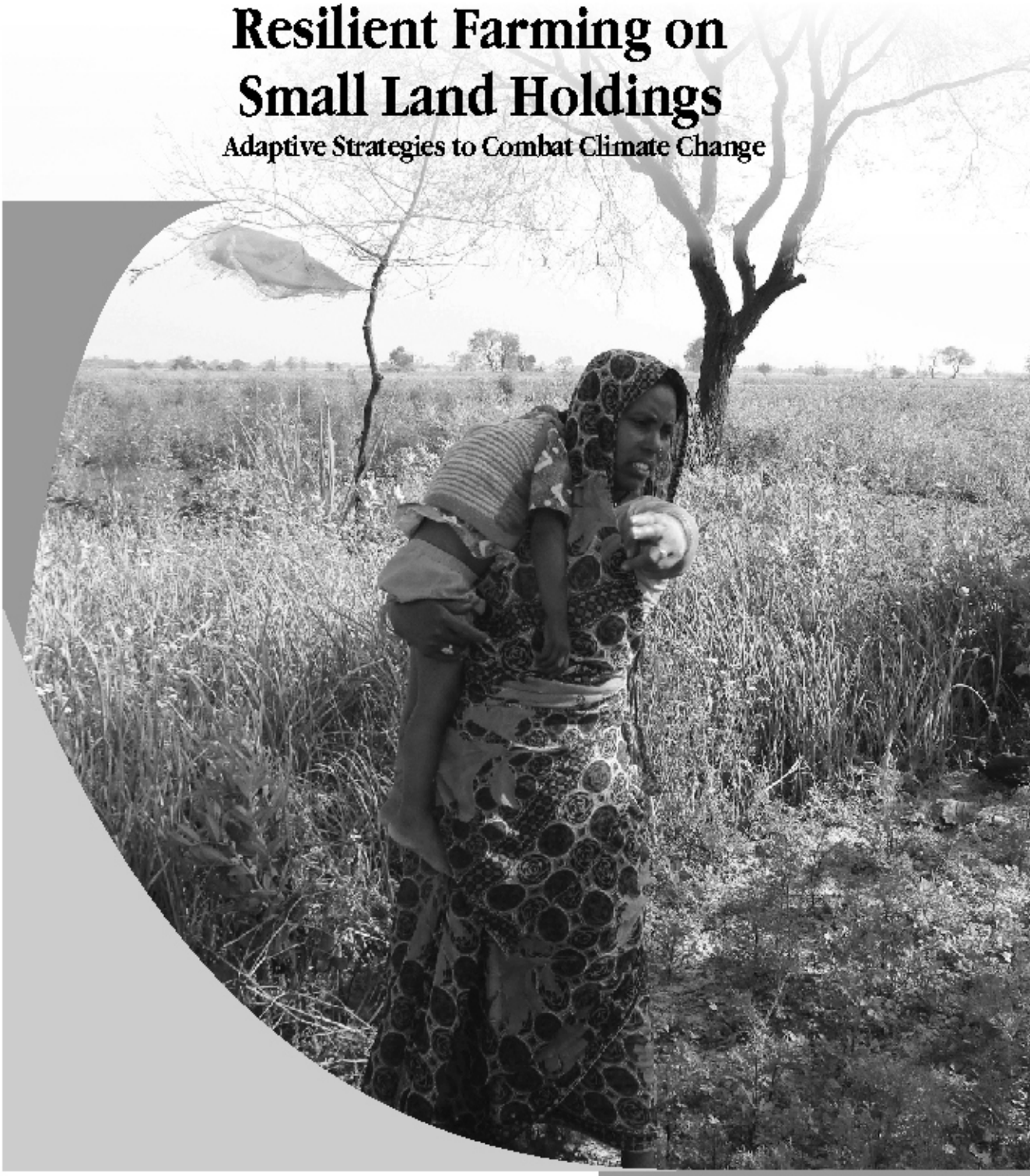
Resilient Farming on Small Land Holdings

Adaptive Strategies to Combat Climate Change



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Adaptive Strategies to Combat Climate Change

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Content

Eastern Uttar Pradesh covers an area of 33,270 sq km that is 11.28% geographical area of the state. This region includes the riparian land system formed by the Gandak, West Rapti rivers and the Rohini river system. The Gandak, a snow-fed river originates in Nepal. Also originating in Nepal is the Rapti that then flows down and meets the Gandak near Gorakhpur town. The Rohini river system that also originates in Nepal is composed of three rivers, the Rohini, the Tinau and the Banganga and their tributaries. Located north of the river Ganga, the region is also commonly known as the trans-Saryu plain.

Floods in this region are a common occurrence. In the Indo-Gangetic plain, approximately 29% of this region is considered flood-prone. These floods have an impact on agriculture that is the primary source of livelihoods for the people living here. Floods also cause large-scale destruction of property and rural infrastructure leading to the disruption of local community lives. Torrential rains cause severe water logging in the low lying areas. On the other extreme are drought conditions that this region is also prone to. The recurrence period of highly deficient rainfall in East Uttar Pradesh has been calculated to be 6 to 8 years. In the recent years, the year 2002 and 2004 were severe in terms of drought, with loss to crop, livestock and property assessed at Rs.7540 crores and Rs. 7292 crores respectively.

Agriculture is the mainstay for the state of Uttar Pradesh. Of state's total geographical area, almost 70% is under cultivation. Agriculture contributes almost 40% to the State GDP and 25% at the national level. The state of Uttar Pradesh contributes an average of 21% to the national production of food grain. Agriculture in Uttar Pradesh is characterized by small land holdings and over 90% of farmers in the state are small and marginal.

Changing Climate in the Region

The climate in this region is perceptibly changing. Farmers here can perceive this change much better since their lives revolve around agriculture that is being impacted by changing weather patterns. There is an increase in the frequency and intensity of natural hazards. In the last few decades the frequency of floods has increased significantly and they now recur every three to four years. It has become a regular and annual occurrence in some places. People whose lives and livelihoods are impacted by floods assign this to climate change. It is now also normal for temperatures to cross 45 degrees and remain so for extended periods during the summer months. The flood plains get directly impacted by such temperatures as glaciers melt rapidly causing an increase in water levels downstream. The unpredictable monsoons leave people unprepared for disasters leading to damage, destruction and disruption of lives. There is also a change in the volume, time and pattern of rainfall. There is an increase in the frequency of flash and accidental floods. The dry spells during the monsoon are on the other hand increasing as are hot winds during the winter months. There is also an increase in water logging

periods. Embankments along rivers, break as a result of heavy flooding and wash away crop lands and mud houses. Frequent flash and accidental floods have increased water logging. Cropping patterns are changing. Pulses, for example, once a major crop in the area and perhaps also the major source of protein are not gown any more due to prolonged periods of water logging.

Signs of Climate Change

Besides seasonal and social indicators of climate change, natural indicators also denote this change. It is believed by the people here that one indication of the oncoming monsoon is when sparrows start taking a dust bath. Unfortunately sparrows themselves have become scarce. This is due to a number of reasons. Change in temperature is one reason, but the main one is the prolific use of chemical fertilizers and pesticides. The phenomenon of sparrows taking a dust bath is thus becoming rare also because monsoons have become erratic. An indicator of the onset of summer also used to be the flowering of mango trees. This too has been delayed now with changing weather patterns.

The flowering, fruiting and harvesting of every crop for example has been associated with particular festivals. These were also seasonal in alignment with crop patterns. For example, traditionally corn was harvested before the '*Nag Panchami Mela*. Corn does not ripen in time for this festival any more. Newly harvested wheat was the traditional offering to the Gods for *Navaratri*. Wheat unfortunately does not harvest in time any more.

Adaptation Strategies

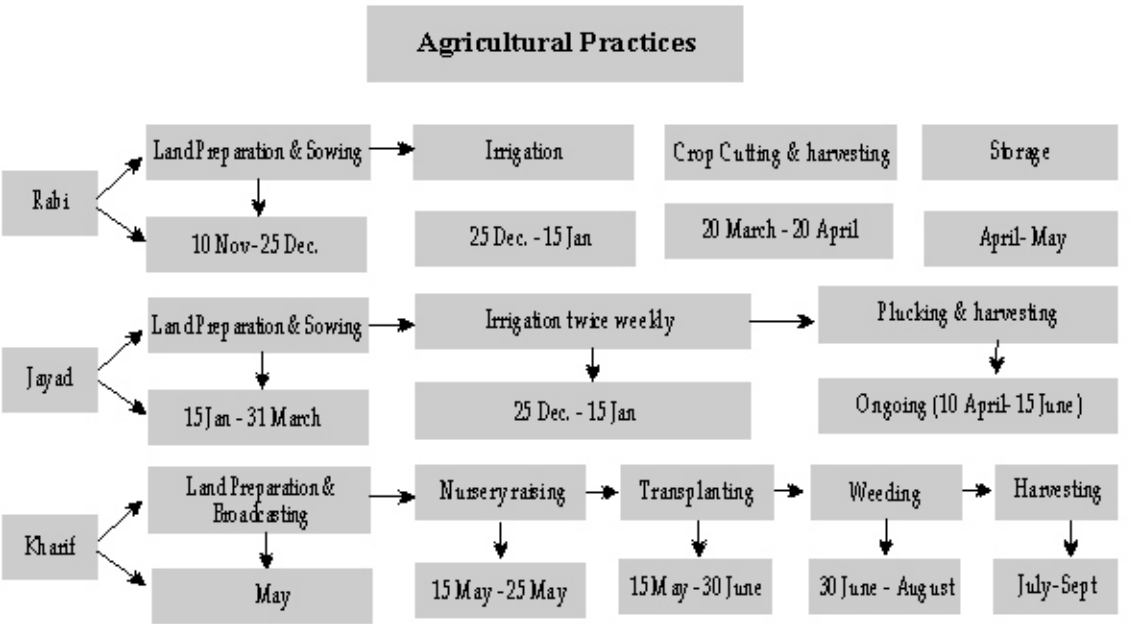
Since floods and droughts is a recurring feature in the lives of people of this region, they have over time developed methodologies to deal with these hazards. People, particularly marginal farmers and small land holders are however unable to cope with the unpredictability of these events over the years and certainly do require both financial as well technical support to contend with climate change. One of the most common responses of people in these changing circumstances is to migrate to surrounding urban areas to seek better livelihood opportunities because they are finding it increasingly difficult to remain in the area and continue with agriculture due to the lack of basic physical amenities as also a lack of social capital such as links with the larger governmental infrastructure. People's accessibility to information particularly in the context of climate change and its impacts is also inadequate.

The Gorakhpur Environment Action Group (GEAG) has focused its work for the past three decades in this region. Given this disaster prone area, GEAG has been working on disaster risk reduction strategies with the poor and marginalized community in the region through participatory planning for disaster management and supporting

strategies that help people cope with these disasters. Changing weather patterns have increased the probability of risk and hence these strategies could now be seen as adaptation strategies to combat climate change. GEAG has through its work helped strengthen community institutions and enabled communities to work at disaster risk reduction through existing schemes and also lend support to and fortify the community's own efforts at combating variability in climatic conditions.

In terms of agriculture, GEAG's interventions have changed the agricultural patterns in the area. People used to routinely take only the *Rabi* and *Kharif* crops in the annual cycle, but now they are able to take the *Jayad* crop as well. The following flow chart illustrates the same. Some of the other interventions are described below.

Changed Time Line as a Result of Project Intervenion



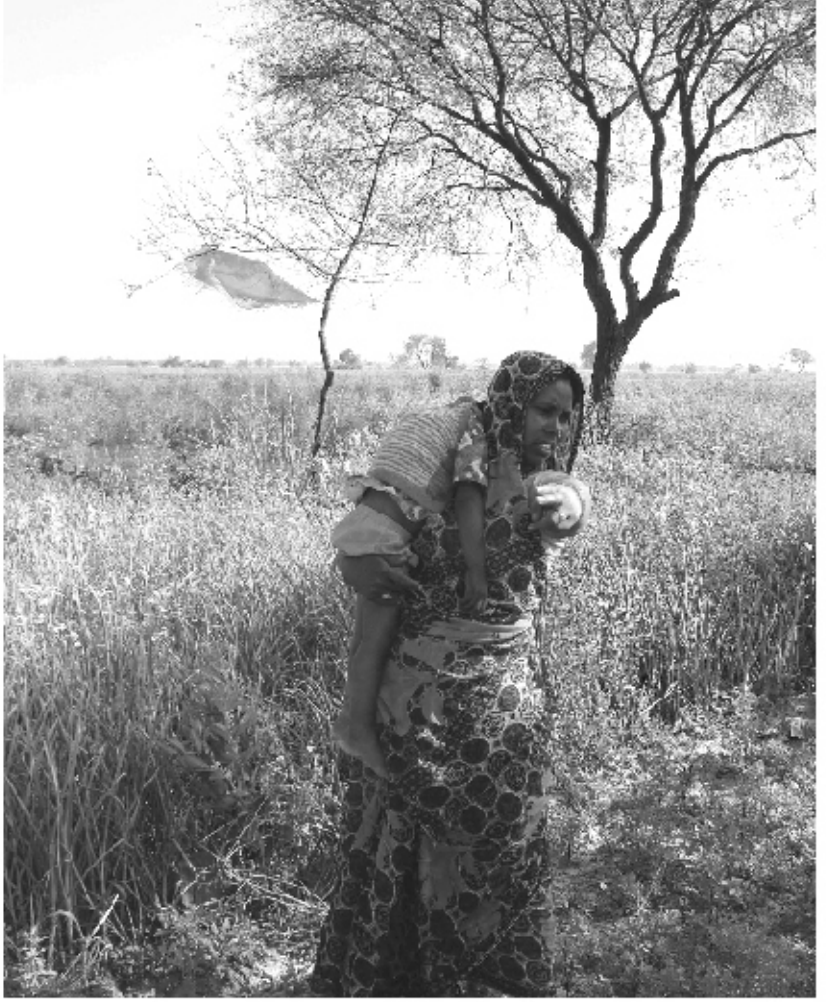
Rabi	Wheat+Musterd+Maize+Radish+Potato+Tomato+Barley+Spangguard+Spainch+Cauliflower etc.
Jayad	Maize+Cucurbits veg+Radish+Kheera+Kakari+Watermelon+Parwal+Ladyfinger+Karaila etc
Kharif	Paddy+Bajara+Sawa+Kodo+Ramdana+Vegetables

Table 2 Seasonal and Spatial Combination of Crops through a Multi-layered System

	Kharif (June-September)	Rabi (October-May)	Jayed (March-May)
Upper Layer (Machaan)	Nenua, Bitter Gourd, Satputia, Bottle Gourd, Pumpkin, Cucumber, Kunduru	Bottle Gourd, Bitter Gourd, Sem, Nenua	Cucumber, Bitter Gourd, Kundru
Standing Crop (On Bunds)	Arhar, Brinjal, Chilli, Spinach	Soya, Brinjal, Chilli	Okra, Maize, Brinjal
Ground Layer	Groundnut, Spinach, Kulthi, Urad, Turmeric	Garlic, Onion, Spinach, Methi, Raddish, Carrot, Tomatoes, Coriander	Onion, Spinach, Tomatoes, Coriander

Source: Singh, K K 2010. Climate Change & Disaster Risk Reduction. *A Case Study of Uttar Pradesh. GEAG. Slide Presentation*

This particular strategy is of great significance for farmers with small land holdings. Vegetables and crops are grown at various levels ensuring full utilization of the land available. There is also a variety of crops and vegetables grown throughout the year ensuring that the land is not left fallow for any time. Crops are chosen based on the availability of water and what is best suited to the time of the year. Farmers like Shri Ramsevak Maurya from Jabbar have earned INR 3100 from the sale of vegetables over a period of three days. These earnings help these small and marginal farmers tide over lean periods, of which there are now few, thanks to the time and space management of crops.



Saraswati Devi grows 22-24 different crops in 1.5 acres of land

Saraswati Devi lives in the village of Sadekhurd, Block Mehdaval, District Sant Kabir Nagar in a household with fifteen members. They practice agriculture on 1.5 acres of land. Before 2006, they used to grow primarily wheat, rice and potatoes. Rice production was only enough to meet their own dietary requirements. Wheat production went up to approximately 12-15 quintals out of which half was for the family's own consumption while the other half was sold to meet other household needs. Over and above this, INR 2000-3000 was taken as credit for other needs. The three men in the household also migrated outside of the village to provide additional income. In the year 2006-2007 Saraswati Devi joined the women farmer training programme organized by GEAG and subsequently was also part of the Disaster Risk Reduction programme. Having understood the implications of changing climate, she changed the crops and cropping patterns on her land. She now grows 22-24 different types of crops on her land including a range of vegetables and condiments. As a result this 1.5 acre land is now as productive as a field of 25 acres. Her annual income from agriculture alone is now INR 38,000/-. This is after keeping aside agricultural products for household consumption.

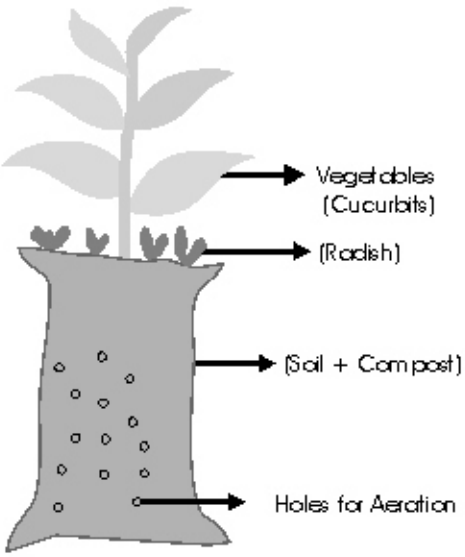
Floating and Raised Nurseries

In the village Makhnoha, Campierganj that is very prone to floods and water logging, the concept of a floating nursery can be seen. These are nurseries developed on bamboo platforms or *machaans*. Seedlings are nurtured at a higher level on top of the *machaan* in a flooded area and can either continue to grow there or can be transplanted to another area when floods recede. Gunny bags filled with soil, compost and relevant seeds are also innovative measures to combat floods. The gunny bag can be suspended from a bamboo

pole in times of floods and subsequent water logging to ensure that seeds will survive the floods. This system is found to be particularly effective for growing cucurbits. Raised nurseries are also prevalent in flood and water logging prone areas. These are developed on higher grounds that can escape the incursion of water. Seedlings survive and can be used at the appropriate time.

Integrated Farming

Farmers in this region have been doing mixed farming for a long time, but they feel that GEAG's support in carrying out other related activities has increased the agricultural output. Time and space management is combined with using bio-manure such as vermi-composting, green manure and NADEP' compost, techniques that have been promoted and supported by GEAG through training and capacity building programmes. In addition to this, farmers are also encouraged to use bio-pesticides and bio-manures that they have been using traditionally for many generations. Other traditional knowledge used by farmers is also encouraged and promoted by GEAG.



Jute Bag Nursery

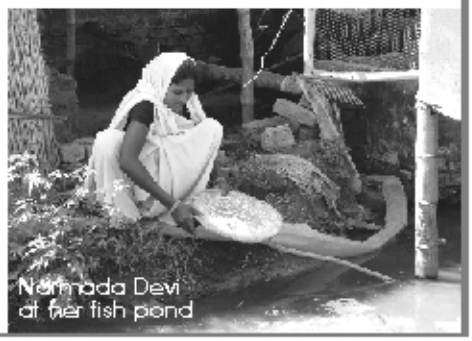
Some Useful Traditional Tips

- Adding ash during the cultivation of garlic, onion and *barseem* promotes growth and also helps combat pests.
- Application of a paste of black Dhatura (*Dhatura metel* 'Fastuosa') combined with cow urine in the fields helps crop production and prevents pest infestation.
- Used tea leaves helps and enhances chilli production
- Use of tobacco leaves helps prevent termite infestation in the soil

"NADEP is a method of organic composting where compost is prepared from organic material like crop residues, plants etc, makes high value fertilizer and is a good substitute for manure where there is no livestock.

Integrated Farming

The village Biloha stands by the river Rapti. The problem of water logging was so acute here that most people worked outside the region to earn their livelihoods. Farmer Sadanand and his wife Narmada Devi used to work in Jammu. Having subsequently been part of GEAG's capacity building programmes, they have developed an integrated farming system. They invested in two goats, some poultry and even built a fish pond. As income levels went up due this diversification, they invested in a flour mill. They now earn a considerable income from selling vegetables as well as other means. Their average annual income ranges from INR 45000-47000/-.They are also gradually adopting more organic agriculture techniques. They already cultivate several indigenous species of rice. As Narmada Devi explained, one variety of rice that needs less water is grown at higher inclines while another variety that needs more water is grown at lower inclines. Narmada Devi is a happy lady and is proud that she can send her children to school. She believes that the integrated farming model has worked well for her.


Narmada Devi at her fish pond

No More Begging for Grain or Implements: Institutional Development


Grain Bank in VRCs

Institutional development to help build the capacity of farmers to adapt and combat climate change has been one of GEAG's strategies. This has been done primarily through the establishment of Village Resource Centres (VRCs). VRCs are community institutions that support farmer's needs in various ways. The VRCs invest in a range of farm implements that farmers could hire when required. The Centres also have temperature and rain gauges that help farmers keep a record of changes and subsequently plan their agriculture through the year. Indicators like the flowering of certain trees etc that heralded change in season and those that farmers traditionally relied upon for commencement of sowing etc are not reliable anymore and the gauges available at the VRCs help farmers now. VRCs also function as grain banks where farmers who have not been able to store enough seed from the previous years can borrow for the next sowing season. Most VRCs have two kinds of grain banks. One is the traditional mud grain storage structure and the other is new aluminum sheet ones. These grain banks serve two purposes. One is to ensure that seed is available to farmers who need it thus enabling availability of local seed without buying from the market. The other purpose is the storage of seed varieties against natural hazards that are now becoming increasingly more common.

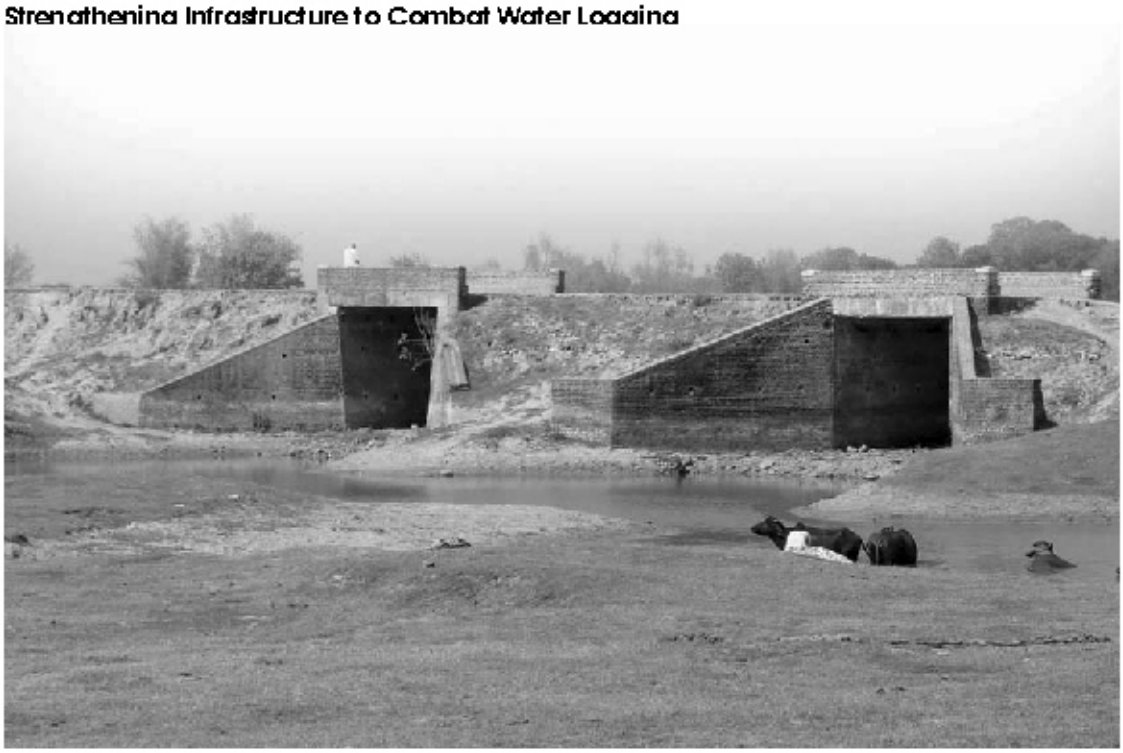
VRCs have thus become a central place for all agriculture related activities of the village. They add to the communal spirit and encourage the sharing of resources. These have also helped significantly in the empowerment of women in many villages.

The village of Sadekalan (Block Mehaval. District: Sant Kabir Nagar) is located by the Budhi Rapti river and is severely impacted by floods and water logging with seasonal regularity. A significant percentage of the population migrates to adjoining states to earn additional income on an annual basis. Majority of the people (barring the economically better off ones) do not have enough resources to invest in adequate agricultural implements. Agriculture has been almost completely dependent on the monsoon which in turn has become increasingly erratic in the last few years. Delivery pipes to enable irrigation for example can make a huge difference to agriculture. Variable weather conditions have also made it very difficult for the farmer to plan ahead. If relevant implements are available, then they help the farmer to adapt to irregular weather patterns. Keeping all this in mind, the VRC in Sadekalan carried out a needs assessment through a participatory appraisal and decided to invest in some basic farm implements such as irrigation pipes, bio-fertilizer and pesticides spray instruments etc. This VRC is managed completely by women. Rajmatiji heads the VRC with Urmilaji as the coordinator. The funds collected through the hire of farm implements go into a bank account and can be used to buy more equipment or whatever else is needed at the village level. With women taking on more of the managerial role, it has become easier for men to migrate but only seasonally as opposed to earlier times when they had to spend much more time away from the village. Rajmatiji, the dynamic head of the VRC here has been successful in using the existing Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA)[2] and has mobilized other women in the village to help create more permanent water bodies.

The VRC at village Jabbar, Block Mehdaval, Sant Kabir Nagar District, follows more or less the same pattern. Discussions with both men and women at the VRC indicated that there is clear move towards organic agriculture. The villagers attribute this awareness to GEAG that carries out capacity building programmes on a regular basis for model farmers. Members of the VRC also proudly displayed a meticulous documentation of accounts. Each VRC also keeps a record of temperature as well as precipitation that will help show weather patterns. Farmers here observed that the frequency of fire had increased along with more drastic wind patterns. They have thus also invested in a fire protection system for the village. The VRC has also facilitated the development of alternate sources of livelihood by investing in some sewing machines. Villagers are also looking at other initiatives such as food processing etc.

[2] *The Mahatma Gandhi National Rural Employment Guarantee Act aims at enhancing the livelihood security of people in rural areas by guaranteeing hundred days of wage-employment in a financial year to a rural household whose adult members volunteer to do unskilled manual work (http://nrega.nic.in/netnrega/home.aspx)*

Strengthening Infrastructure to Combat Water Logging



Combat Water Logging by Strengthening of Infrastructure

Jungle Aghi and Sauraha in Kalyanpur, Campierganj of Gorakhpur district had a severe water logging problem. It was necessary to build infrastructure that would prevent water logging and divert the waters. In both instances villagers have mobilized labour through the concept of '*shram daan*' (voluntary labour) and ensured that the structures were built. The local government subsequently put in funds and helps in managing these structures. Over 500 households have benefited from this drainage system that has reduced water logging and villagers are now able to get three crops as opposed to two.

Adapting for Change

GEAG has over the last three decades helped to bring to the attention of policy makers the plight of the small and marginal farmers that try to survive the harsh conditions of eastern Uttar Pradesh. A major focus of GEAG's work has been on disaster risk reduction. In the face of climate change, disasters are only going to exacerbate and so will the risk. GEAG's interventions in the area have helped farmers adapt better to changing conditions. It has also helped empower women and build their capacity to combat climate change. Migration of the men to surrounding urban centres has been a very common strategy in the region to seek alternate sources of livelihoods. But with GEAG's support, productivity of land has increased. Farmers are also maximizing the use of the land with better time and space management resulting in a significant increase in

income. Migration that used to be over 7-8 months of the year has become seasonal and is reduced to 3-4 months of the year. The Village Resource Centres have become the focal point of agricultural activities. Besides serving as repositories of climate data, they also serve as grain banks to tide over periods of crisis. Increased yields with the use of organic pesticides and fertilizers have encouraged people to move towards organic agriculture. In addition to this is the fact that GEAG recognizes and acknowledges the relevance of people's own traditional knowledge and encourages the use of the same has further empowered people.

GEAG is helping to facilitate adaptation to climate change with innovation and better management. Through the Disaster Risk Reduction project, GEAG works with five Gram Panchayats of Block Campierganj, District Gorakhpur and i5 Gram Panchayats of Block Mehdaval, District Sant Kabir Nagar. At present 20 villages in two districts of the region are benefiting from GEAG's work.

Climate Change in the Policy Context

In June 2008, India's Prime Minister released the country's first National Action Plan on Climate Change (NAPCC) that outlines existing and future policies and programmes targeted at climate change mitigation and adaptation. The plan highlights eight core 'national missions' operating through 2017. These missions direct relevant ministries to draft detailed implantation plans to the Prime Minister's Council on Climate Change by December 2008. The eight missions are: National Solar Mission; National Mission for Enhanced Energy Efficiency; National Mission on Sustainable Habitat; National Water Mission; National Mission for Sustaining the Himalayan Ecosystem; National Mission for a 'Green India'; National Mission for Sustainable Agriculture; National Mission on Strategic Knowledge for Climate Change.[3]

Most relevant for this region is the National Mission for Sustainable Agriculture. To quote the goal of this Mission, "The Mission would devise strategies to make Indian agriculture more resilient to climate change. It would identify and develop new varieties of crops and especially thermal resistant crops and alternative cropping patterns, capable of withstanding extremes of weather, long dry spells, flooding and variable moisture availability. Agriculture will need to be progressively adapted to projected climate change and our agricultural research systems must be oriented to monitor and evaluate climate change and recommend changes in agricultural practices accordingly. This will be supported by the convergence and integration of traditional knowledge and practice systems, information technology, geospatial technologies and biotechnology. New credit and insurance mechanisms will be devised to facilitate adoption of desired practices"[4].

[3] *Government of India. 2008. National Action Plan on Climate Change. Prime Minister's Council on Climate Change, Government of India, New Delhi.*

Gorakhpur Environmental Action Group (GEAG) is a voluntary organisation working in the field of environment and sustainable development since 1975. Ever since its inception, GEAG has been actively engaged in implementing several development projects addressing livelihood issues of small and marginal farmers, particularly women, based on ecological principles and gender sensitive participatory approach. Besides, GEAG has accomplished several appraisals, studies, researches at the micro & macro levels as well as successfully conducted a number of capacity building programmes for various stakeholders including women farmers, civil societies groups and government officials etc.

Today, GEAG has established its identity in North India as a leading resource institution on Sustainable Agriculture, Participatory approaches, methodologies and Gender. Acknowledging its achievements, efforts and expertise, United Nation's Economic and Social Council (ECOSOC) accorded GEAG special consultative status in the year 2000. GEAG has also been recognised recently as North India hub for InterSard, South Asia- a network to facilitate information sharing on issues of concern.

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