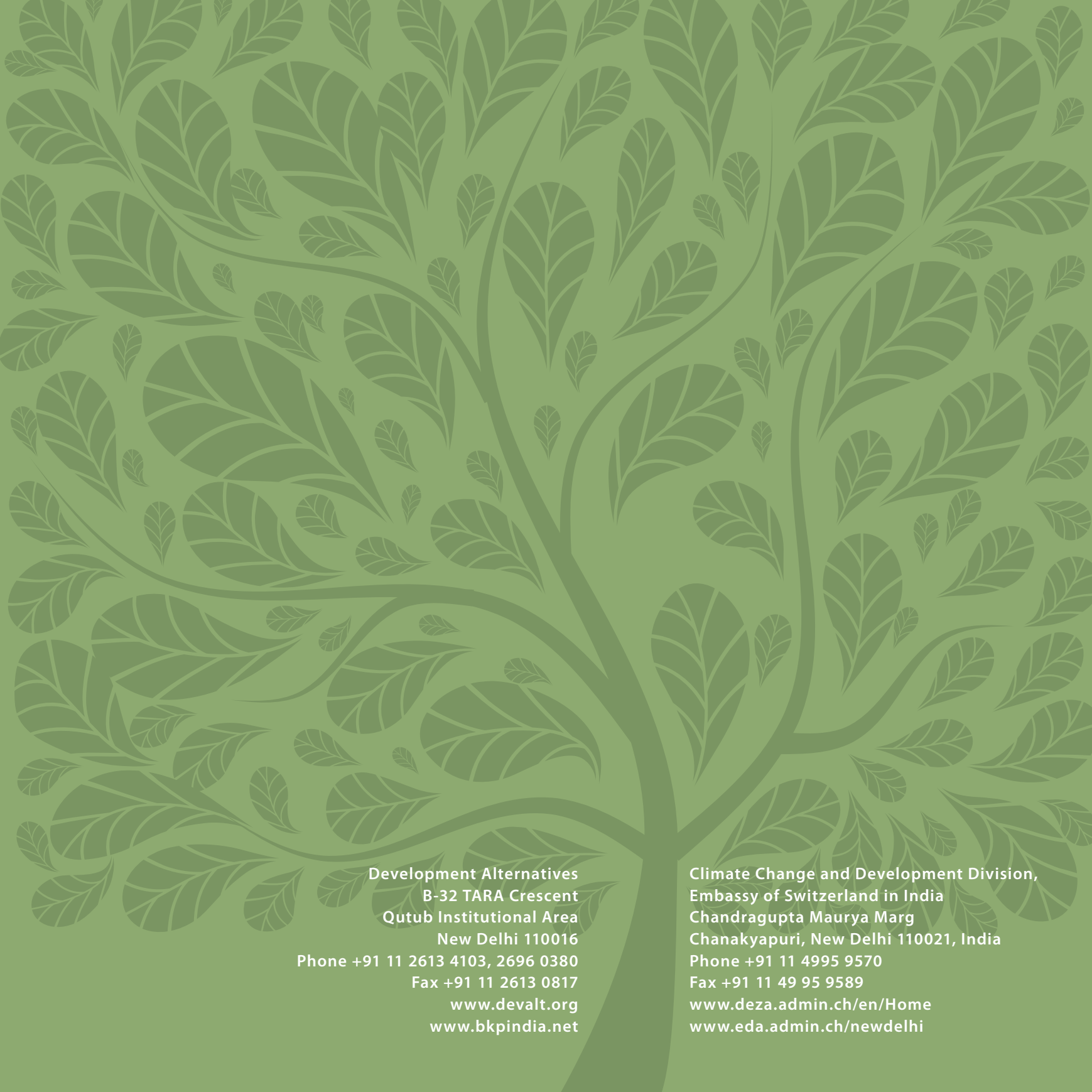
In sum, the current initiative provides lessons from a small sample on an experimental basis. Much more remains to be done by way of analysing policy direction and the impact of its implementation on ground. The influence of good practices such as the ones demonstrated in this initiative will need to be substantiated with other such stories and data from other districts of Bundelkhand as well. A major policy challenge will be dealing with two separate states with different policy directions for the region. Continued engagement with various departments of the two state governments is essential to ensure that the farmers day from the initiatives.

Challenges remain of replicating improved practices across the region, enabling support services for farmers to adopt efficient irrigation systems and policy supports that benefit small and marginal farmers in field and in the market.



Endnotes:

1. Report on Drought Mitigation Strategy for Bundelkhand Region of Uttar Pradesh and Madhya Pradesh by Inter Ministerial Central Team, 2008.
2. Project Report by Development Alternatives titled 'Communicating climate change to rural communities and policy makers in Bundelkhand region'.
3. Radio Bundelkhand is a community radio, an initiative of Development Alternatives.
4. TARAgram, Pahuj Development Alternatives field office promoted as Natural Resource Management (NRM) hub.
5. The figures were not derived from inter-temporal comparison rather it was a cross-sectional comparison between the group of farmers who adopted these practices and who did not.
6. For the purpose of calculating water application the discharge rate has been taken at 300 litres per minute. The value is obtained from: "Comparison of GHG Emissions in Rainfed and Irrigated Farming: A Case Study in Gujarat" 2010.
7. Khan, M.A and Pandey, S.N. (2010)Green Social Enterprises in Bundelkhand as a Viable Option for Livelihood Security, Paper Presented at NIRD.
8. Based on values presented in "Position paper The importance of the conservation agriculture within the framework of the climate discussion" Available online at http://www.ecaf.org/docs/ ecaf/ positionpaperco2ecaf.pdf.
9. The calculations are done as per IPCC 2006 guidelines. The volume data is sourced from Haryana Forest Department and The World Agro-forestry Centre. Values pertain to Acacia nilotica when trees are planted in a hectare of land in a 20 X 20 m matrix (16 trees in total).



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